First Prize *Chemicals*

MANGANESE ORE (INDIA) LIMITED
ELECTROLYTIC MANGANESE DI-OXIDE PLANT
Nagpur (Maharashtra)

Unit Profile

Manganese Ore (India) Limited is promoted jointly by Govt. of India (with 81.57% share holding), Govt. of Maharashtra (9.68%) and Govt. of Madhya Pradesh (8.75%).

The company is primarily engaged in the mining of Manganese Ore in districts of Maharashtra & Madhya Pradesh.

The company is also operating Ferro-Manganese Plant (10000 TPA) & Electrolytic Manganese Di-oxide Plant (1000 TPA). The company accounts for about 70% of country's production of high grade Ore and 45% of Country's total production of Manganese Ore.

The Electrolytic Manganese Di-oxide Plant is having annual installed capacity of 1000 MT per annum. The Plant is located at Dongri Buzurg Mine, Tumsar, Maharashtra. The Plant technology is developed indigenously with the help of National Metallurgical Laboraties and designed by MECON. In the first phase Plant Capacity was 600 MT per annum and increased to 1000 TPA in two phases.

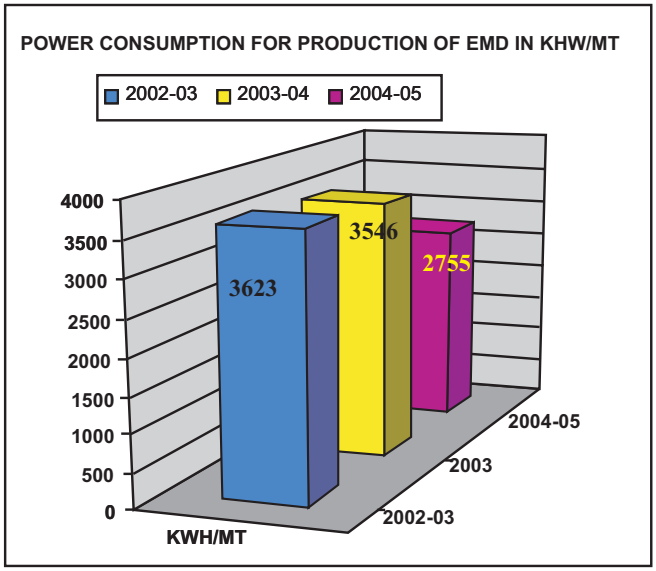
Presently EMD produced from this plant is catering to the needs of leading battery producers.

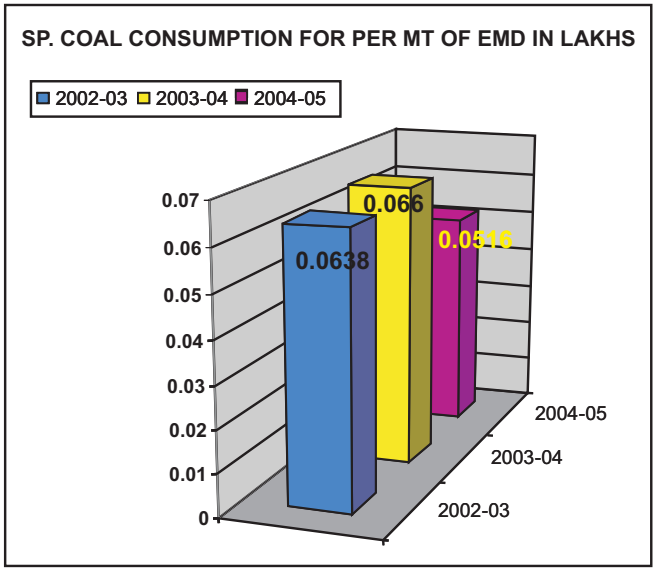
Energy Management Policy

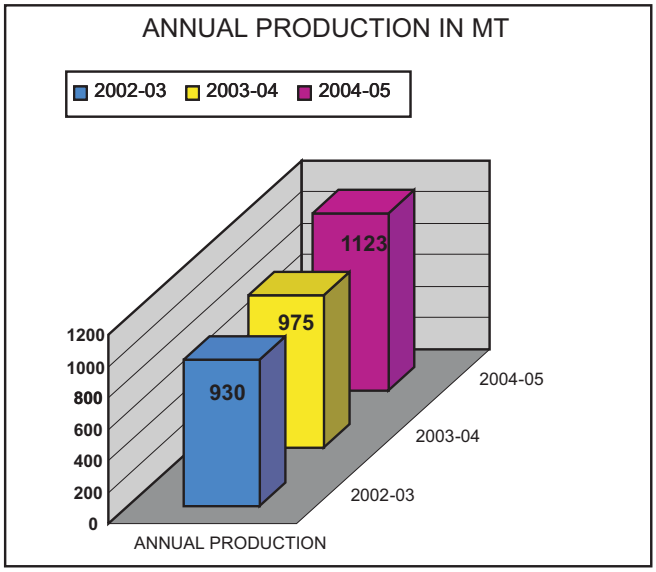
We are committed to reduce specific energy consumptions through

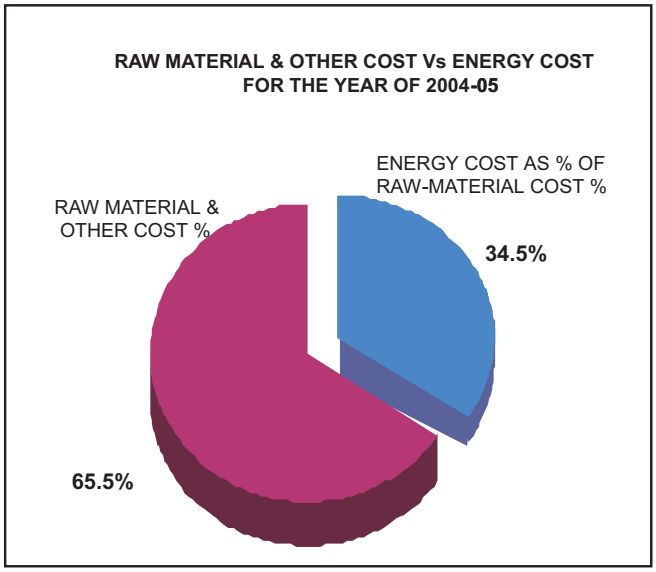
1. Operation of Quality Circles in various sectors
2. Elimination of waste and recovery improvement
3. Optimizing the process parameter & Preventive Maintenance
4. Continuous monitoring of various process parameters.
5. Motivating, training and exposing the employees in latest techniques to enable them to implement the target of reducing consumption of electricity & fuel cost by 3% per annum.

GRAPHICAL REPRESENTATION OF SPECIFIC ENERGY CONSUMPTION:





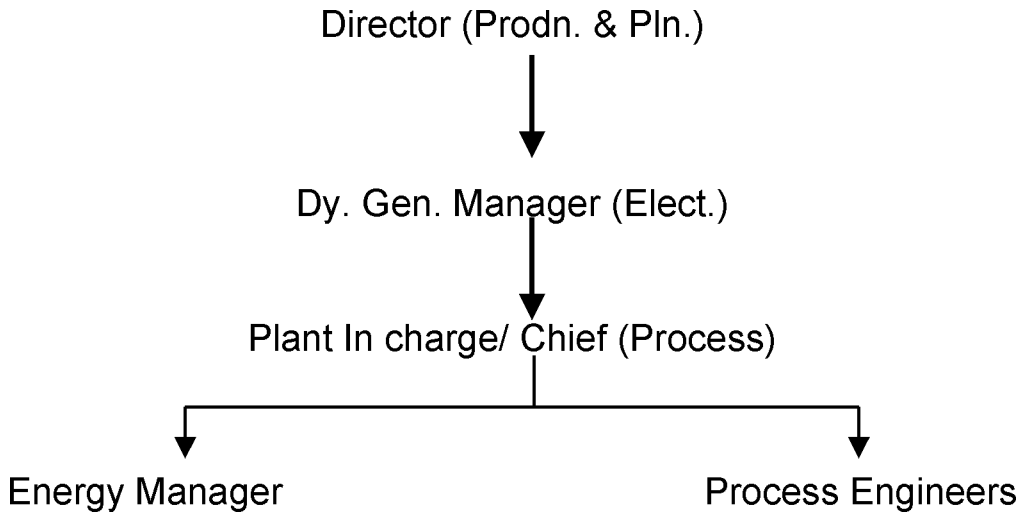




SALIENT FEATURE OF ENERGY CELL

The unit has Energy Conservation Cell headed by Director (Prod. & Pln.) assisted by Dy.Gen.Manager (Elect.) and supported by unit head of the Plant with his team. This team finds various means to bring the energy saving in the working areas through various Quality Circle meetings in which various techniques such as brain storming, bench marking, parato diagram analysis, 5'S techniques are used. The outcomes of the team findings are implemented very sincerely and have been followed with continue monitoring. It already achieved the goal the team is committed for technical up gradation to avoid any energy losses by continuous maintenance and replacement of equipment where was necessary. The team has been interested with the work of reducing electric power and reducing the coal consumptions. The Quality Circle team has been exposed for training relating to the statistical process control techniques to enable them to adopt at the shop floor.

Energy Conservation Cell Structure:



Energy Conservation Achievement

At EMD Plant various energy savings proposed have been implemented. The unit has stopped crushing of EMD flakes, optimized the leaching cycle, recovery of condensate, stopped leakages in boiler valves and leakages in boiler furnace wall and heat recovery unit interface, repair of valves at pressure reducing station, neutralization of EMD flakes without agitation, reducing the time for drying of EMD, increase in recovery.

During 2004-05 with energy conservation measures the unit has saved an amount of Rs. 48.48 lakhs.

MAJOR ENERGY CONSERVATION PROJECTS IMPLEMENTED DURING THE YEAR 2004-05

1 Reduction of Cell Voltage:

Average voltage of cell has been reduced by 25%by following measures

- by changing feed composition
- maintaining uniform bath ratio
- maintaining uniform temperature
- by regular addition of wax
- cleaning of contacts & Cell Bottom.

Net Saving = 540 kWh/MT

Annual Saving = 6.06 lakhs kWh

Annual Monetary Saving = Rs.19.51 lakhs

2. By Stoppage of Crushing of EMD Flakes & Agitation During Neutralization of EMD:

EMD Flakes after stripping were subjected to crushing in Roll Crusher before feeding to Neutralization Tanks with Electrically driven Agitators. This operation has been stopped completely and the stripped flakes are being neutralized directly by soaking in soda water without agitation.

Due to this, recovery has been increased by 5% and power has been reduced. The details are given below:

Total Investment for additional Neutralization Tanks = Rs.3.00 lakhs.

Energy Saving on account of Stoppage of Crusher = 44920 kWh/Year

Energy Saving on account of Stoppage of Agitation = 28075 kWh/Year

Energy Saving on account of increased recovery of EMD = 1,90,910 kWh/Year

Total Saving in Power = 263905 kWh/Year.

Total Amount Saved @ Rs. 3.22 per kWh is Rs. 8.50 lakhs

Pay Back Period = 130 days.

3. Recovery of Condensate Heat:

Due to leakages in condensate pipe line the condensate water was contaminated with acid content and we were unable to feed condensate water to Boiler.

By stopping all leakages unit was able to reduce requirement of steam pressure in Cells below 2 Kg/$cm^{2.}$ Thus reducing drastically the problem of puncture and therefore enable us to use condensate water as feed to Boiler.

The net Saving = 297 MT Coal/Year.
Annual monetary saving @ 1555 Rs/Ton = Rs.4.62 lakhs.

4. Change of Leaching Cycle:

During Leaching, while receiving spent itself addition of other raw materials are being alone and Filteration is being carried out at lower p^H only. Resulted in reduced Leaching time by 3 hours per batch.

The Energy Saving on Account of Reduction in Leaching Time = 74 kWh/ton

Annual Saving = 83102 kWh

Total Amount Saved @ Rs.3.22 per kWh = Rs.2.70 lakhs

5. Modification of tray Drier:

After Neutralization of EMD, the same is dried in Electric Tray Drier. Due to finer size and damaged heating coils the Tray Drier was drawing more power. Now the EMD in flakes form is being dried and the heating coils, pipe & insulation changed to give maximum heat.

Investment = Rs.0.50 lakhs

Power reduced per tone = 47 kcal

Annual Saving = 52781 kcal

Monetary Saving = Rs.1.70 lakhs

Other Projects Implemented During the Year 2004-05

1 Stoppage of idle running of motors.

2 Hour meters provided for leaching vessels.

3 Thermal insulations provided wherever damaged.

4 Switching of lights, fans, Acs, by individuals whenever offices are not occupied.

5 Two Quality Circles are operating in this Plant for implementation of 5's system for good work place

Energy Conservation Plans and Targets

S.N.	ENERGY SAVING MEASURES	INVESTMENT (Rs. Lakhs)	PROJECT
1.	Increase of Current Density	20.00	2006-07
2.	Introduction of Solar Water Heater System	20.00	2006-07
3.	Timers for lighting System	0.20	2006-07
4.	Insulation for Condensate Pipe line	1.00	2006-07
5.	Installation of Energy Saver	2.00	2006-07

Environment and Safety

Safety:- The Plant is working under Mines Act thereby meeting strictly the safety requirement of Mines Act.

In case of any emergency the In charge Officer will co-operate and organize necessary help. A Medical Officer is stationed at Mine head continuously.

First aid centers and fire extinguishers are placed at various places in the Plant. An ambulance is readily available in company hospital to shift patients in case of emergency.

Environment:- Plantation is being done continuously in Plant area and Mine area by taking help from NEERI where ever required.

At MOIL the culture of work is **GOOD PLACE TO WORK** (GPTW) and the quality objective is "To strive for **CLEAN & GREEN MOIL**".

Second Prize ***Chemicals***

INDUSTRIAL ORGANICS LIMITED
Mansa Road, Barnala (Punjab)

Unit Profile

Industrial Organics Limited (IOL), is a chemical manufacturing industry located in Barnala in Punjab. IOL began with a small project of Rs. 650 lacs to manufacture 4500 TPA of Acetic Acid and has now diversified into a multi product company having the facility to manufacture 33000 TPA of Acetic Acid, 23100 TPA of Ethyl Acetate, 8250 TPA of Acetic Anhydride and 600 MTPA of Ibuprofen.

Industrial Organics Ltd. has reached the dizzying heights of success through sheer determination, dedication and hard work leading a team of able Institutional Builders, development Coaches, frontline Entrepreneurs and Associates.

Having worked single mindedly, since inception in 1986 for developing and manufacturing effective products, the company has attained an undisputed market leadership in its product range. The Company has a strong and growing presence in the alcohol based industry in India and facilitates the growth of Indian Industry and has made reputed place in the manufacturing of bulk drugs.

Energy Management Policy

To procure and manage energy supplies and their use in the most cost effective manner consistent with the industry's wider objectives and the resources available.

The industry will increase energy efficiency by:

- Adopting best energy management practices,
- Regularly monitoring energy use
- Reporting quarterly on energy use to staff and at Management Board meetings
- Establishing an Energy Management organization structure
- Encouraging Energy Managers of significant facilities to initiate Energy Management Committees and/or Energy Champions for their facilities
- Ensuring that new appliances, equipment, and building projects are energy efficient
- Identifying all areas of opportunity for improved energy performance via detailed consultation with staff
- Facilitate developing and implementing an action plan
- Checking the effectiveness of the energy saving measures, periodically document any changes in procedures resulting from process improvement, and make comparisons with objectives and targets.

OBJECTIVES

The Energy Management Policy seeks to:

• Avoid unnecessary expenditure;

• Improve cost effectiveness in producing a comfortable working environment;

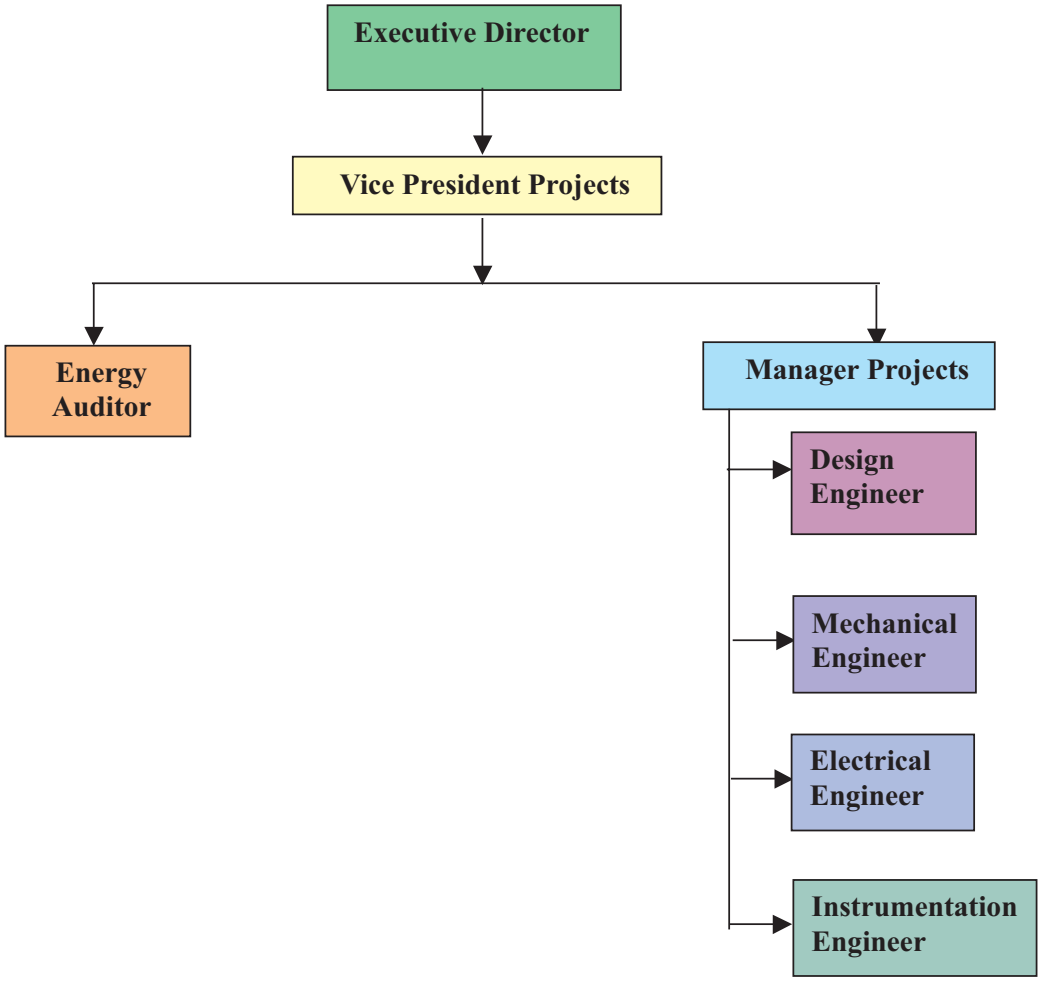
• To increase awareness of energy issues among members of the Industry and encourage 'energy responsible' attitudes.

MANAGEMENT ARRANGEMENTS

• The Policy will be determined by, and implemented under the authority of, Energy Conservation Cell.

• The Environmental Policy Working Group will be responsible for advising Energy Conservation cell on these matters.

• The Environmental Policy Working Group will have a complementary role in energy and water management use among a wider range of environmental issues, and will have a key role in increasing awareness of such issues in the Industry.



Energy Conservation Achievements

Major Energy Conservation Projects Implemented during Year 2004 – 2005

1. Installation of Plate Type Heat Exchangers for recovering Heat from Plant:

In total 5 no. Plate Type Heat Exchangers supplied by M/s Alfa Laval (Pvt.) Ltd. have been installed in the plant. These Heat Exchangers have hot process stream on one side and cold hot stream on the other side. The two streams exchange heat with each other thus reducing load on further heating and cooling equipments in the process.

Total No. of Plate type Heat exchangers installed = 5

Total Cost of Heat Exchangers = Rs. 13.0 lakhs

Steam Saved = 20 TPD = 6600 TPA

This is equivalent to 4356.0 Million kCal of heat per annum

Total amount saved (@Rs. 340/T steam) = Rs. 22.44 lakhs per Annum

Payback period = 208 days

2. Installation of Variable Frequency Drive

The working of VFD system is based on the converter and inverter modulus system. In converter section 3 f AC supply of standard frequency is being converted in DC with the help of Thyristor based rectifier and after that variable DC gets converted in variable frequency of AC voltage with the help of Pulse Width Modulated (PWM) inverter.

This variable frequency accordingly varies the speed of induction motor. Now to make the change automatic, we need a reference point or say feedback for converter system that we can supply from Differential Pressure Transmitter measuring flow, level etc and giving 4-20 mA analogue supply. Hence VFD can be used to control flow, level etc with the help of motor because it also has an inbuilt PID function for continuous process control. Same application for Air Blower, air control in which no ventilation of excess air is required because it will provide as much controlled quantity as will be required.

Power Consumption before installation of VFD = 12000 kWh per day

Power Consumption after installation of VFD = 9500 kWh per day

Total power Saving = 2500 units per day = 825000 kWh per annum

Power Saving (@Rs.4.0 per kWh) = Rs. 33.00 lakhs

Investment on VFDs = 14.00 lakhs

Payback = 155 days

3. Replacement of two no.s Reciprocating compressors with Screw Type Compressors

Atlas Copco Compressor (Screw type) has been installed for supply of Compressed Air to Acetic Acid Plant. Atlas Copco Compressor is single stage, oil-injected screw compressors driven by electric motor and enclosed in a sound-insulated bodywork. Due to its design and screw type compressing system, this compressor is efficient for Power Saving and also requires less maintenance.

Atlas Copco compressor is most efficient in today's date and gives the best results for power saving.

Air is drawn through the filter and unloader is compressed in compressor element. Compressed Air and oil are discharged through check valve to air receiver/ oil separator in which oil is separated from compressed air. The air is blown through minimum pressure valve to air cooler. The cooled air is discharged through condensate trap and outlet valve towards the air net.

Atlas Copco compressor comprises of regulating system, which keeps the net pressure within the programmable pressure limits by automatically loading and unloading the compressor depending on the air consumption.

Power Consumption with Reciprocating Type Compressor = 5000 kWh per day per compressor

= 10000 kWh per day for 2 comp.

Power Consumption with Screw Type Compressor = 3500 kWh per day per compressor

= 7000 kWh per day for 2 comp.

Power Saving = 3000 units per day = 990000 kWh per annum

Savings (@Rs. 4.0 per kWh) = Rs. 39.60 lakhs

Cost of One Atlas Copco Compressors = Rs. 14.0 lakhs

Cost of two Atlas Copco Compressors = Rs. 28.0 lakhs

Payback = 254 days

4. Installation of Hot Water Vapor Absorption Machine for Chilled water Generation:

Earlier the Chilled water was generated by conventional chilled plants using shell and tube heat exchangers and Ammonia for Absorption.

The industry has shifted to Hot Water Vapor Absorption Machine supplied by Thermax India Ltd. This chilled water machine uses hot water instead of steam for chilled water generation. The Hot water is generated from the process and this waste heat is recovered for operation of the Vapor Absorption Machine. Thus utilizing waste heat and reducing steam consumption.

Capacity of one Hot Water Vapor Absorption Machine = 220 TR

Number of hot Water Vapor Absorption Machine = 440 TR

Cost of Machines = Rs. 80.0 lakhs

Steam consumed before installation of HW VAM = 50.0 TPD

Steam consumed after installation of HW VAM = NIL

Savings (@Rs.340/T steam) = Rs. 56.1 lakhs

Payback = 510 days

5. Insulation of all Cold and Hot Stream Pipelines in Plant:

The pipelines and equipments in the plant were provided with no proper insulation system that caused huge energy loses which were indirectly felt from the increase consumption of utilities available (Steam, Cooling water etc).

Materials or combination of materials, which have air or gas, filled pockets or void spaces that retard the transfer of heat with reasonable effectiveness are thermal insulators. The process industry is full of pipelines and equipments, which have different temperature requirements i.e. some, require very high temperature while some require maintenance of low temperatures. Convection is the best mode of heat loses in this case. Pipelines and equipments directly exposed to the surroundings tend to loose heat thus affecting the process side, which then demand more utilities (Steam, Cooling water etc). Conservation of heat and thus the total energy conservation is an economic necessity, and thus insulation has to be provided to the hot surfaces in order to reduce heat losses.

Steam Saving = 24 TPD = 7920 TPA

Steam Saving in Cost (@Rs. 340 per T) = Rs. 26.92 lakhs

Investment = Rs. 8.0 lakhs

Payback = 107 days

6. Furnace Oil Saving by small modification in the Furnace Burners:

In Acetic Anhydride Plant, the Furnace uses furnace oil for heating purposes. By small modification in the placement of the burners the oil spillage was stopped and besides this the heat losses were also avoided.

The total saving in Furnace Oil has been 100 L per day

Furnace Oil Saved = 33000 L per annum

Saving of Furnace oil (@Rs. 11.42 per L) = Rs. 3.76 lakhs

Zero Investment was done in the plant.

Besides this number of other small but significant energy saving projects like; Replacement of Faulty Steam Traps, Steam Distribution Header Redesigning, Control of leakage and seepage in Process and Utility Pipelines have been implemented in the year 2004 - 2005.

Energy Conservation Plans and Targets

In the year 2005 - 2006, the company has planned for the following and the same is under implementation:

- Cogeneration system using high pressure 4.0 MW steam turbine (back pressure) for captive power generation and process steam for heating.
- Replacement of inefficient Furnace with new Thermax designed furnace.
- Utilization of Vent gases (Constituting of nitrogen gas) for vacuum in process. Etc.

The estimated cost of the above projects is Rs.1500 Lacs and the estimated payback is 24 months

Environment and Safety

Industrial Organics Ltd. has a Safety, Health and Environment department to ensure that the standards are met as per requirement.

No compromise is done where Safety, Health and Environment is concerned. The safety manager ensures that all the employees are using Personal Protective Equipments (like Helmet, Safety Gloves, Safety Boots, Safety Goggles etc.) while working in plant.

The plant is continuous process and the operation is thus 24 hours. There are surprise checks at night to ensure that safety is taken care of by employees who are working in night shifts.

The emergency numbers (like Fire Brigade no., Ambulance No., etc.) are displayed at various locations in the plant.

Certificate of Merit *Chemicals*

UNITED PHOSPHORUS LIMITED
Vapi (Gujarat)

Unit Profile

United Phosphorus Limited (UPL) is the largest producer in India of crop protection products with a wide range of products that include fumigants, fungicides, insecticides, rodenticides and herbicides. The company ranks fourth amongst the generic agrochemical companies in the world.

UPL is having their manufacturing units at Vapi, Ankleshwar, Jhagadia, Halol and UK. UPL-Vapi unit was the first unit established in 1969, situated 180 km from Mumbai on national highway no.8.

It is an ISO 9001, ISO 14001 and OHSAS 18000 certified company

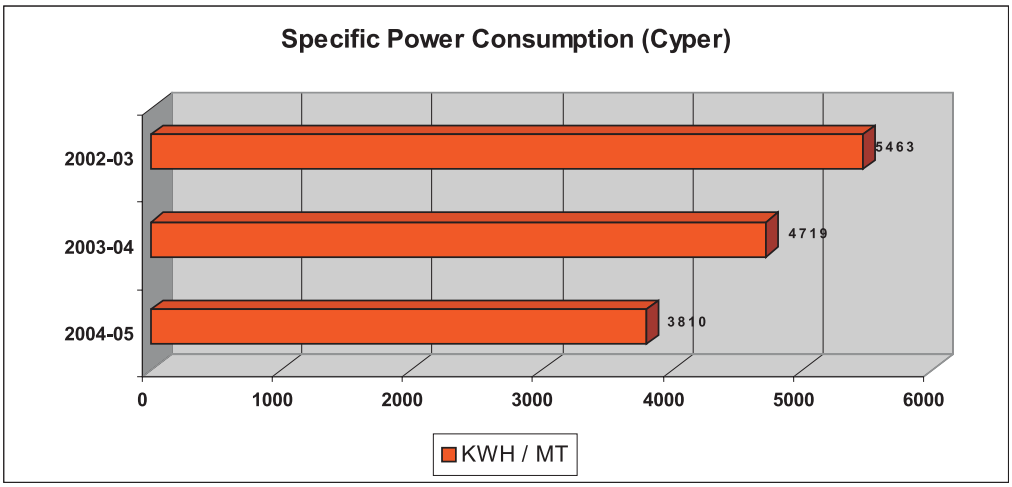
The unit sales turnover was Rs 230.64, 244.75 and 286.77 crores in the year 2002-03, 2003-04 and 2004-05 respectively.

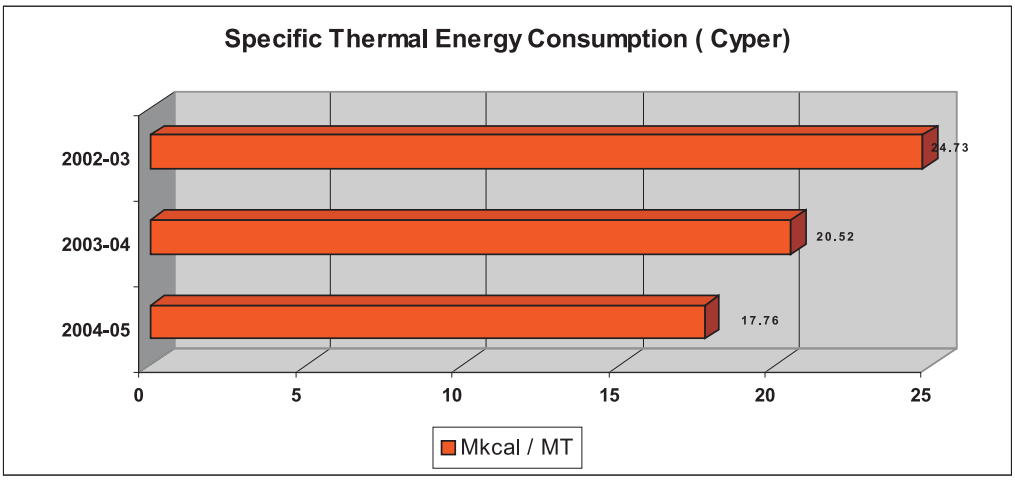
Through acquisitions, strategic alliances and subsidiaries, UPL has built a network across the globe - in Europe, America, Asia Pacific, CIS, Africa and Australia with fully owned subsidiaries in Argentina, Australia, Bangladesh, China, Cuba, Denmark, Honduras, Hong Kong, Japan, Mauritius, Mexico, Poland, Russia, South Africa, USA, UK, Zambia, Zimbabwe and representative offices in Sri Lanka & Vietnam.

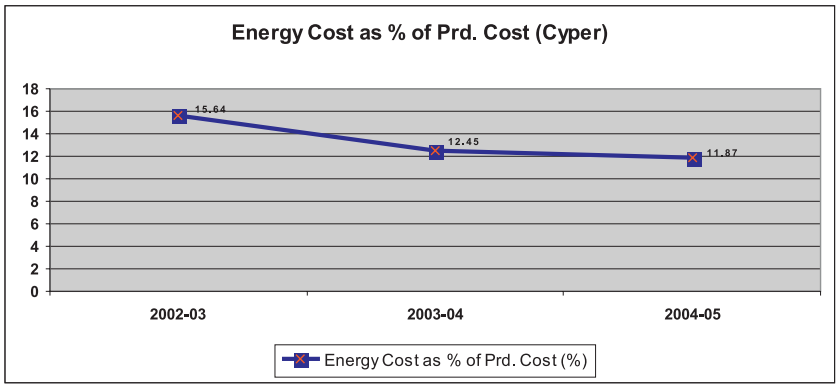
Energy Consumption

The specific Energy consumption of main product Cypermetherine is on declining trend due to various innovations, R&D for yield improvement, Energy conservation, capacity utilization, process improvements measures etc. Cypermetherine is being manufactured with DVACL and MPBAD, combined direct power consumption of these main products are 60 % of the total electricity purchased and combined thermal energy consumed is 80 % of the total thermal energy purchased. The scenario of UPL – VAPI unit in the past three years is as given below.

Description	Unit	2002-03	2003-04	2004-05
Annual production of main product	MT	1739	1827	2320
Specific Energy consumption – Electrical	Kwh / MT	5463.9	4719.02	3810.86
Specific Energy consumption - Thermal	Million Kcal / MT	24.73	20.52	17.76
Total Manufacturing cost	Lakhs Rs	6265.65	7161.66	7897.58
Total Energy cost	Lakhs Rs	957.16	891.6	937.13
Energy cost as % age of Total manufacturing cost	%	15.64	12.45	11.87


Specific Power Consumption (Cyper)
2002-03
2003-04
2004-05
5463
4719
3810
0
1000
2000
3000
4000
5000
6000
KWH / MT


Specific Thermal Energy Consumption (Cyper)
2002-03
2003-04
2004-05
24.73
20.52
17.76
0
5
10
15
20
25
Mkcal / MT


Energy Cost as % of Prd. Cost (Cyper)
18
16
14
12
10
8
6
4
2
0
15.64
12.45
11.87
2002-03
2003-04
2004-05
Energy Cost as % of Prd. Cost (%)

Energy Conservation Commitment, Policy and Set up

UPL is committed for Total Energy conservation, prevention of energy wastages, new technologies implementation and R&D for quality to reduce specific energy consumption of their main product lines. Because of the commitment, one of the main Objectives of the company is to reduce Energy bill by 10 %.

Energy management set up is comprising of three groups

- The Apex group indicates the commitment of the top management. It gives proper guidelines, support, and encouragement to the Energy conservation activities. The group is headed by COO.
- The core group forms the middle Management including GM (works), Dept heads, and Energy Manager.
- The working group comprises of various profession engineers at all plant level. By monthly meeting is conducted, where various energy conservation proposals are put, analyzed, discussed. With no payback proposals are implemented immediately and with investment are reported to the management. Monthly reports of Energy saving and proposal are put to the Management in MIS.

The Commitment of the top management is also reflects, as every three years Energy Audit is conducted by External Auditor.

Energy Management Policy

We shall strive for continuous energy economy through

- To employ cleaner & more efficient technologies.
- Adopting appropriate energy conservation technologies to all new projects.
- Replacement of energy inefficient equipment with energy efficient equipment.
- Carry out regular internal & external audits to identify areas for improvements.
- Enrich our experience on energy conservation by exchange of ideas with our group companies and other organizations.
- Improved capacity utilization.
- To ensure energy conservation Program throughout the organization.
- Formulation of overall energy strategy & targets.

As a part of our energy conservation and environment protection, we are committed to reduce specific energy consumption by 10 % every year till 2007.

Energy Conservation Achievements

Description	Unit	2002-03	2003-04	2004-05
Energy saving activities	Nos	17	14	22
Savings achieved	Rs Lakhs	86	79	117
Investment	Rs Lakhs	21	20	77

Major Energy saving schemes implemented in 2004-05 :

Plant has implemented total 22 major energy efficiency projects in year 2004-05, inclusive of in-house R & D efforts, innovations. The themes of these projects were based on following ideas.

- Optimization of cooling water-pumping system
- Performance improvement of refrigeration plants
- Condensate and flash steam recovery
- Improvement in steam generation and distribution
- Performance improvements of steam ejectors
- Electric heating to steam heating
- Replacement of worm gear boxes with planetary gearboxes
- Replacement of steam ejectors with OTL vacuum pumps
- Power factor improvement by installation of capacitors & APFCR
- Replacement of reciprocating chillers with screw chillers
- Purchasing of Energy efficiency motors for all new requirements
- Replacement of thermocol insulation with PUF for cold services
- Steam ejectors combinations for different applications
- Conversion of indirect heating to direct heating
- Replacement of inefficient compressor to efficient compressor
- Installation of CFL lamps
- Steam trap monitoring and replacement
- Steam / air leakages monitoring

In house R & D efforts / Technology innovations / Process up gradations:

Plant is continuously working on main product line for better utilization of energy, productivity and resources through following ideas:

- Capacity enhancement through process intensification.
- By alternate manufacturing processes.
- Batch to Continuous operation.
- BCT reduction by in-house R&D efforts
- Increase in batch size.
- Better Mixing Technology
- Full capacity utilization.

Details of Energy Conservation Measures implemented in 2004-2005

Project : 1

Background & Observation Made:

Objective is to minimize the operating cost of vacuum generating system at DVACL plant in order to reduce electrical energy.

In DVACL plant, at DVA stage, water ring vacuum pump is used to generate vacuum required in the process of lot sucking. For that water ring vacuum pump is replaced by once through lubrication type vacuum pump. This has reduced not only the operating cost of the system but also the effluent generated due to the water ring vacuum pump.

Technical & Financial Implementation:

With water ring vacuum pump

Power consumption	=	24.25 kwh
Effluent Generated	=	1.8 kL/hr

With OTL type vacuum pump

Power consumption	=	4.85 kwh
Oil Consumption	=	0.4 lit/hr
Solvent recovery	=	74 KL / annum
Power saving	**=**	**1.7 Lac Kwh / annum**
Total Saving/annum	=	Rs. 20.24 lacs
Total investment	=	Rs 4.5 lacs

Impact of Implementation:

- Power saving of 1.7 Lakh Kwh / annum
- Solvent recovery 74 KL / annum
- Overall saving Rs 20.24 Lakh
- Reduces effluent generation

Project : 2

Background & Observation Made:

Objective is to minimize the operating cost of vacuum generating system in order to reduce thermal energy.

In Pesticide plant, at cyper concentration, steam jet ejector is used to generate vacuum required in the process. Cyper concentration steam jet ejector is replaced by once through lubrication type vacuum

pump to reduce the operating cost. This has resulted into reduction in the steam consumption and effluent generation and reduction in solvent consumption.

Technical & Financial Implementation:

Steam consumption	= 250 kg/hr
Power Consumption in water circulation to ejector condenser	= 2.95kwh

with OTL pump

Power consumption	= 8.58 kwh
Oil Consumption	= 0.4 lit/h
Solvent Recovery	= 222 KL / annum
Thermal saving	**= 676 M Kcal / annum**
Total Saving	= Rs 9.65 Lakh p.a.
Total Investment	= Rs 3.5 Lakh

Impact of Implementation:

- Steam saving of 676 M Kcal / annum
- Solvent recovery 222 KL / annum
- Overall saving Rs 9.65 Lakh
- Reduces effluent generation

Project : 3

Background & Observation Made:

For DVACL plant brine requirement was fulfilled by conventional reciprocating type chillers.

To fulfill the requirement of appx. 134 TR load, three no of reciprocating type chillers were used to generate brine at –20 Deg C. The overall efficiency of three different systems were poor. We have decided for the single screw chiller of 134 TR capacity in place of conventional reciprocating type chillers.

Technical & Financial Implementation:

Overall kW/TR	= 2.2 (with Reciprocating type chiller)
Screw chiller Ikw/ TR	= 1.91
Kwh saving	= (2.2-1.91) x 134
Total kWh saving / annum	= 327000
Total Saving/annum	= Rs 17.46 Rs
Total Investment	= Rs 30 Lakh

Impact of Implementation:

- Power saving of 3.27 Lac kWh / annum
- Annual saving of Rs 17.46 Lakh
- No maintenance

Project : 4

Background & Observation Made:

DVA aquous solution evaporation condensate and Flash steam recovery.

Appx. 40 T of condensate and 11 % of flash steam recovery identified and energy utilized in Boiler feed water day tank from DVA aquous solution evaporation plant. The plant has installed M/s Forbes Marshall's supplied pressured powered condensate pump along with flash steam recovery system

Technical & Financial Implementation:

Condensate recovered:	= 40 T / day
Flash steam recovered	= 11 %
Total saving in Thermal Energy	
Condensate	= 813 M Kcal
Flash steam	= 948 M Kcal
Total saving / annum	= Rs 26 Lakh
Total Investment	= 3.5 Lakh

Impact of Implementation:

- Thermal energy saving of 1761 M Kcal / annum
- Annual saving of Rs 26 Lakh
- Reduction in effluent generation

Project : 5

Background & Observation Made:

RP furnaces, indirect type heating element were consuming more power to get the required heat for process with our in house R & D efforts, plant has tried direct type electrical heating in place of indirect heating. It has saved almost 50 % of power required for heating.

Technical & Financial Implementation:

Indirect heating element	**= 18 kW**
Direct type heating element	= 9 Kw
The batch timing remained same for the process	
Total Kwh saving	= 300000
Total Saving/annum	= Rs 16 Lakhs
Total Investment	= Rs 8.25 Lakhs

Impact of Implementation :

- Power saving of Rs 16 Lakhs

Project : 6

Background & Observation Made:

RP furnaces, radiation losses through the furnace wall found high

To control the radiation losses specialized high emissive insulation paint were applied inside the walls of the furnaces. By doing that plant has found that power consumed for the batch has reduced.

Technical & Financial Implementation:

Power reduction for a batch after applying the paint	=	18.93 %
Total kWh saving / annum	=	83000
Total Saving/annum	=	Rs 4.47 Rs
Total Investment	=	Rs 0.5 Lakhs

Impact of Implementation:

- Power saving of Rs 4.47 Lakhs
- Surrounding area good working condition

Project : 7

Background & Observation Made:

Using electrical oil heating for product temperature upto 300 Deg C

It was observed that, the heating was not proper for the batch and it was inefficient. The plant has decided for the oil-fired heater for the same application and installed one 50,000 Kcal/Hr oil fired heater for the same application @ 82% thermal efficiency

It resulted into very fine temperature controlled profile for the product, which has improved product yield and purity also.

Technical & Financial Implementation:

Electrical heater capacity	=	48 kW
Heat requirement	=	41280 kCal/Hr
Operating cost for Electrical heater	=	255 Rs/Hr [Cost of Power]
Operating cost for oil fired heater	=	74 Rs / Hr [Cost of LDO]
Power saving	=	0.81 Lakhs kWh / annum
Total Saving/annum	=	Rs 4.34 Rs
Total Investment	=	Rs 2.5 Lakhs

Impact of Implementation:

- Power saving of Rs 4.34 Lakhs
- Better product result (yield and purity)
- Reduced BCT, increased productivity
- No break down

Project : 8

Background & Observation Made:

Total seven nos cooling water pumps were audited for their operating efficiency. It was found that most of them were operating at 70-75 % efficiency

The plant has selected split flow type instead of back pull type pump and wherever applicable installed online booster pumps for overall better system efficiency. By doing that against 8 operating pumps, unit was able to manage plant requirement with 4 nos better efficiency (80-85 %) pumps.

Technical & Financial Implementation:

Total power saving = 5.23 Lakhs kWh / annum
Total saving = Rs 27.93 Lakhs
Total Investment = Rs 9.3 Lakhs

Impact of Implementation :

- Total energy saving of Rs 28 Lakhs
- Less operating pump numbers
- Low RPM pump 1440 against 2900
- Low maintenance

Project : 9

Background & Observation Made:

Objective is to minimize the operating cost of gearboxes and reduction in noise level.
In DVACL & MPBAD plant, nine Reactors were having worm type gearboxes, which were working on 74% efficiency. For these reactors helical and planetary gearboxes were installed. There efficiencies are around 94 %. This had reduced not only the operating cost of the system but also the noise level.

Technical & Financial Implementation :

Power consumption = 112 kWh (with worm type gear box)
Power consumption = 90 kWh (with planetary & helical type gear boxes)
Total power saving = 1.86 Lakhs kWh / annum
Total saving = Rs 9.29 Lakhs
Total Investment = Rs 5.4 Lakhs

Impact of Implementation:

- Power saving of 1.86 Lakhs kWh / annum
- Noise level reduction
- Less space

Project : 10

Background & Observation Made:

Objective is to minimize the operating cost of vacuum generating system.

In DVACL plant, at DVACL distillation, two steam jet ejector are used to generate vacuum in TFE and FFE in the process. The loads of both the system were studied. Observed that, if the pipeline size can be increased one Ejector can take the load of both the system. This has reduced the operating cost of the system by reduction in steam consumption, and power consumption.

Technical & Financial Implementation:

Total Steam consumption = 600 kg/hr (with two ejectors)
Power Consumption in water circulation to ejector condenser
= 24 kWh (with two ejectors)
Steam consumption = 450 kg/hr (Single ejector)
Power Consumption in water circulation to ejector condenser
= 12 kWh (Single ejectors)
Total power saving = 0.86 Lakh kWh / annum
Total Thermal saving = 731 M Kcal / annum
Total saving = Rs 15.37 Lakh
Total Investment = Rs 0.5 Lakh

Impact of Implementation :

- Saving in thermal energy 731 M kCal / annum
- Saving in Electrical energy 0.86 Lac kWh / annum
- Reduction in effluent

Project : 11

Background & Observation Made:

Objective is to minimize the operating cost of vacuum generating system. In MPBAD plant, at MBB distillation, SS steam jet ejector is used to generate vacuum in the process of the order of one torr. The load of the system was studied and observed that, one torr of the system can be reduced to 3 torr for the same application. This will reduced the operating cost by reduction in steam consumption. The Plant has replaced the ejector from SS to graphite type for better life.

Technical & Financial Implementation :

Steam consumption	=	270 kg/hr (with 1 torr)
Steam consumption	=	170 kg/hr (with 3 torr)
Total saving in thermal energy	=	339 M Kcal / annum
Total Saving	=	Rs. 5.28 lakhs.
Total investment	=	Rs 4 Lakhs

Impact of Implementation:

- Thermal energy saving of 339 M kCal / annum
- Total saving of Rs 5.28 Lakhs
- Low maintenance

Project : 11

Background & Observation Made:

Objective is to minimize the operating cost of vacuum generating system.

In DVACL plant, at TCBACL distillation, steam jet ejector is used to generate vacuum in the process of the order of one torr. It was old design and steam consumption was high. The Plant discussed with the H.K. Industries, the supplier of the ejector system. They suggested to replace the X & W stage diffuser and nozzles, resulting in reduced steam consumption.

Technical & Financial Implementation :

Steam consumption	= 230 kg/hr (Before modification)
Steam consumption	= 140 kg/hr (After modification in X & W stage)
Total thermal saving	= 325 MKcal / annum
Total saving	= Rs. 4.80 lakhs.
Total Investment	= Rs 0.3 Lakhs

Impact of Implementation:

- Thermal energy saving of 325 MKcal / annum
- Total saving of Rs 4.8 Lakhs

Major Energy Conservation Plans and Targets for 2005-06

United Phosphorous Limited, Vapi unit is committed to improve energy performance on continual basis by finding out new ideas / innovations in the field of electrical and thermal energy.

Sl. No.	Energy conservation targets	Expected savings in Rs. Lacs	Investment in Rs. Lacs	Target date
1	MPBAD, MR112 steam ejector to be replaced with OTL vacuum pump	16	4.5	Ordered 15 Oct-2005
2	Boiler blow down heat recovery	13	8.5	Dec-2005
3	Contaminated condensate heat recovery	11	10	Dec-2005
4	Direct condensate recovery DVACL	4.4	1	Sep-2005
5	VFD in Boilers	4.15	2	Oct-2005
6	Electrical heating to steam heating for FO preheat	4.12	1.5	Oct-2005
7	Replacement of inefficient reciprocating chiller to energy efficient screw chiller 170 TR	42	25	Dec-2005
8	Cyper hexane recovery, steam ejector to OTL vacuum pump	9	5	Oct-2005
9	Triple effect evaporator in place of direct evaporation	128	90	Ordered 15th Oct 2005
10	Conversion of incoming GEB line from 11 to 66 KV		192	Ordered 15th Oct 2005
11	Energy efficient N2 plant for continuous operation		30	Ordered 15th Sep 2005
12	DVACL distillation ejector modification	18	5.5	Ordered 15th Oct 2005
13	TCBN distillation ejector modification	5.7	1.2	Ordered 15th Sep 2005
14	DVACL cooling pump replacement	7	1	Oct-2005

For year 2005-06:

Planned investment **= 377.2 Rs Lakhs**
Savings Expected **= 262.3 Rs Lakhs**

HEAVY WATER PLANT
Manuguru (Andhra Pradesh)

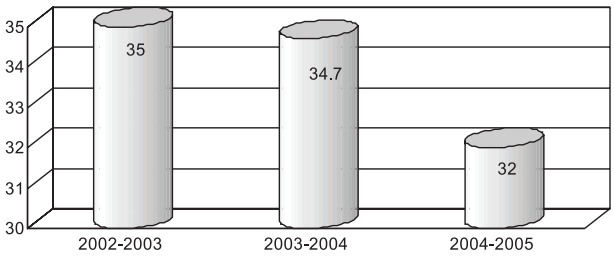
Unit Profile

Heavy Water Plant, Manuguru is an ISO-9001(2000) & 14001(1996) Certified Organisation, owned by Heavy Water Board, Mumbai, Department of Atomic Energy, Government of India. The plant is designed to produce 185 MT/year of Nuclear Grade Heavy Water (D2O) with high Safety, Quality and Environment standards. The principal customer for our product in our country is M/s Nuclear Power Corporation of India Limited (NPCIL) who use our product in their pressurised heavy water based atomic power plants as a coolant and moderator. We have also exported our product to South Korea and China. HWPM meets it's power and steam demands through captive power coal based thermal cycle. HWPM contributes a lion share of 45% of the country's production based on indigenous technology.

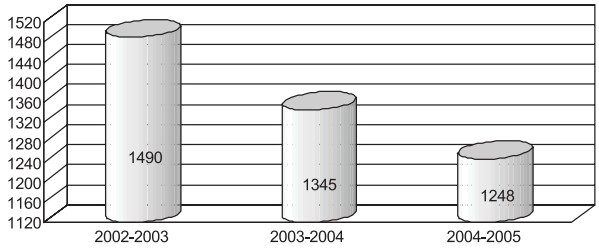
Energy Consumption

Specific Power Consumption Details	Unit	2002-2003	2003-2004	2004-2005
Annual Production (% of design)	% Design	113.59	126.9	136.25
Total Electrical Energy consumption per annum	Kwh(Lakhs)	3131.08	3004.13	3145.97
Total Thermal Energy consumption per annum	Kcal.(Million)	1010903	1048517	1161353
Total Manufacturing cost	Rs. Lakhs	11787	12569	13162
Total energy cost	Rs. Lakhs	6040.9	6497.5	6866.5
Energy cost as % of manufacturing cost	%	51.3	51.7	52.2
Specific Energy	GJ/Kg	35.0	34.7	32.0
Specific Electrical energy consumption	KWH/Kg	1490	1345	1248
Specific thermal energy consumption	Mcal./Kg	4810	4800	4610
Specific electrical energy cost	Rs./Kg	2885	2518	2097
Specific thermal energy cost	Rs./Kg	3243	3276	2843

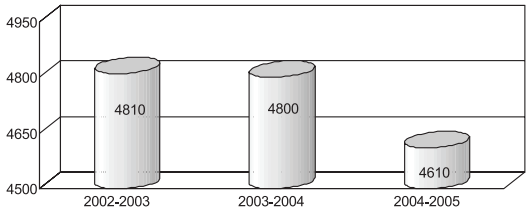
Plant Specific Energy, GJ/Kg



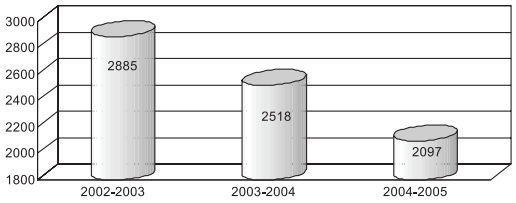
Plant Specific Electrical Energy Consumption, KWH/Kg



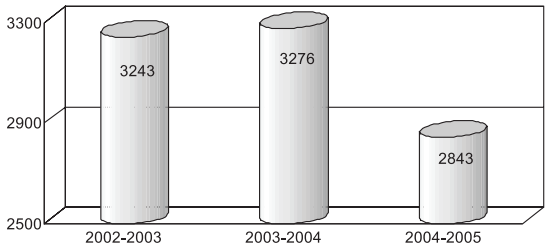
Plant Specific Thermal Energy Consumption, MCal/Kg



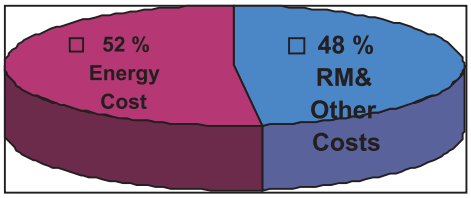
Specific Electrical Energy Cost, Rs./Kg



Specific Thermal Energy Cost, Rs/Kg



Manufacturing cost Vs Energy Cost for the year 2004-05



Energy Conservation Commitment, Policy and Organization Set up

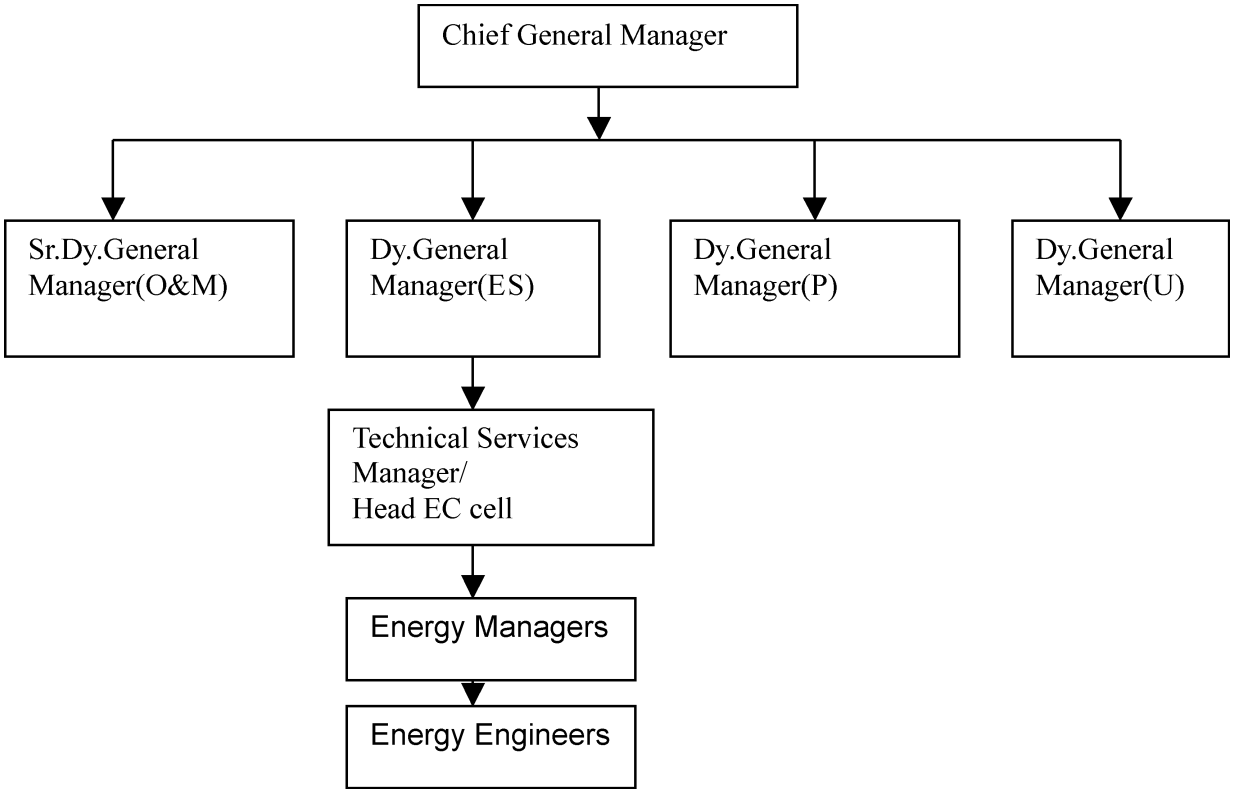
Energy Management Policy

Heavy water plant (Manuguru) is committed to well defined energy policy formulated by Heavy Water Board. The policy in our case is to pay focused attention to all aspects of plant operation and maintenance activities with a view to reduce energy consumption and also identify and implement plant modifications that can result in energy saving with specified limit on pay back period for the capital invested. The energy policy was translated into specific objectives and these objectives are given wide publicity in the plant. Matching action plans are evolved for implementation of energy objectives.

- Maximising production through highest utilization of plant equipment
- Fine tuning of operating parameters to closer to design
- Improvising on stream factor through better maintenance practices and reducing plant planned down time
- Continual Maintenance of heat exchange equipment for their highest efficiencies
- Fast track implementation of energy saving schemes
- Adoption of Re-use, re-cycle and recovery philosophy
- Hydro dynamic Study of process loops and cutting down excess design fats.
- Motivating, training and encouraging our employees to achieve the target of reducing specific energies by employee awareness programmes.
- Continuous monitoring and review of energy consumption pattern

Salient features of energy conservation cell:

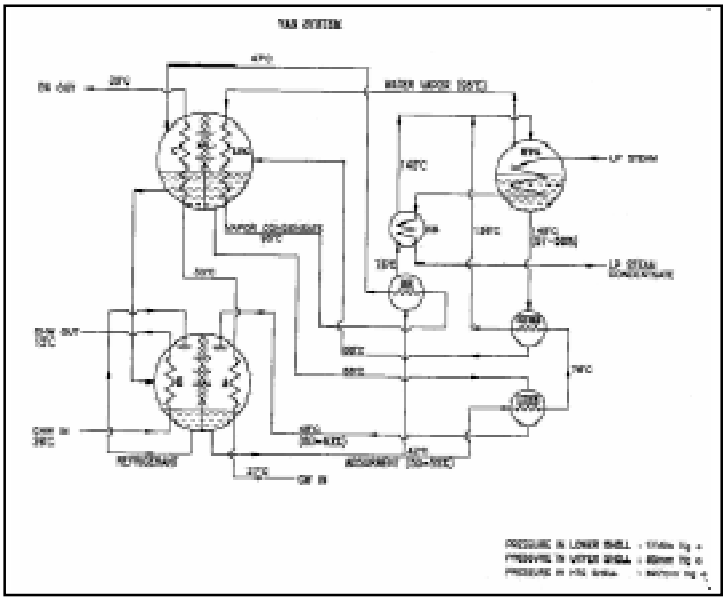
Well defined organisation for energy conservation is set up with an apex committee at site comprising senior officers headed by Chief General Manager of the plant. The plant is in constant interaction with Heavy Water Board for effective implementation of policy and achieving the objectives. The committee is committed for fine tuning operations, maintenance, technology upgradation with energy efficient process and equipment, motivating and training employees in reducing specific energy consumption.



Energy Conservation Achievements

Vapour Absorption Refrigeration System

Subsequent to realization of savings in LP steam consumption through implementation of Waste Heat Recovery Scheme (a scheme for pre-heating boiler feed make up water by XU effluent) and through replacing steam tracing with electrical heat tracing of process piping and impulse lines in Exchange Units, the LP steam is put to use for producing cold energy through LiBr-H_2O based vapour absorption refrigeration cycle of appropriated capacity of 4500 TR to meet plant chilled water requirement. This had resulted in stoppage of two nos. of Vapour compression refrigeration machines driven by electrical motors of 2.2 MW each, utilizing Freon-12 as refrigerant, a ozone depleting substance.



The system consists of 3 nos. of LP steam fired LiBr –H2O Vapour Absorption refrigeration machines each of capacity 1500 TR (appropriated to CW supply temperature of 29 ^{0} C). The primary refrigerant (water) extracts heat from secondary refrigerant (water in chilled water circuit) at a low pressure and temperature and transforms into vapour in an evaporator. This vapourised refrigerant gets absorbed in a suitable concentrated absorbent (Li.Br) at low pressure in an absorber and the absorbent gets heated and diluted. The heat of dilution is removed by cooling water and the diluted absorbent containing the water vapour is concentrated at high pressure in a generator (utilizing LP steam) and brought back to the absorber thereby restoring back to its original concentration for re-circulation. The refrigerant vapourises in the generator and after condensing by cooling water in a condenser again comes back to the evaporator thereby completing the cycle. In HWP(M), double effect vapour absorption refrigeration system has been adopted where the latent heat of condensation of refrigerant generated in the first stage is utilized in the second stage to enhance the efficiency of the cycle thereby reduction in heat input. The system utilized low-pressure saturated steam at 5.0 Kg/cm^{2}g and the LP condensate coming out from the system is pumped back to CPP.

Benefits:

- Phasing out Ozone Depleting Substance(R12) usage
- Net reduction in power consumption by 3.1 MWe. i.e. equivalent to 12 MT/H of Main steam
- Improvisation in operation stability having minimum running machinery along with drastically reduced sound levels.

Condensate Waste Heat Recovery Scheme;
A scheme for heating turbine generator condensate from its condensing temperature to an approachable level by using XU wastewater is commissioned.

The scheme comprise of two nos. of plate type heat exchangers ,an intermediate DM water circulation loop ,piping to interconnect condensate recirculation loop of power plant and exchange unit waste water loop, along with other auxiliary eqpt.

The scheme has reduced waste water temperature of exchange unit to the tune of 1.4 deg. Celsius saving 2.0 MT of steam per hour.

Re-sizing of intake well pump: As Raw water intake rate had been reduced drastically from about 5600 M 3/H to around 1700 M3/H, one pump having capacity of 2500 M3/H was procured and put in operation where in a saving 150 KW is achieved.

Installation of Additional Fire Water Jockey pump: As running of main fire water pump for making up leakages seriously affects the efficiency of the pump, one additional Jockey pump of 100 M3 capacity is installed and put in to service, This has lead to stoppage of main pump and a saving of 125 KW could be achieved.

Common Headering for Aux. CW system for all three units at CPP: Presently one pump is in operation in each unit as per operational requirement. A common header was provided with which operating pumps could be stopped and we could save electrical energy to the extent of 50 KW

Electrical Heat Tracing: Replacement of steam tracing system as planned in phase-I in XU-I & XU-II with electrical heat tracing system completed and a saving of 3.0 MT of main steam could be achieved.

Water/Liquid Effluent Management: Consequent to implementation of 'Zero' discharge from ETP, further review of water consumption pattern and possibility of re-using other plant discharges was taken up. The following modifications were carried out for conserving water.

- Recycling of pump sealant water back to DM water tank.
- Recycling of seal water of vacuum pumps to filter water reservoir.
- Utilizing guard pond water as cooling water make up in main plant and CPP
- Utilizing DM plant (CPP) effluents to the extent of 600 M3/day diverted to ash disposal.
- Utilising cooling towers blow down to the extent of 40 M3/H for ash disposal and area gardening.
- Utilising ETP guard pond outlet water (55 M3/H) for area gardening.

Energy Conservation Plans and Targets

Energy Conservation measures (Planned)	Expenditure Rs. lakhs	Anticipated energy savings Rs. In lakhs	Expected date of completion
Changes in inst. air system at MP/CPP	50	60.5	2006-07
VSD for condensate extraction pump	6	10.1	2005-06
Installation of VSD for FD fans	90	47	2006-07
Replacement of chilled water pumps	4	42	2005-06
Bifurcation of cooling water circuit	20	46.2	2006—07
One stage blinding for 6 BFPs	15	47	2005-06
Aux.steam turbine	500	588	2006-07
Corro-coating of CW circulation pumps	10	23.52	2005-06
Tapping from 4th stage for spray water for desuperheating in BFPs	5	10.1	2005-06
Installation of SBA	292	125	2006-07
Installation of structured packing in all the			
columns of both XUs and variable speed			
drives for A1,A2 and B2 gas boosters.	—-	1165	2006-07
Increased Heat recovery by installing			
additional PPX and WS Heat Exchangers.	—-	770	2006-07

Specific Energy consumption planned Target for the year 2005-06 & 2006-07:

Year	Electrical & Thermal GJ/Kg	Reduction over the year 2004-05
2004-05 (Base year)	32.0 *	-
2005-06	31.5 *	1.56 %
2006-07	28.0 *	12.5 %

Anticipated money saving at the end of 2006-07 = Rs.1891 lakhs

Environment and Safety

Safety

HWPM has a fully dedicated safety department which ensures compliance of safety measures by O&M group, authorize the jobs to be carried out strictly following the guidelines of factories act and Atomic Energy Regulatory Board norms through work permit procedures.

Safety personnel are engaged in round the clock shifts, supporting shift superintendents of the plant for all safety related requirements. HWPM has documented on-site and off-site emergency prepared plans and exercises are conducted on regular basis.

HWPM has an attached first aid and occupational health center to central control room equipped with ambulance, resuscitator equipment and required rescue and first aid medicines.

Environment

HWPM maintains a separate team to achieve zero leakages of water, steam, air and chemicals. A scheme of awarding best operating unit for house keeping is in force for encouraging good house keeping. HWPM was awarded cleaner production organization by APPCB.

HWPM is proud of continually obtaining cess rebates initiated by AP pollution control board for complained with statutory and legal limitations on effluents.