

KOCHI REFINERIES LIMITED

Company Profile:

The Refinery was commissioned in 1966 with a crude oil processing capacity of 2.5 Million Metric Tonnes Per Annum (MMTPA). From the date of commissioning to-date, the refinery undertook 3 expansions in refining capacity and installation of matching secondary processing facilities (FCCU). The present crude processing capacity is 7.5 MMTPA and the capacity of the secondary processing facilities is 1.4 MMTPA. A fuel gas desulphurisation was also installed along with the capacity expansion project as an environmental protection measure to minimize Sulphur dioxide emission.

During the year 1989, the company entered the petrochemical field by commissioning aromatics production facilities with a design capacity of 87,200 tonnes per annum (TPA) of Benzene and 12000 TPA of Toluene.

A Captive Power Plant of 26.3 MW ISO rating was commissioned in March 1991. During the year 1998, an additional Captive Power Plant of 17.8 MW was commissioned.

A Light Ends Feed Preparation unit (LEFPU) to supply Polybutenes feedstock to Cochin Refineries Balmer Lawrie Ltd, (a joint venture company), was commissioned in 1993. (This joint venture was subsequently amalgamated with KRL).

KRL also commissioned a Raffinate Purification Unit (RPU) for the manufacture of 10,000 TPA of Petroleum Hydrocarbon Solvent in January 1994, with the technology developed by the in-house R&D Centre.

The Diesel Hydro Desulphurisation Unit to reduce Sulphur content in diesel to 0.25% along with another Sulphur recovery unit was commissioned in March 2000. Further an additional reactor to reduce sulphur content in diesel from 0.25 wt% to 0.05wt% was also commissioned.

The major product range from KRL include LPG, Gasoline, Naphtha, Kerosene, High Speed Diesel, Light Diesel Oil, Furnace Oil, Low Sulphur Heavy Stock, Bitumen, Benzene and Toluene.

KRL continued to maintain the “Excellent” rating for the thirteenth year in succession for its performance during the year 2003-2004, under the Memorandum of Understanding entered with Govt. of India. Some of the significant achievements during the year 2003-04, were:

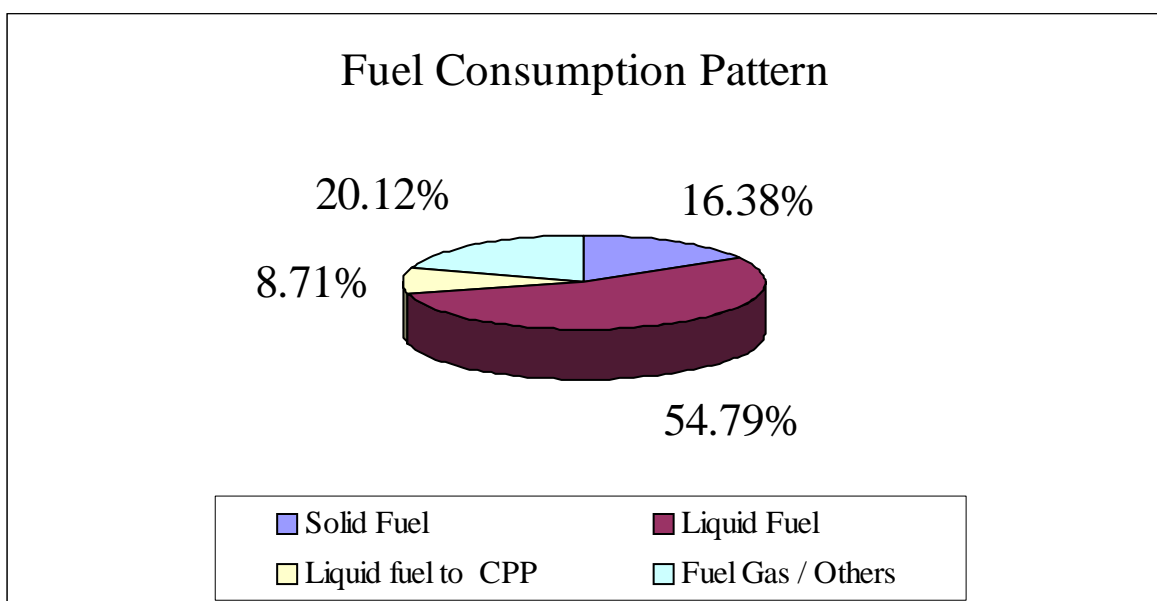
- Highest ever crude oil thru put of about 7.85 MMT
- Highest ever production of value added products like
 - LPG
 - Motor Spirit

- Mineral Turpentine oil
- Natural Rubber Modified Bitumen

Energy Consumption

The fuel consumption pattern of the refinery during 2003-2004 was as follows:

Solid Fuel	74,223	16.38%
Liquid Fuel	248,343	54.79%
Liquid fuel to CPP	39,480	8.71%
Fuel Gas / Others	91,213	20.12%



Energy Conservation Commitment, Policy and set up

KRL has integrated its Energy policy with its environment, health and safety policy, as any energy conservation measure helps in minimising adverse impact on environment.

KRL's commitment to energy conservation begins at the design stage itself by incorporating energy efficient techniques. KRL has also implemented several energy conservation schemes based on the experience gathered during the operation. We have fully optimised heat exchanger trains, air preheaters and steam generators in process heaters and a plant lay out fully utilising the terrain of the area minimising the

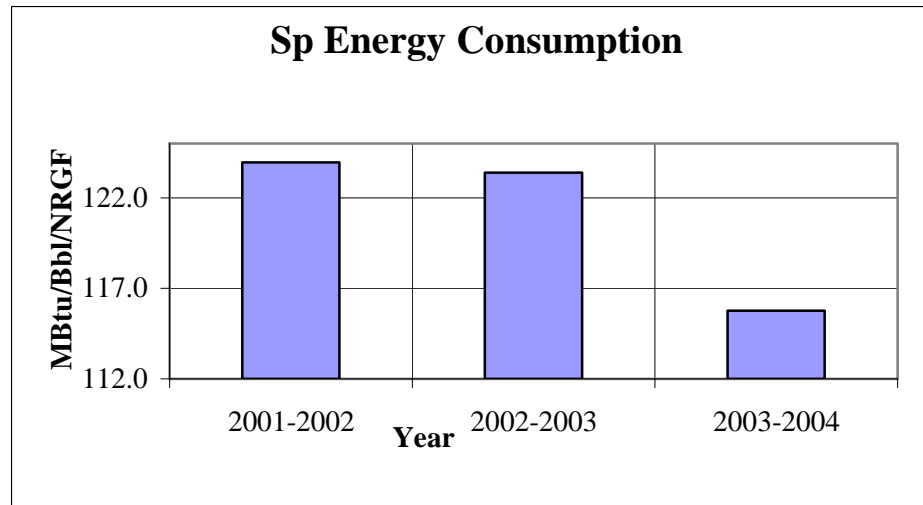
pumping requirements. KRL's policy is to conserve natural resources and to reduce energy consumption. Energy being a national resource KRL's commitment to energy conservation goes beyond the premises of the plant. Through its own R&D effort, KRL has developed natural rubber modified bitumen for road pavement, which gives improved mileage for vehicles thus reducing vehicular pollution. KRL is also implementing modernisation project to meet the future specification of auto fuels.

We have a full-fledged Energy Conservation Cell under the Technical Services Department. A Senior Manager heads this cell., he is supported by the four executives for close monitoring of plant fuel and loss pattern. Regular audits of heater efficiencies, steam, insulation, HC loss, overhauling of the energy consumption patterns are reviewed on daily basis.

In order to propagate the essence of energy conservation beyond the premises of the refinery KRL has formed an ENCON CLUB comprising 26 schools and Colleges in Kerala. The main objective of this club is to drive home the elements of energy conservation and environmental protection in the minds of the public. KRL organises various activities like seminars/workshops/quiz competition etc on energy conservation at different locations within the state for the Encon Club members as well as the general public. Regular visits to the refinery are arranged for the Encon Club members. Encon club also conduct awareness programs for housewives, drivers etc.

KRL conducts regular training programmes on energy conservation for our employees. In order to motivate our employees on energy conservation, we have a practice of distributing Encon mementos as part of Oil Conservation Fortnight Celebrations. As a result of the various energy conservation schemes implemented there has been a steady decline in specific energy consumption as can be seen below:

Year	MBTU/BBL/NRGF
2001-2002	123.95
2002-2003	123.39
2003-2004	115.77



Energy Conservation Achievements:

Details of major Encon projects implemented in 2003-04

1. DHDS Cooling tower fan blade angle reduction

Project Description

The fan blade angle of 2 out of 3 fans in DHDS cooling tower UCMA-204A/C were reduced from 14 Deg to 8 Deg. Reduction in fan blade angle with corresponding reduction in air flow has brought down the power consumption in these fans from 43KW to 21.3 and 43.5 to 24.7KW. The cooling water return temperature increased from 36 to 37.5 with corresponding increase in cooling water inlet temperature from 30 to 31.5. No constraints are noticed due to increases in cooling water return temperatures.

Expected savings is Rs 9.7 Lakhs/annum.

2. Replacement of steam reboiler in LEFPU with hot stream from Vacuum distillation unit

Project Description

In LEFPU (light End Feed preparation unit), LP Steam was being used as a reboiling medium. The VDO (Vacuum Diesel Oil) available from FPU (feed preparation unit) drawn at 160 DegC was identified as a potential source for recovering 2MMKcal/Hr. It was identified that this stream can be used to replace the LP Steam reboiler in LEFPU.

This modification has resulted in reduction of steam consumption in LEFPU. In order to integrate heat between FPU and LEFPU, the following modifications were carried out.

1. A new exchanger in parallel to the existing reboilers in LEFPU is installed
2. Piping modification was carried out for routing VDO to and from LEFPU.

Expected savings is to the tune of Rs 231Lakhs/annum against an investment of Rs 80Lakhs

3. Preheating of DM water with reformer heater process gas

Project Description

DHE14 is the demineralised water preheater located in Hydrogen unit. In this exchanger high temperature process gas is routed through tube side and demineralised water is routed through shell side. By passing through this heat exchanger, heat is transferred from hot fluid to cold fluid and cold fluid comes out of the exchanger at an elevated temperature and hot fluid comes out of the exchanger at a lower temperature. There is a bypass facility provided to bypass the hot gas stream to maintain the desired temperature of demineralised water.

Before implementing this scheme, as the DM water outlet temperature was more than 90 ° C, the process gas was bypassed to maintain the demineralised water temperature at 90 ° C. Increase in DM water outlet temperature is due to the low requirement of DM water. This bypassed gas stream was then cooled in air fin fan exchanger. In order to utilize the heat, which is lost due to bypassing of gas from DHE14, more DM water was passed through DHE14. This additional quantity of DM water is then routed to de-aerator of Boilers UB8&9. Because of this gas bypassing of DHE14 was stopped and one air fin was stopped due to reduction in gas outlet temperature. After implementing the scheme demineralised water which was routed to de-aerator at a temperature was 40 ° C was increased to 80 ° C. Due to this steam requirement for heating the demineralised water to the boiling temperature in de-aerator was reduced to a tune of 2.5-3.0 t/hr.

Expected savings is Rs 130Lakhs/annum against an investment of Rs 10Lakhs

- 4. Routing of FCC Main Air Blower Vent air to Bitumen blowing unit thereby shut down of the dedicated compressor for air supply to bitumen unit**

Project Description

This scheme was implemented for energy saving and reliable operation of Bitumen unit. The excess (the difference between the suction flow of the FCC Air blower and the Air flow to FCCU catalyst regenerator) is vented to atmosphere through the snort control valve for stable operation of the compressor since the operating point of the compressor is near the surge regime. The scheme was implemented for routing part of this excess air to Bitumen unit to replace the air supplied from dedicated compressor and hence to stop the compressor.

Expected savings is Rs 70Lakhs/annum against an investment of Rs 3Lakhs

Energy conservation plans

Our policy is to conserve natural resources and reduce energy consumption. In order to further reduce the energy consumption, the following energy conservation activities are planned to be carried out in future

- i. Additional condensate recovery of 1.5T/Hr from plant fuel and vacuum residue tank.
- ii. Replacement of conventional burners with Low NOx burners with better air control in EH-1.
- iii. Replacement of Aluminium blade with FRP Blade on a trial basis on CF7A/B air fin fan coolers.
- iv. Replacement of NH-1 heater with steam re-boiler.
- v. Replacement of Naphtha stabiliser reboiler heater (LH-1) by optimising of crude pre-heat exchanger train in CDU-1 and replacing NHDS stripper re-boiler heater (HH-2) for achieving higher heat recovery.
- vi. Routing of FCCU off gases to CPP directly through new light-duty compressors in place of RFG compressor to achieve power saving.
- vii. Removal of crude column overhead compressor in primary unit for power savings.
- viii. Installations of additional compressor for routing of HC2 gas to hydrogen

Environment & Safety:

KRL has strived for the continual improvement of environmental performance and prevention of pollution. Commitment for environmental protection starts at the design stage by selecting cleaner technology. Regular audits are carried out by various internal and external agencies and the recommendations are promptly implemented. Further improvement is carried out by in-house efforts. We are the first industry in

the state of Kerala to get consent from the Pollution Control Board for the discharge of treated effluents into the inland waters. We are also the first industry in Kerala to get the ISO 14001 certification. KRL joined hands with Cochin Port trust to install Tier-1 facilities for combating oil spills. This is the first MoU of its kind between any oil company and the Port Trust in the country. KRL was the major contributor (Rs 57 Lakhs) in this venture (80% of the total cost). Regular mock drills are being conducted as part of the oil spill combating exercise.

We have received several awards in recognition of our efforts in the environmental front. We have received a special award from the Kerala State Pollution Control Board for the year 2003 for making substantial and sustained efforts in pollution control.

Major Environmental projects planned to be implemented in future

- i. KRL is taking up the refinery modernization project to upgrade it's auto fuel quality to BS-II standards by 2005.
- ii. KRL is taking up the refinery modernization project to upgrade it's auto fuel quality to BS-III standards by 2010.
- iii. Replacement of old conventional burners in EH-1 heater with Low Nox burners to reduce Nox emission.
- iv. **Ecological Park**: KRL is currently setting up an Ecological Park spread over an area of 5.5 acres within KRL premises, with a view to restore the healthy ecosystem, control pollution, develop clean environment and prevent soil erosion. Over 3752 varieties of plants will be planted in the area. The first phase of the project would be completed by Dec-2004. Total estimated cost is apprx. Rs 10Lakhs.
- v. **Rainwater harvesting**: KRL is implementing an integrated rainwater harvesting system to collect, conserve and protect rainwater for effective utilisation. The proposal includes
 - i) Using rain water collected from roof top during the monsoon for the process operation and drinking water requirement and thereby marginally reducing the intake of water from Periyar river
 - ii) Charging the ground water table using the collected roof rainwater.
 - iii) Harvesting around 1,25,000KL of rainwater per annum falling on the land area by collecting the surface run off.

Safety

Our Company is always vigilant in making the Refinery a safe place for its employees and the community around it and has invested substantially in automated safety and

process control systems to ensure safe working conditions. Our company has achieved level-7 in the International Safety Rating system (ISRS). We are planning to improve on this level and have set a target to achieve Level-9 in the coming year.

Details of major Encon projects implemented in 2003-04

1. DHDS Cooling tower fan blade angle reduction

Project Description

The fan blade angle of 2 out of 3 fans in DHDS cooling tower UCMA-204A/C were reduced from 14 Deg to 8 Deg.Reduction in fan blade angle with corresponding reduction in air flow has brought down the power consumption in these fans from 43KW to 21.3 and 43.5 to 24.7KW .The cooling water return temperature increased from 36 to 37.5 with corresponding increase in cooling water inlet temperature from 30 to 31.5.No constraints are noticed due to increases in cooling water return temperatures.

Expected savings is Rs 9.7 Lakhs/annum.

2. Replacement of steam reboiler in LEFPU with hot stream from Vacuum distillation unit

Project Description

In LEFPU (light End Feed preparation unit), LP Steam was being used as a reboiling medium. The VDO (Vacuum Diesel Oil) available from FPU (feed preparation unit) drawn at 160 DegC was identified as a potential source for recovering 2MMKcal/Hr.It was identified that this stream can be used to replace the LP Steam reboiler in LEFPU.

This modification has resulted in reduction of steam consumption in LEFPU.In order to integrate heat between FPU and LEFPU, the following modifications were carried out.

3. A new exchanger in parallel to the existing reboilers in LEFPU is installed
4. Piping modification was carried out for routing VDO to and from LEFPU.

Expected savings is to the tune of Rs 231Lakhs/annum against an investment of Rs 80Lakhs

3. Preheating of DM water with reformer heater process gas

Project Description

DHE14 is the demineralised water preheater located in Hydrogen unit. In this exchanger high temperature process gas is routed through tube side and demineralised water is routed through shell side. By passing through this heat exchanger, heat is transferred from hot fluid to cold fluid and cold fluid comes out of the exchanger at an elevated temperature and hot fluid comes out of the exchanger at a lower temperature. There is a bypass facility provided to bypass the hot gas stream to maintain the desired temperature of demineralised water.

Before implementing this scheme, as the DM water outlet temperature was more than 90 ° C, the process gas was bypassed to maintain the demineralised water temperature at 90 ° C. Increase in DM water outlet temperature is due to the low requirement of DM water. This bypassed gas stream was then cooled in air fin fan exchanger. In order to utilize the heat, which is lost due to bypassing of gas from DHE14, more DM water was passed through DHE14. This additional quantity of DM water is then routed to de-aerator of Boilers UB8&9. Because of this gas bypassing of DHE14 was stopped and one air fin was stopped due to reduction in gas outlet temperature. After implementing the scheme demineralised water which was routed to de-aerator at a temperature was 40 ° C was increased to 80 ° C. Due to this steam requirement for heating the demineralised water to the boiling temperature in de-aerator was reduced to a tune of 2.5-3.0 t/hr.

Expected savings is Rs 130Lakhs/annum against an investment of Rs 10Lakhs

4. Routing of FCC Main Air Blower Vent air to Bitumen blowing unit thereby shut down of the dedicated compressor for air supply to bitumen unit

Project Description

This scheme was implemented for energy saving and reliable operation of Bitumen unit. The excess (the difference between the suction flow of the FCC Air blower and the Air flow to FCCU catalyst regenerator) is vented to atmosphere through the snort control valve for stable operation of the compressor since the operating point of the compressor is near the surge regime. The scheme was implemented for routing part of this excess air to Bitumen unit to replace the air supplied from dedicated compressor and hence to stop the compressor.

Expected savings is Rs 70Lakhs/annum against an investment of Rs 3Lakhs