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MODERNISATION OF KRIBHCO'S FERTILIZER PLANT[1]

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SUMMARY

After commissioning of Kribhco's plants in 1985 and subsequent years of stabilizing and debottlenecking, the capacity attained in ammonia plant was around 1500 MTPD. Spiralling energy and mushrooming capital costs of the grassroot plants have led to widespread enthusiasm for revamp of the comparatively older generation plant. It is quite attractive these days to revamp/modernize such plants for improving energy efficiency and/or increase plant capacity and adopting technological upgradation measures after careful cost benefit analysis. Assessment of potential for energy savings and capacity upgrade was carried out. In the first phase of modernization in-situ, modification in ammonia converter resulted in energy reduction by 0.257 Gcal/mt ammonia and sustained steady capacity of about 1550-1575 MTPD. In the second phase of modernization, conversion to digital control system, on-line optimization of ammonia and power plant, and primary reformer revamp by changing of old tubes with a better material and higher catalyst volume were carried out.

Next phase of retrofit is to upgrade capacity to 1650 MTPD in each ammonia plant with lowered energy consumption and incorporation of vacuum preconcentrator, medium pressure predecomposer in urea plant to improve upon energy consumption. Paper outlines Kribhco' efforts in its past and future plants.

RESUME

Après réception des ateliers Kribhco en 1985 et les années suivantes de stabilisation et de désengorgement, la capacité atteinte dans l'unité d'ammoniac était d'environ 1500 t/j. Les coûts fluctuants de l'énergie et croissants en capital de l'unité d'origine ont conduit à considérer avec enthousiasme la réhabilitation de l'unité de génération relativement la plus ancienne. Il est très intéressant actuellement de réhabiliter / moderniser ce genre d'installation pour améliorer le rendement énergétique et/ou augmenter la capacité de l'unité en adoptant des mesures d'améliorations technologiques après analyse précise du gain de prix de revient. La détermination des possibilités d'économie d'énergie et d'augmentation de capacité a été effectuée. Lors de la première phase de modernisation in-situ, la modification du convertisseur d'ammoniac a entraîné une réduction de l'énergie consommée de 0,257 Gcal/t d'ammoniac et une capacité soutenue d'environ 1550-1575 t/j. Dans la seconde phase de modernisation, la conversion en un système de contrôle digital, l'optimisation en ligne de l'unité d'ammoniac et de production d'énergie et la réhabilitation du reformer en chargeant les anciens tubes avec une meilleur matériau et un volume accru de catalyse ont été réalisées

La prochaine phase d'amélioration consistera à faire passer la capacité à 1650 t/j dans chacune des unités d'ammoniac avec une consommation moindre d'énergie et l'incorporation d'un préconcentrateur sous vide dans l'unité d'urée pour améliorer la consommation d'énergie. L'exposé décrit les efforts de Kribhco dans les unités anciennes et futures.

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INTRODUCTION

Kribhco is operating two gas based ammonia plants of capacity 1350 MTPD each based on process technology of M W Kellogg, USA. Urea plants are having four streams of 1100 MTPD each based on process technology of Snamprogetti, Italy. The plants were commissioned in December 1985 and commercial production started on 1st March, 1986. The ammonia plants were designed in early eighties with energy consumption of 8.44 Gcal/MT. Urea plants design energy consumption was 6.327 Gcal/MT. In modern ammonia plants energy consumption levels of 6.8 Gcal/MT have been achieved so far. In Kribhco continued efforts have been made to improve capacity utilisation and bring down energy consumption in plants by various modifications. The performance of Kribhco plants in terms of capacity utilisation and energy consumption over the period since commissioning is given in Table 1.

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[1] *Modernisation de l'unité d'engrais Kribhco*

After commissioning of plants a number of teething troubles were faced before the plants were stabilised with incorporation of suitable remedial measures. Later on ammonia plants were operating consistently at the level of 1500 MTPD each. The major problems faced are described briefly in this paper. A reduction in energy consumption and a capacity upgrade have been carried out. In the first phase of modernisation, in-situ modification in ammonia converter resulted in saving in energy consumption by 0.257 Gcal/MT ammonia and sustained steady capacity of 1550-1575 MTPD. In the 2nd phase of modernisation, conversion of conventional pneumatic instrumentation to DCS system, on line optimiser of ammonia plant and primary reformer revamp by changing of old tubes with thinner tubes of improved material were carried out. Next phase of retrofit is to upgrade the production level of each ammonia plant to 1650 MTPD or above without jeopardising reliability.

KRIBHCO achieved about 93.5% capacity utilisation of ammonia plants and 97.4% of urea plants in the very first year of its commercial production in 1986-87. Since then Kribhco has steadily improved its performance in the subsequent years while striving hard for energy conservation, cost reduction, pollution abatement and ecological development. Energy, Efficiency and Environment had been watchwords and key factors for organisation's success. With new targets of achievements in all the fields including production, despatches, energy conservation and safety of the plant, Kribhco has won many laurels through awards and honours.

In order to achieve efficient operation Kribhco's efforts have all along been in these directions:

- Achieve high capacity operation.
- Maximise uninterrupted operation to achieve maximum on stream days.
- Constant monitoring of energy consumption and ensuring process parameters within design or better than design conditions and modifications to check energy losses.

In achieving these objectives many problems were overcome since initial stages of operation.

I. PROBLEMS FACED

1. Secondary Reformer's Catalyst Failure:

In March, 1986, after about four months of operation since commissioning, methane content exit secondary reformers started increasing from 0.3% (design) to gradually 1% over a period of one month.

On inspection it was found that approximately one-third of catalyst bed from top had been fused due to high temperature exposure.

Direct impingement of flame on catalyst possibly caused exposure of catalyst beyond the fusion temperature. Further the minimum distance between tip and catalyst bed should have been 2 times the neck diameter and in this specific case the gap should be 1725 mm against which actual gap was 1250 mm.

The gap between top of target tiles and tip of the burner was increased to 1570 mm by reducing the height of alumina balls by 200 mm at the bottom as shown in Figure 1. The burner tip was also modified by blocking the bottom holes and incorporating baffles in the side holes for increasing air velocity which in turn helped in proper mixing of air and natural gas in order to avoid direct impingement of flame.

2. Benfield Solution Carry Over:

Benfield solution was being carried over from CO_2 absorber top to down stream exchanger 136-C (Syn compressor interstage cooler) causing corrosion of tubes and their failure. The problem was occurring despite the fact that both absorbers and down stream separator have demisters.

The absorber and separator demisters were changed with a density of 192 kg/m^3 compared to 144 kg/m^3 original. The thickness were also increased to 150 mm (earlier 100 mm). These modifications have solved the carry over problem and there had been no tube failure since then.

3. **CO_2 Compressor Seal Loss Recovery System:**

The major bottleneck in urea plant capacity in a natural gas based ammonia-urea plants is limited CO_2 availability. Due to this problem, it is not possible to convert entire quantity of ammonia production to urea. The problem in Kribhco further aggravated due to loss of CO_2 through compressor seals. As per design CO_2 loss through seals is about 500 Nm^3/hr per compressor. Due to this problem front end ammonia plants need to be operated at higher load to generate additional CO_2 for increasing urea production which led to higher energy consumption.

The seal loss recovery system installed at Kribhco consists of an ejector wherein CO_2 gas at a pressure of 23 ata and a temperature of 204°C from compressor second stage discharge is used as motive fluid. The seal losses are recovered by the CO_2 ejector as shown in Figure 2. Motive fluid is drawn from the compressor 2nd stage discharge consumes extra quantity of steam for re-compression of the same. In order to decrease energy consumption a cooling water jacket has been provided at the discharge of ejectors to bring down CO_2 temperature at compressor suction. By recovering seal losses it has been possible to increase urea production by 127 MTPD.

4. **Catalyst Damage in Hydrogen Removal Reactor in Urea Plant:**

Hydrogen removal reactors have been installed in urea plants to reduce H_2 content in the CO_2 stream to 5 ppm so that vent gas mixture is rendered non-explosive. Catalyst used in the reactor is palladium, platinum and rhodium on calcium carbonate and alumina base.

During operation of the reactor it was observed that contaminated whitish condensate started coming from condensate separator when flow through reactor was increased 60% of design.

After opening of R-2 for inspection it was observed that catalyst level had gone down 6 "below the top of the basket and the top 2" layer was full of catalyst powder due to attrition of catalyst pellets at the top portion.

The study of the problem revealed that the flow of gases was from bottom to top and under this flow pattern the catalyst bed could not remain packed. Fluidisation resulted in attrition and breakage of catalyst even though empty space is filled with alumina balls.

After study, following modification were carried out initially in stream - 11 in April'95 as shown in Figure 3.

(a) The flow through the reactor was reversed by interchanging Inlet & outlet lines.
(b) Catalyst was charged in the basket up to 1300 mm level.
(c) Top empty space of approximately 250 mm was filled with alumina balls and top cover flange grip was tightened by providing additional bolts.

With the above modifications, increase of flow to above 100% was possible and no milky condensate was observed afterwards indicating good catalyst condition. This helped to keep H_2 content in MP vent gas out of explosive range and saved the costly catalyst.

II. MODIFICATIONS TO REDUCE ENERGY CONSUMPTION

1. **Purge Gas Recovery Unit:**

A purge gas recovery unit based on cryogenic separation was installed in 1989. The PGR unit is designed to recover ammonia and hydrogen contained in the purge gas from the ammonia synthesis section. The unit consists of three main process/sections in series:

- Ammonia recovery section consists one washing column to wash ammonia from purge gas and one distillation column to recover ammonia.

- Adsorption section consists two adsorbers to adsorb ammonia and water present in the purge gas coming from ammonia recovery section.

- Hydrogen recovery section contains one cold box based on cryogenic system to recover hydrogen from the purge gas.

The designed capacity of this unit is 20,000 Nm^3/hr of purge gas. The guarantee is to recover 90% H_2 and reject 95% inerts from purge gas. The recovered H_2 is fed to the suction of 2nd stage of synthesis gas compressor at 55 kg/cm^2 g pressure. The tail gas is fed to fuel system of the plant. Increase in ammonia production is about 115 MTPD and the overall energy saving is about 0.133 Gcal/MT of ammonia.

2. **Energy Savings During Cold Start-Up and LT Guard Catalyst Reduction of Ammonia Plant:**

Natural gas used for heating catalysts of the desulphuriser and LT shift converter and as carrier gas during LT guard catalyst reduction was being vented. A system has been installed to utilise the vent gas in fuel system. The system comprises a natural gas cooler for reducing gas temperature to 50°C before mixing with fuel gas. In addition a bypass line has been provided on LT shift, converter to facilitate on stream LT shift catalyst change and reduction while ammonia plant remains in operation at 70% load with LT guard only. LT guard reduction is carried out at 8 kg/cm^2 pressure (earlier 5 kg/cm^2) so that the carrier gas can be recycled to fuel system.

3. **Provision of Baffles in Primary Reformer Convection Section of Ammonia plant: (Figure 4)**

It was observed during operation that flue gas passing through steam super heater coil has a temperature difference of about 100°C in both ends of duct resulting in lesser recovery of heat by superheater coil. It was observed that gap provided for expansion of tubes on free end was excessive which was allowing the gas to by-pass the coils. Baffles (Alloy 800 H) were provided on expansion end to change the flow pattern and avoid channelling. The modification was successful and the temperature difference reduced from 100°C to 25°C only, resulting energy savings of about 0.017 Gcal/MT.

III. MODERNISATION AT KRIBHCO

Ammonia plants were stabilised at a production level of 1550 MTPD, after overcoming the plant problems and implementing various modification during early stages of operations.

Advances in technology have made it possible to retrofit old ammonia plants to achieve low energy consumption and higher capacity utilisation. Assessment of energy saving and capacity upgrade was carried out. In the first phase of modernisation, in-situ modification in ammonia converters to reduce energy consumption and sustained steady capacity of 1550-1575 MTPD was carried out. In the 2nd phase of modernisation, conversion of conventional pneumatic instrumentation to DCS system, on line optimiser and primary reformer revamp by changing of old tubes with thinner tubes of improved material and higher catalyst volume were carried out. The schemes are mentioned in detail as under:

1. Ammonia Converter Retrofit:

The original ammonia converter was a axial-three bed quench type Kellogg converter. A feed/effluent exchangers was installed at the top of converter inside the pressure shell which renders it bottle shaped.

The retrofit of converter and other related jobs in Ammonia Plant-II was completed in December, 1993 and full production resumed after reduction of the catalyst.

The old cartridge configuration was changed from 3 bed, 2 quenches to 3 bed with one quench between the 1st and 2nd bed and interchange between the 2nd and 3rd bed. The configuration is shown in Figure 5.

Ammonia Casale S.A., Switzerland had designed the converter retrofit. Their scope included design engineering, supply of components/internals, erection and commissioning supervision.

a. Main Features:

The main features of the retrofit are:

i) The gas flow was changed from axial to axial/radial. In the old converter gas passes through a total catalyst depth of about 9 M. The pressure drop was 3.4 kg/cm^2. Changing to radial flow the gas travels through a catalyst bed of about 0.6 meter. This configuration substantially reduces the pressure drop across the catalyst bed.

ii) Catalyst of size 6 to 10 mm was changed to smaller size of 1.5 to 3 mm without increase in pressure drop through the bed. The smaller sized catalyst provides surface area of 11 to 16 M^2/gm compared to 3 to 8 M^2/gm in case of larger size. Therefore, higher ammonia concentrations are achieved upon use of smaller catalyst.

iii) Introduction of gas / gas exchanger between second and third catalyst bed eliminates the quench and provides thermodynamic advantages in improving the conversion further. The converter temperature vs. ammonia concentration profile before and after retrofit is shown in Figure 6.

b. Erection of Internals:

In-situ modification is so conceived that a new catalyst basket is created within existing basket by assembly of outer and inner collector panels leaving space in between for gas to flow in radial direction in each bed.

At first, the bottom diaphragm of each bed is either cut open or altogether removed as in 3rd bed by plasma cutting. In 1st and 2nd beds perforated diaphragms are covered by new segmental performed plates and welded together. In 3rd catalyst bed length is extended by removing the bottom diaphragm altogether. A new layer of castable refractory is laid on the top of existing refractory and trowelded to a particular shape which is then covered by performed plates.

Outer collectors are then assembled in individual beds and welded together after proper alignment and gap adjustment between the existing wall. This is followed by erection of inner collectors and inter bed exchanger in proper sequence.

c. Other Modifications Required:

After retrofit of ammonia converter the temperature of syn gas at outlet increases to 370°C against earlier design temperature of 321°C due to improved ammonia conversion. The existing syn gas pipe line was therefore replaced with higher grade alloy P-22. Also an additional boiler feed water preheater (123CA) has been installed between converter and existing BFW preheater. Modification in BFW network by way of relocation of exchanger have also been carried out to improve heat recovery.

d. Benefits of Converter Retrofit:

The modified configuration of internals and use of smaller catalyst leads to following changes:

- Increase in ammonia concentration and thereby reduction in syn gas recirculation rate.
- Reduction in converter and syn loop pressure drop.
- Increase in syn gas temperature exit converter.

As a result of the above changes the following benefits are achieved.

i) Power consumption of syn gas compressor reduces due to reduced recirculation flow and lower pressure drop.

ii) The increased NH_3 concentration facilitates more ammonia condensation in water cooled condenser (124-C) thus reducing power consumption in refrigeration compressor.

iii) Increased conversion and resulting higher temperature of syn gas exit converter improves heat recovery in boiler feed water preheater at the downstream.

The changes in operating variables were observed after retrofit (at 1520 MTPD) as follows:

	Before	After
Syn loop pressure, kg/cm^2	200	165
Converter NH_3 conc. % inlet / outlet Temperature °C inlet / outlet	 2.15 / 14.5 144 / 321	 2.16 / 17.1 143 / 370
Increase in NH_3 conc. %		2.6%
Pressure drop kg/cm^2 Converter Syn. Loop	 3.5 13	 2.2 9

The overall reduction in energy is about 0.257 Gcal/MT ammonia. Further the capacity of syn loop has increased to 1670 MTPD. Due to savings in natural gas additional ammonia production of about 70 MTPD urea has been achieved.

2. On Line Optimiser for Ammonia Plant:

The ammonia plants originally had the Taylor 1400 Series pneumatic control system. The plant instrumentation was based on pneumatic controls and IR analysers with one gas chromatograph for methane in NG analysis. Concept of advanced control techniques like multivariable controllers and (close loop) control loops and measurement points from pneumatic to the modern distributed control system (DCS) consistent with the requirement of optimiser was implemented. Mass spectrometer were installed for fast and accurate measurement of process gas composition. KRIBHCO has implemented closed loop optimiser in Ammonia-II and open loop optimiser in Ammonia-I. The plant sections offering opportunities for tighter control and performance improvement were included in the optimization software.

The optimiser project covered installation of DCS system from M/s Siemens, host computer and communication link from M/s Digital Equipments India Ltd., mass spectrometer from M/s Perkin Elmer,US and its communication link from M/s Turnbull Corporation, Madras, and also selected field instruments were converted to electronic system compatible with Siemens DCS. The optimisation software, the heart of the project, were developed by two different renowned suppliers. In Amm-1 it was supplied by M/s ICI, UK and in Amm-2 by M/s Dynamic Matrix Control, USA and M/s Tensa Services, USA.

The hardware scheme of the optimizer is shown in Figure 7.

The Main Features Incorporated for Close Loop Optimiser of Ammonia-II are:

1. Optimiser On/Off switch for each controller and one Common Global On/Off switch was configured at DCS Level.

2. Provision of one software switch was made to transfer control to DCS level.

3. Separate displays on OS, indicating DCS controller set point (DCS-set point) and set point sent by optimiser (DMC-set point) were configured. This was done to ensure that both DCS set points and DMC-set point are tracking each other.

4. DCS / VAX interface link watchdog algorithm was developed at DCS level.

5. Software logic was incorporated to ensure that optimiser program is running and DCS - VAX data link is healthy.

The Main Features of Close Loop Optimiser of Ammonia-II:

The ammonia-I, open loop optimisation package supplied by M/s ICI, U.K. calculates performance figures and gives deviation between the true optimum condition, and current operating condition of the plant. The program generates advisory information for optimising the plant performance. This advisory information is sent back to DCS to display on OS (operator station).

Following functions are provided by the system:

- Monitor Present Plant Performance.
- Provide operational suggestion to improve performance.
- Information about state of the plant.

The advisory information generated by the optimiser was interpreted and used for plant operation.

The close loop package was commissioned in off line mode, with the repeated simulations. Fine tuning of weighting factor is first done using known set of data and then using on line data. The prediction mode operation on real time process data enabled verification of expected performance of the Multivariable Control System.

Benefits Achieved by Optimisation:

The on-line optimisation technique has been implemented in ammonia plant for the first time.

Benefits derived from the Implementation are:

1. Saving in terms of specific energy consumption 1.25% energy saving was achieved from close loop optimisation.

2. Smooth and tight control at steady state operation improved plant and equipment life.

3. Increased operator awareness in plant / process behaviour and interactions. Improved monitoring of plant performance.

4. Continuous and consistent operation of plant very close to operating constraints with safety.

3. Primary Reformers Revamp:

Primary reformers in ammonia plant are Kellogg designed top fired type. There are 504 tubes originally of HK-40 alloy.

The main breakthrough in the last decade was the development of an improved high temperature alloys HP 40 modified. This alloy has a much higher nickel content than HK-40. The improved metallurgy results in reduced thickness of catalyst tubes consequently accommodate more catalyst tube.

After 9-10 years of service old HK-40 tubes were replaced with H39 WM paralloy (0.4% C, Cr 25%, Ni 35%, Nb 1%) tubes. New tube with 85.1 mm ID and thickness 10.7 mm accommodate 9 M^3 more catalyst.

Benefits:

1. Thinner tubes of higher catalyst volume has reduced tube wall temperature by about 20°C compared to original tubes.

2. Pressure drop across primary reformer was reduced from 4.0 kg/cm^2 to 2.5 kg/cm^2.

3. Primary reformer through-put could be increased considerably due to higher catalyst volume, lower tube wall temperature & lower pressure drop.

Future Plans

Ammonia Plant:

Although the plant performance over the years has been persistently good with acceptable level of energy consumption, good capacity utilisation and high on-stream days, it is felt that potential exists to enhance plant capacity and reduce energy consumption substantially without jeopardising reliability and safety of the plant.

The vintage of Kribhco's plants as mentioned is of early eighties and since then quite a number of significant improvements have been accomplished and these have been incorporated in many running plants elsewhere in the world. Kribhco has also incorporated latest technology for converter retrofit and primary reformer revamp. This has lead to significant mismatch of in-built capacity in reformation, CO_2 removal and synthesis section of the plant posing limitations for running the plant at maximum capacity.

M.W. Kellogg, the original designer of the ammonia plants was entrusted for making a feasibility study to upgrade capacity and reduce specific energy consumption keeping in view the scarcity of natural gas supply without any major modification in the plant.

The feasibility study identified limitations for achieving the 1650 MTPD capacity with 8.03 Gcal/MT specific energy and recommended following modifications.

Changing of fuel in reformer:

Existing feed preheater 103-B can be modified to NGL/naphtha vaporiser service and vaporised fuel mixed with tail gas/natural gas were burnt in arch/tunnel burners to overcome the shortfall of NG.

For firing vaporised NGL/naphtha replacement of existing arch and tunnel burners has been recommended.

Additional Process Air Compressor:

Parallel air compressor to augment the process air capacity common for both units is proposed.

Carbon-dioxide removal section:

Addition of UOP additive ACT-1 in Benfield solution for capacity increase has been suggested.

In the recommendations of M/s. M.W. Kellogg, they have indicated that the potential up to 1800 MTPD could be possible with certain changes in the ammonia plant for which a detailed study is required.

M.W. Kellogg in their study (1650 MTPD) have identified following bottlenecks which needs a detail study :

a. Primary Reformer:

In the reforming area, capacity of ID and FD fans would be inadequate and would require replacement. The radiant section, convection coils and the combustion air preheater should perform satisfactorily. The replaced arch burners should be satisfactory for 1800 MTPD rate, using vaporised NGL/naphtha fuel.

b. CO_2 Removal System:

The solution pumps (107-J/108-J) would require replacement at high capacity. In addition, the existing packing in some or all of the absorber and regenerator sections would require replacement with IMTP packing.

c. Synthesis Gas Compressor:

The rotors of both cases of the compressor would require modification for the future capacity increase. The steam turbine may also need modifications. Addition of suction chillers should be considered to avoid modification of steam turbine.

d) ***Synthesis loop:***

The synthesis loop modification would be required to increase the overall ammonia conversion. This can be achieved by installing relatively small add-on Kellogg Advanced Ammonia Process (KAAP) converter in series with the existing ammonia converter. The KAAP converter catalyst is promoted ruthenium on the proprietary support. Increased conversion significantly reduces the circulation flow in the synthesis loop and enables operation at higher capacity. The process parameters will be selected such as to stay with the flow limitation of the existing purge gas recovery unit. Add-on converter can be designed to give ammonia concentration over 20% in the outlet stream. Down stream of the add-on reactor, a waste heat boiler is to be added to recover high level heat for generating steam.

Accordingly initiative was taken by Kribhco to undertake the 1800 MTPD feasibility study before implementation of M.W. Kellogg's recommendations to upgrade the capacity.

Retrofit scheme will be finalised through techno-economic feasibility study, after selection of suitable options from both studies to achieve the desired objectives.

Urea Plant

Urea plants are commissioned in December 1985 and since then plants are running more than 100% capacity utilisation. As plants are becoming older their efficiency and capacity can be improved by in-corporating latest technological developments. The revamp/retrofit measures in the existing plants are very cost effective. To assess the operating conditions with respect to energy, product quality, etc. Snamprogetti, Italy was entrusted to carry out the energy audit in urea plant.

Snamprogetti has studied five different alternatives for improvement of the process taking into consideration the latest design features of Snamprogetti and has finally recommended the alternative consisting of vacuum preconcentrator and M.P. predecomposer as the most cost effective alternative for the existing plant.

Snamprogetti has done similar retrofits in Hydro Agri, Bransbuttel, Germany and Fauji Fertilisers, Pakistan. It was found that above option also meets the objective of reducing energy consumption and improving product quality from the present level of operation. The scheme offers the advantages of simultaneously debottlenecking the operation of the upstream section. The proposed scheme consists of vacuum preconcentrator, MP pre-decomposer, connected auxiliaries and piping.

Vacuum Pre-concentrator:

Vapours coming from the separator of MP decomposer and carbonate solution from the discharge of medium pressure carbonate pumps after mixing will be diverted to shell side of vacuum preconcentrator for heat recovery prior to condensation in existing medium pressure condenser with cooling water as its cooling medium. This will minimise the loss of recoverable heat which is at present being wasted in cooling water and reduced the heat load of 1st stage evaporator resulting substantial saving of LP steam in urea plant.

M.P. Pre-decomposer:

For effective utilisation of additional low pressure steam made available with incorporation of vacuum preconcentrator, the pressure of this low pressure steam is boosted up from 4.5 kg/cm^2 to 5.3 kg/cm^2 with an ejector using medium pressure steam as the motive fluid. This 5.3 kg/cm^2 steam is used as heating medium in the shell side of M.P. predecomposer for preheating the stripper outlet urea solution prior to the existing MP decomposer. Incorporation of MP predecomposer allows the stripper to operate at reduced bottom temp. of 202°C against the existing operating value of 210°C results saving of MP steam as well as enhancing the life of stripper.

Achievements of the Year 1997-1998

With concerted and dedicated efforts of one and all KRIBHCO has improved upon its performance year after year. 19.57 million ton of urea production milestone was achieved within a short span of 12 years (from a single unit). In the financial year 1997 - 1998, we have produced 17.71 lakhs (100,000) MT urea and surpassed earlier record of 17.22 lakhs MT. Original design energy consumption, 8.44 Gcal/MT ammonia and 6.327 Gcal/MT urea were revised to 8.182 Gcal/MT and 6.179 Gcal/MT respectively after ammonia converter in-situ modification. Corresponding consumptions obtained for the year are 8.449 Gcal/MT and 6.233 Gcal/MT respectively.

Kribhco's endeavour towards modernisation i.e. performance improvement through revamp / retrofit will continue to incorporate new technological developments.

Table 1

PRODUCTION PERFORMANCE - FINANCIAL YEAR-WISE				
Financial Year	**Capacity Utilisation (%)**		**Sp Energy Consumption Gcal/MT**	
Ammonia	**Ammonia**	**Urea**	**Ammonia**	**Urea**
86-87	83.55	86.75	9.750	7.160
87-88	104.46	109.14	8.689	6.441
88-89	111.91	114.75	8.688	6.428
89-90	112.37	114.83	8.613	6.365
90-91	118.00	118.30	8.572	6.311
91-92	115.39	117.10	8.656	6.305
92-93	113.18	116.16	8.746	6.396
93-94	102.58	104.37	8.798	6.520
94-95	100.81	100.95	8.562	6.375
95-96	117.80	118.60	8.502	6.296
96-97	110.63	106.09	8.454	6.305
97-98	121.27	122.00	8.449	6.233

Figure 1

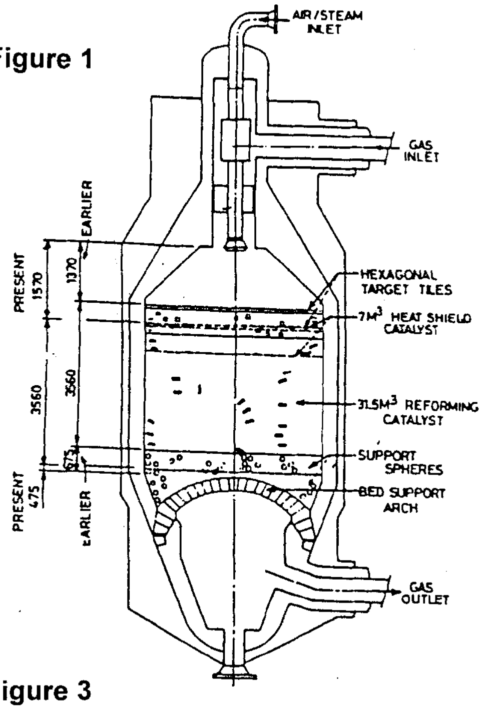


Figure 2

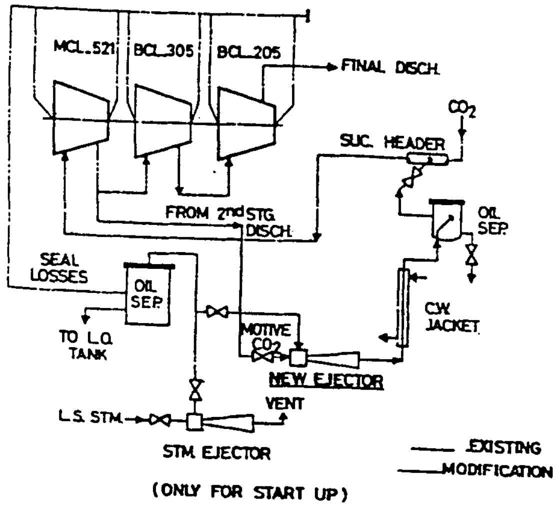


Figure 3

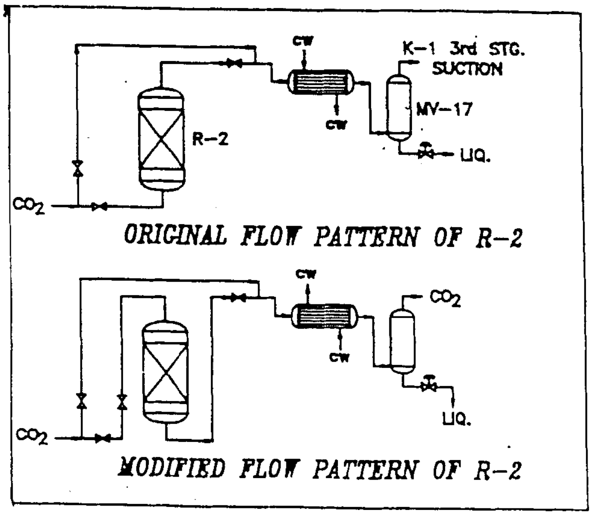
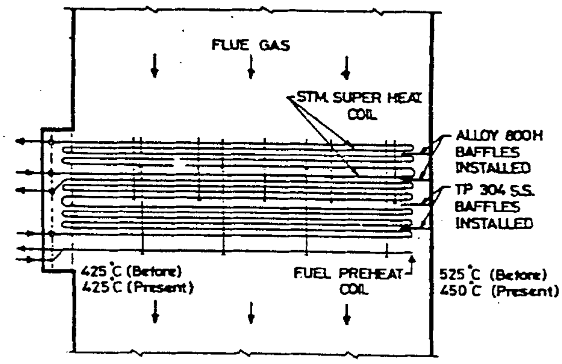
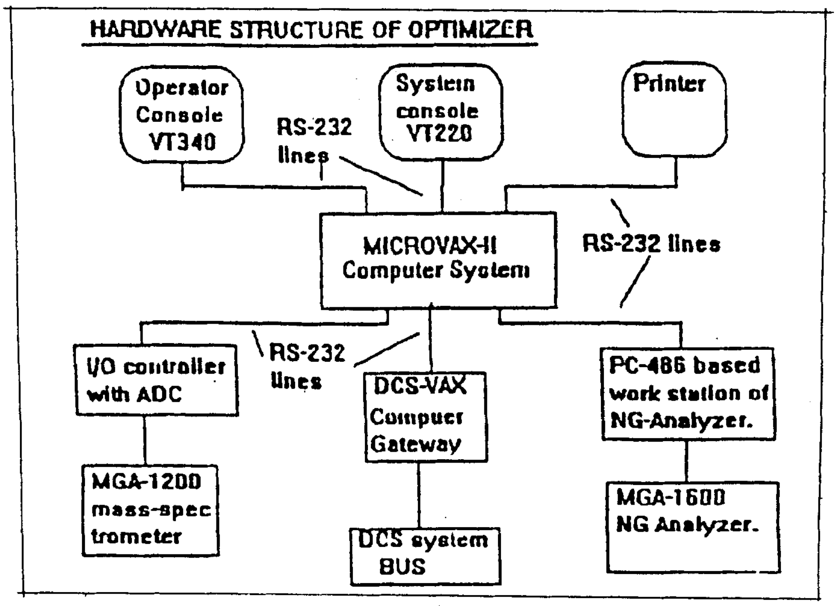


Figure 4



ENERGY SAVINGS : 0.017 MMKCAL/MT

Figure 7



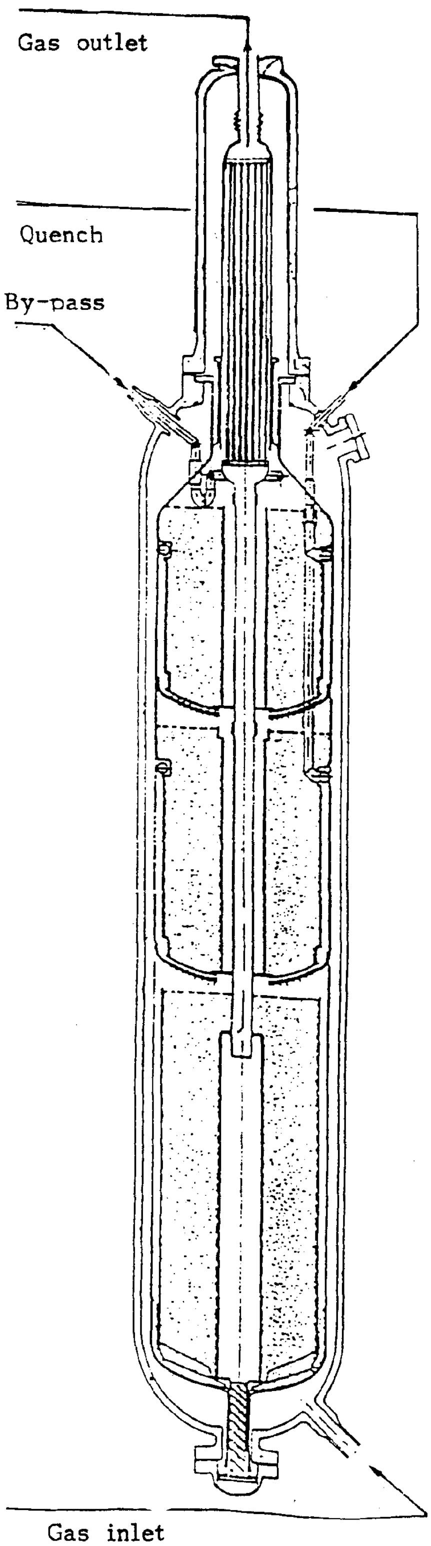


Figure 5

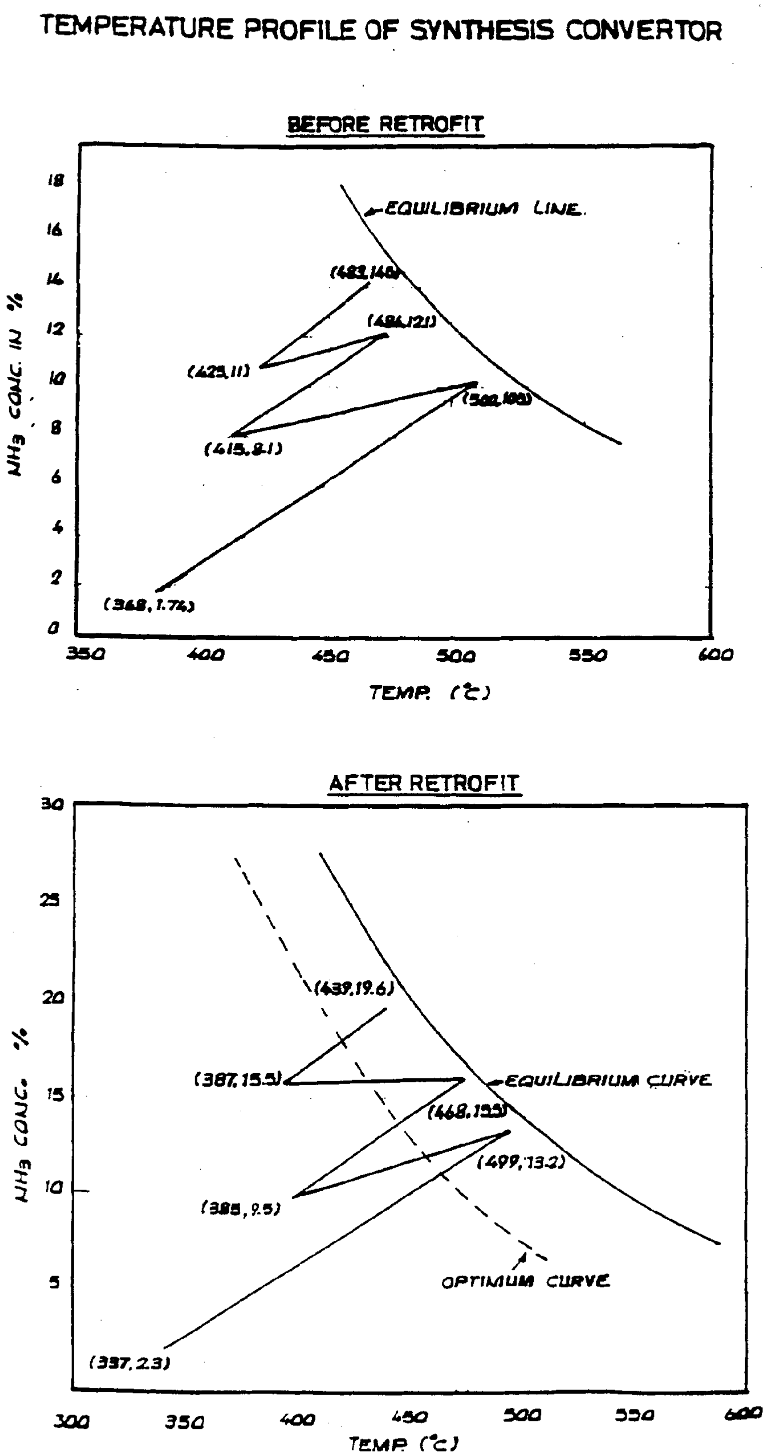


Figure 6