Chapter - 2

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2.1 Introduction

An oil refinery or petroleum refinery is an industrial process plant where crude oil is processed and refined into more useful products such as petroleum naphtha, gasoline, diesel fuel, asphalt base, heating oil, kerosene and liquefied petroleum gas. Oil refineries are typically large, sprawling industrial complexes with extensive piping running throughout, carrying streams of fluids between large chemical processing units. In many ways, oil refineries use much of the technology and can be thought as types of chemical plants. The crude oil feedstock has typically been processed by an oil production plant. There is usually an oil depot (tank farm) at or near an oil refinery for the storage of incoming crude oil feedstock as well as bulk liquid products.

For most of the last century, firms in certain industries, especially public utility industries such as energy, transportation, and communications, have been public owned or regulated to alleviate public fears that such firms would use market power to raise prices artificially. Many of these industries represent scale economies, which meant that a single firm would have the lowest cost of production and could monopolize the industry. Hence, these industries were treated as natural monopolies and regulated to control entry, prices, and profits.

2.2 Oil refinery at world

Petroleum is vital to many industries and it is importance to the maintenance of industrial civilization in its current configuration, and thus it is a critical concern for many nations. The petroleum industry includes the global processes of exploration, extraction, refining, transporting (often by oil tankers and pipelines), and marketing petroleum products. The largest volume products of the industry are fuel oil and gasoline (petrol). Petroleum (oil) is also the raw material for many chemical products, including pharmaceuticals, solvents, fertilizers, pesticides, and plastics. Oil accounts for a large percentage of the world’s energy consumption, ranging from a low of 32% for Europe and Asia, to a high of 53% for the Middle East.

Other geographic regions' consumption patterns are as follows: South and Central America (44%), Africa (41%), and North America (40%). The world consumes 30 billion barrels (4.8 km³) of oil per year, with developed nations being
the largest consumers. The United States consumed 25% of the oil produced in 2007. The production, distribution, refining, and retailing of petroleum taken as a whole represents the world's largest industry in terms of dollar value.

Governments such as the United States government provide a heavy public subsidy to petroleum companies, with major tax breaks at virtually every stage of oil exploration and extraction, including the costs of oil field leases and drilling equipment.

➢ Global Oil Scenario

![Global oil scenario chart]

World oil use is expected to grow from about 80 million barrels per day (mbpd) in 2003 to 98 mbpd in 2015 and 118 mbpd in 2030 as per Energy Information Administration, International Energy Outlook (IEO) 2006. In the IEO 2006 reference case, world oil prices rise from $31 per barrel (in real 2004 dollars) in 2003 to $57 per barrel in 2030, and oil’s share of total world energy use falls from 39 percent to 33 percent. Shift in energy mix over the period of time is shown in the chart.

To meet the projected increase in world oil demand, total petroleum supply in 2030 will need to be 38 mbpd higher than the 2003 level of 80 mbpd. In China is projected to consume additional 9.4 mbpd, US 7.5 mbpd and Asia (other than China & India) 6 mbpd. The balance growth is expected in South America, Africa and
Middle East. As per the same report India is expected to consume additional 2.2 mbpd. OPEC producers are expected to provide 14.6 mbpd of the increase. Higher oil prices cause a substantial increase in non-OPEC oil production—23.7 mbpd, which represents 62 percent of the increase in total world oil supplies over the projection period. In addition, unconventional resources (including bio fuels, coal-to-liquids, and gas-to-liquids) are expected to become more competitive. In 2003, world production of unconventional resources totaled only 1.8 mbpd. Unconventional resource supplies are expected to rise to 11.5 mbpd and would account for nearly 10 percent of total world energy supply in 2030.

Figure 2.2(B): Region-wise Trend in Refining Capacity Additions

Global Refining Scenario

Global refinery scenario particularly that of Asia is turning attractive. In Europe, there has been no substantive addition in the refining capacities. At a number of places refineries are being closed down because of environmental concerns and uneconomic size. In the US, refining capacity has increased marginally. In Central Asia, the refineries are old and require a huge dose of investment. The only area, which has seen a spurt in refining capacity, is the Middle East,
India and China the average annual growth rate of refining capacity in the last one decade in the world is 1.2 percent. Most of this capacity addition has been in Asia-Pacific region, which contributed about 56 percent of the capacity addition. The current region wise refining capacity is shown in the Figure.

The next five years are projected to be crucial for refineries. Cracking margins are expected to remain strong with strong forecast for oil demand growth coming from Asia Pacific and the US and move throughout the world towards cleaner fuels. It is expected that early movers could benefit strong margins for several years.

Figure shows the trend in refining capacity additions in the Atlantic Basin, Asia Pacific and Middle East Regions. It may be seen from the graph that over a period of time the refining capacity share of the Atlantic Basin is reducing and the share of Asia Pacific region is increasing. This is in line with the trend of maximum refining capacity being added in the Asia Pacific region. The world refining capacity at the end of 2010 was about 94 mbpd and around 102 mbpd in 2012. The significant expansion of capacity forecast for China and India would have the effect of pulling the locus of world refining more toward the Asia-Pacific region.

Thus, there appears to be an excellent opportunity for capacity augmentation in the Asia Pacific region. Asia, including India and China, are projected to account for half the incremental consumption. Asia in general is projected to be the centre of growth for the next few decades. This perhaps is an opportune moment for the domestic refining industry to take up this challenge and make India a major refining destination. The viable route, therefore, would be to export surplus products and value-add by production of petrochemicals/polymers and other chemicals. New refineries would necessarily need to meet the projected fuel standards of developed countries to access those markets. Further, India has a geographical advantage due to proximity to source of oil and emerging markets.

- Global Natural Gas Scenario

The oil and gas producers and users across the world are sitting up and revisiting their strategies in view of the increasing prices. The issue of energy security and broad-basing the energy portfolio has become every country’s priority.
Natural gas, accounting for 24 percent of the total global primary energy supply, is the third largest contributor to the global energy basket. Natural gas consumption is expected to increase at an average of 2.4 percent per year from 2003 to 2030 as per. Among the end-use sectors, the industrial sector remains the largest consumer of natural gas worldwide, accounting for 52 percent of the total incremental demand for natural gas between 2003 and 2030. Natural gas is also expected to remain an important energy source in the electric sector, particularly for new generating capacity.

In a global context the natural gas era has truly begun during the last five years. With cross border gas trade becoming a Hobson’s choice for gas producers who aspire to achieve real business growth, the global gas markets are fast integrating, the commercial models are undergoing rapid changes and the market structures are evolving and fast changing. More importantly, the Asian gas markets are leading the growth in global gas sector, with special investment focus on countries like India and China.

Integration of Global Gas Markets has by far been the most significant development during the period 2002-07. LNG has been one of the key drivers of this integration. With an almost 75 percent increase in liquefaction capacities from 87 MMTPA to more than 150 MMTPA over the past 10 years, the share of LNG in global gas trade has grown from 14 percent to 26 percent. This has also been supported by the fact that there is a continuous lowering of cost across the LNG value chain, which has transformed the LNG economics. This has contributed to establishing LNG as a major viable and flexible option. By meeting the buyers’ expectations through price and contractual flexibilities, price review option and destination flexibility, LNG trading has emerged as a truly global and mature business.

At the same time, trans-national gas pipelines have continued to be a dominant gas supply option, especially between contiguous nations, and have emerged as a dominant integrating factor. The Russia–Poland–Central Europe pipeline, the Blue Stream project connecting Russia and Turkey via the Black Sea, the idea of a Northern Trans–Europe Gas pipeline connecting Russia to Finland and the UK via the Baltic Sea indicate the integration on the European side. On the Asian side, the Iran-
Pakistan-India Pipeline, the Myanmar-India Pipeline and the Turkmenistan-Afghanistan-Pakistan-India Pipeline are receiving the highest attention from the concerned Governments. The implications of this integration through global gas trades, propelled by the many factors mentioned above, are far reaching - economically, strategically and, indeed, politically too.

The most integrated gas market today is the European market. The effective integration of sources and markets in Europe not only resulted in physical demand being met but also ensured the lowest gas prices amongst the gas importing nations. The European Union (EU) Gas Directive took decisive shape during 2002-07, driving the gas market reforms of the member nations. The Energy Charter Treaty Secretariat based in Belgium has been playing an active role in enabling smooth trade among the EU Nations.

The focus now is on the integration of the Asian markets, which would provide the major platform for growth for the global gas sector. Asia today accounts for 70 percent of the total LNG trade; Japan and Korea are meeting their entire gas requirement through imports. Natural gas accounts for 3 percent of China’s primary energy consumption and 9 percent of that of India. These two countries today account for less than 3 percent of the global gas consumption. But, with greater integration of the natural gas markets at a global level, the share of natural gas consumption in China and India together is expected to account for more than 17 percent of the total global natural gas consumption by the year 2020 as has been reported in the Energy Intelligence Agency Global Energy Forecast 2004. Therefore, the next 15 years should be very exciting years for both India and China for the development of their gas sectors through integration with global gas markets.

Oil and gas policy, a subset of energy policy, will follow from the assessment of available domestic resources, requirements of growing economy, needs of the citizens, and the emerging global environment. Towards this end, the action taken by the Planning Commission in finalizing the report of the Integrated Energy Policy (IEP) wherein the assessment of the resources and their likely availability of supplies have been dealt with in details.
2.3 Oil refinery in India

2.3.1 Overview

India was the fourth-largest energy consumer in the world after China, the United States, and Russia in 2011, and its need for energy supply continues to climb as a result of the country’s dynamic economic growth and modernization over the past several years. India’s economy has grown at an average annual rate of approximately 7% since 2000, and it proved relatively resilient following the 2008 global financial crisis.

The latest slowdown in growth of emerging market countries and higher inflation levels, combined with domestic supply and infrastructure constraints, have reduced India’s annual inflation-adjusted gross domestic product (GDP) growth from a high of 10.3% in 2010 to 4.4% in 2013, according to the International Monetary Fund (IMF). India was the third-largest economy in the world in 2013, as measured on a purchasing power parity basis. Risks to economic growth in India include high debt levels, infrastructure deficiencies, delays in structural reforms, and political polarization between the country’s two largest political parties, the Indian National Congress and the Bharatiya Janata Party (BJP).

2.3.2 Petroleum and other liquid production and consumptions

Figure 2.3.2
India petroleum and other liquid production and consumption
India was the fourth-largest consumer of oil and petroleum products after the United States, China, and Japan in 2013, and it was also the fourth-largest net importer of crude oil and petroleum products. The gap between India’s oil demand and supply is widening, as demand reached nearly 3.7 million barrels per day (bbl/d) in 2013 compared to less than 1 million bbl/d of total liquids production. EIA projects India’s demand will more than double to 8.2 million bbl/d by 2040, while domestic production will remain relatively flat, hovering around 1 million bbl/d. The high degree of dependence on imported crude oil has led Indian energy companies to diversify their supply sources. To this end, Indian national oil companies (NOCs) have purchased equity stakes in overseas oil and gas fields in South America, Africa, Southeast Asia, and the Caspian Sea region to acquire reserves and production capability. However, the majority of imports continue to come from the Middle East, where Indian companies have little direct access to investment.

2.3.3 India crude oil production by region

According to the *Oil & Gas Journal* (OGJ), India held nearly 5.7 billion barrels of proved oil production at the beginning of 2014. About 52% of reserves are onshore resources, while 48% are offshore. Most reserves are found in the western part of India, particularly the Western offshore area near Gujarat and Rajasthan.

![India crude oil production by region](image)
### 2.3.4 Sector wise crude refining capacity in India

<table>
<thead>
<tr>
<th>Refinery location</th>
<th>Name of company</th>
<th>Crude refining capacity (1,000 barrels/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barauni, Bihar</td>
<td>Indian Oil Corp. Ltd.</td>
<td>120</td>
</tr>
<tr>
<td>Bongaigaon, Assam</td>
<td>Indian Oil Corp. Ltd.</td>
<td>47</td>
</tr>
<tr>
<td>Digboi, Assam</td>
<td>Indian Oil Corp. Ltd.</td>
<td>13</td>
</tr>
<tr>
<td>Guwahati, Assam</td>
<td>Indian Oil Corp. Ltd.</td>
<td>20</td>
</tr>
<tr>
<td>Haldia, West Bengal</td>
<td>Indian Oil Corp. Ltd.</td>
<td>151</td>
</tr>
<tr>
<td>Koyali, Gujarat</td>
<td>Indian Oil Corp. Ltd.</td>
<td>275</td>
</tr>
<tr>
<td>Mathura, Uttar Pradesh</td>
<td>Indian Oil Corp. Ltd.</td>
<td>160</td>
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<tr>
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<td>Indian Oil Corp. Ltd.</td>
<td>301</td>
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<tr>
<td>Mahul, Mumbai</td>
<td>Hindustan Petroleum Corp. Ltd.</td>
<td>131</td>
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<td>Visakhapatnam, Andhra Pradesh</td>
<td>Hindustan Petroleum Corp. Ltd.</td>
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<tr>
<td>Mahul, Mumbai</td>
<td>Bharat Petroleum Corp. Ltd.</td>
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<tr>
<td>Kochi, Kerala</td>
<td>Bharat Petroleum Corp. Ltd.</td>
<td>191</td>
</tr>
<tr>
<td>Manali, Chennai</td>
<td>Chennai Petroleum Corp. Ltd.</td>
<td>211</td>
</tr>
<tr>
<td>Nagapattinam, Tamil Nadu</td>
<td>Chennai Petroleum Corp. Ltd.</td>
<td>20</td>
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<tr>
<td>Numaligarh, Assam</td>
<td>Numaligarh Refinery Ltd.</td>
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<tr>
<td>Mangalore, Karnataka</td>
<td>Mangalore Refinery &amp; Petrochemicals Ltd.</td>
<td>302</td>
</tr>
<tr>
<td>Tatipaka, Andhra Pradesh</td>
<td>Oil &amp; Natural Gas Corp. Ltd.</td>
<td>1</td>
</tr>
<tr>
<td><strong>Joint-Venture</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bina, Madhya Pradesh</td>
<td>Bharat-Oman Refinery Ltd.</td>
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<tr>
<td>Bathinda, Punjab</td>
<td>HPCL-Mittal Energy Ltd.</td>
<td>180</td>
</tr>
<tr>
<td><strong>Private Sector</strong></td>
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<td>Jamnagar</td>
<td>Reliance Industries Ltd.</td>
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</tr>
<tr>
<td>SEZ, Jamnagar</td>
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<tr>
<td>Vadinar, Gujarat</td>
<td>Essar Oil Ltd.</td>
<td>405</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>4351</strong></td>
</tr>
</tbody>
</table>
2.3.5 Role of Oil and Natural Gas Industry in India GDP

i. India is the 6th largest consumer of petroleum

ii. By the year 2010, India is expected to rank 4th in terms of consumption of energy

iii. The contribution of the Indian Oil and Natural Gas Industry is nearly US$13.58 billion

iv. All of the oil refineries in India, apart from two are operated by the states

v. The total refinery output in the period 2005-06 was 130.11 million tonnes

vi. The growth rate of the refinery output was increased by 2.1% in the year 2005-06

vii. The crude oil output at the end of 2006-07 was 33.98 million tonnes

viii. The growth rate of the crude oil output was increased by 5.6% in the year 2006-07

ix. The production of natural gas in the year 2006-07 was 31.55 billion cubic meters

x. Indian petroleum demand depends highly on import of oil and natural gas

xi. Around 70% of the demands are fed by the imports of oil and natural gas

xii. The security pertaining to energy has become one of the primary concerns of the Central Government

xiii. Presently India is trying to grab a share of the oil and gas fields from Central Asia to Myanmar and Africa

xiv. The area of interest for the Indian Oil and Natural Gas Industry is to search for petroleum in both offshore and onshore blocks

2.4 Oil refineries: History, process and product

➤ History

Samuel M. Kier, a native of southwestern Pennsylvania, was the first person to refine crude oil. In the mid-1840s, he became aware of crude oil through his salt business. Occasionally, wells drilled for salt water would produce foul-smelling petroleum alongside the brine. For many in the salt business, the oil was a nuisance, and they were content to burn it or allow it to run off into nearby waterways.
However, Kier was an entrepreneur, and he believed that he could turn the oily by-product of his salt wells into something of value.

Kier first used the flammable oil produced by his salt wells to light his salt works at night. The burning crude produced an awful smell and a great deal of smoke. Nevertheless, Kier was able to light his business without paying for an expensive illuminant like whale oil. Next, Kier packaged pure crude oil in half-pint bottles for sale as a medicine. A bottle of Kier’s Petroleum sold for 50 cents. Kier employed a workforce of salesmen who traveled the countryside in colorful wagons advertising and marketing his medicinal product. Later, he sold Kier’s Petroleum exclusively through drug stores. However, by 1852, oil’s medicinal fad had faded, and Kier needed another way to make his oil useful and valuable.

Kier knew crude oil would burn and thought that it could make a good and inexpensive lamp oil. However, the smell and smoke that burning oil produced made it hard to sell as an illuminant. In 1849, Kier took samples of his crude oil to Philadelphia where they were analyzed by Professor James C. Booth, a chemist. Booth agreed that crude oil could be used for illumination, but that it needed to be distilled or refined to get the best burning fluid. Thus, in 1850, Kier started experimenting with distillation and became the first person in the U.S. to attempt to use liquid petroleum as a starting material to produce lamp oil. His refining experiments were successful and by 1851, Kier produced a product called Carbon Oil, a fuel oil which burned with little smoke and odor. He sold his Carbon Oil for $1.50 a gallon.

In partnership with John T. Kirkpatrick, Kier created the first U.S. petroleum refinery in Pittsburgh, Pennsylvania. He started with a small one or two-barrel still, but by 1854, he had a larger five-barrel still in operation. When Edwin L. Drake struck oil near Titusville, Pennsylvania in 1859, the market became flooded with oil, and Pittsburgh saw seven new oil refineries come into operation. By the end of the 1860s, there were 58 refineries operating in Pittsburgh alone. Samuel M. Kier spent a great deal of his life trying to make crude oil useful and valuable and along the way he gave birth to the U.S. refining industry.

➢ The Process of Refining Crude Oil

In the early days of the oil industry, the methods for refining oil were very different than the methods we use today. People like Samuel M. Kier used horizontal
cylindrical stills that only held 5 to 6 barrels of oil at a time. Using the stills, refiners were able to raise the temperature of the oil very slowly. As the temperature rose, they removed the distillates like gasoline for which they had no use, procuring only the lamp oil or kerosene. Over time, oil’s other distillates became useful and the refining process evolved.

Today, pipelines, railroads, tankers, and trucks transport crude oil to refineries where it is transformed into the products we use every day. Oil refineries seem like they would be dirty places, but most governments have placed restrictions on how refineries dispose of waste products and what they can emit into the air. There are many environmental programs that have made oil refining a safer, cleaner industry.

Once it enters the modern refinery, crude oil goes through a process called fractional distillation. This process separates the different components of crude oil so that they can be further refined. Fractional distillation begins when the crude oil, which is a mixture of different hydrocarbons, is put into a high-pressure steam boiler. This is a tank that makes the oil boil and turn to vapor, much like boiling water turns into water vapor. The crude oil is heated to temperatures up to 1112° Fahrenheit.

After the oil becomes vapor, it enters the bottom of the distillation column through a pipe. The distillation column is a tall tank that contains many plates or trays. The vapor rises in the column, cooling as it rises. The specific vapors cool at their boiling points and condense on the plates or trays in the column. Much like water condensation on the outside of a cold glass, the vapors turn into liquid fractions as they condense. The liquid fractions flow through pipes and are collected in separate tanks. The fractions include gases, naphtha, gasoline, kerosene, diesel fuel, lubricating oils, heavy oils, and other materials.

From here, the liquid fractions are transported to other areas of the refinery for further processing.

Products from Petroleum

The products refined from the liquid fractions of crude oil can be placed into ten main categories. These main products are further refined to create materials more common to everyday life. The ten main products of petroleum are:

Asphalt

Asphalt is commonly used to make roads. It is a colloid of asphaltenes and maltenes that is separated from the other components of crude oil by fractional
distillation. Once asphalt is collected, it is processed in a de-asphalting unit, and then goes through a process called “blowing” where it is reacted with oxygen to make it harden. Asphalt is usually stored and transported at around 300° Fahrenheit.

**Diesel**

Diesel is any fuel that can be used in a diesel engine. Diesel is produced by fractional distillation between 392° Fahrenheit and 662° Fahrenheit. Diesel has a higher density than gasoline and is simpler to refine from crude oil. It is most commonly used in transportation.

**Fuel Oil**

Fuel oil is any liquid petroleum product that is burned in a furnace to generate heat. Fuel oil is also the heaviest commercial fuel that is produced from crude oil. The six classes of fuel oil are: distillate fuel oil, diesel fuel oil, light fuel oil, gasoil, residual fuel oil, and heavy fuel oil. Residual fuel oil and heavy fuel oil are known commonly as navy special fuel oil and bunker fuel; both of these are often called furnace fuel oil.

**Gasoline**

Almost half of all crude oil refined in the United States is made into gasoline. It is mainly used as fuel in internal combustion engines, like the engines in cars. Gasoline is a mixture of paraffins, naphthenes, and olefins, although the specific ratios of these parts depend on the refinery where the crude oil is processed. Gasoline refined beyond fractional distillation is often enhanced with iso-octane and ethanol so that it is usable in cars. Gasoline is called different things in different parts of the world. Some of these names are: petrol, petroleum spirit, gas, petrogasoline, and mogas.

**Kerosene**

Kerosene is collected through fractional distillation at temperatures between 302° Fahrenheit and 527° Fahrenheit. It is a combustible liquid that is thin and clear. Kerosene is most commonly used as jet fuel and as heating fuel. In the early days of oil, kerosene replaced whale oil in lanterns. In the early 21st century, kerosene was used to power New York City Transit buses. Now, kerosene is used as fuel in portable stoves, kerosene space heaters, and in liquid pesticides.

**Liquefied Petroleum Gas**

Liquefied petroleum gas is a mixture of gases that are most often used in heating appliances, aerosol propellants, and refrigerants. Different kinds of liquefied petroleum gas, or LPG, are propane and butane. At normal atmospheric pressure,
liquefied petroleum gas will evaporate, so it needs to be contained in pressurized steel bottles.

**Lubricating Oil**

Lubricating oils consist of base oils and additives. Mineral oils are manufactured by special processes called: solvent extraction, catalytic dewaxing, hydro cracking, and is hydrometerization. Different lubricating oils are classified as paraffinic, naphthenic, or aromatic. Lubricating oils are used between two surfaces to reduce friction and wear. The most commonly-known lubricating oil is motor oil, which protects moving parts inside an internal combustion engine.

**Paraffin Wax**

Paraffin wax is a white, odorless, tasteless, waxy solid at room temperature. The melting point of paraffin wax is between 117° Fahrenheit and 147° Fahrenheit, depending on other factors. It is an excellent electrical insulator, second only to Teflon®, a specialized product of petroleum. Paraffin wax is used in drywall to insulate buildings. It is also an acceptable wax used to make candles for the Jewish Menorah.

**Bitumen**

Bitumen, commonly known as tar, is a thick, black, sticky material. Refined bitumen is the bottom fraction obtained by the fractional distillation of crude oil. This means that the boiling point of bitumen is very high, so it does not rise in the distillation chamber. The boiling point of bitumen is 977° Fahrenheit. Bitumen is used in paving roads and waterproofing roofs and boats. Bitumen is also made into thin plates and used to soundproof dishwashers and hard drives in computers.

**Petrochemicals**

Petrochemicals are the chemical products made from the raw materials of petroleum. These chemicals include: ethylene, used to make anesthetics, antifreeze, and detergents; propylene, used to produce acetone and phenol; benzene, used to make other chemicals and explosives; toluene, used as a solvent and in refined gasoline; and xylene is used as a solvent and cleaning agent.

**2.5 Supply chain management of oil industry**

The petroleum industry plays an important role in the economic development of the country. Performance of its supply chain has become very important. The
The petroleum industry traditionally had prices decided by the Government of India. Effective from August 1, 2004, the Government put in a revised methodology allowing oil companies to revise the prices of motor spirit and High Speed Diesel (HSD). The total investment estimated in the petroleum sector from 1995 till 2010, is expected to be Rs. 4,32,000 cr (US$120 bn), out of which Rs. 2,58,000 cr (US$80 bn), are for the upstream sector alone. Petrochemical industry in India employs around 40,000 people directly and around 4 lakh indirectly.

2.5.1 Upstream

- **Exploration and production**

In 1997-98, the New Exploration Licensing Policy (NELP) was envisioned to deal with the ever-growing gap between demand and supply of gas in India. As per a recent report, the oil and gas industry in India is anticipated to be worth US$ 139,814.7 million by 2015. With India’s economic growth closely linked to energy...
demand, the need for oil and gas is projected to grow further, rendering the sector a fertile ground for investment.

To cater to the increasing demand, the Government of India has adopted several policies, including allowing 100 per cent foreign direct investment (FDI) in many segments of the sector, such as natural gas, petroleum products, and refineries, among others. The government’s participation has made the oil and gas sector in the country a better target of investment. Today, it attracts both domestic and foreign investment, as attested by the presence of Reliance Industries Ltd (RIL) and Cairn India.

2.5.2 Downstream

➢ Refining

The Indian refining industry has come a long way since the Mumbai refinery of HPCL was set up post independence. Over the years, the PSU refineries have gradually increased their capacities at existing locations or constructed Greenfield refineries at new locations. Today there are around 20 refineries in the country with an existing refining capacity of about 178 mn tones per annum (mtpa). Moreover, even large expansions are being planned by Essar and PSUs like IOL, BPCL and HPCL. The major expansion plans include the Vadinar refinery of Essar, the IOC refinery at Paradeep and the planned refineries at Bina in Madhya Pradesh by BPCL and Bhatinda in Punjab by HPCL-Mittal Energy. This coupled with lower capital costs as compared to other Asian countries are expected to enable India to emerge as the global hub for oil refining. Besides, the ability of the latest refineries to process heavy, low-grade crude as well as India’s closeness to other oil-producing regions of the Middle East are expected to further help in this regard.

➢ Marketing

In India, PSUs such as IOC, BPCL and HPCL are involved in marketing of refined oil. Decontrolling of the marketing sector from April 1, 2002 facilitated the entry of new private sector players such as Essar Oil, RIL and Royal Dutch Shell Plc. Public Sector Oil Marketing Companies like IOC, BPCL, and HPCL are also engaged
in marketing of subsidized LPG in the country under the Public Distribution System (PDS).

The entire length and breadth of the country is covered through an elaborate and extensive network of 35,066 retail outlets as on 01-Apr-09. As on 01-Apr-09, there existed 9,366 LPG distributorships and 6,614 superior kerosene oil/light diesel oil (SKO/LDO) dealerships. An ambitious programme for modernization of retail outlets to bring them at par with international standards has been initiated by the oil industry. The supply of oil and gas is carried out through railways (40%), pipelines (30%), coastal tankers (12%) and road (18%). Requirements of the industrial units are met through direct supplies. Further, a National Gas Grid is also planned.

- **Distribution**

  Distribution of petroleum products and natural gas in India is carried through a vast network of pipeline infrastructure. In India had a network of 25 product pipelines with a length of 9,893 km and a capacity to carry 63.66 MMTPA of petroleum products and 3 LPG pipelines with a length of 2,124 km and capacity to carry 4.53 MMTPA of products in place. Moreover, there are 4 crude oil pipelines of 5,559 km with a capacity to transport 45.88 MMTPA.

- **Market size**

  During the year 2014, the total consumption of petroleum products in India was 158.2 million tons (MT). The share of fuels in the country's exports surged from 5.59 per cent in 2003-04 to 20.05 per cent during 2013-14. Total exports of fuel products amounted to US$ 62.69 billion in value terms during the year 2014.

  India is the fourth-largest consumer of oil and petroleum products in the world. Its energy demand is projected to touch 1,464 million tons of oil equivalents) by 2035 from 559 million tons in 2011. Furthermore, the country’s share in global primary energy consumption is anticipated to double by 2035.

  Oil consumption is estimated to reach 4 million barrels per day in the year 2016, expanding at a compound annual growth rate (CAGR) of 3.2 per cent during the year 2008-16.
Investments

According to data released by the Department of Industrial Policy and Promotion (DIPP), the petroleum and natural gas sector attracted foreign direct investment (FDI) worth Rs 31,501.55 crores (US$ 5.13 billion) between April 2000 and July 2014.

Reliance Industries Ltd (RIL) plans to invest US$ 2 billion in its three shale assets in the US. RIL has already invested US $7.3 billion since 2010 towards development of shale gas and oil in the US market. The company also, along with its partner British Petroleum (BP), plans to invest about Rs 800 crores (US$ 130.35 million) for exploratory drilling in an offshore block in the Bay of Bengal. RIL is the operator of the offshore block CY-DWN-2001/2, also known as CY-III-D5, with 70 per cent equity, with BP holding the remaining stake. BP's contribution to the investment would be Rs 240 crores (US$ 39.11 million).

ONGC Videsh Ltd (OVL) has signed Production Sharing Contracts (PSCs) for two blocks in Myanmar. The contracts were signed between OVL, Myanmar Oil & Gas Enterprises Ltd (MOGE), National Oil Company of Myanmar, and Machine & Solutions Co Ltd (M&S). ONGC will also invest over Rs 5,700 crores (US$ 928.73 million) to push up production by 6.9 MT of crude oil and 5 billion cubic meters (bcm) of gas by 2030 from its Mumbai High (North) oil and gas field.

Larsen & Toubro has won an order worth Kuwaiti Dinar 239.7 million from the Kuwait Oil Company (KOC). L&T arm - L&T Hydrocarbon will carry out the order that entails engineer-procure-construct work for a gathering centre for KOC, a subsidiary of Kuwait Petroleum Corporation.

Indian Oil Corporation Ltd (IOCL) through its wholly owned affiliate India Oil Montney Ltd, Canada, has signed transaction agreements with Progress Energy Canada Ltd and PETRONAS Carigali Canada for acquiring a 10 per cent interest in Progress Energy Canada’s LNG-destined natural gas reserves in northeast British Columbia and the proposed Pacific Northwest LNG Ltd (PNW LNG) export facility in Canada’s West Coast.
GAIL (India) Ltd has entered into an agreement with Japan-based Chubu Electric Power Co for collaboration in the area of joint LNG procurement. Additionally, the two companies will look to work together on shipping optimization.

India and Azerbaijan have proposed to form a joint working group in the field of hydrocarbon. The two countries have agreed to explore opportunities for partnership in renewable energy sector, energy efficiency and numerous upcoming projects in petro-chemicals, oil and gas, pipelines, etc., in India, Azerbaijan or other countries, in collaboration or JV.

➢ Government Initiatives

Mr. Kazuyoshi Akaba, State Minister of Economy, Trade and Industry, Japan, met Mr. Dharmendra Pradhan, Minister of State (Independent Charge) for Petroleum and Natural Gas, India. Mr. Pradhan suggested taking the strong Indo-Japan bond to a higher level stating that Japan has inspired India in manufacturing, technology and philosophy of governance.

The expert appraisal committee of Ministry of Environment and Forests, Government of India, has given the go ahead to IOCL’s Rs 4,320 crores (US$ 703.81 million) liquefied natural gas (LNG) terminal project at Ennore, near Chennai. The proposed facility’s capacity will be five million tons per annum (MTPA). The terminal is expandable to 10-15 MTPA. This is part of the corporation’s Rs 56,000 crores (US$ 9.12 billion) investment plan for the 12th Five-Year Plan (2012-17).

2.6 Oil and gas India: The milestones (2000-2012)

➢ Upstream

2000: GoI shares in Lubrizol India Ltd were acquired, and the company became a 50:50 joint venture between Indian Oil and the Lubrizol Corporation of the USA. They entered oil exploration and production as consortium partners with an award of two blocks under NELP-I. ONGC and IOC proposed a strategic partnership by way of setting up an independent corporate entity for exploration and production of hydrocarbons and refining and marketing abroad. ONGC signed a Memorandum of Understanding (MoU) with Venezuelan oil major Patrols for joint efforts in upstream
activities. ONGC and Reliance joined hands with Algeria's Sonatrach to secure an oil field in Iraq for crude oil production. ONGC and Bombay Suburban Electric Supply (BSES) signed an MoU wherein natural gas from an oil well–75 km north of Bombay High–was to be supplied exclusively to BSES.

**2000-01:** NELP-II: Under the second round of the New Exploration Licensing Policy, the GoI invited bids on 15 December 2000 for 25 blocks for exploration of oil and natural gas. Of these, 8 blocks were deepwater, 8 shallow offshore and 9 onland. In March 2001, PSCs were signed for 23 exploration blocks (8 deepwater, 8 shallow offshore and 7 onland).

**2001:** Eight exploration blocks and two CBM blocks were awarded to an Indian Oil-led consortium under NELP-II and CBM-I respectively. Indian Oil Mauritius Ltd (IOML) was incorporated as the first overseas subsidiary. ONGC tied up with IOC for undertaking oil exploration for eight deepwater blocks under NELP-II. The tie-up aimed at reducing financial risks involved in deepwater exploration. ONGC also entered the refining sector with the commissioning of the Tatipaka mini-refinery in East Godavari district.

**2002:** NELP-III: Under the third round of the New Exploration Licensing Policy, the GoI invited bids for 27 blocks for exploration of oil and natural gas. Of these, 9 blocks were deepwater, 7 shallow offshore and 11 onland. PSCs were signed for 23 exploration blocks (9 deepwater, 6 shallow offshore and 8 onland). ONGC decided to offer equity to international oil majors following which the company would enter into agreements for deepwater exploration. ONGC Videsh tied up with Talisman Energy Increase of Canada for the purchase of 25 percent interest in the Greater Nile project in Sudan with oil reserves of 150 MMT. Reliance announced India's biggest gas discovery (in the Krishna-Godavari Basin in Andhra Pradesh) in nearly three decades and one of the largest gas discoveries in the world during this year. The in-place volume of natural gas was in excess of 198.22 BCM, equivalent to about 1.2 billion barrels of crude oil. This was the first ever discovery by an Indian private sector company. Reliance acquired control of Indian Petrochemicals Corporation Limited (IPCL)–India's second largest petrochemicals company. The merger of Reliance
Petroleum Limited with Reliance Industries Limited (RIL) was announced. Reliance Industries became the largest private sector company in India on all major financial parameters including sales, profits, net worth, assets, and exports.


2003: NELP-IV: Under the fourth round of the New Exploration Licensing Policy, the GoI invited bids on 8 May for 24 blocks for exploration of oil and natural gas. Of these, 12 blocks were deepwater, 1 shallow offshore and 11 onland. PSCs were signed for 20 exploration blocks. ONGC discovered major oil and gas fields at five new locations. ONGC received the first consignment of its equity oil from the Greater Nile project in Sudan, the first ever shipment of Indian crude from a foreign field. GAIL had initial success in the form of a significant gas find in the A-1 block in Myanmar and with the discovery of oil and gas in the Cambay Block. The Vizag- Secunderabad LPG pipeline, a 580-km pipeline with a maximum throughput of 1.16 Million Metric Tonnes Per Annum (MMTPA) was completed.

2004: ONGC launched a deepwater campaign named "Sagar Sammridhi". It struck oil in the Bassein offshore field. It decided to float a special economic zone (SEZ) at Dahej, Gujarat in joint collaboration with the Gujarat Industrial Development Corporation (GIDC). ONGC also discovered gas reserves at Khedabari village in Sonamura sub-division of West Tripura district with a production capacity of over 0.2 million cubic metres per day.

Reliance Industries Limited (RIL) emerged as the 'Petrochemicals Company of the Year' at the prestigious sixth annual Platts Global Energy Awards ceremony in New York, USA. Reliance announced it had struck gas off the Orissa coast in the Bay of Bengal. In January, Cairn added the Mangala oil field in Rajasthan to its assets and this, along with the other discoveries in Rajasthan, are expected to form the core of future developments in India.
2005: NELP-V: Under the fifth round of the New Exploration Licensing Policy, the GoI invited bids for 20 blocks for exploration of oil and natural gas. Of these, 6 blocks were deepwater, 2 shallow offshore and 12 on land. PSCs were signed for all 20 exploration blocks. IOC signed an exploration and production sharing agreement with the National Oil Corporation of Libya for a block in the Sirte Basin of Libya.

2006: NELP-VI: A total of 55 blocks were offered during the NELP-VI round for exploration of oil and natural gas in 16 prospective sedimentary basins which consisted of 25 on land, 6 shallow water and 24 deepwater blocks. 165 bids were received from 68 E&P companies (36 foreign and 32 Indian) participating in the bidding process as consortiums/individually. PSCs were signed for 52 exploration blocks (21 deepwater, 6 shallow water and 25 inland).

2007: NELP-VII: A total of 57 blocks were offered during the NELP-VII round for exploration of oil and natural gas in 18 prospective sedimentary basins consisting of 29 on land, 9 shallow water and 19 deepwater blocks. Contracts were signed for 41 blocks out of which 11 were deepwater blocks, 7 shallow water blocks and 23 on land blocks. ONGC signed a MoU with a global oil major, BP, to collaborate in the E&P business in India and abroad.

2008: ONGC started drilling in the Cauvery deepwater block. ONGC and Rocksource signed an Agreement for Partnership in Deepwater Block.

2009: ONGC reported a gas discovery in the west Tripura block in the Assam Arakan Basin. ONGC achieved all-time record in oil and gas production. It awarded a contract worth over Rs 7.53 billion to a UAE-based company. RIL joined the league of global deepwater oil and gas operators after it started producing sweet crude of 420 API.

2010: NELP-VIII: Under the eighth round of the New Exploration Licensing Policy (NELP-VIII), the Indian government signed 31 PSCs on 30 June. It included 8 deepwater blocks, 11 shallow water blocks and 12 onland blocks; these last are in the states of Assam (2), Gujarat (8), Madhya Pradesh (1) and Manipur (1). GAIL was ranked the No.1 company among gas utilities in Asia in the Platts Global Ranking.
During the year, RIL and BP announced a strategic partnership in the oil and gas business. This partnership consisted of BP taking a 30 percent stake in 23 oil and gas PSCs that Reliance operated in India, including the KG-D6 block, and the formation of a joint venture (50:50) for sourcing and marketing gas in India.

2011: GAIL acquired a 20 percent stake in the Houston-based Carrizo Oil and Gas's Eagle Ford shale acreage, the first instance of a PSU acquiring shale assets in the USA. A wholly-owned subsidiary company, GAIL Global (USA) Inc., was formed in Houston, and an office was opened. The office of GAIL Global (Singapore) Pte Ltd opened in Singapore.

2012: NELP-IX: Under the ninth round of the New Exploration Licensing Policy (NELP-IX), the Indian government signed 13 Production Sharing Contracts on 28 March for 2 shallow water blocks and 11 on land blocks, in the states of Assam (2), Gujarat (6), Madhya Pradesh (2) and Rajasthan (1) and in the basins of Gujarat-Kutch (2), Assam-Arakan (2), Cambay (6), Rajasthan (1) and Vindhyan (2).

2012-13: Cairn India became one of the largest independent oil and gas exploration and production companies in India with a market capitalization of US$ 10 billion. Cairn India was rated as the fastest growing energy company in the world, as per the 2012 & 2013 Platts Top 250 Global Energy Company Rankings.

➢ Downstream

2000: Reliance Petroleum and Indian Oil presented a proposal to the Ministry of Petroleum and Natural Gas involving the formation of a new joint venture company to execute the Rs 44 billion Central Indian pipeline. IOC introduced an interactive voice recording system for its Indane LPG customers. This facilitated round-the-clock service to customers.

2001: ONGC also entered the refining sector with the commissioning of the Tatipaka mini-refinery in the East Godavari district. GAIL's Jamnagar-Loni LPG Pipeline Project, the world's longest and India's first cross-country LPG pipeline was commissioned. The Digboi Refinery completed 100 years of operation.
2002: Lanka IOC Pvt Ltd (LIOC) was incorporated as a wholly-owned subsidiary. A branchline on Barauni-Kanpur product pipeline to Lucknow was commissioned. The Haldia-Barauni crude oil pipeline was augmented from 4.2 to 7.5 MMTPA. Reliance acquired control of Indian Petrochemicals Corporation Limited (IPCL) India's second largest petrochemicals company.

2002-03: After taking over MRPL from the A V Birla Group, ONGC diversified into the downstream sector and ONGC entered the retailing business.

2003: IOC's LIOC commenced retail operations in Sri Lanka and became the first Indian petroleum company to begin downstream marketing operations overseas. Gasohol, 5 percent ethanol-blended petrol, was introduced in select states. Reliance's refinery at Jamnagar was ranked best in the Shell Benchmarking for the third consecutive year in 'Energy and Loss' performance from amongst 50 refineries worldwide. Reliance struck oil in an onshore block in Yemen, where it had an equity oil position.

2004: LIOC created history on the Colombo Stock Exchange as the biggest ever equity issue in Sri Lanka. The IPO offered a 25 percent stake and was oversubscribed 11.6 times on the first day. The world's largest single train kerosene-to-LAB (Linear Alkyl Benzene) plant was commissioned in Gujarat, signalling Indian Oil's entry into petrochemicals. Indian Oil paid the highest-ever dividend of 200 percent (for the fiscal year 2003), amounting to Rs 24.53 billion, to shareholders. The concept of branded retail outlets and customer service under an umbrella brand, “XTRA”, was launched. The Panipat-Rewari product pipeline was commissioned. GAIL's Dahej-Vijaipur natural gas pipeline was commissioned. A wholly-owned subsidiary company GAIL Global (Singapore) Pte Ltd was formed in Singapore. Platts declared GAIL the first among Global Gas Utilities based on Return on Invested Capital (ROIC) in its worldwide survey of the Top 250 Energy Companies in this year. Tripura Natural Gas Co. Ltd., a JV for city gas projects in Tripura, and UP Central Gas Ltd., a JV for city gas projects with BPCL in Kanpur, were incorporated. GAIL acquired a 15 percent equity stake in NatGas, Egypt.

2005: The Mathura Refinery became the first Indian refinery to produce Euro-III compliant diesel with the commissioning of a diesel hydrotreater.
**2006:** Indian Oil Blending Ltd (IOBL) merged with its parent company. Indian Oil Panipat Refinery capacity was enhanced from 9 to 12 MMTPA. The Chennai-Trichy-Madurai product pipeline was dedicated to the nation. The Kandla-Bhatinda product pipeline was converted to crude oil service and renamed the Mundra-Panipat pipeline. Koyali-Dahej pipeline was commissioned for product exports. Indian Oil Sky Tanking Ltd was incorporated as a JV company with Indian Oil Tanking and Sky Tanking, Germany. IOC Middle East FZE incorporated in the UAE as an overseas subsidiary. Suntera Nigeria 205 Ltd incorporated as a JV Company with Oil India and Suntera Resources, Cyprus. GAIL brought India's first spot LNG cargo at Dahej.

**2007:** IOC's Panipat Refinery capacity doubled from 6 to 12 MMTPA. Facilities for handling heavy crude oil were commissioned at Mundra; a branch pipeline was laid from Lasariya to Chittaurgarh on the Sidhpur-Sanganer product pipeline. The concept of 'LNG at the doorstep' was launched for customers located away from gas pipelines. In 2006-07, IOC's turnover crossed the Rs. 2,000 billion mark—the only corporate in India to do so. Brahmaputra Cracker and Polymer Limited, a JV company led by GAIL, was formed for implementing the Assam Gas Cracker Project.

**2008:** The Indian Oil Chairman was elected President of the World LP Gas Association. IOC's First LPG pipeline was commissioned from Panipat to Jalandhar. GAIL incorporated for CGD, and the Dahej-Panvel-Dabhol pipeline was commissioned. GAIL won the rights for rolling out city gas distribution projects in Meerut, Sonepat, Dewas and Kota. Reliance signed an MoU with GAIL to explore opportunities to set up petrochemical plants in feedstock-rich countries. In the Refining & Marketing business, Reliance took over majority control of the Gulf Africa Petroleum Corporation (GAPCO) and started shipping products to the East African markets.

**2009:** With the commissioning of the new refinery in its Special Economic Zone (SEZ), RIL’s Jamnagar refinery became the petroleum hub of the world. With 1.24 million barrels per day of nominal crude processing capacity, it is the single largest refining complex in the world. The 'historic amalgamation' of Bongaigaon Refinery &
Petrochemicals Ltd (BRPL) with the parent company, IndianOil, became effective from 25 March of this year. BRPL was inducted as an Indian Oil Group Company on 29 March 2001. The Paradip-Haldia crude oil pipeline was commissioned, with SPM (Single-Point Mooring). The Mundra-Panipat crude oil pipeline capacity was augmented from 6 to 9 MMTPA. IndianOil- CREDA Bio-fuels Ltd was incorporated as a JV company with Chhattisgarh Renewable Energy Development Agency.

**2011:** GAIL won the rights to lay a 1550-km, $1bn natural gas pipeline from Surat in Gujarat to Paradip in Orissa, connecting the west and east coast.

**2012:** GAIL was ranked the World's No. 1 in Downstream Operations by Platts Global Energy Awards. GAIL signed a 20-year agreement with Sabine Pass Liquefaction LLC, a unit of Cheniere Energy Partners, to supply 3.5 MMPTA of LNG. GAIL became the only company from the Oil and Gas sector to be included in BSE's Greenex, India's first energy-efficient index. GAIL's 2200-km Dahej-Vijaipur-Dadri-Bawana-Nangal-Bhatinda cross-country pipeline was inaugurated by the Prime Minister. A GSPA was signed between GAIL and Türkmengaz for the Turkmenistan-Afghanistan-Pakistan-India (TAPI) Gas Pipeline Project.
### 2.7 Location of oil refineries and capacity in India

<table>
<thead>
<tr>
<th>S. No.</th>
<th>NAME OF THE OIL COMPANY</th>
<th>STATE</th>
<th>LOCATION OF REFINERY</th>
<th>CAPACITY (MMTPA)</th>
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<tbody>
<tr>
<td>1</td>
<td>INDIAN OIL CORPORATION LIMITED (IOCL)</td>
<td>BIHAR</td>
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<td>HARYANA</td>
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<td>ASSAM</td>
<td>GUWHATTI</td>
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<td>ASSAM</td>
<td>ASSAM</td>
<td>DIGBOI</td>
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<td>28</td>
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</table>

PSU: PUBLIC SECTOR UNDERTAKING  
JV: JOINT VENTURE  
PVT: PRIVATE
2.8 Impact of global crisis on the oil industry

Deepening the global financial crises during September 08 and consequent slowdown in global economics had dampening impact on the Indian oil and gas industry. The impact of global financial and economic turmoil on the oil & gas industry in India is as follow:

- The reduction in manufacturing activities in the short term, as companies finding it difficult to raise funds from the debt and equity market.
- The global financial and economic crises had led to the decline in valuation of oil and gas companies which provides Indian companies an opportunity to acquire global assets at cheaper rates or on advantageous terms.
- The global credit crunch coupled with lower global crude oil prices since July 2008 adversely affected the feasibility of expenses ventures such as oil sands and deep-water project.
- With the drying up funds from external as well domestic avenues, financing capex and working capital became key area of concern for Indian oil and gas companies.
- Global oil prices remained highly volatile during 2009. The volatility has become a major challenge for upstream companies, as it impact their strategic decision-making and evaluation processes for the execution of new projects.

2.9 Oil market price chronology

2004 to 2008: rising costs of oil

After retreating for several months in late 2004 and early 2005, crude oil prices rose to new highs in March 2005. The price on NYMEX has been above $50 per barrel since March 5, 2005. In June 2005, crude oil prices broke the psychological barrier of $60 per barrel. After the destruction of Hurricane Katrina in the United States, gasoline prices reached a record high during the first week of September 2005. The average retail price was, on average, $3.04 per U.S. gallon. The average retail price of a liter of petrol in the United Kingdom was 86.4p on October 19, 2006, or $6.13 per gallon. Oil production in Iraq continued to decline as result of the nation's ongoing conflict causing a decrease in production to 1 million barrels per day.
In mid-2006, crude oil was traded for over USD 79 per barrel (bbl), setting an all-time record. The run-up is attributed to a 1.9 increase in gasoline consumption, geopolitical tensions resulting from North Korea's missile launch. The ongoing Iraq war, as well as Israel and Lebanon going to war are also causative factors. The higher price of oil substantially cut growth of world oil demand in 2006, including a reduction in oil demand of the OECD. After news of North Korea's successful nuclear test on October 9, 2006, oil prices rose past $60 a barrel, but fell back the next day.

On October 19, 2007, U.S. light crude rose to $90.02 per barrel due to a combination of ongoing tensions in eastern Turkey and the reducing strength of the U.S. dollar. Prices fell briefly on the expectation of increased U.S. crude oil stocks, however they quickly rose to a peak of $92.22 on October 26, 2007.

On January 2, 2008, U.S. light crude surpassed $100 per barrel before falling to $99.69 due to tensions on New Years Day in Nigeria, and on suspicion that U.S. crude stocks will have dropped for the seventh consecutive week. A BBC report from the following day stated a single trader bid up the price; Stephen Schork, a former floor trader on the New York Mercantile Exchange and the editor of an oil market newsletter, said one floor trader bought 1,000 barrels (160 m³), the smallest amount permitted, and immediately sold it for $99.40 at a $600 loss. Oil fell back later in the week to $97.91 at the close of trading on Friday, January 4, in part due to a weak jobs report that showed unemployment had risen.

On March 5, 2008, OPEC accused the United States of economic "mismanagement" that was pushing oil prices to record highs, rebuffing calls to boost output and laying blame at the George W. Bush administration. Oil prices surged above $110 to a new inflation-adjusted record on March 12, 2008 before settling at $109.92. On April 18, 2008 the price of oil broke $117 per barrel after a Nigerian militant group claimed an attack on an oil pipeline. Oil prices rose to a new high of $119.90 a barrel on April 22, 2008, before dipping and then rising $3 on April 25, 2008 to $119.10 on the New York Mercantile Exchange after a news report that a ship contracted by the U.S. Military Sealift Command fired at an Iranian boat.

On June 6, prices rose $11 in 24 hours, the largest gain in history due to the possibility of an Israeli attack on Iran. The combination of two major oil suppliers
reducing supply generated fears of a repeat of the 1973 oil crisis. The mid-July decision of Saudi Arabia to increase oil output caused little significant influence on prices. According to the oil minister of the Islamic Republic of Iran, Gholam-Hossein Nozari, the world markets were saturated and a Saudi promise of increased production would not lower prices. Several Asian refineries were refusing Saudi petroleum in late June because they were over priced grade.

On July 3, "the Brent North Sea crude contract for August delivery rose to $US145.01 a barrel" in Asian trade. London Brent crude reached a record of $145.75 a barrel, and Brent crude for August delivery peaked to a record $145.11 a barrel on London's ICE Futures Europe exchange, and to $144.44 a barrel on the NYM Exchange. By midday in Europe, crude rose to $145.85 a barrel on the NYME while Brent crude futures rose to a trading record of $146.69 a barrel on the ICE Futures exchange.

2008: oil prices peak and then decline

On July 15, 2008, a bubble-bursting sell-off began after remarks by President Bush the previous day that the ban on oil drilling would be lifted. This precipitated an $8 drop, the biggest since the first US-Iraq war. By the end of the week, crude oil fell 11% to $128, also affected by easing of tensions between the US and Iran. By August 13, prices had fallen to $113 a barrel. By the middle of September, oil price fell below $100 for the first time in over six months, falling below $92 in the aftermath of the Lehman Brothers bankruptcy.

A stronger US dollar and a likely decline in European demand were suggested to be among the causes of the decline. By October 24, the price of crude dropped to $64.15, and closed at $60.77 on November 6. By the end of December, 2008, oil had bottomed out at $32.

2009

In January 2009, oil prices rose temporarily because of tensions in the Gaza Strip. From mid January to February 13, oil fell to near $35 a barrel.
2010

On May 21, 2010, the price of oil had dropped in two weeks from $88 to $70 mainly due to concerns over how European countries would reduce budget deficits; if the European economy slowed down, this would mean less demand for crude oil. Also, if the European economic crisis caused the American economy to have problems, demand for oil would be reduced further. Other factors included the strong dollar and high inventories. According to the U.S. Energy Information Administration, gas prices nationwide averaged $2.91 on May 10, dropping to $2.79 two weeks later. The Deepwater Horizon oil spill was not a factor in gas prices since the well had not produced.

Prices rose back to $90/barrel in December 2010. The US average for a gallon of 87 octane regular unleaded averaged $3.00/gallon on December 23, sparking fear of a second recession if prices reached $100/barrel and $4.00/gallon gasoline, as forecasted for spring 2011. The price increases in December were based on global demand and the Arctic blasts affecting North America and Europe.

2011

Political turmoil in Egypt, Libya, Yemen, and Bahrain drove oil prices to $95/barrel in late February 2011. A few days prior, oil prices on the NYMEX closed at $86. Oil prices topped at $103 on February 24 where oil production is curtailed to the political upheaval in Libya.

Oil supplies remained high, and Saudi Arabia assured an increase in production to counteract shutdowns. Still, the Mideast and North African crisis led to a rise in oil prices to the highest level in two years, with gasoline prices following. Though most Libyan oil went to Europe, all oil prices reacted. The average price of gasoline in the United States increased 6 cents to $3.17. On March 1, 2011, a significant drop in Libyan production and fears of more instability in other countries pushed the price of oil over $100 a barrel in New York trading, while the average price of gas reached $3.37. Despite Saudi promises, the sour type oil the country exported could not replace the more desirable sweet Libyan oil. On March 7, 2011, the average price of gas having reached $3.57, individuals were making changes in their driving.
The weakened U.S. Dollar resulted in a spike to $112/barrel with the national average of $3.74/gallon - with expectations of damaging the U.S. economy suggestive of a long-term recession. As of April 26, the national average was $3.87 - with a fear of $4/gallon as the nationwide average prior to the summer driving season.

The national average rose on May 5, 2011 for the 44th straight day, reaching $3.98. However, that same day, West Texas Intermediate crude fell below $100 a barrel, the lowest since March 16. This came after crude oil for June delivery reached $114.83 on May 2, the highest since September 2008, before closing at $97.18 on May 6, a day after dropping 9 percent, the most dramatic single-day drop in over two years. Gas prices fell slightly on May 6, and experts predicted $3.50 a gallon by summer.

In mid-June, West Texas Intermediate crude for July delivery fell nearly $2 to $93.01, the lowest price since February. The dollar was up and the euro and other currencies down, and the European economic crisis made investors concerned. London Brent crude fell 81 cents to $113.21. On June 15 the Energy Information Association said oil consumption was down 3.5 percent from a year earlier, but wholesale gasoline demand was up for the first time in several weeks. The price of gas on June 17 was $3.67.5 a gallon, 25.1 cents lower than a month earlier but 96.8 cents above a year earlier. On June 24, the price of gas was $3.62.8 and expected to go much lower due to the opening of the Strategic Petroleum Reserve. U.S. oil prices fell below $90 before rising again, and Brent crude fell two percent. However, on June 29, West Texas intermediate crude had risen to $94.96, almost $5 above the lowest point reached after the previous week's action. One reason was the falling dollar, as Greece appeared less likely to default on its debt; concern over the Greek debt crisis had caused falling oil prices. After another week, oil for August delivery had risen from $90.61 to $98.67 and gas prices were up five cents. Increased worldwide demand was one reason. Brent Crude remained high at $118.38 partly due to supply problems in Europe, including lower North Sea production and the continuing war in Libya. On August 4, the price of oil dropped 6 percent to its lowest level in 6 months. On August 5, the price had dropped $8.82 in a week to $86.88 per barrel on the New York Mercantile Exchange. The same pessimistic economic news that caused stock prices to fall also decreased expected energy demand, and experts

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predicted a gas price drop of 35 cents per gallon from the average of $3.70.¹ On August 8, oil fell over 6 percent, in its largest drop since May, to $81, its lowest price of the year. On September 24, oil reached $79.85, down 9 percent for the week, due to concerns about another recession and the overall world economy. The average price of gas was $3.51, with predictions of $3.25 by November, but it was below $3 in some markets. During October, the price of oil rose 22 percent, the fastest pace since February, as worries over the U.S. economy decreased, leading to predictions of $4 by early 2012. As of November 8, the price reached $96.80. Gas prices were not following the increase, due to lower demand resulting from the economy, the normal decrease in travel, lower oil prices in other countries, and production of winter blends which cost less. The average rose slightly to $3.41 but predictions of $3.25 were made.

2012

Shortages of oil could have resulted if Iran closed the Strait of Hormuz, through which one-fifth of exported oil travels, as a result of sanctions due to the country's nuclear policies. The price of oil stayed near $100 throughout January because of concerns over supplies, and the European debt situation. The average price of gas was $3.38 on January 20, up 17 cents from a month earlier. Another factor was planned closing of refineries in the U.S. and Europe due to lower demand. By early February, the national average was $3.48, though oil prices were at $98, the lowest in six weeks, and U.S. demand was the lowest since September 2001. On February 20, benchmark March crude oil reached $105.21, the highest in nine months. This came one day after Iran's oil ministry announced an end to sales to British and French companies; though this would have little actual impact on supplies, fears resulted in higher prices. Also, approval of the bailout plan for Greece was expected, and China's action to raise the money supply was likely to stimulate the economy. Brent crude was up 11 percent for the year to $119.58 on February 17, with cold weather in Europe and higher Third World demand, and West Texas Intermediate crude was up 19 percent to $103.24. The average price of gas was $3.53. On February 29, the average was $3.73. The average peaked at $3.94 early in April, and on April 24, it was $3.85 compared to $3.86 a year earlier; it had been two years since gas prices were lower than the previous year. Crude oil prices were down; West Texas Intermediate was $103.55 a barrel, down from over $107 late in March, and Brent
Crude $118.16 after peaking above $128 in March. On May 7, benchmark U.S. crude reached $95.34, the lowest price of the year, after voters in France and Greece ousted government officials who would cut spending to solve the debt crisis. Benchmark oil in New York actually rose for two days straight early in June, to $84.29. With U.S. oil supplies the highest since 1990, gas reached $3.57 on June 5. After falling again to its lowest price since October 2011, Benchmark crude rose 5.8 percent to $82.18 on June 29, with Brent crude up 4.5 percent to $95.51. European bailout efforts included lending money to banks, decreasing likelihood of failures. Also, European countries decided not to buy Iranian oil. The price of gas was $3.35, the lowest since January 6. On July 17, Benchmark Crude reached $89.22 and Brent crude $104 after good economic news in the United States. Gas rose to $3.40.

On August 7, a California refinery fire contributed to a jump in oil futures. Other refinery problems, a pipeline leak, fears about Iran, the crisis in Syria, North Sea problems, and Tropical Storm Ernesto all contributed to a 20 percent jump in oil prices in six weeks. The price of gas reached $3.63 but was not expected to go much higher. Good economic news in the United States contributed to oil reaching its highest price since May on August 17, with Benchmark Crude reaching $96.01, while Brent crude fell slightly to $113.71. Early in September, a mix of bad economic news from the United States and good economic news from Europe caused the price of oil to fall slightly. On September 4, Benchmark Crude reached $95.41, with Brent crude at $114.84. The price of gas went down slightly to $3.82 but was still the highest ever for Labor Day weekend. Hurricane Isaac contributed to a temporary spike in gas prices, but on September 12 gas once again rose, to $3.86, as refineries cut production prior to the switch from summer blend gasoline to winter blend. Benchmark Crude also reached its highest level since early May and continued to rise above $99 after Federal Reserve announcements of actions to improve the economy and the 2012 diplomatic mission’s attacks. Brent crude rose slightly to nearly $116. Early in October, the average gas price was $3.78 and falling, though still a record for the month. Late in the month, the average reached $3.62 after a 13-cent drop in a week, the most since November 2008. Brent crude was down $8 in the previous month. By the start of November, the average was $3.54, partly due to lower demand after Hurricane Sandy. Crude oil futures fell after Barack Obama was re-elected November 6. After Thanksgiving, lower U.S. oil inventories, good economic news in the United States increased the price of oil.
States and good news relating to the Greek bailout helped push Brent crude up to $111.04, and benchmark oil for January delivery to $87.92; benchmark oil reached $86.24 on November 28, and gas was $3.41.

On December 13, Brent crude was down to $109.20, while benchmark oil fell slightly due to U.S. fiscal cliff concerns and rose due to Federal Reserve efforts to help the U.S. economy, ending the day at $86.77. In mid-December, gas prices reached $3.25, the lowest for 2012. Oil was trading for between $84 and $90.

2013

On January 17, with good economic news in the United States, Benchmark oil reached its highest level since September, going over $95. Brent crude rose above $110. Gas was at $3.29. Refinery shutdowns led to a dramatic rise in gas prices. Late in February, gas was at $3.78, up 14 cents from a week earlier. On February 25, with European stock markets doing well, Benchmark crude for April rose above $94 after a significant drop the previous week due to news the Federal Reserve might end its stimulus efforts, making the dollar stronger. Brent crude was over $115. Two days later gas reached its highest point, $3.79 a gallon. By mid-April, with low demand expected due to negative economic news, gas was down to $3.56 as Brent crude fell to $103.04, its lowest price since July. With economic problems worldwide leading to low demand, gas prices fell 3 percent in April, the most in a month in ten years, to the lowest level for that month since 2010.

Before Memorial Day, when gas was $3.63, gas supplies fell even though oil supplies were the highest in 35 years. U.S. economic news was also negative. On May 30, Benchmark crude for July rose slightly to $93.61 after falling the previous day, and Brent crude fell slightly to $102.19. On June 5 the price of oil rose again with supplies lower. Benchmark crude rose above $94. The price of gas was $3.62. On June 12, the International Energy Agency said demand for oil would still rise in 2013, but not as much as previously believed due to the economy. Also, May OPEC production was the highest in seven months. Benchmark crude fell slightly to $95.31, and Brent crude rose to $103.27. On June 20, with the Federal Reserve stating that its stimulus program could end if the U.S. economy continued to improve, as well as economic problems in China, Benchmark crude fell below $97. Brent crude fell to $104.24.
On July 10, oil prices were the highest in more than a year as a result of lower supplies and trouble in Egypt. In the past week, Brent crude had climbed 7 percent to $108.51. Because too much oil was being produced for the infrastructure to handle it, West Texas Intermediate was lower than Brent crude for several years; it has returned to being consistent with Brent. On July 5 it reached $103.22. On July 19 with good economic news in the United States, Benchmark crude reached $108.05, while gas was $3.67, the highest on a Friday since March 22. Brent crude was at $108.07. Gas was $3.63 on August 1, though good economic news in the U.S., China and Europe meant oil was going up again after a decline the previous week. Benchmark crude reached $107.89, while Brent crude was $109.54. On August 16 Benchmark oil was $107.46 after six days of increases as Egypt's problems continued. The concern was access to the Suez Canal, which appears unlikely to be a problem but still concerns companies. Brent crude was $110.48 on August 19. On August 28 West Texas intermediate reached $110.10, the highest since May 2011, and Brent crude reached $116.61, its highest point since February 19, due to concern about U.S. involvement in Syria. Meanwhile, inventories in the United States had their biggest increase in four months. Benchmark crude rose to $107.56 on September 11 due to lower supplies after dropping due to hopes for a peaceful Syria solution; Brent crude rose to $111.50.

Gas was $3.59 at the start of the month, but at the end of September, the price of gas was $3.39, the lowest for the time of year since 2010. The New York Mercantile Exchange price on September 27 was $102.87. Refineries had no hurricanes or other problems. Benchmark crude fell to $103.31 on October 3 after the U.S. government shutdown, and Brent crude was $109. On October 21, Benchmark crude was $99.22, the first time below $100 since July. Higher supplies and fewer threats from the Middle East were the reasons. Brent crude was $109.64 and gas reached $3.35. On November 13, Brent crude reached $107.12 and was $13.24 higher than West Texas Intermediate, the largest difference since April, due to trouble in Libya and sanctions against Iran. On November 25, Benchmark crude decreased to $93.92 while Brent crude reached $110.41 after the agreement regarding Iran's nuclear program. On December 16, Benchmark crude rose to $97.44 and Brent crude reached $110.53 with good economic news from Europe and more Libya trouble. Gas was $3.23, three cents higher than a month earlier. On December 27, due to a better
economy in the United States leading to higher demand, oil closed about $100 for the first time since October. Gas was $3.27, two cents below a year earlier.

2014

On January 2, Benchmark crude fell by the most in one day since November 2012 to close at $95.44. Brent crude was $107.78. Gas was $3.33. With the Iran agreement and increased production from Libya and the North Sea, Benchmark oil was around $92 on January 13 and Brent crude was $105.98. After good economic news from Japan, Benchmark crude fell slightly from its highest close of 2014, $98.23 on January 30. Brent crude fell to $107.25. The difference between the two fell below $10 for the first time since November, partly due to cold weather in the United States which resulted in high heating oil demand. Early in February gas was $3.27. Cold weather led to the price of oil staying above $100 for most of February, but lower prices were expected. With United States fourth quarter economic growth expected to be lower than an early estimate, Benchmark crude fell slightly on February 27 to $102.40, with Brent crude reaching $108.61. On March 24, due to the dispute over Crimea, problems in Libya, and the Houston Ship Channel collision, Benchmark crude rose above $100 and Brent crude rose to $107.41. Economic problems in China kept prices from going even higher. Later in the week, good economic news from the United States, lower oil supplies in Oklahoma and a force majeure by Shell Nigeria pushed prices slightly higher, to $102.12 for Benchmark crude and $108.29 for Brent. On April 7, Benchmark crude fell below $101 and Brent crude fell to $105.64 with news that Libya might open more terminals in May, but more Ukraine problems pushed the prices back up on April 8. Gas was $3.59, matching the level in 2013.

Continued Ukraine problems pushed oil higher on April 24, with Benchmark crude at $101.94 and Brent crude at $110.33, though an April 23 report said U.S. oil supplies were higher than expected. The price of gas was $3.68.5, the highest since March 2013. On April 30, Benchmark crude dropped below $100 for the first time in three weeks as oil supplies continued to rise and the unusually cold winter resulted in negative U.S. economic news. Gas was up 14 cents for the month, the most in three years. More Ukraine trouble pushed Benchmark crude above $100 and Brent crude over $108 on May 12, and further problems in Libya helped push Benchmark crude
over $102 and Brent crude over $110 by May 15, though negative economic news in the U.S. and an unexpected increase in oil stockpiles pushed Benchmark crude back down temporarily. Continued concerns over Ukraine and Libya pushed oil back above $104. The price of gas was $3.65.

Trouble in Iraq resulted in higher prices for oil and gas in June. West Texas crude reached $106 and Brent crude $115.75. At the end of the month Benchmark crude was just above $105 while Brent crude fell below $113. The price of gas was $3.66.

After three weeks of going down, U.S. crude fell below $100 for the first time since May on July 15. However, with Middle East and Ukraine problems sending oil higher, Benchmark crude finished July 18 just above $103, with Brent crude staying above $107. With low demand and plentiful supplies, and despite good economic news from China and the United States, Brent crude fell below $107 on July 24, and U.S. crude dropped to $102.10. On July 28, gas was $3.52, down five cents from a week earlier, due to refiners cutting prices. Two weeks later gas was $3.48, less than a year earlier. And on August 14, light sweet oil was $95.58, the lowest since January, while Brent crude reached $102.01, the lowest since June, after falling the most in one day since January. Production in Libya was up, and economic slowdowns were expected in Europe and China, making even lower prices likely.

As of Labor Day, gas was $3.41, 18 cents lower than in 2013. Low demand and high North American production cancelled out effects of troubles in the Middle East and Ukraine. West Texas crude was below $94 on August 27 and Brent crude below $103. On October 16, West Texas crude fell below $80 for the first time in more than two years, while Brent crude reached $82.60, the lowest since November 2010. OPEC Members were not expected to act as increases in the U.S. supply resulting from high oil shale production added to a worldwide surplus. On October 31, the average price of gas reached $3 and was expected to go below that figure for the first time since December 2010. Demand for oil was down and there were many new sources. United States oil production was up 70 percent since 2008, and Iraq and Canada were producing more. According to the Lundberg survey released December 7, gas was down 12 cents from two weeks earlier to $2.72. Demand was low while
production was high, and the strong dollar contributed. With demand low in China and Europe and OPEC deciding not to cut back, West Texas Intermediate reached $63.50 on December 8, the lowest since July 2009, while Brent crude reached $66.90, a level not seen since October 2009. After Saudi Arabia oil minister Ali Al-Naimi said OPEC members could not cut production on their own, oil prices rose slightly December 18 but finished the day lower with Benchmark crude at $54.11 and Brent crude $59.27, both the lowest since May 2009.\(^1\) Gas was $2.49 a gallon

2.10 SWOT Analysis Indian oil and gas industry

- **Strengths**
  - India is the world’s fifth biggest energy consumer and continues to grow rapidly
  - Major natural gas discoveries by a number of domestic companies hold significant medium to long-term potential.
  - Demand for petroleum products
  - Increase in demand for oil and gas
  - High exploration portfolio

- **Weaknesses**
  - The oil and gas sector is dominated by state-controlled enterprises, although the government has taken steps in recent years to deregulate the industry and encourage greater foreign participation
  - Increase in oil prices
  - Inadequate and slowly developing infrastructure
  - Lack of awareness in safety issues
  - Environmental issues

- **Opportunities**
  - Liquefied natural gas (LNG) imports are still set to grow rapidly over the longer term as domestic consumption expands
  - India has freed gasoline retail price controls
  - Untapped domestic oil and gas potential
  - Strong domestic energy demand growth
  - High recovery rates from existing projects
Threats

✓ Increased competition within government and private players
✓ Continuing government interference
✓ Changes in national energy policies

2.11. The Challenges of Indian Petroleum Products Refineries

Challenges of Petroleum Refining in India: Key changes faced by the refining industry have come with challenges alongside. First is the increase in demand for light petroleum products – gasoline, diesel, jet fuel and kerosene. Regulations on product specifications are also stricter. Specifications on sulphur, aroma and olefin for gasoline and sulphur, cetane number and poly-aroma for diesel are strengthening. The changes and challenges of Asia’s refining industry revealed that sharp increases in demand for light petroleum products as a result of advances in the transport sector has been recorded over the years.

A. The Need to Invest:

The need to invest in capacity expansion for the future in India is important considering expected demand increase and current capacity utilization at about 90%. India’s refining capacity based on Institute of Electrical Engineers of Japan report is expected to increase to 4472 thousand bbl/d in 2015. There is also need to invest in all-inclusive approaches like the DuPont acid plant to equip refineries with a twofold capability to process acid gas and sulphuric acid regeneration which would enable maximizing a refinery’s sulphur recovery unit capability, emissions reduction, and direct manpower and capital towards hydrocarbon processing projects.

B. Effect of Subsidies on Product Pricing:

The process of price and market liberalization is another issue to be addressed. Petroleum products prices in India like in many developing countries are controlled through subsidies. Petroleum product prices in India were regulated through the Administered Pricing Mechanism. The Indian government introduced measures designed to deregulate the downstream oil sector. This enabled private refiners to directly trade petroleum products to customers. The APM operated such that refineries, Oil Marketing Companies and pipelines were assured a 12% post tax return on net worth and were reimbursed for operating costs. A self balancing oil pool account was used to balance prices of petroleum products as well as to protect
customers from volatility in international crude prices. The oil pool account however ran into deficit whenever domestic prices were not raised in line with prolonged international crude price increases. The assured 12% post tax return however did not promote efficiency or the most efficient investment decisions. The consequence of the price controls being that private companies are unable to sustain operations when international crude prices are very high thus having to shut down their retail operations, and those who have restarted have no confidence to invest in capacity expansion or upgrade their operations as crude price increases could render them unprofitable since they have no protection from international crude price changes.

C. Cost of Product Refining:

The cost of refining petroleum products is of concern, as can be seen from data presented in earlier sections. India’s oil consumption exceeds what is available or produced locally and this is a pointer to the fact that in order to maintain the same level of consumption, it has to resort to imports which have got their cost implications. Historically, refining has been significantly less profitable than other segments of the petroleum industry. As such, refiners have had to be careful to control costs to make a profit. In some countries, refineries are not productively utilized. Since refineries make low profits, investors may not be willing to engage in competition. This affects both investments in infrastructure as well as in refinery capacity expansion. Government controlled low prices also cause another problem. This is because in order to sell refined petroleum products at a better price, national oil companies tend to export as much as they can, and this can cause supply shortage on the domestic market. Though, to combat this, the government has issued emergent policies such as imposing export taxes to limit export, the situation depicts pricing not being reflective of the true cost of product refining. It is a further indication that the prevalent pricing need be addressed. The supply and demand balance therefore shows random fluctuations which inhibits the market’s ability to represent fundamental demand and supply.

D. Quality of Petroleum Products:

The quality of petroleum products is also of concern. In line with climate change objectives and environmental legislations, every country is to cut down its Carbon dioxide emissions and make fossil fuels more environment-friendly. The quality of crude oil imports to India mainly ‘sour’ is a challenge as a result of the
stringent product quality requirements currently in place. A reorientation of consumption towards light fractions, or installation of hydro cracking plants for heavy fractions is thus required.

2.12. Sample Profile

The overview, vision, Mission, and corporate value and trade of sampled units have been given in following section:

2.12.1. Introduction of sample profile

There are many oil refineries all over the India, some refineries are public and some refineries are private. Among them, researcher has taken only public sector oil refineries for research purpose. The research study of these units shows the financial position from various aspects. Before analysis and interpretation of data the units undertaken for the study, here is the overview of selected sample units of oil refinery.

The list of sampled refineries is as under:

- Bharat Petroleum Corporation Limited (BPCL)
- Hindustan Petroleum Corporation Limited (HPCL)
- Indian Oil Corporation Limited (IOC)
- Mangalore Refinery and Petrochemicals Limited (MRPL)
- Chennai Petroleum Corporation Limited (CPCL)
- Numaligarh Refinery Limited (NRL)

In this chapter, the researchers have given the information about vision, mission, company profile, its refining capacity of each unit undertaken for the research study.

2.12.2. Bharat Petroleum Corporation Limited (BPCL)

2.12.2.1. Overview of BPCL

BPCL is one of the India’s largest PSU companies with fortune global 500 rank of 287(2008) and has Navratna status. Its corporate office is located at Ballard Estate, Mumbai. Its interests are in downstream petroleum sector. It is considered a pioneer in marketing initiatives, and employs, “Best in Class” practices.
Kochi Refinery is a unit of Bharat Petroleum Corporation Limited (BPCL), embarked on its journey in 1966 with a capacity of 50,000 barrels per day. Formerly known as Cochin Refineries Limited and later renamed as Kochi Refineries Limited, the refinery was originally established as a joint venture in collaboration with Phillips Petroleum Corporation, USA. Today it is a frontline entity as a unit of the Fortune 500 Company, BPCL.

Kochi Refinery, located at Ambalamugal near the city of Kochi in Kerala, is one of the two Refineries of BPCL, presently having a crude oil refining capacity of 9.5 Million Metric Tonnes per Annum (MMTPA). The product portfolio of the 190,000 barrels per day refinery today includes petrochemical feed stocks and specialty products in addition to its range of quality fuels.

BPCL is proud owner of multiple refinery units. Bharat Petroleum produces a diverse range of products from petrochemicals and solvents to aircraft fuel and specialty lubricants and markets them through its wide network of stations, kerosene Dealers, LPG Distributors, lube shoppes, besides shopping fuel directly to hundreds of industries, and several international and domestic airlines.

### 2.12.2.2. Vision
- We are the most admired global energy company leveraging talent and technology
- We are the first choice of customers, always
- We exploit profitable growth opportunities outside energy
- We are the role model for Health Safety, Security and Environment
- We are a learning organization
- We are a model corporate entity with social responsibility

### 2.12.2.3. Corporate Values
- Innovative
- Caring
2.12.2.4. Corporate R & D Center

Corporate R&D center set up at NOIDA near Delhi with state-of-the-art facilities is backed with vision to develop high value products, services, processes & technologies and create innovative R&D solutions to earn customer’s delight. Phase – 1 of the new Corporate R&D center has been set-up at a cost of Rs 780 Millions. The Department of Scientific & Industrial Research, Government of India, recognizes BPCL’s in-house R & D center – Corporate R&D center.

There have been many changes in BPCL in recent years. BPCL introduces SAP Software which has made all work go online. In addition to, the dynamic profile that the BPCL has fosters a need for continuous training and development.

2.12.2.5. International Trade

➢ Crude Imports

The total crude requirement for BPCL and its group company is approximately 22 MMTPA. Part of the requirement, about 40%, is met out of indigenous crude production by ONGC and OIL. Balance requirement is met through Imports on Term and Spot basis.

2.12.3 Hindustan Petroleum Corporation Limited (HPCL)

2.12.3.1. Overview of HPCL

HPCL is a Government of India Enterprise with a Navratna Status, and a Forbes 2000 and Global Fortune 500 company. It had originally been incorporated as a company under the Indian Companies Act 1913. It is listed on the Bombay Stock exchange (BSE) and National Stock Exchange (NSE), India.

HPCL has an annual sales/income from operations of Rs 2,32,188 Crores (US$ 38.75 Billions) during FY 2013-14, having about 20% Marketing share in India among PSUs and a strong market infrastructure. HPCL’s Crude Thruput and Market Sales (including exports) are 15.51 Million Metric tons (MMT) and 30.96 MMT respectively in the same period. It operates 2 major refineries producing a wide variety of petroleum fuels & specialties, one in Mumbai (West Coast) of 6.5 Million
Metric tons Per Annum (MMTPA) capacity and the other in Vishakapatnam, (East Coast) with a capacity of 8.3 MMTPA. HPCL holds an equity stake of 16.95% in Mangalore Refinery & Petrochemicals Limited, a state-of-the-art refinery at Mangalore with a capacity of 15 MMTPA. In addition, HPCL has constructed a 9 MMTPA refinery at Bathinda, in Punjab, with Mittal Energy Investments Pte. Ltd. as a Joint venture.

2.12.3.2. Refineries

HPCL has a number of refineries in India. Some are listed below:

1. Mumbai Refinery - 6.5 Million Metric tons (MMT) Capacity
2. Visakhapatnam Refinery - 8.3 MMT at Visakhapatnam
3. Mangalore Refinery Pvt. Ltd. - 9.69 MMT at Mangalore, Karnataka (HPCL has 16.65% Stake).
4. Guru Gobind Singh Refinery - 9 MMT at Bathinda, Punjab (HPCL & Mittal Energy each have 49% stake).
5. Barmer Refinery - 9 MMT Capacity. It is a Joint Venture with Rajasthan Government.

2.12.3.3. Mission

"HPCL, along with its joint ventures, will be a fully integrated company in the hydrocarbons sector of exploration and production, refining and marketing; focusing on enhancement of productivity, quality and profitability; caring for customers and employees; caring for environment protection and cultural heritage.

It will also attain scale dimensions by diversifying into other energy related fields and by taking up transnational operations."

2.12.3.4. Vision

To be a World Class Energy Company known for caring and delighting the customers with high quality products and innovative services across domestic and international markets with aggressive growth and delivering superior financial performance. The Company will be a model of excellence in meeting social
commitment, environment, health and safety norms and in employee welfare and relations.

2.12.3.5. Operations

HPCL operates two major refineries producing a wide variety of petroleum fuels & specialties, one in Mumbai (West Coast) of 6.5 Million Metric Tonnes Per Annum (MMTPA) capacity and the other in Vishakapatnam, (East Coast) with a capacity of 8.3 MMTPA. HPCL holds an equity stake of 16.95% in Mangalore Refinery & Petrochemicals Limited (MRPL), a state-of-the-art refinery at Mangalore with a capacity of 9 MMTPA. Another Refinery of 9 MMTPA, set up in Bathinda, Punjab by HMEL, a Joint Venture with Mittal Energy Investments Pte.Ltd. HMEL has commenced commercial operations. HPCL has signed a MOU with Government of Rajasthan for setting up a Refinery near Barmer in Rajasthan. It would be operated under a JV Company called HPCL-Rajasthan Refinery Limited.

HPCL also owns and operates the largest lube refinery in India producing Lube Base Oils of international standards, with a capacity of 335 TMT. This lube refinery accounts for over 40% of India's total lube base oil production. Presently HPCL produces over 300+ grades of lubes, specialties and greases.

2.12.3.6. International Ranking

1. HPCL is a Fortune Global 500 company as per the ranking of 2013 and was ranked at position 260.
2. HPCL was featured on the Forbes Global 2000 list for 2013 at position 1217.
3. It is 10th most valuable brand in India according to an annual survey conducted by Brand Finance and The Economic Times in 2010.

2.12.3.7. Network

The marketing network of HPCL consists of 13 zonal offices in major cities and 101 regional offices facilitated by a Supply & Distribution infrastructure comprising Terminals, Aviation Service Facilities, LPG Bottling Plants, Lube filling plants, Inland Relay Depots, Retail Outlets (Petrol Pumps) and LPG & Lube
Distributorships. HPCL has state of art information technology infrastructure to support its core business. The data center is located at Hitech city in Hyderabad.

2.12.4 Indian Oil Corporation Limited (IOC)

2.12.4.1. Overview of IOC

Indian Oil is the second largest player in the domestic petrochemical market. Indian Oil is India's flagship national oil company with business interests straddling the entire hydrocarbon value chain – from refining, pipeline transportation and marketing of petroleum products to exploration & production of crude oil & gas, marketing of natural gas and petrochemicals. It is the leading Indian corporate in the Fortune 'Global 500' listing, ranked at the 96th position in the year 2014. With over 34,000 strong work force, Indian Oil has been helping to meet India’s energy demands for over half a century. With a corporate vision to be the Energy of India, Indian Oil closed the year 2013-14 with a sales turnover of Rs.4,57,553 crores and profits of Rs 7,019 crores.

2.12.4.2. Mission

1. To achieve international standards of excellence in all aspects of energy and diversified business with focus on customer delight through value of products and services, and cost reduction.
2. To maximize creation of wealth value and satisfaction for the stakeholders.
3. To attain leadership in developing, adopting and assimilating state-of-the-art technology for competitive advantage.
4. To provide technology and services through sustained Research and Development.
5. To foster a culture of participation and innovation for employee growth and contribution.
6. To cultivate high standards of business ethics and Total Quality management for a strong corporate identity and brand equity.
2.12.4.3. Operations

At Indian Oil, operations are strategically structured along business verticals - Refineries, Pipelines, Marketing, R&D Centre and Business Development – E&P, Petrochemicals and Natural Gas. To achieve the next level of growth, Indian Oil is currently forging ahead on a well laid-out road map through vertical integration—upstream into oil exploration & production (E&P) and downstream into petrochemicals – and diversification into natural gas marketing and alternative energy, besides globalization of its downstream operations.

Having set up subsidiaries in Sri Lanka, Mauritius and the United Arab Emirates (UAE), Indian Oil is simultaneously scouting for new business opportunities in the energy markets of Asia and Africa.

2.12.4.4. Reach and Network

The Indian Oil Group of companies owns and operates 10 of India's 22 refineries with a combined refining capacity of 65.7 Million Metric tons Per Annum (MMTPA), i.e. 1.30 million barrels per day approximately. Indian Oil's cross-country network of crude oil and product pipelines spans 11,214 km with a capacity of 77.258 MMTPA of crude oil and petroleum products and 10 MMSCMD of gas. This network is the largest in the country and meets the vital energy needs of the consumers in an efficient, economical and environment-friendly manner.

2.12.4.5. Innovation

Indian Oil has a sprawling world-class R&D Centre that is perhaps Asia's finest. It conducts pioneering work in lubricants formulation, refinery processes, pipeline transportation and alternative fuels, and is also the nodal agency of the Indian hydrocarbon sector for ushering in Hydrogen fuel economy in the country. The Centre holds 292 active patents, with over 152 international patents.

Bio-Energy Research Centre has signed an agreement with Lanzatech to develop micro-algae technology which entails development of an acetate-to-lipid pathway and evaluation of its viability for CO₂ gas fermentation technology. In order to harness futuristic energy sources, initiatives are being taken for setting up of an
Indian Oil Centre for Renewable Energy (i-CARE) at Manesar. Besides, bio-energy, this Centre will also focus on gasification technology, solar, thermal and hydrogen including fuel cells.

2.12.5 Chennai Petroleum Corporation Limited (CPCL)

2.12.5.1. Overview of CPCL

Chennai Petroleum Corporation Limited (CPCL) is a world class Refining Company with dominant presence in South India. CPCL, formerly known as Madras Refineries Limited (MRL), was formed in 1965 as a joint venture between the Government of India (GOI), AMOCO and National Iranian Oil Company (NIOC). Subsequent to AMOCO’s and GOI’s disinvestment in 1985 and 2001 respectively, CPCL became a group company of Indian Oil Corporation Limited (IOCL).

In 1969, CPCL set up its first Refinery in Manali, Chennai with an installed capacity of 2.5 MMTPA in a record time of 27 months. CPCL now has two refineries with a combined refining capacity of 10.5 MMTPA. The Manali Refinery has progressively increased its refining capacity to the current level of 9.5 MMTPA and is one of the most complex refineries in India and produces Fuels, Lubes, Wax and Petrochemical feed stocks.

CPCL’s second Refinery is located at Cauvery Basin in Nagapattinam. This unit was initially set up with a capacity of 0.5 MMTPA in 1993 and later enhanced to 1.0 MMTPA with its own captive Jetty. The turnover of CPCL for the year 2008-09 was Rs. 36,490 crores. CPCL plays the role of a Mother Industry supplying feed stocks to the neighbouring industries in Manali.

Chennai Petroleum Corporation Limited (CPCL), formerly known as Madras Refineries Limited (MRL) was formed as a joint venture in 1965 between the Government of India (GOI), AMOCO and National Iranian Oil Company (NIOC) having a share holding in the ratio 74%: 13%: 13% respectively. Originally, CPCL Refinery was set up with an installed capacity of 2.5 Million tons Per Annum (MMTPA) in a record time of 27 months at a cost of Rs. 43 crores without any time or cost overrun.
CPCL has two refineries with a combined refining capacity of 11.5 Million tons Per Annum (MMTPA). The Manali Refinery has a capacity of 10.5 MMTPA and is one of the most complex refineries in India with Fuel, Lube, Wax and Petrochemical feed stocks production facilities. CPCL’s second refinery is located at Cauvery Basin at Nagapattinam. This unit was set up in Nagapattinam with a capacity of 0.5 MMTPA in 1993 and later enhanced to 1.0 MMTPA.

2.12.5.2. Vision

To be the most admired Indian energy company through world class performance, creating value for stakeholders.

2.12.5.3. Mission

1. To manufacture and supply petro products at competitive prices, meeting the quality expectations of the customer.
2. To pro-actively fulfill social commitments, including environment and safety.
3. To constantly innovate new products and alternate fuels.
4. To recognize Human Resources as the most valuable asset and foster a culture of participation for mutual growth.
5. To ensure high standards of business ethics and corporate governance.
6. To maximize growth, achieve national pre-eminence and maximize stakeholders’ wealth.

2.12.5.4. Turnover

The crude throughput for the year 2012-2013 was 9.742 million metric tonnes (MMT). The company’s turnover for the year 2012-13 was Rs.46842.47 crores and the Profit after Tax was (Rs.1766.84 Crores).

2.12.6. Mangalore Refinery and Petrochemicals Limited (MRPL)

2.12.6.1. Overview of MRPL

MRPL is a State of Art Grass root Refinery located in a beautiful hilly terrain, north of Mangalore city, in Dakshin Kannada region. The Refinery has got a versatile design with high flexibility to process Crudes of various API and with high degree of
Automation. MRPL has high standards in refining and environment protection matched by its commitments to society. MRPL has also developed a Green Belt around the entire Refinery with plant species specially selected to blend with the local flora.

2.12.6.2. Capacity

MRPL has a design capacity to process 15 million metric tons per annum and have 2 Hydrocrackers producing Premium Diesel (High Cetane). It also has 2 CCRs producing Unleaded Petrol of High Octane.

2.12.6.3. Vision

To be a world-class Refining and Petrochemicals Company, with a strong emphasis on Productivity, Customer Satisfaction, Safety, Health and Environment Management, Corporate Social Responsibility and Care for Employees.

2.12.6.4. Mission

1. Sustain Leadership in energy conservation, efficiency, productivity and innovation.
2. Capitalize on emerging opportunities in the domestic and international market.
3. Strive to meet customers’ requirements to their satisfaction.
4. Maintain global standards in health, safety and environmental norms with a strong commitment towards community welfare.
5. Continuing focus on employee welfare and employee relations.
6. Imbibe highest standards of business ethics and values.

2.12.6.5. Credit Rating

The implementation of DRP in March 2003 within 4 weeks of acquiring equity in MRPL by ONGC has changed the credit profile of the company ICRA has assigned A1+ rating (indicating highest safety) to the Short Term Borrowing programmed of MRPL on a standalone basis.
2.12.7 Numaligarh Refinery Limited (NRL)

2.12.7.1 Overview of NRL

Nestling in the sylvan environs of the Brahmaputra valley where the beautiful rendezvous of water and land throws up myriad colors, Numaligarh Refinery Limited (NRL), which was set up at Numaligarh in the district of Golaghat (Assam) in accordance with the provisions made in the historic Assam Accord signed on 15th August 1985, has been conceived as a vehicle for speedy industrial and economic development of the region.

The 3 MMTPA Numaligarh Refinery Limited was dedicated to the nation by the erstwhile Hon’ble Prime Minister Shri A. B. Vajpayee on 9th July, 1999. NRL has been able to display creditable performance since commencement of commercial production in October, 2000. With its concern, commitment and contribution to socio-economic development of the state combined with a track record of continuous growth, NRL has been conferred the status of Mini Ratna PSU. The present authorized capital of the company is Rs. 1000 crores and paid up capital is Rs. 735.63 crores.

2.12.7.2 Corporate Vision

To be a vibrant, growth oriented energy company of national standing and global reputation having core competencies in Refining and Marketing of petroleum products committed to attain sustained excellence in performance, safety standards, customer care and environment management and to provide a fillip to the development of the region.

2.12.7.3 Corporate Mission

1. Develop core competencies in Refining and Marketing of petroleum products with a focus on achieving international standards on safety, quality and cost.
2. Maximize wealth creation for meeting expectations of stakeholders.
3. Create a pool of knowledgeable and inspired employees and ensure their professional and personal growth.
4. Contribute towards the development of the region.

2.12.7.4 Excel Performance

- Maximize refinery capacity utilization and optimize product pattern by efficient refinery operation.
- Ensure smooth and timely evacuation of products; create a sound customer base and necessary marketing infrastructure.
- Achieve highest standards in product quality, safety, and health and environment protection.
- Manage and operate the facilities in an efficient and cost effective manner for generation of adequate internal resources.
- Inculcate best business practices through the use of ERP and E-Commerce.
- Focus on development and growth of Human Resource through proper training and career planning.
- Plan for production and marketing of low volume, high value products.
- Remain at the technological forefront by continuous up gradation of in-house expertise and absorption of the latest technologies.
- Establish strong corporate identity and brand equity.

2.12.7.5 Vigilance

Numaligarh Refinery Limited (NRL), a subsidiary of M/s Bharat Petroleum Corporation Limited (BPCL), is a Public Sector Undertaking (PSU) of the Ministry of Petroleum and natural Gas, Govt. of India. It was incorporated in 1993 and is designed to process 3 MMTPA low sulphur indigenous crude oil produced from Upper Assam oil fields by state-of-art technology. NRL has implemented Enterprise wide Resource Planning (ERP) solutions – SAP in the year 2005. Leveraging technology has helped NRL to have an efficient risk mitigation system and also develop a response plan that help repair any kind of damage due to fraudulent practices. NRL has entered into a Memorandum of Understanding with Transparency International India (TII), for implementing “Integrity Pact” for enhanced transparency in business transactions, contracts and procurement processes.
NRL is committed to total transparency, integrity and accountability in its functioning. Vigilance NRL is an integral part of the management and functions with the concept of “Vigilance for Corporate Excellence”. Adopting an approach of “Proactive Vigilance”, NRL’s constant endeavor is to promote improvement in systems, processes and practices. It believes that with best practices, adequate controls and transparency, decisions taken will be professionally efficient, effective and consistent.

2.12.7.6 Quality Policy

NRL strongly believe that quality performance is an integral part of our business and are accordingly committed to attain sustained excellence in all our activities connected with refining, storage, dispatch and marketing of petroleum products.

In pursuance of the above Policy;

- Ensure that the quality of our petroleum products consistently meets the stipulated specifications and the environmental requirements.
- Adhere to the requirement of Quality Management Systems conforming to ISO 9001:2000 in all the relevant activities throughout the organization.
- Maintain focused attention on Customer Satisfaction.
- Aim for minimization of losses and continual improvement of plant performance and competency of the employees.