Reliance Industries Limited Hazira

(i) Unit Profile:

In a short span of two decades, Reliance Industries Limited has grown from a small scale trading company to the number one private sector company in the country. Just two decades of operation is too small a period for any company to set records in corporate history.
In 1977, it was a small company with sales of Rs. 67 crores , net profit of Rs. 3 crores, and net worth of Rs 10 crores. Now after 27 years, for the year ending March 2004, Reliance has notched a gross turnover of 74,418 crores , export of Rs. 14,969 crores and made a net profit of Rs 5,160 (US$ 1,180 million) crores. The company's total assets are valued at **Rs 71,157 crores** and the number of shareholders is over 2.2 million . It is the first private sector company in India to record a net profit of US Dollar over one Billion. Reliance is amongst top 10 producers globally of all its major products.

Reliance makes and markets textiles, polyester fibre, plastics, petrochemicals and oil and gas. The company's vision is to "**Create value for the nation by offering competitive goods and services in the materials and energy value chains and infrastructure facilities**."

The 1000-acre Hazira manufacturing site is located 22 kms west of Surat City in the State of Gujarat on the estuary of Tapi river. The site provides an easy access for bringing raw materials through sea and lies in the center of the consumer intensive western region.
Reliance, Hazira a multi-product, fully integrated complex make plastics, petrochemicals, fibre and fibre intermediates

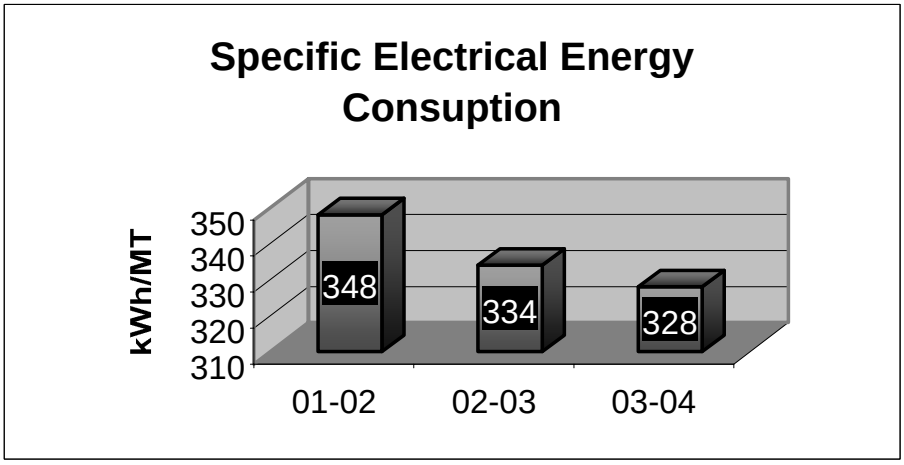
Manufacturing Facilities at Hazira

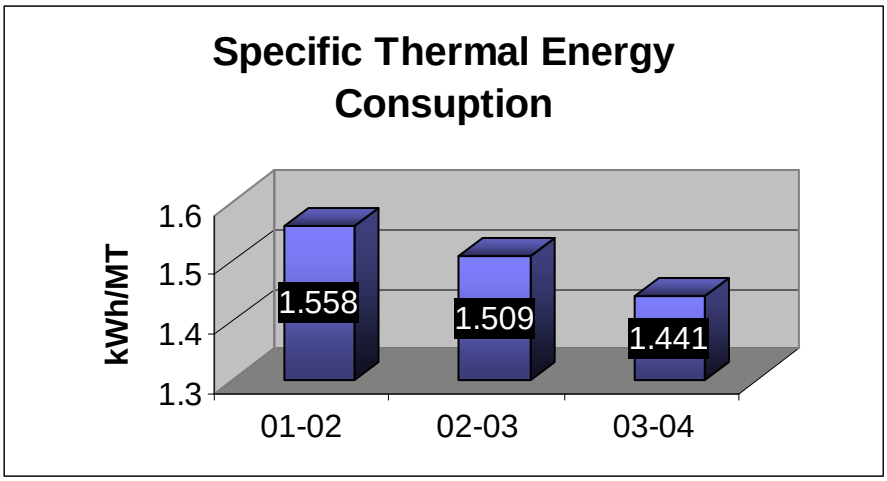
Naphtha is cracked at high temperature to produce ethylene and propylene. Benzene and toluene are extracted from the cracked products. Ethylene is polymerized to LLDPE/HDPE in the polyethylene plant. Propylene is polymerized to PP in the polypropylene plant. Ethylene is chlorinated to ethylene-di-chloride, which is cracked to vinyl chloride and, in turn, polymerized to PVC in the PVC plant. Ethylene is oxidized to ethylene oxide, which is hydrolyzed to MEG in the Mono Ethylene Glycol plant. Paraxylene is oxidized to produce PTA. MEG and PTA are reacted in polycondensation lines to make POY, PSF, Polyester Fibre Fill and PET. The complex has 250 MW of captive power generation capacity based on gas and naphtha. Hazira has its own jetties and a single buoy mooring five km. off the coast for the large tankers to transfer the main raw materials Naphtha and Paraxylene directly to the tank farms. The Hazira complex uses advanced process control systems and the complex operates on a Computer Integrated Manufacturing (CIM) system. Planning the database for the business decision is governed by the vision to use the world class ERP-SAP system uniformly across the reliance for capturing the data at source, for availability of information online, real time to the users for data security and for smooth data transfer interfaces. Hazira Manufacturing process is supported by process control system by ABB, Siemens .Advance process control , real time optimizer and IP-21 (Info plus) systems allow plant operating data access from any where in the world.

(ii) Energy Consumption:

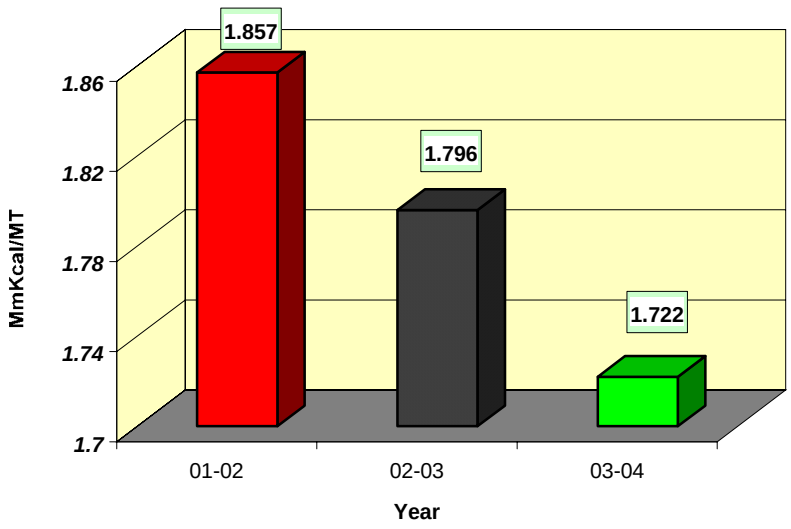
Drooping trend of energy consumption is the result of energy conservation efforts put-forth by RIL Hazira team . Data for the past three years is mentioned below.

Description	Unit	Year		
		2001-02	2002-03	2003-04
Annual Production	MT	4858959	5161629	5387547
Electrical Energy Consumption	Lakh kWh	16907	17242	17651
Thermal Energy Consumption	Mmkcal	7570785	7789020	7761962
Specific Electrical energy consumption	kWh/MT	348	334	328
Specific Thermal Energy Consumption	M kcal/MT	1.558	1.509	1.441
Overall Specific Energy Consumption	Mkcal/MT	1.857	1.796	1.722
Energy Cost/ Manufacturing Cost	%	3.7	3.4	4.48





Overall Thermal and Electrical Energy Consumption



The above specific consumption figures will improve substantially because of

(i) Various Energy Saving Schemes which are in the process of implementation.

(iii) Energy Conservation Commitment, Policy & Set-up:

* To intensify the in-house efforts for improving Energy Efficiency separate Energy Cell was created by the management.
* The Energy Cell is operational since June'1999 under the guidance of Vice president Energy Cell.

Four Tier Energy Management System is followed at Hazira

* The **Apex Group** comprises of primarily the top management at RIL Hazira. The Executive Director (Hazira Site) heads this group.
* Energy Cell is headed by Vice president. He has 4 engineers working with him. This is the **Core Group**.
* Each of the plants has a designated Energy Co-coordinator. The Energy coordinator of Individual plant along with a technical service engineer and a electrical engineer of the same plant forms the **Working Group**.
* **Small Group Activity** is the new initiative to involve shop floor people in the energy conservation. All the plants have nominated members for the SGA and the training for the group was organized through Confederation of Indian

Industries. The groups have started regular meetings for brainstorming and developing ideas in their working area.

The major functions of the four tier groups

Groups	Organization	Functions
Apex Group	• Executive Director – RIL, Hz • President – Manufacturing • Vice President – E & FC • Vice President – CTS/TS • AVP – CPP & U • AVP – Polymer, • GM – Fiber • GM – MEG, • GM - Electrical	> Review complex energy consumption trend. > Review status of schemes. > Major decision making for implementation & continued improvements

Groups	Organization	Functions
Core Group	• Vice President – E & FC • Engineers – E & FC	> Compile energy schemes. > Prioritize the schemes > Review and add values to the schemes. > Arrange for external audit > Provide guidelines to working group. > Arrange for training. > MIS reporting. • **Additional:-** > Economic optimization of various fuels. > Substitution of costly fuels by technically suitable cheaper fuels. > Optimise Power / Utilities operation and reduction in unit cost of steam / power / utilities generated. > Reduction in total demand by user plants for power and utilities.
Working Group	• Plant Energy coordinators • Plant CTS/TS Engineers • Plant Electrical engineers	> Create Data Base > Monitor efficiencies > Audit > Conceive new schemes > Implement approved schemes
Small Group	• Leader and Non-supervisory staff from process, electrical and mechanical	> Brain storming. > Identification of theme on energy conservation. > Study the system w.r.t. energy. > Implementation of energy efficiency projects.

October 03 , 2001

Energy Management policy

Reliance plays a lead role in the national economy by providing quality goods and services in the materials and energy value chains and in infrastructure.

Our mission is,

- To be the **lowest specific energy consumer** in the industry we operate.

- To **maximize the use renewable and low energy level fuels** in our operations.

This we plan to achieve by the following:

- **Manage efficiently** the utilization of energy resources, upgrade hardware and employ cleaner and more efficient technologies.

- **Train employees** to make Reliance the pace setter in the area of energy conservation.

- Carry out regular internal and external **audits** to identify areas for improvement.

- **Benchmark** continuously our performance against the best in world.

- Enrich our experience on energy conservation by **exchange of ideas** with other organizations.

- Promote **awareness** among all members of the large Reliance family

Sd
(Mukesh D. Ambani)

(iv) Energy conservation Achievements:

Major Energy Conservation Schemes implemented during 2003-04

1. Suction chilling of PAC in PTA-1

Seasonal and day–night ambient temp affects the capacity and efficiency of the large Process Air Compressor. This centrifugal turbo compressor is driven by a 20.5 MW motor as well as a 6.0 MW Off-gas Expander. The total power of the train would be 21 MW.

It was proposed to go in for evaporative cooling followed by chilling of inlet air to maintain a constant temp of 15^{o}C at the suction. These results into reduced power consumption as well as increased capacity utilization during higher ambient temp and low power frequency.

Vapor absorption refrigeration machine were used to generate chilled water for suction air-cooling. The steam required for the VAR machine was provided by flashing high-pressure process condensate (waste heat recovery at 3.0 BarG level). This allowed the export of additional equivalent quantity to the complex grid.

The saving achieved was 61.3 Lakh kW/annum of power i.e. Rs 163 Lacs/annum with an investment of Rs 130 Lacs. The simple payback of the scheme is 9.6 Months

2. Maximization of condensate injection in injection heater at HP Dissolver Feed Pump

In purification section of PTA plant feed is heated from 90 °C to 283 °C prior to being fed to the reactor. The heating is achieved by utilizing process heat through process condensate injection in the feed against process flash vapors. The final heating is carried out by SHP steam. Higher process condensate injection leads to higher heat recovery and thus reduced SHP steam consumption.

The saving achieved was Rs 208.3 Lakh without any investment. The payback of the scheme is immediate.

3. Avoid DM Water double pumping by shifting high head pump to CPP

There are two PTA plants in Hazira. DM water consumption in each PTA plant is 130 M^3/hr and 260 M^3/hr in total from both the plants together. This water was being supplied by CPP, which has 5 nos pumps of 160 M^3/hr and 40 mtr head. In the original scheme DM water from CPP was pumped to the ISBL tank of PTA plants. This DM water was again pumped to PTA process with a high-pressure pump of 250 M^3/hr capacity at 13 barg pressure. ISBL pumps of both the PTA plants were under loaded which was leading to energy wastage.

The pressure drop survey in the CPP DM water supply line revealed that if PTA high-pressure pump is shifted to CPP, the required pressure and flow for both the PTA plant can be met with only one pump running.

The saving achieved was Rs 38.9 Lacs/annum with an investment of Rs 9 Lacs. The simple payback of the scheme is 2.8 Months

4. GT1/2 By pass stack damper double sealing arrangement

There are total 7 nos Gas Turbine in Hazira, which are installed in a different phase of complex expansion. GT-1 & 2 were commissioned 1st phase in 1991. Out of efficiency monitoring process, it was observed that unfired steam generation from GT-1 & 2 is 52-53 TPH compared to 55-56 TPH in other 5 nos GT. It was suspected that hot flue gas is bypassing through the bypass stack damper in GT-1 & 2. There was no provision to measure directly this bypassing. Online temp measurement RTD was installed in all GT bypass stack and observed that bypass stack temp in GT-1 & 2 is indicating around 500°C compared to around 70°C in balance 5 nos GT.
Further study revealed that sealing in bypass stack damper of GT-1 & 2 is with single seal as against double sealing in rest of the GTs. Then the single seal of GT-1 & 2 were replaced with double seal. This resulted into increased unfired mode free steam generation of 3 MT/hr per HRSG.

The saving achieved is Rs 4.31 Crores/annum with an investment of Rs 11 Lacs. The simple payback of the scheme is 0.3 Months

5. Stopping Augment Air fan in all five BHEL HRSGs

All 7 nos Heat Recovery Steam Generation (HRSG) units in CPP are mostly running on fuel gas. As per design augmentation air is required only for liquid fuel firing but not for gas firing. It was observed that pilot gun tips are frequently getting damaged due to furnace heat. Vendor suggested for purging the pilot gun with augment air. Thus augment air fan was running all the time. The power consumption in augment air fan was 30 kW, which was brought down to 22 kW by providing an orifice in the fan suction.

Purge air requirement was further studied and found that the air demand for pilot purging is only 500 Nm3/hr for which a fan of 14500 Nm3/hr is running with throttled suction. Then various alternatives were considered and finally decided to meet this small purge air requirement from the spare capacity of HRSG seal air fan. The scheme was implemented in all the 5 BHEL HRSG and power consumption in each HRSG reduced from 22 kW to 3 kW. In addition to the Power saving, heat saving in HRSG was achieved since this air which is not required for the combustion was getting vented to atmosphere @ 200°C.

Total saving of Rs 2.18 Crores/annum was achieved with marginal investment of Rs 50,000. The simple payback of the scheme is immediate.

6. Installation of New STG with HP steam extraction and LP steam injection facility'

HP steam (40K) was being generated through PRDS from SHP steam (105K) since the beginning of the complex in 1991. In 1995 when Cracker plant was commissioned, a Steam Turbine was brought with HP steam extraction facility. But this STG was meeting only part of the total HP steam demand in the complex. This PRDS operation was one of our major concerns. Therefore, enough efforts were put to reduce the HP steam demand either directly through HP steam saving or substitution through lower level steam. After implementation of various such Encon schemes, still demand of 40 TPH HP steam was left out. In 2002 when some additional power demand from new plant projects necessitates expansion of CPP, various alternatives were available for CPP expansion. But a new STG with HP steam extraction facility was finally selected so that PRDS operation is totally stopped.

Not only HP steam extraction facility, but also LP steam injection facility into the new Steam Turbine has been incorporated envisaging the surplus LP steam in future from

various Encon schemes. Therefore, a 40 MW new STG with 40 TPH HP steam extraction and 50 TPH LP steam injection facility was commissioned in the year 2003.

The saving from HP steam extraction was Rs 194 Lacs/annum and since the steam turbine was installed for power augmentation so no investment is considered.

7. **Integration of feed water system in various DM plants and avoiding double pumping**

Filter water from Raw Water Treatment Plant (RWTP) was being pumped to a Central Reservoir and then pumped from central reservoir to DM plant as feed water to DM plant. It was found that two pumps of 500 m3/hr is continuously running for transferring 700 m3/hr filter water from raw water treatment plant to central reservoir. Similarly 2 pumps of 500 m3/hr is continuously running for feeding 600 m^3/hr filter water to DM plant. Thus all four pumps were running at under loaded condition. Also some pumps were running to transfer filter water from raw water treatment plant to central reservoir for some other requirements.

It was found that the head of the pump located in RWTP#1 is inadequate for directly feeding to DM plant. There is another Raw Water Treatment plant (RWTP#3) located nearby which has a pump with adequate head to feed directly to DM plant. Also the filter water tank in RWTP#1 has higher elevation than that of RWTP#3. Thus a gravity flow channel was laid to interconnect the two filter water tanks. Then the scheme was implemented to transfer the filter water directly to DM plant in addition to feeding central reservoir for other requirements by utilizing the pump of RWTP#3.

Implementation has resulted into stopping of 4 nos pumps, which saved Rs 51.3 Lacs/annum with Rs 6 Lacs of investment. Simple payback of the scheme is 1.4 months.

8. Reflux ratio adjustment and stopping one Hiboil column reflux pump

There are 3 reflux pumps in HighBoil Column. The 3rd pump was installed for plant DBN @120%. The normal operating philosophy was to operate 2 pump with 1 pump as standby. After DBN, the reflux was optimized/reduced from 220-225 MT/hr to 195-205 MT/hr without effecting product quality. The reflux flow rate was reduced. This has also reduced load on reboilers. Thus, stopping one pump has saved 18 KWH/hr of power and reduction in reboiler load has saved 2 MT/hr of steam.

The saving achieved was Rs 125.3 Lacs/annum with no investment. The simple payback of the scheme is immediate.

9. Additional Depropaniser column installation

The original Depropaniser tower was designed to provide at least 50 TPH of propylene load. However, in actual practice, the column gets flooded at approximately 82 % of its calculated hydraulic capacity. Limitation in Depropaniser column results in increased C4 slippage from column overhead and increase in next column, propylene tower bottom temperature. Due to this, propylene tower steam consumption has increased by ~ 12 T/hr.

A number of internal tray modifications were carried out in the tower in the previous shutdowns but all of them were only partially successful in removing the existing constraint in the tower i.e, limitation in the tower performance is reached only at @ 42 to 43 TPH of propylene production. Therefore, it is proposed to install a new larger diameter tower,

which will be erected on a new foundation and hooked upto the existing recoilless/ condenser with minimum piping modifications. The old tower will remain on standby.

In addition to the increase in the production volume the benefit of installing the new depropaniser column was reduction in the Reboiler steam load by 12 MT/hr. The cost saving was 6.95 Crores/annum with an investment of Rs 3.71 Crores.

10. CGC discharge line modification

Charge gas compressor (CGC) is used to compress charge gases produced in furnace from 0.6 kg/cm2 g to 36 kg/cm2 g. This compressor is driven by steam turbine, which uses 105 kg/cm2 g steam (SHP Steam) as motive fluid & has 18 K extraction and condensation facility. Presently, CGC turbine is fully loaded and governs the plant capacity.

CGC4th stage discharge line size was increased from 18" to 30 ". This has resulted in reduction in discharge pressure at the same pressure of chilling train. This reduction in pressure drop by ~ 1.2 kg/cm2 had given 0.35 MW extra power for CGC resulting in increased plant throughput. Alternatively, by keeping the same plant throughput, SHP saving of the tune of 1.4 TPH can be achieved.

The saving achieved was Rs 215.4 Lacs/annum with investment of Rs 35 Lacs. The simple payback of the scheme is 1.9 months.

11. VOC burning in POY Dowtherm Vaporiser

Polyester process produces some Volatile Organic Compounds (VOCs) as a part of the main by-product wastewater. These VOCs with wastewater were earlier sent to Organic Stripping Column (OSC) and then to effluent treatment plant. However, with this kind of treatment, all the heat value associated with VOCs was getting lost. Attempts were made to recover the heat value by modifying the treatment and burning the same.

Feasibility was studied for the steam stripping option and burning the column top product containing VOCs in Dowtherm Vaporizers along with main furnace fuel. The column top product having 10% VOC concentration has a NCV of 376.1 Kcal/Kg. Based on the nature of VOCs, old burners were replaced in two Dowtherm vaporizers. The process utilized available stripping column by required modifications to reduce the project cost drastically.

The net heat gain from burning 2300 Kg/Hr stream along with main fuel was equivalent to saving of 84 SM3/hr of fuel gas per hour (Saving of Rs. 66.1 Lacs per year). The total project cost was Rs. 120 Lacs giving a pay back in 21.8 months.

12. Utilization of PTA waste low grade steam in POY stripping column

With modification of Organic Stripping Column (OSC) as described above to carry out steam stripping operation of wastewater, the processing of wastewater needed LP steam. The total requirement of LP steam for processing the wastewater was 2500 Kg/hr. The generation cost of VOCs by using fresh LP steam would have been much higher and the project was becoming unviable. Source of steam available as a by-product from other nearing plants was searched. Waste steam was available in the required quantity from PTA plant, which was having some contamination of PTA plants chemicals. Suitability of using this available waste steam for steam stripping of wastewater in OSC was checked and necessary up gradation of MOC was done to take care of this contamination.

Necessary piping was done to take waste steam from PTA plant to POY OSC with MOC of SS304L. The saving of steam (2300 Kg/Hr) amounted to Rs. 133.2 Lacs per year against the cost of piping and instrumentation, which was Rs. 79 Lacs, giving a handsome pay back period of 7.1 months. By utilizing this steam, the precious energy could be saved thereby saving fuel to generate fresh steam.

Energy Conservation Awards Won

1. National Energy Conservation Award

- 1998-99, 1999-2000, (First Prize)
- 2000-01 (Second Prize)
- 2001-02 (Second Prize)
- 2002-03 (Second Prize)

– By the Ministry of Power (Govt. of India)

2. Petroleum Conservation Research Association (PCRA)

- 2000 –Exemplary Work in Energy Conservation
- 2001 –Exemplary Work in Energy Conservation
- 2002 –Exemplary Work in Energy Conservation

- By Ministry of Petroleum

3. Confederation of Indian Industries (CII)

- 2000 –Excellence In Energy Conservation.
- 2001 –Excellence In Energy Conservation
- 2002 –Excellence In Energy Conservation
- 2004 - Excellence In Energy Conservation (Short listed)

(v) Energy Conservation Plans & Targets:

The Target set for year 2004-05 by the company is -

* Reduction in power consumption by **1.5% minimum** by March 2005
* Reduction in steam consumption by **1.5% minimum** by March 2005.

Major Energy Conservation Schemes Planned for F.Y. 2004-2005

Sr. No.	Energy conservation Measures (Planned)	Anticipated Savings per year		Approximate Investment (Rs. Lakhs)	Project commencement & completion year	
		(Energy Value, Mmkcal)	(Rs. Lakhs)		Start	End
1	Make up water heater in BHEL boilers	207464	1746.8	500	03-04	04-05
2	Complex Cooling water pump internal coating	8291.0	256.3	54	03-04	04-05

3	Optimization in BFW pumping system	2608.0	80.6	10	03-04 04-05
4	Auto stop facility of phase#1 DM water export pumps	392.0	12.1	0.5	03-04 03-04
5	Reduction in plant and Instrument air header pressure	1688.0	52.2	0	03-04 03-04
6	Recovery of Phase-1 boiler Blow down	7780	65.5	8	03-04 03-04
7	Increasing the Heat exchange area of EA- 1552 in CPP	641	19.8	4	03-04 03-04
8	Use of HP steam in place of SHP steam let-down in PTA purification Crystalizers	9354	78.8	10	03-04 03-04
9	Installation of VSD in DH Column Reflux Pump, G-615 and Oxy M/L pump G-412.	362.0	11.2	5	03-04 03-04
10	Usage of one recovery compressor for continuous recovery	754.0	23.3	0	03-04 03-04
11	Provision of VSD in dryer FD fan motors	151.0	4.7	1.5	03-04 03-04
12	Replacement of higher capacity effluent pump with lower capacity pump	204.0	6.3	2	03-04 03-04

Sr. No.	Energy conservation Measures (Planned)	Anticipated Savings per year		Approximate Investment (Rs. Lakhs)	Project commencement & completion year Start End
13	Provision of higher capacity blower in PVC line-1 to stop two nos of small capacity blowers	377.0	11.7	0.5	03-04 03-04
14	Use of Hot recycle solvent to preheat reactor feed in PE-II plant	32802	282.2	25	03-04 03-04
15	Use of flash steam in stripper of PE-I &II	25933	218.4	12	03-04 03-04
16	To import LP steam in place of MP steam letdown in MEG plant.	31658	266.6	10	03-04 03-04
17	Installation of condensate pot for MEG column Reboiler	16269	137.0	24	03-04 03-04
18	Optimization of feed tray location in Hiboil column	21692	182.6	0.5	03-04 03-04
19	Preheating of heads column feed using VCM column bottom stream	3890	32.8	15	03-04 03-04
20	Replacement of HP steam by MP steam in Extract De-Tol tower re-boiler by re-tubing of Re-boiler with high flux tubes.	16645	140.2	60	03-04 04-05
21	Ethylene tower vapor feed directly to VCM plant	2940.0	90.9	128	03-04 03-04
22	Reduction of dilution steam generator blowdown by using a spare exchanger	21692.0	182.0	20	03-04 03-04
	TOTAL	**413587.0**	**3901.8**	**890**	

(vi)

Environment & Safety:

Reliance employs proven technologies from world-class licensers to ensure minimum quantity of waste generation, low emissions and low noise pollution. Hazira was the first petrochemical complex in India to be awarded ISO 14001 certification for an entire site and continual improvement in the environment performance is aimed at and achieved.

Environment Management System of RIL, Hazira was certified ISO-14001 by M/s. Lloyds Register Quality Assurance (LRQA) in 1999 and the certificate was renewed for 3 years in October 2002.

Reliance seeks to make all its plants safe places to work, to protect the interests of employees and stakeholders. Safety overrides production targets at Reliance. Hazira has its own fire brigade to respond within seconds to any incident of fire. World-class occupational health surveillance systems with periodical health monitoring confirming to OSHA standards are practiced for prevention of work related health hazards.

Some of the striking features of RIL , Hazira's are :

1) First integrated petrochemical complex in India to get an ISO 14001 certificate for its entire complex in 1999.Recertified in 2002.
2) More than 80 Environment Management Programmes are implemented each year (since 1999) to achive the objectives and targets set under Environment Management system.
3) Continuous reduction in specific water consumption, effluent generation, power consumption, steam consumption, paper consumption etc.
4) Use of non conventional techniques such as vermiculture technology (for disposal of horticulture waste) , digester (for disposal of canteen waste), Drip irrigation and sprinkler system to ensure sustainability.
5) Substitution of hazardous components such as Carbon Tetra Chloride (CTC), Asbestos gloves, Asbestos blankets etc with non hazardous non toxic alternatives.
6) Implementation of Leak Detection & Repair Programme (LDAR) for reducing the fugitive emissions.
7) Productive management of hazardous and non hazardous wastes.
8) Compulsory training on Environment to all employees and contractors.
9) Use of innovative methods (such as on line environment awareness quiz competition, Spot the environment aspect competition, Environment Awareness skit competition, Environmentalist of the year award, Most environmentally conscious Plant trophy, Environment Improvement suggestion competition, display of useful information on intranet etc) for promoting environment awareness amongst employees at all levels.
10) Implementation of CASH (Change Agents for Safety & Health) project for improving work place environment.
11) Conducting a Health Risk Assessment Survey of the complex.
12) Mapping of high noise area of the complex and display of Noise map (highlighting high noise area) in all plant control rooms for creating awareness on high noise level areas and reducing the exposure to high noise.
13) Vigorous internal review mechanism.
    a) Weekly HSE&F apex body meeting chaired by the Executive Director and attended by all plant heads (CES head & CTS head),
    b) Weekly Waste Management Meeting chaired by the ED and attended by site president, and representatives from ETP, Technical services, Commercial dept and Environment.

c) Quarterly Management review meeting for quality and environment management system chaired by ED and attended by all HODs, Management Representatives and other concerned.

14) Formation of Environment Committee (comprising a representative each from Environment, Process and Technical services) in each plant for environment improvement, promoting awareness and solving plant specific issues.