
WELCOME

ENERGY CONSERVATION TECHNIQUES IN FERTILIZER INDUSTRY

- A CASE STUDY OF R.C.F

Mr. PMC Nair

General Manager (Corporate)

RASHTRIYA CHEMICALS & FERTILIZERS LTD.

Indian Fertilizer Industry Energy Scenario

- Fertilizer industry is one of the highest energy intensive sector

- Energy cost as high as 65% to 87% of production cost.

Fertilizer Industry Scenario

More than 99% of world Nitrogen Fertilizers production is based on Ammonia, produced from some kind of hydrocarbon as feedstock .

Ammonia Production :

- 77% based on Natural gas as feedstock
- 85% based on Steam Reforming
- Remaining with Gasification process using Oil or Coal.

Processing of hydrocarbon into Hydrogen and other gases is an endothermic process :

- Huge amount of heat energy in process and flue gases

Fertilizer Industry Scenario

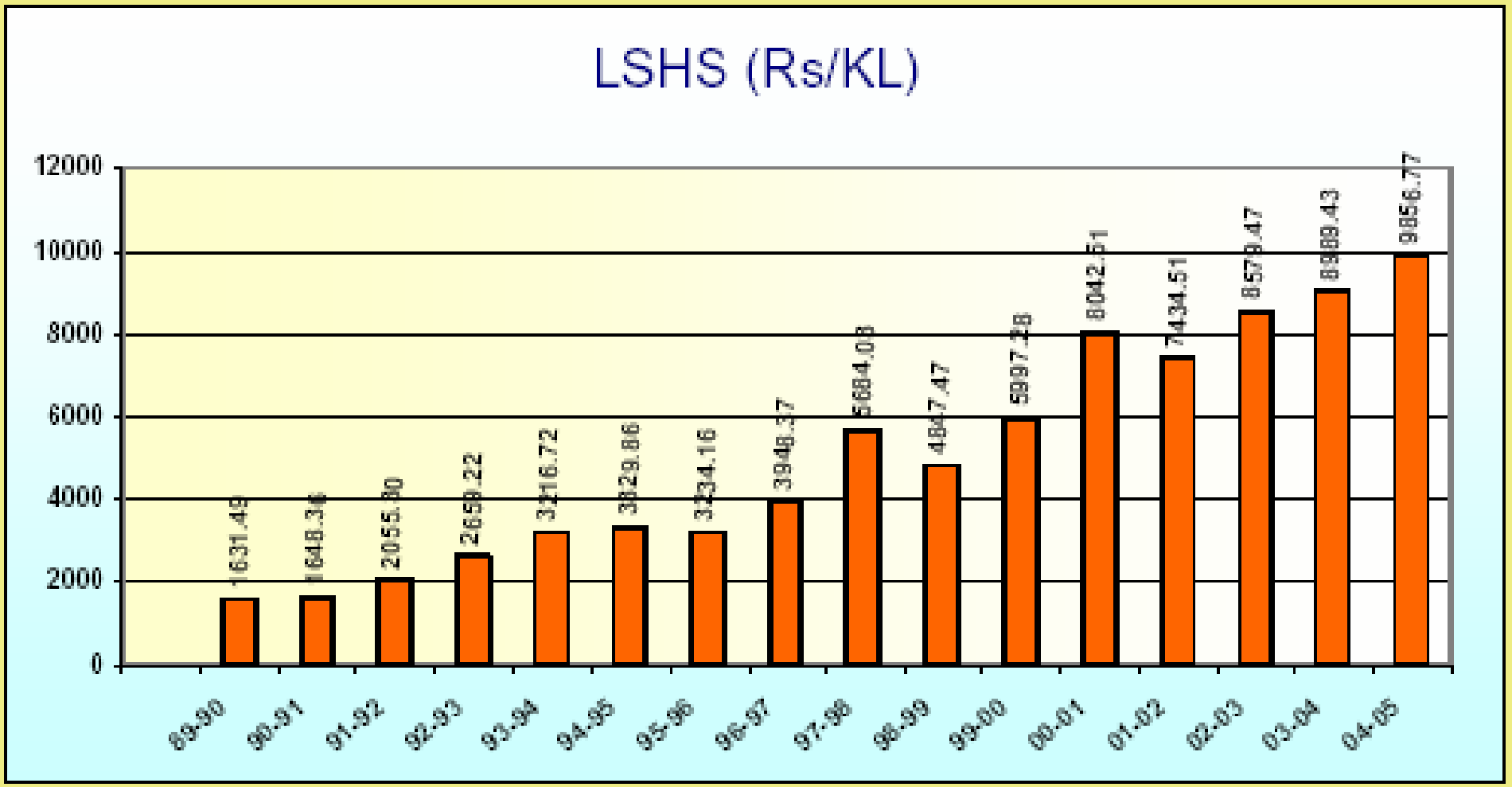
The Energy consumption for Ammonia production remains lowest as Natural gas as feedstock and it increases substantially with Fuel oil utilized as feedstock because of different technologies.

In 1960's average world energy figure for Ammonia production- 17.899 Gcal/MT which reduced to 7.15 Gcal/MT of Ammonia in recent plants.

Typical Energy consumption figures of modern Ammonia plants :

Input	Conventional reforming	Partial Oxidation
Total Energy Gcal/ T NH3	7.63-8.353	9.3-10.74

LSHS PRICE


LSHS (Rs/KL)
12000
10000
8000
6000
4000
2000
0
1631.49
1648.36
2055.30
2659.22
3216.72
3829.86
3234.16
3948.37
5684.03
4847.47
5997.28
8042.51
7434.51
8573.47
8989.43
9856.77
69-90
90-91
91-92
92-93
93-94
94-95
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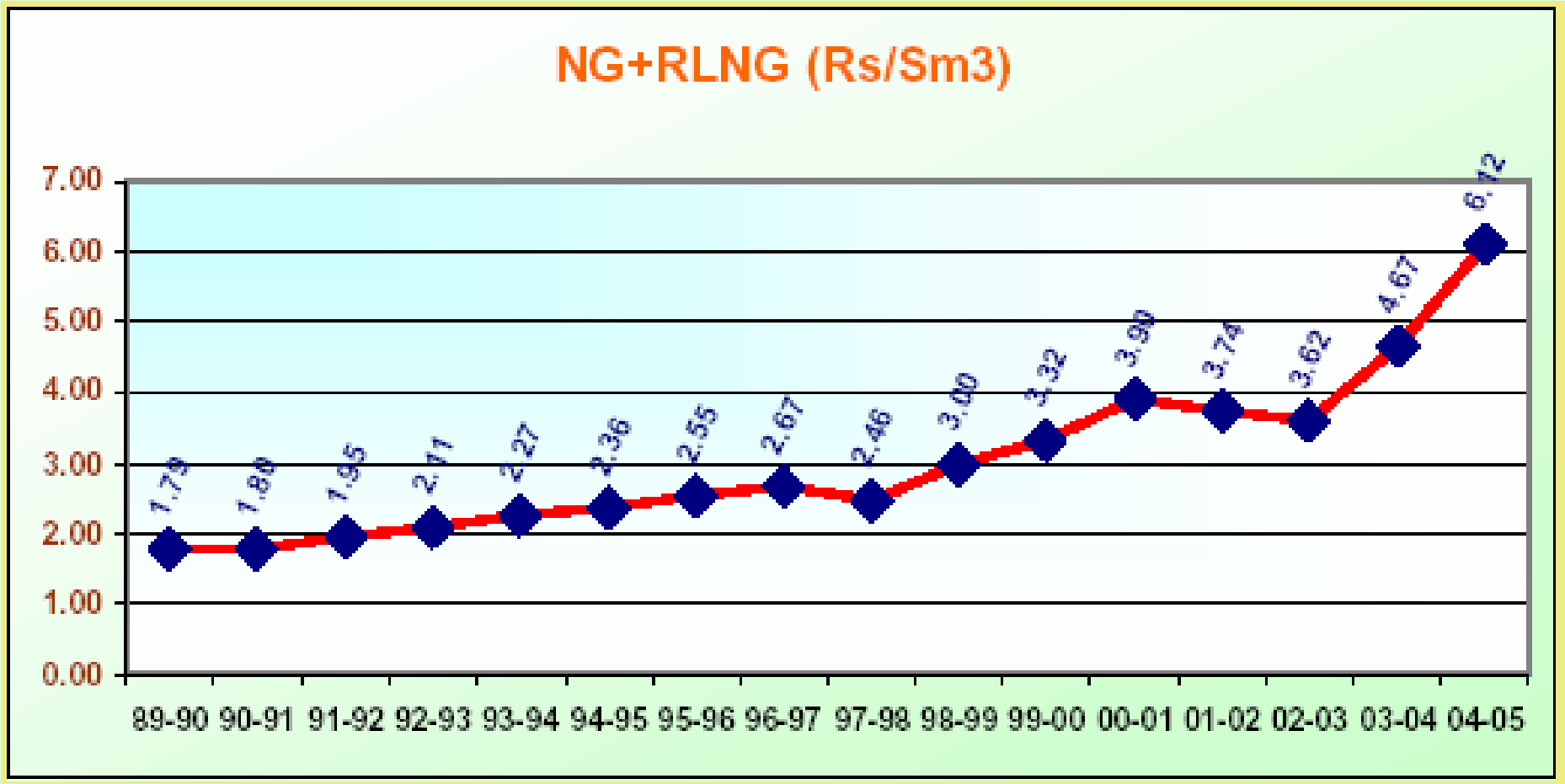
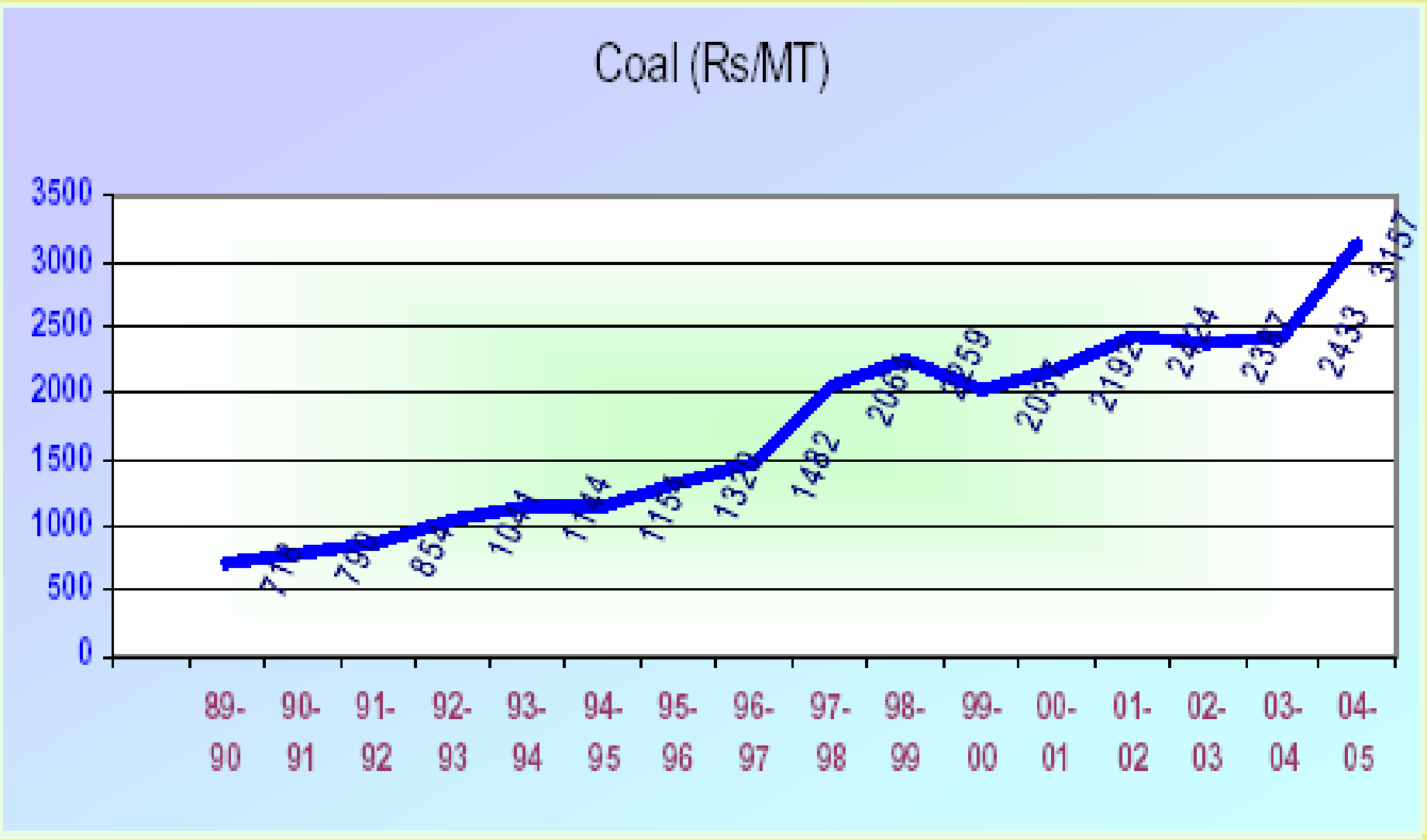
01-02
02-03
03-04
04-05

NG + RLNG PRICE



COAL PRICE


Coal (Rs/MT)
3500
3000
2500
2000
1500
1000
500
0
1482
2433
89-90
90-91
91-92
92-93
93-94
94-95
95-96
96-97
97-98
98-99
99-00
00-01
01-02
02-03
03-04
04-05

Corporate Strategies for Energy Conservation

- **Selection of technologies for new plants /expansion projects, having lower energy consumption level.**

- **To minimise energy consumption for existing units by**
  - **Modernization of plants**
  - **Institutionalizing of saving measures**
    - **i. Forming of an Energy policy**
    - **ii. Carrying out Energy audit for saving**
    - **iii. Setting up of an Energy Cell**
    - **iv. Carrying out Bench marking study**
    - **v. Daily review of specific consumption and cost at corporate level**
    - **vi. Providing Exposure to personnel for new developments**

Corporate Energy Conservation

Considering above actions as a part of macro level management, at micro level various measures are required as :

•Implementation of action plans for improving the efficiency and reducing the wastage of energy.

•Constantly generating new ideas and schemes which can cut down the energy consumption.

•Recognizing the energy cost as a major aspects in all evaluations


RASHTRIYA CHEMICALS
& FERTILIZERS LIMITED
OHSAS-18001
ISO-9002
ISO-14001

MISSION OF OUR COMPANY

The Company's mission
is to produce as well as market
fertilizers and industrial chemicals
efficiently and economically
and serve the farmers and other Customers
with quality products and services
to the benefit of the national economy.

PRODUCTS MANUFACTURED - TROMBAY

FERTILIZERS	CAPACITY
UREA (UJJWALA)	1000 MT / DAY
SUPHALA (15:15:15)	1100 MT / DAY
SUPHALA (20:20:0)	1200 MT / DAY

PRODUCTS MANUFACTURED – TROMBAY contd..

INTERMEDIATE PRODUCTS	CAPACITY
AMMONIA	1250 MT / DAY
NITRIC ACID	1070 MT / DAY
SULPHURIC ACID	300 MT / DAY
PHOSPHORIC ACID	100 MT / DAY

PRODUCTS MANUFACTURED – TROMBAY contd..

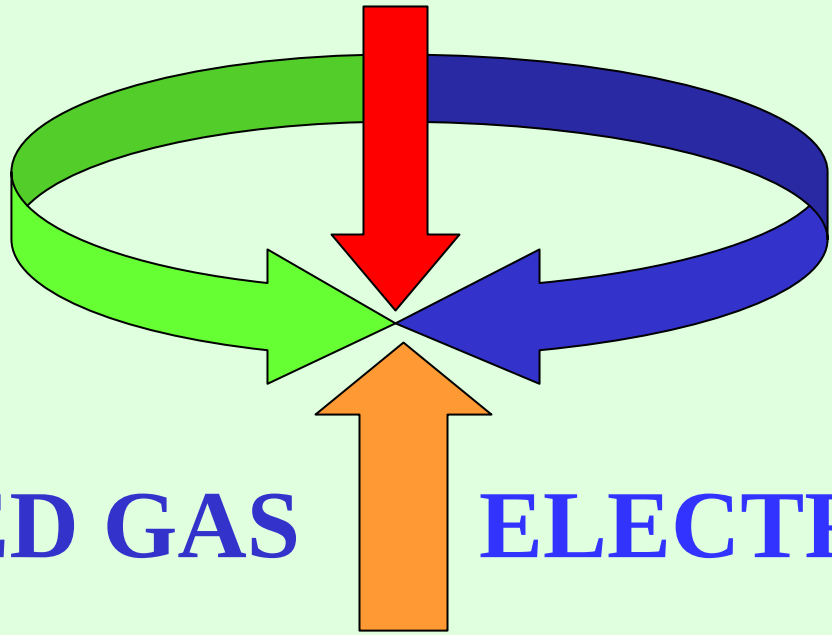
INDUSTRIAL PRODUCTS	CAPACITY	
METHANOL	150	MT/ DAY
AMMONIUM BICARBONATE	12	MT /DAY
CONC. NITRIC ACID	60	MT/ DAY
SOD. NITRATE/NITRITE	12	MT / DAY
METHYLAMINES	12	MT / DAY

PRODUCTS MANUFACTURED - THAL

PRODUCTS	CAPACITY
AMMONIA	1500 X 2 MTPD
UREA	1700 X 3 MTPD
METHYLAMINES	35 MTPD
DIMETHYL FORMAMIDE	7 MTPD
DIMETHYL ACETAMIDE	15 MTPD
FORMIC ACID	30 MTPD

MAJOR ENERGY INPUTS

STEAM



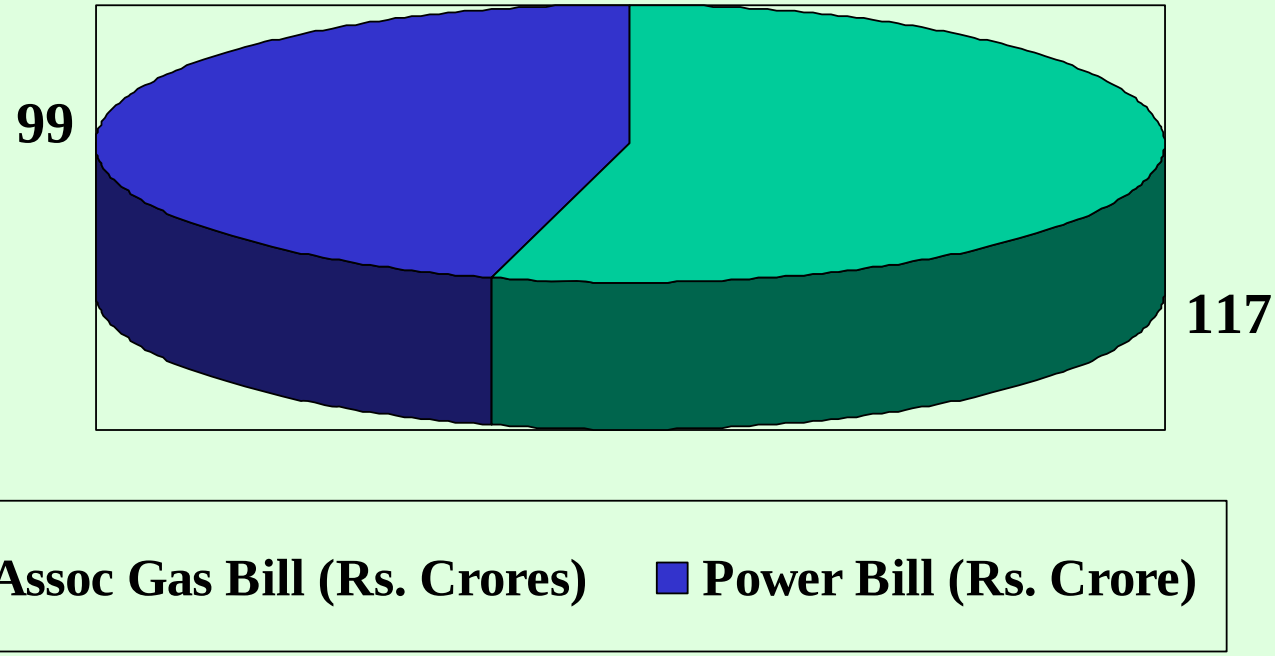
ASSOCIATED GAS **ELECTRICITY**

LSHS/NAPHTHA

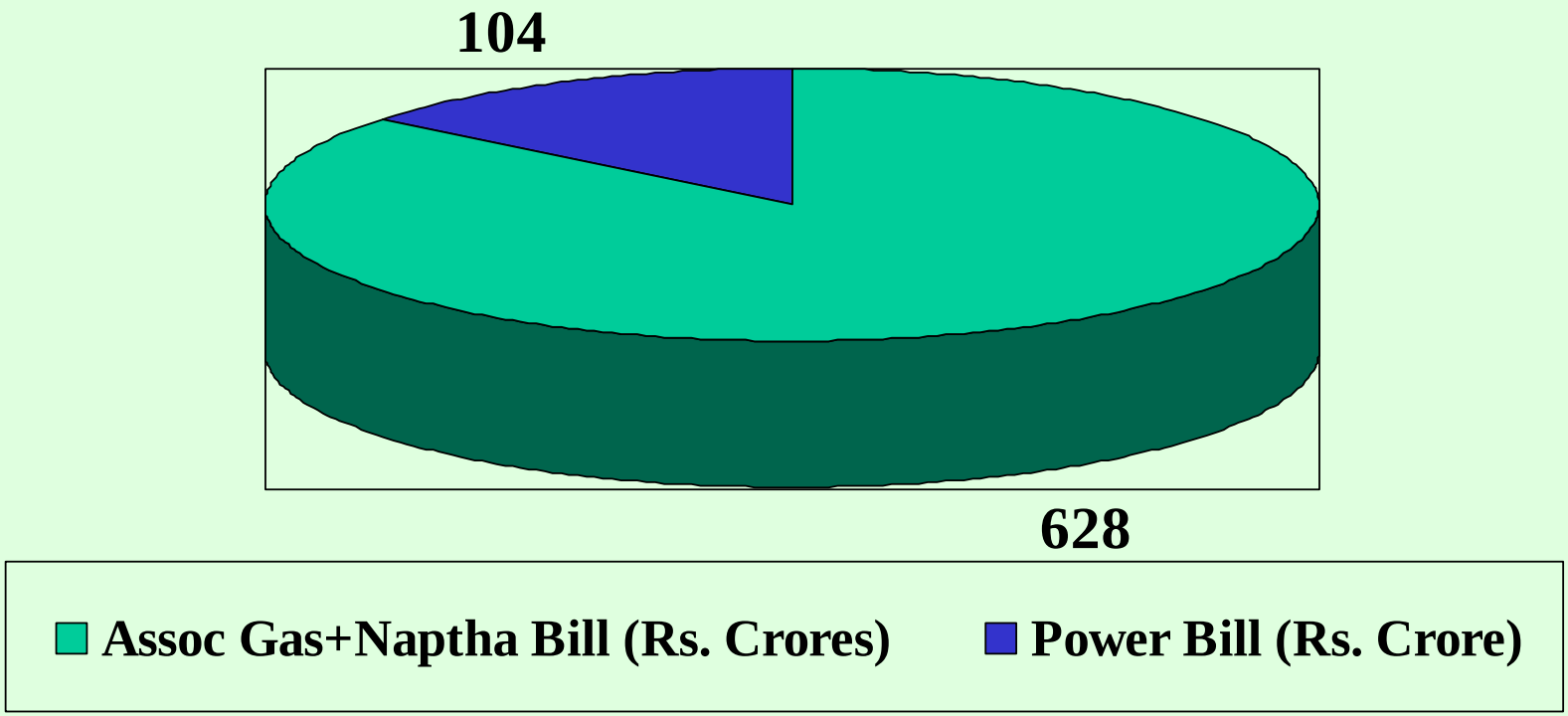
AVERAGE CONSUMPTION LEVELS AT FULL LOAD

ASSOCIATED GAS Trombay	2.0 MMSCMD	660 MMSCMY
ASSOCIATED GAS Thal	4.0 MMSCMD	1,320 MMSCMY
POWER Trombay	46 MW	3,64,320 MWH per YEAR
POWER Thal	25 MW	1,98,000 MWH per YEAR

R.C.F. TROMBAY ENERGY BILL FOR YEAR 2005-2006



R.C.F.THAL ENERGY BILL FOR YEAR 2005-2006



Corporate Energy Conservation Strategy

- **Formation of 'Energy management Cell and nomination of**
- **Energy manager.**

- **Framed the Energy policy.**

- **Specific energy consumption are reviewed at top**
- **management level.**

- **Helps in addressing issues like :**
  - **Fuel management**
  - **Operation of boilers and other furnaces**
  - **Performance of steam and condensate system**
  - **Performance of compressed air network**
  - **Performance refrigeration and air-conditioning system**
  - **Performance of rotating machines**
  - **Electrical load management system and lighting load.**

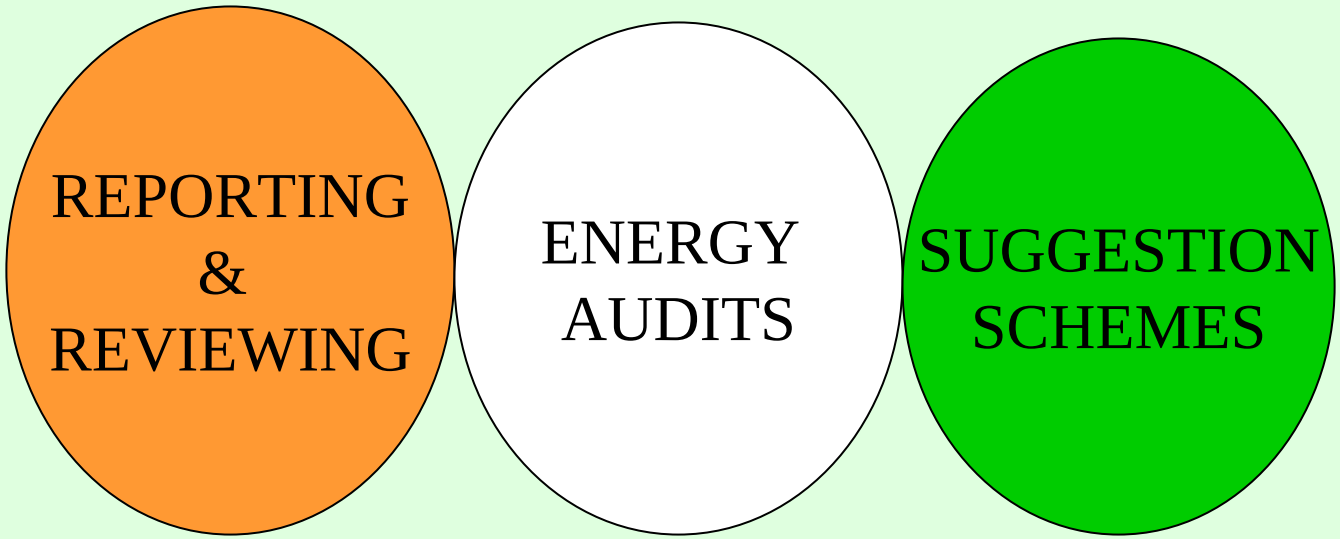
Energy Management Policy

We, at Rashtriya Chemicals & Fertilizers Limited, Trombay Unit are committed to optimally utilize various forms of energy in a cost effective manner aimed at conservation of scarce energy resources. We shall strive to achieve our goal through :

- ☞ **Formulation of overall energy strategy & Targets.**
- ☞ **Adoption of energy efficient technologies/equipment.**
- ☞ **Close monitoring, controlling and reviewing the consumption of various forms of energy through an effective Energy Management System.**
- ☞ **All-round active participation of employees through Small Group Activities.**
- ☞ **Regular Energy Audits aimed to minimize energy losses.**

s/d
(R. K. JAIN)
Executive Director (Trombay)

APPROACH TOWARDS ENERGY CONSERVATION



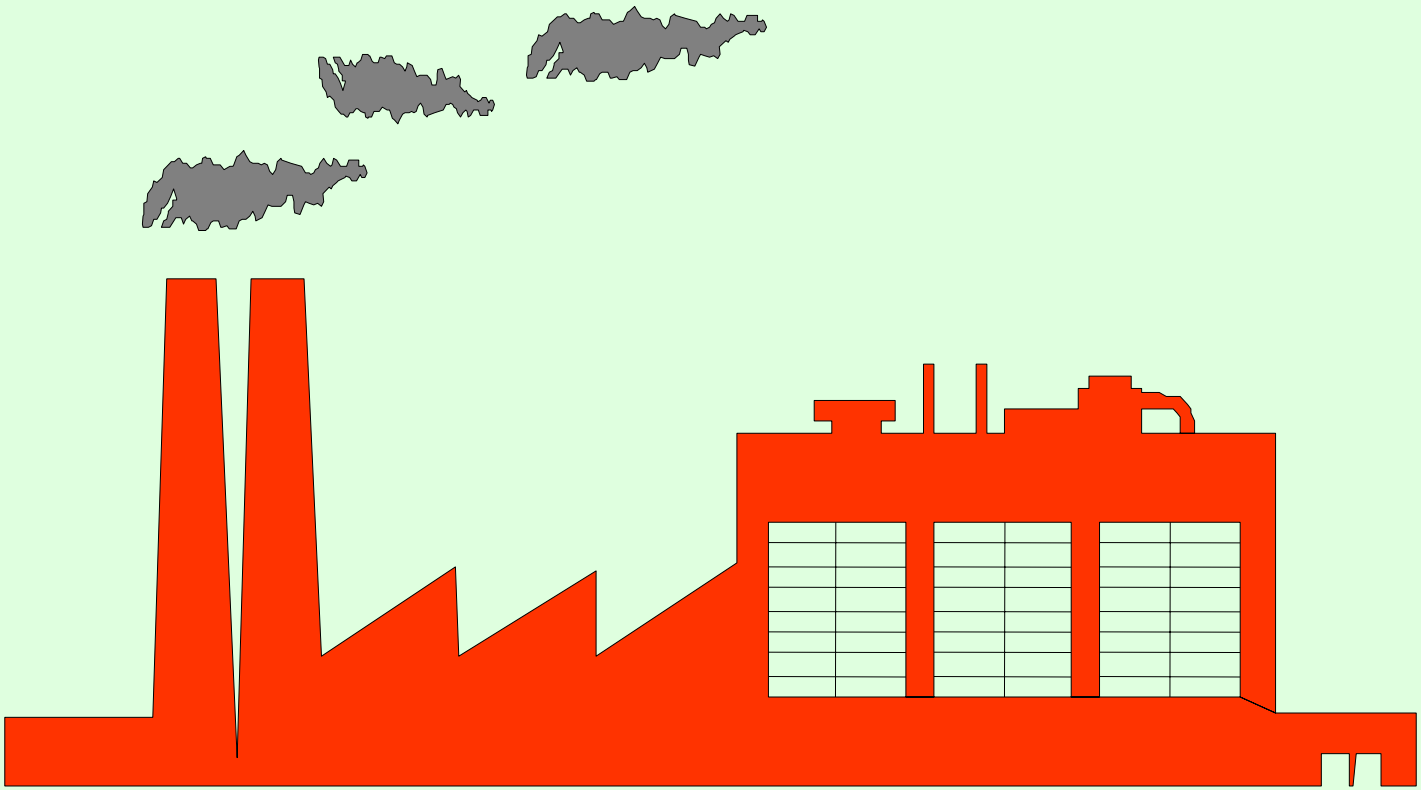
METHODOLOGY FOR EVALUATION OF ENERGY CONSERVATION SCHEMES

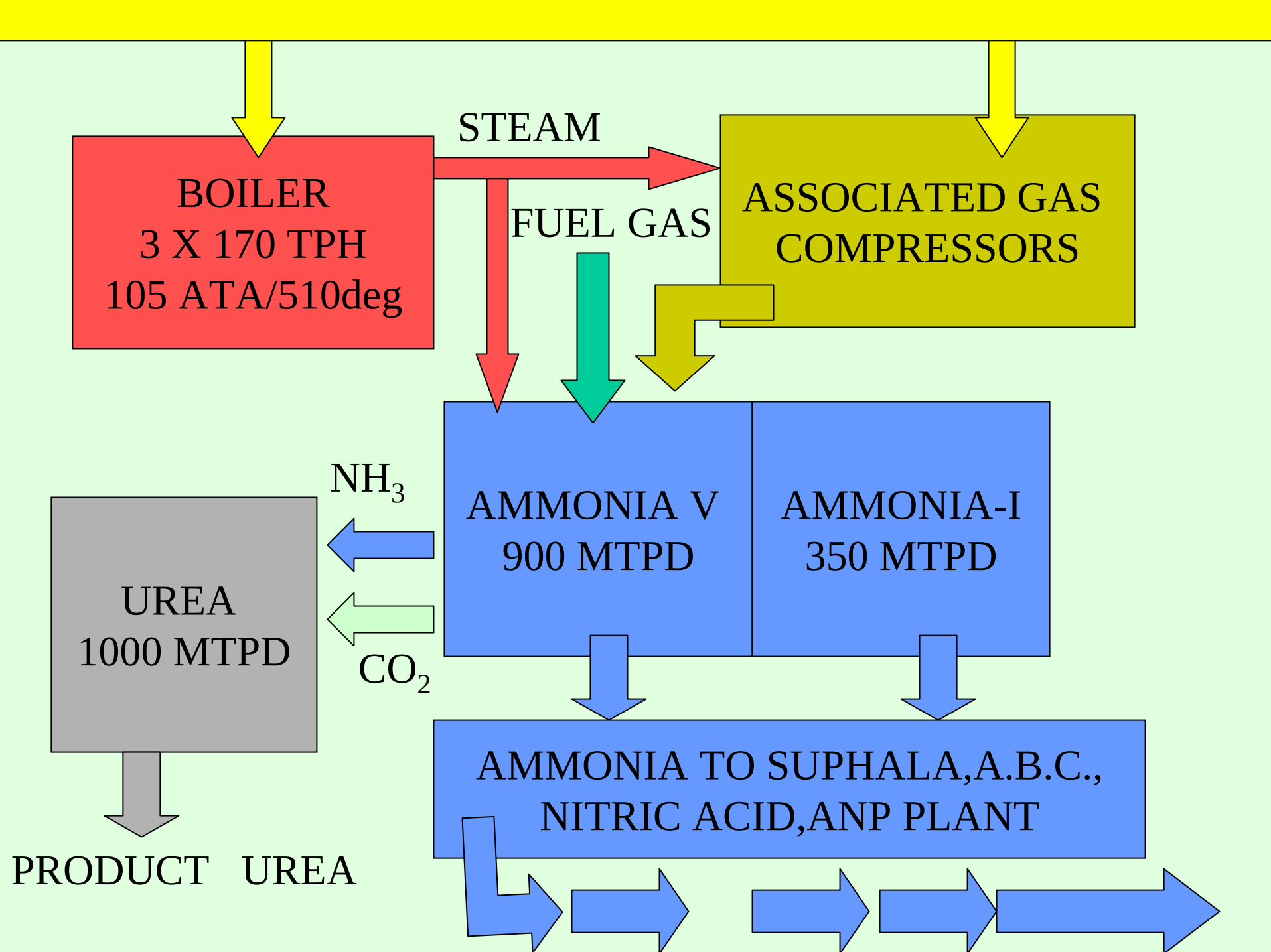
- ✓ Is the scheme Techno-Economically viable ?
- ✓ Is adequate space available for the modification?
- ✓ Is proven technology available for the proposed scheme ?
- ✓ Is the scheme adversely affecting plant startups or shutdowns?
- ✓ Is the extra pressure drop created by modification permissible?

METHODOLOGY FOR EVALUATION OF ENERGY CONSERVATION SCHEMES

- ✓ **Is there a possibility of using some idle equipment within the factory ?**
- ✓ **Is the downtime required for modification acceptable ?**
- ✓ **Is the recovery of energy in one plant going to increase consumption in other plant/section ?**
- ✓ **Is the modification adversely affecting operational reliability ?**

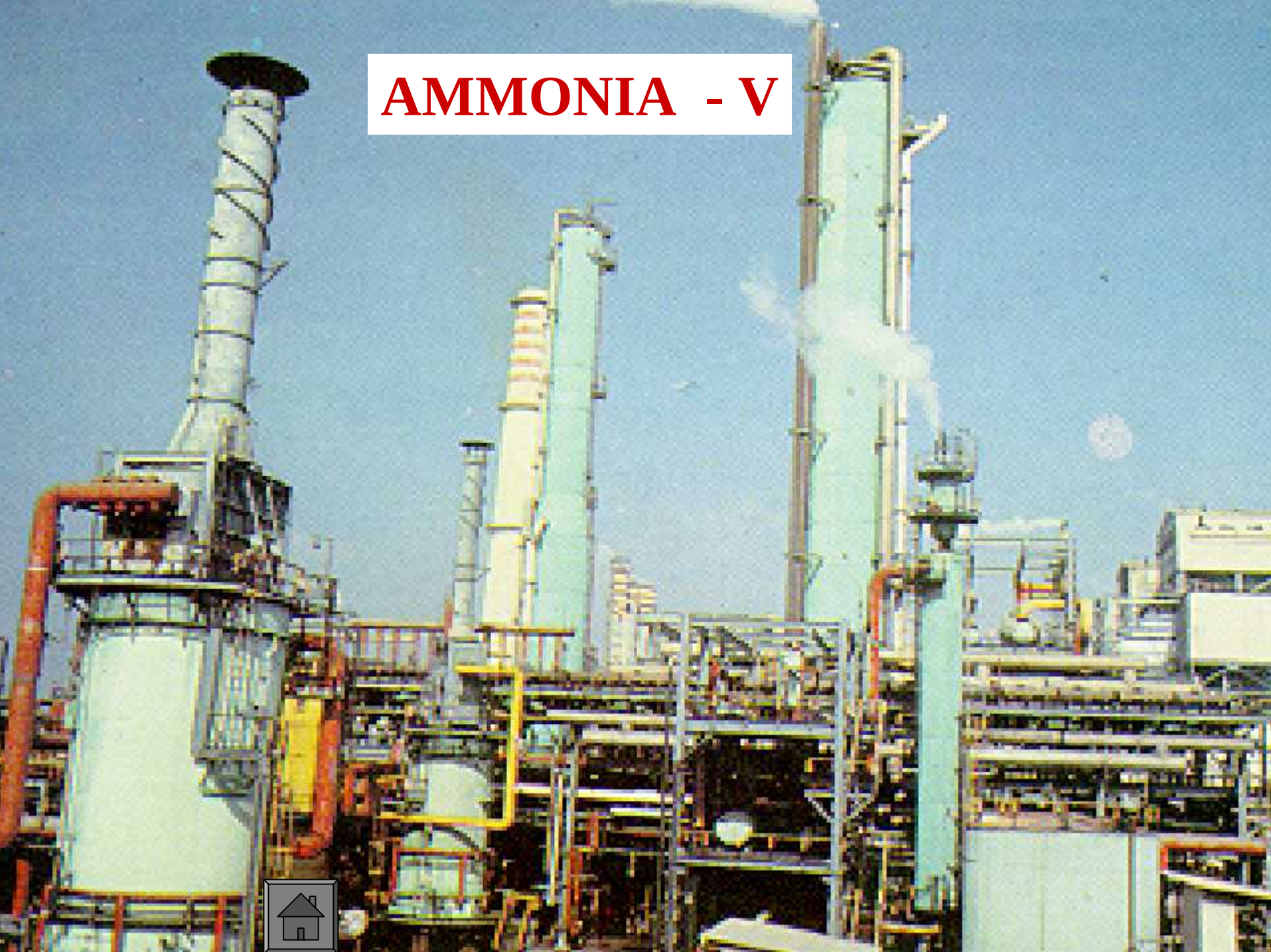
ENERGY INTENSIVE PROCESSES




BOILER
3 X 170 TPH
105 ATA/510deg
STEAM
FUEL GAS
ASSOCIATED GAS
COMPRESSORS
AMMONIA V
900 MTPD
AMMONIA-I
350 MTPD
NH3
CO2
UREA
1000 MTPD
AMMONIA TO SUPHALA,A.B.C.,
NITRIC ACID,ANP PLANT
PRODUCT UREA

ENERGY CONSERVATION SCHEMES IMPLIMENTED AT TROMBAY

AMMONIA - V



SCHEMES IMPLEMENTED

- **REPLACEMENT OF REFORMER TUBES**
- **PURGE GAS RECOVERY UNIT**
- **RETROFIT OF SYNTHESIS CONVERTER BASKET**
- **REPLACEMENT OF C.T. FAN C.I. BLADES WITH FRP.**
- **MAKE UP GAS CHILLER**
- **INSTALLATION OF L.T. SHIFT GUARD.**

SCHEMES IMPLEMENTED

- REPLACEMENT OF TURBINE FOR BENFIELD PUMP
- LP TURBINE ROTOR FOR SYNTHESIS GAS COMPRESSOR
- PRDS REPLACEMENT

REPLACEMENT OF REFORMER TUBES

- **ALL 240 REFORMER TUBES WERE REPLACED WITH BETTER MATERIAL MANURITE**
- **THIS HAS RESULTED IN REDUCTION IN WALL THICKNESS OF TUBES IMPROVING HEAT TRANSFER**
- **INVESTMENT : Rs 7.41 Cr.**
- **SAVINGS : Rs. 1.80 Cr.p.a.**

  0.02 Mkcal/MT

RETROFIT OF SYNTHESIS CONVERTER BASKET

- **OLD BASKET REPLACED WITH MODIFIED DESIGN OF M/S. AMMONIA CASALE.**

- **LOWERED LOOP PRESSURE BY 20 KG/CM^2 & INCREASED AMMONIA CONVERSION FROM 16 TO 19 %.**

- **INVESTMENT = 12.94 CRORES**
- **PAYBACK PERIOD = 18 MONTHS**
- **ENERGY SAVING = 0.17 Gcal/MT**

REPLACEMENT OF C.I. BLADES WITH FRP

- COOLING TOWER FAN AND AIR COOLER FAN BLADES WERE REPLACED WITH FRP BLADES.

- ENERGY SAVING = 0.05 Gcal/MT
- VFD INSTALLED ON COOLING TOWER FANS.
- ENERGY SAVING = REDUCTION IN POWER CONSUMPTION BY 15 %

MAKE UP GAS CHILLER

MAKE UP GAS CHILLER UNIT INSTALLED AT SYNTHESIS GAS COMPRESSOR SUCTION TO INCREASE COMPRESSOR'S EFFECTIVE CAPACITY & REDUCING POWER REQUIREMENT

ENERGY SAVING = 0.05 Gcal /MT

INCREASE IN PRODUCTION = 10-12 MTPD

INSTALLATION OF L.T. SHIFT GUARD

- **GUARD VESSEL INSTALLED AT THE UPSTREAM OF L.T. CONVERTER TO PROTECT CATALYST FROM POISONS LIKE SULPHUR,CHLORIDE & REDUCE CO SLIP FROM 0.3 % TO 0.1 %**

- **ENERGY SAVING = 0.06 Gcal/MT**
- **INVESTMENT = Rs. 7.0 CRORES**

BACK PRESSURE TURBINE FOR BENFIELD PUMP

- ORIGINAL TURBINE WITH POOR RELIABILITY REPLACED WITH DRESSER RAND TURBINE AND TURBINE DRIVEN PUMP.

- INVESTMENT : Rs. 1 Cr.
- PAYBACK PERIOD : 15 MONTHS.
- ENERGY SAVING : 0.1 Gcal/MT

LP TURBINE ROTOR FOR SYNTHESIS GAS COMPRESSOR

- **ROTOR WITH MODIFIED DESIGN WAS INSTALLED AS EARLIER ROTOR BLADES FAILED NUMBER OF TIMES.**

- **STEAM CONSUMPTION REDUCED BY 20 MT/Hr.**

- **INVESTMENT : Rs. 3.90 Cr.**
- **PAYBACK PERIOD: 6 MONTHS.**

PRDS REPLACEMENT

- 105 ATA TO 40 ATA PRDS REPLACED WITH FAST ACTING, TIGHT SHUT OFF VALVES.

- INVESTMENT: Rs. 1.09 Cr.

- BENEFITS :

  STEAM PASSING ARRESTED. FASTER HEADER PRESSURE CONTROL.

OTHER AMMONIA V SCHEMES

- **Change over of Benfield pump from Motor drive to Steam driven**

  POWER SAVED 115.50 Lakh KWH

  TOTAL SAVING Rs. 435.77 Lakhs

- **Down Sizing of cooling tower fans from 123 kW to 75 kW.**

  TOTAL SAVING Rs. 8.0 Lakhs

OTHER AMMONIA V SCHEMES

- **HALF CAPACITY COOLING TOWER PUMP INSTALLED**

POWER SAVED	50 %
TOTAL SAVING	Rs. 84 Lakhs PER ANNUM

- **ID FAN MOTOR ON AUTO START .**

TOTAL SAVING	Rs. 18.0 Lakhs PER ANNUM

PURGE GAS RECOVERY UNIT

PURGE GAS RECOVERY UNIT

- RECOVERS AMMONIA, HYDROGEN, NITROGEN , ARGON AND METHANE FROM PURGE GAS AND FLASH GAS STREAMS OF BOTH AMMONIA PLANTS.
- COMMISSIONED IN MARCH 1995.
- ENERGY SAVING = 0.2 Gcal/MT
- INVESTMENT = RS. 45 CRORES.
- PAYBACK PERIOD = 3.5 YEARS

Ammonia V (REVAMP)

Study has been conducted by M/s. HTAS to reduce energy consumption in the plant. The scheme aims to reduce energy consumption in Trombay – V Plant by 2.0 MKcal / MT. Some of the modifications implemented are as follows:

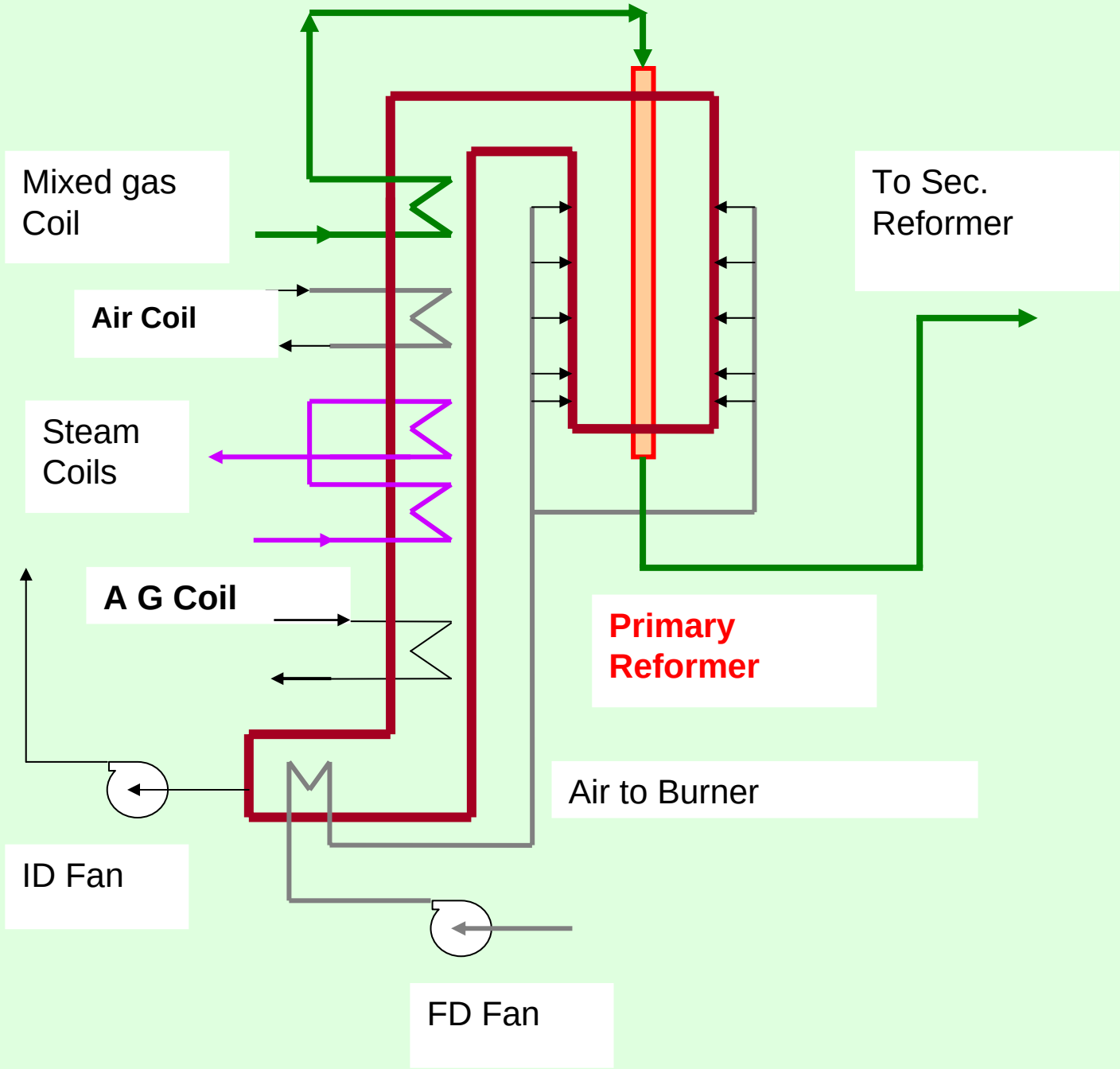
1.0 Primary Reformer Revamp:

1.1 Replacement of existing staggered tube lay out with single row tube lay out.

1.2 Installation of combustion air pre-heater in waste heat section in lieu of BFW preheater.

1.3 Installation of combustion air blower with dual drive (common with fired steam superheater).

1.4 Replacement of burners by forced draft type burners.


Mixed gas Coil
Air Coil
Steam Coils
A G Coil
ID Fan
FD Fan
Air to Burner
Primary Reformer
To Sec. Reformer

Ammonia V (REVAMP)

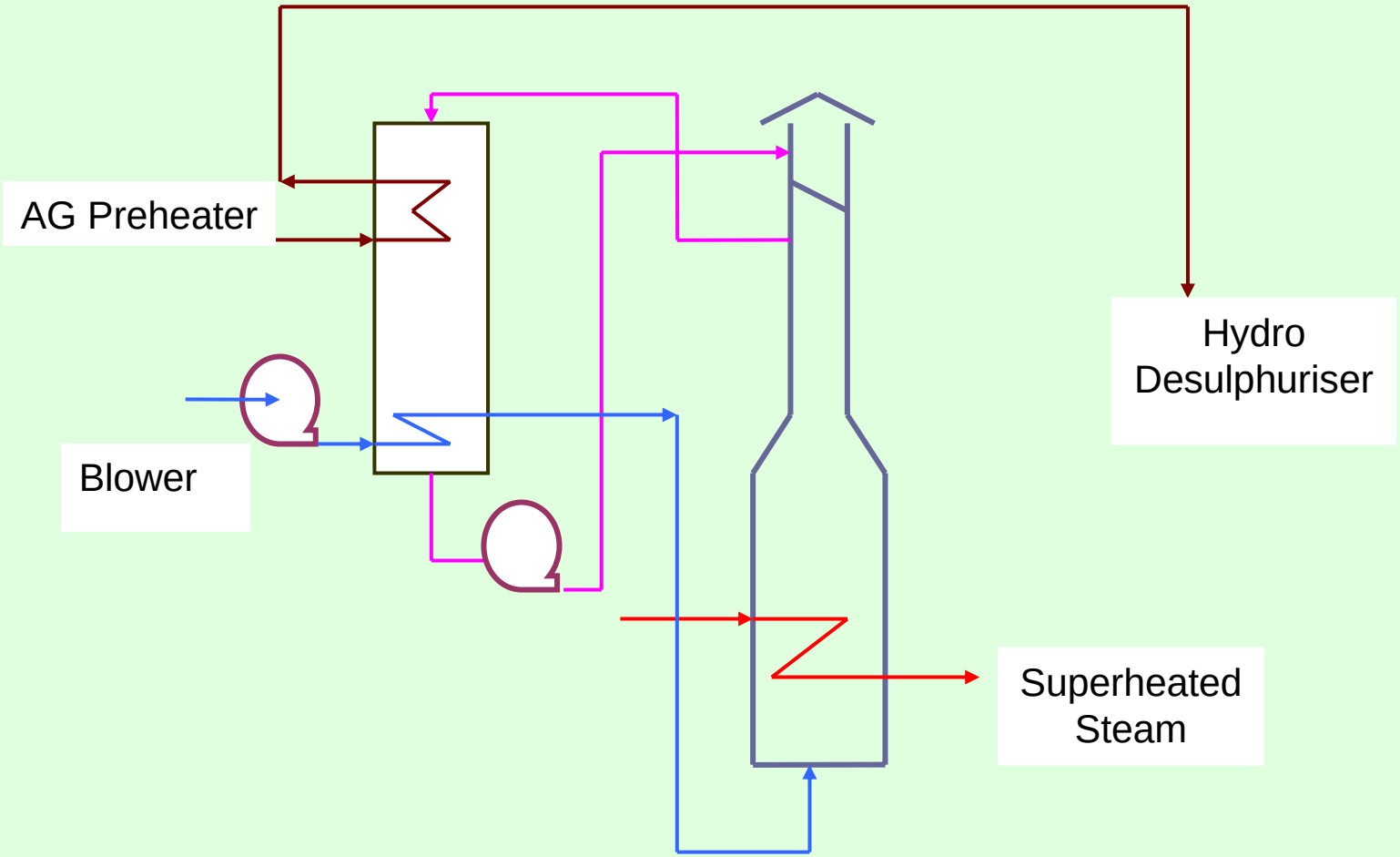
2.0 Auxiliary steam superheater :

To modify and install raw gas preheater coil and combustion air pre heater in the waste heat section

33.0 LT Catalyst Temp. Control :

44.0 M.P. condensate stripper: To install medium pressure condensate stripper in place of existing low pressure condensate stripper

Auxiliary Steam Superheater



Ammonia V (REVAMP)

5.0 CO2 – Removal / Methanation :

55.1 Installation of 5 stage flash vessel with mechanical steam compressor

5.2 Installation of hydraulic turbine with generator on rich solution

5.3 Replacement of tower packing by high efficiency IMTP or equivalent packing.

5.4 Installation of additional gas/gas exchanger (E311B)

5.5 Installation of additional DM water pre-heater for steam generation plant which shall recover all the heat available with low pressure CO2.

Ammonia V (REVAMP)

6.0 Revamp of Process Air Compressor

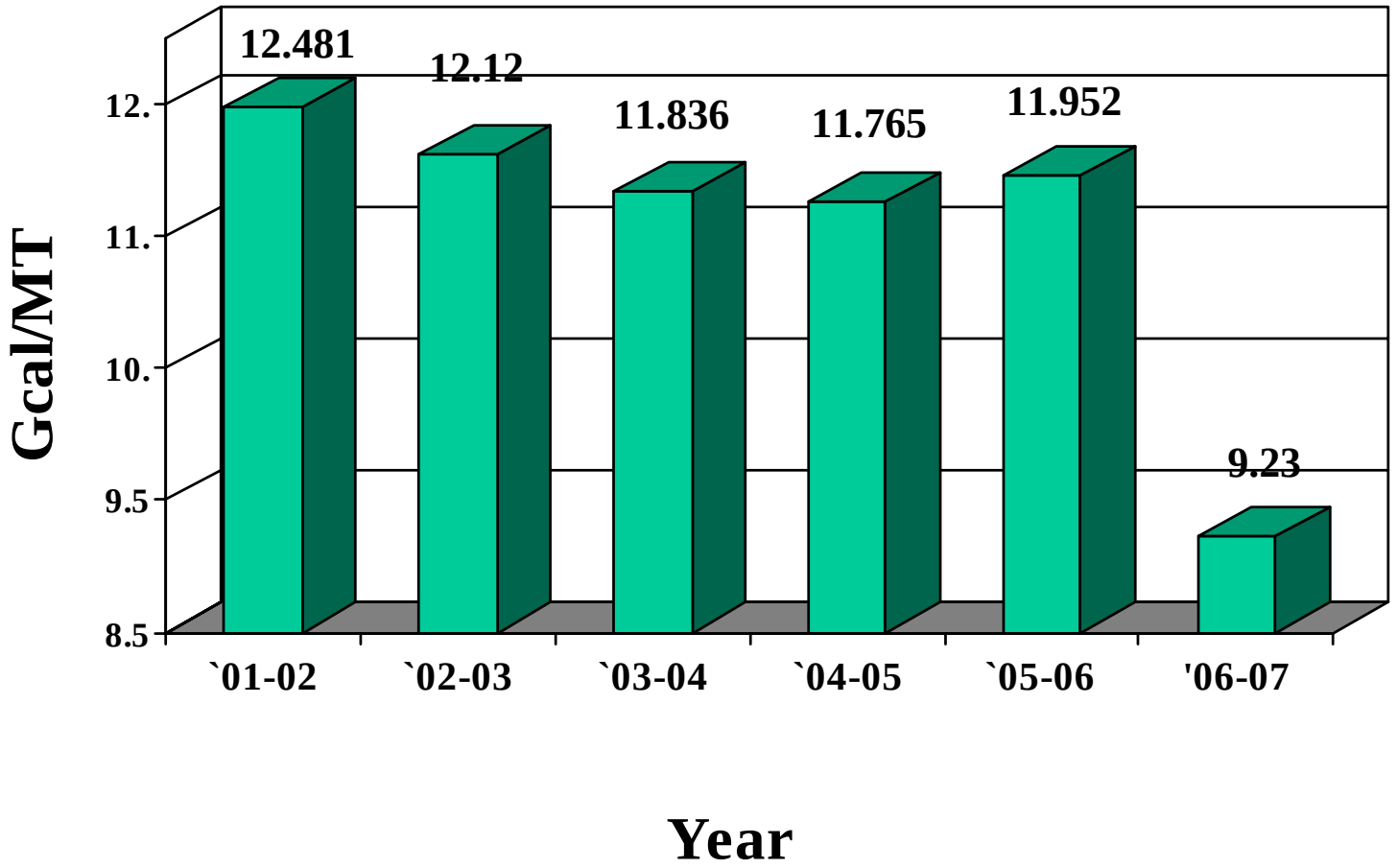
77.0 Flare System : Installation of new hot flare system in place of existing cold vent stack.

8.0 New Syn Gas Compressor and modified Syn Section : Old synthesis gas compressor has been replaced with most energy efficient compressor.

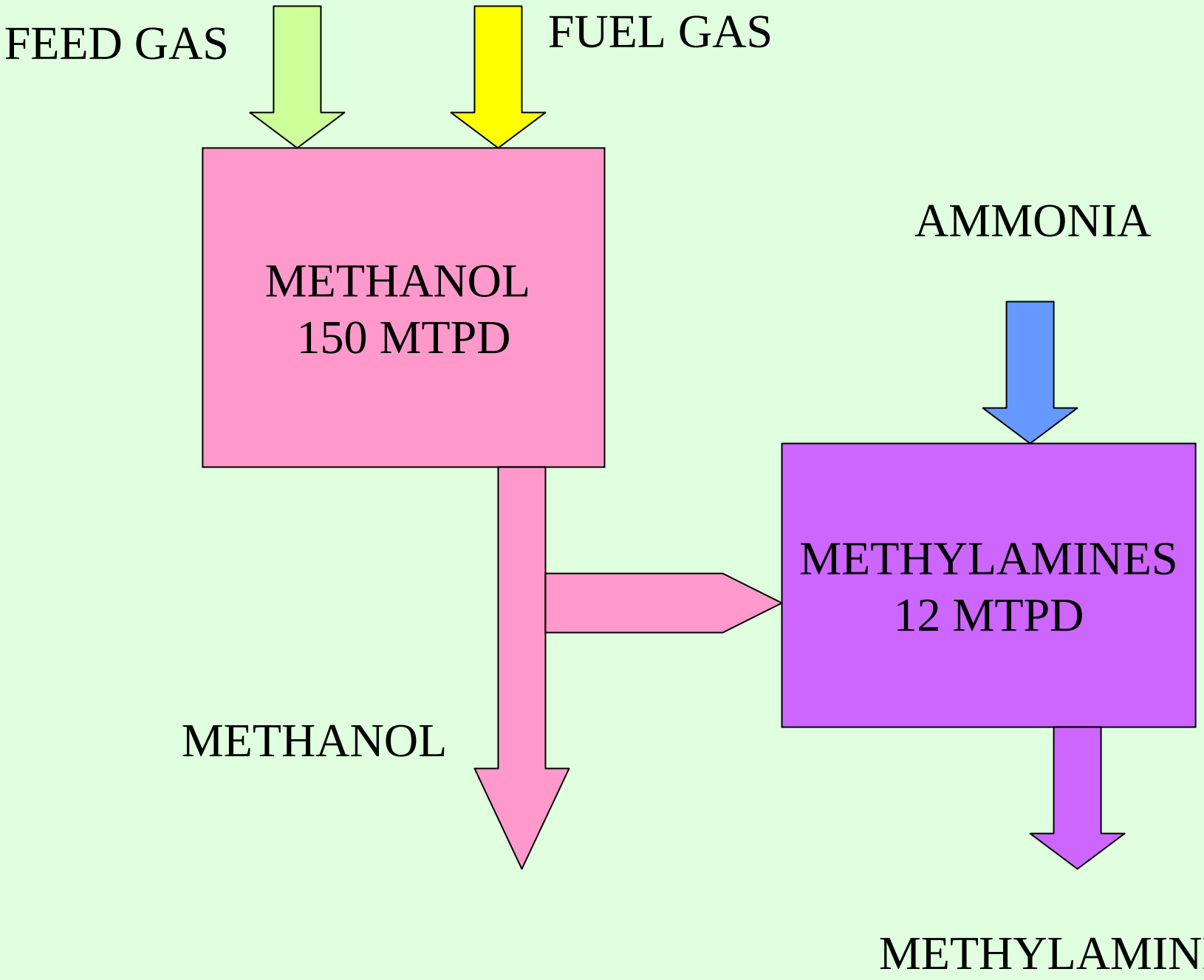
Modifying existing synthesis loop by additional S50 converter and Installation of loop boiler.

9.0 L.P Condensing Turbine for B.F.W Pump.

AMMONIA -V ENERGY CONSUMPTION



INDUSTRIAL PRODUCTS


FEED GAS
FUEL GAS
METHANOL
150 MTPD
AMMONIA
METHYLAMINES
12 MTPD
METHANOL
METHYLAMINES

METHANOL MODERNIZATION

- **ORIGINAL HIGH PRESSURE SYNTHESIS PROCESS CHANGED TO 70 KG/CM^2, LOW PRESSURE PROCESS WITH NECESSARY CHANGES IN DISTILLATION SECTION.**

- **ENERGY CONSUMPTION REDUCED BY 44 % FROM 16.5 TO 8.85 MKCAL/MT**

- **ADDITIONAL BENEFITS : INCREASED STREAM DAYS AND REDUCED MAINT.**

METHANOL CONTD...

- **REPLACEMENT OF ALL 90 REFORMER TUBES OF HK - 40 WITH MANURITE 36 XM**
- **REDUCTION IN ENERGY CONSUMPTION BY 0.1 MKCAL/MT**

INSTALLATION OF PURGE GAS CONVERTER IN 2003

(SAVING OF 0.05 MKCal/MT)

METHANOL CONTD...

Stoppage of One Cooling Tower pump based on ambient conditions and optimizing cooling water circulation through Heat Exchangers.

Investment	**Nil**
Savings:	
In Power	**10.23 Lacs KWh/Yr.**
	Rs. 40.53 Lacs/Yr.

METHANOL CONTD...

In Methanol Plant, Chiller unit has been commissioned which has helped in increasing Methanol production by 9.0 MTPD and reducing specific energy consumption.

GAS SAVED	**7.04 Lakh NM3**
TOTAL SAVING	**Rs. 20.56 Lakhs**
INVESTMENT	**Rs. 120.00 Lakhs**

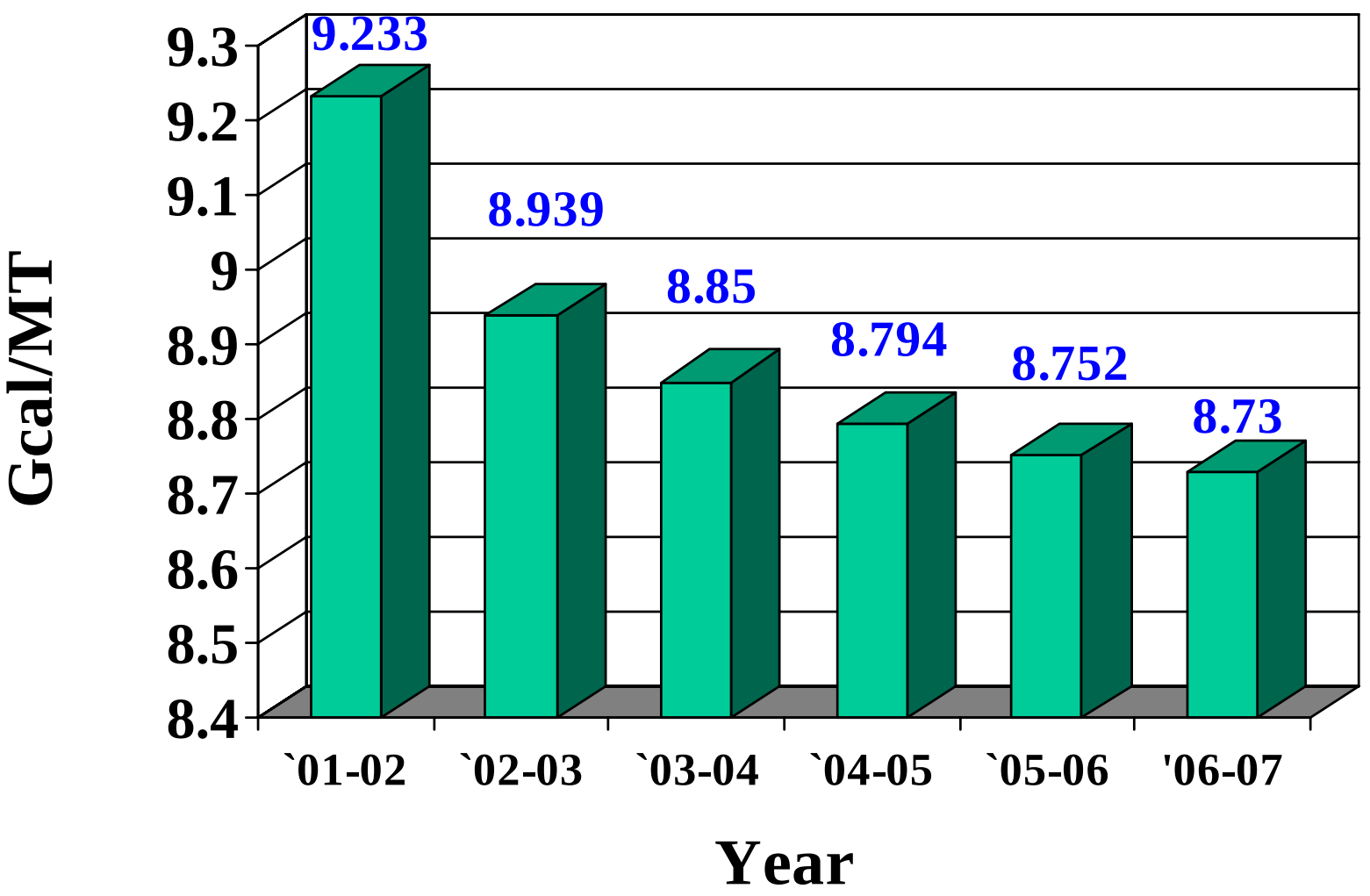
METHANOL CONTD...

A)**INSTALLATION OF LOW CAPACITY CO2 COMPRESSOR SAVING SPECIFIC ENERGY UPTO 0.01 MKCAL**

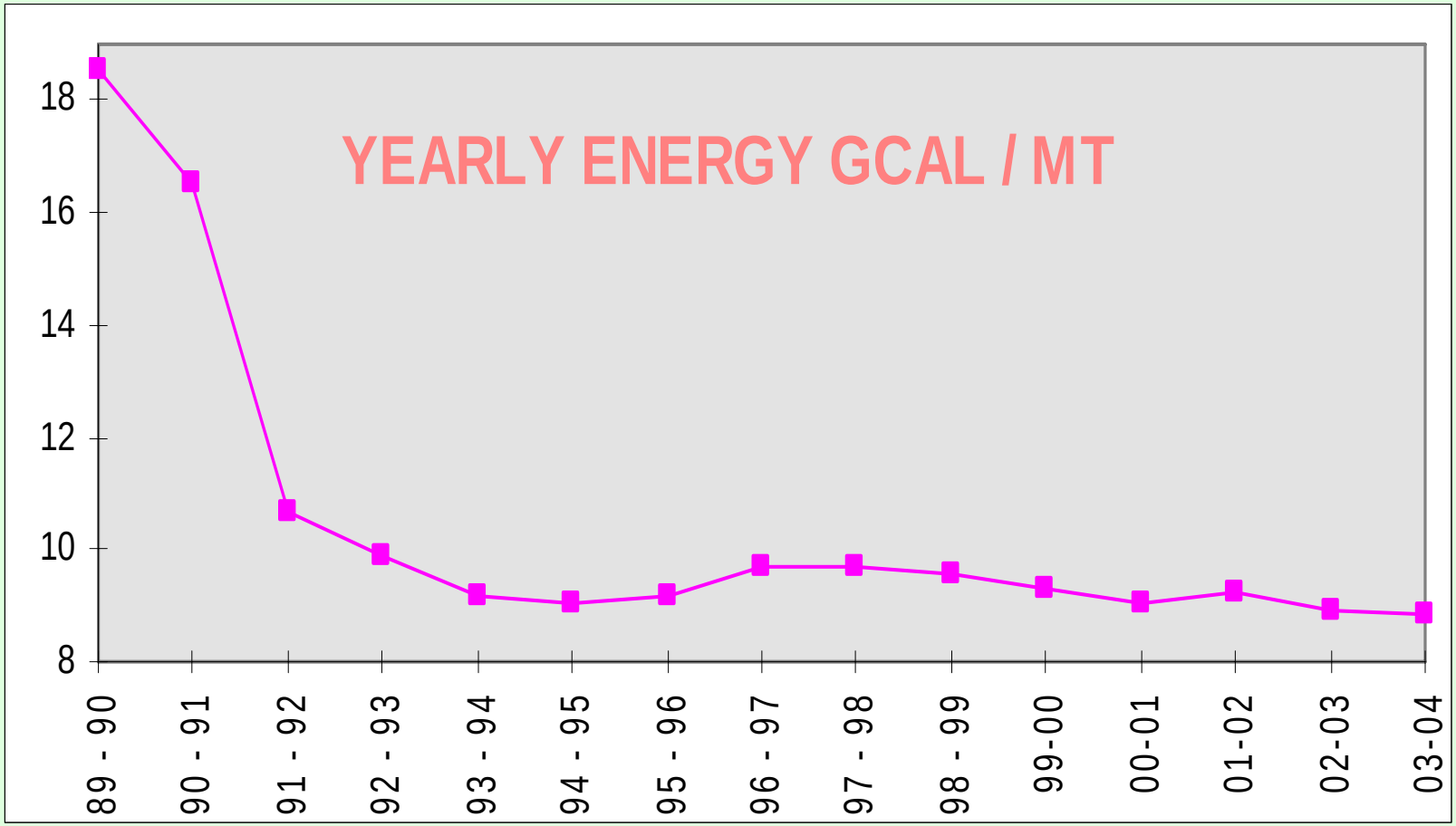
B) INSTALLATION OF SUITABLE HEAT RECOVERY COILS AT ID FAN SUCTION TO RECOVER ADDITIONAL HEAT IN THE FLUE GAS.

C)INSTALLATION OF MEMBRANE FOR HYDROGEN RECOVERY.

METHANOL ENERGY CONSUMPTION



METHANOL ENERGY PROFILE



ENERGY REDUCED FROM 18.8 TO 8.85 Gcal / MT

ENERGY MANAGEMENT SYSTEM AT RCF

“SMALL GROUPS” METHODOLOGIES

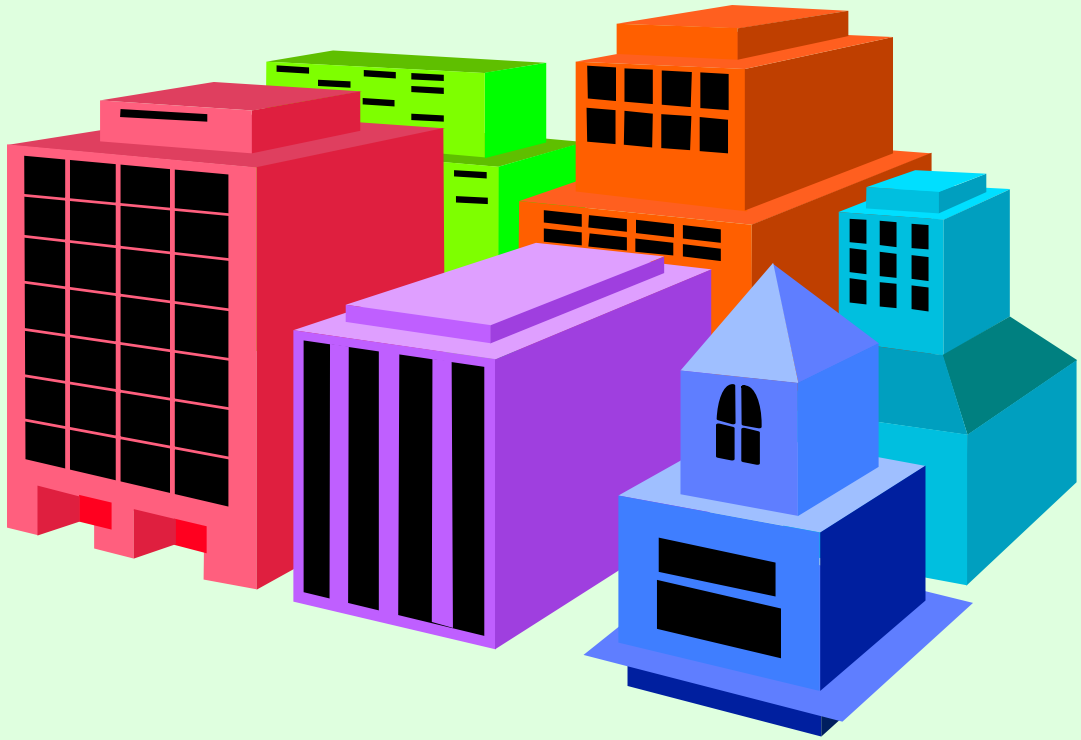
- **13 NOS. OF GROUPS FORMED FOR IMPLEMENTING THE IDEAS AND SCHEMES IN ORDER TO REDUCE THE COST OF MANUFACTURING**

MAJOR SCHEMES / SUGGESTIONS

SR.NO.	PLANT	SCHEME	ENERGY SAVING POTENTIAL
1	NSGP	Stoppage of one Instr. Air Drier heater,(30 KW)	99 MWH/annumRs.4.4 lakhs/annum)
2	WTP	Stopping the 50 HP Pump	35 MWH/annum(Rs.1.5 lakhs/annum)
3	NNAP	Downsizing of C.T. Fan, To stop one C.T. Pump by Overhauling of all pumps	2,500 MWH/annum (Rs.103 lakhs)
4	NSGP	Replacement of all HPMV lamps with HPSV lamps	(Rs.2.3 lakhs/annum)

CONTINUED

SR.NO	PLANT	SCHEME	ENERGY SAVING POTENTIAL
5	SNNP	All HPMV lamps to be replaced with HPSV.	15% saving in lighting energy consumption.
6	ETP/STP	R.O. Reject Pump – To increase the head by suitable modification in Existing impeller.	300 KWH/day (Rs.4.4 lakhs/annum)
7	SUPHALA	Stop the 40 HP motor pump which is exclusively supplying water for floor washing.	60 KWH/day(Rs. 1.0 lakh/annum)



ADDITIONAL SCHEMES

OPTIMISATION OF STEAM NET WORK

• **MANAGEMENT OF STEAM (AVAILABLE AT 4 , 12 ,20, 40 & 105 ata PRESSURE LEVELS) HAS BEEN OPTIMISED AND IS CLOSELY MONITORED.**

•40/20 ATA STEAM TURBINE IS BEING PROCURED TO SAVE ENERGY OTHERWISE WASTED IN PRESSURE REDUCTION THROUGH PRDS **(SAVINGS OF 1250 MWH)**

STEAM TRAP SURVEY

• EXTENSIVE SURVEY HAS BEEN CONDUCTED AND FAULTY TRAPS HAVE BEEN REPLACED **(EXPECTED SAVINGS OF 1. 3CRORES AT 4 MONTHS PAYBACK)**

INSULATION SURVEY

STEAM LINE INSULATION CONDITION IS CHECKED PERIODICALLY AND CORRECTIVE ACTION S ARE TAKEN TO REDUCE HEAT LOSSES.

Instrument Air Leakage Surveys

Water Loss Surveys.

ENERGY CONSERVATION MEASURES AT THAL

MAJOR MEASURES

AMMONIA:

1. NGC BOOSTER DISCHARGE INTERCONNECTION.
2. EVAPORATING COOLING SYSTEM FOR PAC-I.
3. REPLACEMENT OF 20W TUBELIGHT BY ENERGY EFFICIENT 14W T-5 TUBELIGHTS (25 fittings).
4. HOLLOW FRP BLADES FOR BENEFIELD COOLER FANS (8 Nos).
5. ACS FOR LINE-II IN AMMONIA.
6. CORRO-COATING OF COOLING WATER PUMPS 2801A & 2801B.
7. “Z” BLOCKS INSULATION IN PLACE OF REFRACTORY BRICKS IN PRIMARY REFORMER.
8. SGC-I GUIDE BLADE CARRIER CHANGE.
9. EVAPORATING COOLING SYSTEM FOR PAC-II.
10. REPLACEMENT OF 20W TUBELIGHT BY ENERGY EFFICIENT 14W T-5 TUBELIGHTS (25 fittings). pt

MAJOR MEASURES

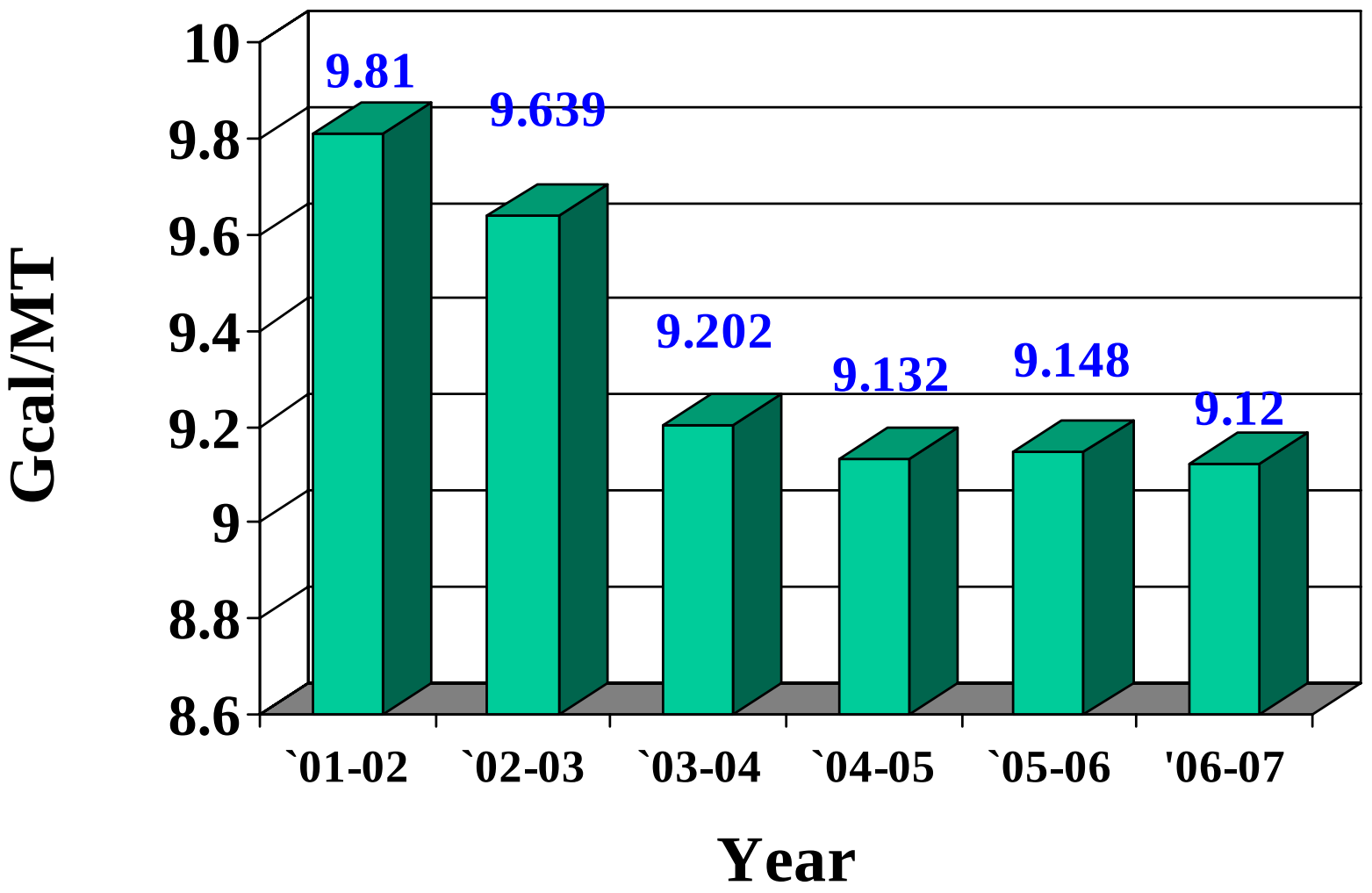
UREA

11. USE OF P-8 SOLUTION FOR CROWN WASHING IN MV-06 FOR UNIT-31.
12. REPLACEMENT OF 20W TUBELIGHT BY ENERGY EFFICIENT 14W T-5 TUBELIGHTS (70 fittings).
13. AUTO LOADING-UNLOADING OPERATION FOR IAC
14. USE OF P-8 SOLUTION FOR CROWN WASHING IN 1ST VACUUM SEPARATOR MV-06 FOR UNIT 21.
15. CORRO-COATING OF COOLING WATER PUMP-C (Spare).
16. PASSIVATION AIR BLOWERS FOR CO2 COMPRESSOR FOR ALL STREAMS.
17. REPLACEMENT OF 20W (210 Nos) CONSUMING 26W BY ENERGY EFFICIENT 24W CONSUMING 25W T-5 TUBELIGHTS (70 Nos).
18. STOPPING OF P-4 PUMPS IN ALL THREE STREAMS.
19. PASSIVATION AIR COMPRESSOR FOR AIR TO STRIPPER.
20. PC-108 OFF GASES TO PRIMARY REFORMER AS FUEL.

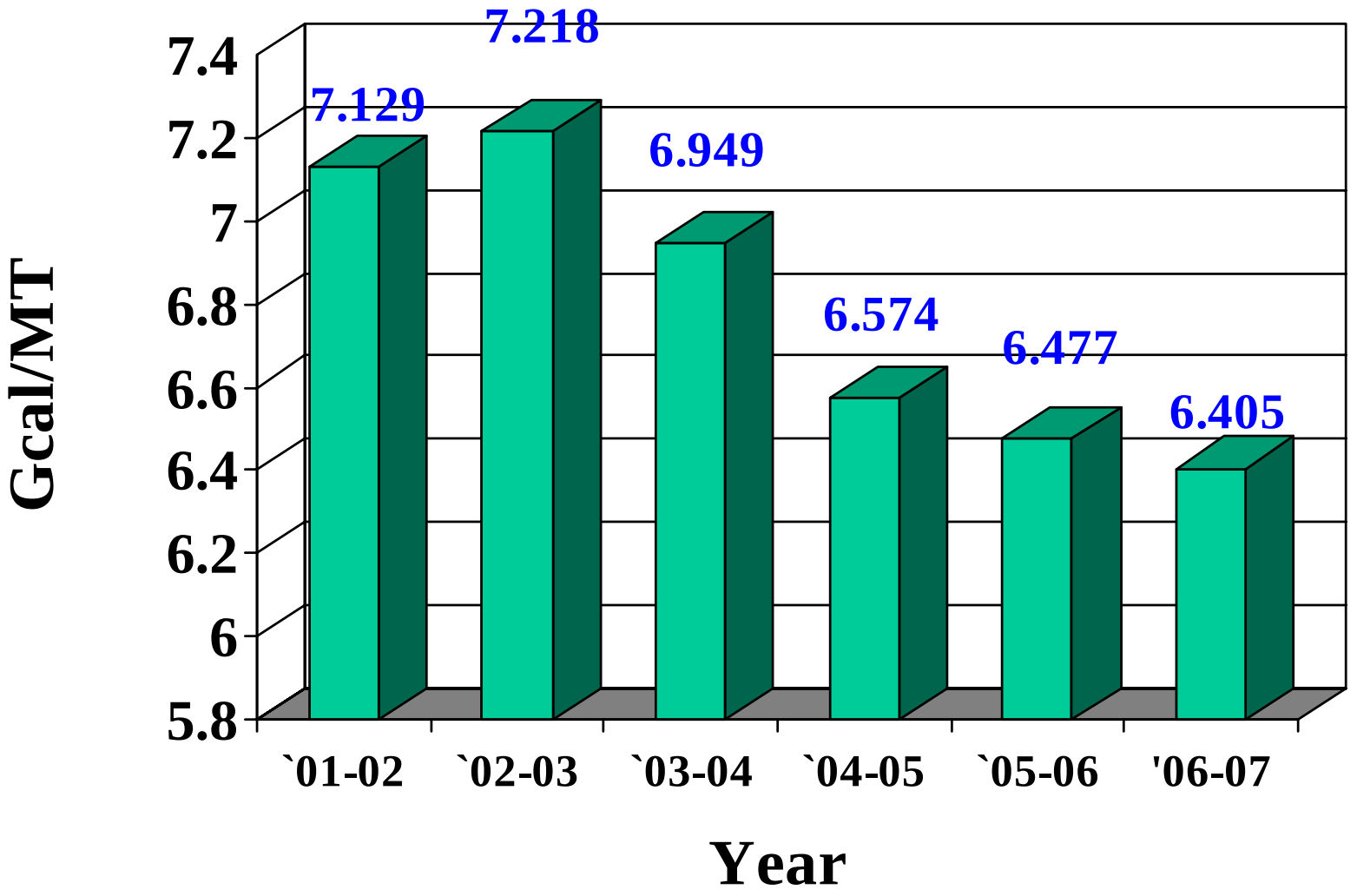
INNOVATIVE TECHNOLOGIES & USE OF RENEWABLE ENERGY SOURCE

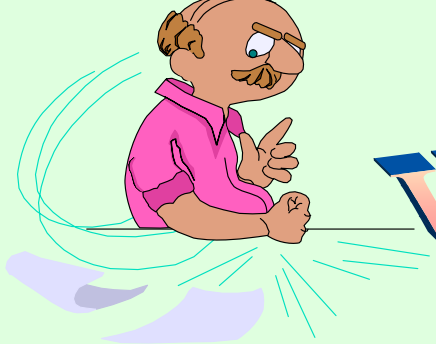
1. CORRO-COATING
2. EVAPORATING COOLING FOR PAC
3. “Z”BLOCK INSULATION
4. USE OF MAGNETIC RESONATOR FOR BOILER FUEL
5. USE OF P-8 SOLUTION FOR CROWN WASHING
6. PC-108 OFF GASES TO PRIMARY REFORMER AS FUEL
7. USE OF ACS IN AMMONIA
8. USE OF ELECTRONIC GOVERNERS IN PLACE OF HYDRAULIC
9. USE OF SOLAR WATER HEATERS
10. USE OF VFDs
11. USE OF HOLLOW FRP BLADES
12. USE OF ENERGY EFFICIENT A/Cs
13. LIGHTING

THAL AMMONIA ENERGY CONSUMPTION



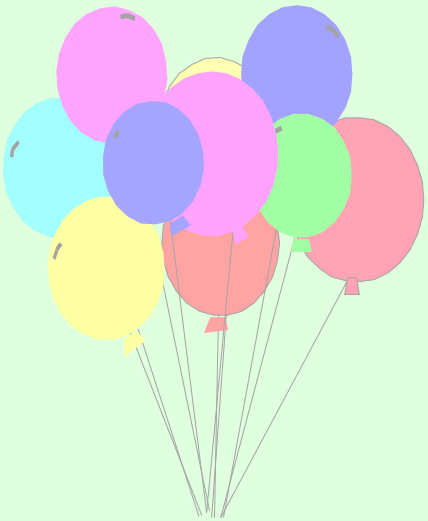
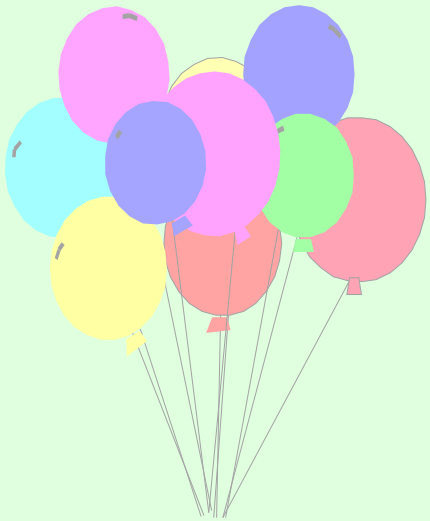
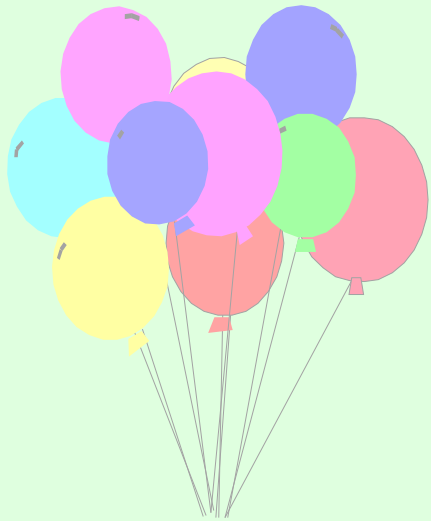
THAL UREA ENERGY CONSUMPTION





WE BELIEVE

- **Energy conservation is not only a matter of desire but it is also a product of teamwork.**
- **We have been talking of energy for years, but we can not implement energy conservation merely by applying work measurement or budgetary control.**
- **The root cause of our deficiency does not lie in the lack of techniques or lack of resources. It lies in our approach in our mind.**

THANK YOU