

RELIANCE INDUSTRIES LIMITED

Refinery Division, Jamnagar (Gujarat)

Unit Profile

Reliance, Jamnagar is the largest grass root refinery set up with annual capacity of 27 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 Hydrotreater (2 trains), VGO Hydrotreater (2 trains), Sulfur (3 trains), Hydrogen(2 trains), Coker, Fluid Catalytic Cracker, Propylene Recovery Unit, Amine treating Unit, Desalination Units, Naphtha Hydrotreating, Catalytic Reforming, Paraxylene Extractions trains (3 nos), Tatoray Unit, Xylene extraction, Polypropylene Unit(3 trains), Captive Power Plant and a Effluent treatment plant.

Highlights :

- Largest Grass Root Refinery.
- World's Largest FCCU – 8.5 MMTPA (175 KBPSD).
- World's Largest Coker – 7.6 MMTPA (145 KBPSD).
- World's Largest Aromatics Complex – 1.6 MMTPA (PX + OX) capacity in one site.
- World's largest PP in one site – 750,000 MTPA
- India's largest Sulfur Recovery Complex – 1350 TPD
- Large size Captive Power Plant 360 MW Capacity (Power) and 1500 MT/Hr (HHP Steam)
- India's largest Petroleum Terminal, Oil movement and Storage area.

Energy Consumption

Year	Sp Power Cons Kwhr/MT of intake	Themal Consumption Mkcal/MT of Intake
2001-02	72.18	0.672
2002-03	73.87	0.668
2003-04	73.49	0.661

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*
2000	95.6	2000	69.5
2001	94.3	2002	64.0
2002	88.7		
2003	87.6		

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 three years.

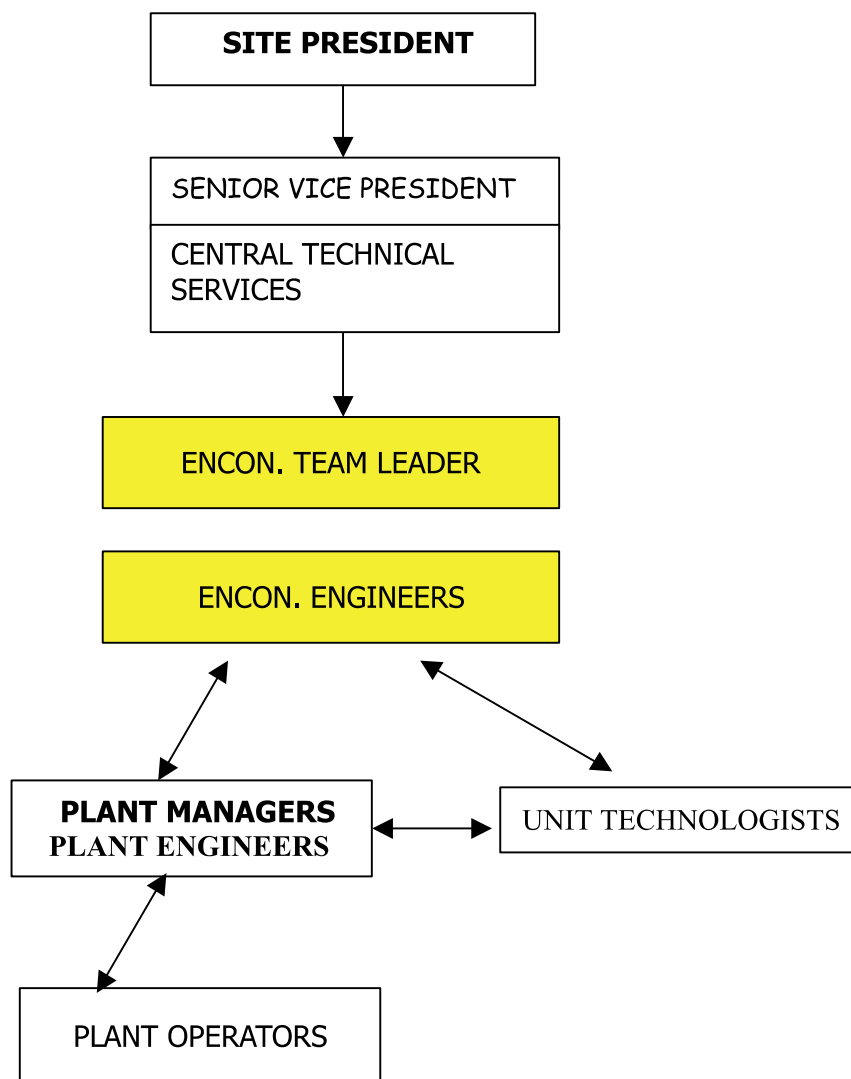
Energy Conservation Commitment, Policy and Set up

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 / optimise energy consumption .

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 work out together for implementation of the projects is shown in figure below:

Energy Conservation Organogram:



Energy Conservation Achievements

Project Details of all Projects implemented in 2003-04

Project Details Sr No 1 (Rerouting of Rich Amine flash gases to Sat gas Absorber)

Background : Rich Amine from Recycle gas Scrubbers in DHT 1 & VGOHT-1 was flashed in R.A flash drum at a pressure of 6.8-7.2 Kg/cm²g. The flashed gas containing more than 80% H₂ was being flared to LP Flare. An innovative scheme was developed to route these flash gases to Sat Gas Absorber using high pressure flash gases from the Cold flash drum as motive fluid to increase the pressure to 9 kg/cm²g with the help of Ejector.

Observations :

Flash gas equivalent to 256 Kgs/hr which was being flared is being recovered in the Sat Gas Absorber & after removal of H₂S in the Absorber is routed as feed to Hydrogen

Technical & Financial Analysis

Savings for VGOHT-1 = $256/1000 \times 8000 \times 11,000$ =Rs 226 lakhs/annum

Project Details Sr No 02 (FLARE GAS RECOVERY)

Background: Hydrocarbon losses in Petroleum Refinery result in substantial energy losses if losses are not checked. A hydrocarbon loss in refinery flare is a direct energy loss. The objective in a Flare Gas Recovery Project is to minimize hydrocarbon loss by recovering Flare loss from Main Flare System and reuse as Fuel gas in process furnaces, Gas Turbines, HRSGs (Heat Recovery Steam Turbine) and Auxiliary Boilers.

Observations made:

Particulars	UNITS	Flare Gas Recovery Compressor	
		Before	After
Average Hydrocarbon Flaring via stack	MT/Hr	2.2	0.4
Net recovery of Hydrocarbon Via Compressor	MT/Hr	0	1.8
Power consumption by compressors(2 nos)	KW		720
Fuel saving /annum	Rs Crores/annum		15.5
Cost of running compressor motor of 360 KW each	Rs Crores/annum		1.4
Net Benefit	Rs Crores/annum		14.0
Cost of the Project	Rs Crores		10.0
Payback period	Months		8.6

Technical & Financial analysis

The savings have been calculated after the Flare Gas Amine absorber was taken into line. The Hydrocarbon recovery via the two compressors is 2 T/Hr (4000 Nm³/Hr at Amine absorber outlet). But since fuel gas flared via the control valve is 0.2T/Hr, net hydrocarbon recovery is 1.8 T/Hr. Net benefit achieved is 14 Crores (after deducting compressor power consumption).

Project Details Sr No 3 (Reduction of reflux in Tatoray Stripper Column)

Background : Reflux reduction in Tatoray Stripper was identified as a no cost option of reducing Energy Consumption without effecting the Benzene purity

Observations made

Before Reduction of Reflux

Reflux to feed ratio : 0.58

Total HP Steam to Reboiler : 60.802 T/hr

After Reduction of Reflux

Reflux to feed ratio : 0.44

Total HP steam to Reboiler : 51.851 T/hr

Technical & Financial Analysis

The savings are on account of the reduction in HP steam @ 8.951 T/hr in reboiler

This works out to Rs 859 Lakhs/Annum

Savings : Rs 859 Lakhs/Annum

Project Details Sr No 4 (Reduction of Column Pressure in Xylene Column Fractionators)

Background : Reduction in Xylene Column pressure in all three trains was identified as a no cost option of reducing Energy Consumption without effecting the OX purity (minimum 99.10%)

Observations made :

Before Pressure reduction

	Xylene Train 1	Xylene Train 2	Xylene Train 3	Units
Column Pressure	7.00	7.00	7.00	Kg/cm2g
Fuel to reboiler	8653	9429	9109	Kgs/hr

After Pressure reduction

	Xylene Train 1	Xylene Train 2	Xylene Train 3	Units
Column Pressure	6.7	6.7	6.7	Kg/cm2g
Fuel to reboiler	8525.4	9048	8796	Kgs/hr
Net Fuel Reduction	127.6	381	313	Kgs/hr

Technical & Financial Analysis

The savings are on account of the reduction in Fuel in the Reboiler

This works out to Rs 677 Lakhs/Annum

Savings : Rs 677 Lakhs/ Annum

Project Details Sr No 5 (Energy savings by On line water wash in Five nos of Gas Turbines (1,2,3,5 & 8)

Background: As per original design , only GTs of Nuovo pignone make were having Nozzles for On-Line water wash. BHEL GTs did not have Nozzles installed for On-line water wash.

The losses/risks for not carrying out On-Line water wash in GT were:

-Increase in the G.T heat rate and thereby increase in the fuel consumption in Gas Turbine for the same power output.

Observations made:

Improvement in GT heat rate after Online water wash: 6.11 Kcals/KW per Gas Turbine

Savings in Fuel are 0.014 MT/hr

Considering 345 days of operation this works out to

$$0.014 * 345 * 24 * 5 = 600.26 \text{ MT}$$

Technical & Financial Analysis

The savings are on account of savings in Fuel

Savings : Rs 371 Lakhs/ Annum

Project Details Sr No 6 (STRIPPER OFF GASES TO PRIMARY ABSORBER (BYPASS HP RECIEVER) IN CRUDE UNIT)

Background: The Overhead vapour from the Stripper Column (mainly C1,C2,H2S with small qty of C3/C4's) were recycled back to the HP receiver. These gases got reabsorbed in HP receiver liquid and get recycled again to stripper increasing the Stripper Reboiler load.

To reduce the recycled load to the Stripper, the overhead vapour was directly routed to the Primary Absorber via a new condenser

Observations made:

Due to the reduced load on the Stripper lead to savings of 9 T/hr per train of MP steam in the Stripper Reboiler



Inlet Air Fogging in Gas Turbines



World's Largest Xylene Production Units at single location

Technical & Financial Analysis

The savings are on account of savings in MP Steam

Savings : Rs 210 Lakhs/ Annum

Project Details Sr No 7 (INLET AIR FOGGING IN GAS TURBINES)

Background: The objective of Inlet Air fogging in Gas Turbines is to minimise fuel consumption and to maximise power production capability and increase specific power output of the Gas turbines by carrying out fogging at GT intake air duct to lower the suction air temperature close to wet bulb temperature.

Thus saving fuel by load improved GT heat rate lowering STG condensing load and consistent power margin for Gas turbines leading to energy efficient and reliable captive power plant operation.

Observations made:

Benefit Cost analysis after commissioning of Inlet Air Fogging system

Particulars	Units	Value
Average Depression of GT Suction air Temp for 12 hrs in a day	Deg C	8
Total Extra power gain from 8 GT's	MW	= 0.915 * 8 = 7.32
Corresponding Reduction in Condensing load of STG	T/hr	=3.93 * 7.32 =28.77
Cost of Condensing (A)	Rs/hr	=28.77 * 942.5 =27115
Cost of Additional Fuel Consumption in GT's (B)	Rs/hr	12055
Net Benefit due to reduced condensation (C)	Rs/hour	(A)-(B) =15060
Benefit due to increased unfired Steam (D)	Rs/hr	=7.32 * 1.8* 942.5 =12418.4
Benefit of Fogging (E)	Rs/hr	(C) + (D) 27478
Cost of DM Water for 8 GT's (F)	Rs/hr	=1.61 *8 *45.7 =588.6
Cost of Power for fogging (G)	Rs/hr	=7.45 KW * 8 * Rs 3.05 =181.8
Net Benefit of Fogging	Rs/hr	(E)-(F)-(G) =26707.6
Net Benefit of Fogging/annum (8500 hrs)	Rs Crores/a nnum	22.7
Investment	Rs Crores	9.456
Payback period	Months	5.0

Technical & Financial Analysis

The savings are on account of savings are Rs 2267 Lakhs/annum

Reliance, Jamnagar's energy conservation efforts not only brought best ranking in SHELL Benchmarking in the year 2003 but also got many National awards for its performance in Energy.

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. The list of planned projects is shown under :

Sr. No	Energy Conservation Measures (Planned)	Anticipated savings		Invest. (Rs.lakhs)
		Energy	Rs. Lakhs / Annum	
		KTSRF/Annum		
1	Stripper gases bypass HP receiver and go to Primary Absorber in Crude (322)	0.69	55.44	14.4
2	Heat Recovery from HK product when routed to storage	8.33	672	288
3	Installation of 2nd Effluent Desalter-Wash water exchanger	2.98	240	240
4	Antifoulant Injection in CDU-1	7.99	644	580.8
5	Steam / Power cycle calculation tool / Optimizer for fuel to generate steam & power	3.57	288	230.4
6	Heat recovery from Condensate from Crude & Sulphur Units	15.48	1248	1200
7	Flash Steam & condensate recovery from Deaerator	1.13	90.99	24
8	To install axial flow FRP blades in CT -1, 2 & 4 in place of alluminium blades	1.08	87.36	67.2

9	Impeller dia change for one charge pump & one recycle liquid pump in LNUU	0.31	25	0
10	Power saving by running Single LPG pump between two HMU's for LPG backup.	0.12	9.78	4.8
11	LPG product pump -P03 impeller & motor uprating to stop one pump of the existing two pumps operation.	0.40	32.2	168
12	Changing the Lean & Rich Amine Shell & Tube exchanger by Plate type Exchanger	17.22	1389	1171.2
13	Use of LP steam condensate in SGU	0.10	8	4.8
14	Reduce Sweet VGO to RTF and save pumping cost	6.88	555	0
15	FRP blades for fin fan coolers in Aromatics, Coker , Crude, PRU ,HMU & Sulphur Complex	5.40	435.35	336
16	LLP flare gas recovery from Coker Blowdown drum	7.42	598	105.6
17	Acid gas flare recovery	2.92	235.2	244.8
18	Use merox wash vessel as buffer vessel to minimise FG to flare and LPG back-up in 742 during Coker drum change over	6.20	500	To be calculated
19	Provision of smaller capacity pumps in MTF	5.13	414	158.4

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 and 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 improvements achieved during 2000-2003.

- Reduction in Emission of CO₂ (Tons/Kilotons of Crude processed) to 10.25
- Planting of 4.0 million trees in and around the complex has already been done till 2004 which includes

planting of 25,000 Nos of additional Trees during last year.

- Reduction of plastic cup consumption from 5.1 Lakhs cup (In 2000) per month to 3.2 Lakh (2003) per month
- Construction of landfill facility for the disposal of hazardous waste

The Jamnagar refinery complex is certified as ISO-14000 company conforming the Environmental Management System. State pollution control board has given rebate in the water Cess consecutively for the past three years.

Commitment to Safety is of paramount importance at Reliance. New work permit procedures developed are being consistently followed in Jamnagar. The new procedure provide for more checks and responsibility according to the hazard potential of each activity.



Highly Efficient Co-generation Captive Power Plant