# Orchid Chemicals & Pharmaceuticals Ltd.,

# COMPANY PROFILE IN BRIEF

- Manufacturer of bulk Cephalosporin range of products (antibiotics), Intermediates and Neutraceuticals with two sophisticated manufacturing facilities in India (one at Alathur near Chennai and the other at Aurangabad)
- Our Alathur facility has a work force of about 1200 and a turnover of **Rs.648 crores**
- Largest manufacturer of Cephalosporin products in India and one among the top five in the world
- 100% EOU with ISO 9000, ISO 14000, US-FDA, TGA EDQM, MHRA certifications

# NATURE OF MANUFACTURING

- Cephalosporin manufacturing is based on low temperature technology upto -70°C and beyond
- Approx. 4700 TR equivalent of refrigeration systems at various temperatures (+7,0,-10, -25, -30, -40 & -70deg.C)
- Steam generation of 22 Tons/ Hour
- Energy cost is approx. 6.2 % of the turnover
- Zero discharge by Evaporation, Ultra Filtration & RO technology
- A typical manufacturing process stream is as under:

  Reactors - Centrifuging - Drying - Powder Processing - Cold Storage – Despatch

# ENERGY SCENARIO

- **Electrical power**

  **CPP 10.56 MW ( 3.38 x 2nos. + 3.8 x 1no. FO Gensets )**

  **110 KV TNEB supply is in service as a prime source.Due to TNEB realisation the plant demand has come down to 9.5 MVA against 10.5 MVA when operated on CPP due to improvement in p.f**

  **Wheeling from gas generated units from Ramnad is in force**

- **Steam**
  **550 Tons per day**
  **4 Nos. of FO fired boilers ,3 Nos.of WHRBs**

- **Fuel bill - approx. Rs.40 crores per annum**
  **(50% for Utility, 20% for ETP and 30% for process)**

# Summary of Encon Projects 2004 - 07

| Sl. no. | Year | Total No.of Projects | Savings / annum (Rs.in Lacs ) |
|---|---|---|---|
| 1 | 2004 - 05 | 4 | 138.1 |
| 2 | 2005 - 06 | 18 | 276.7 |
| 3 | 2006 - 07 | 26 | 466.4 |
| 4 | Target for 2007 - 08 | 28 | 700.0 |

# Summary of ENCON activities for the year 2004 -07

| Sl.no. | Activities | Savings/Annum achieved in Lakhs |
|---|---|---|
| 1 | Innovative projects | 315.57 |
| 2 | Continuous improvement projects | 565.73 |
| 3 | Specific energy consumption reduction from 42.99 to 39.92 | 7.14% |
| 4 | Renewable energy sources | |
| | Wind | 208.1 |
| | Solar thermal | 20.8 |
| | Biomass | 110.8 |
| | | |

# List of Projects with cost Benefits ( 2004-05 & 2005-06 )

# List of ENCON Projects with cost Benefits 2004 – 05

## No.of Projects :- 4  Total Savings :- 138.11 Lacs

| S.No. | Title of Encon Projects | Energy saved/annum | | Savings/ annum |
|---|---|---|---|---|
| | | Electrical (Units) | Thermal (FO in KL) | (Rs.in lakhs) |
| 1 | In MPSR chiller the load on +10 refrigeration system was shifted to CT. The load on CT was shifted to air cooled radiators | 1800000 | 0 | 47.52 |
| 2 | Load on -65 refrigeration system was shifted to -70 system (The KW per TR in the former was higher) | 1050000 | 0 | 27.72 |
| 3 | In Solvent Recovery continuous distillation the feed tray location was optimised to have more stripping section resulting in the "nil" reflux for a given purity | 560000 | 168 | 30.50 |
| 4 | In 16 TPH boiler the old centrifugal conventional burners have been replaced by the new Dunphy co-axial ratiotronic micro-processor controlled burner, which could trim the excess oxygen levels closer to 1.2% (the excess air required for combustion got reduced by 7%) | 0 | 346 | 32.37 |
| | TOTAL | | | **138.11** |

# List of ENCON Projects with cost Benefits 2005 – 06

## No.of Projects :- 18  Total Savings :- 276.7 Lacs

| S. no. | Title of Energy project **2005 – 06** | Energy saved / annum | | Savings / annum ( Rs. in Lacs ) |
|---|---|---|---|---|
| | | Electrical in Units | Thermal FO in KL | |
| 1 | Reduction of boiler flue gas to 150 deg. C. Hence to prevent corrosion, boiler was designed with Feed water heating coil inside the boiler to increase the feed water temperature.Fuel steam ratio 15.4 | 0 | 7842.50 | 96.30 |
| 2 | Replaced vapour absorption system with water cooled energy efficient centrifugal compression system at utility-1 | 0 | 379.35 | 46.30 |
| 3 | Bifurcation of HP condensate to Boiler and LP condensate to Ecology | 0 | 13.80 | 1.50 |
| 4 | Operating the waste heat recovery boiler at low pressure and thereby 500 kg/hr steam generation increased | 0 | 270.96 | 43.00 |
| 5 | In Utility 40TR and 102TR systems, evaporative condenser fan pumps were interlocked with compressor | 30657 | | 1.50 |

# List of ENCON Projects with cost Benefits 2005 - 06

| S.no. | Title of Energy project 2005 – 06 | Energy saved / annum | | Savings / annum (Rs.in Lacs ) |
|---|---|---|---|---|
| | | Electrical in Units | Thermal FO in KL | |
| 6 | Additional pump, operation stopped by relocating the distillation column condenser from higher level to lower level | 50000 | 0 | 1.70 |
| 7 | Lube oil economizer lined up in the lube oil line to increase the engine return oil temperature to 75 deg from 65 deg. C | 170000 | 0 | 6.20 |
| 8 | By continuously monitoring the flow pattern and rectifying the leakages. Installing pressure reducing valves for low pressure application. | 670000 | 0 | 23.20 |
| 9 | Optimization of cooling tower usage by interconnecting the cooling tower and pumps delivery lines and stopping one cooling tower pump and fan | 440000 | 0 | 15.20 |

# List of ENCON Projects with cost Benefits 2005 - 06

| S.no. | Title of Energy project 2005 – 06 | Energy saved / annum | | Savings / annum ( Rs. in Lacs ) |
|---|---|---|---|---|
| | | Electrical in Units | Thermal FO in KL | |
| 10 | Segregation of cooling tower pumps based on different head level | 160000 | 0 | 5.50 |
| 11 | Ecology incinerator system I.D. Fan stopped by interconnecting evaporator & Scrubber vent | 180000 | 0 | 6.20 |
| 12 | Provided Desuper heater for –40 deg.C40TR Refrigeration system | 100000 | 0 | 3.40 |
| 13 | Interlocking of centrifuge Hydraulic system motor such a way that it will run only when scrapping and door opening of centrifuges. Done for three centrifuges). | 16826 | 0 | 0.70 |
| 14 | Higher head pump replaced with lower head pump in 0 deg C refrigeration system | 130000 | 0 | 4.50 |

# List of ENCON Projects with cost Benefits 2005 - 06

| S.no. | Title of Energy project 2005 – 06 | Energy saved / annum | | Savings / annum ( Rs. in Lacs ) |
|---|---|---|---|---|
| | | Electrical in Units | Thermal FO in KL | |
| 15 | Primary pump operation eliminated in refrigeration system | 260000 | 0 | 9.00 |
| 16 | Reduction in lamp wattage by converting 160 ML lamp to 3x 18 w CFL lamps considering the required illumination level ( 90 fittings converted) | 40000 | 0 | 1.40 |
| 17 | Pumps impeller trimmed based on the load requirement. | 205495 | 0 | 6.90 |
| 18 | Optimizing the compressor usage by adjusting the compressor tripping set point from O deg.C to 5 deg.C. | 100960 | 0 | 4.20 |
| | Total | | | 276.7 |

# List of Projects with Cost benefits ( 2006-07)

# ENCON ACTIVITIES 2006-07 AN OVERVIEW

| S.No | Activities | Annual Energy Savings | | | | |
|---|---|---|---|---|---|---|
| | | THERMAL | | ELECTRICAL | | Total Rs.Lacs |
| | | FO(KL) | Rs. lacs | Units | Rs. lacs | |
| 1 | Continuous improvement Projects | 206.9 | 31.0 | 7441770 | 331.6 | 362.6 |
| 2 | Innovative Projects | 326.3 | 52.2 | 1248230 | 54.9 | 103.8 |
| TOTAL SAVINGS | | | | | | 466.4 |

## List of Continuous improvement ENCON Projects :

**No Investment**

| S.no. | Title of Continuous improvement ENCON project 2006 - 07 | Energy saved / annum | | Savings / annum ( Rs. in Lacs ) |
|---|---|---|---|---|
| | | Electrical in Units | Thermal FO in KL | |
| 1 | Optimizing the chilling plant pumps operation by regulating flow rate. | 1139530 | 0 | 50.58 |
| 2 | Auto operation of chilling plants | 354050 | 0 | 15.72 |
| 3 | In PH-18 Non critical area heat load reduced by eliminating heating and cooling system | 0 | 84.00 | 12.60 |
| 4 | Elimination of furnace oil heating in storage tank | 54750 | 0 | 2.43 |
| 5 | Optimizing the refrigeration usage in process area by increasing the chiller set points without affecting the process | 803000 | 0 | 35.65 |
| 6 | Optimising the refrigeration accessories operation by interlocking | 60225 | 0 | 2.67 |

## List of Continuous improvement ENCON Projects :

| S.no. | Title of Continuous improvement ENCON project 2006 - 07 | Energy saved / annum | | Savings / annum ( Rs. in Lacs ) |
|---|---|---|---|---|
| | | Electrical in Units | Thermal FO in KL | |
| 7 | LP steam from evaporator given to Phase-19 and HP steam from boiler isolated | 0 | 122.94 | 18.44 |
| 8 | Desuperheater installed in –70 VGC | 20440 | 0 | 0.91 |
| 9 | Optimization of efficient centrifugal chiller operation | 876000 | 0 | 38.89 |
| 10 | Installation of inverter for Utility-1,2&3 – 10 deg sec pump | 97455 | 0 | 4.32 |

## List of Continuous improvement ENCON Projects :

| S.no. | Title of Continuous improvement ENCON project 2006 - 07 | Energy saved / annum | | Savings / annum ( Rs. in Lacs ) |
|---|---|---|---|---|
| | | Electrical in Units | Thermal FO in KL | |
| 11 | Optimization of chilling plant , cooling towers accessories,operation tower | 156950 | 0 | 8.9 |
| 12 | B-1206 Scrubber blower motor 70HP is replaced with 45HP | 87600 | 0 | 3.89 |
| 13 | Converting –10$^0$c brine circulation by chilled water for powder process AHUs | 337625 | 0 | 14.99 |
| 14 | Elimination of primary pump in –10/ 30TR and 50TR systems | 205130 | 0 | 9.11 |
| 15 | Effective utilisation of cooling tower by interconnecting near by cooling tower | 855560 | 0 | 37.98 |

## List of Continuous improvement ENCON Projects :

| S.no. | Title of Continuous improvement ENCON project 2006 - 07 | Energy saved / annum | | Savings / annum ( Rs. in Lacs ) |
|---|---|---|---|---|
| | | Electrical in Units | Thermal FO in KL | |
| 16 | Liquid nitrogen connection and bifurcation of LP & HP nitrogen ,air circuits. | 1462920 | 0 | 64.95 |
| 17 | Installation of economizer to reduce the power consumption by improving the chiller efficiency –25/102 TR | 78840 | 0 | 3.5 |
| 18 | In PH-19 AHU-1901 no. of air changes reduced. | 13870 | 0 | 0.62 |
| 19 | In –12/100TR plant by increasing the RPM of the evaporative condenser blower discharge pressure was reduced | 176660 | 0 | 7.84 |
| 20 | Phase-25 plant + 7 Chilled water 30TR load shifted from MPSR air cooled chiller to +7 water cooled chiller in Utility-1 | 146000 | 0 | 6.48 |

## List of Continuous improvement ENCON Projects :

| S.no. | Title of Continuous improvement ENCON project 2006 - 07 | Energy saved / annum | | Savings / annum ( Rs. in Lacs ) |
|---|---|---|---|---|
| | | Electrical in Units | Thermal FO in KL | |
| 21 | Installation of inverter for -10$^0$c secondary pump in Utility-3 ,-10$^0$C secondary pump in Utility-1 | 97455 | 0 | 4.32 |
| 22 | Conversion of 160W ML (Mercury Lamp) fittings to CFL (Compact Flourescent Lamp) 54 Watts | 197730 | 0 | 8.78 |
| 23 | Elimination of primary pump in -10/30TR1 & 2, -10/50TR 1 & 2 | 205130 | 0 | 9.11 |
| Total | | | | 362.6 |

# Innovative Projects implemented in 2006-07

# List of Innovative ENCON Projects : 2006 - 07

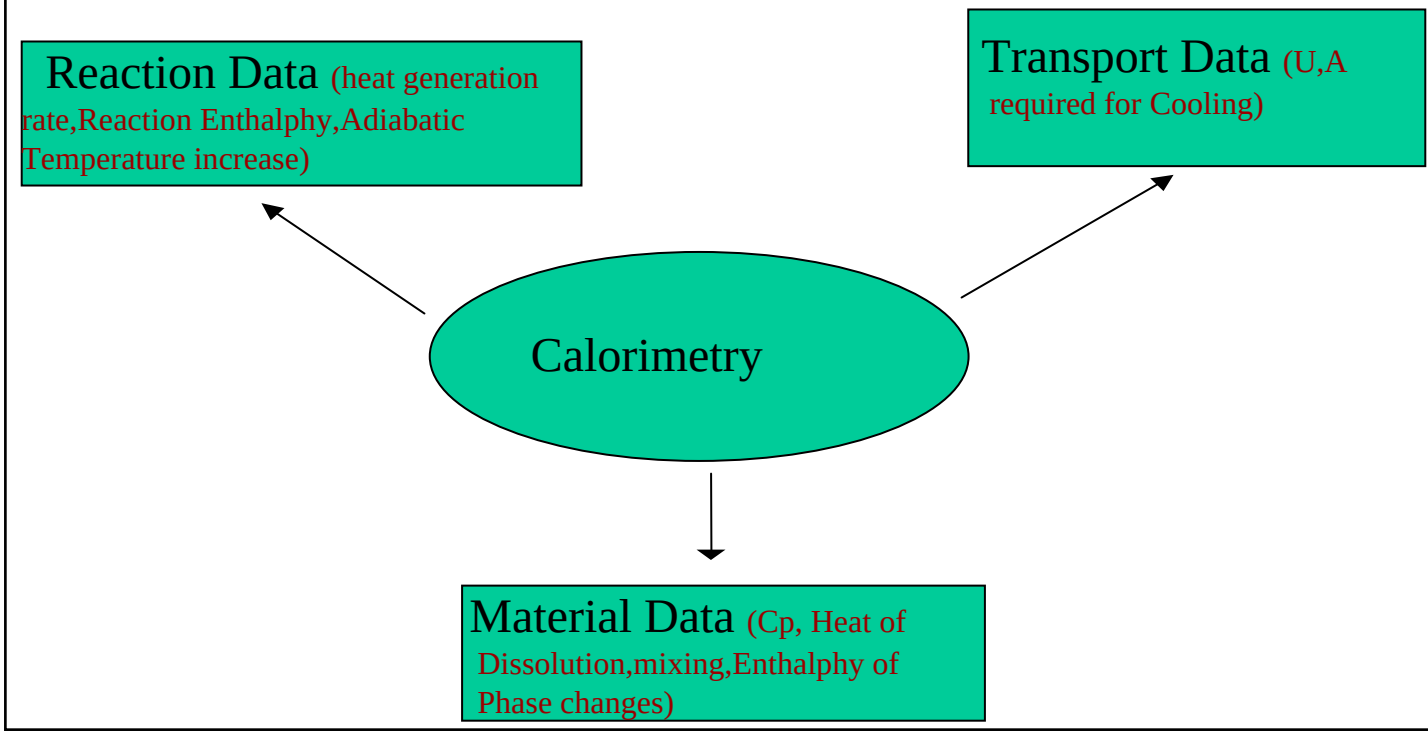
| S.no. | Title of Innovative ENCON project 2006 - 07 | Energy saved / annum | | Savings / annum ( Rs. in Lacs ) |
|---|---|---|---|---|
| | | Electrical Units | Thermal FO in KL | |
| 1 | Using Calorimetry for process reaction | 992730 | - | 43.5 |
| 2 | In PH-18 Hot water coming out of AHU is diverted to WFI Cooling | 255500 | 222.84 | 44.76 |
| 3 | Optimization of Distillation column operation Aspen Software | 0 | 103.47 | 15.51 |
| Total | | | | 103.8 |

## Innovative Projects implemented in 2006 - 07

# 1.Using reaction calorimetry for optimising the energy requirement In the Chemical Reactions

# Using reaction calorimetry for Chemical Process

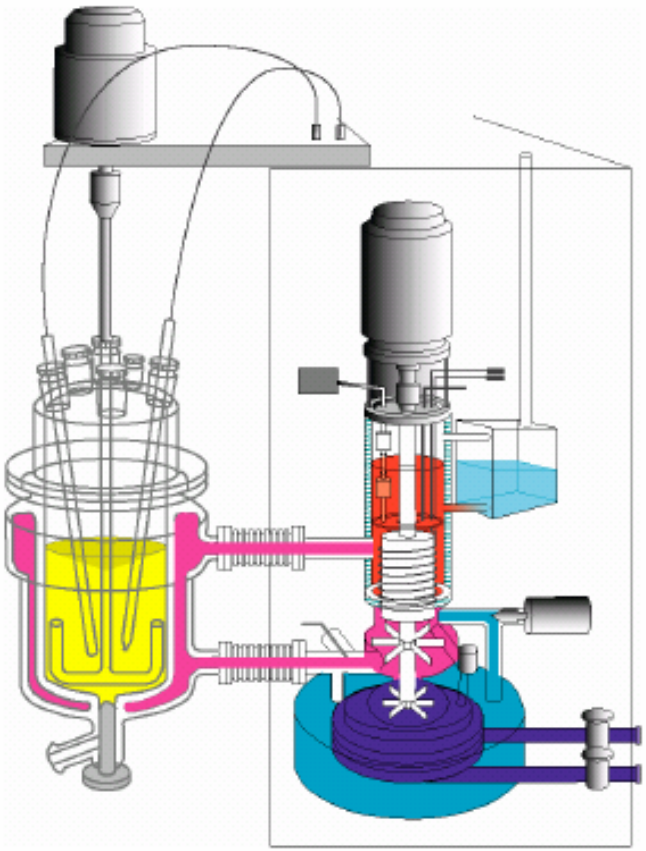
Information that could be generated through Reaction Calorimetry



# Using reaction calorimetry for Chemical Process

REACTION CALORIMETER---METTLER, **RC1e**

# Equipment Details: RC1e's Thermostat system



Complete instrument family covering widest application ranges:

- temperatures: - 90 °C ... + 300 °C
- heat flow at reactor: ± 350 W/kg
- temperature control modes: isothermal-, isoperibolic-, adiabatic- and distillation-mode with high heating and cooling rates
- sophisticated safety system

# Using reaction calorimetry for Chemical Process

## Example

a. Consider a process ( Temp desired = 0+/- 5 Deg C) that is exothermic in nature with a high adiabatic temperature rise ( 40 Deg C)

b. The heat of reaction from calorimeter gives the exact reason for the adiabatic temperature rise ,whether due to

   1, Reaction

   2, Reagent addition

c. Based on the heat release rate and the type , we can decide the process temperature and the utility temperature that is required

# Using reaction calorimetry for Chemical Process

- Exact utility type/temperature required for the process

| Present Process | Recommended Process |
|---|---|
| •Process temperature :-40 Deg<br>•Reagent addition : dumping<br>•Dosing Reagent Temp: 5 Deg c<br>•Utility temperature : -70 Deg C<br>•Total Process Time : 4 hrs<br>*Utility load has to overcome both heat of reaction and heat of dosing and* ***dosing heat is dominating in this case*** | •Process temperature :0 Deg C<br>•Reagent addition : Controlled<br>•Dosing Reagent Temp: 0 Deg c<br>•Utility temperature : -10 Deg C<br>•Total Process Time : 2 hrs<br>*Utility to overcome heat of reaction only and* ***dosing reagent is to be reduced to 0 Deg C*** |

# Using reaction calorimetry for Chemical Process

- Optimal Flow rate of the utility required.

  Minimum flow rate of the utility required for the process of interest could be calculated based on the rate of heat that is released/ absorbed by the process

- Optimal Surface area for heat transfer controlled processes

  there-by selection of right reaction vessels.

***Utility costs 14.56 Lacs/Annum are drastically reduced by making using of higher temperature brine***

## Innovative Projects implemented in 2006-07

# 2.Optimum utilisation of Energy in Water for injection system (WFI) and Air Handling Units (AHU)

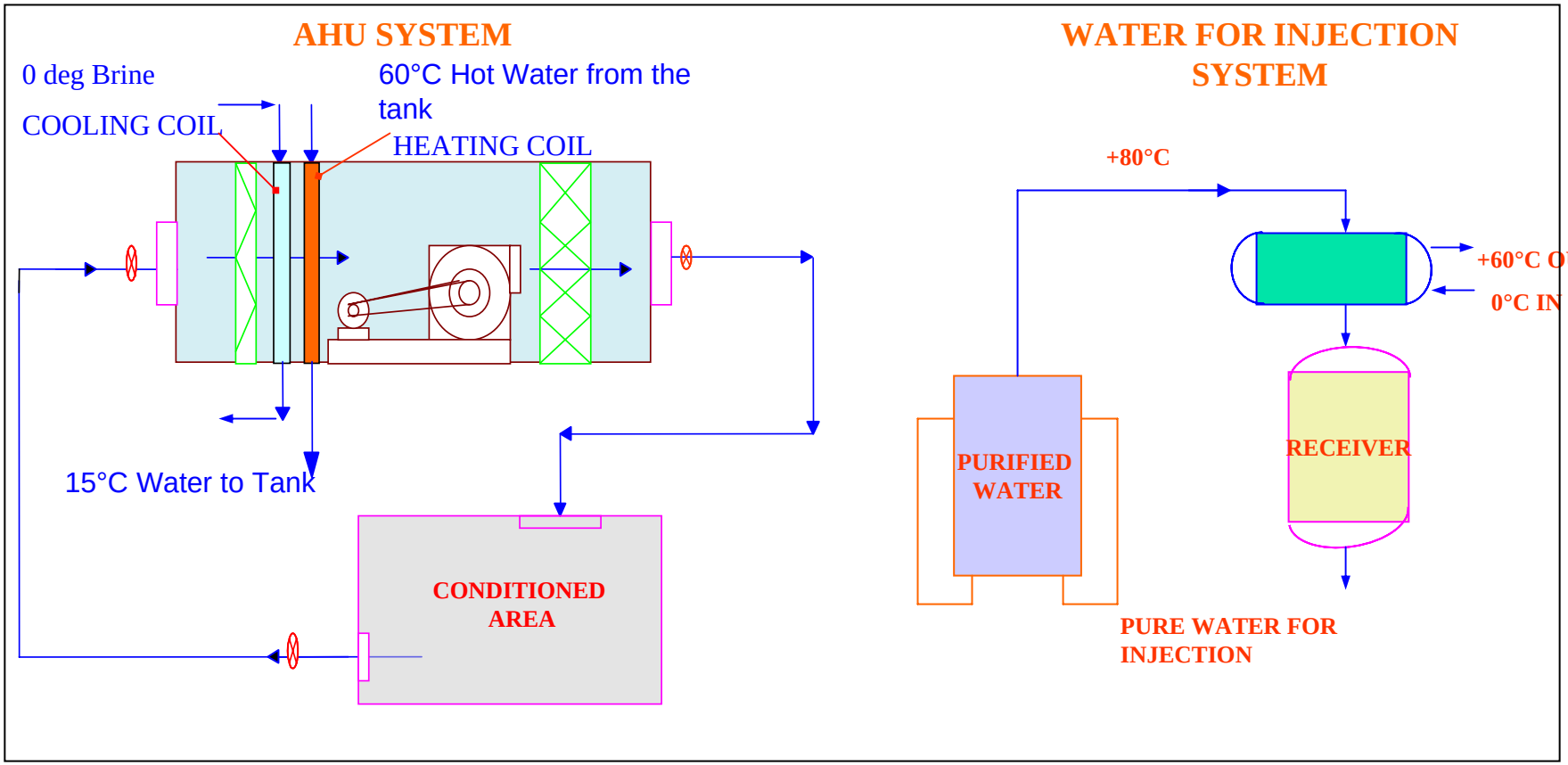
(Refer Schematic diagrams on the following pages)

# Optimum utilisation of Energy in Water for injection system (WFI) and Air Handling Units (AHU)

- **Existing Practice** : Steam was used to heat the dehumidified air in AHU and 0°C brine is used to cool the pure steam generated in WFI system
- **Modified Practice** :Water is being used to cool the pure steam generator and hot water which is coming out from the WFI is circulated to AHU heating coil
- **Investment** : Rs.1 Lacs
- **Savings Achieved** : Rs.44.7 Lacs/Annum

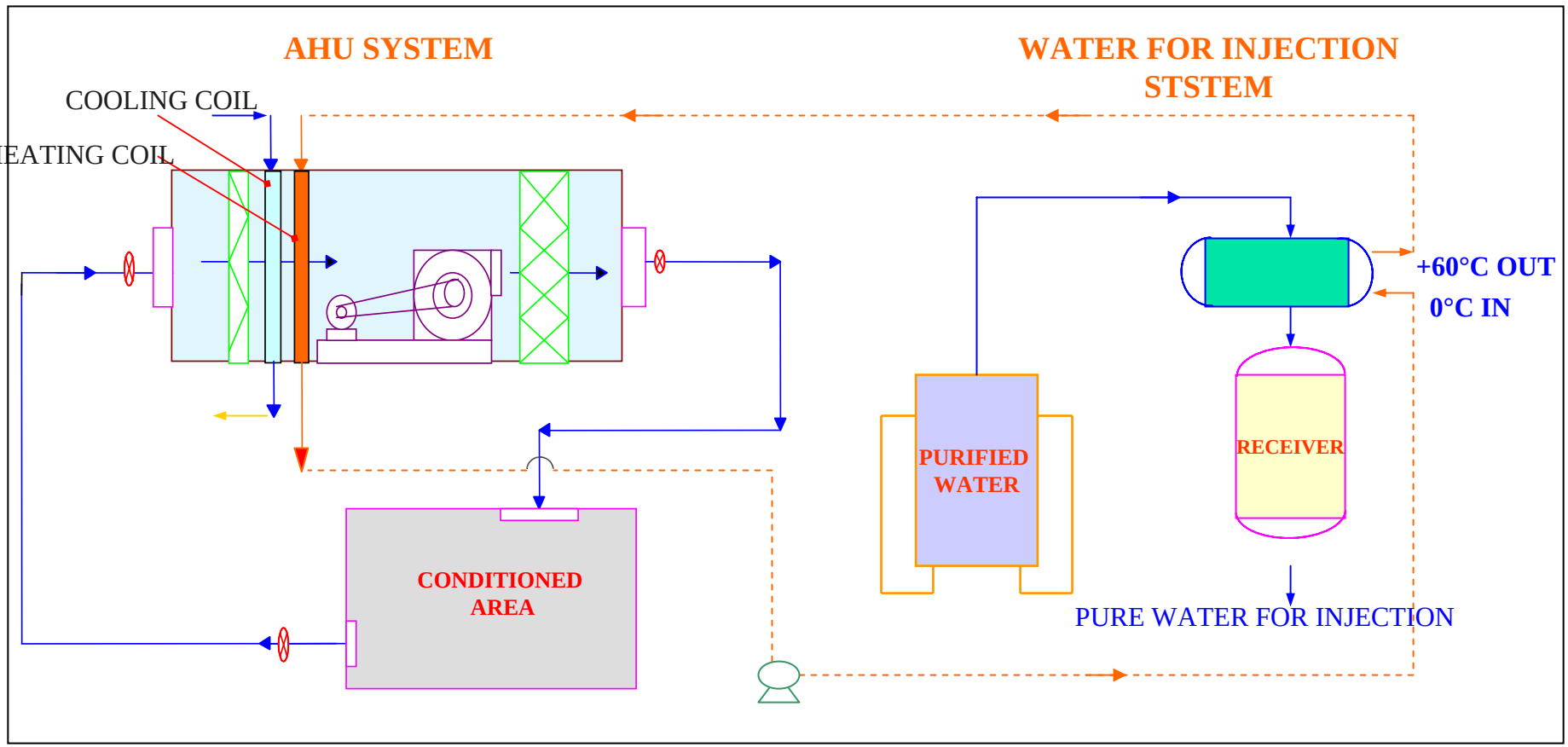
# Optimum utilisation of Energy in Water for injection system (WFI) and Air Handling Units (AHU)

## Existing System



# Optimum utilisation of Energy in Water for injection system (WFI) and Air Handling Units (AHU)

## Modified System



## Innovative Projects implemented in 2006-07

# 3.Optimization of distillation column operation using Aspen Software (Simulation Technology)

# Optimization of distillation column operation using Aspen Software (Simulation Technology)

## Features of Aspen Software

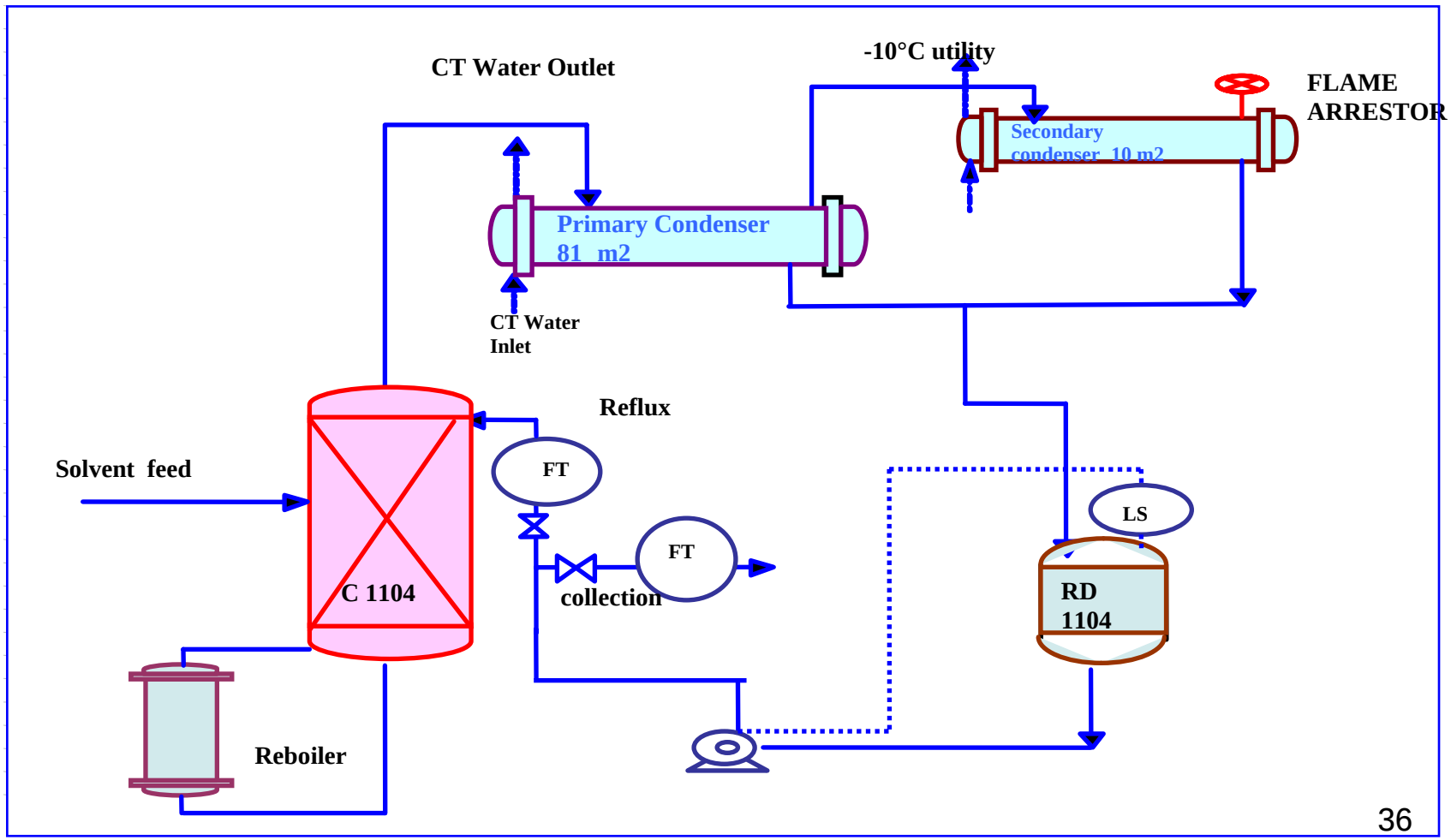
- The column operations can be optimized based on energy, impurities, etc. and various constraints like condenser & reboiler duty.
- Detailed heat and mass balance Can be calculated for all the unit operations like heater, cooler, condenser and reboiler load for distillation column.
- For reducing energy various scenarios can be created using either sensitivity analysis e.g. change of column pressure, reflux ratio, feed tray location, etc.
- Using batch reactor model, we can calculate the optimum reaction time & temperature in a batch reactor

# Optimization of distillation column operation using Aspen Software (Simulation Technology)

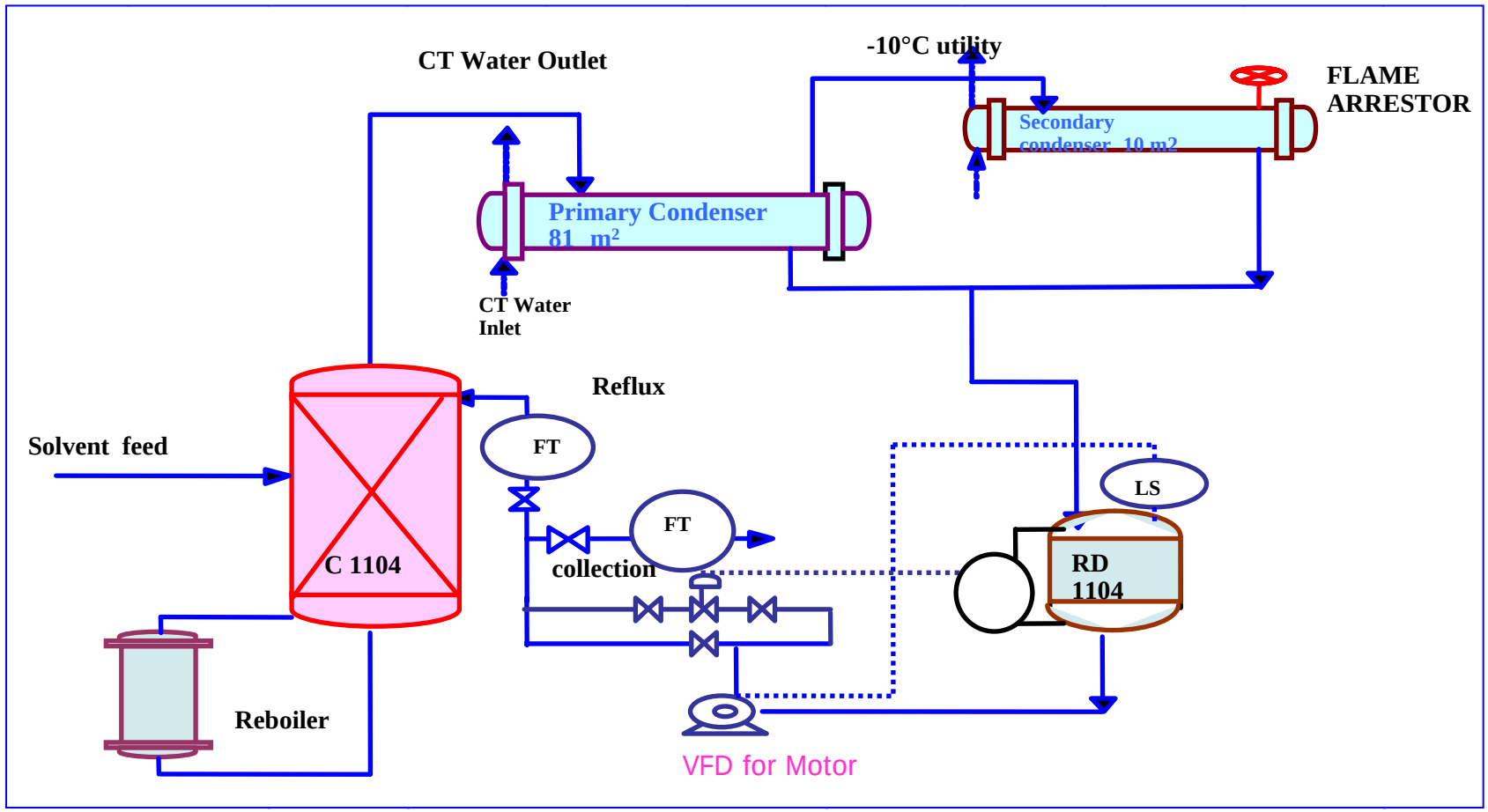
## Example

- **Existing Practice** :Reflux ratio was maintained 8 to separate Ethyl Acetate (EA) & Tetra Hydro Furan(THF) from EA+THF mixture
- **Modified Practice** :Reflux ratio was reduced to 5 from 8 to separate EA & THF from EA+THF mixture without affecting the quality
- **Investment** : Rs.2 Lacs
- **Savings Expected** : Rs.17 Lacs/Annum (In terms of steam reduction)

# Distillation setup before modification



# Distillation setup after modification

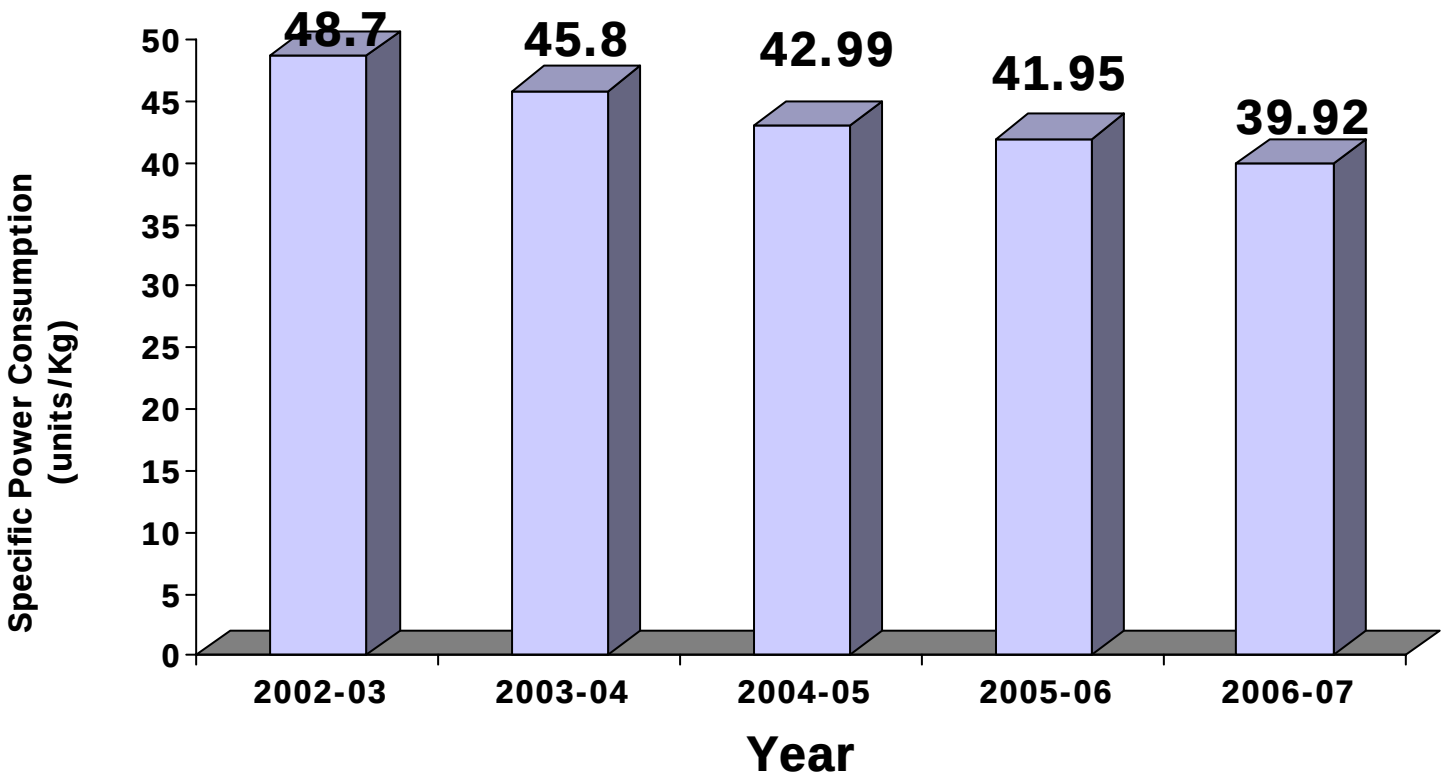


# Sustainability in reduction of Specific energy consumption norms

# Sustainability in reduction of Specific energy consumption norms

## Power

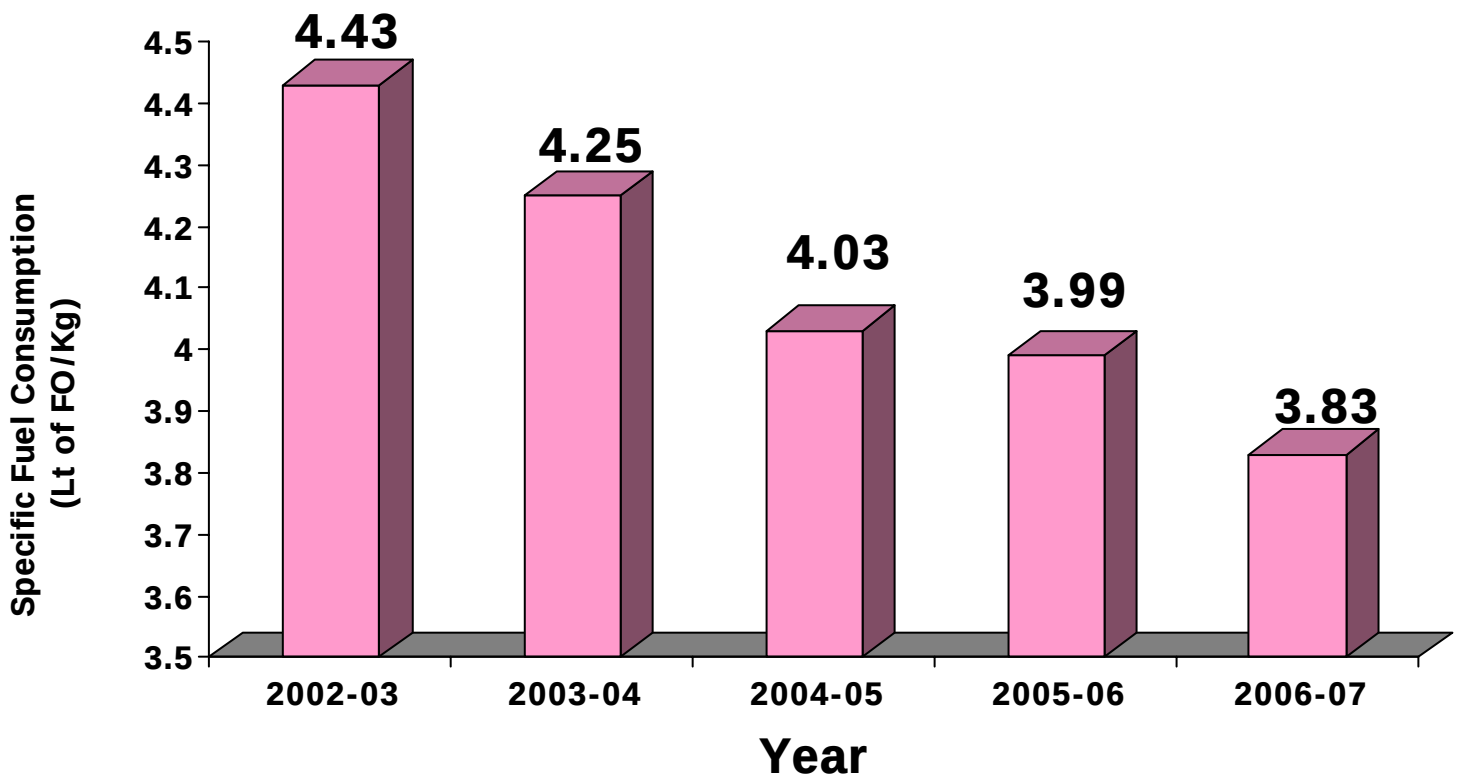
Reduction in Specific Power Consumption (Units/kg)



# Sustainability in reduction of Specific energy consumption norms

## Thermal

Reduction in Specific Fuel Consumption (Litres of FO/kg)



# Renewable Energy and Environmental projects

# Renewable Energy and Environmental projects

## 1. Solar Evaporation

**The rate of evaporation = 3 mm per day**

**Equivalent Fuel Savings = 75 KL per annum**

**Savings about = Rs.10Lacs per annum**

## 2. Utilisation of Waste

## Composting of Bio-Sludge

- Bio-Sludge generation- -360 tons per annum
- Equivalent Fuel Savings = 349 KL
- Savings about = Rs.45.0Lacs per annum

## Composting of Effluent Treatment Plant Bio-Sludge ( Dynamic Pile Process)

## Alternative to Incineration

## 3. Energy conservation by conserving water

- Orchid, being a 'Zero Discharge Unit', adds value to water by 100% recycling
- Saving 150000 KL of water/ annum by recovering water from effluent using\ UF and RO
- By using air cooled heat transfer equipment, Water evaporation loss of 75000 KL/year is avoided
- A major part of CT make up water is obtained from:
  Defrost water, container wash water, AHU humid water,water ring vacuum pump expel water, hot water tank, overflows, reactor jacket draining etc.
- Providing orifices before the water usage points

**All the above resulted in the reduction of specific water consumption**

# MONITORING AND REPORTING SYSTEM

Daily Steam & Power consumption at various user ends are monitored,recorded and reported on daily basis to the respective user departments and displayed in the notice board.

Systemwise energy meter provided and reported on daily basis.

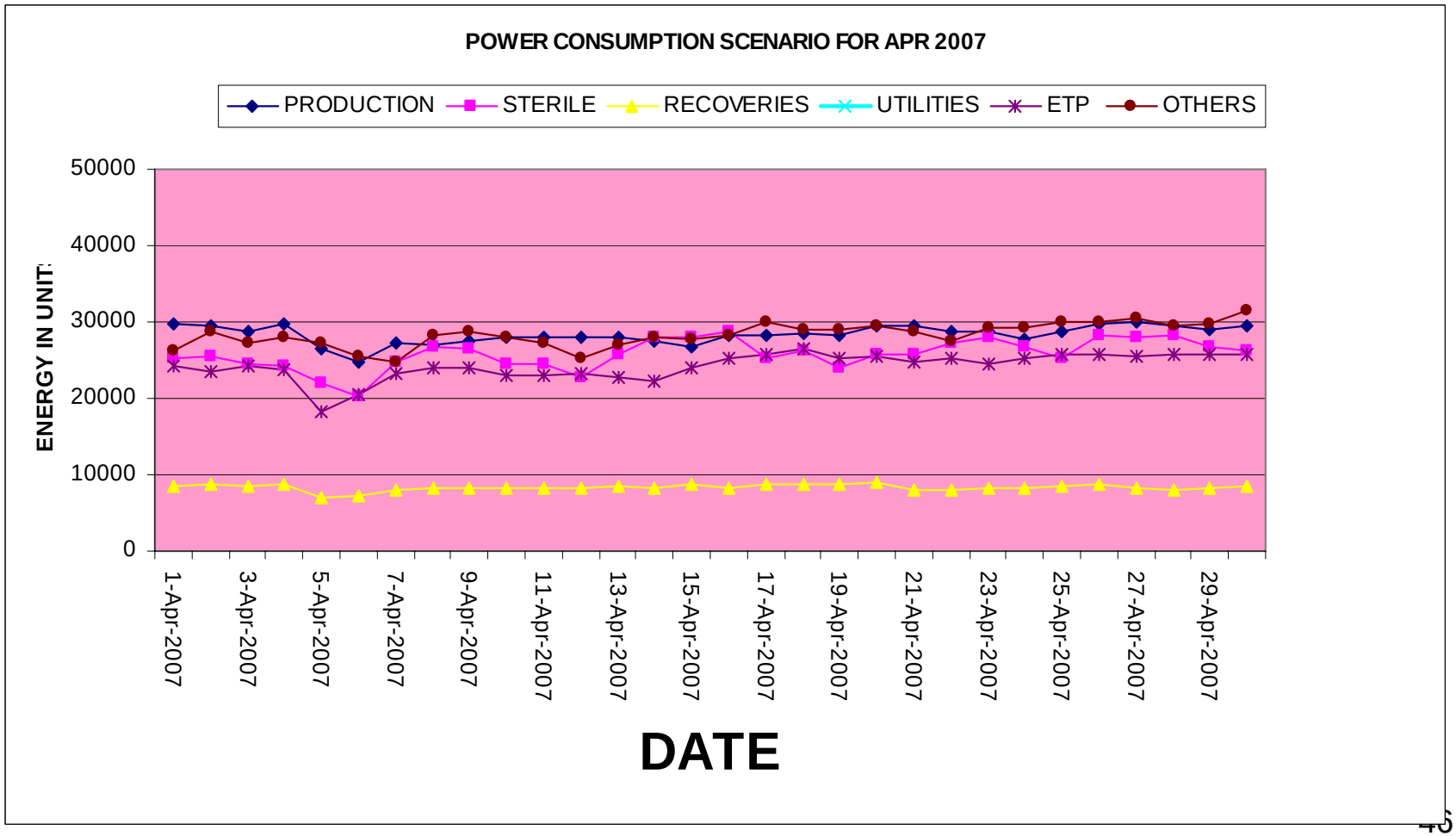
Shiftwise ‘A’ category power consumption reported and monitored.

On line oxygen analyser to operate the nitrogen plant with optimum air comsumption.

Sample reporting format is as follows:

| S.No. | Date | Product name | Qty. | Power units | Fuel (lit) | SPC | SFC |
|---|---|---|---|---|---|---|---|
| 1. | 30.07.06 | Cephalexin | 2000 kgs | 83900 | 7980 | 41.95 | 3.99 |

# Department wise Power Trend



# Daily Power Report

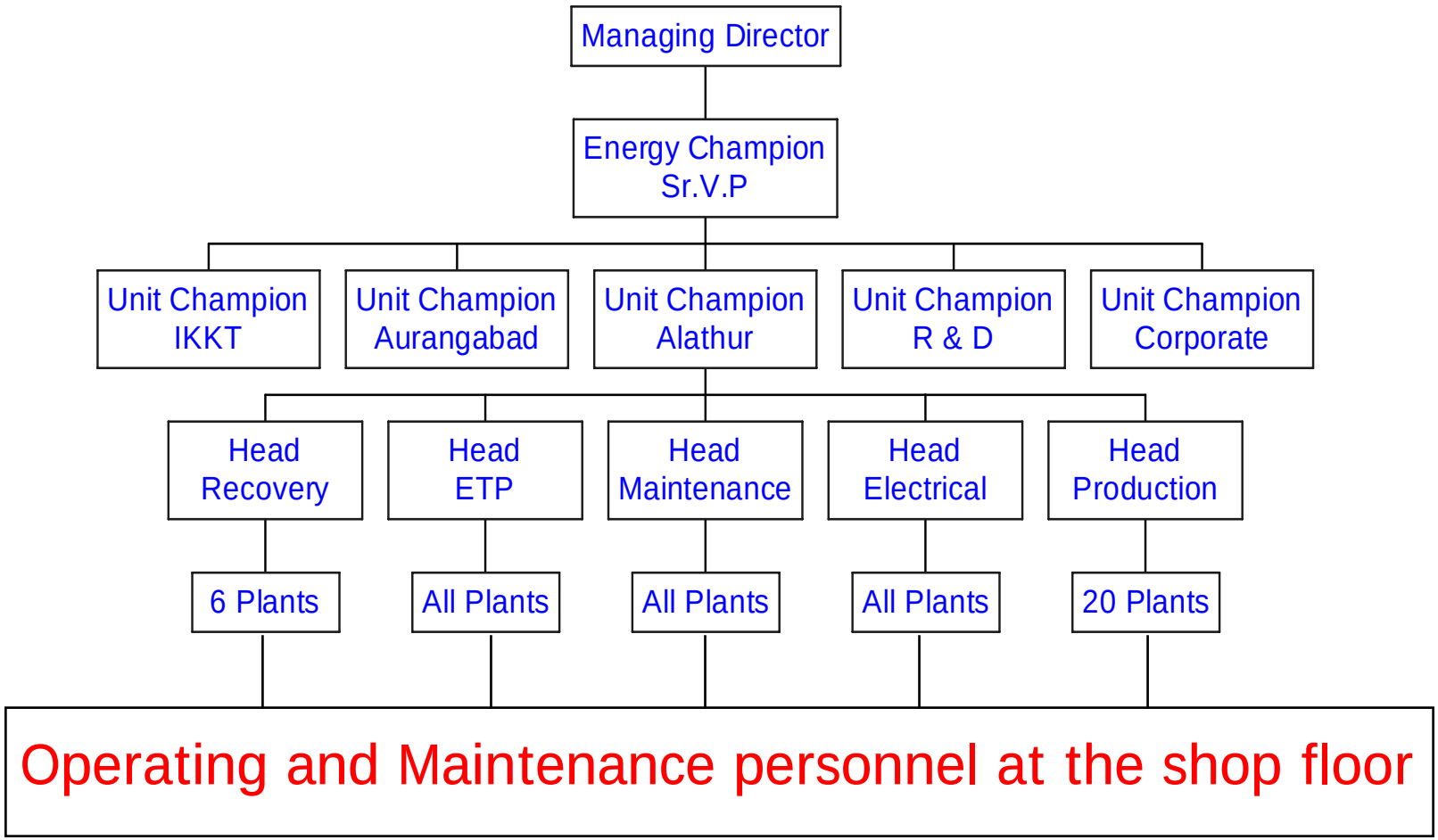
**"Information Motivates, Empowers shift operators !"**

**16.07.2007**

| | Shift-In-Charge | Utility-1 | | Utility-2 | |
|---|---|---|---|---|---|
| | | kwh | Operator | kwh | Operator |
| A | J.Krishnamoorthy | 5861 | Venkatesh/Balan | 9834 | Venkatesan |
| B | K.Kannadasan | 6239 | Karthic/Balan | 10156 | Madhan |
| C | Venkateswarayadev | 5659 | Babu/Elumalai | 10106 | SAGADEVAN |
| TOTAL | | 17759 | | 30096 | |

| PLANT | EQUIPMENT NAME | A/SHIFT - 05.00 HRS | | | B/SHIFT - 21.00HRS | | |
|---|---|---|---|---|---|---|---|
| | | INITIAL | FINAL | DIFF | INITIAL | FINAL | DIFF |
| UTILITY-1 REFRIGERATION | -10/110 TR | 61429 | 62692 | 1263 | 62692 | 63940 | 1248 |
| | -10/30TR-1 | 266900 | 267300 | 400 | 267300 | 267600 | 300 |
| | -10/30TR-2 | 201300 | 201700 | 400 | 201700 | 202200 | 500 |
| | -10/50TR-1 | 271300 | 271700 | 400 | 271700 | 272100 | 400 |
| | -10/50TR-2 | 384300 | 384600 | 300 | 384600 | 384800 | 200 |
| | TOTAL | 2763 | | | 2648 | | |
| | -25/102 TR | 0 | 0 | 0 | 0 | 0 | 0 |
| | -30/10TR HS | 11690 | 11800 | 110 | 11800 | 11920 | 120 |
| | -30/10TR LS | 0 | 0 | 0 | 0 | 0 | 0 |
| | -30/20TR HS | 33040 | 33160 | 120 | 33160 | 33190 | 30 |
| | -30/20TR LS | 21340 | 21400 | 60 | 21400 | 21470 | 70 |
| | -40/40 TR | 55418 | 56632 | 1214 | 56632 | 57933 | 1301 |
| | -70 POWER | 1504 | | | 1521 | | |
| | -70/'X' HS | 282300 | 282300 | 0 | 282300 | 282400 | 100 |
| | -70/'X' LS | 189900 | 189900 | 0 | 189900 | 190000 | 100 |
| | -70/'VGC' HS | 55204 | 55324 | 120 | 55324 | 55673 | 349 |
| | -70/'VGC' LS | 17517 | 17591 | 74 | 17591 | 17812 | 221 |
| | -70/ NEW HS | 626100 | 626800 | 700 | 626800 | 627600 | 800 |
| | -70/ NEW LS | 479400 | 480100 | 700 | 480100 | 480600 | 500 |
| | TOTAL | 1594 | | | 2070 | | |
| | TOTAL UTY-1 | 5861 | | | 6239 | | |

# ENCON ORGANOGRAM



# Role of Energy Manager

- We have a Designated Energy Manger
- Two Energy Manager have been sponsored for energy management exam.
- Fortnightly review meetings are organized and once in a month review with MD
- The saving proposals are discussed in the Meeting
- The energy audits are conducted in every quarter

# Excellent Energy Efficient Unit – 2005-06

# MOTHER TERESA AWARD – BEST CORPORATE CITIZEN 2000

# ORCHID'S MODEL FOR SUSTAINABILITY