# RELIANCE INDUSTRIES LTD,
# REFINERY DIVISION, JAMNAGAR

## Unit Profile:

Reliance, Jamnagar is the largest grass root refinery set up with annual capacity of 32 million tons and the 3rd largest refinery in the world at any single location.

The refinery and Petrochemical Complex comprises of Crude Unit (2 parallel trains), Diesel Hydrotreator (2 trains), VGO Hydrotreator (2 trains), Sulfur (3 trains), Hydrogen (3 trains), Coker, Fluid Catalytic Cracker, Propylene Recovery Unit ( 2 trains), Amine treating Unit (4 Nos) , Desalination Units, Naphtha Hydrotreating, Catalytic Reforming, Paraxylene Extractions trains (3 nos), Tatoray Unit, Xylene extraction, Iso Benzene unit, ED unit, Polypropylene Unit (4 trains), Captive Power Plant, RO plant and a Effluent treatment plant. Block flow diagram of the complex is attached.

## Highlights:

- ✓ **Largest Grass Root Refinery.**
- ✓ **World's Largest FCCU – 10.05 MMTPA (200 KBPSD).**
- ✓ **World's Largest Coker – 8.3 MMTPA (163 KBPSD).**
- ✓ **World's Largest Aromatics Complex – 2.1 MMTPA (PX + OX) capacity in one site.**
- ✓ **World's largest PP in one site – 750,000 MTPA**
- ✓ **India's largest Sulfur Recovery Complex – 1650 TPD**
- ✓ **Large size Captive Power Plant 450 MW Capacity (Power) and 1875 MT/Hr (HHP Steam)**
- ✓ **India's largest Petroleum Terminal, Oil movement and Storage area.**

## Energy Consumption

| Year | Sp Power Cons Kwhr/MT of intake | Thermal Consumption Mkcal/MT of Intake |
|---|---|---|
| 2005-06 | 74.23 | 0.668 |
| 2006-07 | 79.86 | 0.714 |
| 2007-08 | 80.44 | 0.714 |

In the Refinery Energy monitoring, the practice of evaluation of Energy Index is prevailing. An Energy Index is the ratio of actual energy consumed and the standard or theoretical energy consumed. Lower the Energy Index better is the Energy Efficiency.

In Energy Indices evaluation, the feed stocks of all the processing units are considered and the energy Index arrived at by International Systems such as either Shell or Solomon Benchmarking normalizes all the specific energy consumption and the reduction in the Index Indicates true reduction in the energy consumption. Following are the Energy Indices for Reliance Jamnagar

| ***Shell Benchmarking*** | | | ***Solomon Benchmarking*** | |
|---|---|---|---|---|
| ***Year*** | ***CEL**** | | ***Year*** | ***EII**** |
| ***2002*** | ***88.7*** | | ***2002*** | ***72*** |
| ***2003*** | ***87.6*** | | ***2004*** | ***69*** |
| ***2004*** | ***86.9*** | | ***2006*** | ***69*** |
| ***2005*** | ***89.5*** | | | |
| ***2006*** | ***86.5*** | | | |
| ***2007*** | ***85.4*** | | | |

Reliance Jamnagar is topping the list of Shell Benchmarked Refineries in the world and also topping the list of Large Complex Refineries in Solomon Benchmarking in the Asia Pacific Region for last five years. Reliance Jamnagar is the pace setter refinery in the field of energy conservation in shell and Solomon benchmarking continuously since six five years. Increase in CEL in year 2005 is due to the major VMP shutdowns taken for regular maintenance, Capacity enhancement and commissioning of new units.

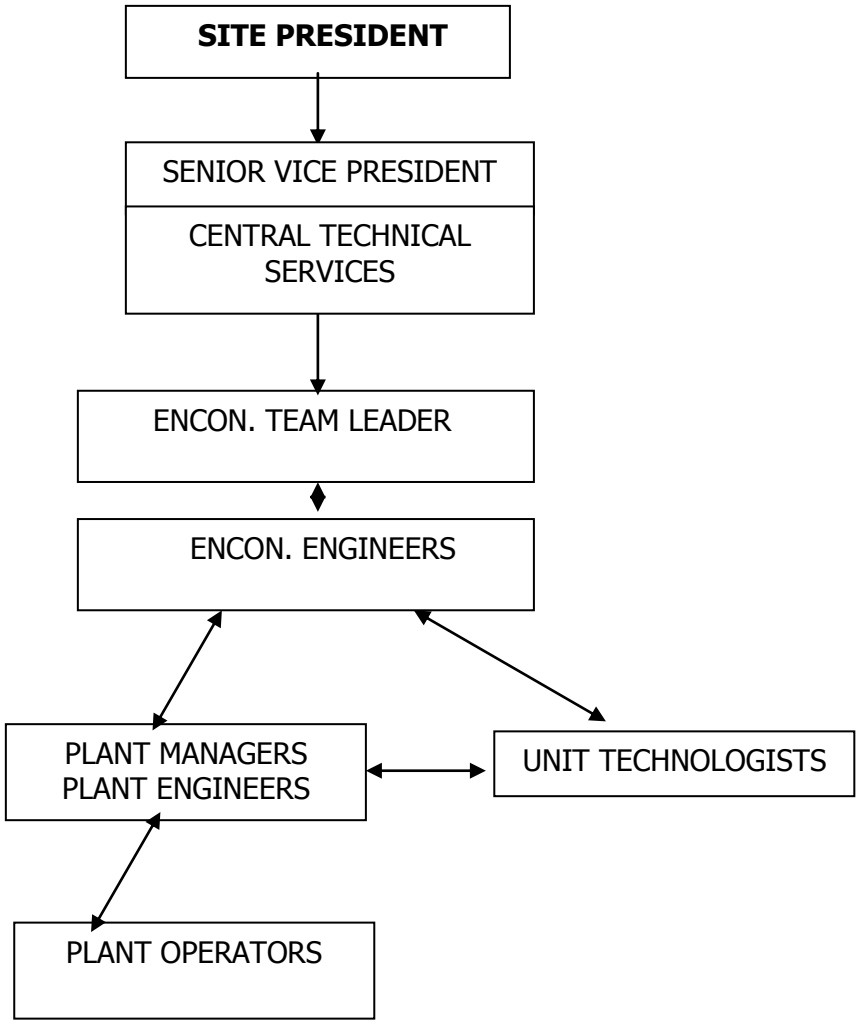
**Energy Conservation Commitment, Policy and Organizational Set up**

Reliance has a comprehensive policy on energy conservation. Innovative energy conservation practices are practiced all throughout the site. Better operating practices, improved operating efficiencies, optimum utilization of resources increased automation, introduction of advanced control systems, new techniques and technologies, higher capacity utilization are the various methods used which aim at the corporate goal or commitment to conserve / optimize energy consumption .The Company's Energy Management policy is attached.

**Energy Management Set-up**

At Reliance Jamnagar on a continuous basis, a detailed review is made at sector chief levels fortnightly with complete focus on Energy Consumption. A rigorous plan is generated by Central Technical Services for implementation of the various projects which are being implemented or are planned in future. Top, middle, junior management and workmen of all level are committed and involved to meet the same corporate goal. The Energy conservation team structure which works out together for implementation of the projects is shown in figure below:

**Energy Conservation Organogram:**



# Major Encon Projects in 2007-08

## Increase in Crude Preheat Temperature by Heat recovery from VGO Product stream in Crude Distillation Unit I.

**Objective:**

The purpose of the project activity is to increase in Crude Preheat Temperature from 247 $^{o}$C to 267 $^{o}$C by Heat recovery from VGO Product stream in Crude Distillation Unit I by using Pinch Technology.

**Brief Description:**

The Crude Preheat train is broadly divided into 3 sections, namely, Cold Preheat Train, Warm Preheat Train and Hot Preheat Train.

1. In cold preheat train , Crude enters unit battery limit at 30 Deg C and is split and directed to 2 parallel Cold Preheat trains, flow being equally split between the 2 trains by flow controllers. In the first cold train, the crude is preheated against Circulating Naphtha pump-around (S01), Circulating Heavy Kerosene pump-around (S-02), MP steam preheater (S03) & VR (S25), and S03 & S25 are in parallel. In the second cold train, crude is preheated against Naphtha pump-around (S04), Light Kero rundown product (S05) and Diesel pump-around exchanger (S08). The 2 crude streams from each train combine and pass to the De-salters. In this train crude is preheated to 145 $^{o}$C.

2. From the outlet of the De-salters, the crude at 145 $^{o}$C, is again split and passes through 2 parallel Warm Preheat Trains. In the first warm train, the crude is preheated against HAGO pump-around (S09) and Vacuum Residue (S10). In the second warm train, crude is preheated against Heavy Kero pump-around (S11) and HVGO pump-around (S12). The 2 warm crude trains flow separately and pass to the Pre-flash Drum. In this train crude is preheated from 145 $^{o}$C to 170 $^{o}$C.

3. Pre-flashed Crude is directed to the Hot Preheat Train by pump P04. The hot train consists of 2 parallel trains. In each train, crude is firstly preheated against the HVGO pump-around (S13/S513), the HAGO pump around (S14/S514), slope wax pump around (S28) and finally by Vacuum Residue (S15/S515). In this train crude is preheated from 170 $^{o}$C to 247 $^{o}$C.

4. The crude finally leaves the preheat rain at approximately 247 $^{o}$C, to the Crude Unit Furnace for further preheating.

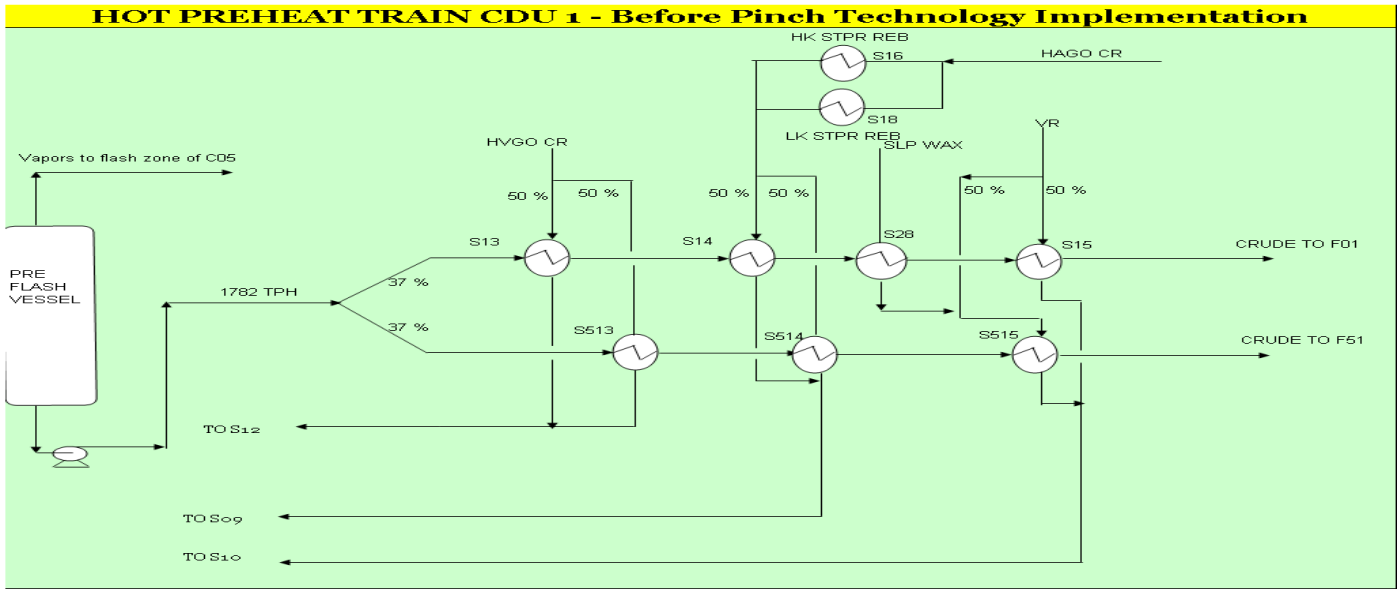
As part of the energy optimization study, crude preheats trains optimization was carried out using the Pinch Technology to exploit potential available of integrating crude unit with other units.

Therefore modifications have been implemented in the hot preheat train of CDU I plant which involved Hot VGO stream routing from VGOHT-1 to CDU-1. Additional exchangers (S-713/714/715) were added as 3$^{rd}$ parallel Hot Preheat train to extract heat available in Hot VGO stream for preheating crude.

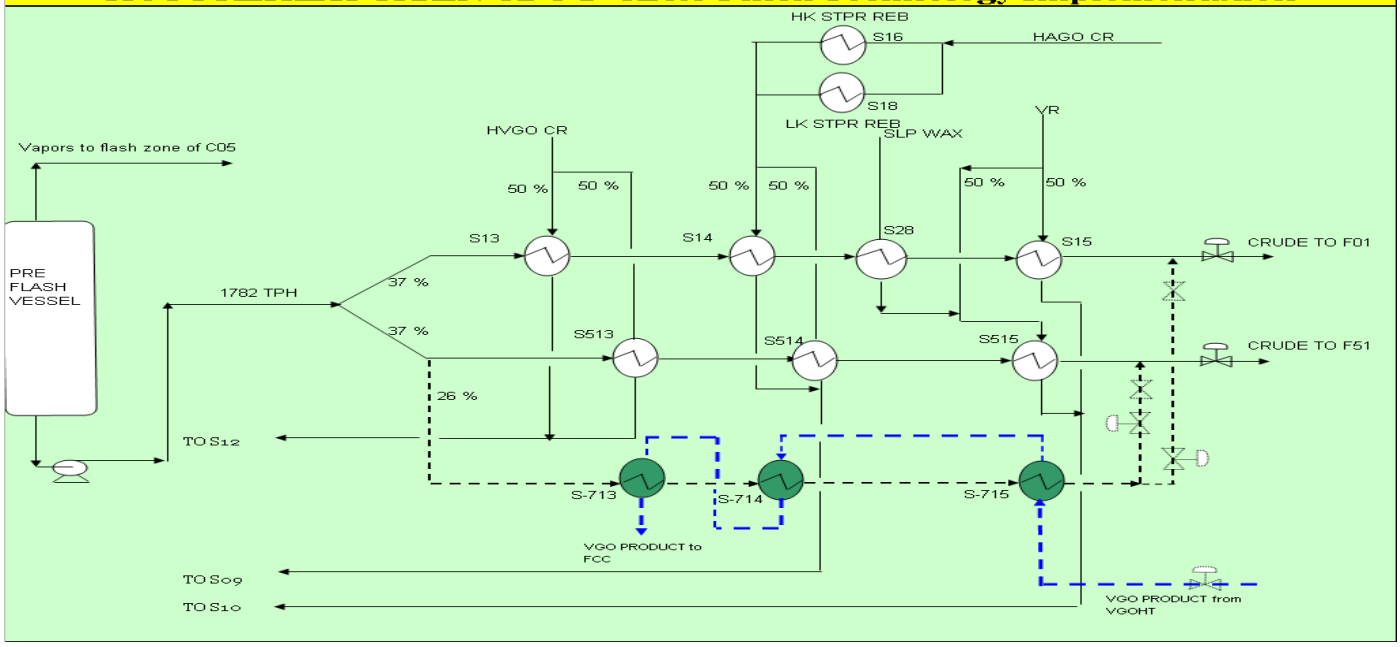
This has increased the inlet temperature of Crude Heaters F-01 and F-51 by **20 $^{o}$C** (from 247 $^{o}$C to 267$^{o}$C) for the throughput of 325 KBPSD.

The increase in heaters inlet temperature reduced the firing in the F-01 and F-51 heaters by **25 Gcal/Hr** combined which is equivalent to saving of **20,000 MT/yr** of fuel oil. The cost of implementation of this project in CDU I was **Rs**. **44.10** Million.

## HOT PREHEAT TRAIN CDU 1 - Before Pinch Technology Implementation




## HOT PREHEAT TRAIN CDU 1 - After Pinch Technology Implementation



## Energy Awards

| Sr. No. | Name of the Award | Remarks | Year |
|---|---|---|---|
| 1 | CII award | Excellence in energy management | 2003,2004,2005, 2006,2008 |
| 2 | ICMA / ICC award | Excellence in energy management | 2003,2005 |
| 3 | Federation of Gujarat Industries award | Excellence in energy Conservation | 2004 |
| 4 | BEE-National energy Conservation Award (Ministry of Power) | Excellence in energy Conservation | 2004,2005,2006, |
| 5 | PCRA award (MoP&NG) | Energy conservation award | 2004,2005 |
| 6 | Oil & Gas Conservation Fortnight Award (Centre for High Technology – MoP & NG award) (Steam Leak) | For the excellent performance of Jamnagar Refinery in reduction of Steam Leaks in the refinery complex. | 2005, 2007 |
| 7 | Oil & Gas Conservation Fortnight Award (Centre for High Technology – MoP & NG award) (Boiler/Furnace Performance) | For the excellent performance of Jamnagar Refinery in Boiler/Furnace/Heaters performance | 2006 |
| 8 | Infraline Energy Award | The Refiner Award was presented by Infraline Energy Research and Information Services (New Delhi) in Oct.'07 for the excellence of Jamnagar Refinery in Petroleum Refining and its excellent contribution to the Indian Energy Sector. | 2007 |

**Energy Conservation Plans and Targets**

Reliance Jamnagar aims/plans to become the pace setter and world leader in respect of Energy Conservation and Management in the refining sector. Reliance objectives are also indicated in Energy Management Policy mentioned in Sheet-8 item 13 (e). The List of Planned projects is shown under:

| Sr. No. | Project | KTSRF/yr. |
|---|---|---|
| **1** | **Heat recovery from New plate-frame type Rich /lean Amine Exchanger in ATU-4** | 5.526 |
| **2** | **Reduction in Flare loss by providing flare flowmeters at HP, LP & Parex Flare headers in Aromatics unit.** | 0.510 |
| **3** | **Routing of Propylene Treater Regeneration Gases to LLP Flare** | 0.997 |
| **4** | **BFW preheating by flue gas heat in all the HRSGs.** | 1.960 |
| **Total** | | **8.993** |

**Ultimate Target**

The ultimate target is to achieve lowest energy consumption per barrel of Crude oil feed stock processed.

- To achieve Solomon International Energy Intensity Index of 55 or lower.
- To achieve Shell Corrected Energy and Loss Index of 80 or lower.

## Environment & Safety

At Reliance Jamnagar, clean environment for sustainable development is of prime concern, and is an important business objective, achieved by every employee's contribution and responsibility towards environmental performance.

Reliance Jamnagar is committed to the protection of environment. The design of state of the art effluent treatment plant, low NOX burners in Furnaces and zero liquid effluent discharge ensure the safety of the environment. Treated sewage, industrial effluent and stack emissions are extensively monitored to ensure no harm is done to the environment. Reliance is committed to transform the arid land in and around the complex into a lush green belt. Following are the major efforts in this direction:

- Plantation of 11,500 trees in the direction of further enhancement of benefits of greening like CO2 absorption & improved microclimate etc during last year.
- Development of green belt 3 times more than the statutory requirement.
- Integrated plantation with optimum mechanization
- Biodiversity Enrichment for improving ecology
- Construction of landfill facility for the disposal of hazardous waste.
- Incinerator plant is installed of 200Kg/Hr capacity for to incinerate the Hazardous Waste like Oily Rags, Oily sludge & other oily contaminated material.
- Reverse Osmosis (RO) installed of cap. 110 m3/hr.
- Integrated Water Management – 100 % reuse of treated effluent
- Well-structured, certified EMS complying with ISO 14001:2004 standard.
- Use of Solar Water heaters in township. Total 1300 Solar Heaters are installed, 1000 no. having 300 lit capacity and 300 no. having 500 lit capacity. This has resulted in saving of 9,900,000 electricity units, which in turn have reduced CO2 emissions by 6750 tonnes annually.
- Looking beyond compliance, we have taken special initiatives like:-
  - **Biogas Generation** from canteen food waste
  - **Disposal of Fused / discarded tube lights** through tube light crusher unit in environmental friendly manner.
- Pollution Prevention (P2 Concept) instead of pollution Control
- **During last two year reduction in emission of CO2 by 4.98 Tons/Kilotons of Crude processed**
- **During last two year reduction in waste generation: 5.98 kgs/KT of crude processed**

**HSEF & Energy Conservation Awards and Recognition**

| Sr. No | Name of award / Rank | Awarding Authority with address | Year & Month | Area in which award is given | Level (International, National, State) |
|---|---|---|---|---|---|
| 1. | National Safety Award | British safety Council | March 2001 | Safety | International |
| 2. | Shell safety Award | Shell Global Solutions | March 2001 | Safety | International |
| 3. | Shell Safety Gold Plaque | Shell Global Solutions, The Hague Netherlands | 2001 | Safety | International |
| 4 | ISO 14001 | Lloyd's Register Quality Assurance, India Andheri, Mumbai | April, 2003 | Environmental Management System Standard | International |
| 5. | Five Star Health and Safety Management System Audit | British Safety Council, UK | May 2003 | HSEF | International |
| 6. | Good Housekeeping Award | Baroda Productivity Council , Baroda ,Gujarat | June 2003 | Housekeeping | State |
| 7. | Greentech Environmental Excellence Award (Gold) | Greentech Foundation, New Delhi | Dec 2003 | Environmental Excellence | National |
| 8. | FICCI Annual Award 2003-04 for Environmental conservation and pollution Control | FICCI | Dec 2004 | Environmental conservation & pollution Control | National |
| 9. | Greentech Environmental Excellence Award | Greentech Foundation, New Delhi | Nov 2004 | Environmental Excellence | National |
| 10. | International Safety Award 2004 | British Safety Council,UK | May 2005 | Commitment to Corporate health and safety. | International |
| 11 | OHSAS-18001 | Lloyd's Register Quality Assurance, India | Sept 2005 | Occupational Health & Safety Management System Standard | International |
| 12 | Good Housekeeping Award | Baroda Productivity Council , Baroda ,Gujarat | Dec 2005 | Housekeeping | State |
| 13 | Gujarat State Safety Awards 2005 ( Runners) | Gujarat Safety Council & Directorate of industrial Safety & Health, Gujarat State | Dec 2006 | Lowest Disabling Injury Index & for working more than 3 million man hours | State |

| Sr. No | Name of award / Rank | Awarding Authority with address | Year & Month | Area in which award is given | Level (International, National, State) |
|---|---|---|---|---|---|
| 14 | CII award for excellence in water management | CII, New Delhi | Dec 2005 | Water Management | National |
| 15 | Greentech Golden Safety Award 2005-06 | Greentech Foundation, New Delhi | Jan 2007 | Safety | National |
| 16 | ICC award for water resource management in chemical Industry | ICC, New Delhi | Mar 2007 | Water Management | National |
| 17 | Good Housekeeping Award 2006-07 | Baroda Productivity Council , Baroda ,Gujarat | May 2007 | Housekeeping | State |
| 18 | Golden Peacock Award for Occupational Health and Safety award | World Environment Foundation, New Delhi | June 2007 | Occupational Health and Safety | National |
| 19 | Srishti G-Cube Award for Good Green Governance | Srishti Publication Limited, New Delhi | April 2008 | Environment | National |
| 20 | Greentech Award for Environmental Excellence | Greentech Foundation, New Delhi | Sep 2008 | Environment | National |

# National Energy Conservation Award – 2008

## (1) World's Largest Grass Root Refinery:

## (2) World's Largest Grass Root Crude Distillation Unit

## (3) World's Largest FCC Unit


## (4) World's Largest Delayed Coker Unit

## (5) World's Largest Para Xylene Production Units at single location

## (6) Highly Efficient Co-generation Captive Power Plant

## (7) Multiple Effect Evaporator Desalination Units

## (8) India's Largest All Weather Petroleum Terminal

## (9) India's first Automated Rail Gantry in Single Spur

## (10) Crude Receipt by Two SPMs (Single Point Mooring)

## (11) Refinery Green Belt is spread over 1500 Acres

## (12) Green Belt has more than 3 Million Trees


## (13) Scrapped Tube light Disposal System


## (14) Solar Water Heater

## (15) Anaerobic Digester

Reliance
Industries Limited
Growth is Life

# Energy Management Policy

Reliance Industries Limited plays a leading role in the national and global economy by providing quality goods and services in the materials and energy value chain.

Our Mission is :

- To become the lowest specific energy consumer in the industry.
- To widen our opinions for energy sources and
- To minimize the adverse impact of our operations on the environment.

We plan to achieve the above within the framework of sustaining the business by :

- Integrating energy management with the business management and establishing perfomance driven goals.
- Upgrading hardware, deploying new technologies and improving our practices to increase energy efficiency, reduce greenhouse gas emissions and minimize environmental impacts.
- Supporting scientific research and technological efforts to deliver new sources of energy including renewable and alternate fuels.
- Carrying out regular audits and training employees to promote energy conservation as a culture across the entire business functions.
- Continuously benchmarking our energy efficiency and energy productivity against others.
- Promoting awareness on energy conservation among all members of the Reliance family and the community at large.

Mukesh D. Ambani
March 2007