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Developed specifically for Designated Consumers notified under Perform Achieve and Trade (PAT) Program for National Mission for Energy Efficiency (NMEEE)

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Foreword

Perform Achieve and Trade (PAT), a flagship initiative under National Mission for Enhanced Energy Efficiency (NMEEE), is a regulatory intervention for reduction of specific energy consumption, with an associated market based mechanism through which additional energy savings can be quantified and traded as ESCerts.

Fertilizer sector is one of the 8 notified energy intensive sectors under which a total of 29 plants are participating in this program. These plants have been mandated to reduce their Specific Energy Consumption (SEC) from baseline year of 2009-2010. It is expected that these plants may save 0.478 million tons of oil equivalent annually by the end of PAT cycle – I.

The publication of “Normalization Document and M&V Guidelines” for Fertilizer Sector is an effort to facilitate the DCs to comply with notified PAT rules to participate with the PAT scheme and contribute towards achieving national target of energy savings. This document will also be helpful to all empanelled Accredited Energy Auditors (EmAEAs) and State Designated Agencies (SDAs) in the monitoring and verification process of PAT.

I want to record my appreciation for members of the Sectoral Expert Committee on Fertilizer Sector, chaired by Dr. S. Nand, Dy. Director General, Fertilizer Association of India, Shri Sameer Pandita, Asst. Energy Economist, BEE and Shri VK Goyal, Sector Expert, Shri Vikas Ranjan, Technical Expert, GIZ who worked tirelessly to put together the baseline data, normalization factors and M&V methodology for the sector.

I also compliment the efforts of all participating industrial units towards their endeavor in contributing to the national energy saving targets.

(Ajay Mathur)
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### Special Thanks to Team NMEEE

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1. Introduction

The National Action Plan on Climate Change (NAPCC) released by the Prime Minister on 30 June, 2008, recognises the need to maintain high economic growth to raise the living standards of India’s vast majority of people and simultaneously reducing their vulnerability to the impacts of climate change.

The National Action Plan outlines eight national missions that represent multi-pronged, long-term, and integrated strategies for achieving key goals to mitigate the impact of climate change. These missions are listed below:

- National Solar Mission
- National Mission for Enhanced Energy Efficiency
- National Mission on Sustainable Habitat
- National Water Mission
- National Mission for Sustaining the Himalayan Ecosystem
- National Mission for a Green India
- National Mission for Sustainable Agriculture
- National Mission for Strategic Knowledge for Climate Change

1.1 National Mission for Enhanced Energy Efficiency

The National Mission for Enhanced Energy Efficiency (NMEE) is one of the eight national missions with the objective of promoting innovative policy and regulatory regimes, financing mechanisms, and business models which not only create, but also sustain, markets for energy efficiency in a transparent manner with clear deliverables to be achieved in a time bound manner. It also has inbuilt provisions for monitoring and evaluation so as to ensure transparency, accountability, and responsiveness. The Ministry of Power (MoP) and Bureau of Energy Efficiency (BEE) were tasked to prepare the implementation plan for NMEE.

NMEE spelt out the following four new initiatives to enhance energy efficiency, in addition to the programmes on energy efficiency being pursued. These are:

- Perform, Achieve and Trade (PAT), a market based mechanism to make improvements in energy efficiency in energy-intensive large industries and to make facilities more cost – effective by certification of energy saving that can be traded.

<table>
<thead>
<tr>
<th>Perform, Achieve and Trade (PAT)</th>
<th>Market Transformation for Energy Efficiency (MTEE)</th>
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NMEE
Market Transformation for Energy Efficiency (MTEE) accelerates the shift to energy-efficient appliances in designated sectors through innovative measures that make the products more affordable.

Energy Efficiency Financing Platform (EEFP), a mechanism to finance demand side management programmes in all sectors by capturing future energy savings.

Framework for Energy Efficiency Economic Development (FEEED), for developing fiscal instruments to promote energy efficiency.

2. Perform, Achieve and Trade (PAT) Scheme

Under the National Mission on Enhanced Energy Efficiency (NMEEE), a market based mechanism known as Perform, Achieve and Trade (PAT) has been developed and launched to improve energy efficiency in the large energy intensive industries. It is envisaged that 6.686 million tonnes of oil equivalent will be reduced by 2014-15, which is about 4% of energy consumed by these industries. Under the PAT scheme, targets have been specified for all energy intensive industries notified as designated consumers (DCs) under the Energy Conservation Act, including thermal power stations.

![National Energy Saving Targets under PAT (%)](chart.png)

3. Background

The fertiliser industry in India has grown to its present size over five decades, starting in the 1960s. With a total production of about 38.6 million tonnes (mt) of fertiliser products containing 16.5 mt of plant nutrients (N + P2O5), India is the second largest producer of fertilisers in the world. With a consumption of 28.12 mt of nitrogen (N), phosphate (P) and potash (K), India is the third largest consumer of fertilisers in the world. India’s fertiliser industry is world class in terms of size of plants, technology used and efficiency levels achieved.

India produces both nitrogenous and phosphatic...
fertilisers with installed capacity of 12.947 mt nitrogen and 6.201 mt of P2O5. Urea is the major nitrogenous fertiliser and accounts for 83% of the total nitrogen production. Other nitrogenous fertilisers are ammonium sulphate (AS) and calcium ammonium nitrate (CAN), which are produced in smaller quantities. Among complex fertilisers, di-ammonium phosphate (DAP) and various grades of NP/NPK are produced. Apart from these, single super phosphate (SSP), also contributes to the phosphate production. There are about 141 fertiliser plants in operation in India. Out of these, 29 units produce urea, 19 units produce di-ammonium phosphate (DAP) and NP/NPK complex fertilisers, 82 units produce single super phosphate (SSP), 11 units produce ammonium sulphate, calcium ammonium nitrate and ammonium chloride. India is completely dependent on import of potassic fertilisers mainly as potassium chloride. India produced about 22 mt urea in 2010-11. About 18 mt urea was produced using gas as feedstock, while balance about 4 mt was produced using naphtha and fuel oil as feedstock.

Among all the processes in the fertiliser industry, production of nitrogenous fertilisers is the most energy intensive. Ammonia is used as the basic chemical in the production of nitrogenous fertilisers. Globally, over 80% of all ammonia manufactured is used in the production of nitrogenous fertilisers, and urea is the main nitrogenous fertiliser manufactured in India. The feedstocks used for ammonia production are natural gas, naphtha and fuel oil. Coal based units have been closed due to non-economic viability and high specific energy consumption levels. Among the feedstock, natural gas-based fertilisers are the most energy efficient, followed by naphtha based fertilisers.

Most of the existing plants in operation, have upgraded the technology continuously by way of revamp, retrofit and replacements. Some of the major upgradation are incorporation of radial-axial or radial flow ammonia converters, additional heat recovery from furnace flue gases, revamp of CO2 removal section with better solvent, improved packing of absorption/desorption towers, additional purification of synthesis gas, use of more efficient catalyst, refurbishing or replacement of rotating machines including major compressors and turbines, better heat integration, utilisation of low level heat, etc. Four plants using fuel oil as feedstock are preparing to use gas as feedstock with total investment of the order of Rs 5,000 crore.

There are 28 urea and one ammonia plants in operation in the country with capacity of 22.21 mt per annum. Most of these plants are of 1980s and 1990s vintage. With continuous efforts for upgradation of technology, these plants have brought down energy consumption from 8.42 Gcal/t in 1990-91 to 6.24 Gcal/t urea in 2010-11. The major modernisation measures include two-stage concentration, more efficient trays in urea reactor, recovery of nutrients from process effluents, recycling treated process condensate, refurbishing or replacement of rotating machines, etc. Most urea plants have energy consumption within a range of 5.25 to 6.0 Gcal/t urea. For manufacturing urea fertiliser, out of total energy consumed at designated consumer plant boundary, stoichiometric energy of 2.53 Gcal/t urea is contained in urea product and goes out as such.

Thus, the net energy utilised in urea manufacture is total energy input at designated consumers’ boundary reduced by 2.53 Gcal/t Urea. The figure is worked out by considering heat energy of ammonia as 4.46 Gcal/t ammonia and specific consumption 0.567 t of ammonia/t urea. By the end of the first PAT cycle, the energy savings of 0.478 million tonne of oil equivalent/year is expected to be achieved, which is 7.15 % of total national energy saving targets assessed under PAT.
4. **Status of Designated Consumer (DCs)**

Threshold limit for becoming a DC = 30000 metric tons of oil equivalent (MTOE) per annum

Total number of identified DCs = 29.

Estimated Energy Consumption = (13.35 - 5.15) = 8.20 Million Tonnes of Oil Equivalent.

5. **General Rules for Establishing Baseline Values**

A. **Definitions**

1. **Baseline Year**
   Baseline year is declared as 2009-10.

2. **Baseline Production \( (P_{base}) \)**
   The arithmetic average of Production figures of 2007-08, 2008-09 and 2009-10

3. **Baseline Specific Energy Consumption \( (SEC_{base}) \)**
   The weighted average of SEC figures of 2007-08, 2008-09 and 2009-10.

4. **Baseline Capacity Utilisation in % \( (CU_{base}) \)**
   The arithmetic average of CU figures of 2007-08, 2008-09 and 2009-10.

B. **Data Consideration**

1. In case of plants more than 5 years old, data for the last 3 financial years will be considered, provided the CU is uniform. Normalisation will be done in case of abnormality in CU in any of the three years.

2. In case of plants more than more than 5 years old, but has data for less than 3 years, the same will be considered, provided the CU is uniform. If the CU is abnormally low in any of the years, the same will not be considered.

3. In case of plants less than 5 years old and has data for less than 3 years, the available year’s (or years’) data will be considered, provided the CU is uniform. If the CU is abnormally low in any of the years, the same will not be considered.

4. In case of new plants, the data would be considered for the years where the CU is greater than 70%. If data exists for only one year data, the same will be considered irrespective of the CU.
C. Grouping of DCs

DCs are suitably grouped based on similar characteristics with the available data. This is to arrive at a logical and acceptable spread of SECs among DCs which may be compared in setting targets.

On analysis of the data, it has been observed, there is vast diversity in design and operating conditions of each plant. Some of these are enumerated below:

- Vintage of plants varies widely i.e. from year 1967 to 1999 (43 to 12 yrs)
- Size of single stream also varies i.e. for Ammonia / Urea from 600 / 1000 MTPD to 1500/2620 MTPD.
- Different feedstock is used i.e. NG, Naphtha, Fuel Oil.
- Technology in fertiliser industry has evolved successively over the last 5 decades. It is not financially viable for old generation plants to switch over to new generation technology.
- Drawing power from the state grid, causes unpredictable plant shut-downs due to fluctuations in frequency and also non-availability of power. A majority of plants have isolated from the state grid by installing captive power plants (CPP). However, some plants have power from both CPPs and the grid.
- In old plants (there are 6 of them), coal is used for steam and power generation, whereas new plants use NG.

Under this scenario, each individual operating plant (DC), operates under its unique operating environment. This ultimately has direct impact on energy consumption as well as potential to reduce the same. This makes it difficult to adopt a generalist approach for fixing the targets of reduction in energy consumption.

5.1 Grouping of DCs for Fixing SEC Reduction Targets

A graph has been plotted showing weighted specific energy consumption after reducing energy contained in urea product i.e. 2.53 million Gcal/mt urea for three years, i.e. 2007-08, 2008-09, 2009-10, of each DC.

The SEC varies from 2.68 to 16.89 Gcal/mt urea. The average value is 4.0. The wide variation is due to a number of factors as brought out at section 3 above.

(1) Group – 1 (DC’s : 2)

BVFCL Namrup – II (1976) and BVFCL Namrup – III (1987) are having very high energy consumption of 16.89 & 11.54 Gcal/MT Urea respectively. These are operating at lower capacity utilization of around 70% due to inherent problems arising out of location as well as technology. These Plants being outliers, have been segregated for fixing the targets. Assessed potential for reduction is 12% for each Plant.

(2) Group – 2 (DC’s : 4)

In case of Fuel Oil based Plants (4 nos), energy consumption is very high i.e. 5.45 to 7.58 Gcal/MT Urea. These Plants came up between 1977 and 1982. All of these Plants are under conversion for switching over of feed stock to NG. This will reduce SEC, significantly. So, these Plants are treated as a separate group. Assessed potential for reduction is based on respective DFR.

(a) In this Group, GNFC Bharuch (1982) is having lower energy consumption of 5.45 Gcal/MT Urea. Reduction in energy consumption targets is to be fixed based on revamped Plant using
NG in place of Fuel Oil. Existing Plant shall also be utilized at part load to augment CO2. Commissioning is scheduled in 2012-13. Assessed potential for reduction is 10%.

(b) NFL Nangal (1974), NFL Bhatinda (1977), NFL Panipat (1977) having energy consumption of 7.04, 7.14, 7.58 Gcal/MT Urea respectively are in the process of conversion for switching over feed stock to NG. Commissioning is scheduled in the year 2012-13. Reduction in energy consumption has been assessed as 25, 24, 22 % respectively.

(3) Group – 3 (DC’s : 11)

(a) Old vintage Plants SCF Kota (1969), GSFC Vadodra (1967) & IFFCO Phulpur – I (1981) are having energy consumption of 5.1, 4.0, 4.28 G cal/MT Urea. These Plants were originally designed for Naphtha feed. Subsequently, these have changed over to NG and also carried out retrofits. Thus, there is no margin left for further improvement. Assessed potential for reduction is 1.0 each.

IFFCO Kalol (1975) is having lower SEC of 3.367 G cal/MT Urea. Plant has carried out major retrofits during last 3 years. Assessed potential for reduction is 1 %.

RCF Trombay-V (1982) having energy consumption of 4.97 Gcal/MT Urea has been under shut down and restarted only in the year 2009-10. Performance data for last 3 years is not available. Assessed potential for reduction is 2.0 %.

(b) Three Plants have undertaken major retrofits, which are under implementation. Results will be
available during 2012-13. Their potential for reduction in SEC, has been assessed based on available information.

(i) NFL Vijaipur – I (1987), having energy consumption of 3.28 Gcal/MT Urea. Plant was commissioned in 1987. Assessed potential for reduction is 2.7%.

(ii) RCF Thal (1985) is having energy consumption of 3.91 Gcal/MT Urea. Assessed potential for reduction is 6.5%.

(iii) KRBHC O Hazira (1986) having energy consumption of 3.4 Gcal/MT Urea. Assessed potential for reduction is 5.0%.

(c) Three Naphtha based Plants i.e. MFCL Mangalore (1976), ZIL Goa (1973), MFL Manali (1971) are having energy consumption of 4.2, 4.35, 5.32 Gcal/MT Urea respectively. These Plants are still operating on Naphtha due to non availability of NG. Use of Naphtha results in higher energy consumption. Assessed potential for reduction is 2.4% each.

(4) Group – 4 (DC’s : 11)

Eleven Plants, were commissioned during nineties and late eighties. During this period, the technological development in manufacturing of ammonia / urea was at its peak. Plants having yearly capacity of 8,64,500 MT and using NG, came up during this period, are having low SEC. Also, these Plants have carried out further retrofits during last 3-4 years and the results in terms of reduction in SEC, have reflected in the Base line data. Thus, there is very little margin left for improvement without incurring huge expenditure, which may not be economically viable. Thus, a token value of 1.0% reduction in SEC over average of last 3 years has been assessed. These Plants are:-

a) TCL Babrala (1994) adopted innovative design and achieved exceptionally lower average energy consumption of 2.68 G cal / MT Urea, which is the lowest among Indian Plants. At the same time, it is at par with International standards.


c) CFCL Gadepan-II (1999), IFFCO Phulpur – II (1997) have changed over from Naphtha to NG. These Plants are having average energy consumption 2.98, 3.28 Gcal/MT Urea respectively.

d) NFCL Kakinada-II (1998) and NFCL Kakinada-I (1992), are having lower yearly capacity of 5,97,300 MT Urea each. Still these Plants are having low energy consumption of 3.03, 3.12 Gcal/MT Urea.

e) NFL Vijaipur – II (1997) is NG based having energy consumption of 2.98 G cal/MT Urea. Plant was commissioned in 1997.

f) KRBHC O ShymFert. Ltd. (1995) are having low energy consumption of 3.23 Gcal/MT Urea.

g) IFFCO Aonla – I (1988) is having energy consumption of 3.167 G cal/MTUrea.

h) IGFCL Jagdishpur (1988) is having low energy consumption of 2.94 Gcal/MT Urea.
(5) **FACT Udyogmandal** produce and also import ammonia. They do not produce Urea. During the last 3 years, average of Fatamphos Fertilizer produced is 127720 MT and that of Ammonium Sulphate Fertilizer is 112956 MT. This accounts for total energy consumption of 64263 MTOE, and thus they qualify as DC. Their reported SEC is 9.84 G cal/MT Ammonia. It was decided that the targets for reduction shall be fixed based on SEC for Ammonia.

Assessed reduction target is 1.5% based on SEC, G cal/MT Ammonia.
[A] The following exclusions are considered:
(a) Energy consumed in internal transportation

[B] The equivalent thermal energy of the electricity supplied to the grid is DEDUCTED from the total energy input to the plant boundary. The following expression is used:

\[
\text{Equiv. Thermal Energy (kCal)} = \text{Electricity supplied to Grid (kWh)} \times 2717 \text{ kCal/kWh}
\]

[C] Correction factors which may be developed for variability during Target period
(a) Higher energy consumption due to environmental regulations
(b) Energy consumption due to temporary construction works, capacity expansion etc.

E. Target Setting
[1] Sectoral target is allocated based on a pro-rata basis of total energy consumption in the Fertilizer sector among all the 8 sectors under PAT scheme.

[2] Sub-Sectoral target is allocated based on a pro-rata basis of total energy consumption in the sub-sector among the total aluminium sector.

[3] The DC level target is allocated based on each DC’s potential to reduce energy consumption, due to vast diversity in design and operating conditions of each DC. The DC level target is allocated based on a statistical analysis derived from ‘Relative SEC’ concept. This approach will be applicable to all the DCs of a sub-sector only.

Apportionment of Sub-Sector Target of Energy Saving in Fertilizer Sector
Calculation of Energy Saving:

\[
\text{Energy Saving} = P_{\text{base year}} \times (\text{SEC}_{\text{base year}} - \text{SEC}_{\text{target year}})
\]

Where Energy Saving is in MTOE

\[
P_{\text{base year}} = \text{Production in MT}
\]

\[
\text{SEC} = \frac{\text{Specific energy consumption}}{\text{MTOE/MT}}
\]

6.0 Normalization factors for the Fertilizer sector

6.1. Low capacity utilization

Lower capacity utilization due to following reasons has been considered for normalization (i) Shortage of raw material including feed, fuel, water, electricity etc. (ii) High cost of inputs leading to unviable urea production beyond certain capacity (iii) Major equipment failure (iv) Force majeure i.e. factors like shortage of raw materials (mainly the gas), decline in market demand, change in Govt. policy etc. which are beyond the control of Designated Consumers. These factors may force the plant to be operated at lower capacity, thus causing adverse effect on energy consumption. In such cases, normalization shall be allowed as follows:

6.1.1. Pre-requisites for Normalisation

1. Designated Consumers shall furnish detailed and convincing reasons with supporting documents for reduction in capacity utilization, due to factors, beyond their control.

2. Following criteria shall be adopted:-
   a) No compensation shall be allowed if the capacity utilization of urea plant on annual basis is 95% or above.
   b) Compensation shall be allowed for capacity utilization between 70-95%.
   c) Below 70%, the data shall be discarded.
3. The claim will be based on Technical operating data (TOP), which is being reported to Fertilizer Industry Coordination Committee (FICC) of Department of Fertilizers, Govt. of India.

4. Normalization due to low capacity utilization will be considered only in one of the plants i.e. either ammonia or urea.

5. Subsequent to the baseline year i.e. 2007-10, some DCs have carried out major revamp of their plant for capacity enhancement in line with New Investment Policy for urea notified by the Govt. in 2008. Govt. recognized enhanced capacity, while reimbursing cost of production under the pricing policy. The enhanced capacity shall be considered, while calculating capacity utilization for normalization, subject to confirmation from DoF, Government of India and also verification certificate issued by an Accredited Energy Auditor to Designated Consumer which seeks to declare their enhanced installed capacities, production and energy use. Cost of this audit will be borne by the Designated Consumer. Check tests of such verification could be carried at by BEE, if needed.

6. Some plants are having ammonia plant capacity higher than the quantity of ammonia required for urea production and thus, diverting surplus ammonia for production of other products or direct sales. In such cases, due to Govt. policy and/or market conditions, consumption of surplus ammonia for production of other products becomes unviable and under these circumstances, ammonia plant is operated at lower capacity, thus resulting in higher energy consumption per MT of ammonia, which also get transferred to urea, even if the urea plant is operated at full load; Normalization shall be allowed.

7. In case of ammonia / urea complex having ammonia capacity matching with urea Production, capacity utilization of urea plant shall be considered.

6.1.2. Calculation of normalization factor

1. Based on the operating data collected from plants at 100%, 85% and 70% plant load, average normalization factor works out to be 0.02 Gcal per MT of urea per percentage reduction in plant load below 95% up to 70%.

2. Impact of Lower Capacity utilization shall be worked out as follows:-
   
a. Maximum permissible value (Gcal/ MT urea) = (95 - % Capacity utilization) * 0.02.

b. Actual unproductive energy (Gcal/ MT urea) = Annual Energy, Gcal/MT of Urea - Weighted Average of Monthly Energy Consumptions, GCal/MT urea for the months with Capacity Utilization of 100% or more

c. Lowest of the either (a) or (b) shall be considered for allowing the impact of lower capacity utilization.
### 6.1.3. Supporting data / documentation

Data shall be maintained in the following formats:-

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Description</th>
<th>Unit</th>
<th>2007-08</th>
<th>2008-09</th>
<th>2009-10</th>
<th>Baseline data</th>
<th>Previous Year 2013-14</th>
<th>2014-15</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
<td>F</td>
<td>G</td>
<td>H</td>
<td>I</td>
<td></td>
</tr>
<tr>
<td>1.0</td>
<td><strong>Ammonia Plant</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>Installed capacity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1.1</td>
<td>Re-assed capacity</td>
<td>MT</td>
<td>445500</td>
<td>445500</td>
<td>445500</td>
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<td></td>
<td></td>
<td>TOP</td>
</tr>
<tr>
<td>1.1.2</td>
<td>Re-vamp capacity</td>
<td>MT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>TOP</td>
</tr>
<tr>
<td>1.1.3</td>
<td>Actual production</td>
<td>MT</td>
<td>302940</td>
<td>382165</td>
<td>506010</td>
<td>397038</td>
<td>507000</td>
<td>TOP</td>
<td></td>
</tr>
<tr>
<td>1.1.4</td>
<td>On stream days</td>
<td>days</td>
<td>301</td>
<td>324</td>
<td>365</td>
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<td></td>
<td>TOP</td>
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<tr>
<td>1.1.5</td>
<td>Capacity utilization</td>
<td>%</td>
<td>68.0</td>
<td>85.8</td>
<td>113.6</td>
<td></td>
<td></td>
<td></td>
<td>93.1 TOP</td>
</tr>
<tr>
<td>1.1.6</td>
<td>Sp. Energy consumption</td>
<td>GCAL/MT ammonia</td>
<td>7.634</td>
<td>7.520</td>
<td>7.098</td>
<td>7.370</td>
<td>7.253</td>
<td>TOP</td>
<td></td>
</tr>
<tr>
<td>2.0</td>
<td><strong>Urea Plant</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1</td>
<td>Installed capacity</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>MT</td>
<td>370600</td>
<td>370600</td>
<td>370600</td>
<td></td>
<td></td>
<td></td>
<td>TOP</td>
</tr>
<tr>
<td>2.1.2</td>
<td>Re-vamp capacity</td>
<td>MT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>TOP</td>
</tr>
<tr>
<td>2.1.3</td>
<td>Actual production</td>
<td>MT</td>
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<td>333500</td>
<td>374300</td>
<td>319933</td>
<td>330000</td>
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<tr>
<td>2.1.4</td>
<td>On stream days</td>
<td>days</td>
<td>358</td>
<td>362</td>
<td>365</td>
<td></td>
<td></td>
<td></td>
<td>340 TOP</td>
</tr>
<tr>
<td>2.1.5</td>
<td>Capacity utilization</td>
<td>%</td>
<td>68.0</td>
<td>90.0</td>
<td>101.0</td>
<td></td>
<td></td>
<td></td>
<td>83.3 TOP</td>
</tr>
</tbody>
</table>

TOP: Technical Operating Data as submitted to FICC. Data in the above table is representational and may vary from unit to unit.
1.3.2 Month-Wise production & energy consumption during the year (2014-15)

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Month</th>
<th>Daily capacity MTPD</th>
<th>Ammonia</th>
<th>1650</th>
<th>Urea</th>
<th>1200</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Monthly capacity</td>
<td>On production</td>
<td>CU</td>
<td>SEC</td>
<td>Monthly capacity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MT</td>
<td>days</td>
<td>MT</td>
<td>%</td>
<td>MT</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GCal/MT</td>
<td></td>
<td></td>
<td></td>
<td>GCal/MT</td>
</tr>
<tr>
<td>1</td>
<td>April</td>
<td>49500</td>
<td>8</td>
<td>12000</td>
<td>24.2</td>
<td>8.560</td>
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<tr>
<td>2</td>
<td>May</td>
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<tr>
<td>3</td>
<td>June</td>
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<td>4</td>
<td>July</td>
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<td>5</td>
<td>August</td>
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</tr>
<tr>
<td>6</td>
<td>September</td>
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<td></td>
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<td></td>
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</tr>
<tr>
<td>7</td>
<td>October</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>November</td>
<td>49500</td>
<td>30</td>
<td>50490</td>
<td>102.0</td>
<td>6.955</td>
</tr>
<tr>
<td>9</td>
<td>December</td>
<td>51150</td>
<td>31</td>
<td>51670</td>
<td>101.0</td>
<td>6.905</td>
</tr>
<tr>
<td>10</td>
<td>January</td>
<td>51150</td>
<td>31</td>
<td>51670</td>
<td>101.0</td>
<td>6.905</td>
</tr>
<tr>
<td>11</td>
<td>February</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>March</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

1.3.3 Monthly best performance during the year (2014-15)

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Month</th>
<th>On production stream</th>
<th>Ammonia</th>
<th>CU</th>
<th>SEC</th>
<th>Total energy</th>
<th>Urea</th>
<th>CU</th>
<th>SEC</th>
<th>Total energy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>days</td>
<td>MT</td>
<td>%</td>
<td>Gcal/MT</td>
<td>Gcal/yr</td>
<td></td>
<td>MT</td>
<td>%</td>
<td>Gcal/MT</td>
</tr>
<tr>
<td>1</td>
<td>November</td>
<td>30</td>
<td>50490</td>
<td>102</td>
<td>6.955</td>
<td>351158</td>
<td>30</td>
<td>36900</td>
<td>102.5</td>
<td>6.395</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>4</td>
<td></td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
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<td>0</td>
</tr>
<tr>
<td>Sub-total</td>
<td></td>
<td>50490</td>
<td></td>
<td></td>
<td>351158</td>
<td>36900</td>
<td></td>
<td></td>
<td></td>
<td>235975.5</td>
</tr>
<tr>
<td>Weighted Average</td>
<td></td>
<td></td>
<td>6.955</td>
<td></td>
<td></td>
<td>6.395</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes:
(i) Take the month in which, plants have run for all the calendar days.
(ii) Capacity utilization during the month should be equal to or above 100%.
(iii) Similarly, tabulate data for the years 2007-08, 08-09, 09-10 and 2013-14

### 6.1.4. Calculation of Normalization factor for low capacity utilization

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Description</th>
<th>Unit</th>
<th>Baseline data 2007-08</th>
<th>Baseline data 2008-09</th>
<th>Baseline data 2009-10</th>
<th>Baseline data Average</th>
<th>Previous year 2013-14</th>
<th>Assessment year 2014-15</th>
<th>Guidelines for filling data Reference to excel sheet</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Urea plant capacity utilization</td>
<td>%</td>
<td>68.0</td>
<td>90.0</td>
<td>101.0</td>
<td></td>
<td>83.3</td>
<td></td>
<td>Based on “Re-assessed capacity” or “Revamp capacity: whichever is latest.</td>
</tr>
<tr>
<td>1</td>
<td>Eligibility for normalization</td>
<td>“True” is eligible</td>
<td>FALSE</td>
<td>TRUE</td>
<td>FALSE</td>
<td>TRUE</td>
<td></td>
<td></td>
<td>[Formula in excel sheet AND(95&gt;V7,V7&gt;70)]</td>
</tr>
<tr>
<td>2</td>
<td>Maximum permissible value</td>
<td>Gcal/MT urea</td>
<td>0.100</td>
<td></td>
<td></td>
<td></td>
<td>0.233</td>
<td></td>
<td>(95 - % Capacity utilization) * 0.02</td>
</tr>
<tr>
<td>3</td>
<td>SEC achieved</td>
<td>Gcal/MT urea</td>
<td>6.395</td>
<td>6.604</td>
<td>6.542</td>
<td>6.525</td>
<td>6.5</td>
<td>Actual from TOP (Ref: Table 1.3.1 above);</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Average SEC for best operating months</td>
<td>Gcal/MT urea</td>
<td>6.35</td>
<td>6.52</td>
<td>6.457</td>
<td></td>
<td>6.395</td>
<td>Ref: Table 1.3.2 above</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Un-productive energy due to low CU(4-5)</td>
<td>Gcal/MT urea</td>
<td>0.045</td>
<td>0.084</td>
<td>0.085</td>
<td>0.105</td>
<td></td>
<td>SEC achieved for year – Avg SEC for best operating months</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Allowable un-productive energy; lower of Sr no 3 &amp; 6</td>
<td>Gcal/MT urea</td>
<td>0.045</td>
<td>0.084</td>
<td>0.085</td>
<td>0.000</td>
<td>0.105</td>
<td>Lower of “ Max permissible value” and “ Un-productive energy due to low CU” [Formula in excel sheet MIN(V9,V12)]</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Average impact on SEC during baseline period (Weighted Average)</td>
<td>Gcal/MT urea</td>
<td></td>
<td></td>
<td></td>
<td>0.084</td>
<td></td>
<td>To be calculated manually for the baseline years in which Sr. No 2 is “True”.</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Normalization Factor (NF) due to low CU</td>
<td>Gcal/MT urea</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.021</td>
<td>Sr No I7 – Sr No G8</td>
<td></td>
</tr>
</tbody>
</table>

Units are advised to refer the Proforma (Production_energy_best monthly ) to Sd Form -1 for better understanding of the notations above. Data is purely representational and shall vary from DC to DC.

### 6.2. Cold startup of the plant after forced shut down

In case of sudden failure of a critical equipment, or external factors (as notified), ammonia plant undergoes a forced shut down. Restarting the plant from cold conditions (Cold start up), consumes unproductive energy and shall be normalized. Cold start up is defined as Fuel and Feed cut to reformer for a minimum period of 72hrs.

1. The list of critical equipment failure of which leads to complete shutdown of plant and consequent cold start up, allowed under this normalization factor is given below :-
   1. Primary Reformer
   2. Secondary Reformer
   3. Heat Exchange Reformer
4. Reformed Gas Boiler
5. Carbon dioxide absorber and stripper
6. Air, Refrigeration and synthesis compressors
7. Synthesis converters
8. Synthesis Gas Waste Heat Boilers
9. High pressure urea reactor, stripper and carbamate condenser
10. Carbon dioxide compressor
11. Utility boiler furnace
12. Gas turbine/HRSG
13. Cooling Tower
14. Major Fire leading to complete shutdown of plant and cold startup
15. Turbo generator along with GTG
16. Purifier
17. CO Shift Converter

2. The Designated Consumer (Designated Consumer) shall furnish a detailed report on failure of such equipment and its impact on energy consumption. The Designated Consumer shall declare with back up documentation, what portion of such unproductive consumption during the month is due to cold shutdown and startup activity.

3. This actual energy loss due to shut down and cold startup in Gcal/MT of Urea shall be compensated, subject to maximum of 0.03 Gcal/MT of Urea.

6.2.2. Calculation of normalization factor
1. Energy loss during the month(s) for which additional cold startup is being claimed shall be calculated as follows:
   a. (Monthly Energy per MT of Ammonia during the month – Weighted Average Monthly Energy Consumption per MT of Ammonia for the months with 100% on-stream days) X Monthly Ammonia production for the month of Startup.
   b. This Energy Loss shall be divided by Annual Urea Production to identify total unproductive loss in a month.
   c. The Designated Consumer shall declare what portion of such unproductive consumption during the month is due to cold shutdown and startup activity.
   d. This actual energy loss due to shut down and cold startup in Gcal/MT of Urea shall be compensated, subject to maximum of 0.03 Gcal/MT of Urea.

6.3. Use of naphtha
1. Using part naphtha involves additional energy consumption as follows:
   a) For each startup of facilities to use naphtha as feed including pre-reformer
   b) For the period of use of naphtha as feed
   c) For the period of use of naphtha as fuel
2. Designated Consumers shall furnish detailed and convincing reasons with supporting documents for use of naphtha due to non-availability of gas on account of factors, beyond their control.

6.3.1. Pre-requisites for Normalization
1. As per directives from Department of Fertilizers, Govt. of India, use of naphtha is to be discontinued in phased manner. As such, use of naphtha is not foreseen. However, provision is being made, in case naphtha has to be used due to shortage of natural gas in future, with permission from DoF.
2. In case of use of naphtha, Designated Consumer will furnish details regarding Non-availability of gas, leading to use of naphtha.
6.3.2. Calculation of normalization factor

Following formula shall be used:

\[ \text{Energy loss (Gcal/MUrea)} = \frac{(185S + 0.625N_{\text{feed}} + 0.443N_{\text{fuel}})}{\text{urea production in MT}} \]

\( S = 1 \) if naphtha is used as feed in startup
\( S = 0 \) if naphtha is not used as feed in startup

\( N_{\text{Feed}} = \) quantity of naphtha used as feed in MT.

\( N_{\text{Fuel}} = \) quantity of naphtha/LSHS/FO used as fuel in MT.

6.4. Catalyst reduction

Fresh catalyst is in oxidized form and needs to be reduced with synthesis gas, wherein hydrogen reacts with oxygen and gets converted into water. Whole plant is operated at 60-80% load for around 48 to 120 hours, depending upon type and quantity of catalyst.

Thus, replacement / reduction of ammonia synthesis and CO shift catalysts consumes large amount of unproductive energy. Therefore, normalization due to replacement / reduction of these catalysts will be allowed.

6.4.1. Pre-requisites for Normalization

1. In case of ammonia synthesis catalyst, in the older plants, oxidized form of the catalyst is used which takes around 4-5 days for reduction, causing corresponding un-productive energy consumption. Presently, “Pre-reduced catalyst” is also available, which is expensive but takes around 48 hours for reduction, thus consuming lesser un-productive energy. This aspect will be taken care, while calculating normalization factor.

2. This will be considered subject to certification by DCs and furnishing to BEE information as follows:
   a) Year in which the catalyst were last changed along with copies of purchase order, last placed with the vendor, time taken in commissioning of catalyst, facts and figures clearly indicating and quantifying rise in the energy consumption of plant due to the replacement of this catalyst.
   b) Copies of purchase orders placed by units with the vendors for supply of fresh catalysts.

6.4.2. Calculation of normalization factor

Adjustment shall be allowed on the basis of actual plant data, subject to a maximum of 0.04 Gcal/MT of Urea.

6.5. Deterioration in quality of Coal

The quality of indigenous coal has been deteriorating gradually, thus affecting boiler efficiency adversely. The reduction in boiler efficiency due to poor quality of coal shall be compensated.

6.5.1. Pre-Requisites for Normalization

Weighted average of three years data shall be worked out. In case there is significant variation, then normalization factor shall be applied based on the actual impact due to the variation.

6.5.2. Calculation of normalization factor

1. Quality of coal affects boiler efficiency, which shall be calculated by following empirical formula:-

\[ \text{Boiler Efficiency} = 92.5 - \frac{(50A + 630(M + 9H))}{GCV} \]

Where

\( A = \) Ash content of coal (%)
\( M = \) Moisture (%)
\( H = \) Hydrogen (%) 
\( GCV = \) Kcal/Kg
2. Boiler efficiency shall be converted into specific energy consumption, as follows:

Additional Energy Consumption, Gcal/MT of Urea = Energy of Coal per MT of Urea in Target Year, Gcal/MT of Urea* (Boiler Efficiency in Base Year – Boiler Efficiency in Target Year)/Boiler Efficiency in Target Year.

6.6. Additional provisions

1. Normalization factors to be applied during assessment year, shall also be applied on baseline data for 2007-10.

2. Provision of normalization factors is intended solely to save plants from penalties for non-achieving the saving targets, for reasons which are beyond the control of DCs. However, availing of any of the normalization factors shall render the DC ineligible for issuance of E-certificates under PAT scheme. Therefore, DCs may seek normalization factors only when the specified energy saving target is not achieved for reasons beyond the control of DC.

3. Designated Consumers claim will be examined based on Technical operating data (TOP), which is being reported to Fertilizer Industry Coordination Committee (FICC) of Department of Fertilizers, Govt. of India as well as by Accredited energy auditors designated by Bureau of Energy Efficiency (BEE).
Part-II
MONITORING & VERIFICATION GUIDELINES
1. Introduction

1.1. Background

Ministry of Power and Bureau of Energy Efficiency (BEE) have been implementing several programs for efficient use of energy and its conservation. This is further supplemented by the National Mission for Enhanced Energy Efficiency (NMEE), which is one of the missions under the National Action Plan on Climate Change (NAPCC), launched by Hon’ble Prime Minister on 30th June 2008 to ensure increase in the living standards of the vast majority of people while addressing climate change concerns.

The Perform Achieve and Trade (PAT) Scheme is one of the initiatives under the NMEE program, which was notified on 30th March 2012. PAT scheme is a market assisted compliance mechanism to accelerate implementation of cost effective improvements in energy efficiency in large energy-intensive industries, through certification of energy savings that could be traded. The genesis of the PAT mechanism flows out of the provision of the Energy Conservation Act, 2001 (Amended in 2010).

The key goal of the PAT scheme is to mandate specific energy efficiency improvements for the most energy intensive industries. The scheme builds on the large variation in energy intensities of different units in almost each notified sector, ranging from amongst the best in the world and some of the most inefficient units. The scheme envisages improvements in the energy intensity of each unit covered under it. The energy intensity reduction target, mandated for each unit is dependent on its current efficiency: the reduction target is lesser for those who are more efficient, and is higher for less-efficient units.


The scheme covers 478 Units, known as Designated Consumer (DC) in 8 sectors (Thermal Power Stations, Iron and Steel Plants, Cement, Fertiliser, Textile, Pulp and Paper, Chlor Alkali & Aluminium sector) in the cycle I. Together these designated consumers used about 36% of the fossil fuel consumed in India in 2010. Each designated consumer has been mandated to achieve a specific reduction in its specific energy consumption. Percentage reduction targets were notified in March, 2012, and the percentage reduction target is less for a designated consumer that is already efficient, and more for one that is less efficient. Overall, all the plants together are to achieve a 4.05% reduction in the average energy consumption by the year 2014-15. This would imply a reduction of about 6.686 million tons-of-oil-equivalent in their annual energy consumption, and a reduction of about 23 million tons of carbon dioxide annually.
A robust monitoring, reporting and verification process will ensure effective and credible assessment of energy performance, achieved by industries covered under PAT.

1.2. Purpose

A reliable monitoring, reporting and verification (M&V) system forms the backbone of assessment process of the PAT scheme. The objective of the M&V system is to streamline the activities to be carried out for verifying the energy performance achieved by the Designated Consumer in the target year.

The documents sets out the requisite guidelines for M&V in the Monitoring and Verification phase under the PAT Rules. It provides practical guidance and procedures to Designated Consumers (DCs) and Empanelled Accredited Energy Auditors (EmAEA) on verification requirements, and aims to establish a verification process consistent with relevant rules and regulations.

The Assessment of performance verification involves an independent evaluation of each activity undertaken by the DCs for compliance under PAT rules. Verification plays a crucial role in maintaining the integrity of the scheme and ensuring transparent validation.

The verification process will ensure that the information and data in Form 1 and Pro-forma are free from material omissions, misrepresentations and errors.

The process requires EmAEA to verify the monitoring and verification of energy performance of DCs in accordance with PAT rules while taking into the consideration, normalization factors and any other relevant conditions as defined PAT Rules.

The verification must be completed between 1st April to 30th June of the year, following the assessment year. Submission of final verification report, verified annual Form 1, Sector Specific Pro-forma, EmAEA’s verification report along with authentic supporting documents shall be done by the DC to the concern State Designated Agency (SDA) and Bureau of Energy Efficiency before 30th June.

The document:

- Provides Designated Consumers and EmAEA set of guidelines to establish methods for assessment of specific energy consumption.
- Defines broad techniques for assessing/determining factors that affect the performance of establishment.
- Provides general terms, which are applicable to all sectors and also includes specific sector term.
- Will be guided as per the provisions conferred under Rule 3 of PAT Rules 2012.
- Provides support to the Designated Consumer to meet its obligation specified in Rule 7 and Rule 15 of the PAT Rules.

1.3. Definition of M&V

M&V is the process to verify the specific energy consumption through verifiable means of each Designated Consumer in the baseline year and in the assessment year by an empanelled accredited energy auditor.

The underlying principles for Monitoring and Verification include:

- **Consistency:** By applying uniform criteria to meet the requirements of the sector specific methodology throughout the assessment period.
- **Transparency:** Information in the verification reports shall be presented in an open, clear, factual, neutral and coherent manner based on documentary evidence.
- **Acceptability:** The Empanelled Accredited Energy Auditors shall base their findings and conclusions upon objective evidence,
conduct all activities in connection with the validation and verification processes in accordance with the rules and procedures laid down by BEE, and state their validation or verification activities, findings, and conclusions in their reports truthfully and accurately.

**Measurability:** Measurement is a fundamental starting point for any kind of data captured for Energy Performance Index.

i. Measurement in energy saving projects: The energy saving from any project is determined by comparing measured parameters before and after implementation of a project, making appropriate adjustments for changes in conditions.

ii. Measurement of parameters for data captured in Pro-forma: The parameters entered in the pro-forma shall be taken from the measured logs with supporting documentation through computational documentation from basic measurement at field.

iii. Measurement activities in the baseline and assessment year consist of the following:
- meter installation, calibration and maintenance
- data gathering and screening,
- development of a computation method and acceptable estimates from the basic measurement at field,
- computations with measured data, and
- reporting, quality assurance

A measurement boundary is a notional border drawn around equipment and/or systems that are relevant for determining the savings achieved through implementation of Energy saving projects.

**Traceability:** The documents presented for substantiating the reduction in specific energy consumption or savings from ECM should be verifiable and visible.

**Verifiability:** The validation of filled in data in the Pro-forma and savings from Energy Conservation Measures through proper authentic documentation are to be carried out by the EmAEA.

1.4. **Empanelled Accredited Energy Auditor or Verifier**

Accredited Energy Auditor firm empanelled with BEE under PAT rules will be the verifier of PAT M&V process.

“verification” means a thorough and independent evaluation by the accredited energy auditor of the activities undertaken by the designated consumer for compliance with the energy consumption norms and standards in the target year compared to the energy consumption norms and standards in the baseline year and consequent entitlement or requirement of energy savings certificate.

“certification” means the process of certifying the verification report or check-verification report by the accredited energy auditor to the effect that the entitlement or requirement of energy savings certificate is quantified accurately in relation to compliance of energy consumption norms and standards by the designated consumer during the target year;

“check-verification” means an independent review and ex-post determination by the Bureau through the accredited energy auditor, of the energy consumption norms and standards achieved in any year of the three year cycle which have resulted from activities undertaken by the designated consumer with regard to compliance of the energy consumption norms and standards;
1.4.1. Qualification of Empanelled Accredited Energy Auditor (EmAEA) for Verification and Check-Verification

A firm registered under the Indian Partnership Act, 1932 (9 of 1932) or a company incorporated under the Companies Act, 1956 (1 of 1956) or any other legal entity competent to sue or to be sued or enter into contracts shall be entitled to undertake verification and check-verification regarding compliance with the energy consumption norms and standards and issue or purchase of energy savings certificate if it:

(a) has at least one accredited energy auditor whose name is included in the list of the accredited energy auditors maintained by the Bureau under regulation 7 of the Bureau of Energy Efficiency (Qualifications for Accredited Energy Auditors and Maintenance of their List) Regulations, 2010;

(b) has at least three energy auditors;

(c) has adequate expertise of field studies including observations, probing skills, collection and generation of data, depth of technical knowledge and analytical abilities for undertaking verification and check-verification;

(d) has a minimum turnover of ten lakhs rupees per annum in at least one of the previous three years or in case of a newly formed organisation, a net worth of ten lakhs rupees.

The application shall be accompanied by a certificate of registration or incorporation as the case may be.

1.4.2. Obligation of Empanelled Accreditor Energy Auditor

For the work of verification or check verification, the accredited energy auditor shall constitute a team comprising of a team head and other members including Process Experts:

Provided that a person who was in the employment of a designated consumer within the previous four years, shall not be eligible to perform the work of verification or check-verification for such designated consumer;

(1) Provided further that any person or firm or company or other legal entity, who was involved in undertaking energy audit in any of the designated consumer within the previous four years, shall not be eligible to perform the work of verification or check-verification for such designated consumer.

(2) The accredited energy auditor shall ensure that persons selected as team head and team members must be independent, impartial and free of potential conflict of interest in relation to activities likely to be assigned to them for verification or check-verification.

(3) The accredited energy auditor shall have formal contractual conditions to ensure that each team member of verification and check-verification teams and technical experts act in an impartial and independent manner and free of potential conflict of interest.

(4) The accredited energy auditor shall ensure that the team head, team members and experts prior to accepting the assignment inform him about any known, existing, former or envisaged link to the activities likely to be undertaken by them regarding verification and check verification.

(5) The accredited energy auditor must have documented system for determining the technical or financial competence needed to carry out the functions of verification and check-verification and in determining the capability of the persons, the accredited energy auditor shall consider and record among other things the following aspects, namely:

(a) complexity of the activities likely to be undertaken;
(b) risks associated with each project activity;
(c) technological and regulatory aspects;
(d) size and location of the designated consumer;
(e) type and amount of field work necessary for the verification or check-verification.

(6) The accredited energy auditor shall have documented system for preparing the plan for verification or check-verification functions and the said plan shall contain all the tasks required to be carried out in each type of activity, in terms of man days in respect of designated consumers for the purpose of verification and check-verification.

(7) The names of the verification or check-verification team members and their biodata shall be provided by the accredited energy auditor to the concerned designated consumer in advance.

(8) The verification or check-verification team shall be provided by the accredited energy auditor with the concerned working documents indicating their full responsibilities with intimation to the concerned designated consumer.

(9) The accredited energy auditor shall have documented procedure-
(i) to integrate all aspects of verification or check-verification functions;
(ii) for dealing with the situations in which an activity undertaken for the purpose of compliance with the energy consumption norms and standards or issue of energy savings certificate shall not be acceptable as an activity for the said purposes.

(10) The accredited energy auditor shall conduct independent review of the opinion of verification or check-verification team and shall form an independent opinion and give necessary directions to the said team if required.

(11) In preparing the verification and check-verification reports, the accredited energy auditor shall ensure transparency, independence and safeguard against conflict of interest.

(12) The accredited energy auditor shall ensure the confidentiality of all information and data obtained or created during the verification or check verification report.

(13) In assessing the compliance with the energy consumption norms and standards and issue of energy savings certificates, the accredited energy auditor shall follow the provisions of the Act, rules and regulations made thereunder.

(14) After completion of the verification or check-verification, the accredited energy auditor shall submit the verification (in Form- “B”) or check-verification report, together with the certificate in Form-‘C’, to the Bureau.

1.5. Important Documents required for M&V process

I. Accepted Baseline Audit Report (Available with BEE and DC)\textsuperscript{1}

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\textsuperscript{1}Baseline Report: Available with BEE and respective DCs. EmAEA to verify the consistency of Report
II. Form 1 & Sector Specific Pro-forma available with BEE
III. Form A, B, C, D as covered in PAT rules
IV. Normalisation Factors Document available with BEE
V. Normalisation Guidelines Document available with BEE
VI. Check List to be used by all stakeholders
VII. Reporting Format for EmAEA
VIII. ESCerts Management Registry

Figure 2: Stakeholders

2. Broad Roles and Responsibilities

The various roles assessed to be performed in the verification process include administration, regulation and services delivery. The key stakeholders are Ministry of Power, Bureau of Energy Efficiency, State Designated Agencies, Adjudicator, Designated Consumers and Empanelled Accredited Energy Auditor.

2.1. General

The roles and responsibilities of individuals and designated consumer are set out in Energy Conservation Rules 2012.

The roles and responsibilities of the Designated Consumer (DC), Empanelled Accredited Energy Auditor (EmAEA), Bureau of Energy Efficiency (BEE), State Designated Agencies (SDA), Adjudicator and Ministry of Power (MoP) can be summed up as under

The Designated Consumer shall fill the data in the Sector Specific Pro-forma and Form 1 stating source of data in the Form, of its installation as per GtG boundary concept manually in Excel Sheet Pro-forma and in PATNET. The filled in Forms with the authentic source of data in terms of hard copy document shall have to be kept ready by Designated Consumer for verification. The designated consumer in consultation with the EmAEA, shall put in place transparent, independent and credible monitoring and verification arrangement. The verifier shall ensure transparency, independence and safeguard against conflict of interest.

As part of verification process, the EmAEA shall

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carry out a strategic and statistical Analysis, checking of relevant and authentic document, Quarterly, Yearly and End of Cycle internal data audit reports, Performance Assessment Documents (Form A), Form I and sector specific pro-forma from DCs, the actual verification produce an internal verification report, Form B from EmAEA. These verified Forms, documents and reports will then be submitted to the SDA with a copy to the Bureau. The SDA, in turn after proper verification of Form A sent by DC may send comment to BEE for final verification based on the SDA Check List.

If the accredited energy auditor records a positive opinion in his verification report, the Bureau shall consider that all the requirements with regard to the compliance with energy consumption norms and standards, entitlement about issue or liability to purchase energy savings certificate have been met.

BEE on satisfying itself about the correctness of verification report, and check-verification report, wherever sought by it, send its recommendation under clause (aa) of sub-section (2) of section 13 to the Central Government, based on the claim raised by the designated consumer in Form ‘A’, within ten working days from the last date of submission of said Form ‘A’ by the concerned state designated agency, for issuance of energy savings certificates under section 14A Guidance on these responsibilities are presented in the Energy Conservation Rules 2012.

2.2. Designated Consumer

The Designated Consumers have the following responsibilities with respect to EOC or mid cycle verification as per guidelines in Energy Conservation Rules 2012:

1. To monitor and report in accordance with the monitoring plan approved by the BEE.
2. Establish data and information management system as per Sector Specific Supporting Pro-forma for Form 1, Normalization formulae
3. M&V arrangements for energy consumption and production by Designated Consumer
4. Without prejudice to the monitoring plan approved by the BEE, DC must comply with on-going obligations imposed under PAT Rules 2012
5. The monitoring methodology or the Input Data Entry with Normalisation factors shall be changed if this improves the accuracy of the reported data and for taking out any errors reported by DC in the Sector Specific Pro-forma (Linking formulae, error formulae or wrong data entry)
6. The designated consumer in consultation with the accredited energy auditor, shall put in place transparent, independent and credible monitoring and verification arrangements for energy consumption and production based on the Bureau of Energy Efficiency (Manner and Intervals of Time for Conduct of Energy Audit) Regulations, 2010 for compliance with the energy consumption norms and standard, and the said arrangements shall include,

i) Preparation and Maintenance of Quarterly Data Reports to be prepared by DCs from 2012 onwards up to assessment year
   a. On the performance of plant and production process
   b. Internal Field Audit Report on Energy and Process
ii) Preparation and Maintenance of Yearly Data Reports to be prepared by DCs from 2012 onwards up to assessment year
   a. On the performance of plant and production process
b. Outcome of Internal Field Audit

c. Measures to reduce energy consumption and improve energy efficiency

d. Measures taken to improve the efficiency of the production processes during each year

iii) Preparation and Maintenance of Yearly Data Reports to be prepared by DCs from 2012 onwards up to assessment year

a. Report on production achieved, energy consumed

b. specific energy consumption achieved, specific energy consumption

c. reduction achieved, measures adopted for energy conservation and quantity of energy saved;

iv) Preparation and Maintenance of Consolidated End of Cycle (EOC) Data Reports to be prepared by DCs from 2012 onwards up to assessment year

a. Report on production achieved, energy consumed

b. specific energy consumption achieved, specific energy consumption

c. reduction achieved, measures adopted for energy conservation and quantity of energy saved;

7. The DC has to maintain in set tabulated format and set reports template as per above guidelines for submission to EmAEA

8. The DC has to fill the data in the Sector Specific Pro-forma for the Normalisation factors including M&V protocol for its facility in conformity with the Sectoral Normalisation factor guidelines prepared by BEE

9. The data to be filled in the latest version of MS Office Excel sheet and PATNET

10. Designated Consumers shall facilitate verification and check-verification work by the EmAEA and SDA.

11. The designated consumers shall,-

(a) for assessment of their performance for compliance with the energy consumption norms and standards, get the work of verification done through accredited energy auditors;

(b) take all measures including implementation of energy efficiency projects recommended by the accredited energy auditor and good practices prevalent or in use in the concerned industrial sector so as to achieve the optimum use of energy in their plant:

I furnish the full and complete data, provide necessary documents and other facilities required by the accredited energy auditor for the purpose of performing the function of verification and check-verification.

12. The designated consumer for the purpose of achieving the compliance with the energy consumption norms and standards during the target year, in the relevant cycle shall take the following action and after completing the said action, furnish the status of compliance to the concerned state designated agency with a copy to the Bureau in Form D’ by the end of five months from the last date of submission of Form ‘A’-

(a) by implementation of energy conservation and energy efficiency improvement measures or;

(b) where the measures implemented in terms of clause (a) are found
inadequate for achieving compliance with the energy consumption norms and standards, the designated consumer shall purchase the energy savings certificates equivalent in full satisfaction of the shortfall in the energy consumption norms and standards worked out in terms of metric ton of oil equivalent.

2.3. Empanelled Accredited Energy Auditor (EmAEA)

The EmAEA is responsible for verification of Energy Consumption Norms and Standards for Designated Consumers, Gate to Gate Specific Energy Consumption of baseline and assessment year as per guidelines of PAT Rules 2012 with subsequent attributes:

13. To ensure that the verification is carried out by properly trained and competent staff as per Section 1.4.2

14. The EmAEA is responsible for ensuring that the systems and processes adopted by the DC for determination of GtG SEC from the data in Sector Specific Pro-forma along with Normalisation sheets and information protocol have been maintained in conformity with the various notifications and information provided by BEE/SDA from time to time

15. EmAEA is required to perform different roles such as technical review of manufacturing processes & energy consumption patterns, system variabilities and their impact on energy consumption, and on issues including application of statistical methods and finally performance of verifications including integrity of data

16. The accredited energy auditor shall independently evaluate each activity undertaken by the designated consumer for compliance with the energy consumption norms and standards and entitlement or requirement of energy savings certificate, to ensure that they meet with the requirements of these rules.

(A) The accredited energy auditor, in order to assess the correctness of the information provided by the designated consumer regarding the compliance with energy consumption norms and standards shall-

(a) Apply standard auditing techniques;

(b) Follow the rules and regulation framed under the Act;

(c) Integrate all aspects of verification, and certification functions;

(d) Make independent technical review of the opinion and decision of the verification team; also take into consideration, a situation where a particular activity may or may not form part of the activities related to the compliance with the energy consumption norms and standards, and the procedure for the assessment shall include,-

(B) Document review, involving

(i) Review of data and its source, and information to verify the correctness, credibility and interpretation of presented information;

(ii) Cross checks between information provided in the audit report and, if comparable information is available from sources other than those used in the audit report, the information from those other sources and independent background investigation;

(C) Follow up action, involving-

(iii) Site visits, interviews with personnel responsible in the designated consumers’ plant;
Monitoring & Verification Guidelines

(iv) Cross-check of information provided by interviewed personnel to ensure that no relevant information has been omitted or, over or under valued;

(v) Review of the application of formulae and calculations, and reporting of the findings in the verification report.

(D) The accredited energy auditor shall report the results of his assessment in a verification report and the said report shall contain,

(a) The summary of the verification process, results of assessment and his opinion along with the supporting documents;

(b) The details of verification activities carried out in order to arrive at the conclusion and opinion, including the details captured during the verification process and conclusion relating to compliance with energy consumption norms and standards, increase or decrease in specific energy consumption with reference to the specific energy consumption in the baseline year;

(c) the record of interaction, if any, between the accredited energy auditor and the designated consumer as well as any change made in his assessment because of the clarifications, if any, given by the designated consumer.

17. EmAEA to prepare a verification report as per Reporting template to be provided by BEE

18. EmAEA to resolve errors, omissions or misrepresentations in the data/records/calculations in consultation with the DCs prior to completing the verification report

19. EmAEA to resolve calculation errors in the Sector Specific Pro-forma in consultation with the BEE prior to completing the verification

2.4. State Designated Agencies (SDA)

All the documents like verified Sector Specific Pro-forma, Form 1, Verification report of EmAEA and related documents will be routed to BEE via SDA.

20. The technical role of SDA are

i. Inspection & enforcement for M&V related systems

ii. Assist BEE in information management process

iii. Review and validation of Sector Specific Pro-forma, Form 1, Verification report of EmAEA and related documents before sending it to BEE

iv. After submission of duly verified Form ‘A’ by designated consumer, SDA may convey its comments, if any, on Form ‘A’ to the Bureau within fifteen days of the last date of submission of Form ‘A’.

v. BEE, in consultation with SDA may decide to undertake review on Check verification

vi. The EmAEA in-charge of check verification shall submit the report with due certification Form C to the BEE and the concerned SDA

vii. The State designated agency may furnish its comments on the report within ten days from the receipt of the report from the said EmAEA. In case no comments are received from the concerned state designated agency, it shall be presumed that they have no comments to offer in the matter
viii. The State designated agency within two months from the date of the receipt of the report referred to in sub-rule (9) shall initiate-

(a) action to recover from the designated consumer the loss to the Central Government by way of unfair gain to the designated consumer;

(b) penalty proceedings against the persons mentioned in the said report, under intimation to the Bureau;

(c) register complaint for such fraudulent unfair gain if designated consumer does not pay penalty and loss to the exchequer in the specified time mentioned in the penalty proceedings.

21. The administrative role of SDA are

The designated agency may appoint, after the expiry of five years from the date of commencement of this Act, as many inspecting officers as may be necessary for the purpose of ensuring compliance with energy consumption standard specified under clause (a) of section 14 or ensure display of particulars on label on equipment or appliances specified under clause (b) of section 14 or for the purpose of performing such other functions as may be assigned to them.

Subject to any rules made under this Act, an inspecting officer shall have power to-

(a) inspect any operation carried on or in connection with the equipment or appliance specified under clause (b) of section 14 or in respect of which energy standards under clause (a) of section 14 have been specified;

(b) enter any place of designated consumer at which the energy is used for any activity and may require any proprietor, employee, director, manager or secretary or any other person who may be attending in any manner to or helping in, carrying on any activity with the help of energy to afford him necessary facility to inspect-

(A) any equipment or appliance as he may require and which may be available at such place;

(B) any production process to ascertain the energy consumption norms and standards

2.5. Adjudicator

Section 17 and Section 28 of EC Act 2001 shall be referred for power to adjudicate

2.6. Bureau of Energy Efficiency

BEE shall co-ordinate with the Designated Consumers, SDA, Sectoral technical committee and other agencies to administer and monitor the Scheme as per PAT Rules and EC Act 2001.

22. BEE recommend to the Central Government the norms for processes and energy consumption standards required to be notified under clause (a) of section 14 of Energy Conservation Act 2001

23. Preparation and Finalization of Sector Specific Pro-forma for annual data entry in consultation with the Technical Committee set up by BEE

24. Preparation and finalization of Sector Specific Normalization Factors applicable in Assessment year in consultation with Technical Committee set up by BEE

25. Empanelment of Accredited Energy Auditor Firm as Verifier for M&V
26. Capacity building of SDA, EmAEA, Energy Manager of DCs

27. The Bureau on satisfying itself about the correctness of verification report, and check-verification report, wherever sought by it, send its recommendation under clause (aa) of sub-section (2) of section 13 to the Central Government, based on the claim raised by the designated consumer in Form ‘A’, within ten working days from the last date of submission of said Form ‘A’ by the concerned state designated agency, for issuance of energy savings certificates under section 14A

2.7. Ministry of Power

28. Roles and Responsibilities of Central Government have been covered under Energy Conservation Act 2001 and notified PAT Rules 2012

2.8. Institutional Framework for PAT

Transparency, flexibility and Industry engagement in program design help ensure effective industrial energy efficiency policy with adequate buy-in from the covered facilities. PAT’s design phase involved extensive consultations with the DCs. Consultations ensured the design phase was transparent and allowed industry to engage in the process.

Since, PAT being largely a federal government scheme, hence involvement of State Designated Agencies as an extended arm of enforcement agency ushers outcome in the right direction.

An institutional frame work consisting of State Designated Agencies, Designated Consumers, Accredited Energy Auditors, Trading Exchanges and Financing facilities has been established to implement the scheme. Bureau of Energy Efficiency is leading the process with state level capacity supported by AEA and Sectoral Technical committee constituted for rationalizing the process.

Figure 3: Institutional Framework

[Diagram showing the institutional framework with various stakeholders and processes, including MoP (Ministry of Power), BEE (Bureau of Energy Efficiency), SDA (State Designated Agency), AEA (Accredited Energy Auditors), Designated Consumers (DCs), Financial Facilities, and Trading Exchanges.]
3. Process & Timelines

3.1. Activities and Responsibilities

The Energy Conservation Rules, 2012 clearly defines the timelines of activities and responsibilities to be carried out for accomplishment of PAT scheme. Timely submission of action plan from DC to trading of ESCerts needs to be done in a definite time zone. Constant performance monitoring of the program by the Administrator, through parameters like total ESCerts issued & traded, complying sectors or participants, market liquidity etc., will be carried out. Delays at any point of the process-chain will be identified and timely action be taken by the Administrator/Regulator.

Automation of processes wherever feasible will be carried out for seamless implementation of the PAT scheme.

<table>
<thead>
<tr>
<th>S. No</th>
<th>Name of Form</th>
<th>Submitted by</th>
<th>Time of Submission</th>
<th>Submission authorities</th>
</tr>
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<tr>
<td>1.</td>
<td>Form A</td>
<td>DCs</td>
<td>Three months from conclusion of target year (end of first, second or third year of relevant cycle) <strong>30th June, 2015</strong></td>
<td>SDA &amp; BEE</td>
</tr>
<tr>
<td>2.</td>
<td>Form B (Certificate of verification by AEE)</td>
<td>DCs</td>
<td>Three months from conclusion of target year (end of first, second or third year of relevant cycle) <strong>30th June, 2015</strong></td>
<td>SDA &amp; BEE</td>
</tr>
<tr>
<td>3.</td>
<td>BEE’s Recommendation to MoP for issuance of ESCerts</td>
<td>BEE</td>
<td>10 working days from receipt of forms A &amp; B</td>
<td>Ministry of Power</td>
</tr>
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<td>4.</td>
<td>Issuance of ESCerts</td>
<td>Central Government (MoP)</td>
<td>Within 15 days from receipt of recommendations by BEE</td>
<td>BEE</td>
</tr>
<tr>
<td>5.</td>
<td>Form D (status of Compliance)</td>
<td>DC</td>
<td>End of 5 months from the last date of submission of Form A</td>
<td>SDA &amp; BEE</td>
</tr>
<tr>
<td>6.</td>
<td>Form C (check verification report and certificate)</td>
<td>AEA (Accredited Energy Auditor)</td>
<td>Within 6 months after issuance of ESCerts or within 1 year of submission of compliance report</td>
<td>BEE</td>
</tr>
</tbody>
</table>
3.2. Process Interlinking

The complete process from notifying the targets to issuing Escerts are interlinked among different stakeholders complying a definite time frame as defined below.

Figure 4: Stakeholders Interlinking

- (A) Targets from Central Government to DCs
- (B) Performance Assessment Document (Form A) from DC to SDA
- (C) PAD (Form-A) with recommendation for issuance, if overachieved from SDA to BEE
- (D) Recommendation of ESCerts Issuance by BEE to Central Government
- (E) ESCerts Issuance Instruction from Central Government to BEE
- (F) Electronic ESCerts Issuance Instruction from BEE to Depository
- (G) DC Interaction with Depository A/c
- (H) ESCerts credit to DC’s A/c