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Why there are few takers of ISO-50001 standard in Indian Fertilizer industry

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Since India has an agrarian economy, fertilizer plays an important role in the stability and growth of our economy. Hence fertilizer industry has been given outmost importance by the central government for its improvement and growth. With the total production of 38.6 million tones of fertilizer product, India comes as second largest fertilizer producer in the world. Major fertilizers produced in India are-

- Urea : 22.21 million metric tons (MMT)
- DAP (Di –ammonium phosphate): 5.3 MMT
- NP/ NPK (Nitrogen phosphorous & potassium): 8.1 MMT
- SSP (Single super phosphate): 2.9 MMT

The above figures tell us that Urea manufacturing units are of prime importance as far as India is concerned. Some of the typical features of urea plants are given below-

- **Urea Production is energy intensive process.** It has mainly two steps-

a) Production of ammonia (and CO_2 as by-product) from Natural Gas
b) Production of Urea from NH_3 & CO_2

- **Cost of energy varies from 65% to 87% of the total production cost**.

- Feed stocks used by the plants are natural gas, naphtha, fuel oil, LSHS etc.
- Technology used by Ammonia plants are- Haldor Topsoe (HTAS), Kellogg Brown Root (KBR), ICI, CF Braun, Udhe etc.
- Technology used by urea plants are- Snamprogetti, Toyo, Stamicarbon etc.
- Due to variation in feed stock, technology & age of the plant, SEC (Specific Energy Consumption) of Urea industry varies on a wide band.

- **It is to be noted that overall urea making reaction is exothermic**. Hence theoretically no extra heat should be required once the reaction is started. However evaporation of liquid ammonia, evaporation of water, melting of urea, recycling of carbamate, vacuum concentration of urea etc consumes lot of additional energy. Therefore tremendous scope existed for reduction of SEC (specific energy consumption) in urea industry.

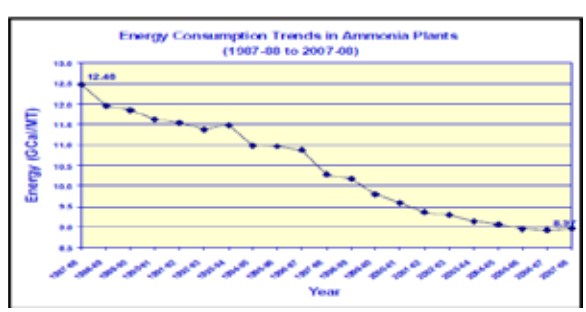
The most important observation one can make from the above points is- energy cost is the most critical factor in urea manufacturing process. Hence to make the fertilizer cost bearable to the farmers, cost of production is to be reduced by optimizing the input energy cost. Fertilizer industry started working in this direction since beginning and achieved a remarkable performance till date. Let us look at the history of Indian fertilizer industry.

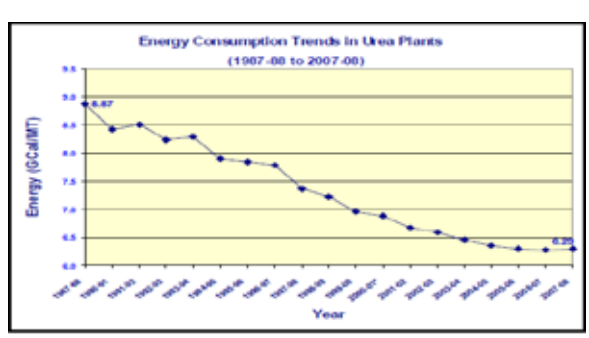
The first fertilizer plant of India came in 1937 at Sindhri. At that period SEC of urea plant was 14.78 GCal/MT. Since then lot of evolutions have been seen in fertilizer industry by means of-

- Adoption of new technology
- Retrofitting of energy efficient equipment
- UDP (Urea De-bottlenecking Projects)
- Improvement in operational practices
- Improved MIS – Technical Operating Data (TOP) of all fertilizer plant has to be reported to FICC (Fertilizer Industry Co-ordination Committee) on regular basis and this a mandatory requirement.
- Benchmarking with world standard &
- Mandatory Energy Saving Target under PAT (Perform Achieve & Trade) scheme.

Let us look at the energy performance of urea industry (both ammonia and urea plant) in two parts-

I. Till introduction of PAT scheme (2007-08, 2008-09 & 2009- 10 data were taken to draw the energy baseline under PAT scheme)
II. After completion of first PAT cycle (March, 2015)





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Energy performance data of first PAT cycle of few urea manufacturing plants are given below-

Name of the Plant	SEC achieved (GCal/MT of urea)
Tata Chemicals Limited, Babrala	2.68
Chambal Fertilizer & Chemicals (unit-II), Gadepan	2.98
National Fertilizer Limited (unit-II), Vijapur	2.98
Indo Gulf Fertilizer & Chemicals Limited, Jagdishpur	2.94
National Fertilizer & Chemicals Limited (unit-II), Kakinada	3.03
KRIBHCO Shyam Fertilizer Limited	3.23

From the above it can be seen that these plants have not only performed well but also achieved world benchmark figure. This is the testimonial of the facts that over a period of time fertilizer plants have developed a robust operation and energy management system which has helped them to achieve their annual objective and targets along with continual improvement in energy performance. This is the reason why fertilizer plants have not shown any interest in ISO-50001 standard.

Apart from this there are few other issues which make the case unique for fertilizer industry and there are no specific guidelines in 50K standard to handle such issues.

A) Accounting Methodology:

Globally the fertilizer fraternity adopts "**Box Approach**" to report their energy performance which is different from the conventional one. Under this methodology the whole plant is considered as a single box with one input i.e. NG and single output i.e. urea. This is to be noted that NG has dual role in this case- part is used as raw material (feed to the process) and the other part is used as fuel to supply energy for the process. However under box method SEC is calculated as: (Total ammonia consumption X its GCV) / (Total urea production). Reporting under this definition is required for benchmarking process i.e. compare one's own performance with leading global players.

Under conventional **GtG** (**Gate to Gate**) methodology, which is also followed under PAT scheme, consumption of NG is divided in to three parts-

i) Amount consumed as raw material in ammonia plant
ii) Amount consumed as fuel in ammonia plant &
iii) Amount consumed as fuel in urea plant

Next SEC of ammonia plant E1 (process-1: NG→NH_3) & SEC of urea plant E2 (process-2: NH_3→ NH_2CONH_2) are being determined separately. Now the SEC of the combined process (NG to NH_2CONH_2) is being calculated stoiiometrically by the formula: **E = 0.567E1 + E2**

Hence fertilizer industry needs to maintain multiple baselines for different purposes.

B) Monitoring & Accounting of variables:

In the operation of fertilizer plant there are number of internal & external factors which affect the plant energy performance adversely. These factors (which are beyond the control of plant management) should be accounted for while measuring the energy performance of the plant – otherwise true performance shall never be revealed. BEE (Bureau of Energy Efficiency) has therefore issued separate guidelines while measuring the plant performance under PAT scheme. Some of the major points are mentioned below-

• **Capacity Utilization Factor**: Plant can take the benefit of low capacity utilization and allowed to normalize the performance. However normalization shall be allowed only in one plant i.e. either ammonia or urea plant. In case ammonia capacity is matching with the urea production capacity- capacity utilization of urea plant shall only be considered. On an average normalization factor works out to be 0.02 GCal/MT of urea per percentage reduction in plant load.

• **Cold start up**: In case of failure of critical equipment or due to shortage of NG- sometimes ammonia plant need to undertake forced shutdown. Starting the plant again from cold condition needs unproductive energy which should be discounted for. To take this shutdown under "Cold Start Up" category – fuel and feed cut to reformer has to be for a minimum period of 72 hours. Maximum allowable compensation under this factor is 0.03 GCal/ MT of urea.

• **Use of Naphtha in place of NG**: Due to shortage of NG, sometimes plants are compelled to use naphtha as feedstock. This changeover leads to higher SEC of the plant. The following formula shall be used to calculate the energy loss-

E (GCal/MT of urea) = (185*S + 0.625*N_{feed} + 0.443*N_{fuel}) / Urea production in MT where

S = 1 if naphtha is used as feed in start-up
S= 0 if naphtha is not used as feed in start-up
N_{feed} = quantity of naphtha used as feed in MT
N_{fuel} = quantity of naphtha/LSHS/ FO used as fuel in MT

• **Catalyst Reduction**: Two major types of catalyst used in manufacturing process are-

a) Ammonia synthesis catalyst &
b) CO shift catalyst

Fresh catalyst remains in oxidized form and needs to be reduced with synthesis gas. During this reduction process, the whole plant is operated at 60 to 80% load for around 48 to 120 hours depending upon the type and quantity of catalyst. Unproductive energy on account of catalyst reduction shall have to be taken into consideration while measuring the actual energy performance of the plant.

Thus we see that Indian fertilizer industry has developed its own energy management and monitoring system which is well structured and quite effective. Further, overall policy and operational guidelines come from FICC, an apex body under ministry of "Fertilizer & Chemicals". As a designated energy consumer fertilizer industry comes under PAT scheme hence mandatory energy reduction target comes from BEE, an apex body under ministry of power. New fertilizer units are mostly built based on pinch technology where potential of further reduction of SEC is almost nil. Under such scenario ISO-50001 certification can hardly make any visible impact on the energy performance of the plant.