

IFFCO, Kalol Unit Unit profile

The Rs. 75 crore IFFCO, Kalol Unit, located 26 kms. from Ahmedabad on the Ahmedabad Mehasana highway, started commercial production in April, 1975 in a area covering 96 hectares. The unit consists of plants to produce 1100 tpd Ammonia, 1650 tpd Urea, 6 tpd Dry Ice and 12 tpd Liquid CO₂ alongwith necessary offsite facilities. The natural gas available in the vicinity of the unit is used as the feed stock for the manufacture of ammonia along with 250 tpd naphtha feed based pre-reformer system. Associated gas, naphtha and LSHS are used as fuels. Water is supplied by GIDC from 15 borewells around the Unit.

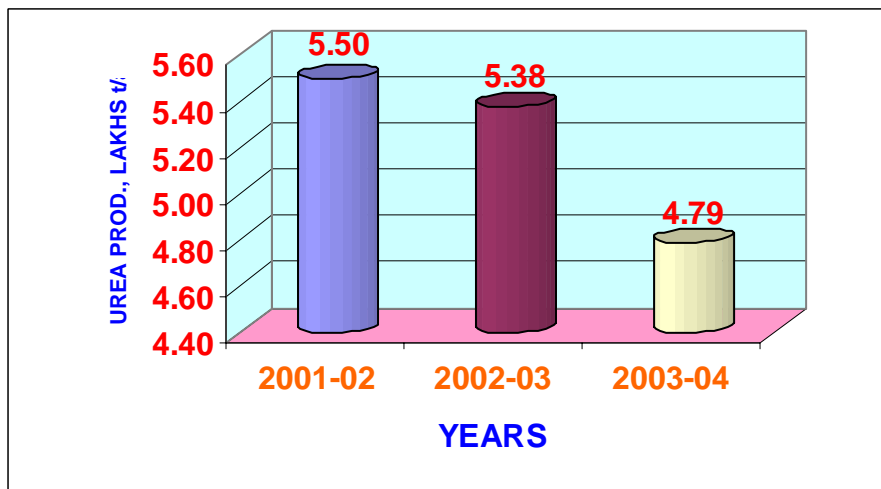
The Kalol unit produced 479504 tonne of urea and 321508 tonne of ammonia during the year 2003-2004 attaining a capacity utilisation of 88.06 % and 88.57 % respectively. The production performance of kalol unit is steady improving is as shown below.

Urea Production and capacity utilisation

Paticulars	Unit	2001-2002	2002-2003	2003-2004
Urea Production	tonne/year	550297	538096	479504
Cap. Utilisation	%	101.06	98.82	88.06#

Urea plant was shut down from 20/08/03 to 30/09/03 to spare ammonia for IFFCO Kandla for DAP production. Necessary permission for the same was obtained from Ministry of Chemical & Fertilisers, Department of Fertilisers, New Delhi vide letter Ref.No.DO.No.5197/JSM/03 dated 19th August 2003 and 22nd September 2003.

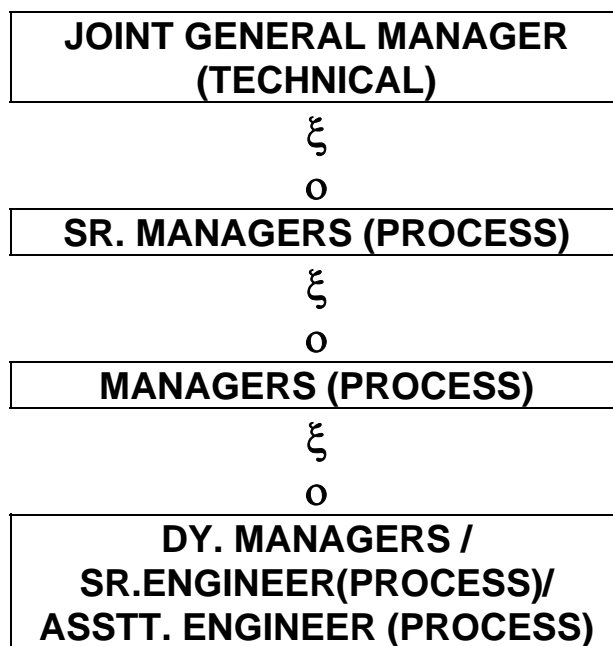
Production performance of urea plant is as under.



Energy Conservation Commitment, Policy and Set-up

Process Engineering Section of Technical Department is the main internal agency for regular energy audit. Process engineering section is headed by one Joint General Manger, Two Sr. Manager and he is assisted by three Manager. At present, there are Two Dy.Manager, one Senior Engineer and one Asstt. Engineer working at Process Engineering Section.

Organisation chart of Process Engineering Section



Process Engg. Section, IFFCO Kalol carry out energy audit on regular basis. Plant operation are studied in detail to identify the areas for reducing specific energy consumption and minimizing losses.

- Conducting in-house energy audit for the plant.
- Monitoring the energy consumption norms and corrective actions for the deviations.
- Development of human resource for the energy awareness.
- Adoption of improved technology for enhancing the energy efficiency, improving the productivity and the plant reliability.
- Creating the safe, healthy and energy conscious working environment.

Energy Conservation Plans and targets

IFFCO Kalol unit is committed to further improve its energy performance by finding out new avenues on continuous basis. The Kalol unit is working on the following proposals as a part of its future plans for energy conservation.

Following schemes will be implemented in the year 2005-06 in ammonia plant to save 409600 Gcal per year.

- Heat recovery in offsite BFW coil.
- New ID fan, turbine for primary reformer in ammonia plant.
- LTS Guard bed + new BFW Preheaters.
- Improved shift outlet system.
- Two Stage aMDEA system for CO₂ removal in ammonia plant.
- Dry MU-gas (Ammonia wash) + Change MU point .
- S-50 converter incl 1st cat charge, intern electric SU-heater, MP boiler.
- Syn gas compressor LP/HP modifications+New kickback.
- Modifications in ammonia refrigeration compressor.

Environment

As a part of concern for cleaner environment and commitment for ISO – 14001 certification for both plant and township, following activities have been carried out during Year 2003-2004.

1. Water Conservation

Final liquid effluent is utilized for gardening purpose within the plant premises so as to reduce raw water consumption.

2. Tree Plantation

In order to develop cleaner & greener environment, 28.5 acres & 30.5 acres area are covered as green belt in plant & township respectively and 1 acres of land is covered as green belt during year in the plant. Also 1990 Nos. fruit plants and 4812 Nos. forestry plants have been distributed to near by villages during the year.

(3) Disposal of Biomedical waste :

We have our own set up for bio medical waste treatment facility like autoclaving, chemical treatment and also disposal facility for sharpes (needles and blades) by burying in rectangular pit constructed as per the guidelines mentioned in clause of Biomedical waste rule 1998.

(4) Solid Waste Disposal

Sludge generated in effluent treatment plant (ETP) contains natural salt to Ca and Mg same is disposed off to GPCB approved land fill site at Ahmedabad. Spent catalyst are sold to GPCB approved vendors for reprocessing. Spent lube oil is collected and mixed with fuel oil to use as fuel in the boiler.

(5) Vermicomposting System

To avoid air and land pollution which was caused due to burning of solid waste, vermicomposting system for conversion of 350 kg/day of domestic and garden waste into organic manure has been implemented at IFFCO township during Aug.2002. As a part of it domestic waste is segregated. Bio-degradable waste after partial decomposition at vermicomposting site is shifted to vermibeds wherein special species of earthworms are utilized for further treatment of waste. The resulting manure rich in NPK is utilized for farming and gardening purpose.

Township of Kalol unit is the first as single identity in India which has been selected by USAID for ISO-14001 certification. IFFCO Kalol township has been awarded ISO-14001 certification for its Environment Management System by BVQI on 2nd June'2001.

Following schemes have been implemented during last three years to reduce the effluent and to reuse the same.

- Dust Extraction System in B & MH Plant.
- Non-Chromate based cooling water system.
- Installation of Sewage Water Treatment Plant at Township & reuse of treated water for gardening.
- Disc Oil skimmer
- Rain water recharging well.
- Use of effluent water for horticulture purpose.
- Ammonia recovery from flash tank condenser offgases.
- Recycle and reuse of effluent water for scrubbing of HCL fumes.
- Use of bulk effluent for horticulture purpose.
- Use of circulating cooling water for backwash of sand filters in place of raw water.
- Diversion of flash tank vapours to first evaporator scrubber

Safety

Kalol Unit has won second prize "RUNNER-UP from **NATIONAL SAFETY AWARDS 2003**" under **Scheme No.II (Manufacturing of Chemicals & Fertiliser Industries Group)** at National Level. This is the highest award in Industrial Safety in India being given by Government of India.

Protecting the public in the vicinity and the employees from exposure to toxic, has been a keystone of the company's overall safety programme. It involves integrated approach to human safety that began with selection of proven manufacturing technology and extends through personnel training, protective equipment's usage, workplace monitoring, safety audit, inspection and transport precautions.

Safety audit and risk assessment surveys by safety specialists is being carried out every year to assess workplace hazards and to check the safety of operating persons and plants..

Employees exposed to hazardous materials are given proper protective equipment and trained how to use it during regular operations and in emergency situation. Upgrading of the safety appliances for improving the reliability of the personnel protection is a regular feature at our unit. Operation, Maintenance and Safe Handling procedures are written for various hazardous substances and are circulated to all the employees.

The safety philosophy and commitment is spelt out in our safety, health & environment policy duly issued by the Managing Director of IFFCO. The policy is widely circulated to all employees and is also binding on the contractor and is a contractual obligation.

Safety, health and Environment control are responsibilities of all levels of management and Employees and they are considered collectively as one of the measures for their career development.

Safety promotion is a regular activity at IFFCO Kalol. Total commitment of top management has enthused the staff for achieving a good work environment and accident free job performance. This is reflected by winning safety awards at most every year from Gujarat Safety Council.

There are two safety committee like Shop Floor Safety Committee and Central Safety Committee to provide safe and fearless working conditions at working place, which have enhanced the moral of the employees, resulting higher productivity without any accident i.e. safer production.

Finally it is conclude that genuine concern and sincere commitment of the top management has brought in an ambiance where there is a total

commitment of all the employees to get along with their jobs with lot of confidence and safety consciousness. Varied facets of the safety and health aspects were kept in mind and the holistic approach of the company could make our plant a place to work comfortably and neighbourhood to live peacefully.

Energy Policy

At IFFCO Kalol, optimum utilisation of energy and the total energy management are the part of corporate mission and IFFCO is fully committed to reduce the specific energy consumption in the production of nitrogenous fertiliser through :-

- Conducting in-house energy audit and monitoring the energy consumption norms.
- Carrying out various minor and major modifications.
- Adoption of technological advancement befitting to the old plant.
- Development of human resources.
- Creating safe, healthy and energy conscious working environment.
- Better housekeeping in the plant.

Chief Executive Officer
INDIAN FARMERS FERTILISER CO-OPERATIVE LTD.
KALOL UNIT

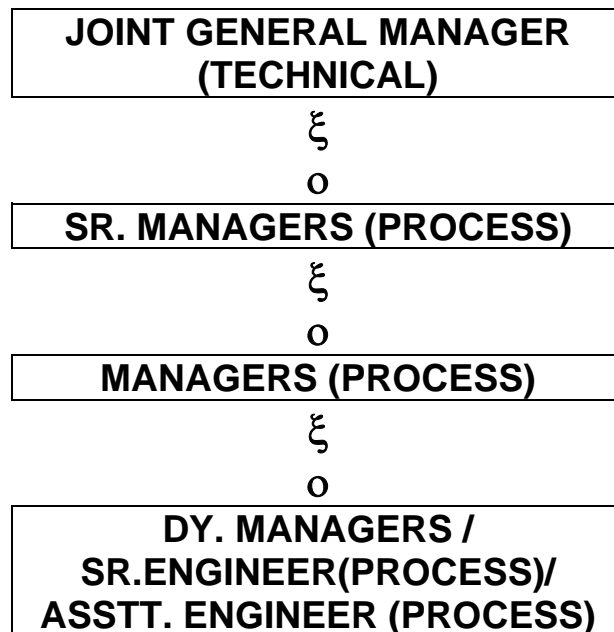
Energy Conservation Cell's Constitution, Functions and Achievements

At IFFCO Kalol, energy audit is a continuous process. During the initial period, urea plant specific energy consumption was about 7.775 Gcal/t and of ammonia plant was 12.67 Gcal/t. Energy conservation commitment of the unit has lowered down the specific energy consumption to 6.521 Gcal/t urea and 9.424 Gcal/t ammonia in the year 2001-02. Kalol Unit is continuously in touch with technical upgradation of fertiliser manufacturing process and regular energy audits are carried out to debottleneck the energy consuming points.

1.0 Energy conservation team constitution and their functions

Process Engineering Section of Technical Department is the main internal agency for regular energy audit. Process engineering section is headed by one Joint General Manager, Two Sr. Manager and he is assisted by three Manager. At present, there are Two Dy.Manager, one Senior Engineer and one Asstt. Engineer working at Process Engineering Section.

Organisation chart of Process Engineering Section



Process Engg. Section, IFFCO Kalol carry out energy audit on regular basis. Plant operation are studied in detail to identify the areas for reducing specific energy consumption and minimizing losses.

2.0 Energy policy

At IFFCO Kalol, optimum utilisation of energy and the total energy management are the part of corporate mission and IFFCO is fully committed to reduce the specific energy consumption in the production of nitrogenous fertiliser through :-

- Conducting in-house energy audit and monitoring the energy consumption norms.
- Carrying out various minor and major modifications.
- Adoption of technological advancement befitting to the old plant.
- Development of human resources.
- Creating safe, healthy and energy conscious working environment.
- Better housekeeping in the plant.

3.0 Energy conservation achievement

By way of continuous monitoring and energy audit following modifications are carried out for conserving the energy:-

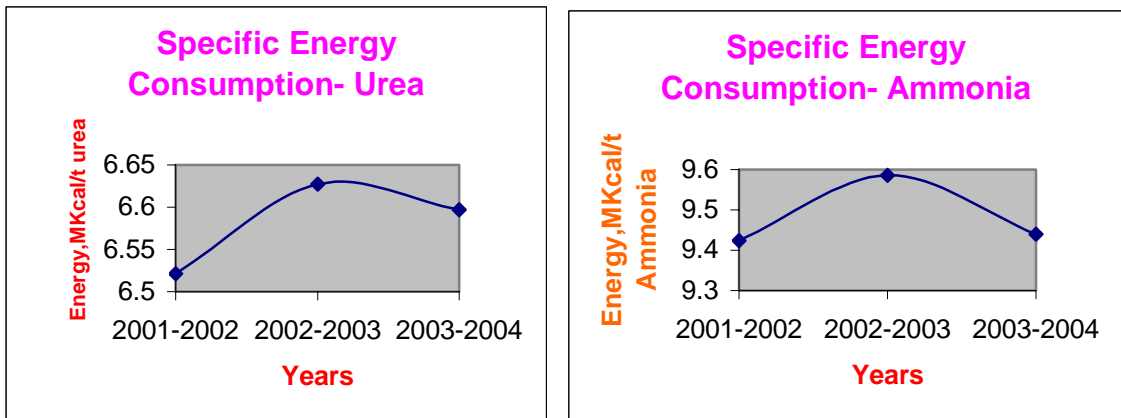
- LP absorber for HP scrubber off gases.
- Ammonia side cooling tower extension.
- UCAR amine guard II system.
- Purge gas recovery plant.
- Urea recovery system
- BFW coil in convection zone.
- Atmospheric scrubber for LP vent gases
- CCS-II heat recovery system.
- Ammonia converter retrofit.
- Convection zone coils retrofit.
- Primary reformer retrofit.
- CO₂ removal system revamp.
- Replacement of primary reformer arch burners
- Condensing turbines for cooling water pump.
- DCS system for ammonia and urea plant.
- Urea plant revamp.

Specific energy consumption was reduced to 6.597 Gcal/t of urea and 9.440 Gcal/t of ammonia during 2003-04 from 7.775 Gcal/t of urea and 12.67 Gcal/t of ammonia respectively in 1974-75. Last three years energy consumption figures are as under.

Specific energy consumption per tonne of ammonia and urea

Product	Unit	2001-2002	2002-2003	2003-2004
Urea	MKcal/tonne	6.521	6.627	6.597
Ammonia	MKcal/tonne	9.424	9.586	9.440

With the implementation of various energy conservation measures and optimisation of process parameter being an ongoing practice, there is steady decline of specific energy consumption is shown in the graph.



In addition to energy conservation, various pollution control measures are implemented to reduce effluent and to maintain the quality of effluents and vent gases. Also IFFCO have planted about 19884 of various type of trees in surrounding area. In August'2000, IFFCO Kalol unit has been awarded ISO - 14001 by BVQI for Environmental Management System.

Following schemes are implemented at the capital investment of more than Rs.15 Crores to reduce the effluent and to reuse the same.

- Desorber modification in urea plant.
- Atmospheric scrubber to recover ammonia from LP vent gas in urea plant.
- Use of 2% NaOH from mixed bed effluent for neutralisation.
- Diversion of ammonia from gland leakage of HP ammonia pump to ammonia oil separator.
- Recycling of condensate from turbines, Rv's & from water separators to the jacket water pump pit.
- NG Compressor & Syn.Gas Compressor seal oil trap gases diversion to fuel header.
- Diversion of Syn.Gas Compressor Inter stage Separator drain to strong effluent pit and ammonia water tank.
- Dust Extraction system in transfer tower area of B & MH Plant.

- i) Dust extraction System in B & MH Plant.
- j) Non-Chromate based cooling water system.
- k) Ammonia Recovery system in Ammonia Plant.
- l) Disc Oil skimmer
- m) Use of bulk effluent for horticulture purpose.
- n) Use of circulating cooling water for backwash of sand filters in place of raw water.

Also the Safety, health and Environment control are responsibilities of all levels of management and Employees and they are considered collectively as one of the measures for their career development.

3.0 Finances available

There is no limitation to finance availability for energy conservation schemes. Top management is providing top priority for in-house energy conservation schemes.

4.0 Future Plans

Future plans for energy saving are given in Annexure-IX.

DETAILS OF ENERGY AUDIT CARRIED OUT DURING LAST THREE YEARS

Details of energy audit	Date of conducting energy audit	Name of agency which conducted the energy audit	Major findings
<u>2001-2002</u>			
Steam balance and Furanace efficiency of ammoia plant	13-09-2001	Process Engineering Section, IFFCO Kalol	Refer note No. 1
Urea & Utility plant Steam balance	13-09-2001	Process Engineering Section, IFFCO Kalol	Refer note No. 2
<u>2002-2003</u>			
Steam balance and Condensate balance of urea plant	29-10-2002	Process Engineering Section, IFFCO Kalol	Refer note No. 3
Steam balance And cooling water Balance of ammonia plant	11-10-2002	Process Engineering Section, IFFCO Kalol	Refer note No. 4
BHEL boiler efficiency	03-02-2003	Process Engineering Section, IFFCO Kalol	Refer note No. 5
<u>2003-2004</u>			
Ammonia plant energy saving study	12-08-2003	HTAS, Denmark	Refer note No.6

Process Engg. Section, IFFCO Kalol carry out energy audit on regular basis. Plant operations are studied in detail to identify the areas for reducing specific energy consumption and minimizing losses.

Note No. 1 :

1. Steam to carbon ration was high. Suggested to optimise the same.
2. Steam consumption in refrigeration compressor turbine was high.
3. To reduce LP steam consumption, lube oil and seal oil turbines of Air compressor/ Refrigeration compressor, Syn.gas compressor and NG compressor by more efficient turbine will be replaced.
4. Due to limitation of MF coil, it is proposed to install process steam desuperheater. This will save about 2000 kg/h MP steam.
5. To improve steam super heat temperature by 4 deg C, installation of LT steam super heat coil with high heat transfer area, low pressure drop and superior material for better performance and longer life of coil is under implementation.
6. Installation of ammonia wash unit and syn. loop repiping will save about 6.7 t/h 38 kg/cm²g steam.

Note No. 2 :

1. LP steam in 1st and 2nd desorber was higher due to higher ammonia water concentration.
2. Steam was leaking from steam inlet valve, by pass valve, and exhaust valve. To reduce the steam losses, it is suggested to attend these valves.
3. CCS-I inlet temperature to LPCC was 60 deg C. CCS-I cooler bypass control valve was 34% open. Both the CCS-I pump was in service. It is suggested to keep one pump in service and close the bypass control valve.

Note No. 3 :

1. 9 ata steam drum pressure was 10.5 kg/cm²g, it was suggested to reduce the same to 9 ata. This will facilitate more 23 ata condensate flashing in 9 ata drum.
2. Normal heat duty of pre-evaporator is met by circulating condensate and balance is met by LP steam. LP steam consumption in pre evaporator was 2686 kg/h. It was suggested to avoid bypassing of circulating condensate.
3. 14 ata steam is used for tracing duty of LSHS storage and pumping system. It was suggested to use 4 ata LP steam instead of 14 ata. This will reduce about 1 t/h 60 ata steam letdown to 14 ata.
4. It was suggested to maintain vacuum in evaporators at design value to reduce steam consumption.

Note No. 4 :

1. It was suggested for maintenance of the passing steam traps.
2. It was suggested to inspect and unload the catalyst in some tubes of primary reformer during plant turn around.
3. The performance of secondary reformer catalyst was satisfactory, however it was suggested to inspect top layer of catalyst and target bricks.
4. Temperature profile of LTS indicate that the top 40 % of bed has been deactivated. The pressure drop across LTS and HTS observed high. It was suggested to replace catalyst in both LTS and HTS to reduce pressure drop and catalyst activity.
5. Higher S/C ratio was maintained at primary reformer inlet due to MF coil design outlet temperature limitation. With mixed feed coil desuperheater, it will be possible to reduce the S/C ratio i.e. steam consumption. This will also facilitate the higher tunnel firing which in turn improve the steam superheat and will reduce the total steam consumption.

Note No. 5 :

1. The overall efficiency of boiler based on BS-2885 (1974) method was 85.79 %. Overall efficiency as per heat input with fuel and heat output with steam was 84.48 %. The efficiency was lower due to higher stack temperature. Cleaning of RAH and furnace tubes and RAH seal checking should be carried out at available opportunity as per present practice.
2. Excess air before RAH was 9.95 % (O₂ in flue gas 1.9 %) against design value of 5 % of combustion air. Excess air after RAH was 28 % (O₂ in flue gas 4.6 %). Air leakage from air to flue gas side through RAH is 17% against design value of 14 % of theoretical air requirement.
3. Furnace pressure remains high i.e 300 mm WC. This is due to high differential pressure across regenerative air heater. It was suggested to clean air heater at suitable opportunity.
4. 4 ata steam consumption in LSHS heater (H-5113-C) is 71 kg/h. This is low due to fouling of heater. Tube side steam pressure in new LSHS heater (H-5113-D) is 11 kg/cm²g. This is high due to fouling of heater. Cleaning of both heaters should be carried out.
5. Superheater steam safety valve was passing., suggested to attend the same.
6. 14 ata steam consumption is Excess steam/ passing of some steam traps is observed in LSHS 14 ata steam tracing outlet collection header. It is suggested to divert all 14 ata and 60 ata steam traps outlet to CBD tank in BHEL area to generate LP steam from flashing and to utilise generated condensate as CT makeup.

Note No. 6 :

Sr. No.	Energy Conservation measures planned	Gcal Per year
1	Thermal	
1.1	Heat recovery in offsite BFW coil	9600
1.2	New ID fan, turbine	3200
1.3	LTS Guard bed + new BFW Preheaters	25600
1.4	Improved shift outlet system	9600
1.5	Revamp of CO2 removal to Two Stage aMDEA	144000
1.6	Dry MU-gas (Ammonia wash) + Change MU point	25600
1.7	S-50 converter incl 1st cat charge, intern electric SU-heater, MP boiler	102400
1.8	Syn gas compressor LP/HP modifications+New kickback cooler	57600
1.9	Modifications in ammonia refrigeration compressor	32000
	Integrated energy for Year 2005-06	332145

- There will be a energy saving of 0.915 Gcal/day

During last three years following major schemes have been implemented.

Ammonia Plant

1. Replacement of ejector assembly of surface condenser.
2. Replacement of discharge line and de-staging of hot ammonia pump.
3. Heating of associated gas (AG) with boiler blow down drum condensate
4. Diversion of LP case seal oil off-gases of synthesis compressor
5. Use of AG for deaeration in pre-reformer
6. Stoppage of associated gas supply during plant turnaround
7. Mixing of cold and hot ammonia in ammonia plant
8. Replacement of LO/SO coolers
9. Retubing of Heat exchangers
10. Washing of convection zone coils.
11. Reduction of MP steam in Air-Steam coil in convection zone of primary reformer.
12. Replacement of LT steam superheat coil Desuperheating of Mixed Feed Coil Inlet gas
13. Diaphragm replacement in BFW Pump turbine

Urea Plant

1. Heat recovery from LP steam condensate by CO₂ turbine surface condensate.
2. Heat recovery from desorber effluent by CO₂ turbine surface condensate.
3. HP case rotor modification for CO₂ compressor.
4. Pressurized operation of ammonia oil separator.
5. Ammonia recovery by diversion of LP off gas.
6. Low level heat recovery from desorber effluent.
7. Condensate recovery from inter stage coolers of CO₂ compressor.
8. Replacement of high pressure stripper
9. Provision of inert gas for ammonia supply system
10. Use of 4-ata steam for LSHS heating upstream of 14-ata heater
11. To reduce urea plant start up time, provision of 4-ata steam venting for BHEL boiler start up.
12. Inlet air fan pulley modification in prill cooling system
13. Single reflux pump operation by providing bigger size reflux tank level control valve.
14. Provision of hot CO₂ to first desorber/reflux condenser

ENERGY EFFICIENCY SCHEMES IMPLEMENTED
DURING THE YEAR 2002-2003 AND 2003-2004

FOR THE YEAR : 2002-2003

1 Heating of associated gas (AG) with boiler blow down drum condensate

Boiler blow down water at 147^o C was utilised as CT make up along with jacket water over flow. Low level heat of boiler blow down is now used to heat AG from about 50^o C to 105^o C. About 0.173 Gcal/h low level heat is recovered. Annual financial savings are about Rs 12 lakhs. Old material is utilised for the modification.

2 Diversion of LP case seal oil off-gases of synthesis compressor

LP case seal oil gases having 75% hydrogen were burnt in furnace. LP case seal oil leak off gas has been diverted to the suction of NG compressor to use it as feed stock. Cost of modification is Rs 2.5 lakhs and annual financial saving is Rs 32 lakhs. Payback period is less than a month.

3 Use of AG for deaeration in pre-reformer

Earlier natural gas (NG) was used for deaeration of naphtha and heating of desulphurisation section of pre-reformer. NG supply is depleting day by day. To use maximum natural gas as feed stock associated gas (AG) is used for above purpose. This has reduced the use of naphtha as feed stock. About 5000 Sm³/day, additional NG is available as feed. Cost of modification is Rs. 2 lakhs. Annual monetary saving is Rs. 3 lakhs.

4 Stoppage of associated gas supply during plant turnaround

AG is required during plant turn around for use in flare stacks of ammonia storage and for canteens & guest house. About 12000 to 15000 Sm³/day AG consumption was reported as against the actual consumption of about 1000 Sm³/day. This is less than 1% and AG flow meter's design range of 3 lakhs Sm³/day. Due to this, flow indicated by GAIL meter was higher. During 2002 turn around, AG was totally isolated and provision of LPG cylinders was made. Annual monetary saving is Rs. 10 lakhs.

5 Mixing of cold and hot ammonia in ammonia plant

To reduce the refrigerant compressor discharge pressure, the hot ammonia from refrigeration condenser is mixed with cold ammonia from storage. This has reduced the discharge pressure of refrigerant compressor by about 0.5 kg/cm². The resulting MP steam saving of about 1.0 t/h is achieved due to reduction of discharge pressure of refrigerant compressor. Cost of modification is about Rs 1 lakh and annual financial saving is about Rs 30 lakhs. Pay back period is less than one month.

FOR THE YEAR : 2003-2004

1.0 AMMONIA PIANT

1.1 Replacement of LT steam superheat coil

LT Steam super heat coil located in convection zone of primary reformer was in operation since 1975. The coil was aged, its supports were damaged / distorted and coil was lying in sacked position. Fins & tubes of the coil were also damaged. Microstructure of the tubes was also deteriorated. An overall thickness of LT steam superheat coil was reduced by 15 %. So it was replaced with bigger and modified design coil. New coil have 22 % higher surface area. After Installation of new LT coil and washing of convection zone coils HP steam super heat temperature has increased from 415⁰ C to 427⁰ C and stack temperature is reduced from 220⁰ C to 200⁰ C. This has improved the efficiency of turbines in ammonia plant. Cost of project was Rs 1.83 crore. Annual financial saving is about Rs 48 lakhs.

1.2 Desuperheating of Mixed Feed Coil Inlet gas

The mixed feed coil is designed to raise temperature of mixed feed (NG and steam) from 297⁰ C to 547⁰ C for total flow of 90.971 MT/hr.

With reduction in NG supply and designed S/C ratio, it was difficult to maintain the mixed feed temperature at exit of MFC at about 545 to 547⁰ C. Higher S/C was required to be maintained in primary reformer resulting into inefficient operation of ammonia plant.

Following operating constraints were faced with reduction in NG flow during normal plant operation:-

- To maintain coil outlet temperature within design temperature, it was required to feed higher process steam of about 4 t/h with NG in mixed feed coil (MFC).
- Due to higher mixed feed coil exit temperature, tunnel burners could not be fired. This was limiting the better superheat in high pressure (HP) steam of ammonia plant and affecting the turbine performance.

Scheme for desuperheating of mixed feed gas by boiler feed water (BFW) was implemented in May-June-2003 turnaround. Scheme is in operation since June-2003 and is performing well. Cost of the implemented scheme was : Rs 20.00 lakhs and financial saving @ 4 MT/hr MP steam is Rs 234 lakhs per annum.

1.3 GRAB loading in HTS & LTS

HT Shift Converter catalyst was replaced with graded alumina balls of 60 mm, 37 mm and 19 mm. LT Shift Converter catalyst was replaced with graded alumina balls of 50 mm, 37 mm and 19 mm. Pressure drop in HTS/LTS has reduced by about 0.5 kg/cm². This has saved about 0.5 t/h MP Steam. The cost of the catalyst loading in HTS/LTS was 12 lakhs. Monetary saving of about Rs. 40 lakhs annually.

1.4 Diaphragm replacement in BFW Pump turbine

New improved indigenous diaphragms are installed in BFW pump turbine. This has saved 4 % MP steam i.e about 300 kg/hr. The cost of the replacement of diaphragm of BFW pump turbine was 37 lakhs (Cost of imported diaphragms are 200 lakhs). There is annual monetary saving of about 23 lakhs.

2.0 UREA PLANT

2.1 Inlet air fan pulley modification in prill cooling system

Inlet air fan is provided to supply air to fluidized bed cooler in urea plant for fluidization and cooling of urea prills. About 60 mm WC pressure loss was observed across the fan discharge dampener. To operate the fan at lower speed to reduce energy consumption, fan drive pulley size was increased from original 765 mm diameter to 875 mm diameter (i.e. 114 % higher size). About 62 kWh power is saved, resulting into financial saving of Rs 25 lakhs per year. Cost of modification was Rs 0.25 lakhs.

2.2 Single reflux pump operation by providing bigger size reflux tank level control valve

During normal plant operation, two reflux pumps were remaining in operation and LICV-1353 was remaining about full open. Reflux tank level (LICV-1353) was replaced with bigger size redundant SS control valve (HICV-1204) to reduce pressure drop in the control valve. Bigger size level control valve remains in operating range with one pump in operation. This has saved about 6.0 kWh of electric power equivalent to annual monetary saving of about Rs 2.6 lakhs.

2.3 Provision of hot CO₂ to first desorber/reflux condenser

For maintaining N/C mole ratio in reflux carbamate condenser, about 200 to 600 kg/h CO₂ is supplied to first desorber or reflux condenser from Hitachi CO₂ compressor. Provision is made to supply hot CO₂ to first desorber from Hitachi CO₂ compressor second stage discharge at 180⁰ C -185⁰ C instead of inter cooler outlet at 40⁰ C to utilize low level heat of CO₂ for stripping in first desorber instead of dumping it to cooling water.

The cost of modifications and providing insulation on hot CO₂ supply line to hydrolyser system was around Rs. 25000. Use of CO₂ from second stage discharge at 180-185⁰ C has save about 1.5 t/d LP steam in desorber. Annually monetary saving is about Rs. 2 lakhs.

2.4 Providing insulation on HP scrubber inlet/outlet CCS II lines

Heat of formation of carbamate produced in HP scrubber (H-1203) is removed by circulating condensate (CCS II). CCS II enters the U tubes of HP scrubber at 119⁰ C (design 120⁰ C) and leaves the scrubber at about 138⁰ C (Design 138.5⁰ C). The CCS II condensate heat is recovered in pre evaporator hot water part by heating urea solution flowing in tube side and cooling the CCS II condensate in shell side from 138⁰ C to 119⁰ C. The cooled condensate from pre evaporator flows to HP scrubber circulation pump (P-1204 A/B) and is pumped to H-1203 through CCS II cooler. During normal plant operation, most of heat of CCS II is recovered in pre evaporator and CCS II cooler remains bypassed.

Cost of providing 2” thick mineral wool insulation on entire length of CCS II inlet and outlet line from HP scrubber was Rs. 1 lakh. The monetary saving is about Rs. 17 lakhs per annum. The pay back period is less than one month..

3.0 UTILITY

3.1 Replacement of bulk effluent pump by smaller capacity pump

Existing (242 M3/hr) bulk effluent pump is replaced with (150 M3/hr). Power consumption of old pump was 35 kWh and power consumption of New Pump is 30 kWh. About 5 kWh power will be saved which is equivalent to Rs. 2.2 lakhs per annum. The cost of the new pump is 2.75 lakhs. The payback period is 1.25 years.

4.0 BAGGING & MATERIAL HANDLING

4.1 To increase product output from vibrating screen in B & MH plant

4 Nos. of single deck, circular design urea vibrating screens each having a capacity of 26 t/hr in the transfer area of B&MH plant are installed for separation of 1 mm and below urea fines/dust.

The design reclaim capacity is 150 t/hr. The feed to each screen is through 500 mm diameter MS pipe and product outlet openings are 400 x65 mm (6 nos) with bolted covers. Out of 6 opening, two openings of screens were used to get material out from each screen. 568 mm diameter discharge chute is provided for discharge of the product and 520 mm diameter Chute is provided for discharge of fines. Additional discharge chute of 100 mm diameter was provided by increasing the height of skirt of each screen. Modification was carried out to increase 100 mm discharge opening 200 mm. Now with 200 mm discharge, there is no spillage of urea from screen and improve the screen performance. The cost of modifications was Rs. 20000.

ENERGY EFFICIENCY SCHEMES IMPLEMENTED
DURING THE YEAR 2003-2004

FOR THE YEAR : 2003-2004

1.0 AMMONIA PIANT

1.1 Replacement of LT steam superheat coil

LT Steam super heat coil located in convection zone of primary reformer was in operation since 1975. The coil was aged, its supports were damaged / distorted and coil was lying in sacked position. Fins & tubes of the coil were also damaged. Microstructure of the tubes was also deteriorated. An overall thickness of LT steam superheat coil was reduced by 15 %. So it was replaced with bigger and modified design coil. New coil have 22 % higher surface area. After Installation of new LT coil and washing of convection zone coils HP steam super heat temperature has increased from 415⁰ C to 427⁰ C and stack temperature is reduced from 220⁰ C to 200⁰ C. This has improved the efficiency of turbines in ammonia plant. Cost of project was Rs 1.83 crore. Annual financial saving is about Rs 48 lakhs.

1.2 Desuperheating of Mixed Feed Coil Inlet gas

The mixed feed coil is designed to raise temperature of mixed feed (NG and steam) from 297⁰ C to 547⁰ C for total flow of 90.971 MT/hr.

With reduction in NG supply and designed S/C ratio, it was difficult to maintain the mixed feed temperature at exit of MFC at about 545 to 547⁰ C. Higher S/C was required to be maintained in primary reformer resulting into inefficient operation of ammonia plant. Following operating constraints were faced with reduction in NG flow during normal plant operation:-

- To maintain coil outlet temperature within design temperature, it was required to feed higher process steam of about 4 t/h with NG in mixed feed coil (MFC).
- Due to higher mixed feed coil exit temperature, tunnel burners could not be fired. This was limiting the better superheat in high pressure (HP) steam of ammonia plant and affecting the turbine performance. Scheme for desuperheating of mixed feed gas by boiler feed water (BFW) was implemented in May-June-2003 turnaround. Scheme is in operation since June-2003 and is performing well. Cost of the implemented scheme was : Rs 20.00 lakhs and financial saving @ 4 MT/hr MP steam is Rs 234 lakhs per annum.

1.3 GRAB loading in HTS & LTS

HT Shift Converter catalyst was replaced with graded alumina balls of 60 mm, 37 mm and 19 mm. LT Shift Converter catalyst was replaced with graded alumina balls of 50 mm, 37 mm and 19 mm. Pressure drop in HTS/LTS has reduced by about 0.5 kg/cm². This has saved about 0.5 t/h MP Steam. The cost of the catalyst loading in HTS/LTS was 12 lakhs. Monetary saving of about Rs. 40 lakhs annually.

1.4 Diaphragm replacement in BFW Pump turbine

New improved indigenous diaphragms are installed in BFW pump turbine. This has saved 4 % MP steam i.e about 300 kg/hr. The cost of the replacement of diaphragm of BFW pump turbine was 37 lakhs (Cost of imported diaphragms are 200 lakhs). There is annual monetary saving of about 23 lakhs.

2.0 UREA PLANT

2.1 Inlet air fan pulley modification in prill cooling system

Inlet air fan is provided to supply air to fluidized bed cooler in urea plant for fluidization and cooling of urea prills. About 60 mm WC pressure loss was observed across the fan discharge dampener. To operate the fan at lower speed to reduce energy consumption, fan drive pulley size was increased from original 765 mm diameter to 875 mm diameter (i.e. 114 % higher size). About 62 kWh power is saved, resulting into financial saving of Rs 25 lakhs per year. Cost of modification was Rs 0.25 lakhs.

2.2 Single reflux pump operation by providing bigger size reflux tank level control valve

During normal plant operation, two reflux pumps were remaining in operation and LICV-1353 was remaining about full open. Reflux tank level (LICV-1353) was replaced with bigger size redundant SS control valve (HICV-1204) to reduce pressure drop in the control valve. Bigger size level control valve remains in operating range with one pump in operation. This has saved about 6.0 kWh of electric power equivalent to annual monetary saving of about Rs 2.6 lakhs.

2.3 Provision of hot CO₂ to first desorber/reflux condenser

For maintaining N/C mole ratio in reflux carbamate condenser, about 200 to 600 kg/h CO₂ is supplied to first desorber or reflux condenser from Hitachi CO₂ compressor. Provision is made to supply hot CO₂ to first desorber from Hitachi CO₂ compressor second stage discharge at 180⁰ C -185⁰ C instead of inter cooler outlet at 40⁰ C to utilize low level heat of CO₂ for stripping in first desorber instead of dumping it to cooling water.

The cost of modifications and providing insulation on hot CO₂ supply line to hydrolyser system was around Rs. 25000. Use of CO₂ from second stage discharge at 180-185⁰ C has save about 1.5 t/d LP steam in desorber. Annually monetary saving is about Rs. 2 lakhs.

2.4 Providing insulation on HP scrubber inlet/outlet CCS II lines

Heat of formation of carbamate produced in HP scrubber (H-1203) is removed by circulating condensate (CCS II). CCS II enters the U tubes of HP scrubber at 119⁰ C (design 120⁰ C) and leaves the scrubber at about 138⁰ C (Design 138.5⁰ C). The CCS II condensate heat is recovered in pre evaporator hot water part by heating urea solution flowing in tube side and cooling the CCS II condensate in shell side from 138⁰ C to 119⁰ C. The cooled condensate from pre evaporator flows to HP scrubber circulation pump (P-1204 A/B) and is pumped to H-1203 through CCS II cooler. During normal plant operation, most of heat of CCS II is recovered in pre evaporator and CCS II cooler remains bypassed.

Cost of providing 2” thick mineral wool insulation on entire length of CCS II inlet and outlet line from HP scrubber was Rs. 1 lakh. The monetary saving is about Rs. 17 lakhs per annum. The pay back period is less than one month..

3.0 UTILITY

3.1 Replacement of bulk effluent pump by smaller capacity pump

Existing (242 M3/hr) bulk effluent pump is replaced with (150 M3/hr). Power consumption of old pump was 35 kWh and power consumption of New Pump is 30 kWh. About 5 kWh power will be saved which is equivalent to Rs. 2.2 lakhs per annum. The cost of the new pump is 2.75 lakhs. The payback period is 1.25 years.

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