

## **RELIANCE INDUSTRIES LTD, REFINERY DIV, JAMNAGAR**

### **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 (3 trains), Coker, Fluid Catalytic Cracker, Propylene Recovery Unit ( 2 trains), Amine treating Unit, 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 – 1350 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 Kw/hr/MT of intake	Thermal Consumption Mkcal/MT of Intake
2004-05	73.1	0.662
2005-06	74.23	0.668
2006-07	79.86	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

<i>Shell Benchmarking</i>		<i>Solomon Benchmarking</i>	
<i>Year</i>	<i>CEL*</i>	<i>Year</i>	<i>EII*</i>
<i>2001</i>	<i>94.3</i>	<i>2002</i>	<i>72</i>
<i>2002</i>	<i>88.7</i>	<i>2004</i>	<i>69</i>
<i>2003</i>	<i>87.6</i>	<i>2006</i>	<i>69</i>
<i>2004</i>	<i>86.9</i>		
<i>2005</i>	<i>89.5</i>		
<i>2006</i>	<i>86.5</i>		

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.

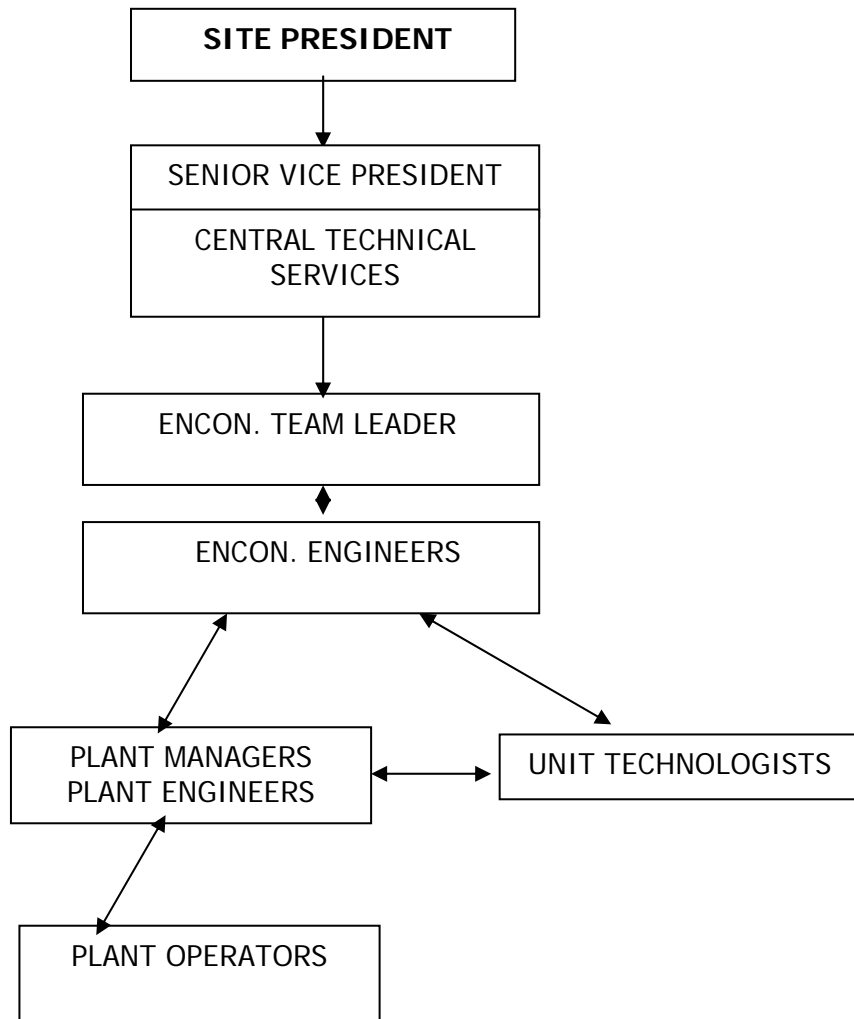
### Energy Conservation Commitment, Policy and Organizational Set up

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 2006-07

### **REDUCTION IN STEAM CONSUMPTION IN STRIPPER REBOILER OF AMINE TREATING UNITS (ATU)**

#### **Objective:**

The purpose of the project activity is to reduce steam consumption by replacing Shell & Tube Heat Exchanger with Plate & Frame Heat exchanger in Amine treating units.

#### **Brief Description:**

The project is implemented in two Amine Treating Units at Jamnagar Complex of Reliance Industries Limited. The primary function of Amine Treating Unit is to remove H<sub>2</sub>S and CO<sub>2</sub> from fuel gas or LPG in Absorber section and to regenerate the rich amine in Stripper section. The scheme is to install Plate & Frame heat exchanger which will increase the stripper feed (Rich Amine) temperature from 83 to 104 °C. Steam is consumed in the stripper reboiler to heat column bottoms.

The primary function of Amine Treating Unit is to remove H<sub>2</sub>S from sour sat fuel gas in Sat fuel gas absorber section and to regenerate the rich amine in stripper section. Lean amine, which is formed after stripping H<sub>2</sub>S from rich amine, is used to absorb H<sub>2</sub>S in off-gas throughout the refinery. The removal of hydrogen sulfide (H<sub>2</sub>S) from liquid and gaseous hydrocarbon streams has long been desired to reduce the malodorous and corrosive characteristics of streams rich in this compound. The process is continuous absorption / regeneration process employing an aqueous solution of basic alkanolamine. These ethanol amines have high affinity for H<sub>2</sub>S and low solubility in hydrocarbons which enhances their suitability in this process.

The three important equipments in Amine treating unit, are Rich amine flash drum, Amine stripper and Amine absorber. Main function of Amine Stripper is to regenerate rich amine and supplies lean amine to all lean amine consumers located throughout the refinery. Liberated H<sub>2</sub>S is sent to SRU for recovering sulfur. The rich amine is heated in the amine stripper feed/bottoms exchanger and sent through level control into the top of the amine stripper column. Flowing down through the stripper, the rich amine solution is heated to its boiling point and stripped of H<sub>2</sub>S by rising steam generated in the reboiler. Lean amine is collected in the stripper column bottom, cooled in the feed/bottoms exchanger, and circulated once again back to the absorbers.

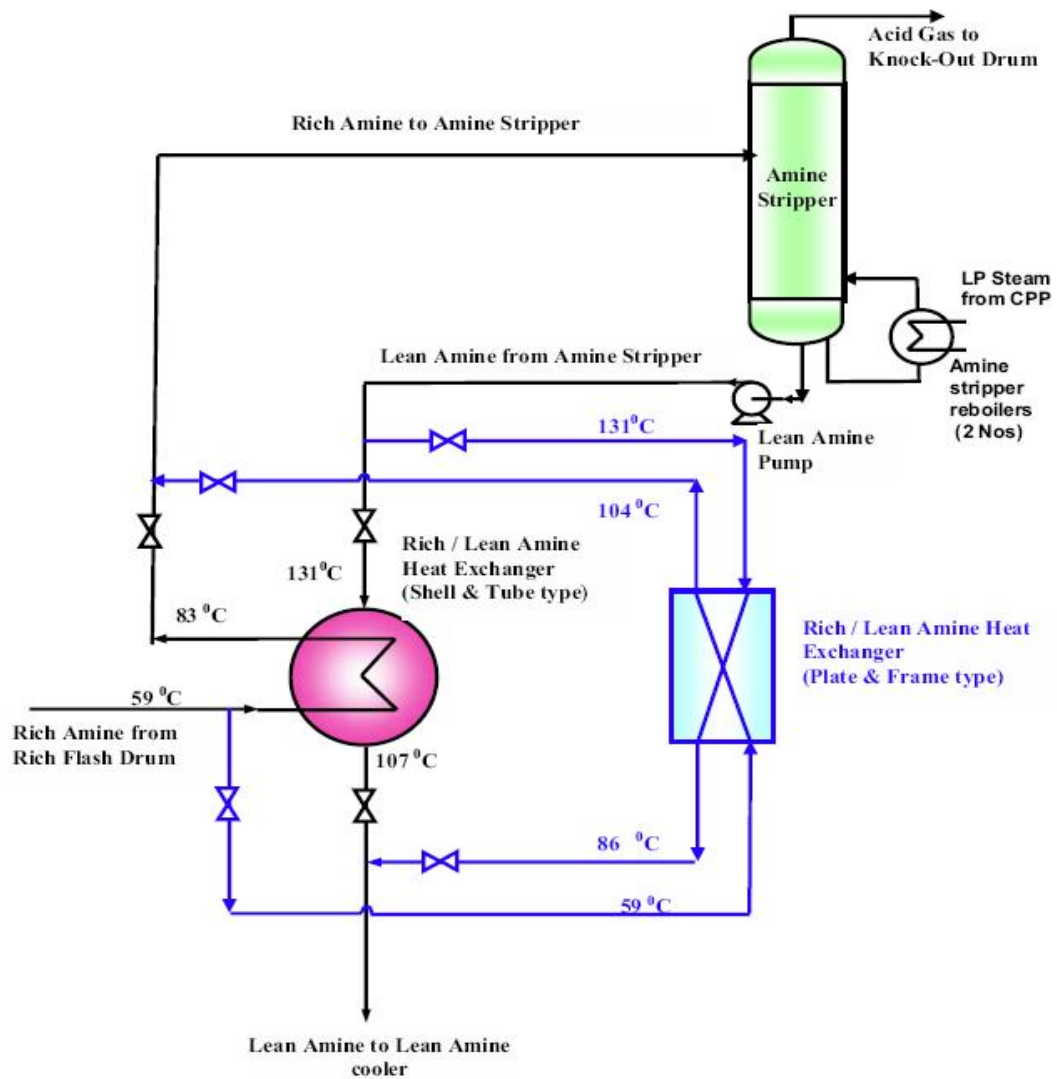
In the original design supplied by world's leading technology provider, the Lean Amine from the stripper bottom is routed through a Shell & Tube heat exchanger which gets cooled while heating Rich Amine feed to stripper. (Shell side is Lean Amine, Tube side is Rich Amine). Shell Inlet / Outlet temperature: 131 °C / 107 °C. Tube Inlet / Outlet temperature: 59 °C / 83 °C. Presently the approach temperature in existing shell & Tube heat exchanger is 48 °C. Through this project, additional heat is to be recovered by installing an additional Plate & Frame exchanger in place of existing Shell & Tube heat exchanger. In the plate and frame heat exchanger, the approach is expected to reduce to 27 °C, thus increasing the heat recovery from hot lean amine solution into the feed to stripper. The temperature profile before and after the project is elaborated in the following table:

**Table 1: Temperature Profile**

<b>Sr. No.</b>	<b>Process Stream</b>	<b>Inlet Temperature (°C)</b>	<b>Outlet Temperature (°C)</b>
<b>Profile in shell &amp; tube heat exchanger(Before)</b>			
1	Hot Lean Amine from Stripper Bottoms (Shell Side)	131	107
2	Rich Amine feed to stripper ( Tube Side )	59	83
3	Approach temperature	48	
<b>Profile across Plate &amp; Frame heat exchanger (After)</b>			
4	Hot Lean Amine from Stripper Bottoms	131	86
5	Rich Amine feed to stripper	59	104
6	Approach temperature	27	

The schematic given below is showing stripper reboiler in Amine Treating Unit with new Plate and Frame Heat Exchanger.

Stripper reboiler in Amine Treating Unit with new Plate and Frame Heat Exchanger.



The project is implemented in two ATUs units and remaining two will be commissioned as and when opportunity is available. All the four ATU units are identical in all respects.

This measure will reduce thermal duty of Stripper Reboiler leading to saving in Low Pressure (LP) steam consumption by 48 TPH in 4 ATU's.

## Energy Awards

- Reliance, Jamnagar has bagged ICMA (Indian Chemical Manufacturers Association) Award 2002 and 2005 for Excellence in Energy Conservation and Energy Management.
- Reliance, Jamnagar has bagged award from BEE (Ministry of Power) for Excellence in Energy Conservation and Energy Management in 2004, 05 & 06.
- It has received award for "Excellence in Energy Management - 2002, 2003, 2004, 2005 and 2006 by CII (Confederation of Indian Industries).
- Reliance, Jamnagar has bagged award in the Large projects for Exemplary work in Energy Conservation by PCRA (Petroleum Conservation Research Association) in 2005.
- Reliance, Jamnagar received Oil & Gas Conservation Fortnight-2005 Award from Ministry of Petroleum & Natural gas for First prize in minimum Steam leaks. Steam leak rate in Jamnagar was as low as @ 0.044 Kgs/Ton of Steam and second prize in minimum Steam leaks for 2006-07.
- Reliance, Jamnagar received Oil & Gas Conservation Fortnight-2006 Award from Ministry of Petroleum & Natural gas for First prize for excellence in Boiler / Furnace performance.

It has received award for "Excellence in Energy Conservation - 2003" by FGI (Federation of Gujarat Industries)

### 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	Increase in crude preheat temperature by 20°C in CDU1 by Heat recovery from hot VGO product stream.	21.16
3	Heat recovery from New plate-frame type Rich /lean Amine Exchanger in two train of ATU.	8.54
4	Optimization of CPP operation using offline optimizer	6.34
5	Hydrotreaters stripper HP steam to be replaced by MP steam	8.36
7	Reduction in Flare loss by providing flare flow meters at various units battery limits	3.09
8	Flash steam and condensate recovery in CPP	1.54
Total		49.03

### **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 improvements achieved during 2000-2007.

- ✓ Reduction in Emission of CO<sub>2</sub> (Tons/Kilotons of Crude processed) to 10.25.
- ✓ Planting of 4.0 million trees in and around the complex has already been done till March 2005 which includes planting of 51,000 Nos of additional Trees during 2004-05. Plantation of 35,000 trees in the direction of further enhancement of benefits of greening like CO<sub>2</sub> absorption & improved microclimate etc 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.
- ✓ 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 m<sup>3</sup>/hr.
- ✓ Commitment to Safety is of paramount importance at Reliance. New work permit procedures developed with the help of M/S Shell experts are being consistently followed in Jamnagar. The new procedure provide for more checks and responsibility according to the hazard potential of each activity.
- ✓ The British Safety Council conducted a Safety and Health Management audit at Jamnagar and awarded the highest Five Star rating to the site in 2003.

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.

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