CHAPTER IV -

PHYSICAL PERFORMANCE OF IOC
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1.1- Product and Services — an Overview

1.2 -Segment wise Performance

I-Products

II-Mega Plants

III- Special Products

IV- Superior Kerosene

V- Crude Oil

1.3- Services

I- Refining

II- Pipelines

III-Marketing

IV- Services

V- Training

VI- Research and Development

1.4 -Sales Performance of IOC

1.5 -Revenue and Income Summary
As a leading public sector enterprise of India, IOC has successfully combined its corporate social responsibility agenda with its business offerings, meeting the energy needs of millions of people everyday across the length and breadth of the country, traversing a diversity of cultures, difficult terrains and harsh climatic conditions. The Corporation takes pride in its continuous investments in innovative technologies and solutions for sustainable energy flow and economic growth and in developing techno-economically viable and environment-friendly products & services for the benefit of its consumers.

1.1 - PRODUCT AND SERVICES- AN OVERVIEW

Benchmarking Quality, Quantity and Service to world-class standards is a philosophy that IOC adheres to so as to ensure that customers get a truly global experience in India. Its continued emphasis is on providing fuel management solutions to customers who can then benefit from their expertise in efficient sourcing and least cost supplies keeping in mind their usage patterns and inventory management.

IOC is a heritage and iconic brand at one level and a contemporary, global brand at another level. While quality, reliability and service remains the core benefits to its customers, stringent checks are built into operating systems, at every level ensuring the trust of over a billion Indians over the last four decades.

IOC’s retail Brand template of XtraCare(Urban), Swagat(Highway) and Kisan Seva Kendras(Rural) are widely recognized as pioneering brands in the petroleum retail segment. IOC’s leadership extends to its energy brands - Indane LPG, SERVO Lubricants, Autogas LPG, XtraPremium Branded Petrol, XtraMile Branded Diesel, XtraPower Fleet Card, IOC Aviation and
XtraRewards cash customer loyalty programme. India, being a vast country, a wide network of pipelines becomes the paramount requirement of transporting petroleum products to interiors from refineries and crude oil to the land lock refineries For the year 2008-09, IOC’s eight refineries achieved the highest ever throughput of 51.4 million tones and 103.4% capacity utilization registering 8.4% growth in crude oil processing over the previous year.

Table IV.1

PRODUCTS GROWTH OF IOC DURING THE FY - 2008-09

<table>
<thead>
<tr>
<th>Products</th>
<th>Growth (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HSD (Diesel)</td>
<td>12.2</td>
</tr>
<tr>
<td>MS (petrol)</td>
<td>14.4</td>
</tr>
<tr>
<td>Xtramile</td>
<td>1.6</td>
</tr>
<tr>
<td>Xtrapremium</td>
<td>3.10</td>
</tr>
<tr>
<td>Non domestic LPG</td>
<td>23</td>
</tr>
<tr>
<td>Bulk LPG</td>
<td>59</td>
</tr>
<tr>
<td>Xtrapower fleet card</td>
<td>24</td>
</tr>
<tr>
<td>ATF (Aviation fuel)</td>
<td>0.8</td>
</tr>
<tr>
<td>Finished Lubes</td>
<td>2.3</td>
</tr>
</tbody>
</table>

The Corporation operates the largest marketing network in the country. Retail sales in MS (petrol) and HSD (diesel) registered a robust growth of 14.4% and 12.2% respectively, in 2008-09, with expansion of the countrywide network to 18,278 petrol/diesel stations (retail outlets),
including 500 special format kisan seva Kendra (ksk) outlets commissioned in rural market during the year.

Indane is today one of the largest packed- LPG brands in the world. The number of households using Indane cooking gas is nearly 529 lakes and 21 lakhs new LPG customers enrolled during the year 2008-09. Non domestic packed LPG sales recorded a 23% growth while bulk LPG sales registered a 59% growth in 2008-09 as compared to 2007-08. IOC has setup 173 Auto LPG Dispensing stations (ALDS) covering 82 cities across India. Auto Gas impacts greenhouse emissions less than any other fossil fuel when measured through the total fuel cycle. Conversion of petrol to Auto Gas helps substantially reduce air pollution caused by vehicular emissions.

Due to innovative initiatives, strong brand communications and sales promotion campaigns conducted during the year, IOC’s branded fuels- XTRAPREMIUM petrol and XTRAMILE diesel – maintained their firm leadership status in 2008-09, with a market share of 48.6% and 59.6% respectively which was 45.5% and 58% in 2007-08 recording the growth of 3.10% and 1.6%. respectively.

The usage of XTRAPOWER fleet card by fleet owners grew by 24% as compared to 2007-08, with transactions of over Rs. 12000 crore. More IOC outlets were upgraded to superior service standards of XTRACARE during the year XTRAPREMIUM and XTRAMILE are now available at 6,446 and 9,256 retail outlets ear, taking total to over 2100. Company’s aviation services continued to lead the aviation fuel business with growth in market share of 63.3% in 2008-09 as compared to 62.5% in 2007-08. Several new businesses of international airlines were generated during the year.

IOC Aviation is a leading aviation fuel solution provider in India and the most preferred supplier of Jet fuel to major international and domestic
airlines. Between one sunrise and the next, IOC Aviation service refuels over 1500 flights – from the bustling metros to the remote airports linking the vast Indian landscape from the icy heights of Leh (the highest airport in the world at 10,682 ft) to the distant islands of Andaman & Nicobar.

The Corporation was able to improve its market share in finished lubricants despite depressed market conditions. During the year 08-09, IOC’s market shares in the finished lubes segment grew by 2.3 %. SERVO lube network was also expanded to 210 auto stockiest, 72 industrial stockiest, nine marine stockiest and 26 CFAs.

IOC’s world class SERVO lubricants were formally launched in Oman and exports commenced to wholly owned subsidiary IOC Middle East FZE and Toyota, Oman.

(News releases- Mumbai, November 20, 2008)

Over the past three decades, IOC R & D center has developed over thousands of formulations of lubricating oils and greases responding to the needs of Indian industry and consuming sectors. 186 lubricant formulations were developed during the year, of which 153 were commercialized. 47 approvals were also received from OEMs (Original equipment manufacturers), 17 new patents were filed, of which 10 were approved. This takes the total number of patents to 214, including 113 international patents. Company owns and operates country’s largest pipeline network of 10000 km. Commissioning of Indian new projects worth about 2300 crore including LPG and R-LNG pipelines will reach the capacity to 75 million metric tones per annum. For transporting crude oil and petroleum products, registered the highest ever-operational throughput of 59.5 million tones in 2008-09 as compared to the previous year. The crude oil pipelines registered
a 6.7% growth at 38.2 million tones in 2008-09. Over the last four decades the pipeline network of IOC has grown to 9273 km with a capacity of about 62 million metric tones per year. IOC plans to take the group refining capacity 80 million tones per annum by the year 2011-12.

1.2- SEGMENTWISE PERFORMANCE

I-PRODUCTS

AUTO GAS

AutoGas (LPG) is a clean, high octane, abundant and eco-friendly fuel. It is obtained from natural gas through fractionation and from crude oil through refining. It is a mixture of petroleum gases like propane and butane. The higher energy content in this fuel results in a 10% reduction of CO2 emission as compared to MS.

AutoGas is a gas at atmospheric pressure and normal temperatures, but it can be liquefied when moderate pressure is applied or when the temperature is sufficiently reduced. This property makes the fuel an ideal energy source for a wide range of applications, as it can be easily condensed, packaged, stored and utilised. When the pressure is released, the liquid makes up about 250 times its volume as gas, so large amounts of energy can be stored and transported compactly.

The use of LPG as an automotive fuel has become legal in India with effect from April 24, 2000, albeit within the prescribed safety terms and conditions. Hitherto, the thousands of LPG vehicles running in various cities have been doing so illegally by using domestic LPG cylinders, a very unsafe
practice. Using domestic LPG cylinders in automobiles is still illegal. The fuel is marketed by IOC under the brand name ‘AutoGas’.

IOC has setup 173 Auto LPG Dispensing Stations (ALDS) covering 82 cities across India. AutoGas impacts greenhouse emissions less than any other fossil fuel when measured through the total fuel cycle. Conversion of petrol to AutoGas helps substantially reduce air pollution caused by vehicular emissions.

The saving on account of conversion to AutoGas in comparison to petrol is about 28%. Low filling times and the 28% saving is a reason enough for a consumer to convert his vehicle to AutoGas.

**IOC AVIATION SERVICE**

IOC Aviation Service is a leading aviation fuel solution provider in India and the most-preferred supplier of jet fuel to major international and domestic airlines. Between one sunrise and the next, IOC Aviation Service refuels over 1500 flights – from the bustling metros to the remote airports linking the vast Indian landscape, from the icy heights of Leh (the highest airport in the world at 10,682 ft) to the distant islands of Andaman & Nicobar.

Jet fuel is a colorless, combustible, straight-run petroleum distillate liquid. Its principal uses are as jet engine fuel. The most common jet fuel worldwide is a kerosene-based fuel classified as JET A-1. The governing specifications in India are IS 1571: 2001 (7th Rev).

IOC is India's first ISO-9002 certified oil company conforming to stringent global quality requirements of aviation fuel storage & handling. IOC Aviation also caters to the fuel requirements of the Indian Defence Services,
besides refueling VVIP flights at all the airports and remote heli-pads/heli-bases across the Indian subcontinent.

IOC Aviation group regularly organizes International Aviation conferences that act as a vital information facilitator with participation from leading international and all domestic airlines, allied industries, statutory aviation authorities and government agencies from over 35 countries. IOC is the only oil company in India to market the widest possible range of fuels used by the aviation industry in India- JP-5, Avgas 100LL, Methanol Water Mixture, Jet A-1 and aviation lubricants, etc.

Aviation Turbine Fuel (ATF) is dispensed from specially designed refuellers, which are driven up to parked airplanes and helicopters. Major airports have hydrant refuelling systems that pump the fuel right up to the filling outlets on the tarmac through underground pipelines for faster refuelling. Essentially, ATF is pumped into an aircraft by two methods: Overawing and Underwing. Overawing fuelling is used on smaller planes, helicopters, and piston-engine aircraft and is similar to automobile fuelling - one or more fuel ports are opened and fuel is pumped in with a conventional pump. Underwing fuelling, also called single-point is used on larger aircraft.

To ensure that you receive the best service, every one of our 101 AFSs follows specific quality audits based on a Quality Control Index System benchmarked to global standards. In addition, 15 Quality Certification Laboratories provide complete specification tests round-the-clock. Ensuring that these standards are always upheld, there is a back up of a highly skilled, qualified and dedicated team of officers and refueling crew. IOC has a strategic partnership with Air BP, the world leader in aviation business. IOC regularly organizes seminars, symposiums and workshops to constantly
interact with its partners, which apart from being a two-way channel of communication, helps us to stay abreast with advances in technology.

**BITUMEN**

The common binders used in bituminous road constructions are road tars and Bitumen. Bitumen has gradually replaced road tar for road construction purposes mainly because of its greater availability as compared to road tars. It is principally obtained as a residual product in petroleum refineries after higher tractions like gas, petrol, kerosene and diesel, etc., are removed generally by distillation from suitable crude oil. Indian standard institutions define Bitumen as a black or dark brown non-crystalline soil or viscous material having adhesive properties derived from petroleum crude either by natural or by refinery processes.

IOC refineries at Panipat, Mathura, Koyali, Haldia and CPCL produce grades Bitumen 80/100; Bitumen 60/70; Bitumen 30/40; Bitumen CRMB and Bitumen Emulsion- 'Indmul'. It is available both in packed and in bulk.

**General uses of Bitumen:**

For civil engineering works

- Constructions of roads, runways and platforms.
- Water proofing to prevent water seepage.
- Mastic floorings for factories and godowns.
- Canal lining to prevent eroding.
- Dump-proof courses for masonry.
- Tank foundation.
- Joint filling material for mason
Industries

• Electrical cables and junction boxes.
• Battery manufacturers as sealing compound.
• Paint industries for manufacturing black paints and anti corrosive paints.
• Ceramic industries.
• Printing inks.
• Water proof papers.
• Electrical capacitors.
• Bituminous felts.
• Bituminous grease for lubricating open gears.

HIGH SPEED DIESEL

Petroleum derived diesel (called as petrodiesel) is a mixture of straight run product (150 °C and 350 °C) with varying amount of selected cracked distillates and is composed of saturated hydrocarbons (primarily paraffins including n, iso, and cycloparaffins), and aromatic hydrocarbons (including napthalenes and alkylbenzenes).

Diesel is used in diesel engines, a type of internal combustion engine. Rudolf Diesel originally designed the diesel engine to use coal dust as a fuel, but oil proved more effective. Diesel engines are used in cars, motorcycles, boats and locomotives. Automotive diesel fuel serves to power trains, buses, trucks, and automobiles, to run construction, petroleum drilling and other off-road equipment and to be the prime mover in a wide range of power generation & pumping applications. The diesel engine is high compression, self-ignition engine. Fuel is ignited by the heat of high compression and no spark plug is used.
The Indian Standard governing the properties of diesel fuels is IS 1460:2005 (5th Rev). Important characteristics are ignition characteristics, handling at low temperature, flash point. Diesel fuel often contains higher quantities of sulphur. In India, emission standards (equivalent to Euro II, Euro III, Euro IV) have necessitated oil refineries to dramatically reduce the level of sulphur in diesel in view of the auto fuel policy brought in force by Govt of India. BIS has brought out specification for "Diesel with 5% Biodiesel" that may be marketed in near future.

**XTRAMILE**

IOC’s XTRAMILE Super Diesel, the leader in the branded diesel segment is blended with world-class ‘Multi Functional Fuel Additives (MFA). Commercial vehicle owners choose XTRAMILE because they see a clear value benefit in terms of superior mileage, lower maintenance costs and improved engine protection. A growing section of customers who own diesel automobiles, both in the ‘lifestyle’ and ‘passenger’ category, prefer XTRAMILE as a fuel for its added and enhanced performance. XTRAMILE has brought in a huge savings in the high mileage commercial vehicle segment. Transport fleets that operate a large number of trucks crisscrossing the country are using XTRAMILE to not only obtain a higher mileage but also for low maintenance costs.

**BULK/INDUSTRIAL FUELS**

In the large volume consumer segment, IOC's provides complete Fuel Management Solutions to customers who require fuels in bulk and have dedicated facilities for storage and handling. These customers benefit from IOC's efficient sourcing and supplies matched to their usage patterns and
inventory. The optimization on and optimization of supplies is especially relevant in the light of high-energy input costs in the recent past, which is expected to continue in the future too. IOC's tankages are strategically located across the country and are custom-designed to maintain low-cost supplies that can be rapidly transported through a sophisticated supply-chain management system.

Whether it is an immediate need, a long-term supply contract or even setting up dedicated storage and handling facilities at your premises, IOC's network is at your service.

IOC's marketing operations network of storage, distribution and supply hubs is backed by on-time logistics and round-the-clock after-sales service. Many institutional customers like the railways, steel plants, thermal power plants, textile mills, power plants, state transport undertakings, large corporates and fleet & logistics companies tie-up for long-term contracts backed by IOC's comprehensive fuel & lubricants consultancy—a formidable expertise that IOC has built over nearly five decades of working with a cross-section of customers from a wide-range of industrial sectors. IOC's bulk liquid fuel supply covers the complete gamut of fuels-Auto fuels, Light Diesel Oil, Low Sulphur Heavy Stock, Special Products and much more.

**INDANE GAS**

**Indane** is today one of the largest packed-LPG brands in the world. IOC pioneered the launch of LPG in India in the 1970s and transformed the lives of millions of people with the introduction of the clean, efficient and safe cooking fuel. LPG also led to a substantial improvement in the health of women in rural areas by replacing smoky and unhealthy *chullahs* with
**Indane.** It is today a fuel synonymous with safety, reliability and convenience.

LPG is a blend of Butane and Propane readily liquefied under moderate pressure. LPG vapour is heavier than air; thus it normally settles down in low-lying places. Since LPG has only a faint scent, a mercaptan odorant is added to help in its detection. In the event of an LPG leak, the vapourisation of liquid cools the atmosphere and condenses the water vapour contained in it to form a whitish fog, which is easy to observe. LPG in fairly large concentrations displaces oxygen leading to a nauseous or suffocating feeling.

Suraksha LPG hose, flame retardant aprons and energy efficient Green Label stoves are recommended to enhance safety measures while using LPG as fuel.

To prevent diversion, the **Indane** brand is being backed by RFID technology, a new concept that helps track the movement of LPG cylinders. Initial trials are currently going on, after which it will be implemented on a countrywide basis.

**SERVO LUBRICANTS & GREASES**

IOC's **SERVO** range of lubricants reigns as undisputed market leader in Indian lubricants market. Known for its cutting-edge technology and high-quality products, **SERVO** backed by IOC's pioneering R&D, extensive blending and distribution network, sustained brand enhancement and new generation packaging is a one-stop shop for complete lubrication solutions in the automotive, industrial and marine segments.

In the retailing segment, besides IOC petrol stations, **SERVO** range of lubricants is available through a network of **SERVO press** stations, bazaar
outlets and thousands of auto spare parts shops across the country. The SERVO range includes over 500 lubricants and 1200 formulations encompassing literally every lubricant requirement.

The SERVO press is a one-stop shop for quick, easy and convenient auto care, providing customers with a refreshing experience. The SERVO press stations have facilities for oil change, tyre/battery checkups, A/C service, vacuum cleaning, perfuming, and upholstery cleaning, polishing and lamination installation too.

Lubrication is the art of reducing friction between rubbing and rolling surfaces. In the recent past two terminologies have gained currency - Tribology, the science of Rubbing; Rheology, the study of stream or flow. The earliest knowledge of lubrication is evident from grease lubricated chariot wheels excavated from the ruins. The rapid development of this science can be said to have started from the 18th century, with significant technological progress in commercial usage in the 20th century. Most lubricants are liquids. Water is a natural lubricant but has extremely limited application due to its very low viscosity and very low boiling point besides its contribution to rusting and corrosion. Vegetable oils have excellent lubrication properties but have very poor oxidation stability, high pour point rapid thickening and may even let out foul odors in time. Most of the liquid lubricants used at present all over the world are petroleum-based mineral oils.

MARINE FUELS & LUBRICANTS

IOC caters to all types of bunker fuels and lubricants required by various types of vessels operating throughout the world in the shipping industry. The Bunker supplies are made at all major ports of India; Mumbai, Kandla,
Vasco, Chennai, Tuticorin, Vizag, Cochin, New Mangalore, Kolkata, Paradeep, JNPT, Port Blair and Haldia. Apart from Indian Navy whose 100% bunker requirement is met by IOC, it also supplies bunker fuels to all major shipping and dredging companies of India. Spot requirement of different vessels calling at Indian ports are undertaken through nominations received from local shipping agents and international bunker trader/brokers. While IOC supplies Furnace Oil (FO), Light Diesel Oil (LDO) and High Flash High Speed Diesel (HFHSD) meeting the stringent BIS specifications, it also offers the entire range of SERVO brand of marine grade lubricants. Supplies are made through pipeline, barges and tank trucks. Bunker supplies are undertaken through pipeline at specified jetties at Haldia, Vasco, Port Blair, Mangalore, Vizag, JNPT and Chennai; Tank Trucks are used for bunker supplies at Tuticorin, Paradeep, Port Blair, Mangalore and Haldia; Barges are used for bunker supplies at jetties and inner anchorages at Haldia, Mumbai, Kandla, Vizag, Cochin and Chennai.

**MS/GASOLINE**

Automotive gasoline and gasoline-oxygenate blends are used in internal combustion spark-ignition engines. These spark ignition engine fuels are primarily used for passenger cars. They are also used in off-highway utility vans, farm machinery and in other spark ignition engines employed in a variety of service applications. Gasoline is a complex mixture of relatively volatile hydrocarbons that vary widely in chemical & physical properties and are derived from fractional distillation of crude petroleum with a further treatment mainly in terms of improvement of its octane rating. The hundreds of individual hydrocarbons in gasoline range from \( \text{C}_4 \) to \( \text{C}_{11} \).
An oxygenate is an oxygen-containing, ashless organic compound (such as an alcohol or ether) which can be used as a fuel or fuel supplement. Motor gasoline is sold at retail outlets where it is directly delivered into the automobile tank. The Indian Standard governing the properties of motor gasoline & gasoline-oxygenate blends is IS 2796: 2000 (3rd Rev).

In view of the auto fuel policy issued by Govt of India, more & more stringent specifications (equivalent to Euro II, Euro III, and Euro IV) are being made applicable for the gasolines being marketed in India. This has led to reduction of environmentally polluting factors in gasolines.

**XTRAPREMIUM**

XTRAPREMIUM Petrol is India’s leading branded petrol boosted with new generation multifunctional additives known as friction busters that prevents combustion chamber deposits. XTRAPREMIUM is custom designed to deliver higher mileage, more power, and better pick up, faster acceleration, enhanced engine cleanliness and lower emissions.

XTRAPREMIUM is a sought after fuel among discerning customers who own new generation, high-performance cars who have endorsed its unmatched performance.

In terms of fuel system cleanliness XTRAPREMIUM is hugely superior to any other alternative fuel in this segment, with the additional benefit of fuel efficiency through the friction modifier. The additive package contains proprietary components including a detergent dispersant, a friction modifier and a corrosion inhibitor, as a perfectly optimized formulation in synthetic carrier oil. The detergent dispersant cleans the fuel system and the friction modifier drastically reduces friction in the non-lubricated engine area contributing to fuel economy.
PETROCHEMICALS

India is amongst the fastest growing petrochemicals markets in the world. Taking this into consideration and to enhance its downstream integration, IOC is focusing on increasing its presence in the domestic petrochemicals sector besides the overseas markets through systematic expansion of customer base and innovative supply logistics.

Petrochemicals have been identified as a prime driver of future growth by IOC. The Corporation is envisaging an investment of Rs 30,000 crore in the petrochemicals business in the next few years. These projects will utilise product streams from the existing refineries of IOC, thereby achieving better exploitation of the hydrocarbon value chain. Beginning with a low-investment, high-value projects such as Methyl Tertiary Butyl Ether (MTBE) and Butene-1 at Gujarat Refinery, Vadodara, IOC has set up a world-scale Linear Alkyl Benzene (LAB) plant at Gujarat Refinery and an integrated Paraxylene/Purified Terephthalic Acid (PX/PTA) plant at Panipat. A Naphtha Cracker complex with downstream polymer units is coming up at Panipat and a refinery-cum-petrochemicals complex is proposed at Paradip on the east coast of India.

These initiatives are designed to catapult IOC among the top three petrochemicals players in Southeast Asia in the long term.

In order to penetrate the petrochemicals market effectively, a separate Strategic Business Unit (SBU) has been created in IOC for marketing of petrochemicals. This SBU has five exclusive sub-groups, classified product wise (LAB, PTA, Polymers) and function wise (Logistics & Exports), in addition to regional/field set-ups to offer reliable customer service. This SBU has already established IOC's LAB business both in India and abroad. Today, IOC is a major supplier to the key players in the detergent industry,
both national and international. Similarly, in PTA business, all major domestic customers are catered to by IOC. A robust logistics model has been the key to IOC's success story and facilities have been put in place for seamless product dispatches to customers by rail, road and sea.

II- MEGA PLANTS:

LINEAR ALKYL BENZENE (LAB) PLANT, GUJARAT REFINERY: With an installed capacity of 1, 20,000 tonnes per annum (TPA), it is the largest grassroots single-train Kerosene-to-Lab unit in the world. Currently the plant produces two grades of superior quality LAB-high molecular weight and low molecular weight for manufacture of environment-friendly biodegradable detergents.

PARAXYLENE/PURIFIED TEREPTHALIC ACID (PX/PTA), PANIPAT: It is the most technologically advanced plant in the country which manufactures ParaXylene (PX) from captive Naphtha, and thereafter converts into Purified Terephthalic Acid (PTA) The PX plant is designed to process 5, 00,000 TPA of heart-cut Naphtha to produce 3, 60,000 TPA of PX whilst the PTA plant has a world scale capacity of 5, 53,000 TPA.

NAPHTHA CRACKER PLANT, PANIPAT: A world class Naphtha Cracker and downstream polymer units are being set up at Panipat refinery of IOC. Planned to be commissioned by the end of 2009, this project is designed to produce 8, 57,000 TPA of Ethylene (from Naphtha) and 6, 50,000 TPA of Propylene, using technology from ABB Lummus, USA.
Based on this, other downstream polymer units are being established at Panipat Refinery to produce Linear Low Density Polyethylene, High Density Polyethylene, Polypropylene and speciality chemical Mono Ethylene Glycol (MEG). The technology and capacities of the Naphtha Cracker and Polymer units are world class, with products ranging from commodity to niche grades.

III- SPECIAL PRODUCTS
Other than the regular petroleum products like light distillates, middle distillates, heavier products like Furnace Oil, Bitumen, etc., IOC refineries also manufacture petroleum products for specific applications. These specific applications could be feed stock for chemical industry, raw material for specific industries and solid fuels. The petroleum products, produced for specific applications are called, 'Petrochemicals and Specialties (P&S) Products'.
Every petroleum refinery is not designed to produce P&S products but IOC's refineries have been planned to make a large portfolio of P&S products. The indicative list of products from IOC's various refineries is as follows:

<table>
<thead>
<tr>
<th>Refinery</th>
<th>P&amp;S Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barauni-</td>
<td>Carbon Black Feedstock (CBFS), Raw Petroleum Coke (RPC), Sulphur</td>
</tr>
<tr>
<td>Digboi-</td>
<td>Paraffin Wax</td>
</tr>
<tr>
<td>Guwahati-</td>
<td>Raw Petroleum Coke (RPC)</td>
</tr>
<tr>
<td>Haldia-</td>
<td>CBFS, Jute Batching Oil (JBO), Micro Crystalline Wax (MCW), Turpentine Oil (MTO), Sulphur</td>
</tr>
</tbody>
</table>
Koyali - LABFS, Mineral Turpentine Oil (MTO), Sulphur, Toluene
Mathura - Propylene, Sulphur
Panipat - Benzene, Mineral Turpentine Oil (MTO), Petcoke, Sulphur

Basic end uses:

Benzene: Chemical industry
CBFS: Carbon black manufacturers
JBO: Jute industry
LABFS: LAB manufacturers
Micro Crystalline Wax (MCW): Pharmaceutical industry
MTO: Paint industry
Paraffin wax: Candle manufacturers
Petcoke: Cement industry
Propylene: Chemical industry
RPC: CPC manufacturers
Sulphur: Sulphuric Acid manufacturers and sugar industry
Toluene: Explosives manufacturers

IV- SUPERIOR KEROSENE OIL

Kerosenes are distillate fractions of crude oil in the boiling range of 150-250°C. They are treated mainly for reducing aromatic content to increase their smoke point (height of a smokeless flame) and hydrofining to reduce sulphur content and to improve odour, colour & burning qualities (char value).

Kerosene is used as a domestic fuel for heating / lighting and also for manufacture of insecticides/herbicides/fungicides to control pest, weeds and fungi. Since kerosene is less volatile than gasoline, increase in its
evaporation rate in domestic burners is achieved by increasing surface area of the oil to be burned and by increasing its temperature. The two types of burners which achieve this fall into two categories namely vaporisers & atomizers.

The Indian Standard governing the properties of kerosene are IS 1459:1974 (2nd Rev).

**V- CRUDE OIL**

Crude oil - as petroleum directly out of the ground is called - is a remarkably varied substance, both in its use and composition. Crude oil is formed from the preserved remains of prehistoric zooplankton and algae, which have been settled to the sea (or lake) bottom in large quantities under anoxic conditions. It was formed over millions of years from the remains of tiny aquatic plants and animals that lived in ancient seas due to compression and heating of ancient organic materials over geological time. The oldest oil-bearing rocks date back to more than 600 million years, the youngest being as old as about 1 million years.

Although various types of hydrocarbons - molecules made of hydrogen and carbon atoms - form the basis of all crude oils, they differ in their configurations. The chemical structure of petroleum is composed of hydrocarbon chains of different lengths. Because of this, petroleum may be taken to oil refineries and the hydrocarbon chemicals separated by distillation and treated by other chemical processes, to be used for a variety of purposes. It can be a straw-colored liquid or tar-black solid. Red, green and brown hues are not uncommon.

Crude oil is classified by the location of its origin (e.g. West Texas Intermediate, WT, Brent, Dubai or Minas) and often by its relative weight or viscosity (light, intermediate or heavy); refiners may also refer to it as
'sweet', which means it contains relatively little sulphur, or as 'sour', which means it contains substantial amounts of sulphur and requires more refining in order to meet current product specifications. The number of carbon atoms determines the oil's relative 'weight' or density. Gases generally have one to four carbon atoms, while heavy oils and waxes may have 50, and asphalts, hundreds.

Crude oil from an area in which the crude oil's molecular characteristics have been determined and the oil has been classified are used as pricing references throughout the world. These references are known as Crude oil benchmarks.

After considering availability of indigenous crude oil, balance crude oil is required to be imported. IOC sources its crude oil requirement from Far East, Gulf region, Mediterranean, West Africa and Latin American sources.

1.3- SERVICES

- Refineries
- Pipelines
- Marketing
- Services
- Training
- Research and Development
REFINERIES
Stream-sharing between group refineries ensured better optimisation, capacity utilisation, value addition and enhanced gross refining margins. In a significant measure towards capacity building and upgradation, new projects worth almost Rs. 32,000 crore were approved during the year. These include a state-of-the-art refinery at Paradip (Rs. 29,777 crore), and Motor Spirit Quality Improvement projects at Barauni (Rs. 1492 crore), Guwahati (Rs. 372 crore) and Digboi (Rs. 356 crore) refineries.
To widen the crude oil basket, several new grades were procured from Angola, Malaysia, Gabon, Congo, Nigeria, Libya and Egypt. Continuing with direct chartering of ships for petroleum imports, IOC imported a record quantity of 47.8 million tonnes of crude oil in 2008-09 as against 46.11 million tonnes in 2007-08. During the year, IOC entered into term contracts with Angola and Brunei for import of low sulphur crude oil and over 95% of the LPG imports were finalised through term contracts.

PIPELINE
IOC’s sustained pursuit and implementation of proven safety and environmental management systems have brought rich results. All operating pipeline units have been accredited with ISO 9000 and ISO 14001 certificates.
Various initiatives in the field of project management, operations and maintenance including training in countries like Oman, Ethiopia, Kuwait and Sudan have been undertaken.
Today IOC is well placed to provide seamless services in the entire spectrum of petroleum pipelines covering techno-economic feasibility studies, design
and detailed engineering, project execution, operations and maintenance, consultancy services in augmentation and modernization, etc. Supervisory Control and Data Acquisition (SCADA) and application software expertise are available from project implementation to commissioning including field services, maintenance and operational support. Tanker handling, petroleum product and crude oil accounting, quality control, ocean loss control, pigging procedure development and analysis of pigging data, selection, testing and evaluation of drag reducers, operations and maintenance of tank farm and pump stations are other areas of expertise available with IOC’s Pipelines Division.

MARKETING
IOC provides a wide range of marketing services and consultancy in fuel handling, distribution, storage and fuel/lube technical services. With a formidable bank of technical and engineering talent, IOC is fully equipped to handle small to large-scale infrastructural projects in the petroleum downstream sector anywhere in the country. Project teams have independently or jointly as a consortium, have set up depots, terminals, pipelines, aviation fuel stations, filling plants, LPG bottling plants, amongst others. IOC's fuel management system to bulk customers offer customized solutions that deliver least cost supplies keeping in mind usage patterns and inventory levels. A wide network of lubricant and fuel testing laboratories are available at major installations which is further backed by sector-wise expertise in the core sectors of power, steel, fertiliser, gas plants, textile mills, etc. Cutting edge systems and processes are designed around one simple belief-to provide valuable customers with an unbeatable edge in their business. IOC's supply and distribution network is strategically located
across the country linked through a customized supply chain system backed by front offices located in conceivably every single town of consequence. The wide network of services offered by IOC, Marketing Division is illustrated in this section, which includes; commercial/reticulated LPG; total fuel management/consumer pumps; IOC Aviation Service; LPG Business (non-fuel alliances); loyalty programs; retail business (non-fuel alliances) and SERVO technical services.

**TRAINING**

Success is people driven. Building competencies through training is one of the core strengths of IOC. The IOC Institute of Petroleum Management- a centre of excellence for nurturing future leadership, situated on the outskirts of New Delhi, conducts advanced management education programmes in collaboration with premier business schools and topline professionals. IOC operates 18 training centres across the country for up-skilling, re-skilling and multi-skilling of employees in its pursuit of corporate excellence. IOC has been serving as a source of technical support and expertise to petroleum companies of various countries across the globe. Some of these countries, which have partnered for excellence, include Sri Lanka, Kuwait, Bahrain, Iraq, Abu Dhabi, Tanzania, Ethiopia, Algeria, Nigeria, Nepal, Bhutan, Maldives, Malaysia and Zambia.

**RESEARCH & DEVELOPMENT**

IOC's world-class R&D Centre, established in 1972, has state-of-the-art facilities and has delivered pioneering results in lubricants technology,
refining process, pipeline transportation, bio-fuels and fuel-efficient appliances.

Over the past three decades, IOC R&D Centre has developed over thousands of formulations of lubricating oils and greases responding to the needs of Indian industry and consuming sectors like Defence, Railways, Public Utilities and Transportation. The Centre has also developed and introduced many new lubricant products to the Indian market like multigrade railroad oils.

Focussed research in the areas of lubricants and grease formulations, fuels, refining processes, biotechnology, additives, pipeline transportations, engine evaluation, tribiological and emission studies, and applied metallurgy has won several awards. The R&D Centre's activities in refining technology are targeted in the areas of fluid catalytic cracking (FCC), hydroprocessing, catalysis, resid upgradation, distillation simulation and modeling, lube processing, crude evaluation, process optimization, material failure analysis and remaining life assessment and technical services to operating units.

In FCC, apart from process optimization and catalyst evaluation the accent is on the development of novel technologies aimed at value addition to various refinery streams. IOC's R&D Centre is fully equipped to provide technical support to commercial hydrocracker units in the evaluation of feedstocks and catalysts, optimization of operating parameters, evaluation of licensors' process technologies, development of novel processes and simulation models.

Material failure analysis and remaining life assessment of refinery equipment and installations is a highly specialized service being provided by the R&D Centre to the refineries of IOC as well as other companies.
With a vision of evolving into a leader as technology provider through excellence in management of knowledge, technology and innovation, IOC has launched IOC Technology Ltd. The new subsidiary markets the intellectual properties developed by IOC R&D Centre.

1.4-SALES PERFORMANCE OF IOC

Sales of IOC have been increasing on the years, It can be seen with the help of following table:-

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Petroleum Products</td>
<td>48.166</td>
<td>46.217</td>
<td>53.363</td>
<td>57.548</td>
<td>60.887</td>
</tr>
<tr>
<td>Gas</td>
<td>0.694</td>
<td>1.297</td>
<td>1.482</td>
<td>1.737</td>
<td>1.666</td>
</tr>
<tr>
<td><strong>Total Domestic</strong></td>
<td>48.860</td>
<td>47.514</td>
<td>54.845</td>
<td>59.285</td>
<td>62.553</td>
</tr>
<tr>
<td>Export</td>
<td>1.956</td>
<td>2.089</td>
<td>3.131</td>
<td>3.331</td>
<td>3.613</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>50.816</td>
<td>49.603</td>
<td>57.976</td>
<td>62.616</td>
<td>66.166</td>
</tr>
<tr>
<td>Refineries Throughput</td>
<td>36.630</td>
<td>38.519</td>
<td>44.002</td>
<td>47.401</td>
<td>51.367</td>
</tr>
<tr>
<td>Pipelines Throughput</td>
<td>43.030</td>
<td>45.348</td>
<td>51.693</td>
<td>57.121</td>
<td>59.627</td>
</tr>
</tbody>
</table>

As per above Table we analyze that company’s Petroleum products sales is in increasing trends from last five Financial Years. It is 48.16% in FY 2004-05 while it is decreasing 1.5% in FY 2005-06 but after that it is continuously increase from further three financial years 2006-07,2007-08 and 2008-09 and its growth percentages are 7.15%, 4.18% and 3.34% subsequently. As same as above Gas sales is also in increasing trend from last five financial
years. Overall, we record 13.62% average growth in the sales of Domestic Products and it’s the great compliment for the company.

We record 1% growth in Export Products from first two financial years (2004-05 and 2005-06) approximately and after that we record 0.23% average growth from last three years 2006-07, 2007-08 and 2008-09 subsequently.

Pipelines performance is also good from last five financial years. Its average growth rate is 2% approximately from first two Financial years (2004-05 and 2005-06) and after that it records 3% of average growth from last three Financial years. We record fast growth of Pipeline’s performance in 206-07 and 2007-08. It is 6.35% in 2006-07 and 5.53% in 2007-08.

1.5– NEW INITIATIVES
Corporation has taken various initiatives and entered in to several partnership with reputed firms from India and abroad. IOC sold 1.7% million tones of R-LNG during 2008-09, thus generating a turnover of Rs. 2425 crore (growth 16.1% over previous year) In addition to IOC earning international recognition as a technology provider, the year also marked IOC winning operate ship rights of two type- oil & gas blocks in Cambay Basin under NELP- VII.

To consolidate the city gas distribution (CGD) business, the corporation signed MOUs with several players, which include Adani energy, Reliance Gas corporation, OIL and ONGC. After more than four decades as a closed economy and 17 years of reforms, India has finally ascended the world stage and laid the foundations for growth. Now the Indian economy has become more open, globally integrated and competitive. Our industry and enterprises are now far more confident, competitive and ambitious about their future.
Infact, India deserves praise for all the recent economic development too like growth of a world class Information Technology sector, development of a competitive automotive industry and burgeoning middle class. The Petrochemical sector plays an important role in the economical development of our country. Petrochemical has a dominant share of bulk customer business, including that of railways, state transport undertaking, agriculture and marine sector. The Corporation is envisaging an investment of Rs. 30,000 crore in the petrochemicals business in the next few years. IOC creates customer delight and to stay ahead of the competitors with demand for petroleum products and services in India, projected to grow 368 million metric tons by 2025. At the time when the petroleum industry is moving towards new horizons, exploring new technologies, collaborating and developing symbiotic relationships to ensure secure, environment – friendly and affordable energy supplies, IOC too is seeking quantum leaps in its core business, adding on new and emerging segments on the way.

IOC and GAIL (India) Ltd. Signed a Memorandum of Understanding for cooperation in the area of Petrochemicals to collaborate for exploring the possibility of setting up of a Cracker complex.

IOC forayed a wind energy business with the commissioning of a Rs. 130 crore, 21 MW wind Power project in the Kutch district of Gujrat. The cumulative power generation from the 14 wind Turbine generators has crossed 159 lakh KW since commissioning in January 2009.

IOC and CREDA hold 74% and 26% equity in IOC CREDA Biofuels ltd. respectively. That was formed for carrying out farming, cultivating, manufacturing, production and sale of biomass, biofuels and allied products and services.
IOC has tied up with National Renewable Energy Laboratory (NREL), US, for a pilot project to produce second-generation bio fuel from cellulosic biomass or degradable agriculture waste and wood. In order to explore sources of production of bio fuels, research programmers were taken up during the year on bio-Hydrogen, algal fuels and lignocelluloses ethanol.