



# **Energy Efficiency Workshop**

## **Approach & Case Studies**

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# Introduction-LUPIN

- Pharmaceutical, bulk drug and bulk drug intermediates manufacturing
- R&D Park at Pune for Basic and Generic research
- Manufacturing Range :
  - Anti-Tuberculosis Drugs
  - Antibiotics
  - Cardiovascular drugs



# Manufacturing Facilities

S. No.	Location	Manufacturing Range
1	Ankleshwar	APIs & Intermediate
2	Tarapur	Fermentation & Synthesis plant
3	Mandideep	API & finished dosage - <i>Injectable &amp; Oral</i> Cephalosporins
4	Aurangabad	Solid Oral Dosage
5	Goa	Solid Oral Dosage
6	Jammu	Solid Oral Dosage
7	Indore	API & Finished Dosage
8	Baroda	API & Intermediate



# Lupin-Ankleshwar

## Bulk Drugs (API) :

- Ethambutol Hydrochloride
- Cefadroxil

## Bulk drug intermediates :

- 7-ADCA
- 7-ACCA
- 7-AE
- 7-APCA
- 7-ANCA
- 7-AVCA
- Cefpodoxime Acid
- L- Mandelic Acid & D-Mandelic Acid
- D2-Aminobutanol & L2-Aminobutanol

The Ankleshwar unit has a workforce of about 850 and turnover of Rs.650 crores



# Energy Scenario

## Energy Bill (Rs.Lacs)



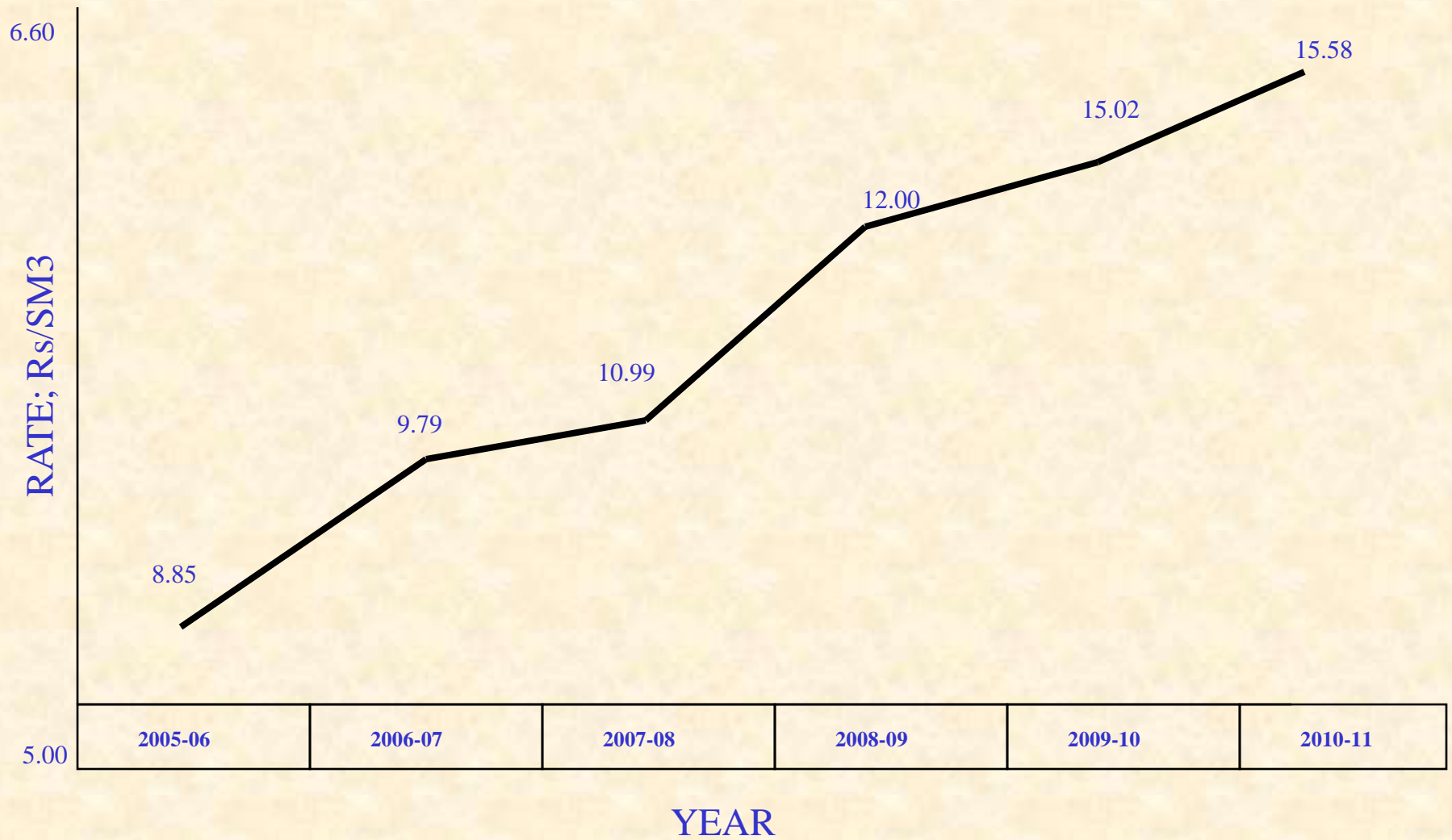


# GEB POWER RATE





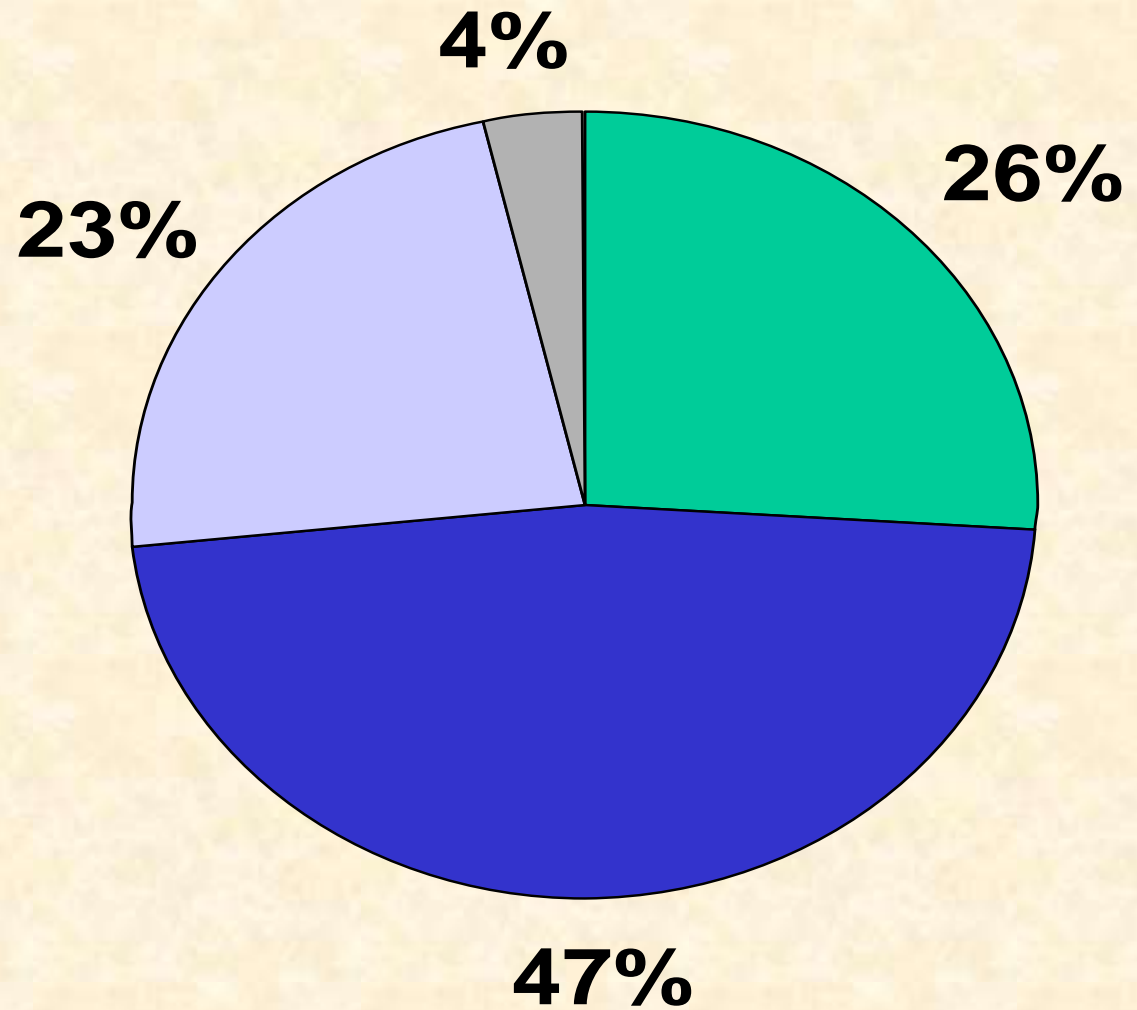
## Natural Gas Rate





# Power Consumption

- Utility
- Plant
- ETP
- Lighting





# Energy Management - Approach at LUPIN

1. **Setting targets** : Setting targets to reduce energy consumption
2. **Recording** : Day to day energy consumption
3. **Analysing** : Correlating energy consumption to the measured output, such as production output.
4. **Comparing** : Comparing energy consumption to the appropriate standards or benchmark
5. **Monitoring** : Comparing energy consumption to the set targets
6. **Reporting** : Reporting results including any variance.
7. **Controlling** : Implementing measures to correct any variance.
8. **Long term plan** : Replacing old technology equipment with energy efficient equipment



# Energy Conservation Measures-Thermal

- Optimization of Distillation column by feed preheating/vaporisation using vapor heat recovery technique.
- MDC Condensation by Cooling water instead of Chilled Brine using PHEs.
- Avoiding double distillation of DMF, Water & Sodium acetate mixture by direct fractionation
- Converting Vapor feed column to Liquid feed column for DMF + Water separation.
- Waste heat recovery from Jacket water of Gas engines for Effluent evaporation



## Energy Conservation Measures-Thermal

- Replacement of direct contact condenser by indirect cooling
- Installation of economizer & waste heat recovery boiler to conserve heat from exhaust of captive power plant
- Installation of multiple effect evaporators to reduce heat input for process stream.
- Increased steam condensate recovery upto 75%
- Installation of back pressure steam turbine to replace pressure reducing station to generate additional power.
- Optimisation of solvents in the process & reviewing the utility/process parameters requirement .
- Automation of distillation columns



## Energy Conservation Measures-Electrical

- Utility flow reduction by networking (Series operation)
- Decentralization & installation of CT tower at height to take advantage of static head.
- Power Factor Improvement of CPP power by installing APFC panel.
- Capacity optimization of vacuum pumps to suit system requirement
- Use of energy efficient agitator, pumps and motors.
- Use of energy efficient bulbs- replacement of 80 HPMV lamps with 50 W metal halide lamps.
- Installation/conversion of energy efficient chilling plants based on Ammonia as refrigerant
- Avoidance of part load operation of utility equipments
- Auto control of vacuum in reactors



# Uniqueness in approach

- Reduction at source
  - Solvent usage reduction in processes
  - Utilization of Higher temperature utility by increasing HT Area
- Latest more energy efficient technology /equipments in place of old
- Total energy Efficiency at generation ,transmission & utilization
- Standardization of Energy efficient proven equipments from project stage.
- Review of requirement of utilities in terms of quantity and type in coordination with process without affecting intended purpose.
- Explore possibilities of energy saving potential in plant equipments.
- Analysis of replacement of equipments based on efficiency/elongated life cycle/spares reduction to reduce operational cost.



# Reduction in Distribution Losses

- Effective insulation of hot and cold surfaces
- Transmission & distribution losses (Voltage drop &  $I^2R$  ).
- Review of in steam network for potential saving.
- Leakages/pressure drop in Air distribution network.



# Energy conservation -ETP

- We have reduce COD load at ETP by reduce COD at source.
- Reduce blower/pumps power of installed 330 HP.
- Improved RO water recovery and reduce MEE evaporation load.
- Overall utility cost reduction at ETP Operation 103 Lacs/annum



## Reduction In Usage

- Review & optimization of Utility requirement of process. (Air, brine, raw water, Cooling Water).
- Review & optimization lighting requirement.
- Reduction of operating steam pressure after PRS.
- Conversion of hot water generation direct heating system to indirect system to increase condensate recycling.

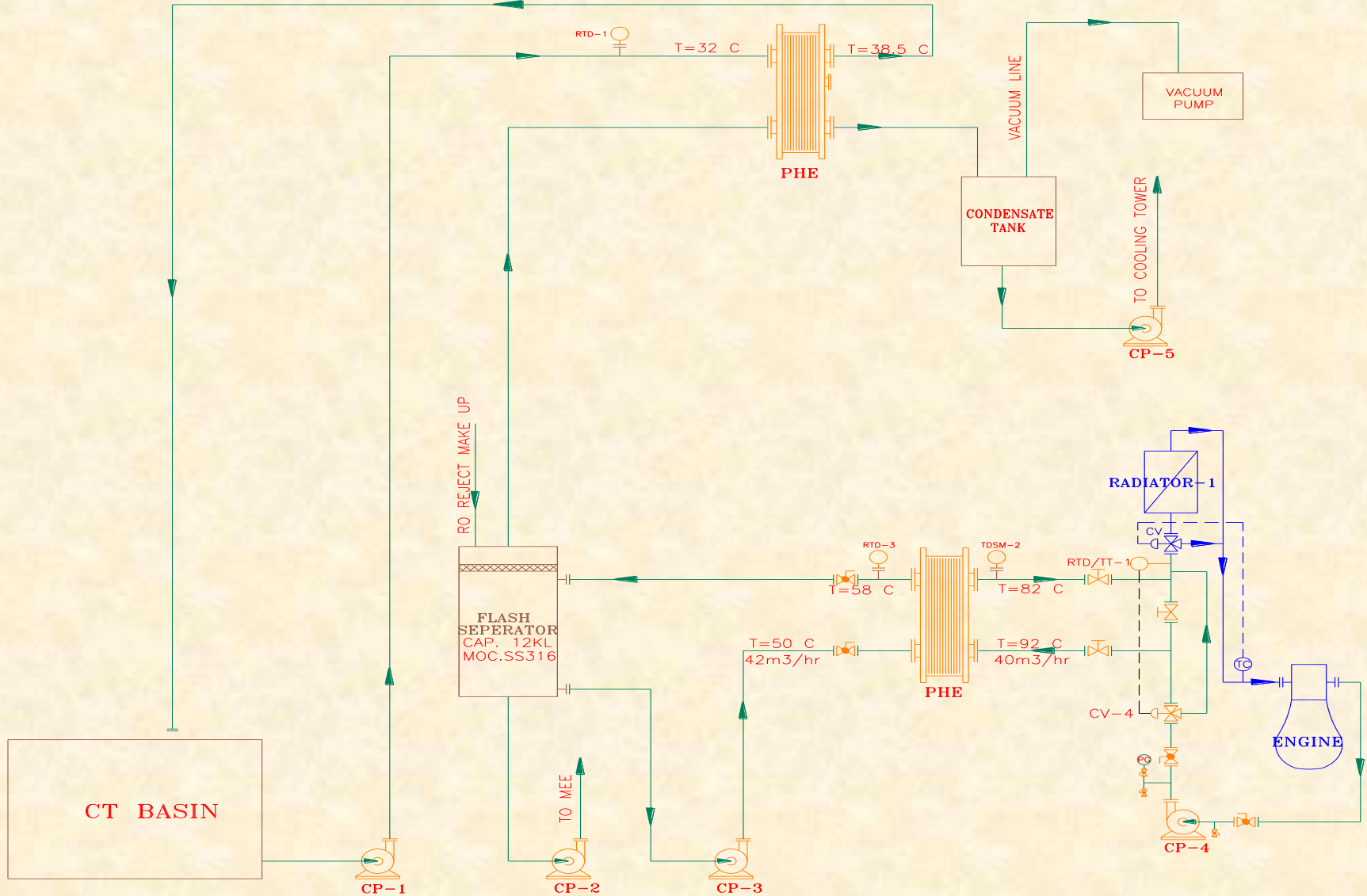


## Case Study-1: CPP Heat Recovery

- There are 3x1MW gas fired generators
- HT circuit jacket water of 92 degC was getting cooled by air in radiators to 82 deg C
- In a proposed system, the energy from HT circuit water is utilized to heat and then flash the RO reject (to evaporate water)
- The entire plant is automated.
- This proposal saved the steam consumption worth Rs. 171 Lacs/annum
- Total investment of project – Rs. 107.5 Lacs
- IRR – 10.73 months

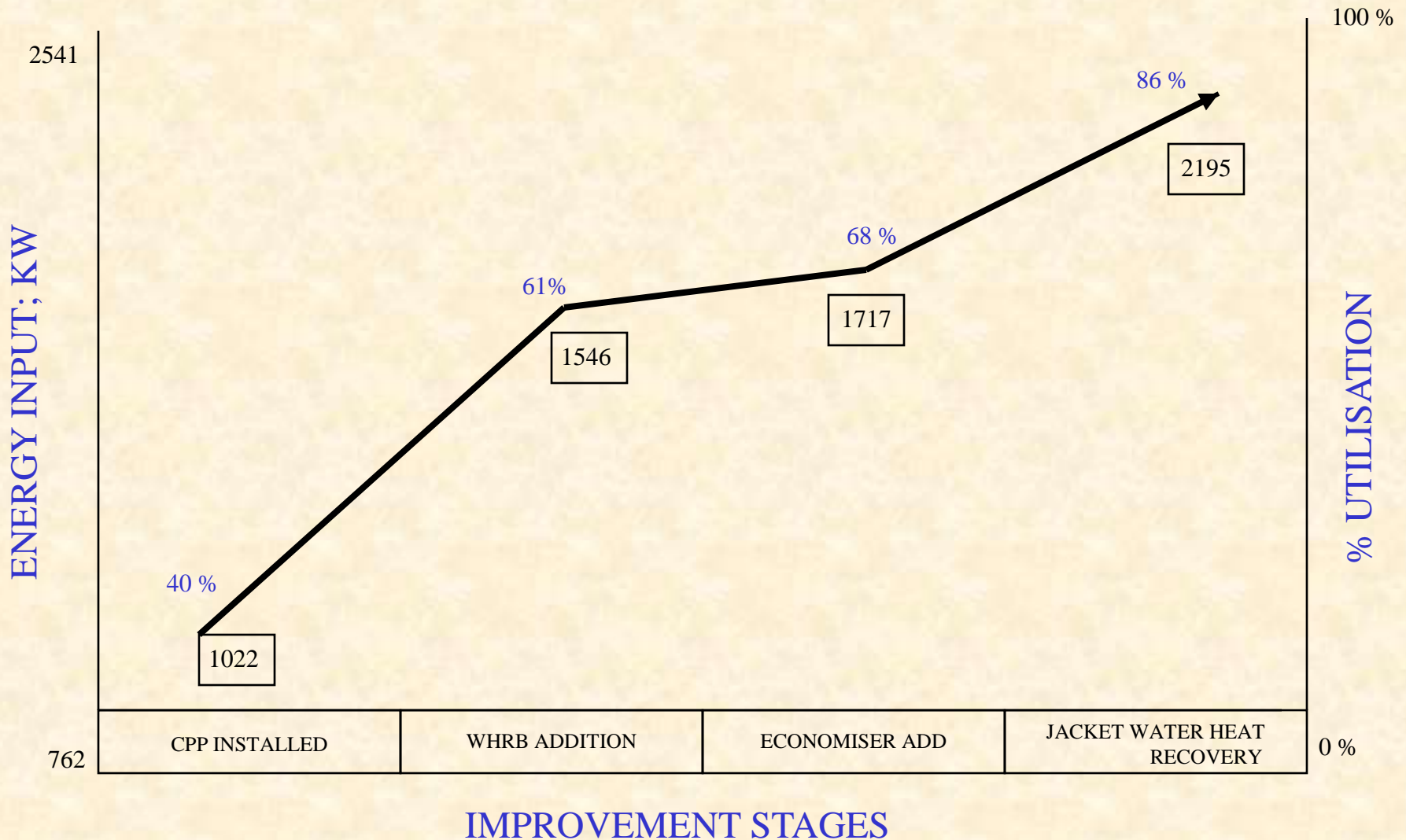


# CPP Heat recovery





# CPP WASTE ENERGY UTILISATION



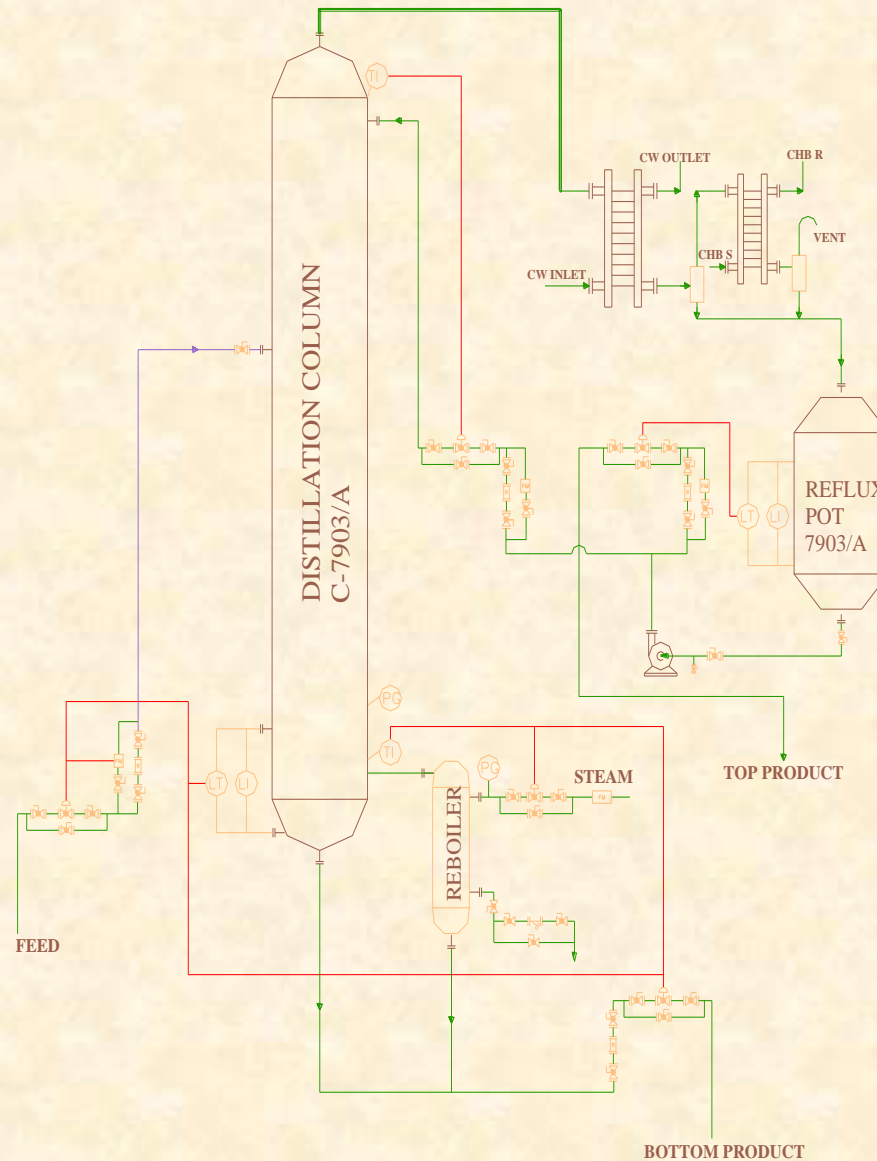


## Case Study-2: Distillation column

- The distillation column was used for separation of methanol – water (having 70% Methanol and 30% Water) stream
- Top vapors of methanol were condensed in PHE
- Bottoms was sent for flash distillation in reactor to remove solid impurities
- In a proposed system, the heat content of water vapors from flash reactor was used to partially vaporize the methanol column feed
- For that, a kettle reboiler was installed
- Also, a spiral coil was installed inside the vapor line to preheat the feed to the column
- The packing in the enriching sections were changed from IMTP to structured packing to reduce the reflux
- This saved the steam consumption worth Rs 30.8 Lacs/annum
- Total investment was – Rs. 14.27 Lacs
- Payback – 5.55 months



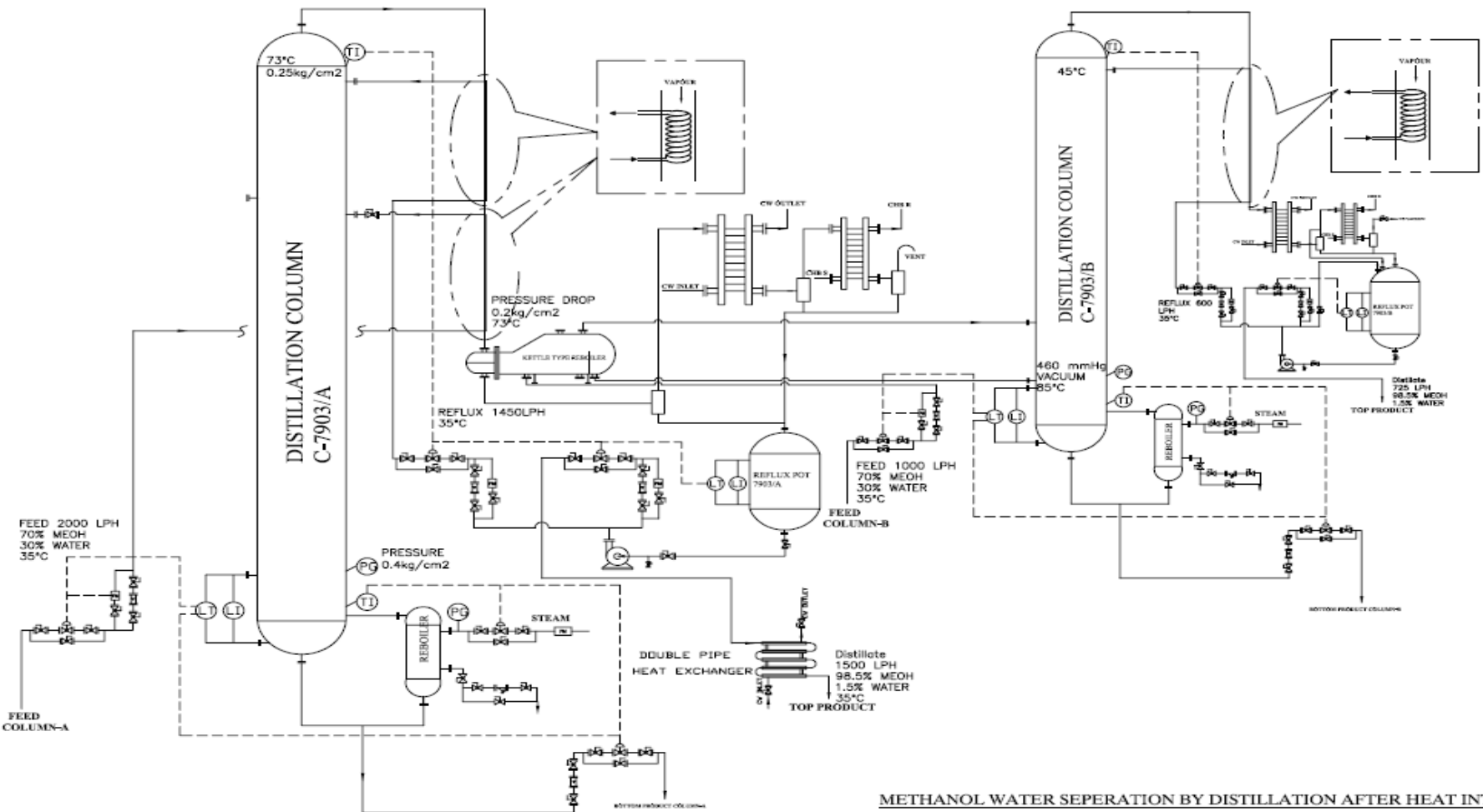
# Distillation column







# Distillation column



METHANOL WATER SEPARATION BY DISTILLATION AFTER HEAT INTEGRATION



## Case Study-3:Utility usage reduction

- By installing PHE for MDC Recovery, we changed from +5 Deg Chilled water to cooling water. Mcal/annum – 1359000
- Avoiding double distillation. Mcal/annum – 1684000
- Solvent usage reduction in the process by improving process. Saving – 27.0 Lacs/annum (without investment)
- Saving Rs 118.0 Lacs/annum
- Total investment – 50 Rs. Lacs
- Payback - < 7 months



# Utility consumption /Kg of products (Percentage of total overhead)

Year	Product - 1	Product - 2	Product - 3
2007-08	33	34	40
2008-09	35	36	43
2009-10	38	38	40
2010-11	38	39	40



## Energy management

**Do not estimate when you can  
calculate**

**Do not calculate when you can  
measure**



THANK YOU