Frank Notes

Enhancing Efficiency of Fertiliser Plants

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The built up of fertiliser production capacity in the country began with setting up of small sized (150-400 MTPD) ammonia plants and corresponding capacity of urea plants in 1960s. This was followed by installation of mid-sized ammonia plants (600-1000 MTPD) in 1970s and large sized ammonia plants (1100-1520 MTPD) in 1980s and 1990s. There has been no new urea plant in last 17 years. Thus, India operates plants of 18-50 year's vintage. There was highest ever production of 24.5 million metric tonnes (MMT) of urea in 2015-16. The urea production increased by 24% from production of 19.8 MMT in 2007-08. This increase in production is equivalent to capacity of almost 4 modern day plants. This was achieved by making large investment in de-bottlenecking projects. A number of plants changed their feedstock from naphtha and fuel oil to natural gas under policy direction. Industry invested more than Rs 10,000 crores in feedstock change, debottlenecking of capacity and energy efficiency schemes during last 10 years. The results are reflected not only in higher production but also higher energy efficiency. The energy efficiency of the urea plants improved by about 7% during this period. This has resulted not only saving in fossil fuel but also corresponding reduction in carbon dioxide emission to environment. Benchmarking of Indian ammonia plants with international data available for 2013-14 shows that Indian ammonia plants' average energy consumption was better at 8.48 Gcal/MT than average of world plants of 8.60 Gcal/MT ammonia.

Fertiliser industry is also covered under the Energy Conservation Act 2001 as one of the energy intensive industries. The Act mandated saving of energy through a Market Based Mechanism termed as Perform Achieve and Trade (PAT). The PAT cycle operates for a three-year period under which the qualified plants, also known as Designated Consumers, have to save energy according to targets notified by the Bureau of Energy Efficiency (BEE). The first PAT Cycle was for 3 years period of 2012-13 to 2014-15. The fertiliser plants exceeded the target for total energy saving by 63% in the first cycle. Six more fertiliser plants have been added in PAT Cycle II. All these plants have been given individual energy saving targets to be achieved by the year 2018-19.

Urea plants operate under pricing and subsidy policy of Government of India. There are energy consumption norms under the policy which are used for calculating and reimbursement of cost of production of urea. Government notified New Urea Policy 2015 under which energy consumption norms for urea plants were revised downwards w.e.f 2015-16. Another downward revision in energy consumption norms will be effective from 2018-19. Thus, urea plants have to comply with energy consumption norms of DOF to remain viable as well as meet BEE energy saving targets to avoid penalty. Schemes for further energy savings require replacement of capital equipments. This in turn requires large capital investment with very long payback period. There is no provision for servicing the capital investment either in New Urea Policy or PAT scheme. Thus, several urea units face the serious challenge in meeting the new energy saving targets.

Fertiliser plants are continuous process plants and hence efforts are to operate plants without any unforeseen shutdown. Most of these plants are single stream plants with large capacity. An unplanned shutdown causes huge loss of energy and production. As plants are getting older, greater efforts are required to maintain the reliability of the equipments. To ensure the reliability of the plant and equipment, predictive and preventive maintenance practices are adopted. For cost effectiveness, condition based maintenance has also been adopted. Sophisticated monitoring equipments are used to monitor the health and integrity of all static equipments and moving machines.

A number of modifications have been carried out to improve reliability of rotating and static equipments. Heat exchangers in ammonia and urea plants are common cause of downtime. These are replaced with better design and better materials of construction heat exchangers. Rotating equipments such as synthesis gas compressor are very critical to continuous operation and requires regular

maintenance. A number of innovative methods have been used to improve reliability and integrity of compressors without stoppage of plants. Improvement in condition of equipments not only results in higher reliability but also in high operational efficiency. Urea plants achieved an average 331 on stream days in 2015-16.

Complex fertiliser plants operate under a policy where a fixed subsidy is provided per tonne of product. Production of complex fertiliser depends almost completely on imported raw materials. These plants are facing unfair competition from imports due to adverse import duty structure on import of raw materials. As a result, the capacity utilisation of complex fertiliser plants is hovering between 60% to 70% during last five years. Under such an environment, operational efficiency of complex fertiliser plants including raw materials recovery efficiency becomes critical for survival. Complex fertiliser plants have undertaken several modifications to optimise cost by use of several low grades rock phosphates and optimisation of operation. Modifications in granulation system, utilisation of waste heat and low grade heat in process and improving scrubbing efficiency to recover raw materials which otherwise escape to environment are some important measures implemented by almost all plants. With concerted efforts, the Nitrogen (N) recovery efficiency of complex fertiliser plants has improved from 93 % in 1992-93 to 97.8% in 2015-16. The P_2O_5 recovery efficiency has improved from 94% to 97.8% during same period. This translates to saving of about 0.15 million tonnes ammonia and phosphoric acid each to achieve the production level of 2015-16 compared to efficiency in 1992-93.

Fertiliser industry has made concerted efforts in improving productivity, on-stream efficiency, safety and environmental performance. Fertiliser plants are capable to produce enough fertilisers to meet the entire demand of the country and that too at competitive prices provided favourable policy environment is in place.

Fertiliser production involve use of hazardous chemicals and severe temperature and pressure. Therefore, safety of plant and personnel is of paramount importance. There are in-built safety features in the design of plants. In addition, plants have adopted process safety management systems, advanced technology and in-house innovative measures to further improve the safety of the process and manpower. Wireless technology was employed for monitoring of parameters in areas of hazardous operation in a recently commissioned complex fertiliser plant. One of the urea plants has devised innovative solution to control emission of ammonia through pressure safety valve vent stack to improve safety and environment protection. Safety survey conducted by FAI shows a significant reduction in safety related incidents over the years. There are only a very few incidents due to process related problems. Majority of the incidents are due to human error. Focus on behavioural aspect of safety will help to further reduce the safety incidences.

Environment has always been accorded a high priority by plant managements. Most of the plants are not only meeting the prescribed standards laid down by the Central and State Regulators but have gone beyond statutory requirements. Conservation of water has been focus area for quite some time. Water consumption has been reduced through reuse and recycle of water and by reducing evaporative losses. The water consumption per tonne urea has been reduced by more than 46% over last 25 years and in case of complex fertiliser plant there is reduction of about 42% during the same period. Similar trend is observed in discharge of waste water from factory battery limit.

Fertiliser industry continues to face challenges from adverse policy environment. Plants management are not able to generate sufficient surplus funds to invest in the plants to keep them running at high level of efficiency. Fertiliser plants are capable to produce enough fertilisers to meet the entire demand of the country and that too at competitive prices. Industry is not seeking any favourable treatment but policy environment which enables the industry to realise its full potential.

This special issues of IJF documents some of the recent efforts of industry to improve efficiency of operation. A status paper highlights the achievements of the industry in areas of production, energy efficiency, on stream efficiency, safety and environment. Another paper presents the performance of fertiliser plants under Perform Achieve and Trade (PAT) scheme of BEE. Six case studies present the details of measures implemented by fertiliser plants in different areas to improve overall operational efficiency. ■