Resume

FAI Workshop on "Improving Energy Efficiency in Fertilizer Plants"

13-14 August, 2012, New Delhi

FAI organized a two-day Workshop on Improving Energy Efficiency in Fertiliser Plants during August 13-14, 2012 at New Delhi.

The Workshop was inaugurated by Dr. Ajay Mathur, Ex-Director General, Bureau of Energy Efficiency, New Delhi, Shri Satish Chander, Director General, FAI delivered the keynote address and Shri K.L.Singh Chairman, FAI Technical Advisory Committee & Director (Technical), IFFCO, New Delhi, also addressed the participants. The workshop was attended by 52 participants from 25 fertiliser plants.

Dr. Ajay Mathur, in his inaugural address deliberated upon the Perform Achieve and Trade (PAT) Scheme being implemented for energy intensive sectors including fertilizer sector. Dr. Mathur referred to wide variation in energy consumption across various consumers in the same sector on account of technology, feed stock, plant size and vintage etc. He recalled that while working on modalities for setting the targets, it was not found feasible to fix uniform target for all DCs. Therefore, targets have been fixed , specific to every consumer to improve upon their own baseline specific energy consumption. He appreciated the extensive collaboration and efforts made by FAI, in collecting baseline data as well as working out modalities for setting up energy reduction norms. It was on FAI's behest that the Stoichiometric energy contained in urea product was excluded from total energy consumption. He recognized that in each sector, some plants have achieved energy efficiency of international standards. However, he maintained that, the Act mandates even most efficient plant should endeavor for continual improvement. He also referred to the incentive available under the scheme, in the form of Energy Saving Certificates (ESCert). Shri Mathur strongly advised that all DCs must comply with various requirements of the Act and advised to submit "Action plan" for achieving energy reduction targets which was to be submitted by 30.06.12. He also stressed on the need for integration of software tools and developing algorithms to improve energy efficiency on real time basis.

Shri Satish Chander in his keynote address, informed that India produces about 22 million tonnes of urea per year. The energy cost accounts for 80% of the cost of production. Therefore, survival of the industry depends on improvement in energy efficiency. He expressed concern that no fresh investment has been made for adding new capacity during last 12 years and attributed the reason mainly to existing pricing policy and uncertainty in availability and pricing of natural gas. He further noted that Indian plants are producing urea at a cost much lower than the price of imported urea even with higher input feedstock cost. India imports around 7 million tonnes of urea every year. By producing this additional quantity indigenously, country could have saved significant amount on subsidy.

Shri K.L.Singh, in his special address, noted that subsequent to NPS-1, the industry has been striving to minimize energy consumption and has ultimately reached the saturation point. Now, fixation of energy reduction norms under PAT Scheme has tightened it further.

He added that there are innumerable efforts made by the industry to improve energy efficiency. A number of retrofits have been implemented, resulting in considerable improvement in performance. Now, measures for saving even very small energy are being implemented.

One such measure is installation of Furnace Management System which is more efficient for monitoring of burners than conventional pyrometer system. It helps in optimizing the furnace performance and thus saving fuel. He gave another example wherein in an ammonia plant based on Kellogg's process, regenerative pre-heater having circumferential clearance has been replaced with SS plate type heat exchanger, reducing stack temperature considerably.

Earlier **Dr. S. Nand**, Dy. Director General FAI, welcomed the guests and participants. While briefing about the regulatory environment, he acknowledged the valuable understanding and support extended by Bureau of Energy Efficiency and Dr. Ajay Mathur in appreciating industry's problems and constraints while setting up energy saving targets. He also mentioned FAI's association with BEE in collecting baseline energy data from all designated consumers in fertilizer sector.

He briefed the participants about the various activities of the Association. He informed that FAI organizes a large number of programme in various areas of technology, marketing, fertilizer use, IT etc in a year. FAI collects data from primary sources and brings out a number of publications. FAI also undertakes specialized studies related to fertilizer and agriculture.

Shri Manish Goswami, Dy Chief (T), FAI proposed a vote of thanks at the conclusion of the inaugural function. He especially thanked Dr. Ajay Mathur and Shri K.L.Singh for sparing their valuable time and their valuable advice.

The Workshop was spread over four technical sessions chaired by Shri A.K. Singh, Sr. Executive Director, IFFCO, New Delhi, Shri Rajesh Agarwal, Director (Technical), NFL Noida and Dr. S. Nand.

SUMMARY OF THE SESSIONS

Technical Session – I

The Session was Chaired by Dr. S. Nand, Dy. Director General, FAI New Delhi. In all, two papers were presented in the Session viz, (i) Efficiency in Fertilizer Plants – Industry Overview by Shri Manish Goswami, Dy Chief (Tech), FAI New Delhi (ii) Implementation of PAT Scheme in Fertilizer Sector by Shri Sameer Pandita, Asstt. Energy Economist, BEE, New Delhi.

Shri Manish Goswami presented the statistics during last two decades, showing trends regarding capacity, production and consumption of nitrogenous and complex fertilisers as well as requirement, availability and import of raw materials and intermediates. Urea and NP/NPK plants were categorized based on vintage, size and feedstock. He elaborated on the trends in energy consumption in ammonia and urea plants, bench marking of ammonia plants, efficiency of NP/NPK plants.

He also presented down time analysis, carried out by FAI, based on the data received from 29 ammonia plants (26 reforming and 3 gasification) and 28 urea plants, for the period 2008-09 to 2010-11 and compared the same with previous two analysis (2002-05 and 2005-08). In ammonia plants, the planned turnaround (18.0 DDPY) and forced downtime (16.8 DDPY) has come down, whereas in urea plants, planned turnaround (20.3 DDPY) has increased and forced downtime remain at 16.8 DDPY. This is also reflected in higher on stream days for ammonia plants at 330.1 DPY as compared to 326.0 DPY in previous survey. For urea plants, on stream days at 322.7 DPY were lower as compared to 326.0 DPY for the same period. Down time due to equipment failure at 8.8 DDPY for ammonia plants and 6.9 DDPY for urea plants have increased as compared to previous survey.

He also presented that the trends in water consumption and effluent discharge is consistently downward for both urea and phosphatic plants.

Presenting the safety survey analysis, he mentioned that, 31 plants were covered, which accounted for 97% production of “N” and 88% of total P_2O_5. Total manpower of all the plants is around 52.4 thousands. Average accident free days have improved significantly from 459 days (1995-2000) to 929 days (2005-10). Incident rate (No of accidents per million man hours worked) has also reduced significantly from 1.69 to 0.47 from 2001 to 2009. However, severity rate (million man hours lost per million man hour worked x 100) almost at the same level of 0.38 during last 15 years. Fatal accident frequency rate has not come down, which is a matter of concern.

To a query that international bench marking data is too old, he clarified that recent data is not yet available and information would be updated, as and when same is available.

To another query on increasing gap between production and consumption of fertilisers, he informed that the production is stagnant as no new plant has come up during last 12 years; however, the new investment policy in 2008 did boost up revamped urea capacity by 2 million tonnes. It was also opined that apart from policy, availability of gas is also a constraint in construction of new capacity.

Shri Sameer Pandita, BEE, gave detailed presentation on Energy Conservation Rules, 2012 (PAT Rules). He briefly sailed through target setting phase of PAT scheme involving establishment of baseline, review of baseline data and finalization of SEC reduction targets as well as notification.

He deliberated on the various requirement, to be complied by DCs viz (i) submission of action plan to State Designated Authority (SDA) with copy to BEE, within three months from date of notification i.e. by 30th June 2012. The action plan should contain brief description of identified energy saving measures, estimated cost of each individual measure and implementation plan (ii) submission of performance assessment document (PAD) in Form A duly verified and certificate in Form B given by AEA, within three months of conclusion of the target year (iii) In case, a DC so desires (optional), he may submit PAD document within three months after the end of 1st and 2nd year of cycle for claiming benefits for the respective years (iv) preparation and maintenance of production and energy consumption data reports at the end of each (a) quarter (b) year (c) cycle period, for the purpose of monitoring and verification (v) BEE on its own or receiving a complaint regarding correctness of reports submitted by DCs, shall initiate action by way of check verification and issue notice to DC as well as AEA. DC within 10 working days from receipt of such notice. BEE may issue orders for check verification by different AEA.

He further explained the **check verification procedure,** which is applicable, in case a complaint is filed against a DC. BEE will give notice to DC and accredited energy auditor (AEA). If not satisfied with their reply, it will appoint an AEA , who had not performed the verification of the same DC earlier. AEA will submit its report in Form C to BEE and concerned State Designated Agency (SDA). In case the complaint is found true, DC will have to return the amount of ES Certs under scrutiny plus 25% of their value.

To a query, he clarified that submission of action plan is mandatory, even if the targets are achievable / achieved. In case, the proposals included in the action plan are not implementable, same can be changed. He expressed concern that, only 14 DCs have submitted the action plan so far, although BEE had written to all DCs in this regard. He informed that some of the action plans are not adequate. During discussion, he cautioned that the Ministry of Power (MOP) may impose penalty in case of non-compliance.

Some of the delegates raised specific queries like, in case of most energy efficient plants, targets of reduction in SEC should be nil, plants operating below 70% capacity utilization, should be taken out of PAT scope and it was also suggested that normalization factors might also include ageing of catalyst. It was informed that all such points would be deliberated in Technical Expert Committee of BEE.

While concluding the session, the Chairman emphasized upon the delegates to ensure compliance of requirement of PAT implementation i.e. to submit Action plan and Form 1, to State Designated Authority (SDA) with copy to BEE.

Technical Session – II

The Session was Chaired by Shri A.K.Singh, Sr. Executive Director (Tech), IFFCO New Delhi. Four papers were presented in the Session viz, (i) Experience of Implementation of Energy Efficient Measures in ammonia urea plants by Shri Sudhir Agarwal, Chief Manager (Projects), and Shri Anurag Jaiswal, Sr. Manager (Projects), NFL Vijaipur (ii) Experience of Implementation of Energy Saving Schemes in Ammonia and Urea Plants by Shri Ashwni Kaul, Addl General Manager, SFC Kota (iii) Energy Efficiency Improvement Initiatives at Indo Gulf Fertilisers by ShriTapas Bag, Sr. Mgr (Process Engg.), Indo-Gulf, Jagdishpur (iv) Utilization of Low Grade Heat in Fertiliser Plants by Shri M N Tekchandani, Chief Manager, GNFC, Bharuch

Shri Sudhir Agarwal and Shri Anurag Jaiswal of NFL, described various in-house energy saving effort made from time to time i.e. (i) Installation of high efficiency trays in urea reactor (ii) Installation of Casale's pre-concentrator (iii) utilization of C-3 off gas from urea plants as supplementary fuel in CPP boilers (iv) Generation of LP steam by raising pressure of steam condensate tank (v) replacement of GRP blades with hollow FRP blades in cooling towers (vi) replacement of condensing steam turbine of one cooing water pump with motor, in urea plant etc.

They presented salient features of revamp project for energy saving and capacity enhancement, executed recently.

In case of **Ammonia-I**, major revamp schemes are (i) replacement of existing combustion air pre-heater with SS plate type to reduce stack temperature from 174 ^{o}C to 125 ^{o}C (achieved 140 ^{o}C) (ii) conversion of Benfield CO2 removal section to GV (iii) installation of S-50 converter (iv) installation of parallel air compressor (v) Addition of one new CT cell. As a result, revamped capacity of ammonia-I has increased from 1520 to 1750 MTPD and projected energy saving is 0.385 Gcal/tonne ammonia.

In case of **Urea-I**, major revamp schemes are (i) installation of MP decomposer (ii) additional ammonia pump of smaller capacity (iii) bulk flow urea prill cooler (iv) addition of one cell and pump in cooling tower. As a result, revamped capacity of urea-I has increased from 2620 to 3030 MTPD and projected saving in energy consumption is 0.189 Gcal/tonne of urea.

In case of **Ammonia-II**, major revamp schemes are (i) replacement of existing combustion air pre-heater with SS plate type to reduce stack temperature from 174 ^{o}C to 125 ^{o}C (achieved 140 ^{o}C) (ii) replacement of primary reformer burners (iii) replacement of secondary reformer burner nozzle (iv) replacement of packing in GV tower (v) up-gradation of synthesis gas compressor (vi) installation of S-50 converter. As a result of revamp, capacity has increased from 1520 to 1864 MTPD and projected saving in energy consumption is 0.17 Gcal/tonne ammonia.

In case of **Urea-II,** major revamp schemes are (i) revamp of CO2 compressor (ii) additional small capacity HP ammonia pump (iii) replacement of HP carbamate pumps (iv) installation of MP decomposer (v) installation of pre-concentrator (vi) bulk flow urea prill cooler As a result, capacity of urea-II has increased from 2620 to 3231 MTPD and projected saving in energy consumption is 0.09 Gcal/tonne of urea.

To a query, Shri Jaiswal informed that while changing from Benfield to GV process, same solution is used and no chemical is to be disposed off.

Shri Ashwini Kaul, SFC shared experience of implementation of energy saving schemes in ammonia and urea plants. In the ammonia plant (700 MTPD) based on Haldor Topsoe A/S naphtha reforming process, the feedstock was changed over from naphtha to natural gas in 2006. The major changes involved (i) replacement of all burners of primary reformer (ii) installation of combustion air pre-heater and feed gas (iii) new FD and ID fans (iv) fuel NG pre-heater, etc.

Urea plant of 1200 MTPD capacity is based on Stamicarbon process.

He emphasized that through optimizing the operations, the energy consumption has been reduced considerably from 9.02 Gcal in 1991-92 to 7.35 Gcal per tonne of urea in 2011-12. SFC also achieved reduction in plant tripping and equipment breakdown.

He also listed some of the future plans to improve efficiency viz (i) revamp of Benfield section (ii) APC in ammonia and urea plants (iii) suction chilling of process air compressor (iv) additional heat recovery from primary reformer flue gases (v) Using off gas from urea plant as fuel for primary reformer.

Responding to a question, he informed that for conversion from naphtha to gas, the investment was around Rs 36 Crore and energy saving around 0.1 Gcal/ Te ammonia.

Shri Tapas Bag, IGFL, gave details on the energy efficiency initiatives, with special reference to advance process control system (APC) referred as " Profit controllers". Three APCs are provided in ammonia plant viz (i) profit controller 1, for controlling methane slippage, S/C ratio, excess oxygen , synthesis compressor suction pressure and CO_2 slip in GV section (ii) profit controller 2, (ammonia synthesis) for controlling H_2/N_2 ratio, inert in synthesis loop (iii) profit controller 3, for optimizing steam consumption. In addition, an ammonia plant optimizer permits global optimization across ammonia plant subject to the individual profit controller constraints.

In urea plant four APCs have been provided viz (i) profit controller 1, for controlling suction pressure and O_2 in CO_2 (ii & iii) profit controller 2 & 3, for controlling NH_3/CO_2 ratio, HP ammonia pump load distribution, LS export , control of critical process parameters (iv) profit controller 4, for controlling process condensate treatment.

As a result, variation in process parameters could be reduced significantly.

To a query, he replied that cost of APC in ammonia plant was around Rs 65 Lakh and energy saving is around 0.02 Gcal/ Te ammonia. For urea plant, cost was Rs 48 lakh and energy saving of around 0.005 Gcal/ Te urea. The implementation time was 6 months and hook up was done on- line.

Shri. M.N. Techchandani, GNFC, shared experience on utilization of low grade heat in a 60 TR VAM machine was installed in the year 2011 in CAN plant. He further shared the operating experience i.e. the system being sensitive to variations in heat input, which may result into crystallization of Li-Br solution. The system is also sensitive to vacuum fluctuations Elaborate instrumentation can be used to fully automize the operation. He presented comparison of VAM machine with conventional refrigeration unit consuming electricity. In a VAM machine, electricity requirement is extremely low, since low heat is utilized. The saving is of the order of Rs 20 lakh per year for a unit of 100 TR. However, that would depend on the machine and source of low heat.

To a query, he informed that at GNFC, 6 VAM units have been installed. GNFC has old VAM units in other plants and some of them are operating for last 15 years.

The Chairman concluded the session with his observation that all the plants achieved improvement in capacity utilization as well as reduction in energy consumption by implementing numerous measures i.e. incorporating retrofits suitable for individual plants, effective monitoring and review of plant performance, better operation and maintenance practices, systematic approach to energy management, development of in-house idea for all round improvement. However, recent revamp projects which are mainly meant for capacity enhancement may not have significant impact on energy reduction.

Technical Session III

The Session was Chaired by Dr. S Nand, Dy. Director General, FAI, New Delhi. Three papers were presented in the Session viz, (i) Regulations for Renewable Energy Obligations By Shri Rakesh Shah, Adviser (Renewable) CERC, New Delhi. The presentation was followed by discussions on industry experience of implementation of RE obligations (ii) NFCL efforts to meet PAT and RE Obligations by Shri Shivaramakrishna, Manager (Process) NFCL (iii) Implementation of ISO 50001 in Fertiliser Plants by Shri S.K.Bose, General Manager BSi India, New Delhi (iv) Improving Energy Efficiency of Complex Fertiliser Plants by Shri G.M. Patel, Director, Rahimtula Group, New Delhi.

Shri Rakesh Shah of CERC, gave presentation on Renewable Purchase Obligations (RPO). He gave some useful statistics viz installed capacity of power generation in India is 2.06 lakh MW contributed by thermal (66.3%), Hydro (19.1%), nuclear (2.3%) and renewable (12.3%) resources. The present renewable power capacity is 25409 MW contributed by wind (69.4%), small hydro (13.4%), bio-mass (13.1%) and solar (4.1%). During next 12 years, India's power requirement is expected to grow 2.5 times. For producing this much power, country will continue to import large part of its energy requirement. Further he added that a study report indicates that there is a potential of 6-8 lakh MW power generation from renewable sources.

Further, he explained that the Electricity Act – 2003, mandates State Electricity Regulatory Commission (SERC) to specify RPO targets as a percentage of the total consumption/production of electricity. Each State Regulator (SERC), has specified RPO obligations as percentage of total production of power. These obligations vary from State to State. Consumers, who are drawing power from grid, do not have RPO, since electricity supplier / distributor has to meet these targets. However, consumers having captive power plants have to meet obligations themselves.

He also elaborated on " Renewable Energy Certificates (REC)". These seeks to address the gap between availability of RE sources and requirement of purchase obligations. RE generator can sell the electricity generated from renewable plant at average pool power purchase cost and apply for RECs, which one can trade in power exchange. Power distributers can either purchase power generated from renewable resources or buy REC to meet their RPO obligations.

Fixing the RPO targets being under the jurisdiction of SERC, each plant has to refer to the notification issued by respective State.

Shri Shivaramakrishna, NFCL, shared the efforts of their plant to meet PAT & RE obligations. In order to meet PAT obligations, the retrofit measures under consideration are (i) replacing turbo drives with energy efficient motors (ii) installation of VFD for identified pumps

The measures for Unit II are (i) providing high efficiency Casale urea reactor trays (ii) using LP steam from urea plant in VAM in ammonia plant (iii) installing vortex mixer in urea II reactor.

Some measures common to ammonia and urea plants are (i) insulating bare steam lines and flanges (ii) magnetic resonators for NG fuel lines (iii) Avoiding process condensate cooling load by installing a dedicated hot CPU.

Regarding RPO obligations, he informed that Andhra Pradesh Electricity Regulatory Commission (APERC) has released RPO regulations on 21st March'2012, according to which, NFCL is obliged to purchase power from renewable energy source @ 4.75% from noon-solar and 0.25% from solar RE source, of its energy consumption during each of the financial year from 2012-13 to 2015-16.

He further informed, regarding various options available for meeting RPO obligations viz setting up own wind farm, having long term power purchase agreement with existing RE developers, and lastly purchase of REC's from trading platforms.

Shri S.K.Bose, BSi India, explained that the **ISO 50001** is a specification created by the International Organization for Standards, which specifies requirements for establishing, implementing, maintaining and improving an energy management system. The purpose of certification is to enable an organization to follow a systematic approach in achieving continual improvement of energy performance, including energy efficiency, energy security, energy use and consumption.

He further elaborated that energy system model comprises of four stages viz (i) **Plan** i.e. energy policy & energy planning (ii) **Do** i.e. implementation and operation (iii) **Check** i.e. measure and monitor (iv) **Act** i.e. analyze, management review and make decisions.

To a query, he informed that the audit time is usually 6-8 months and the certificate is valid for 3 years. It was also informed that IFFCO Phulpur has taken ISO 50001 in 2009 and IFFCO Paradeep is in the process of obtaining the same.

Shri G.M.Patel, Rahimtula Group, focused on various energy conservation aspects in Acids and Complex Fertilizer Plants for energy efficiency improvements.

He explained, various processes for production of phosphoric acid highlighting their main characteristics i.e. Furnace acid process (FAP) requires benefication of ore and is power intensive, Improved hard process (IHP), can use low quality ore, Wet acid process (WAP), is eco- friendly and consumes lesser power. He further explained that among different wet acid processes, energy efficiency increases in the order of hemi process, hemi di- process and di-hydrate process.

He further explained various developments in sulphuric acid technology viz (i) SS spiral and plate heat exchanger and latest anodically protected shell and tube heat exchanger, which improved the energy efficiency of sulphuric acid plants dramatically by additional 0.2 Kg steam production per Kg of acid (ii) introduction of LP steam production from waste heat further added 0.5 to 0.6 Kg of LP steam per Kg of sulphuric acid (iii) By use of ceasium promoted catalysts there is significant emissions reduction.

In the production of DAP/ complex fertilizers, several advanced features are incorporated to enhance energy efficiency viz dual mole reactor – granulator scrubbing, vaporizer scrubber, automated recycle control system, screen diverter system, dual diameter reactor, pipe reactor, cooler air chiller, tran-tech product cooler, variable frequency drives, etc.

To a query, he informed that dual diameter reactor is used to increase production. In India, there is no plant based on this technology. However, there are 3 plants located in USA.

In his concluding remarks, the Chairman cautioned regarding mandatory RPO obligation and informed that, although many States have not yet notified it, yet the units should remain prepared for the compliance.

Technical Session IV

The Session was Chaired by Shri Rajesh Kumar Agarwal, Director (Technical) National Fertilizer Limited Noida . Two papers was presented in the Session viz, (i) Experience of Implementation of Energy Savings Schemes in Ammonia and Urea Plants by Shri N B Hirde, Chief Engineer (Projects), RCF, Thal (ii) Energy Efficiency Improvement and use of Renewable Energy in CFCL by Shri Arvind Kumar Manager (Urea) CFCL

Shri N.B.Hirde of RCF Thal, shared experience of implementation of major revamp schemes at RCF Thal viz (i) Replacement of old combustion air pre-heater with a new SS plate type heat exchanger to reduce reformer stack temperature from 180 C to 127 C (ii) modification of reformer burners (iii) increasing number of inlet / outlet coil of NG pre-heater from 4 to 8 to reduce differential pressure in front end by 1.2 Kg/cm2 (iv) increasing fuel gas header pressure from 0.4 to 2.0 Kg/cm2 (v) replacement of Benfield process with GV process to reduce specific regeneration heat, reduction in CO2 slip and increase in CO2 pressure from 0.45 to 0.8 Kg/cm2 (vi) installation of S-50 converter to reduce loop pressure from 195 – 200 Kg/cm2 to 178 Kg/cm2 and increase HP steam production (vii) replacement of existing LP condensate stripper with MP stripper, (viii) installation of LP steam turbine to utilise surplus steam. The revamp project is scheduled to be completed by December 2012.

The expected enhancement in ammonia capacity is from (1500 x2) to (2x1750) MTPD and combined capacity of three urea plants from 5175 to 6060 MTPD. The specific energy consumption is expected to be reduced by 0.6 Gcal/ Tonne of ammonia.

To a query, he opinioned that for S-50 design, cold wall design is better but costlier.

Shri Arvind Kumar, CFCL, informed about various measures taken regarding energy efficiency improvement viz (i) providing VFD's on ammonia feed pumps, BFW pumps and Lean solution pumps (ii) advance process control in ammonia-I ((iii) load manager for GTG (iv) replacement of rotary compressor with screw compressor in air conditioning unit.

He further informed that, subsequent to major revamp in 2008-09, further measures were implemented viz (i) replacement of catalyst in LT shift converter and secondary reformer (ii) complete overhaul of gas turbine – II and air compressor (iii) Increasing size of piping at methanator outlet spool piece. Some schemes under consideration are increasing size of absorber outlet line from 16” to 20” in ammonia – I and installation of addition CT cell in Urea – II.

To achieve further energy conservation and use of renewable energy, various measures planned are (i) to install solar geysers in hostel building, security barracks, fire barracks, canteen, houses, to result in saving of 160 KW power (ii) to replace GSL lamps with energy efficient CFL lamps (iii) to install solar lights in 15 locations (iv) to replace existing tube lights / chokes with energy efficient T-5 tube lights and electronic chokes (v) installation of LED lamps of 70 watts in place of sodium vapor fixtures of 250 watt (35 nos) (vi) to install briquetting machine of 2000 te/year to use horticulture waste.

Experience of “Furnace management system in a KBR design, top fired reformer, having 8 rows of tubes was also shared. Under the scheme, there are (9+9) cameras equipped with photo light sensors to sense flame intensity. Life of camera is 10 years. These are kept cooled by supplying chilled air at 7-10 ^oC at 5 Kg/cm2. Main advantages are lower frequency of burners cleaning and low maintenance cost. Most important is that the reformer can be operated in close range of maximum allowable tubes surface temperature.

The Chairman Shri Rajesh Agarwal concluded the session by sharing his vast experience in fertilizer industry. He elaborated on the following most crucial aspects :

Improved material for reformer tubes

Regarding material of reformer tubes, a comparison was made between the conventional IN 519 and modified material HP – Mod Nb (25Cr :35 Ni : 1.5 Nb). The modified material offers expected tubes life of 200000 hrs against 100000 hrs ; tube skin temperature can be 906 ^oC against 900 ^oC; due to reduction in thickness, 6-7 % more catalyst can be charged. This results in either increasing reformer capacity or reducing pressure drop leading to reduction in energy consumption.

Front end operating pressure

In KBR process, front end pressure is being maintained at 55 Kg/cm2. This reduces duty on synthesis gas compressor, making it smaller in size.

Reformer flue gas stack temperature

Due to very low sulphur content in natural gas, recent trend is to go for lower flue gas stack temperature. In feed stock conversion project at NFL Nangal, stack outlet temperature is designed at 108 ^oC. However, to avoid consensation during winter season, provision has been made for heating with steam coils.

Regular cleaning of reformer burners @ 4-6 burners/day , improves combustion efficiency.

CO2 Removal section

Out of commercially known processes, MDEA is most efficient. It requires 440-460 Kcal/1000 Nm3, having CO2 slip lesser than 200 ppm. Against this GV process consumes 620-630 Kcal/Nm3 and yields 600-1000 ppm CO2 slip. On the other hand, Benfield process consumes 800-850 Kcal/Nm3 and yields 1000-1200 ppm CO2 slip.

Additional ammonia synthesis converter (S-50)

Additional ammonia converter (S-50) of HTAS with hot wall design has no basket for catalyst. There is a thin cylinderical sheet holding the catalyst. Practically there is no clear annular space. In case of damage to this sheet, the hot catalyst has a tendency to accumulate in the space between holding sheet and the shell.This makes the hot shell brittle and prone to failure.

Further the catalyst volume is very high. For a 1750 MTPD ammonia plant, catalyst volume in S-200 basket is 100 M3. Besides, S-50 also contains 125 M3 catalyst. However, the additional ammonia production from the combined system is 100 MTPD.

IFFCO is retrofitting with Casale's cold wall type additonal ammonia converter.

Some technology suppliers are offering ammonia synthesis loops operating at 80-140 Kg/cm2 pressure.

Design of new ammonia / urea plants

Modern plants have a design capacity of up to 2000 MTPD ammonia and up to 3850 MTPD single stream urea. It requires 2900 MTPD of CO2 gas. Energy level is quoted at 6.316 to 6.57 Gcal/ Te ammonia, almost by all technology suppliers, with a number of conbinations of process steps.

Regarding steam consumption in urea plant, KBR employs MP steam (158 Te/hr, 47 bar, 400 ^{o}C) for CO2 compressor with 67 Te/hr extraction steam. Whereas in other process, HP steam (114 Te/hr, 105 bar, 510 C) is used with similar pattern of extraction steam. Additional 10 Te/hr steam is required for stripper.

Process guarantees

Ammonia	:	0.567 Te/ Te urea i.e. with ammonia purity of 100%. 0.570 Te/ Te urea is considered achievable with ammonia purity of 98.8%.
CO2	:	0.733 Te / Te urea at 100% CO2 purity. 0.736 – 0.737 Te / Te urea is considered achievable at actual operating parameters.

Make up water: 5 M3/ Te urea
5-6 M3 / Te urea is considered normal.
Circulating water: 90 M3 / Te urea

Electricity : 20-23 KWH / Te urea

Sp. energy consumption :

Ammonia : 6.7 Gcal/ Te ammonia on daily basis
Plus 3% for yearly consumption.
Feedstock is natural gas containing 98.5% methane (CH4).

Urea : 4.60 – 4.62 Gcal/ Te urea on daily basis
4.75 – 4.80 Gcal / Te urea should be a reference under ideal conditions.

ONGC gas (C3 gas) contains 2-4% CO2. GAIL is extracting LPG (C2, C3 etc) from natural gas and to compensate for pressure loss, CO2 is injected in the gas network. It reduces ammonia production capacity of the plant. Further, CO2 contains sulphur, which require more H2 recycle in HDS reactor. There are other local factors, which increase the energy consumption on yearly basis.

Therefore, various claims regarding SEC figure of 5.0 Gcal / Te urea for new plants on annual basis, does not seem to be realistic.

CDR vs H2 recycle

CDR plant of 450 MTPD capacity consumes additional energy of 0.11 to 0.13 Gcal/ Te ammonia. It is also a pollution abatement measure However, carbon credits are not allowed.

On the other hand, H_2 recycle requires additional 7-8% capacity in front end thus causing additional energy consumption of 0.08 Gcal/ Te ammonia. However, more steam is generated in RG boiler.

Other points

. In existing ammonia plants of 1520 MTPD capacity, reformer has 288 catalyst tubes, whereas new 900 MTPD plants have 108 tubes in XMR material of construction. New tubes are longer by 1 meter and thus help in reducing size.

Conclusion

Dr. S. Nand made the following concluding remarks :-

(i) He advised that, all Units must submit the " Action plan for achieving energy reduction targets", to BEE, as required under PAT Rules. In case of any problem, same may be addressed to FAI for possible remedial action.

(ii) He informed that, further interaction with BEE would be done in the forth coming meeting of FAI Technical Advisory Committee scheduled to be held on 4th Septtember, 2012, for which the Units may send their comments on various factors, which may affect the energy consumption adversally.

(iii) As regards RPO, many States have not yet started implementing it. However, the Units should remain prepared for the compliance.

(iv) He also informed regarding ongoing discussions with Central Pollution Control Board for setting up new environmental standards.

Dr. S. Nand, thanked Shri A.K.Singh and Rajesh Agarwal for chairing the Session and giving their valuable comments. Shri Rajesh Agarwal distributed the certificates to the participants. The Workshop was concluded with a vote of thanks by Shri Manish Goswami, FAI.
