Shriram Fertilisers and Chemicals Kota

1. UNIT PROFILE :

Shriram Fertilisers and Chemicals (SFC) is a division of DCM Shriram Consolidated Ltd., a conglomerate of diverse business interests making and trading products critical to the country,s growth. SFC is engaged in the ,manufacture of Urea, PVC, Caustic Soda, Liquid Chlorine, Hydrochloric Acid, Cement.

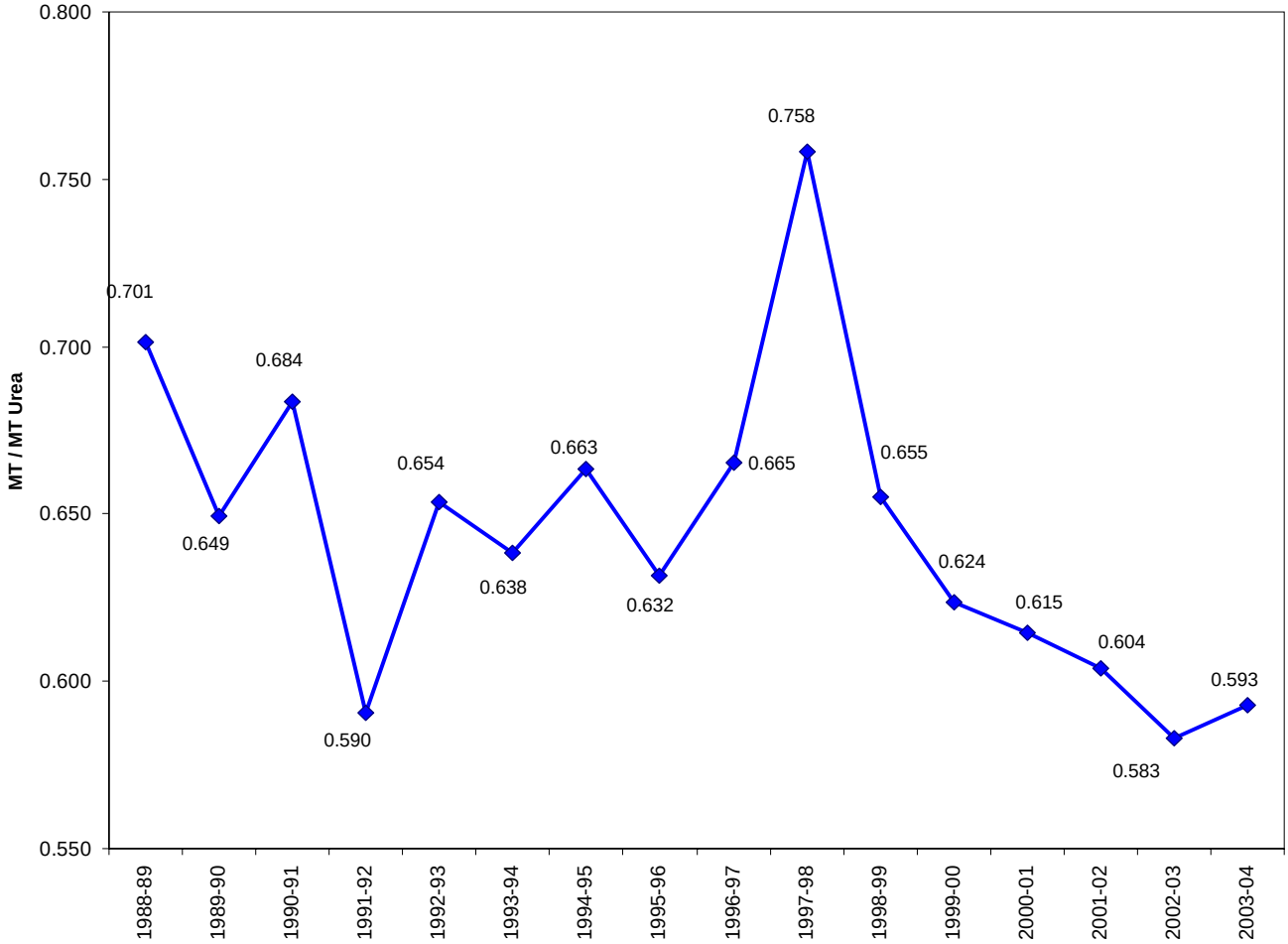
SFC,s complex is located at Kota, Rajasthan. The Fertiliser Unit was commissioned in February 1969 by Chiyoda Chemical Engineering and Construction Co. of Japan. Installed plant capacities were 450 TPD of Ammonia and 700 TPD of Urea.

AMMONIA / UREA PLANT :

Naphtha is the main feedstock for the Plant. The various technology licensors for the Ammonia Plant are Shell of USA, for Naphtha desulphurisation section, Haldor Topsoe of Denmark for the reforming and synthesis sections and Benfield Corporation of USA for the carbon dioxide removal system. Stamicarbon's Total Recycle Process has been utilised in the Urea process scheme.

The Plant capacity was expanded in 1974 to 600 TPD Ammonia and 1000 TPD Urea. New equipments were added to the plants and several equipment were replaced. A separate synthesis loop of 120 TPD capacity was added. With subsequent technology upgradation this loop has now become redundant. Immediately after expansion in 1974 the energy performance of the plant remained below par. Many initiatives were identified and undertaken to improve the performance of the plant since then.This has resulted in remarkable improvements in energy consumption over the years. Apart from some of the major energy conservation schemes the Convertor basket was changed to the radial flow type in 1992. This was followed by replacement of reactor trays in the Urea plant with high efficiency trays.A hydrolyser stripper was also installed to improve effluent quality and save water.

2. ENERGY CONSUMPTION :



Since energy cost form 76% of the production costs energy conservation is a vital aspect of Ammonia - Urea Plants. The key focus has therefore always been on the reduction of energy consumption in the existing plant as well as on incorporating new process schemes into the plant to achieve better and better energy efficiency.

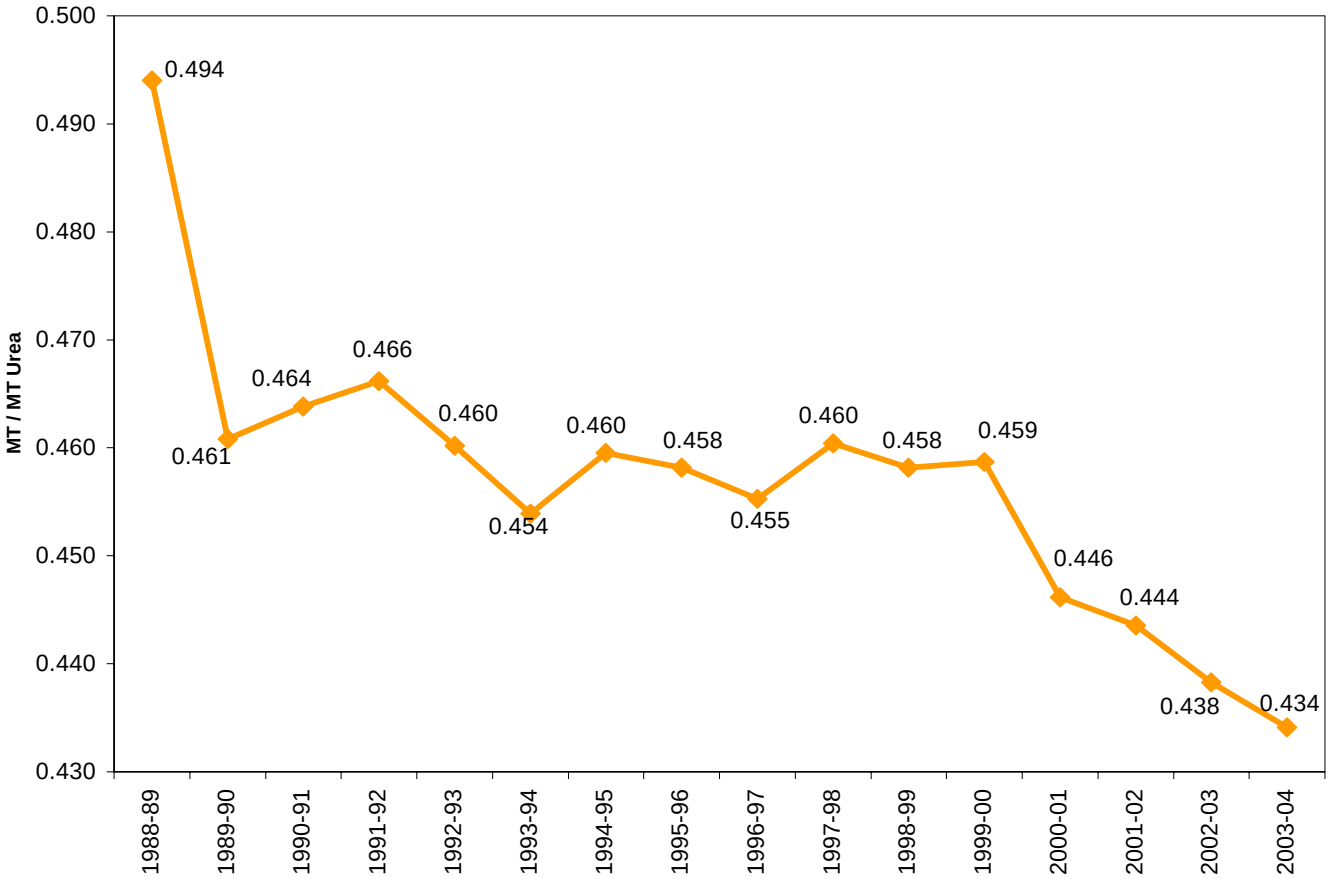
The main energy consumers in the plant are the Primary Reformer, the motor driven positive displacement type compressors and the refrigeration equipment of the synthesis section. A dedicated captive power plant of 35 MW and, to some extent, the State Electricity Board caters to the power requirements of the complex.

In order to avoid energy losses in any form in the plant energy audits are carried out periodically. This includes monitoring of critical plant parameters, steam and water balance, pressure drop surveys etc. Process analysis based on computer simulation of the plant process & various modifications undertaken have drastically reduced the energy consumption.

Thermal Energy Reduction at SFC, Kota

S.No.	Particulars	Unit	2001-02	2002-03	2003-04
1.	Input Consumption :				
	- Naphtha	T/T Urea	0.444	0.438	0.434
	% Reduction over 2001-02	%	-	1.35	2.25
	- Coal	"	0.604	0.583	0.593
	% Reduction over 2001-02	%	-	3.5	1.8
2.	Thermal Energy	MKCal/T	5.49	5.48	5.44
	% Reduction over 2001-02	%	-	0.2	0.9

NAPHTHA CONSUMPTION PER TON UREA



COAL CONSUMPTION PER TON UREA

With consistent efforts Naphtha consumption per ton of Urea has been reduced from the earlier levels of 0.494 to 0.434 MT/MT i.e. a reduction of more than 12%.

The above has resulted in overall energy consumption reduction from levels of 9.02 MKCal/MT Urea to present levels of 7.80 MKCal/MT i.e. a reduction of more than 13% in last 13 years. **To our knowledge our plant is the most energy efficient plant of this vintage based on naphtha feedstock.**

ROLL OF HONOURS

The following Awards have been received by our unit.

1983-84 : FAI Runner Up Award for "Best Production Performance of Nitrogenous Fertiliser Unit".
1989-90 : NPC Award for "Best Productivity Performance in Fertiliser Industry".
1990-91 : FAI Runner Up Award for "Best Production Performance of Nitrogenous Fertiliser Unit".
1990-91 : NPC Award for "Best Productivity Performance in Fertiliser Industry".
1990-91 : RPCB's Award for "Excellence in Pollution Abatement Measures".
1991-92 : National Award for "Public Recognition of Outstanding Activity for Prevention & Control of Pollution".
1993-94 : FAI Award for "Best Production Performance of Nitrogenous Fertiliser Unit".
1993-94 : NPC Award for "Best Productivity Performance in Fertiliser Industry".
1995-96 : FAI Runner up Award for "Best Production Performance of Nitrogenous Fertiliser Unit.
1996 : Energy Conservation Award in the Chemical Sector.
1996-97 : NPC Runner Up Award for "Best Productivity Performance in Fertiliser Industry".

1998 : Star Award SAP R-3/SAP Star Customer Award 98
2000 : National Energy Conservation Award-2000 (Fertiliser Sector)
2003-04 : Greentech Silver Safety Award

3. ENERGY CONSERVATION COMMITMENT, POLICY AND SET UP :

We are committed to be one of the most energy efficient plants in the World and we endeavor continuously to reduce the energy consumption to the levels of new technologically advanced plants. Technical personnel are kept abreast with the State of Art technology in various fields through interactions in various forums. Technical personnel are nominated to participate in national and international technical conferences and the available information and technical inputs are absorbed into the plant processes wherever possible. External agencies are periodically employed to carry out energy audits to enable a fresh view of the systems and processes in operation.

4. ENERGY CONSERVATION ACHIEVEMENTS :

1. Conditioned water is circulated in First stage Carbamate condenser through a pump. Three pumps are installed in the plant for this service. One pump is in operation and two are kept standby.

   It was found that two pumps (Pump A & C) were operating at an efficiency level of 33 % and pump 'B' was operating at 36%.

   A New pump of revised specifications was installed at a cost of Rs. 3.1 Lacs. Thus a power saving of 1.33 Lakh Kwh was achieved.

2. In the Naphtha prefractionation system of Ammonia Plant, No.1 Naphtha reflux pump of 3.7 KW was required to be run to maintain level of reflux drum. As the system operating pressure was 1.5 Kg/Cm2, it was felt desirable to send fuel naphtha directly to the tank without being pumped. However, due to higher system pressure drop it was not possible to do so. A detailed study of the system was carried out and it was found that it could be possible to increase system pressure from existing level of 1.5 Kg/CM2 to 2.0 Kg/Cm2 by changing line size from 1.5" to 2". **The pipeline was replaced from level control valve to fuel tank from 1.5" to 2". Thus with this modification, it was possible to transfer naphtha to fuel tank without pump. A saving of 0.3 Lakh Kwh was realised.**

3. In the Naphtha prefractionation system of Ammonia Plant, naphtha is prefractionated into higher and lower fractions in Prefractionation columns. The upper product from No.1 Prefractionator is used as Process Naphtha. m. Hot naphtha from rebloiler was circulated at the bottom of No.1 Prefractionator to increase its temperature. It was observed that quality of naphtha being received by us has improved significantly. The Final Boiling Point of the naphtha was in the range of 140 – 150 deg C against a design value of 180 deg C. After a detailed technical analysis, it was decided to stop the pump. **A saving of 0.8 Lakh Kwh of power was realised by stopping this pump.**

4. In our Ammonia Plant, CO2 gas is cooled in a direct water cooled cooler before being compressed. There was a once through cooling system in the design and water used for this service used to drain into the effluent. In 1994, a dedicated cooling tower was installed and water could be recycled after cooling. This dedicated

cooling tower has a cold water pump and a hot water pump. It was noted that the pressure of return water was 0.6 Kg/Cm2 and it was possible to stop this pump. Operation of vertical hot water pump was stopped and **a saving of 1.3 Lakh Kwh of power was realised.**

5. In our Urea Plant, Prill Cooling system was installed in 1991 to cool prills from 100 deg C to 50 deg C with atmospheric air. This atmospheric air is sent to a fluidised bed cooler by a FD Fan. The design air throughput of FD fan is 2,05,000 Nm3/Hr and head developed in 280 mm WC. The motor rating of the pump is 265 Kw. Actual measurements of air flow, head developed and power consumption were taken and found much below design values. Since actual flow and head requirements were less these were being obtained by closing suction damper of the fan upto 45%. This closing of suction damper was causing power loss. **A Pulley drive replacing gear box was installed at a cost of only Rs. 0.8 Lacs and a saving of 2.9 Lakh Kwh of power i.e. Rs. 12.8 Lacs was realised.**

6. In our Ammonia and Urea plant cooling towers, there are seven horizontal pumps installed to supply water required for process cooling. These pumps have gland packings to restrict loss of water along the shaft (Drive and non-drive end). Due to the friction between the gland packing and shaft sleeve of the pump, lot of energy is wasted. It was decided to install mechanical seal in two pumps on trial basis. **Power saving of about 220 Kwh per day was realised and also a saving of about 15 M3/Day of cooling water was achieved.**

5. ENERGY CONSERVATION PLANS & TARGETS :

In the Ammonia Plant several schemes for energy conservation are under consideration.

Some of the major upcoming projects listed below illustrate the thrust on energy conservation measures.

- The Changeover of feed stock from naphtha to LNG/Gas
- Installation of a Combustion Air Preheater in the primary reformer,
- Revamp of CO2 Removal section
- Installation of New Methanator heat exchanger etc.
- Heat Recovery from 1st stage Carbamate condenser in Urea Plant

We are planning to install a system in which preheated air will be used. The atmospheric air will be heated up by flue gases leaving reformer at 220 – 225 deg C. This is expected to reduce energy consumption by about **3.5 MKCal/Hr**.

The energy consumption in our CO_2 removal section is very high compared to modern gas based plants. We are planning to revamp this section by installing a flash vessel and replacing existing activator with a better one. An energy saving of about **4.1 MKCal/Hr**. is expected with this scheme.

In Ammonia Plant, Carbon Monoxide present in the raw synthesis gas is converted to CO_2 in two stages, first at high temperature followed by low temperature. The low temperature reaction is carried out in a reactor called Low Temperature Shift Reactor. The pressure drop in this reactor is very high. To reduce pressure drop we are planning to install an additional reactor in parallel to existing one. This is expected to save about **1.1 MKcal/Hr** of energy.

In the urea plant revamp of the synthesis section is being studied alongwith enhanced heat recovery from the first stage carbamate condenser. This is to be finalized and implemented in next two years to bring down the steam and power consumptions in the Urea plant.

6. ENVIRONMENT AND SAFETY :

In line with our commitment to preservation of the environment and improvement of our safety performance we have embarked upon a new initiative to implement the safety management system as formulated by the British Safety Council. The system, under advanced stage of implementation covers not only the operating personnel but also the contract workmen as well as persons engaged in commercial functions. This is expected to be fully in place by November 04.

In our pro active approach to the subject we have installed and built in adequate pollution control devices so as to prevent any discharge of effluents or emission of gases. Electrostatic Precipitators have been installed in the power plant. The fertiliser plant effluent is treated and pollutants are removed and recycled to the process. Special attention has been accorded to create a clean and green environment in the plant and towards this goal about 2.20 lac trees have been planted.

A new Hydrolyser Stripper System has been installed in Urea Plant at an expenditure of Rs. 6.3 Crores. This has resulted in improving effluent quality significantly. The discharged water is now being used as boiler feed water/cooling tower make up instead of being drained.

Our unit has received recognition at the national level in 1991-92 for Prevention and Control of Pollution from the Govt. of India. Again in 2003-2004 the unit has received the Greentech Silver Safety Award for our performance in the field of EHS.

Our Fertiliser and Power plants have been certified for ISO-14001 and OHSAS-18001.

Safety of manpower is accorded highest priority and all measures are taken to ensure safe operation. Continual training is given to the operating staff and workmen so that all operations are carried out safely and there are no accidents. Safety audits of the buildings, plants, equipments and rotating machinery are carried out by in-house safety officers every month and external agencies once a year to identify and rectify any short comings.

Operating practices and safety practices are audited periodically and improved by benchmarking with the best practices world over.

Any new change or modifications are subjected to HAZOP studies and adequate measures are taken at the design stage itself.

Competitions on safety awareness are organised to further reinforce the concept of safe working. Training is also accorded to any contract labour engaged for working in the factory.

WRITE UP ON ENERGY SAVING SCHEMES IMPLEMENTED DURING 2003-04

1. Installation of a more efficient conditioned water pump in Urea Plant

Background of the project :

Conditioned water is circulated in First stage carbamate condenser through a pump. Three pumps are installed in the plant for this service. One pump is in operation and two are kept standby. As a routine their current efficiencies were checked.

Efficiencies of all the three pumps were checked individually by following method:

- The input power to the motor was measured with the help of Energy Manager.
- The flow was measured with the help of Orifice meter installed on line.
- Head was measured with calibrated Differential pressure gauge mounted on suction and discharge piping.

Observations made :

It was found that two pumps (Pump A & C) were operating at an efficiency level of 33 % and pump 'B' is operating at 36%. The input power to motors of each of these pumps were measured and it was found that Pump 'A' & 'C' were consuming 98 & 93 KW respectively and pump 'B' consumed 85 KW.

After above observations, it was decided to keep pump 'B' in continuos operation till new more efficient pump is procured. Thus power saving of **8KW** was realised immediately.

Technical and financial anaylsis :

Design specifications of the pump were reviewed. The design head was 23 m while actual measured head was only 12 m. Also calculated pressure drop for existing piping, fittings and heat exchanger (i.e. complete loop) was 12 m for the required flow (850 m^3/ Hr). Thus new design specifications for the pump and motor were specified for procuring new pump .

Impact of Implementation :

The new pump was commissioned and is in continuos operation since then. The input power to the motor was measured along with flow and pressure drop and **a saving of 1.33 Lakh kwh has been obtained**.

2. Stoppage of one Naphtha Reflux pump in Ammonia Plant by increasing line size and system pressure

Background of the project :

In the Naphtha prefractionation system of Ammonia Plant, No.1 Naphtha reflux pump of 3.7 KW was required to be run to maintain level of reflux drum by pumping fuel naphtha to Fuel Tank. During energy survey it was observed that this pump could be stopped as the column pressure was sufficient and that the fuid can be sent to the tank without pumping.

Observations made :

As the system operating pressure was 1.5 Kg/Cm2, it was felt desirable to send fuel naphtha directly to the tank without being pumped. However, due to higher system pressure drop it was not possible to do so.

Technical and financial anaylsis :

A detailed study of the system was carried out and it was found that it could be possible to increase system pressure from existing level of 1.5 Kg/CM2 to 2.0 Kg/Cm2. The line size was also increased from 1.5" to 2" to reduce pressure drop. The pipe of required length and size was available in house.

The pipeline was replaced from level control valve to fuel tank from 1.5" to 2". Thus with this modification, it was possible to transfer naphtha to fuel tank without pump.

Impact of Implementation :

A saving of 0.3 Lakh Kwh of power was realised by stopping this pump.

3. Operation of one Naphtha Reboiler Pump in Ammonia Plant was stopped due to better naphtha quality.

Background of the project :

In the Naphtha prefractionation system of Ammonia Plant, naphtha is prefractionated into higher and lower fractions in Prefractionation columns. The upper product from No.1 Prefractionator is used as Process Naphtha. Necessary heat is supplied through a Reboiler by injecting 36 K Steam. Hot naphtha from rebloiler was circulated at the bottom of No.1 Prefractionator to increase its temperature.

Observations made :

It was observed that quality of naphtha being received by us has improved significantly. The Final Boiling Point of the naphtha was in the range of 140 – 150 deg C against a design value of 180 deg C.

Technical and financial anaylsis :

Operating data of the prefractionation system and quality parameters of naphtha being received were collected and studied. After a detailed technical analysis, it was decided to stop the pump.

Impact of Implementation :

A saving of 0.8 Lakh Kwh of power was realised by stopping this pump.

4. Stoppage on Vertical Hot Water pump installed in Ammonia Plant for CO2 Cooler dedicated cooling tower.

Background of the project :

In our Ammonia Plant, CO2 gas is cooled in a direct water cooled cooler before being compressed. There was a once through cooling system in the design and water used for this service used to drain into the effluent. In 1994, a dedicated cooling tower was installed and water could be recycled after cooling. This dedicated cooling tower has a cold water pump and a hot water pump.

Observations made :

The vertical hot water pump is used to pump return water to the top of the cooling tower. It was observed that the pressure of return water was 0.6 Kg/Cm2. There was a natural gradient available and it was expected that the water could be sent to the top of the dedicated cooling tower without repumping.

Technical and financial anaylsis :

Initially, for experimental purpose, the pump was stopped to see whether return water can go upto top of the tower without a pump. After this experiment, the operation of the vertical hot water pump was stopped. Now the hot water is returning by its own pressure.

Impact of Implementation :

Operation of vertical hot water pump was stopped and a saving of 1.3 Lakh Kwh of power was realised.

5. Replacement of Gear Box with Pulley Drive in F. D. Fan of Prill Cooling System of Urea to reduce power consumption .

Background of the project :

In our Urea Plant, Prill Cooling system was installed in 1991 to cool prills from 100 deg C to 50 deg C with atmospheric air. This atmospheric air is sent to a fluidised bed cooler by a FD Fan. The design air throughput of FD fan is 2,05,000 Nm3/Hr and head developed in 280 mm WC. The motor rating of the pump is 265 Kw.

Observations made :

Actual measurements of air flow, head developed and power consumption were taken. These are given below :

- Actual air flow	:	1,40,000 to 1,90,000 Nm3/Hr.
- Head developed	:	125 to 178 mm WC
- Power consumed	:	148 to 155 Kw

Technical and financial anaylsis :

As can be seen above, the actual values are much less than those of design values. Since actual flow and head requirements were less these were being obtained by closing suction damper of the fan upto 45%. This closing of suction damper was causing power loss.

Several possible options were studied to reduce power consumption of the fan. The most cost effective solution was to replace gear box by a pulley drive. In this option, flow across the fan was reduced by reducing Fan RPM which in turn increased fan efficiency as lower is the fan speed lower are the losses due to eddies and friction.

Impact of Implementation :

Pulley drive was installed at a cost of only Rs. 0.8 Lacs and a saving of 2.9 Lakh Kwh of power i.e. Rs. 12.8 Lacs was realised.

6. Conversion of gland packing to mechanical seal in two out of seven cooling water pumps to reduce power consumption .

Background of the project :

In our Ammonia and Urea plant cooling towers, there are seven horizontal pumps installed to supply water required for process cooling. These pumps have gland packings

to restrict loss of water along the shaft (Drive and non-drive end). Due to the friction between the gland packing and shaft sleeve of the pump, lot of energy is wasted.

It was decided to install mechanical seal in two pumps on trial basis. Following observations were made during installation :

Observations made :

- Gland plate had to be modified to suit the pump.
- It was felt necessary during installation that provision of 'O' ring should be there in shaft sleeve.
- To facilitate the adjustment of sleeve, it was felt that a small collar at a defined distance should be provided.

Technical and financial anaylsis :

After the installation of seal, no water spillage was observed. Electrical power consumption of the pumps were also checked and a reduction in power consumption was observed.

Impact of Implementation :

Power saving of about 220 Kwh per day was realised and also a saving of about 15 M3/Day of cooling water was achieved.