Reliance Industries Limited, Hazira

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 29 years, for the year ending March 2005, Reliance has recorded a gross turnover of 73,164 crores , export of Rs. 25,532 crores and made a net profit of Rs 7,572 (US$ 1,731 million) crores. The company's total assets are valued at **Rs 80,586 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

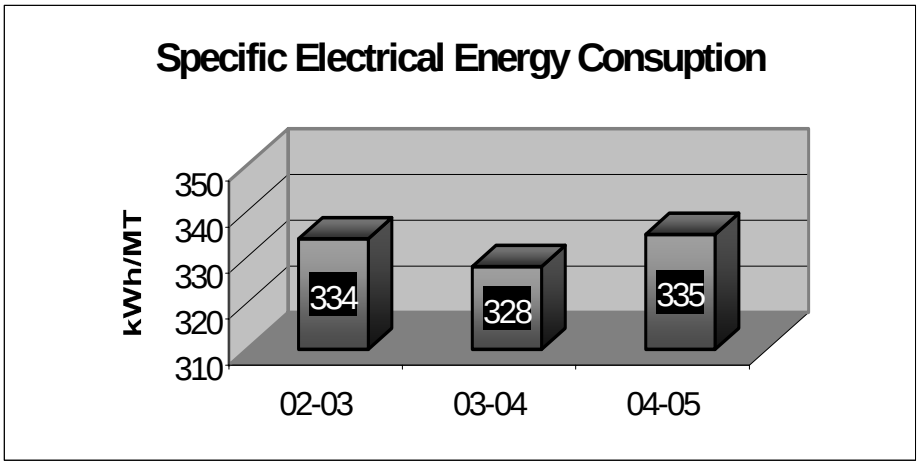
Manufacturing Facilities at Hazira

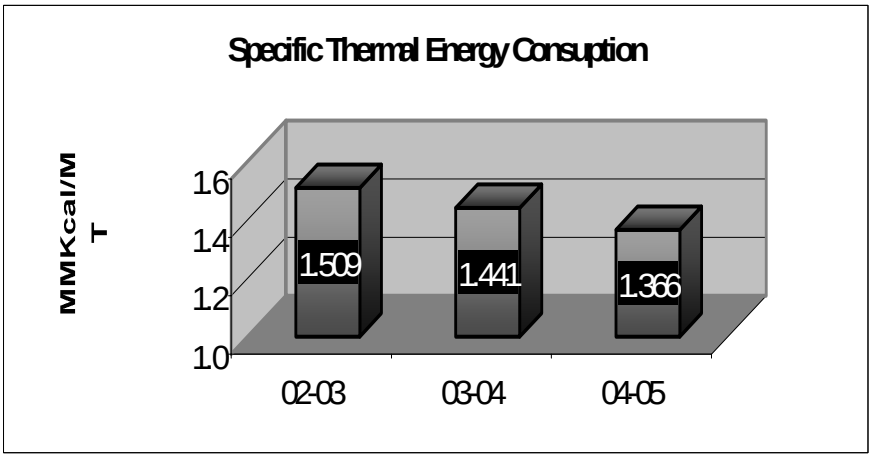
Naphtha is cracked at high temperature to produce ethylene and propylene. Benzene and toluene are extracted from the cracked products. Ethylene is polymerized to LLDPE/HDPE in the polyethylene plant. Propylene is polymerized to PP in the polypropylene plant. Ethylene is chlorinated to ethylene-di-chloride, 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.

Energy Consumption:

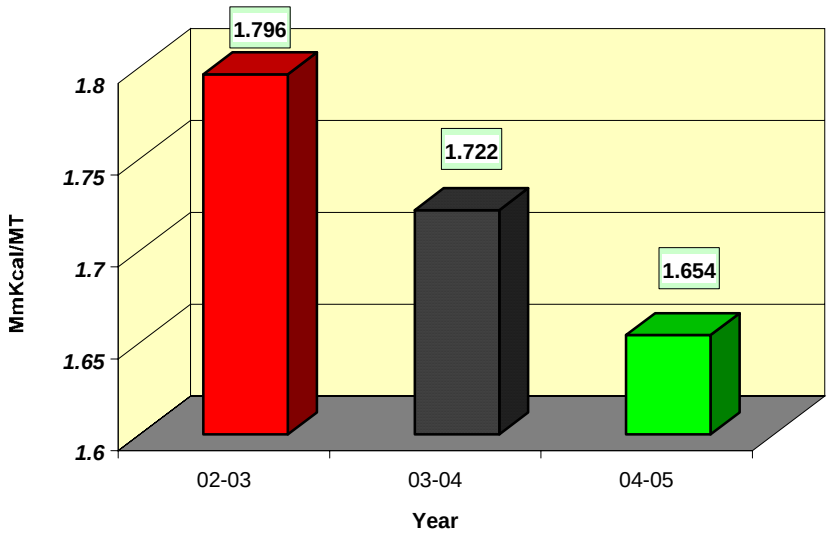
Drooping trend of energy consumption is the result of energy conservation efforts put-forth by RIL Hazira team . Data for the past three years is mentioned in the table:

Description	Unit	Year		
		2002-03	2003-04	2004-05
Annual Production	MT	5161629	5387547	5585260
Electrical Energy Consumption	Lakh kWh	17242	17651	18710
Thermal Energy Consumption	Mmkcal	7789020	7761962	7627549
Specific Electrical energy consumption	kWh/MT	334	328	335
Specific Thermal Energy Consumption	M kcal/MT	1.509	1.441	1.366
Overall Specific Energy Consumption	Mkcal/MT	1.796	1.722	1.654
Energy Cost/ Manufacturing Cost	%	3.4	4.48	3.31





Overall Thermal and Electrical Energy Consumption



The above specific consumption figures will improve further 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 '99 under the guidance of Sr. Vice President, Energy & Fuel 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 based on quality circle philosophy.

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
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.

Energy conservation Achievements:

Major Energy Conservation Schemes implemented during 2003-04

1. Fractionation scheme with benzene boil first

Fractionation unit in Aromatics plant was designed to operate along with MSTDP unit to convert Toluene in to Benzene and para rich Xylene. The separation of these component is done through 2 nos. distilation colum cascaded in serise which first seperates para rich xylene as bottom product from the feed containing about 50% Benzene. The next column sepeares Benzene as top product and Toluene as bottom product. Thus, original fractionation scheme for separating Benzene, which was major component having around 50 % concentration in feed, was getting boiled twice.

In case Benzene is separated first then substantial energy saving could be achieved on acount of reduced steam consumption in the reboilers. The feasibility of interchanging of existing distillation columns with minimum modifications checked. It was observed on through process simulation that the existing columns are suitable for revised service.

A field change order was made and detailing of the scheme was carried out. Project was taken on fast track basis and executed as designed. It was observed the there was no compromise with quality of products e.g. Benzene, Toluene and Xylene. The scehme resulted in the saving of 5 TPH of steam.MP steam. Thus total savings of Rs. 200 lacs per annum was achieved at an expenses of Rs. 5 lacs. The scheme is unique in its kind having potencial to become a trend settler in the industry of simmilar nature.

2. Make up water heater in BHEL HRSG

At RIL Hazira, from Gas Turbines exhaust gases, high pressure steam is generated through Heat Recovery Steam Generator (HRSG). In BHEL HRSG's the stack temperature used to remain around 200°C. The dew point temperature of the flue gases was calculated based on the liquid fuel firing and found out to be 130°C. Therefor it was found that the stack temperature can be safely brought down to 145°C safely. Hence it is decided based on cost-benefit analysis to utilise this residual energy for preheating the boiler feed water routed to De-aerator.

The scheme was implemented in one HRSG for trial and substantial saving of Rs 5.35 crores/annum could be achieved with an investment of Rs 2.06 Crores. For remaining 4 HRSG's make up water heater procurement is in progress.

3. Ethylene tower vapor feed directly to VCM plant.

This scheme takes out direct vapor product from the distillation column instead of liquid. By this mode the vapor product condensation to liquid product is not there,hence the duty on distillation column condenser is reduced as now it need not condense product. With this the condenser got offloaded & the propylene refrigeration duty also got reduced & the propylene refrigeration compressor got offloaded. The steam saving realized in propylene refrigeration compressor steam turbine driver was ~ 2 MT/hr SHP steam.

The investment for the modification is 125 lacs and the saving realized is Rs 221 Lacs/annum. Simple payback of the scheme is 6.8 Months

4. Use of Hot recycle solvent to preheat reactor feed in PE-II plant

Polyethylene production in PE-2 plant is carried out by polymerisation of ethylene at 160 kg/cm^2 pressure and 250 ^oC temperature in an adiabatic reactor. This is a Solution Polymerisation

process which uses Cyclohexane as the solvent which converts monomer (Ethylene) and comonomer (Butene) to polyethylene.

The recycle Cyclohexane coming from reflux drum after purification to reaction area is at 160^{o}C. It is cooled to 28^{o}C by cooling water in recycle coolers. It is further cooled to 20^{o}C in chilled water exchanger. The total heat is lost in cooling water.

A Process- Process heat exchanger is installed in parallel to the existing reactor feed heater in the bypass line to conserve MP steam in reactor feed heater. The recycle Cyclohexane which was loosing the residual heat in cooling water is now used to preheat the reactor feed before going to cooling water. Suitable instrument system has been designed to control the reactor feed temperature.

The saving achieved was Rs 397 Lacs/annum with an investment of Rs:32 lacs. The simple payback is 1 Month.

5. APH modification from co-current to counter current (AX / BX)

In Dowtherm Vaporiser - Air Pre Heater (APH) combustion air is heated prior to feeding in the vaporiser by the residual heat of flue gases. The preheater was designed for co-current flow directions. The analysis through process simulation revealed that counter current flow direction is likely to enhance the heat transfer efficiency. By siutably changing the combustion air duct, flow direction was changed to counter current therby reducing fuel gas consumption by 11 Nm3/hr worht Rs. 7.5 lacs p.a. at the expence of Rs. 0.8 lacs (Simple pay back : 9.4 months) per vaporiser.

The scheme was implented for 2 nos. vaporiser during Sept '04 and Oct '04.

6. Optimization of Slurry mole Ratios in all Esterification areas to reduce heat loads

The esterification reaction of polyester plants is designed to operate at atmospheric pressure. To achieve complete conversion of all MEG and PTA to oligomer, excess MEG is used in the rawmaterial mix. The excess MEG is vaporised in the estrefication process which in turn condensed. By using a lower mole ratio, the quantity of excess MEG was reduced thereby reducing the amount of heat used for vaporization the excess MEG.

Total saving of Rs 29.4 Lacs/annum could be achieved without investment.

7. Preheating of heads column feed using High boil product stream.

In VCM plant, crude EDC produced from Oxy reactor contains lighter components such as ethyl chloride, chloroform, carbon tetrachloride etc. These are separated in Heads Column – I. The light components are required to be removed from EDC as these are coker for EDC cracking furnaces. In Hiboil column product EDC is withdrawn from 35th tray of the column at about 90^{o}C. Hot EDC is cooled by cooling water in Hiboil column product coolers EA-6310 A/B/C/D and stored in Furnace feed tanks at ambient temperature. In this process the heat is lost to cooing water.

It is proposed to recover heat from Hiboil column product by preheating feed to Heads column–I using a shell and tube heat exchanger. Hot feed from this exchanger will be fed to Heads column. This has resulted in the savings of 0.5 TPH MP steam which is equivalent to Rs. 33.1 lacs per annum at an investment of Rs. 13.75 lacs.

8. Optimization of feed tray location in Hiboil column.

In VCM plant, Hiboil Column is used to remove heavy chlorinated hydrocarbon impurities from EDC and purify EDC to the required quality for feeding to EDC cracking furnaces. Hiboil column is having 40 superfrac trays and packed bed of 5 m height with 2" pall ring packing. Following three different feed streams are fed to Hiboil column for further purification.

1. Heads column – I bottom stream at 8th tray
2. Heads column – II bottom stream at 8th tray
3. VCM Column bottom stream at 16th tray

Product withdrawal is from top tray and stream containing heavies is removed from column bottom. Column is operating with top pressure of ~ 0.2 kg/cm^2 g and reflux ratio is in the range of 0.8-0.9. Column reboiler uses LP Steam at the rate of 32-34 TPH.

It is recommended to change the feed location of Heads column II bottom stream in Hiboil column as follows:

a. When TCA content in Heads column II bottom stream is less than 100 ppm divert it to reflux stream.
b. When TCA content in Heads column II bottom stream is more than 100 ppm feed it at tray no. 32

Average reduction in LP steam consumption by 4 TPHis achieved which is equal to Rs. 265 lacs per annum.

Energy Conservation Plans & Targets:

The Target set for year 2005-06 by the company is -

* Reduction in power consumption by **1.5% minimum** by March 2006
* Reduction in steam consumption by **1.0% minimum** by March 2006

Major Energy Conservation Schemes Planned for F.Y. 2005-2006

Sr. No.	Energy conservation Measures (Planned)	Anticipated Savings per year		Approximate Investment (Rs. Lakhs)	Project commencement & completion year
		Energy Value (Mmkcal)	Rs. Lacs		
1	C3R compressor steam reduction by cold recovery from de-methaniser, pre-stipper column	6539	40.2	76	05-06 06-07
2	Dilution steam generator blowdown to be reduced by 17 m3/hr by using a exchanger	16801	103.2	20	05-06 06-07
3	Cracker fuel gas compressor suction pressure drop reduction	4541	38.4	13	05-06 06-07
4	Use of MSTDP de-tol tower in place of extract de-tol tower	23181	194.7	-	05-06 05-06

5	Optimisation in effluent pump in PVC	204	5.4	2	05-06 05-06
6	Generation of LP steam from HP condensate	7720	59.1	6	05-06 05-06
7	Stopping of SHP let down to 22k for HRSG 5/6/7	5231	32.1	8	05-06 05-06
8	Reduction in GT – 1 and 2 back pressure by imporved chemical cleaning	7193	44.2	0	04-05 05-06
10	Reudction in plant and instrument air header pressure	1688	44.4	20	05-06 05-06
11	Installation of balance make-up water heater in HRSGs	108074	663.7	439	04-05 05-06
12	Stopping of one VGR compressor during HOMO grade in Polypropylyne plant	5879	154.42	0	05-06 05-06
13	Chilled water cold tank by-passing in POY plant	3015	52.5	65	05-06 05-06
14	Automatic change over from Delta to Star for 75 kw motor in baler	93	2.44	0	05-06 05-06
SUB TOTAL		**190158**	**1434.76**	**649**	

Sr. No.	**Energy conservation Measures (Planned)**	**Anticipated Savings per year**		**Approximate Investment (Rs. Lakhs)**	**Project commencement & completion year**
		Energy Value (Mmkcal)	**Rs. Lacs**		
15	Fuel gas export header globe valve to be replaced by a gate valve	1112	10	0.15	05-06 06-07
16	Brian – I pump and motor replacement with higher size for energy saving	117	3.07	3.5	05-06 05-06
17	Replacement of SHP steam by HP steam in PE plant steam purge heater and cyclohexane make-up dryer	2838	19.2	0.2	05-06 05-06
18	Heat recovery from purification vent scrubber to geenrate LP steam	3088	15	TBQ	05-06 05-06

19	Reduction in stack temperature of POY dowtherm vaporisers and reuction in emission	11700	80	TBQ	05-06 06-07
20	Air pre-heater of DTA vaprisers to be converted from co-current to counter current	432	7.5	2	05-06 05-06
21	Replacement of SHP steam with 17 barg steam & generation of flash steam from HP condensate	31423	160	80	05-06 05-06
SUB TOTAL		**50710**	**295.24**	**86**	
TOTAL		**240868**	**1730**	**735**	

Make up water Heater in BHEL HRSG - CPP

Ethylene Tower Vapor Feed To VCM

Process – Process Exchanger – PE Plant