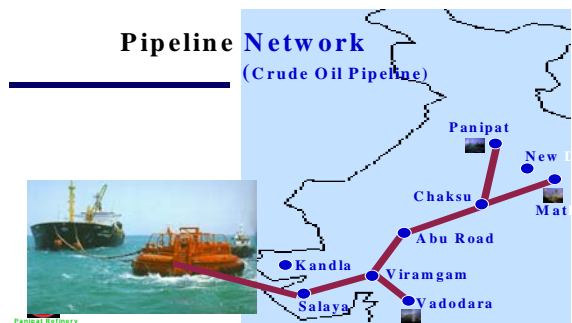




**INDIAN OIL CORPORATION LIMITED
PANIPAT REFINERY**

I. UNIT PROFILE

Panipat refinery is the 7th refinery of Indian Oil Corporation. It is located about 20 kms from Panipat city and 100 km from Delhi. Panipat Refinery built at the cost of Rs. 3868 crores (including Marketing and pipelines installation) with an installed capacity of processing 6 million metric tonnes per annum of crude oil. It is India's one of the most modern refinery with global technologies from IFP, France, Haldor Topsoe Denmark, UNOCAL/UOP, Stone & Webster USA. The refinery receives crude oil through a 1350-KM long pipeline originating from Salaya in Gujarat and reaching Panipat via Chaksu.



Refinery capacity has been expanded to 12 MMTPA since Jun'06.

The Refinery produces annually about cooking gas (LPG), Petrol, jet fuel, kerosene & Diesel apart from other products such as Naphtha, Bitumen, HPS, MTO & Propylene. For environment protection & conservation, the refinery has also commenced production of ultra low sulphur diesel and 1 % benzene petrol.

Products from Refinery

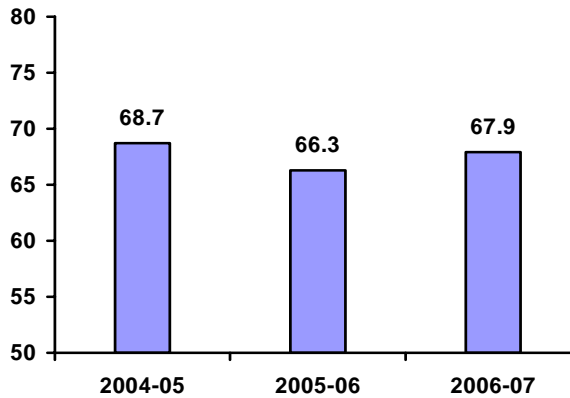


To meet the demand of various petroleum products the refinery has a number of process units along with captive power plant, utilities block and effluent treatment facilities. The various units of the refinery are :

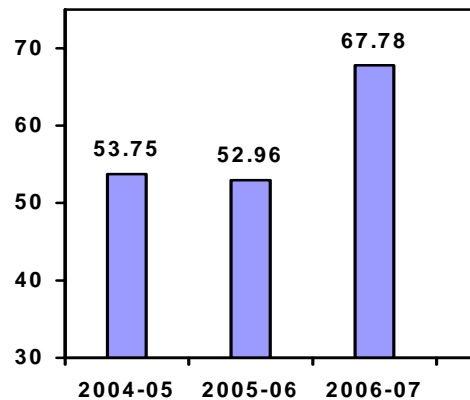
- AVUs (Atmospheric & Vacuum Distillation Units) : (6.0 x 2 = 12 Million Metric Ton Per Annum): Crude oil distillation / fractionation for further processing in secondary units
- HGUs (Hydrogen Generation Units – 1 old + 2 new) : (0.038 + 70 x 2 MMTPA): Hydrogen generation for processes requiring hydrogen
- CCRU (Continuous Catalytic Reforming Unit) : (0.5 MMTPA): For improving octane number of petrol component. This process eliminates requirement of environmentally hazardous TEL (Tetra Ethyl Lead) blending in petrol.
- RFCCU (Resid Fluidized Catalytic Cracking Unit) : (0.7 MMTPA): Catalytic cracking of heavy intermediate stocks for production of lighter products viz. LPG, Petrol, Diesel components
- BBU (Bitumen Blowing Unit) : (0.5 MMTPA) : For production of Bitumen.
- VBU (Visbreaker Unit) : (0.4 MMTPA): Thermal cracking of Vacuum Residue is carried out for viscosity reduction and production of HPS Fuel
- OHCU (Once through Hydrocracker Unit) : (1.6 MMTPA) and HCU (MMTPA) : (1.7 Million Metric Ton Per Annum) : Heavy petroleum stock is subjected to hydrocracking for production of lighter products viz. LPG, Petrol, Diesel components
- DHDS (Diesel Hydro desulphurisation Unit): (0.7 MMTPA) and DHDT (Diesel Hydrotreating Unit) (3.5 MMTPA): For removal of sulphur components and production of low sulphur environment friendly Diesel
- DCU (Delayed Coking unit) (2.4 MMTPA): Thermal cracking of Vacuum Residue is carried out for production of Distillates and HPS Fuel

II. ENERGY CONSUMPTION

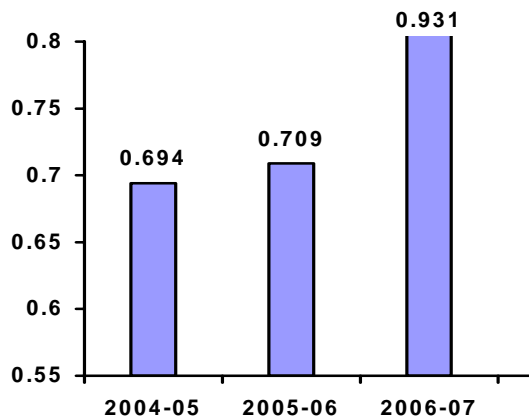
The refinery primarily consumes own generated Fuel Oil (IFO, LDO & Naphtha) and Refinery off-gas to meet its entire energy demand including power generation at its captive power plant. Power import is nominal. The total energy consumption is monitored on regular basis. Energy conservation receives top priority at Panipat refinery. The Top Management commitment to perform and outpace the international pacesetter refineries has percolated down to the line staff. As a result of various ENCON & other operational improvements, the total energy cost of the refinery have steadily declined from a level of 8.5% in 2001-02 to the current level of 6.0% of the total manufacturing cost including crude oil cost. Specific electrical energy consumption has come down from 55.6 KWh/ MT crude processed in 2001-02 to 52.96 KWh/MT crude processed in 2005-06. Similarly, thermal energy consumption has come down from 0.738 MMKCal/ MT crude processed in 2001-02 to 0.709 MMKCal/MT crude processed in 2005-06. However, during 2006-07, both electrical and thermal energy consumption has increased due to addition of new process units, boilers, gas turbines and other associated facilities under refinery expansion. Energy & loss performance in terms of MBN (MBTU/BBL/NRGF – the measure extensively used in crude oil refining sector for energy performance evaluation) has come down from 81 in 2002-03 to 66.3 in 2005-06. However, in 2006-07, it was marginally higher at 67.9.



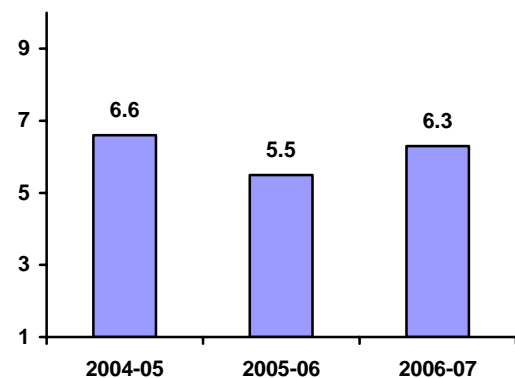
**ENERGY + LOSS PERFORMANCE :
MBN (MBTU / BBL / NRGF)**



**SPECIFIC ELECTRICITY CONSUMPTION :
KWH / MT CRUDE PROCESSED**



**SPECIFIC THERMAL ENERGY CONSUMPTION :
MMKCal / MT CRUDE PROCESSED**



ENERGY COST AS % OF MANUFACTURING COST

III. ENERGY CONSERVATION COMMITMENT, POLICY AND SETUP

ENERGY POLICY

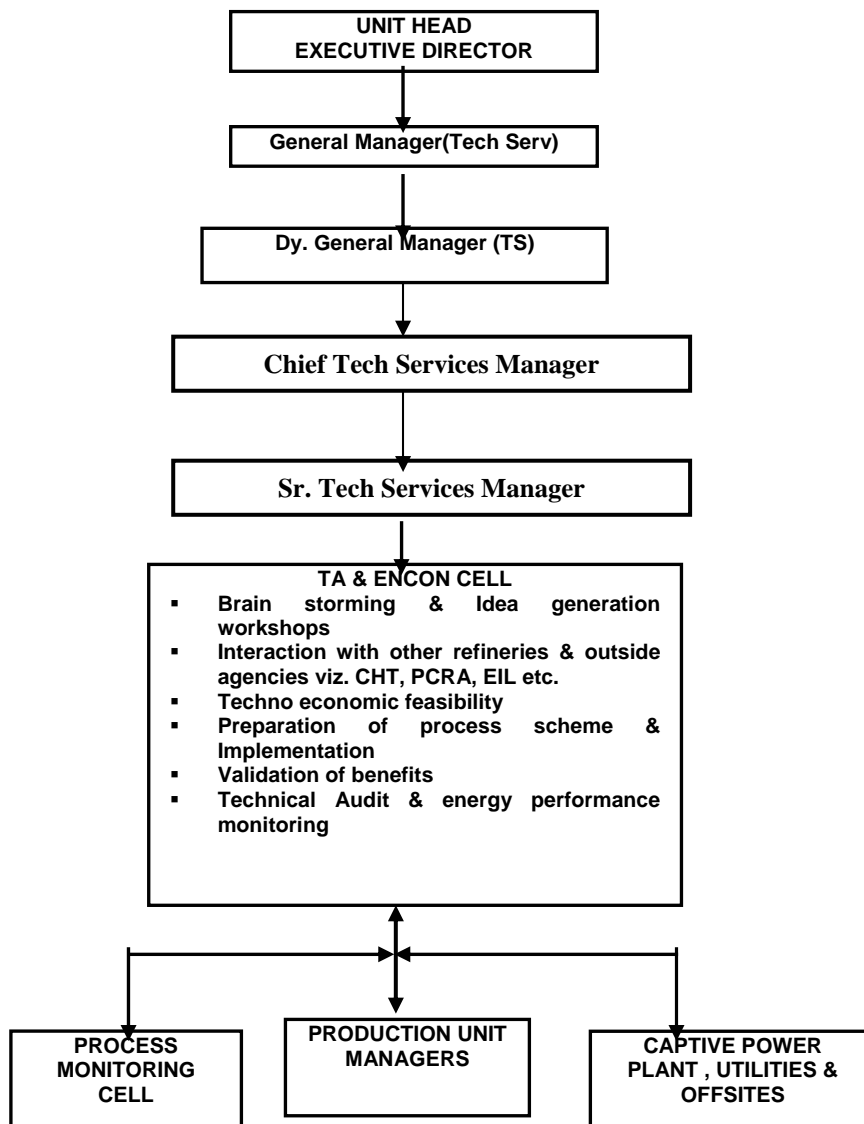
**To be a World Class Performer in
Energy Management by**

- Adopting energy efficient and environment friendly technologies.
- Benchmarking our performance with the best in the world and endeavoring to be ahead.
- Promoting use of renewable sources of energy.
- Fostering a culture of participation and innovation amongst stake holders for continual improvement in energy conservation.
- Propagating the message of avoiding wastage of energy to the community.



Indian Oil Corporation Limited

Energy Conservation Team Structure



iv. Energy Conservation Achievements :

Details of Schemes Implemented in 2006-07 :

1. Scheme : Replacement of existing metallic/GRP fans with new Energy efficient FRP (Fiber Reinforced Plastic) Fans at Process Units & Cooling Towers

Background :

125 nos. of metallic/GRP fans in process units and Cooling towers out are proposed to be replaced with Energy efficient FRP (Fiber Reinforced Plastic) Fans to save around 25% power consumption.

Observation :

Total power consumption in the metallic/ GRP fans in process units and Cooling towers were 2728 KWH. After replacing these fans with FRP fans, power consumption has reduced by around 25% average level.

Technical / Financial Analysis :

Power savings = 682 KWH
 Power savings in a year = 5457 MW.
 Equivalent fuel savings = 16370 Million Kcal/Year

Impact of Implementation :

Replacement with new Energy efficient FRP fans resulted in savings of about 1670 MT fuel per year.
 Financial Savings : Rs. 267 Lac per year

2. Scheme : Utilisation of LP Steam from PREP Hydrogen Generation Unit to Captive Power plant deaerator and Sulphur Recovery Unit

Background :

LP steam was surplus and getting vented through PREP LP steam header of new HGU. Inside new power plant, most of the LP steam requirement for deaerators and other boiler auxiliaries was being met through MLP steam import from PREP units and hot DM water return from DHDT unit.

Observation :

It was observed that PREP MLP steam was to be diverted to old CPP deaerator with some modification utilizing the existing LP steam export line ex-CPP and utilize the PREP LP steam (30 TPH) being vented, by routing to new CPP deaerator and Sulphur recovery unit.



New Hydrogen Generation Unit

Technical / Financial Analysis :

30 MT/ hr LP steam utilized.
 Equivalent fuel savings of about 156860 Million kcal per year.

Impact of Implementation :

Implementation of modification scheme to utilize 30 MTPH LP steam resulted in savings of about 16006 MT fuel per year.
 Financial Savings : Rs. 25.61 Crore per year

3. Scheme : Recovery of LP steam condensate in Standby Sulphur Recovery Unit

Background :

Earlier LP steam condensate from various condensate stations of SSRU was being drained locally. The drained quantity of LP steam condensate was approx. 2 m³/hr.

Observation :

To recovery this condensate, a modification was carried out to route the LP steam condensate to atmospheric flash drum from where it is being pumped to condensate recovery network, which is having adequate capacity to take this additional load.



Standby Sulphur Recovery Unit

Technical / Financial Analysis :

Steam savings = 2 MT/ hr
Equivalent Fuel savings : 10670 MKcal per year.

Impact of Implementation :

After implementation, Steam saving resulted in 1089 MT per year fuel saving.
Financial Savings : Rs. 174 Lacs per year

4. Scheme : Optimisation of steam turbine operations for ID and FD fans of the reformer and HP BFW pump in new Hydrogen Generation unit.

Background :

In new HGU unit, there are 6 nos. of steam turbine which are used for driving ID and FD fans of the reformer and HP BFW pump. Steam consumption by these drives are higher than anticipated and so the efficiency was comparatively low.

Observation :

It was observed that closing of the optional hand valve (jet valves) located on the outside of the turbine casing would reduce steam consumption. Both the optional hand valves BFW pump turbine were gradually isolated one by one and the steam load came down substantially by 5 MT/ Hr (from 18.5 T/hr to 13.7 T/hr). This was done for ID and FD fan turbine also and 2.0 MT/hr steam saving was achieved.

The RPM of the BFW turbine was also reduced by around 125-150 and further resulted in the steam load coming down by 1.0 MT/hr. Presently the unit is running with almost 8.0 MT/hr less steam load by these turbines compared to previous run.

Technical / Financial Analysis :

After adjusting steam turbine operations, total steam saved : 8 MT/ hr.
Equivalent fuel saving = 42670 Mkal/Yr

Impact of Implementation :

After adjusting steam turbine operations, steam optimization resulted in 4354 MT per year fuel oil saving.
Financial Savings : Rs. 6.97 Crore per year.

5. **Scheme** : **Supply of FD fan discharge air to ID outlet gate damper sealing in Boiler no.2.**

Background :

The Guillotine gates at the inlet & outlet of the ID fans in Boiler no. 2 are provided for the Gas/ Air isolation, safety and shutdown purposes. One of these two outlet gates of ID fan is provided one air blower for supplying seal air to ensure proper sealing.

Observation :

It is observed that air to be supplied from FD fan discharge for sealing purposes and the blowers are to be removed. This hot air will also reduce the chances of corrosion inside the duct. The temperature of hot air is 55-60 deg C.



Captive Power Plant

Technical / Financial Analysis :

The savings in power consumption besides the improved life of ID fan ducts after stopping the Guillotine damper blower = 2.2 KWH
Total power saving : 17600 kWh/year

Impact of Implementation :

Financial Savings : Rs. 0.9 Lac per year

V) Energy Conservation Plans and Targets

Panipat refinery is committed to achieve international standards of excellence in energy consumption. The Refinery has following major plans for reduction of Energy Consumption :

Energy conservation measures (planned)	Anticipated savings in Energy		Approx. Investment (Rs. Lakhs)	Project commencement & completion year
	Energy value (MT Fuel/Yr)	Rs. Lakhs/ Yr		
Enhancing capacity of WHB in SSRU (SRU/ SSRU segregation job)	2860	467	100	2007-08
Interconnection of PX PTA LP steam header to PREP SRU LP header	4000	653	30	2007-08
Low cost RFCCU revamp - Additional steam by Heat Recovery from bottom stream	2500	408	9021 *	2007-08
Provision of Plug Valves/ Zero Leak Slab Gate Valves for Naphtha and MS Tanks Manifolds	600	98	207	2006-07
Provision of Zero Leak Slab Gate Valves (30 nos.) with electrical actuators for 6 nos. HSD Tanks Manifolds in 2nd phase	250	41	200	2008-09
H2 recovery from additional CRU off-gas generation after CCRU revamp	6000	980	7809 *	2008-09
Secondary seal in floating roof tanks of MS & Naphtha	150	24	120	2008-09
Secondary seals in Crude oil tanks (total 8 nos.) in 2nd phase.	190	31	200	2008-09
Stepless capacity control system in OHCU compressor	850	139	222	2008-09
Installation of installation of Variable frequency Drives in CDU-2 Crude Feed Pumps	1210	198	500	2008-09
Total	18610	3039	18409	

* Estimated total project cost including Encon.

VI) ENVIRONMENT & SAFETY

• ENVIRONMENT MANAGEMENT

Panipat Refinery's Environment Management System is accredited with ISO-14001 since 2001. Panipat Refinery bagged the Golden Peacock Award in 2000 and also in 2003 for Environment Management initiatives from the World Environment Foundation. Panipat Refinery is also maintaining zero discharge of treated effluent since inception. Extensive efforts have gone in for these distinct achievements which comprise:

1. Measures Taken At Design Stage

- Provision of Tall Stacks (100 m and above) for better dispersion of pollutants
- Desulphurization of Fuel Gas
- Provision of 100 % Stand by Sulphur Recovery Unit with guaranteed 99 % recovery
- Provision of CO Boiler in RFCCU Unit
- Low Sulphur Fuel Oil use in Furnaces
- Provision of on line continuous Sulphur di oxide analyzers in major stacks of refinery.

- Establishment and commissioning of 7 continuous Ambient Air Monitoring Stations to monitor Ground level SO₂ concentrations.
- State of art Effluent Treatment Plant with Physical , Chemical & Biological Treatment facilities
- Recycling, Reusing resulting zero effluent discharges refinery.

2. Actions Taken After Commissioning of the Refinery

- **Zero Discharge of Treated Effluent:** - To ensure zero discharge, it became imperative to reuse / recycle the treated effluent in our own refinery system right from the commissioning of refinery. Schemes were implemented and the reuse / recycle system further strengthened in the following areas :-
 1. Cooling water Make-up
 2. Fire Water Make-up
 3. Irrigation of Green Belt developed and maintained by the Refinery.
 4. Treated Effluent reuse for solution preparation in Wastewater Treatment Plant.
- **Use of Storm Water in Green Belt & Firewater network :** Rain water is harvested in the refinery and collected in storm water pond. This storm water is used for the irrigation of Green belt and make-up to fire water network
- **Hydrogen peroxide Treatment of Process Effluent :** Traditionally Ferrous Sulphate Treatment was used for sulfide treatment of Process Effluent. However, this resulted in generation of chemical sludge, which was difficult to dispose. Panipat Refinery introduced hydrogen per oxide treatment of sulfides for the first time in the country, which has eliminated chemical sludge generation.
- **Bio-remediation of oily sludge :** Oil content of Oily sludge is degraded with the oilyvorous bacteria developed by IOCL R&D center and TERI. This process of bio-remediation is used in the refinery to treat the oily sludge generated from tank cleaning and waste water treatment.

(B) SAFETY & OCCUPATIONAL HEALTH MANAGEMENT

- **Panipat Refinery is the first refinery in the country to get OHSAS-18001** for Occupational Health & Safety Management System.
- **Panipat Refinery is the first industrial unit in India to be certified at level 7** in the base audit itself of ISRS(International Safety Rating System) which is a unique achievement of Panipat Refinery within a short span of operation.
- Refinery accredited **International Safety Rating System (ISRS) Level 9** by M/s DNV in 2004.
- Panipat Refinery's Occupational Health and Safety Management System is certified at level 5 star (the highest level under 5 star audit program) and is also awarded the Sword of Honour by British Safety Council, United Kingdom . **Panipat Refinery is the first industrial unit in India to achieve this distinction in the first audit itself.**
- **Occupational Health and safety Management system** re-certified for 3 years as per OHSAS – 18001 by M/S DNV in May'2003.

- The three certificates for ISO-9001, ISO-14001 & OHSAS-18001 revalidated after two surveillance audits in Dec'2006 and July 2007 conducted by M/s DNV.
- National Safety Council conducted a safety awareness survey at Panipat Refinery in Jan'2002. **Safety awareness level was found to be the highest amongst all IOC refineries.**
- **Yogyata Param Patra** instituted by National safety council for the safety performance of the year 2002.

VI AWARDS / ACCREDIATIONS : Panipat Refinery bagged the following awards in the recent past :

A) Energy Conservation Awards

1. Panipat Refinery has won **1st position in Jawaharlal Nehru Centenary award: 2001-02** by Centre for High Technology for best improvement in energy consumption over past best performance as well as 2nd position in Jawaharlal Nehru Centenary award : 2001-02 by for best performance in energy consumption.
2. PR also won **2 nd prize in Group-I - Jawaharlal Nehru Centenary awards for 2002-03, 2003-04, 2004-05 AND 2005-06**, instituted by Centre for High Technology, Ministry Of Petroleum & Natural Gas for annual performance in the area of Energy consumption measured in terms of MBTU/ BBL/ NRGF.
3. PR received **first prize-“National Energy Conservation Award”** (Refineries Sector) from Ministry of Power, **consecutively for two years – 2002 and 2003.**
4. PR was recipient of PCRA's award for **Exemplary Work in Energy Conservation – 2003, 2004 and 2005.**
5. PR won the **first prize in furnace/boiler efficiency** (category -2 : total heat duty more than 400 mmkcal/hr), in Furnace / Boiler Efficiency survey conducted by **Centre For High Technology, Ministry Of Petroleum & NG** during Oil & Gas Conservation Fortnight-Jan'2004.
6. PR won the **third prize in steam leaks survey** conducted by **Centre For High Technology, Ministry Of Petroleum & NG** during Oil & Gas Conservation Fortnight-Jan'2007.
7. Refinery received '**National award for excellence in Energy Management 2004'** as an "Energy Efficient Unit", from **Confederation of Indian Industry.**
8. PR has won **Anil Raj Trophy** for best improvement in Energy Consumption (amongst IOC refineries), **consecutively for three years – 2000-01, 2001-02 & 2002-03.**

B) Environment & Safety Awards

1. Won **Golden Peacock Environment Management Award –2003** from the World Environment Foundation.
2. Won **Greentech Safety Silver Award 2002-03** in June'03.
3. Declared Runners Up for **National Safety Award-2003** by Ministry of Labour, Govt. Of India under Scheme-I (Lowest Average Frequency Rate) & Scheme-II (Longest Accident Free Period)
4. Received **National Safety Award** for outstanding performance in industrial safety **during year 2005** for achieving "accident Free Year".

C) Others :

1. Commendation certificate for **Rajiv Gandhi National Quality award-2003** for quality management system in industry. Also won the prestigious **Rajiv Gandhi National Award for the Year 2005** in the category of Large Scale Manufacturing Organisation at National level
2. **NPMP award** for excellence in project management of SSRU project.
3. **Shram Shree award** by Hon'ble Prime Minister to one of our employees for exemplary job carried out in RFCC unit avoiding shutdown.
4. **NABL Accreditation** of Quality Control laboratory was obtained in May'03 as per new system ISO/IEC -17025. NABL accreditation has been continued for the year 2005 & 2006 after surveillance audit by NABL.
5. **CII-Exim Bank award for Business Excellence 2004** - Commendation Certificate received for Strong Commitment to Excel.
6. **Rajbhasha Shield - 2003-04** - Town Official Language Implementation Committee (TOLIC), Panipat Refinery declared first position by Ministry of Home Affairs, for commendable work for propagation of Official language.
7. **Gold certificate** under the category of Process Industries, under **India Manufacturing Excellence Award-2005**.
8. **Second Prize in the national Kaizen conference** held at Kolkata on 18-19th Oct'05, under the auspices of TPM Club India. With this, Indian Oil has become the **first public sector company to bag the Kaizen award in any TPM competition** at national level.