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Message

Energy is one of the vital inputs for economic growth and development of our country. In order to achieve sustainable development, efficient utilization and conservation of energy resources is extremely important.

With the objective of enhancing energy conservation and efficiency, Ministry of Power with Bureau of Energy Efficiency (BEE) has taken various initiatives in the areas of appliances, buildings and industry under the framework of Energy Conservation Act 2001. One such flagship programs for improving energy efficiency for large industries was launched as the Perform, Achieve and Trade (PAT) scheme under the National Mission for Enhanced Energy Efficiency (NMEEE). In the first cycle of PAT, 478 large industrial units of 8 sectors (Aluminum, Cement, Chlor-Alkali, Fertilizer, Iron & Steel, Paper & Pulp, Thermal Power, Textile) were given total energy savings target of 6.686 million ton of oil equivalent. It is heartening to see that this target has been exceeded by about 30% with a realization of savings of 8.67 million ton of oil equivalent.

The PAT scheme has not only resulted in energy saving benefits as well as avoided generation costs, but also created job opportunities for energy professionals. The investment in energy efficient technologies has led to adoption of new products, thereby enhancing domestic production.

This booklet provides a snapshot of the achievements under this program for the large energy intensive sectors. It gives an analysis of various other environmental and social co-benefits in terms of avoided emission of Green House Gases (GHG) and skill enhancement of associated energy professionals.

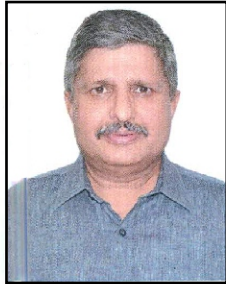
I congratulate the entire PAT team consisting of officials from Ministry of Power, BEE, partner organizations like GIZ and participants from the industries.



(A.K. Bhalla)



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MESSAGE


The strategy adopted by the Government of India, to make power available to all at affordable rates, includes promotion of energy efficiency and its conservation in a sustainable manner. This is not only the least cost option, but also is in keeping with the commitments made by India under the Nationally Determined Contributions at the Conference of Parties. India has taken timely action to mitigate and adapt to climate change. One of the Missions under the National Action Plan on Climate Change is the National Mission on Enhanced Energy Efficiency (NMEEE). Under NMEEE, the Perform, Achieve and Trade (PAT) is an innovative initiative, which has borne fruits.

This scheme while promoting energy efficiency has also encouraged research and development for developing energy efficient technologies and processes. It has also led to capacity building and creation of a pool of professionals in the field of energy efficiency. Most importantly, this scheme has changed the ethos in several industries making them more energy efficient.

It is heartening to learn that the energy saved in PAT cycle-I is 8.61 million tonnes of oil equivalent which is a 30% over-achievement from the target. This itself depicts the acceptance of this scheme by the industries who have invested around Rs.26,000 crores in energy efficiency and related measures.

It gives me immense pleasure to mention that the programme was successful in saving 31 million tonnes of CO₂. It is a moment of personal pride for each and every individual directly or indirectly involved in this endeavour. The scheme has been greatly appreciated and some countries are in the process of initiating similar ventures.

A brief report on the outcome and preliminary analysis of PAT cycle-I has been compiled which gives an insight to the tremendous efforts made by the industries and their achievements need to be lauded.


(Raj Pal)



MESSAGE

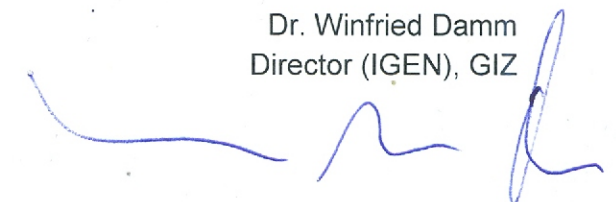
The Indo-German Technical Cooperation in the energy sector dates back to 1995. The objective of the Indo-German Energy Programme (IGEN) is to support policies and programmes envisaged in the Energy Conservation Act, 2001. Currently under IGEN the primary focus is on energy efficiency and renewables.

The current IGEN energy efficiency programme focuses primarily on the Perform Achieve and Trade scheme. As you are all aware PAT is one of the flagship programmes under the National Mission for Enhanced Energy Efficiency (NMEEE) which is one of the missions under the PM's National Action Plan on Climate Change. The German government feels extremely privileged to partner this scheme as it would help India in fulfilling some of its nationally determined contributions committed by ratifying the UNFCCC agreement.

The design of PAT which is a market based mechanism to enhance cost effectiveness of improvements in energy efficiency in large energy intensive industries is based on a carrot and stick policy where energy savings are translated into tradable instruments. Under the PAT programme GIZ has been associated with several activities which include capacity building of industries covered under PAT (Designated Consumers), development of sector specific forms, normalization procedures, the M&V process etc. I am happy to note that the hard work put in by both partners as well as the participating designated consumers has resulted in the PAT cycle I over achieving its targets. Against a target of 6.68 MTOE the achievement has been 8.67 MTOE. It has also resulted in a CO₂ reduction of 31 million tonnes. A lot of credit goes to the industries who have invested around Rs. 26,100 crores in energy efficiency technologies and related measures which is praiseworthy. PAT has had a strategic impact on industries by creating a conducive environment for helping industries to identify and remove barriers and exploit opportunities to accelerate the adoption of all cost-effective energy efficiency measures as a matter of standard practice so as to make them sustainable in the long run. It has fostered research and development and has created a pool of professionals in the sector of energy efficiency especially energy auditors and managers through the BEE's certification programme.

The preliminary report on the performance of PAT cycle-I analyses the processes and procedures involved and clearly brings out the various achievements accomplished. I congratulate all the players who have acted in concert to make PAT cycle-I a success and I am hopeful that the momentum will be maintained in the subsequent cycles as well.

Dr. Winfried Damm
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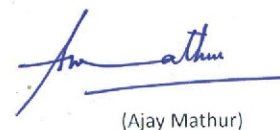
Foreword

The Perform, Achieve and Trade (PAT) programme was created to operationalize the mandate in the National Action Plan on Climate Change to create, “a market-based mechanism to enhance cost effectiveness of improvements in energy efficiency in energy intensive large scale industries and facilities through certification of energy savings that could be traded. In order to facilitate the implementation of this mandate, the provisions in the Energy Conservation Act, 2001, for prescription of energy consumption norms for energy intensive industries were amended in 2010 so that energy savings certificates (ESCerts) could be issued to those industries whose energy consumption was less than the prescribed norm, and to allow the purchase of these ESCerts for compliance, by those industries who are unable to meet their prescribed norms.

Under these legal provisions, 478 industrial units in 8 industrial sectors were specified as energy intensive industries who had to meet the prescribed norms over a 3-year period. These prescribed norms were notified d on 31st March 2012, and had to be achieved by 31st March 2015. In establishing the prescribed norms, large scale consultation was carried out with the industrial units, civil society, and experts. It was decided that the prescribed norms would be in the form of specific energy consumption (SEC), defined in terms of the total amount of energy that entered the gates of the industrial units during a financial year, divided by the total amount of finished product that left the gates in that year. A baseline audit of all the plants were carried out to establish the baseline energy consumption. It was also decided, as part of the consultation that all industrial units would reduce their specific energy during the 3-year period, with the most efficient plants being required to achieve a lower percentage reduction in their SEC than those which had higher specific energy consumption. The process and methodology of establishing the norms was agreed so that the consumption norms could be determined in a transparent manner. A process of third-party verification was also established so that the actual SEC at the end of the 3-year period could be independently verified, leading to either the issuance of ESCerts or determining the need for an industry to purchase ESCerts.

It has been a matter of great satisfaction that industry has participated fully in this programme, and sees this programme as being aligned with their own goals of productivity enhancement and increased competitiveness. The massive over-achievement of the target achieved in the first PAT cycle speak volumes of the capacity of the industry to achieve – and overachieve – ambitious energy efficiency targets, as well as of the asymmetry of information due to which the targets were not at a higher level. However, it is worth noting that 75% of the industries reached and overachieved the prescribed SEC norm, and the balance will need to purchase the ESCerts for compliance. The energy savings that have been achieved are formidable 2% of the commercial energy consumption in the country.

The initiation of trading of the ESCerts marks the successful culmination of the process of incentivise ambitious energy savings in energy intensive industries. India can be justly proud of this innovative programme to enable energy savings in energy intensive industries, especially in a global environment in which public policy is apprehensive of applying compliance measures to energy intensive industries – largely for fear of loss of competitiveness. This programme is a shining example of the Indian industry's proactive stance and of the innovativeness of our public policy system.


(Ajay Mathur)



अभय बाकरे, आईआरएसईई
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Director General



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BUREAU OF ENERGY EFFICIENCY
(Government of India, Ministry of Power)

PREFACE

Energy is seen as the key driver for economic growth and so has been observed for long till countries like Japan decoupled this correlation between economic growth and energy consumption. As the discourse on sustainable development gains louder, conservation and efficient utilization of critical resources like energy is extremely important not only from resource conservation perspective but from the other angle that the anthropogenic use of fossil based energy resources has found main cause for global temperature rise.

As India aims to raise the living standards of millions of its population, demand for energy is going to increase rapidly coupled with increased consumption in industry, buildings and other end uses of energy. Furthermore, as our country is highly import dependent on such supply and in tumultuous geo-political formations, energy security is one of the prime concern. Vulnerability to the impacts of any change in the natural cycles such as monsoon due to factors causing climate change remains another challenge. As our country faces various supply side constraints, emission caused by fossil-fuel-based power generation contributes to climate change, demand side options holds the promise to share the avoided energy resources for raising the living standards of many.

Looking at the necessity and capacity, India has assumed leadership role in promotion of energy efficiency and conservation towards addressing global issue of climate change. India has committed in its Nationally Determined Contributions (NDCs) itself to reduce the emission intensity of its GDP by 33 to 35% from 2005 level.

Moreover, at a time when the global climate change is manifested in various unprecedented climatic events such as breaking of iceberg as big as four times as that of Delhi, recording of year 2017 as the hottest year, increased frequency of floods and droughts, India has taken leadership role and committed to ambitious goals to combat this climate change.

Recognizing the challenge of climate change to country like ours, the National Action Plan on Climate Change (NAPCC) was drafted under which mitigation activities to be carried out on mission mode was envisaged and hence a mission called National mission for Enhanced Energy Efficiency (NMEEE) was brought out.

Under the National Mission for Enhanced Energy Efficiency (NMEEE), Perform, Achieve and Trade (PAT) scheme is a market based mechanism to incentivize energy savings by converting the energy savings to a tradable instrument. Under the scheme, in the first cycle of PAT, 478 industrial units of eight sectors (Aluminum, Cement, Chlor- Alkali, Fertilizer, Iron & Steel, Paper

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Upon completion of the cycle, through a process of rigorous process of monitoring and verification, it was found that these units have over achieved their energy savings target by about 30% recording saving of 8.67 million tonn of oil equivalent.

The units have explored energy conservation measures, and as most of the sectors have over achieved their targets indicating that there is huge scope of energy saving potential. This scheme has also shown that along with energy saving benefits it has opened up job opportunities for energy professionals and their capacity building along with investment in energy efficient technologies and products thereby enhancing domestic production.

BEE in its efforts to consolidate the outcomes of the PAT cycle I has compiled a summarized details of the overall as well as sectoral achievements and key energy conservation measures including energy efficient technologies deployment.

The aim of this publication is to provide a snapshot of the achievements of the participating units and impacts that has been able to realize. It has also been our endeavor to highlight how the energy conservation activities has contributed to the realization of various other benefits in terms of mitigating Green House Gas Emissions (GHG) emission and skill enhancement of associated energy professionals. It also aimed to highlight key energy conservation measures that have been undertaken by various units representing different sectors and level of investment that has gone in.

I think, release of this booklet will be extremely useful to disseminate the achievements to the larger pool of stakeholders to learn technology options deployed and benefits accrued. It will also provide a sense of the size of business opportunities in the energy efficiency areas.

This publication will add to many of the useful publications that BEE has brought in the course of its implementation of the scheme such as Normalization Documents, Proforma and others.

अभय बाक्रे
(Abhay Bakre)

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2.	Shri. Sadguru Kulkarni	Jt. President (Technology), HINDALCO	Member
3.	Shri. Debashish Ghosh	General Manager (Energy), HINDALCO	Member
4.	Shri. Deepak Prasad	Vice President & Head Operation, BALCO	Member
5.	Shri. Dayanidhi Behra	Vice President & Head Operation, Sesa Sterlite Ltd.	Member
6.	Shri. Anupam Agnihotri	Director, JNARDDC	Member
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3.	Shri. Sanjay Sharma	Central Electricity Authority (CEA), New Delhi	Chief Engineer
4.	Shri. Chandrashekhar	Central Electricity Authority (CEA), New Delhi	Chief Engineer
5.	Shri. S. C. Shrivastava	Central Electricity Authority (CEA), New Delhi	Joint Chief (Engg.)
6.	Shri. Praveen Gupta	Central Electricity Authority (CEA), New Delhi	Director
7.	Shri. Sankar Bandyopadhyay	NTPC Limited	General Manager, CenPEEP
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10.	Shri. N. Sankar	Tamil Nadu Generation and Distribution Corporation (TANGEDCO), Tamilnadu	Director (Generation)
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4.	Shri. Deependra Kashiva	EX- Sponge Iron Manufactures Association	Member for Sponge Iron
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4.	Shri. O. P. Sharma	Joint Industrial Advisor, Department of Chemicals & Petrochemicals	Member
5.	Shri. K. Srinivasan	Secretary General, AMAI	Member
6.	Ms. Harjeet K. Anand	Dy. Director (Technical), AMAI	Member
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3.	Shri. S. K. Handoo	Technical Advisor and CMA	Member
4.	Dr. K. N. Rao	Director (Energy & Environment) ACC Limited	Member
5.	Shri J. S. Kalra	Sr. Joint President, Satna Cement Works	Member
6.	Shri. Rakesh Bhargava	Vice President, Shree CEMENT Ltd. Bewar, Rajasthan	Member
7.	Shri Sanjay Jain	Assistant Executive Director, Dalmia Cement Ltd.	Member

Executive Summary

The Government has released the National Action Plan on Climate Change (NAPCC) to promote and enable sustainable development of all citizens, while promoting low carbon and high resilience development path. To operationalize the action plans, eight National Missions have been framed under the NAPCC. One of the missions is the National Mission for Enhanced Energy Efficiency and the Perform, Achieve and Trade (PAT) scheme is one of the initiatives under that mission. As India takes a leadership role in enhancing energy efficiency in its economy in line with the commitments given under Intended Nationally Determined Contributions (INDC), enhancing energy efficiency in Industries is envisaged as one of the prime instruments to meet these commitments.

PAT is an indigenously developed market based mechanism to enhance cost effectiveness of improvements in energy efficiency in energy intensive large industries listed in schedule of EC Act, 2001 where energy savings is translated into tradable instruments called Energy Savings Certificates (ESCerts). Those industries which over achieve their targets are issued energy saving certificates and those who under achieve are entitled to purchase energy saving certificates for compliance. The platform for trading are the existing power exchanges. However, those who under achieve their target and do not take advantage of the option of buying ESCerts for compliance would be required to pay equivalent penalty as prescribed under the Energy Conservation Act.

The first cycle of PAT was started in April, 2012. To operationalize the scheme, the identified units were given targets to reduce the specific energy consumption (SEC) i.e. energy used per unit of production. In its first cycle, 478 industrial units of 8 sectors viz. Aluminum, Cement, Chlor- Alkali, Fertilizer, Iron & Steel, Paper & Pulp, Textile and Thermal Power Plant were included. The Energy saving targets were given to these industrial units called Designated Consumers (DCs) based on their baseline levels of energy efficiency. Among them, 30 % of the DCs were from thermal power plant sector followed by textile (19%), Cement (18%) and Iron and Steel (14%). The overall SEC reduction target in the eight sectors was about 4.05% with an energy saving of 6.686 million tonne of oil equivalent (toe). The first cycle came to end in March, 2015. The overall achievement of cycle I was 8.67 million toe and it exceeded the target by almost 30%.

The total energy saving of 8.67 million toe is equivalent to a saving of about 20 million tonnes of coal and an emission reduction of CO₂ by about 31 million tonnes.

In terms of monetary value, the saving in energy consumption under PAT cycle I is about Rs. 9500 Cr.

It has also been reported that the DCs participated in PAT cycle I have invested about Rs. 26100 Cr to undertake energy efficiency and other related measures. It is found that maximum investment was made in the fertilizer sector i.e. about Rs. 8733 Cr (33%) followed by iron and steel sector with investment about Rs. 6175 Cr (24%). The private sectors have invested about Rs. 13714 Cr followed by the Central sector about Rs. 7764 Cr. In the private sector the maximum investment was made by the iron and steel sector (27%) followed by textile (21%). Under the CPSUs the maximum investment was from the fertilizer sector (61%) followed by iron & steel (30%).

The PAT scheme is based on actual verified performance demonstrated by participating DCs. Hence Monitoring and Verification (M&V) is the key to the scheme and professionals tasked to do so play an important role.

A cadre of professionally qualified energy managers and auditors are being continuously developed through the certification programme. For this National level certification examinations are being conducted by BEE. India now has

12228 certified energy managers of which 8536 are additionally qualified as certified energy auditors. Out of these 201 energy auditors have been accredited.

PAT Cycle II, III and Beyond :

In its second cycle, it aims to achieve an overall energy consumption reduction of 8.869 MTOE for which reduction targets have been given to DCs under 11 notified sectors (eight existing sectors and three new notified sectors). PAT Cycle II has commenced from 1st April, 2016 under which 621 DCs (448 existing and 89 new DCs from existing sectors and 84 DCs from new notified sectors viz. Railways, Electricity DISCOMs and Refineries) have been notified. There is likely to be an emission reduction of about 60 million tonnes of CO₂.

PAT cycle III has been notified on 30th March, 2017. PAT Scheme in its third cycle seeks to achieve an overall energy consumption reduction of 1.06 MTOE for which SEC reduction targets have been assigned to 116 Designated Consumers from six sectors viz. Thermal Power Plant, Cement, Aluminium, Pulp & Paper, Iron & Steel and Textile. The energy consumption of these DCs is 35.00 MTOE. As PAT scheme is now being implemented on a rolling cycle basis, new DCs will be notified every year.

As of now, under PAT cycle II and III, total 737 numbers of DCs have been assigned to reduce the mandatory energy consumption reduction targets of about 9.929 million toe by FY 2020. The state wise number of DCs in various sectors may be seen at Section 6.

Under PAT Cycle IV the likely sectors to be included are commercial Buildings of 24 hours usage (hotels) and Petrochemicals.

Sector Specific Achievements :

a. Aluminium Sector :

All units above the notified energy consumption threshold limit of 7500 tonne of oil equivalent (toe) of energy consumed per annum were covered under the cycle - I. The total number of plants covered were 10 and 50% of which are concentrated in the state of Odisha. Against a reduction target of 0.456 million toe, the achievement in this sector was 0.73 million toe, that amounts to an over achievement of the target by 60%.

b. Cement Sector :

The energy consumption threshold limit of 30,000 toe per annum was notified for the cement sector. The total number of units covered under the cycle - I were 85 and the highest number of units were concentrated in Rajasthan (19) followed by Andhra Pradesh (17) and Madhya Pradesh and Tamil Nadu (13). Against the target of 0.815 million toe, the achievement was 1.48 million toe which is about 81.6 % over and above the target.

c. Chlor Alkali :

All units above the notified energy consumption threshold limit of 12000 toe per annum were included under the cycle I. Out of 22 plants the majority are concentrated in Gujarat (8) followed by Tamil Nadu (3), Andhra Pradesh (2) and Punjab (2). Against a total reduction target of 0.054 million toe, the achievement verified was 0.093 million toe which was 72% over and above the target.

d. Fertilizer Sector :

The notified energy consumption threshold limit for the fertilizer sector was 30000 tonnes of oil equivalent (toe) of energy consumed per annum. The total numbers covered were 29 plants out of which the majority are concentrated in Uttar Pradesh (7) followed by Gujarat (4) and Rajasthan. Against a total reduction target of 0.477million toe, the achievement was 0.78 million toe which was 64% over and above the target.

e. Iron and Steel Sector :

Units in this sector above the notified energy consumption threshold limit of 30000 tonne of oil equivalent (toe) of energy consumed per annum were covered under cycle I. The total numbers covered were 67 plants of which the majority are concentrated in Chhattisgarh (21) followed by Odisha (14) and Maharashtra (10). Against a total reduction target of 1.486 million toe, the achievement was 2.10 million toe which was 41% over and above the target.

f. Pulp and Paper Sector :

Units in this sector above the notified energy consumption threshold limit of 30000 tonne of oil equivalent (toe) of energy consumed per annum were covered under cycle I. The total numbers covered were 31 plants of which the majority are concentrated in Uttar Pradesh (5) followed by Tamil Nadu(4), Punjab (3) and Odisha (3). Against a total reduction target of 0.119 million toe the achievement was 0.89 million toe which was 143% over and above the target.

g. Textile Sector :

All units in this sector above the notified threshold limit of 3000 tonne of oil equivalent (toe) of energy consumed per annum were covered under PAT cycle I. The total numbers covered were 90 plants of which the majority are concentrated in Rajasthan (31) followed by Maharashtra (14), Punjab (11) and Gujarat (11). Against a total reduction target of 0.066 million toe the achievement was 0.129 million toe which was 95% over and above the target.

h. Thermal Power Plant Sector :

Units in this sector above the notified energy consumption threshold limit of 30000 tonne of oil equivalent (toe) of energy consumed per annum were covered under PAT cycle I. With 30% of the total plants included under cycle I, the thermal power plant sector was given 48% of the overall target. The total numbers covered were 144 plants of which the majority are concentrated in Tamil Nadu (20) followed by Gujarat (17), West Bengal (13) Uttar Pradesh (12) and Maharashtra (12). Against a total reduction target of 3.21 million toe the achievement was 3.06 million toe. Though the TPP sector missed the overall target by about 5%, but the sector as a whole has contributed to meeting about 35% of the overall target which is the maximum contribution by any sector in PAT cycle I.



A. Snapshot to PAT Performance

1. Introduction

The objective of the National Action Plan on Climate Change (NAPCC) is to promote and enable sustainable development of all citizens, while promoting low carbon and high resilience development path.

The National Mission on Enhanced Energy Efficiency (NMEEE) is one of the Missions under NAPCC. The progress made under these Missions is closely monitored by the PM's Council on Climate Change. The objective of NMEEE is to promote innovative policy measures, regulatory regimes, financing mechanisms and business models which will create and sustain markets for energy efficiency in a transparent manner.

The Perform Achieve and Trade (PAT) Scheme is one of the initiatives under NMEEE. PAT is a market based mechanism to enhance cost effectiveness of improvements in energy efficiency in energy intensive large industries. Those Industries which overachieve their targets are issued energy saving certificates (ESCerts) and those who underachieve are entitled to purchase energy saving certificates which are tradable. If the option of purchasing energy saving certificates (ESCerts) for compliance is not taken by those who have under achieved then they would be required to pay penalty as per the Energy Conservation Act. CERC is the Regulator for the trading of ESCerts, POSOCO is the Registry and the platform for trading ESCerts are the power exchanges. BEE is the administrator and manages the PATNET portal.

2. PAT Cycle- I (2012-2015):

The first cycle of the scheme was designed to reduce the specific energy consumption (SEC) i.e. energy used per unit of production of 478 industrial units in 8 sectors viz. Aluminum, Cement, Chlor- Alkali, Fertilizer, Iron & Steel, Paper & Pulp, Textile and Thermal Power Plant. The sector wise coverage of DCs may be seen in pie chart given below:

The Energy saving targets were given to these 478 industrial units called Designated Consumers (DCs) based on their current levels of energy efficiency. The energy efficient units were given lower targets compared to those units which were less energy efficient. The overall SEC reduction target in the eight sectors was 4.05% with an energy saving of 6.686 million tonne of oil equivalent.

Against the target of 6.686 Million Tonne of Oil Equivalent (MTOE) under PAT cycle I, an energy saving of 8.67 MTOE has been achieved. The details of given targets and achievement against the targets are given in the pie charts: -

TARGETS

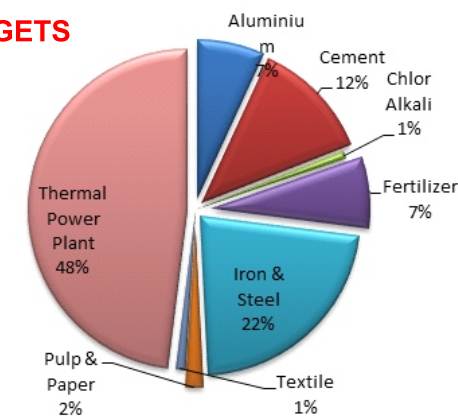


Fig2. Sector wise saving target share under PAT Cycle I

ACHIEVEMENTS

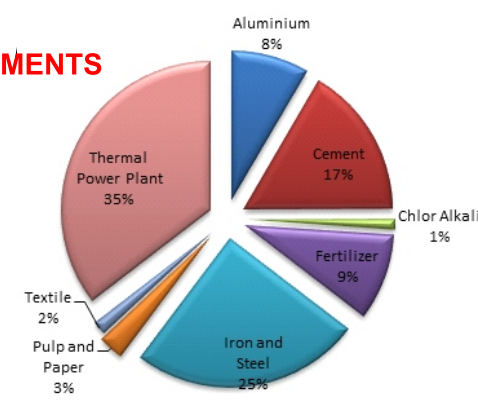


Fig.3 Sector wise Achievement under PAT Cycle I

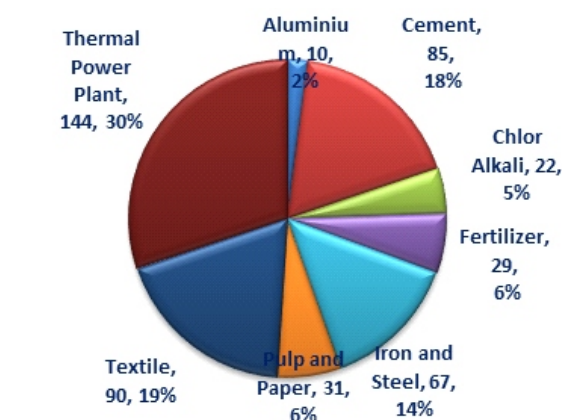
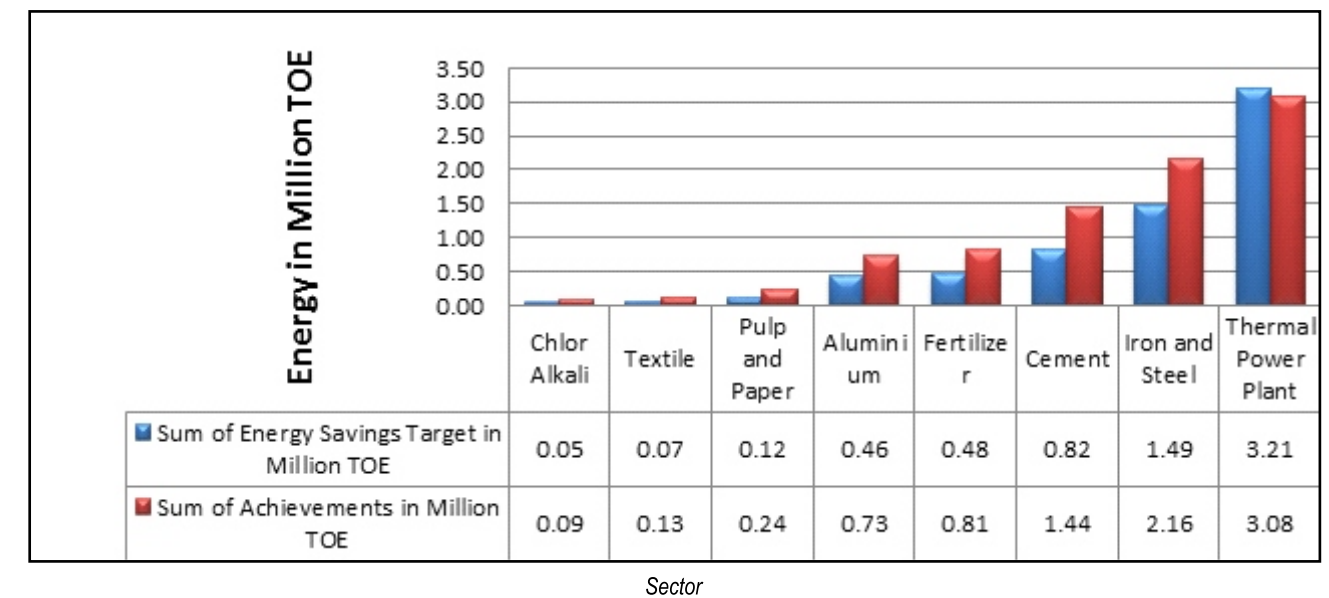


fig. 1. Sector wise share of DCs under PAT cycle I (in nos, %)

Target and Achievements in million toe



2.1 SAVINGS IN EQUIVALENT COAL UNDER PAT CYCLE - I

The total energy saving of 8.67 million toe is equivalent to about 20 million tonne of Coal. (Coal GCV @4400kcal/kg). Sector wise saving in terms of million tonne of coal is given in the pie chart.

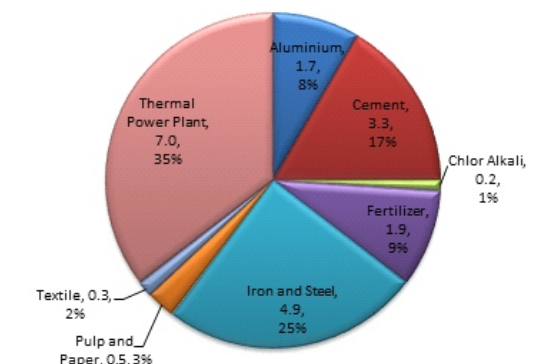


Fig.4. Sector wise Coal Saving (in million tonnes, %) under PAT Cycle I

2.2 EMISSION REDUCTION :

The CO₂ emission reduction through the implementation of the PAT cycle I is about 31 million tonnes. The details of CO₂ emission reduction from each sector of PAT is given in the pie chart :

From the pie chart, it is clear that the maximum contribution in CO₂ emission reduction is from thermal power plant sector (44 %) followed by iron and steel (21%), cement (14%), aluminium (10%) and others (11%).

2.3 MONETARY VALUE OF SAVINGS IN ENERGY CONSUMPTION UNDER PAT :

PAT cycle not only witnessed huge investment, but also huge savings. These savings were in terms of coal, oil, gas, electricity and other fuel sources. The equivalent monetary value derived from these fuel savings comes to be about Rs. 9500 Cr. These savings were an outcome of low hanging fruits as well as long term measures. The figure mentioned here only indicates savings made in assessment year, i.e., one year, but the actual benefits of these energy savings measures and projects will be reaped in future as well.

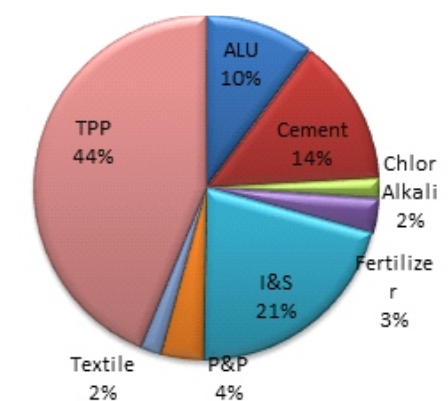


Fig.5. Sector wise contribution towards CO₂ emission reduction (%)

2.4 INVESTMENTS MADE FOR ACHIEVEMENT OF TARGETS :

PAT cycle-I was successful on account of the measures implemented by the DCs. While some chose to tap the low hanging fruits, others invested in major and minor projects. The DCs also improved their O&M practices. Some of the measures were even inhouse, involving little or no investment, and hence could not be quantified. The reported investment figure from the DCs of PAT cycle - I is approx. Rs. 26100 Cr.

The sector wise breakup of investment made by DCs of 8 sectors is given in the pie chart. The fertilizer sector contributed the maximum share which is about 33% of the total investment followed by iron and steel sector (24%), thermal power plant (13%), textile sector (11%) and cement (10%) sector. The remaining % share of investment is from chlor alkali, pulp and paper and aluminium sector. In the aluminium sector, there are only 10 DCs. The total investment from the aluminium sector is about Rs. 94 Cr which is about 0.004 %.

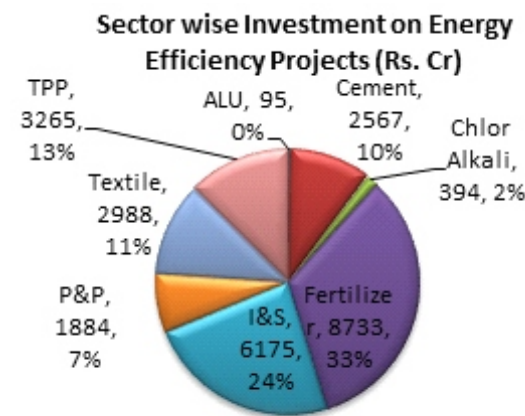


Fig. 6. Sector wise Investment on EE Projects (Rs. Crore, %)

The sector wise categorization of DCs with respect to the investments made is tabulated below :

Sector	Central		Cooperative		Private		State		Total No. of DCs	Investment (Rs. Cr.)
	No. of DCs	Investment (Rs. Cr.)	No. of DCs	Investment (Rs. Cr.)	No. of DCs	Investment (Rs. Cr.)	No. of DCs	Investment (Rs. Cr.)		
Aluminium	3	20			6	75			9	95
Cement					65	2567			65	2568
Chlor Alkali					11	332	4	62	15	394
Fertilizer	9	4745	6	1837	7	533	2	1618	24	8733
I&S	6	2361			31	3813			37	6175
P&P	2	0			15	1884			17	1884
Textile					64	2988			64	2986
TPP	17	638			20	1521	33	1106	70	3265
Grand Total	37	7764	6	1837	219	13714	39	2786	301	26101

Footnote: Investment details have been furnished by only 301 DCs.

The maximum share in the total investment is from the Private sector Industries Rs. 13714 crores (52%) followed by Central PSUs Rs. 7764 crores (30%) and State PSUs Rs. 2786 crores (11 %). There are 6 Co-operative Industries in Fertilizer sector which have also contributed Rs. 1837 crores (7 %) of the total investment. The details may be seen in the given pie chart.-

Investment in Rs. Cr

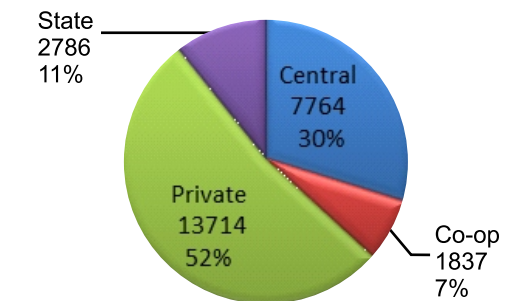


Fig.7. Ownership wise Investment on EE Projects (Rs. Cr, %)

2.5 QUANTIFICATION OF ENERGY SAVINGS WITH AND WITHOUT PAT

The annual energy consumption of these 8 energy intensive sectors in the baseline was reported to be 165 million tonnes of oil equivalent and the target was to reduce about 4.05 % of this consumption at the end of PAT cycle I. After monitoring and verification (M&V), it was found that the industries have achieved the target by more than 30 %, i.e., against the reduction target of 4.05 % of baseline energy consumption, 5.03 % reduction was achieved.

PAT Cycle-I witnessed huge investments in energy efficient projects. These projects brought down the specific energy consumption of the plants reducing the overall energy consumption. It would be worth estimating the impact without the implementation of such projects, with the actual production/ generation profiles in the assessment year.

The annual energy consumption of these DCs during baseline year and assessment year with and without PAT scheme has been shown in the given bar chart. The red bar depicts the energy consumption of the baseline. The blue bar represents the actual energy consumption in the assessment year. The green bar represents the hypothetical situation where the industries did not undertake energy conservation measures. Sector wise analysis of these conditions has been depicted below :

The most energy intensive industries i.e. Aluminium, Cement, Iron and Steel and Thermal Power Plant have played the major role in reducing their annual energy consumption during the assessment year compared to the baseline year after implementation of the PAT scheme.

The annual energy consumption reduction in the assessment year from fertilizer, pulp and paper, textile and chlor alkali sector may also be seen in the given chart. Each sector has reduced their annual energy consumption from the level of their baseline annual energy consumption after implementation of the PAT scheme.

It could be observed that the blue bar in any case is smaller than the green bar which represents that the energy consumption without PAT scheme would have been much higher.

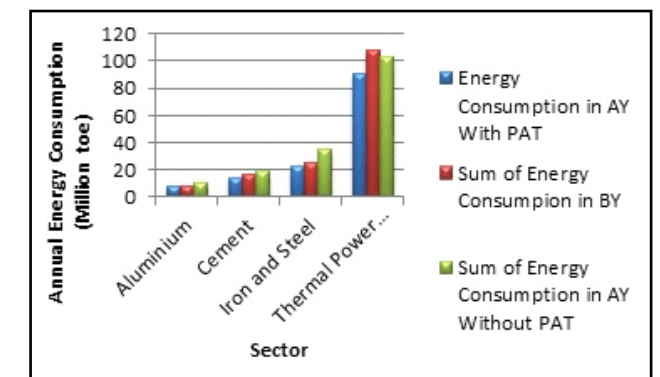


Fig.8. Annual Energy Consumption in AY with and Without PAT

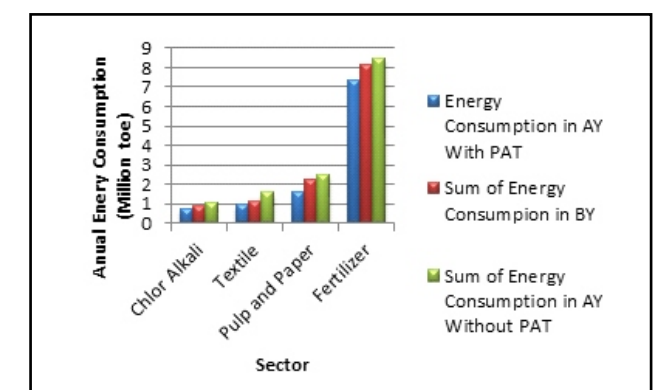


Fig.9. Annual Energy Consumption in AY with and Without PAT

2.6 MARKET TRANSFORMATION OF THE INDIAN INDUSTRY DUE TO IMPLEMENTATION OF PAT:

PAT has had a strategic impact on industries by creating a conducive environment for helping them to identify & remove barriers and exploit opportunities to accelerate the adoption of all cost-effective energy efficiency measures as a matter of standard practice so as to make it sustainable in the long run.

As per the provision of EC Act, it is mandatory for every designated consumer to appoint an energy manager in their plant. The requirement of mandatory energy audit and monitoring and verification of the performance of DCs by third party agency after completion of each cycle of PAT has created the demand for energy managers and energy auditors in the market.

2.7 SKILL DEVELOPMENT / CREATION OF A POOL OF HUMAN RESOURCES :

A cadre of professionally qualified energy managers and auditors with expertise in policy analysis, project management, financing and implementation of energy efficiency projects is being developed through the certification programme. BEE has been designing training modules and regularly conducting a National level examination for certified energy managers and energy auditors. Till date, 16 National Certification examinations for Energy Managers and Energy Auditors have successfully been conducted. India now has 12228 Certified Energy Managers, out of which 8536 are additionally qualified as Certified Energy Auditors till date. This is further supplemented by the accreditation of energy auditors through recommendations of "Accreditation Advisory Committee". Accredited energy auditors would undertake mandatory energy audits in energy intensive industry as mandated in EC Act. As on date, there are 201 accredited energy auditors.

3. PAT CYCLE-II (2016-17 TO 2018-19) :

In its second cycle, it aims to achieve an overall energy consumption reduction of 8.869 MTOE for which reduction targets have been given to DCs under 11 notified sectors (eight existing sectors and three new notified sectors). PAT Cycle II has commenced from 1st April, 2016 under which 621 DCs (448 existing and 89 new DCs from existing sectors and 84 DCs from new notified sectors viz. Railways, Electricity DISCOMs and Refineries) have been notified. The estimated emission reduction is 60 million tonnes of CO₂. The estimated investment by DCs is likely to exceed Rs. 30,000 Cr.

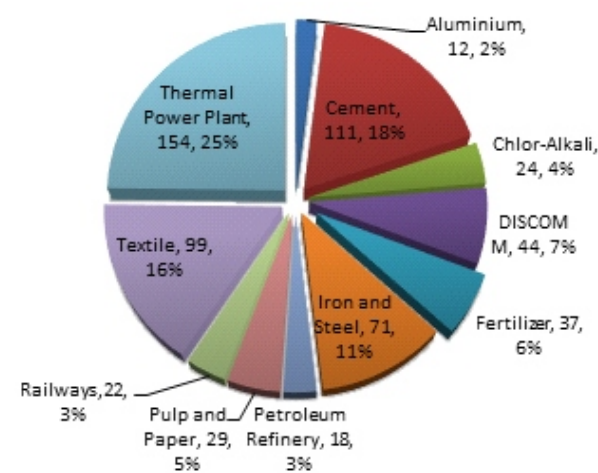


Fig.10. Sector wise share of DCs under PAT cycle II (in nos, %)

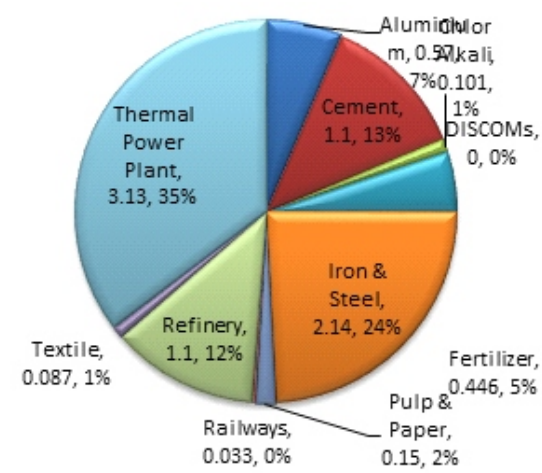


fig. 11. Sector wise saving target share of DCs under PAT cycle II (in Million TOE, %)

4. PAT CYCLE III- (2017-18 TO 2019-20) AND BEYOND:

PAT cycle –III has been notified on 30th March, 2017. PAT Scheme in its third cycle seeks to achieve an overall energy consumption reduction of 1.06 MTOE for which SEC reduction targets have been assigned to 116 Designated Consumers from six sectors viz. Thermal Power Plant, Cement, Aluminium, Pulp & Paper, Iron & Steel and Textile. The energy consumption of these DCs is 35.00 MTOE. As PAT scheme is now being implemented on a rolling cycle basis, new DCs will be notified every year.

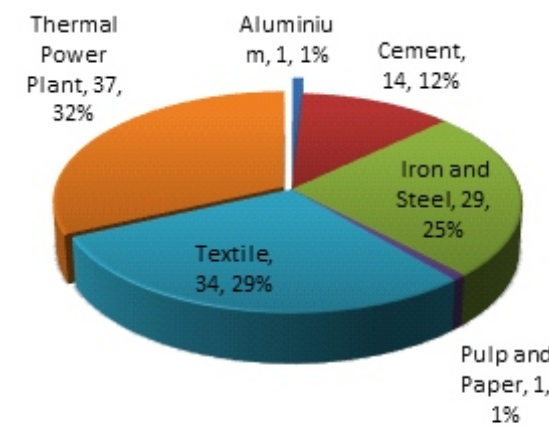


Fig12. Sector wise share of DCs under PAT cycle III (in nos, %)

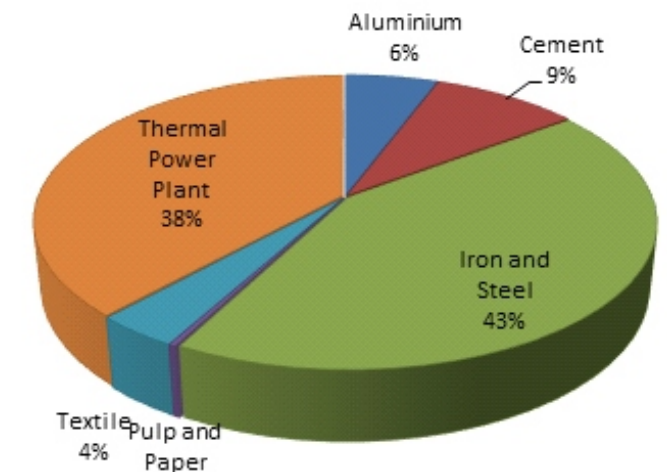


Fig. 13. Sector wise saving target share of DCs under PAT cycle III

As of now, under PAT cycle II and III, total 737 numbers of DCs have been assigned to reduce the mandatory energy consumption reduction targets of about 9.929 million toe by FY 2020. The state wise number of DCs in various sectors may be seen at Section 6.

Under PAT Cycle IV the likely sectors to be included are commercial buildings of 24 hours usage (hotels) and petrochemicals.



B. Sector Specific Achievements

5.1 Aluminium Sector

Introduction

The Indian Aluminium Industry is a highly concentrated industry with the top 5 companies constituting majority of the country's production. With the growing demand of Aluminium, the industry is also growing at an enviable pace. In fact, Aluminium production in India is currently outpacing the demand. India has the fifth largest reserves of bauxite, the raw material used in production of aluminium, with deposits of about 2.3 billion tonnes (6.76% of the world deposits). The total aluminium production in India is about 3% of the global capacity.



Primary aluminium production involves two major steps:

1. Refining of bauxite to alumina
2. Smelting of alumina to aluminium.

Smelting is an energy intensive process and consumes electrical energy, accounting for about 85% to 90% of the electrical energy consumption.

Coverage of DC :

In the Aluminium Sector, to become a designated consumer, the notified threshold limit is 7500 toe of energy consumed per annum. Under PAT cycle-I, 10 numbers of designated consumers have been covered to reduce their specific energy consumption from the level of their baseline year.

The aluminium sector has been categorised, on the basis of the processes involved, into four sub-sectors— Refinery, Smelter, Integrated and Cold sheet mill. The details of categorisation of Aluminium sector may be seen in fig. 1.

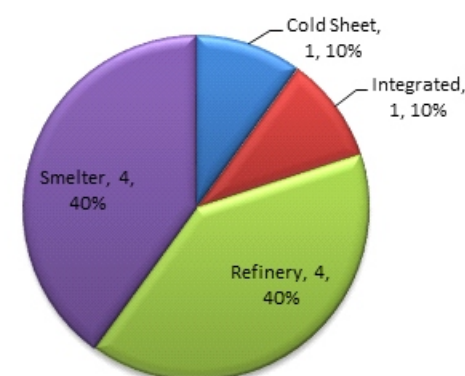
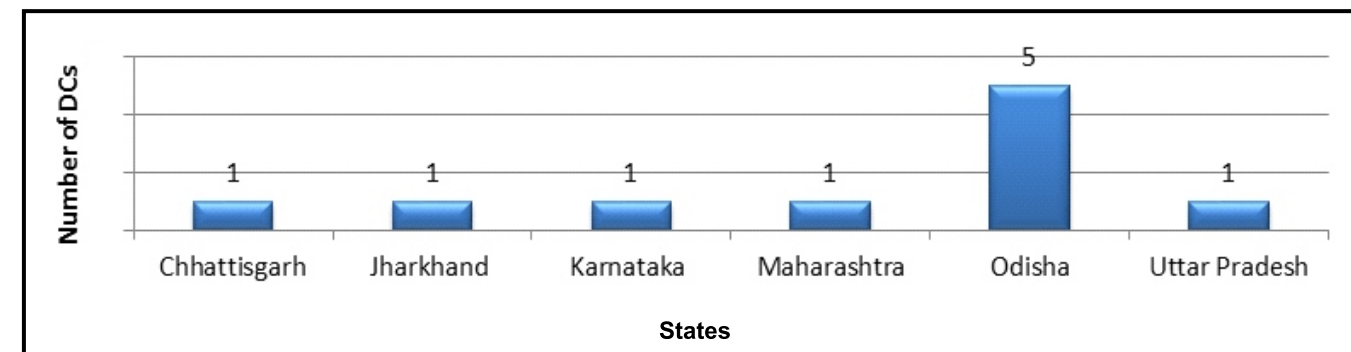


Fig.1. Categorization of Aluminium Sector

State wise Categorization of DCs:

The maximum numbers of DCs in Aluminium Sector are from the state of Odisha followed by Karnataka, Jharkhand, Chhattisgarh, Maharashtra and Uttar Pradesh. The state wise number of DCs may be seen in fig. 2.



Energy savings in the sector in terms of MTOE :-

The Energy saving target for aluminium sector was given as 0.456 Million toe, however, the achieved saving from the sector is 0.730 Million TOE, which is around 60 % higher than the saving targets from 10 Nos of notified DCs. The saving detail is shown in below table:

S.No	Sector	Notified DCs	Energy Consumption (MTOE)	Target (MTOE)	Achieved (MTOE)	Achievement over and above the target in % age.
1.	Aluminium	10	7.71	0.456	0.730	60%

The overall SEC of the notified DCs has reduced around 3.55 % inth assessment year from baseline year. The average electrical SEC reduction of Molten Aluminium is around 1.94%. For the refinery sub-sector, the average thermal SEC of Hydrate alumina is around 12%. The average SEC of Cold Sheer sub-sectors has also reduced around 9.6%. The reduction in SEC in assessment year from the baseline year may be seen in fig. 3.

Best Practices & Technology up gradation :

Some of the significant energy-efficient technologies & best practices adopted by Aluminium Sector's DCs are outlined below:

1. Implementation of slotted anode in pots
2. Reduction in Stub to Carbon voltage drop
3. Eco-contact to reduce voltage drop at conductor joints
4. Use of self-developed fuel "CRYSTAL" additive for dozing inside the furnace

In addition, to these technologies, operational behavioral changes were also observed. The plants opted for better operational practices like switching off cooling tower fans as per need, stoppage of driers in service air system, Interconnection of pump's, installation of efficient pumping system, modification of compressed air system, CPP's R&M, optimization etc.

5.2 Cement Sector

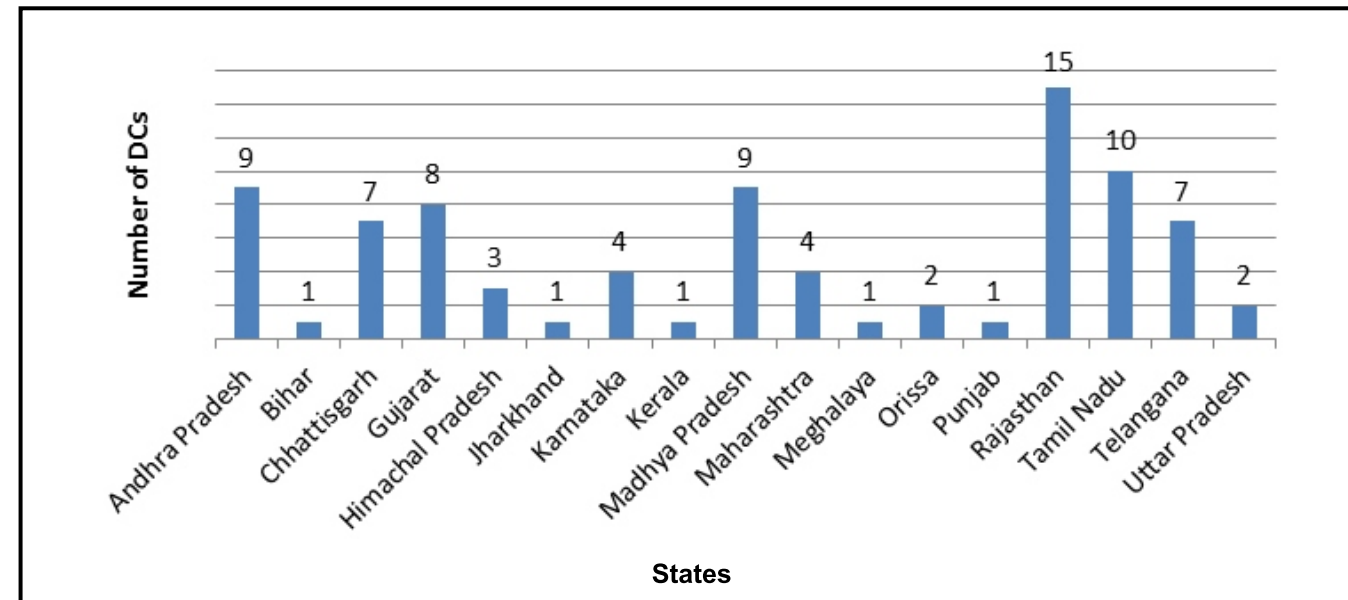
Introduction

India is the 2nd largest cement producer as well as consumer in the world led by the enormous growth in the infrastructure and construction sector for the last two decades. There are total 200 Cement Plants across India with a production of 300 million tonnes and the average electrical and thermal energy consumption is 65 KWh/ton & 667 Kcal/Kg. Under PAT I the total no of plants covered are 85.



Coverage of DC :

★ States



Energy Saving in terms of MTOE :

The total reported energy consumption of these designated consumers was about 15.01 mtoe. By the end of the first PAT cycle -I, the energy saving target was 0.815 mtoe, which was around 12% of the total national energy saving target assessed under PAT Cycle -I. However, the saving achieved for the cement sector is 1.480 Million TOE, which is around 81.6% higher than the target. The details are indicated in the table below:

S.No	Sector	Notified DCs	Energy Consumption (MTOE)	Target (MTOE)	Achieved (MTOE)	Achievement over and above the target in % age.
1.	Cement	85	15.01	0.815	1.480	81.6%

The overall SEC of the notified DCs has reduced around 8.5 % in the assessment year from the baseline year.

Best Practices & Technology up gradation :

1. Installation of Vertical Grinding Mill
2. Installation of High efficient screw compressor
3. Increasing the usage of Alternate Fuel in the Kiln.
4. Increasing the number of stages of preheater
5. Installation of High Efficiency 3rd Generation Air-Separator

5.3 Chlor Alkali Sector

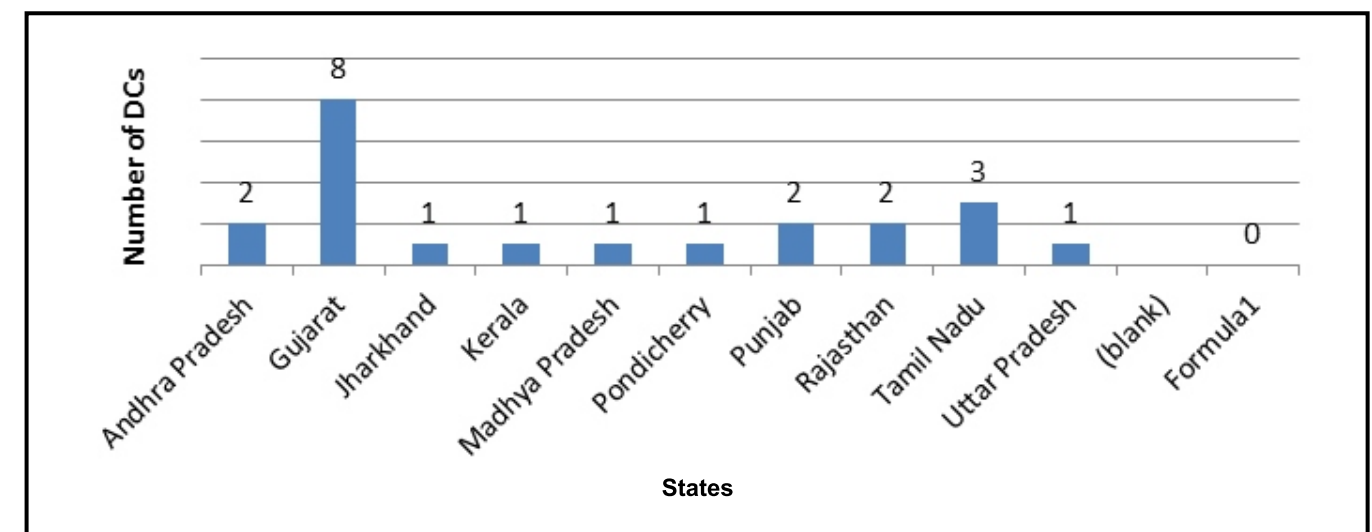
Introduction

The Chlor-Alkali industry is the oldest and largest segment of the inorganic chemical industry. It comprises of Caustic Soda, Liquid Chlorine and Hydrogen. In PAT cycle-1, 22 plants located in various states have been identified and assigned mandatory energy reduction target having energy consumption equal or more than notified threshold limit of 12000 toe of energy consumption annually. Plants are running on state of the art energy efficient membrane cell technology. Gujarat is the largest Caustic Soda producing state with 1.8 Million tonnes capacities.



Coverage of DC :

★ States

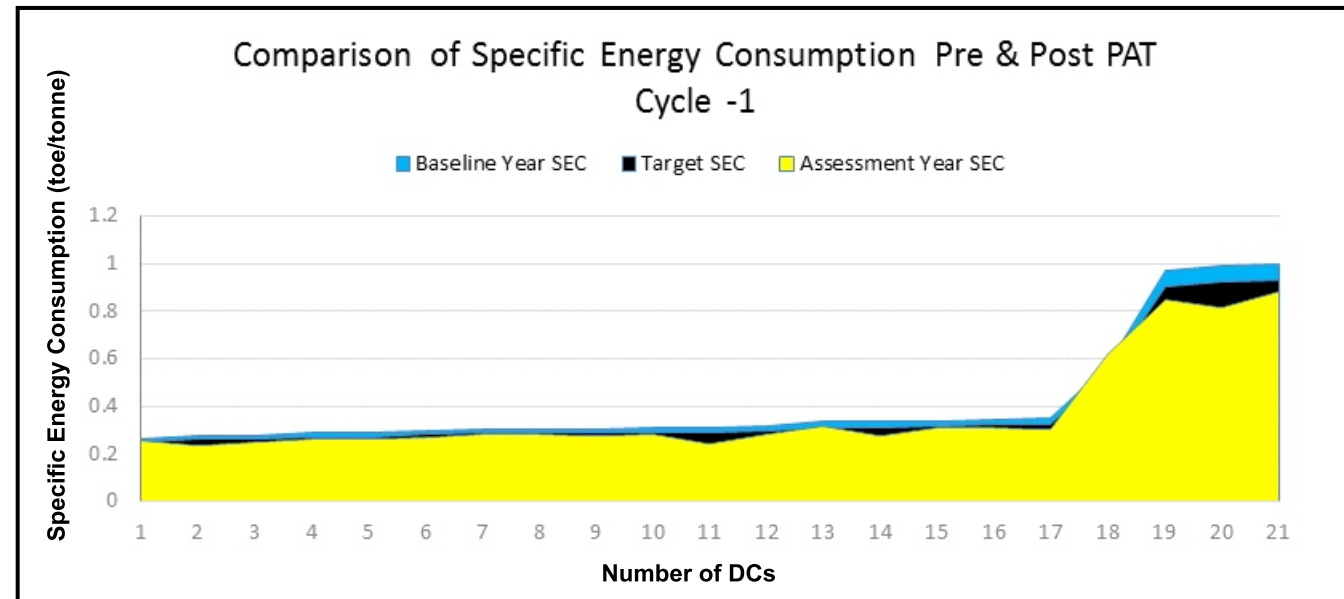


Energy savings in the sector in terms of MTOE :

The total reported energy consumption of these Designated Consumers was about 0.885 Million tonne of oil equivalent/year. Specific energy consumption of the units in this sector varies from 0.262 to 0.997 toe/tonne of equivalent major product for these 22 Designated Consumers. By the end of first PAT cycle-I, energy savings equivalent of 0.093 Million tonne of oil equivalent annually has been achieved, which is around 72% higher than the saving targets from 22 Nos. of notified DCs.

S.No	Sector	Notified DCs	Energy Consumption (MTOE)	Target (MTOE)	Achieved (MTOE)	Achievement over and above the target in % age.
1.	Chlor Alkali	22	0.885	0.054	0.093	72%

The reduction in SEC in the assessment year from the baseline year may be seen in fig. given below:



Best Practices & Technology up gradation :

Some of the important energy-efficient technologies & best practices adopted in Chlor- Alkali plants are outlined below:

1. Upgrading to 6th Generation/ Zero gap type Cell in Electrolyser.
2. Installation of Back pressure turbine to eliminate letdown from HP to LP steam and recover power.
3. Recovery of waste heat for process heat or power generation.
4. Feeding of 48% Caustic Soda Lye (CSL) at 90° C directly to Caustic Concentration Unit (CCU) from Caustic Evaporation Unit (CEU).
5. Installation of Vapor Absorption Machine (VAM) to recover heat from 48% CSL.
6. Optimization of Electrolysers for current consumption by monitoring cell voltages and replacing membranes in time.
7. Heat recovery by Provision of Brine and Chlorine re-cuperator for pre-heating the feed brine towards the Cell.

5.4 Fertilizer Sector

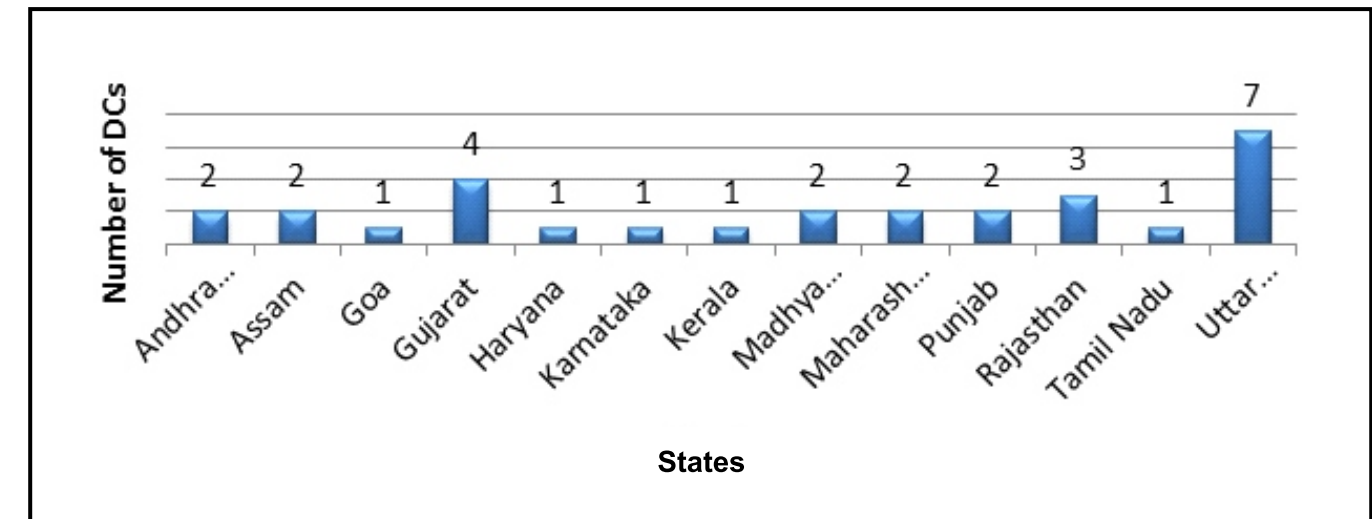
Introduction

India is the third largest producer of fertilizers in the world, with the total production of about 38.6 million metric tonnes (MMT) of fertilizer products containing 16.5 MMT of plant nutrients. Fertilizer industry in India is world class in terms of size of plant, technology used and efficiency levels achieved. The average energy consumption of Indian urea plants was 5.95 GCal/MT urea in 2015-16. The best performing plant had energy consumption of 5.2 GCal/MT urea, which is at par with world standards.



Coverage of DC :

★ States



Energy savings in the sector in terms of MTOE :

The energy consumption during the assessment year 2014-15 was 13.240 mtoe against the baseline figure of 13.537 MTOE, resulting in saving of 2.2%. There is a major saving of 1.27 MT in fuel oil consumption mainly due to conversion of four fuel oil based plants from fuel oil to natural gas as raw material for improved efficiency.

The fertilizer sector as a whole, has achieved total energy saving of 0.78 Million toe while comparing the performance during assessment year 2014-15 w.r.t. baseline data, without normalization. Thus the energy reduction target of 0.477 mtoe has been exceeded by 0.303 Million toe. The details are indicated below :

S.No	Sector	Notified DCs	Energy Consumption (MTOE)	Target (MTOE)	Achieved (MTOE)	Achievement over and above the target in % age.
1.	Fertilizer	29	8.2	0.477	0.78	64%

Best Practices & Technology up gradation:

During sixties and mid-seventies, fertilizer plants were based on raw materials readily available at that time i.e. electricity (for electrolysis), coke, naphtha, fuel oil etc. These older plants tried to fill in the technological gaps by incorporating revamps and retrofit measures, whichever were possible, in various phases.

Over a period, the fertilizer industry has adopted a large number of revamp technologies available for ammonia production such as

- ★ radial-axial flow converters, additional heat recovery from furnace flue gases, additional purification of synthesis gas, use of more efficient catalyst, refurbishing or replacement of rotating machines including major compressors and turbines, better heat integration, vapour absorption refrigeration (VAR) to utilize low level heat to generate chilled water and using the same to reduce section temperature of air/process gas at suction of respective compressors.

- ★ In urea plants, a number of improvements include replacement of Urea Stripper with Bi-metallic Stripper, replacement of trays in Urea reactor with high efficiency trays, suction cooling of CO₂ Compressor, installation of Medium Pressure Pre-decomposer for recovering heat from vapors of Decomposer, installation of Pre-concentrator before Vacuum Concentration Section, High Pressure Urea Hydrolyser etc.

5.5 Iron & Steel Sector

Introduction

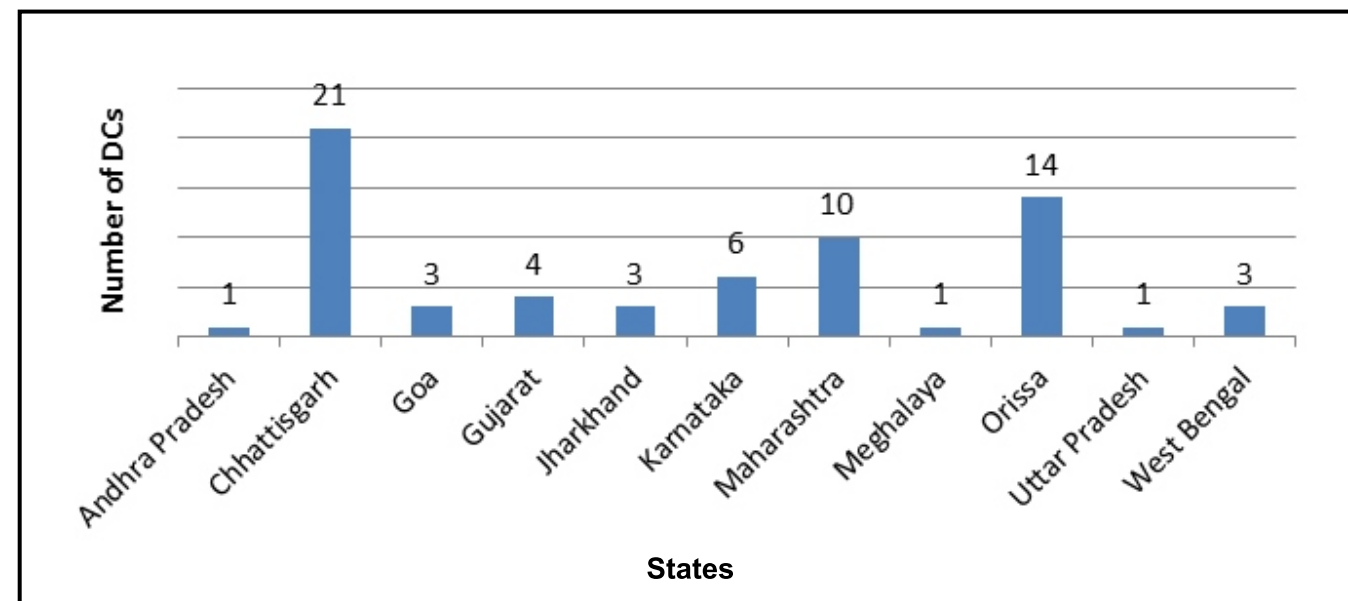
Iron & Steel Industry in India is on an upswing because of the strong global and domestic demand. In 2015-16, India produced 90 MT of crude steel and attained the position of 3rd largest steel producer in the world, after China and Japan. Under Iron & Steel sector, a total of 67 plants are identified and assigned mandatory energy reduction targets. The notified threshold limit is 30000 TOE of energy consumption per annum for the Iron and Steel Sector.



Iron & steel sector has been categorized on the basis of their products/processes into eight sub-sectors, i.e. Integrated steel plant, Sponge Iron, Sponge Iron + Steel Melting Shop, Sponge Iron + Steel Melting Shop + Others, Ferro alloys, Ferro chrome, Mini Blast Furnace and Steel Processing units.

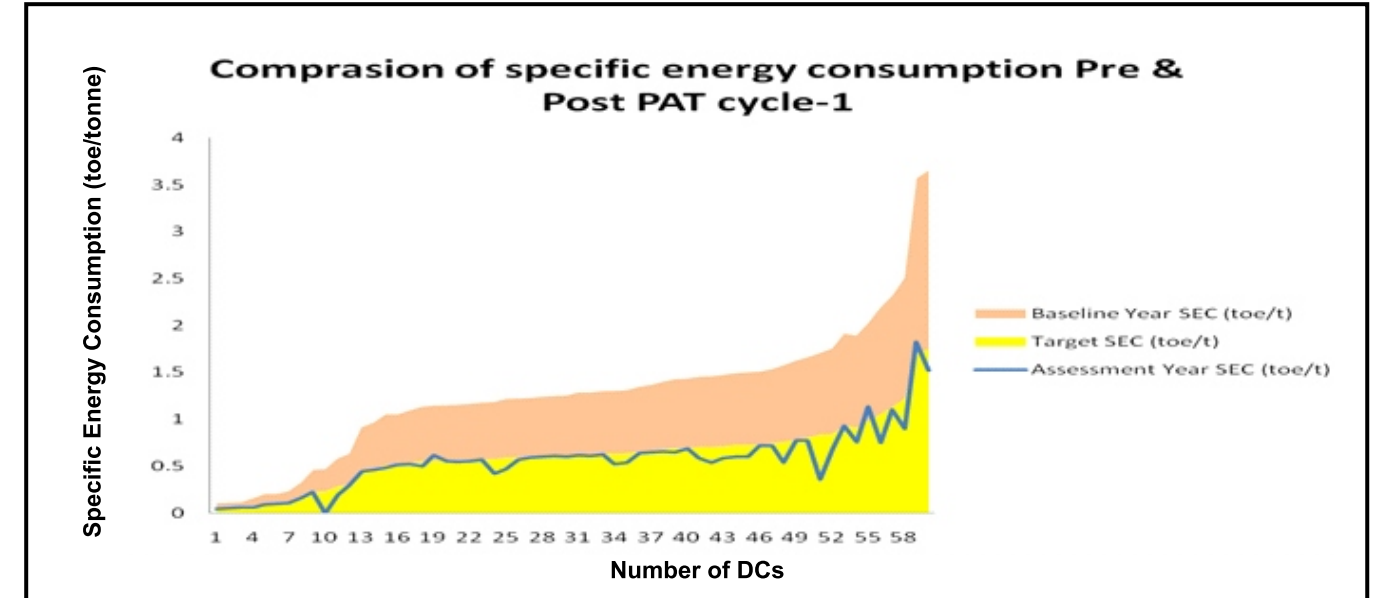
Coverage of DC :

- ★ States



Energy savings in the sector in terms of MTOE

By the end of first PAT cycle-I, energy savings equivalent of 2.10 Million tonne of oil equivalent annually has been achieved, which is around 41% higher than the saving targets from 67 Nos. of notified DCs. The major share in energy saving is through integrated steel Plants which is around 65% of total energy savings achieved.



S.No	Sector	Notified DCs	Energy Consumption (MTOE)	Target (MTOE)	Achieved (MTOE)	Achievement over and above the target in % age.
1.	Iron and Steel	67	25.32	1.486	2.10	41%

Best Practices & Technology up gradation :

Some of the significant energy-efficient technologies & best practices adopted by Iron and Steel Sector's Designated Consumers are outlined below:

1. Use of 100% pellets as iron burden reduces coal consumption, improves better metallization of pellets, reduces fines generation and iron ore loss and improves work environment.
2. High top pressure blast furnaces also provide an ideal opportunity for recovering energy from the large volumes of pressurized top gas. TRT (Top Recovery turbine) can be used to generate electricity from this high-top pressure.
3. Waste heat recovery from DRI (Direct Reduced Iron) process reduces massively the need for external fuel like coal for generates the same amount of electricity.
4. Direct Rolling of hot continuous cast billet to produce TMT (Thermo Mechanically Treated) bars and therefore, completely avoided uses of Furnace oil in reheating furnace.
5. The major benefit from Coke dry quenching (CDQ) is recovery of heat to produce steam & power which in terms also benefit the environment.

5.6 Pulp and Paper Sector

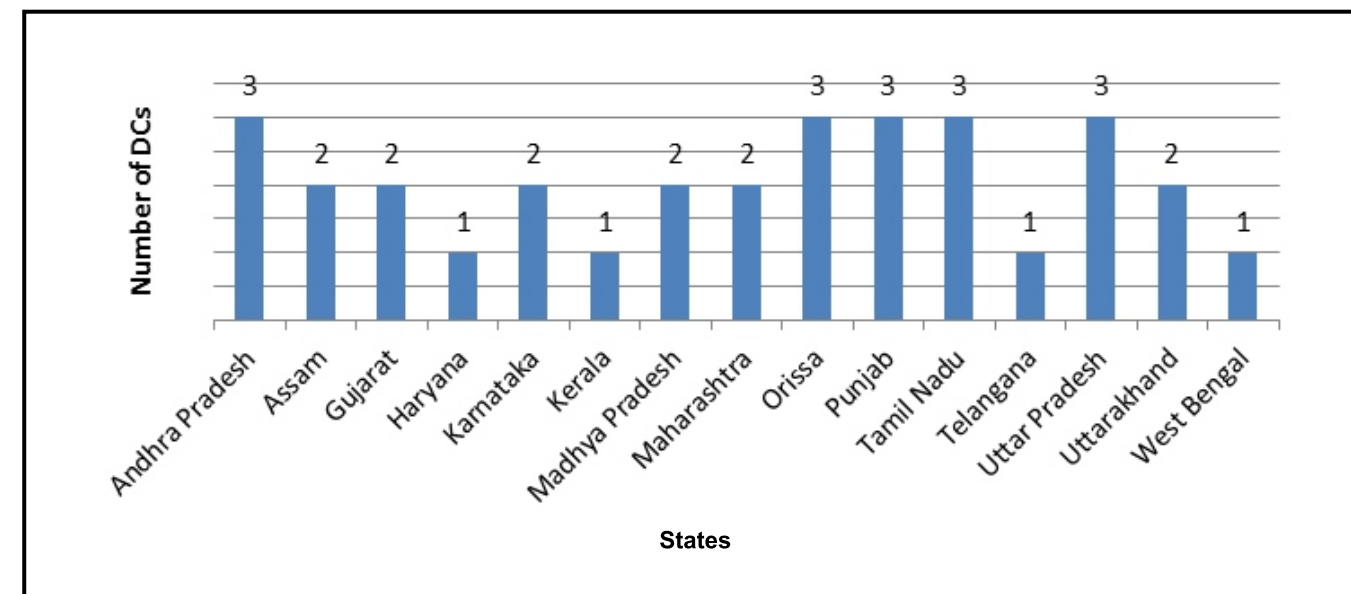
Introduction

The Indian paper industry accounts for about 1.6% of world's production of paper and paperboard. There are total 650 paper mills across India with a production of 153 lakh tonnes and the average energy consumption of 52GJ/tonnes of paper. The total no. of mills covered under PAT I were 31.



Coverage of DC :

★ States

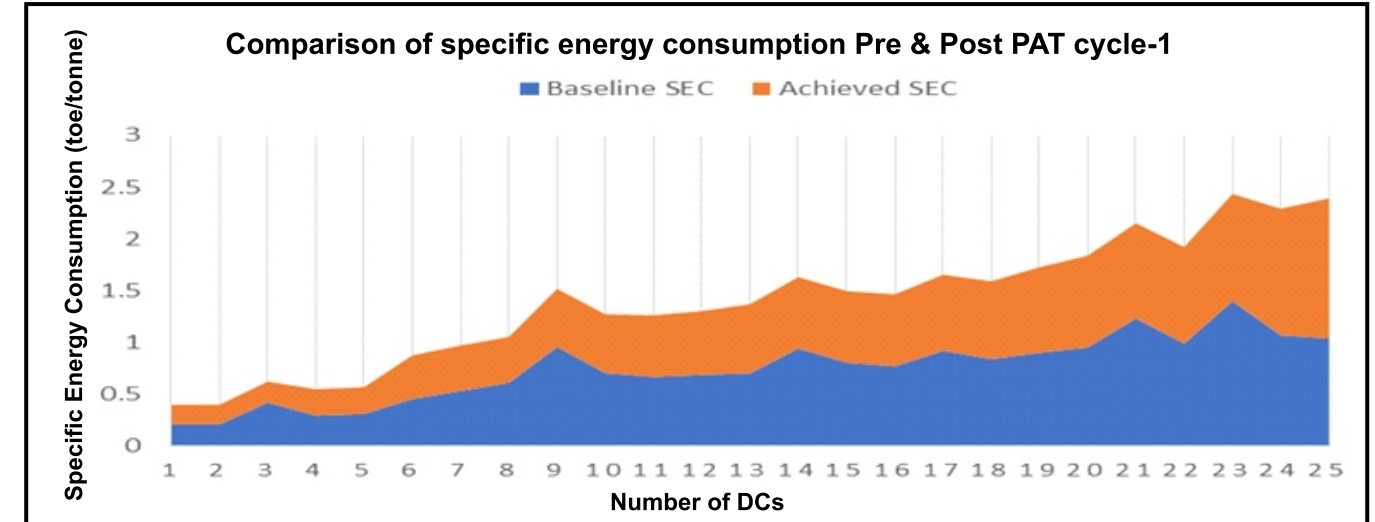


Energy Saving in terms of MTOE 0.29

The achieved saving for Pulp & Paper sector is 0.289 Million TOE, which is around 143 % higher than the saving target notified for 31 Pulp & Paper sector DC's. The details are indicated below.

S.No	Sector	Notified DCs	Energy Consumption (MTOE)	Target (MTOE)	Achieved (MTOE)	Achievement over and above the target in % age.
1.	Pulp and Paper	31	2.08	0.119	0.289	143%

The overall SEC of notified DC has reduced around 19 % in the assessment year from the baseline year.



Best Practices & Technology up gradation :

- Chemical Pulp Mill**: Lime Kiln Oxygen Enrichment, Carbon Dioxide Washing Aid, Digester Blow Heat Recovery System, Use of Pulping Aids to Improve Yields, Tertiary and Quaternary Combustion Air, Solid Fueled Lime Kiln
- Mill Wide**: Collect and Reuse Mill Hot Water, Use Variable Frequency Drive (VFD) on Motors with variable loads, Use EE Motors, Minimize Pressure Drops, Install and Use Real Time Energy Monitoring Systems, Capture White Water Waste Heat to Pre-Heat Mill Water.
- Paper Machine**: Use Dryers Bars and Stationary Siphons in Rimming Dryers, Use a Dryer Management System, Operate Pocket Ventilation between 180-195% oF, Wet Dry End Broke Surge Tanks, Variable Speed Thick Stock Basis Weight Control, Paper Machine Hood Heat Recovery
- Utility Plant**: Black Liquor in Recovery Boiler, Modified soot blower Operation, Distributed Boiler Control System, Recover Heat from Boiler Blow down, Upgrade Boiler Burner
- Others**: Automatic Chip Handling and Thickness Screening, Recover Heat from Latency Chest vent, Install Mid-Consistency Drum Pulper, Secondary Fiber High Efficiency Pulper Rotor, Use Load Management in Refining

5.7 Textile Sector

Introduction

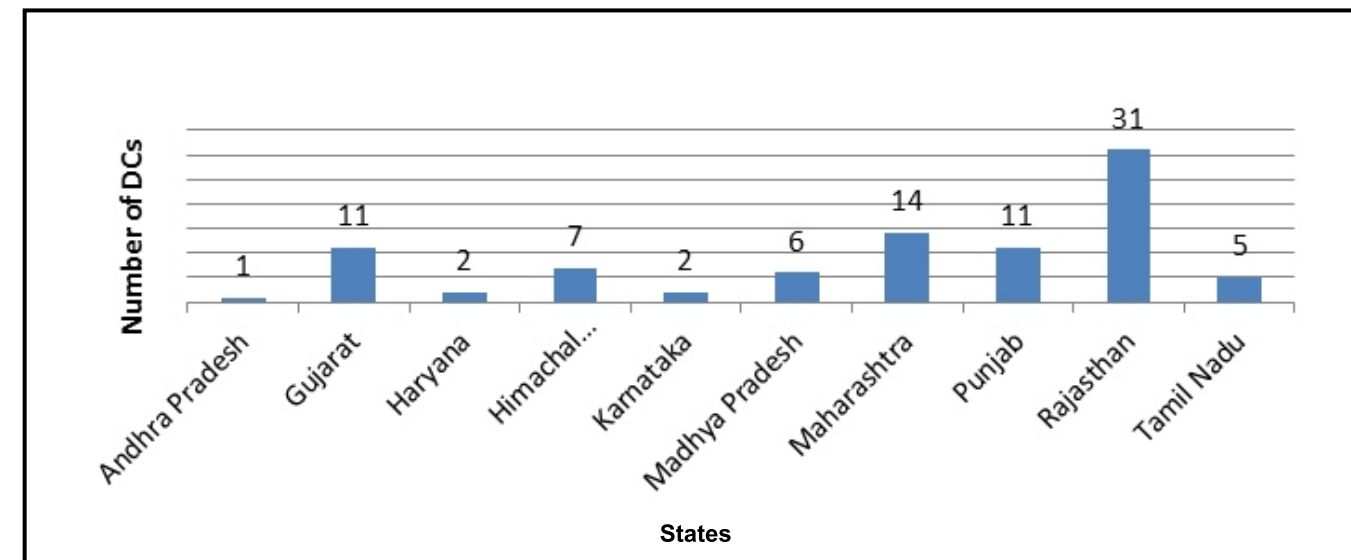
The Textile industry plays a pivotal role in its contribution to industrial output, employment generation and export earnings. It contributes to 10% of manufacturing production, 2% of India's GDP and 13% of the country's export earnings. With over 45 million people employed directly, textile industry is one of the largest sources of employment generation in the country. Owing to the energy intensive consumption pattern, this industry has been notified under the PAT scheme.



Threshold level	:	3000 toe
Sub-sectors	:	Spinning, Processing, Composite & Fiber
Reported energy consumption (PAT-I)	:	1.2 million toe/ year
Savings target (PAT-I)	:	0.066 million toe (1% of overall PAT-I Target)

Coverage of DC :

★ States

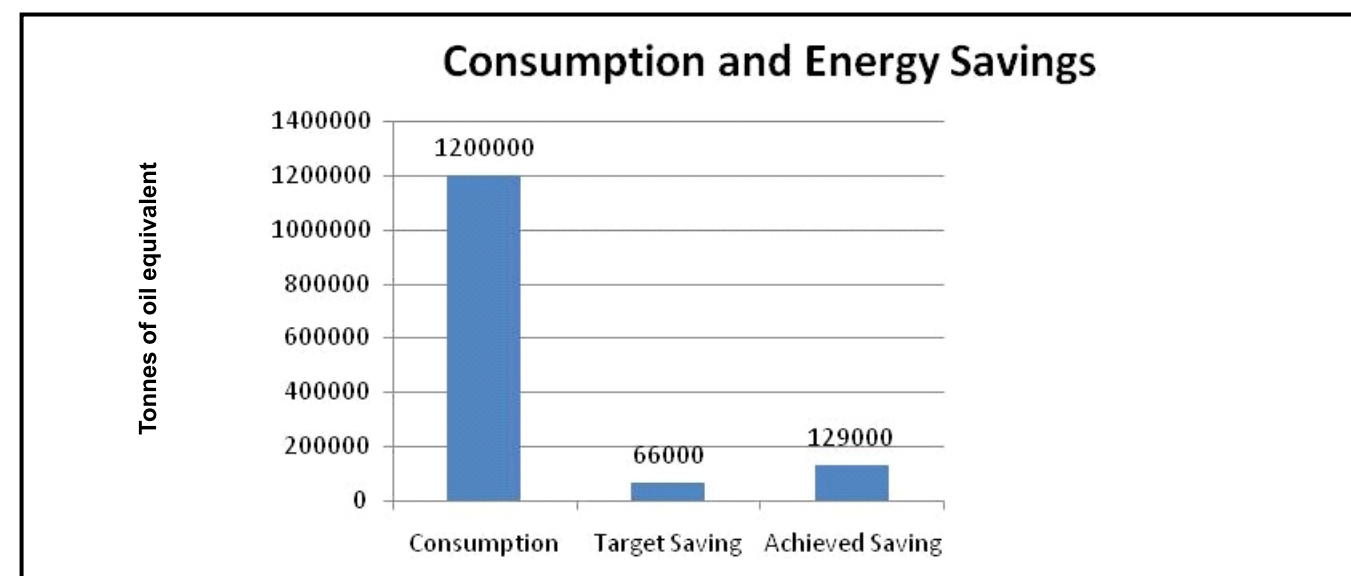


Energy savings in the sector in terms of MTOE

The achieved saving from the sector is 0.129 Million TOE, which is around 95 % higher than the saving targets from 90 units notified under the sector.

S.No	Sector	Notified DCs	Energy Consumption (MTOE)	Target (MTOE)	Achieved (MTOE)	Achievement over and above the target in % age.
1.	Textile	90	1.2	0.066	0.129	95%

Specific energy consumption varies from 0.199 to 5.2 toe/t across the sector except couple of outliers.



Best Practices & Technology up gradation:

1. Use of variable speed drives at all applicable motors/pumps.
2. Replacement of metallic blade fans with FRP blades, with optimized blade angle.
3. Approach for direct drive instead of belt drive.
4. Optimization of suction pressure of Pneumafil in open and ring frame.
5. Installation of energy efficient motor by replacing old/rewinded motors.
6. Replacement of Compact Florescent Lamp (CFL)/ High Pressure Sodium Vapor (HPSV) with Led lights.
7. Installation solar water heating arrangements for yarn conditioning machine.
8. Intermittent running of overhead blower wherever installed.

5.8 Thermal Power Plant Sector

Introduction

The Thermal power sector being one of the most energy intensive industries, is one of the 8 sectors included under PAT I, and was given a total savings target of 46% All units above the threshold of 30000 tonnes of oil equivalent (TOE) energy consumption were included and almost 88.6% of country's installed thermal power generating capacity (as of 2011) were covered. This capacity consisted of stations with coal, gas, and diesel as their fuel type. The contribution of coal was highest with 86.5%-97 plants, followed by gas at 12.71%-40 plants and finally diesel which contributed 0.71%-7 plants.



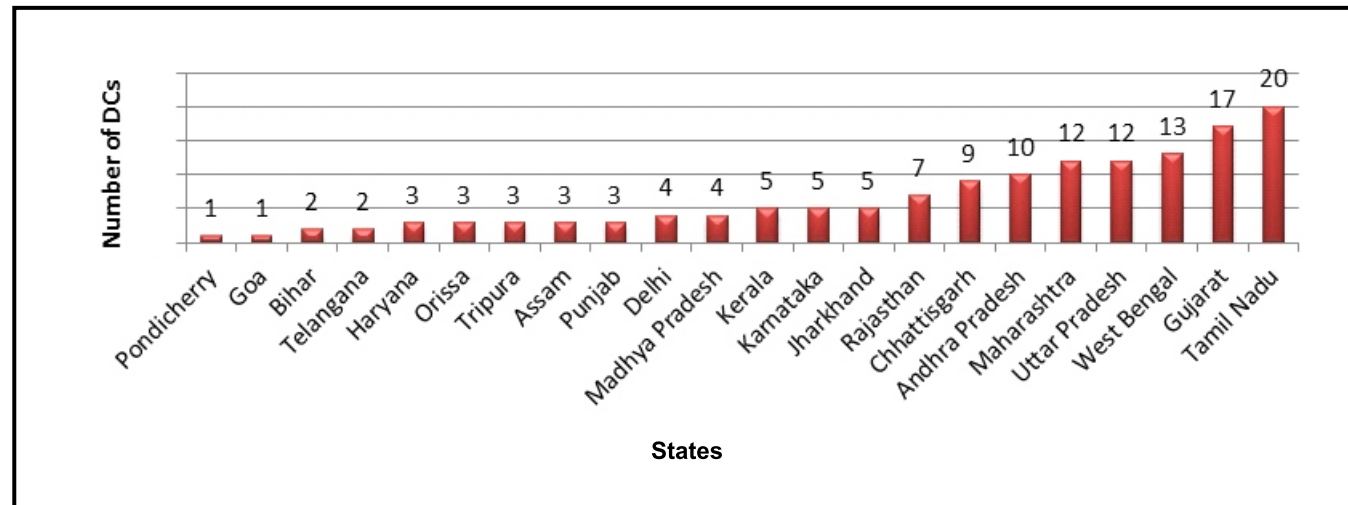
Coverage of Designated Consumers (DCs):

The categorization of thermal power station under the scheme is based on fuel i.e. Coal/Lignite, Oil/Diesel and Gaseous Fuel consumed in Plant. Apart from the type of fuel, designated consumers are also categorized in to State, Central and Private. The categorizations of thermal power station as designated consumers in PAT cycle I are shown below:

Fuel based Power Plant	State		Central		Private		Total		
	DC's No.	Net Gene ration (MU)	DC's No.	Net Gene ration (MU)	DC's No.	Net Gene ration (MU)	DC's No.	Net Gene ration (MU)	% Share
Coal	56	241666	23	264431	17	44127	96	490458	67%
Gas	19	21799	9	26906	13	21306	41	70011	28%
Diesel	4	966	0	0	3	2324	7	3290	5%
Total	79	264431	32	231571	33	67757	144	563759	100%

Table 1. Categorizations and Distribution of Thermal Power Plant under PAT cycle-I

State wise coverage of DCs:



Energy savings in the sector in terms of MTOE

The thermal power sector in PAT Cycle-I achieved 3.06 million tonnes of oil equivalent (toe) against a target of 3.21 million toe, which was a shortfall of 5% from the assigned target. Though the TPP sector missed the overall target by about 5%, but the sector as a whole has contributed to meeting about 35% of the overall target which is the maximum contribution by any sector in PAT cycle I.

S.No	Sector	Notified DCs	Energy Consumption (MTOE)	Target (MTOE)	Achieved (MTOE)	Achievement over and above the target in % age.
1.	Thermal Power Plant	144	104	3.21	3.06	-5%

Best Practices & Technology up gradation:

While most of the plants invested in least payback period option of saving in Auxiliary Power Consumption (APC) by changing to LED lamps, installation of variable frequency drives (VFD) and stage reduction in pumps as per the need. Some of the other significant energy-efficient technologies & best practices adopted by Designated Consumers are indicated below :

1. Use of washed coal
2. Dynamic coal balancing
3. Intelligent soot blowing system
4. Installation of Waste Heat Recovery (WHR) and Steam Turbine gas based plants
5. Installation of Vapour Absorption Machines(VAM)

6. State wise total nos. of Designated Consumers (DCs) under PAT Scheme (Cycle II and III)

Name of State	Aluminium	Cement	Chlor-Alkali	DISCO Ms	Pulp & Paper	Fertiliser	Iron & Steel	Textile	TPP	Refinery	Railways		Total
											Railways (Zonal)	Railways (Production)	
Andhra Pradesh	0	21	2	2	3	2	1	0	14	1	0	0	46
Assam	0	0	0	1	2	2	0	0	4	2	1	0	12
Bihar	0	1	0	2	0	0	0	0	2	1	1	0	7
Chhattisgarh	1	9	0	1	0	0	29	0	17	0	1	0	58
Delhi	0	0	0	2	0	0	0	0	5	0	1	0	8
Goa	0	0	0	0	0	1	4	0	0	0	0	0	5
Gujarat	0	9	10	4	2	6	4	21	22	4	0	0	82
Haryana	0	0	0	2	1	1	1	2	6	1	0	0	14
Himachal Pradesh	0	5	0	1	1	0	0	7	0	0	0	0	14
Jharkhand	1	3	1	1	0	0	3	0	8	0	0	0	17
Jammu & Kashmir	0	0	0	1	0	0	0	0	0	0	0	0	1
Karnataka	1	6	0	4	1	1	9	3	5	1	0	1	32
Kerala	0	1	1	1	1	1	0	0	3	1	0	0	9
Madhya Pradesh	1	13	1	3	1	2	0	12	5	1	1	0	40
Maharashtra	1	5	0	1	2	4	12	17	19	2	2	0	65
Meghalaya	0	5	0	0	0	0	1	0	0	0	0	0	6
Odisha	7	2	1	4	3	2	27	0	4	0	1	0	51
Punjab	0	1	2	1	3	2	0	19	5	1	0	2	36
Puducherry	0	0	1	0	0	0	0	0	1	0	0	0	2
Rajasthan	0	19	1	3	0	3	0	31	12	0	1		70
Tamil Nadu	0	14	3	1	4	2	2	18	21	1	1	1	68
Telangana	0	8	0	2	0	0	1	0	2	0	1	0	14
Tripura	0	0	0	0	0	0	0	0	3	0	0	0	3
Uttar Pradesh	1	3	1	5	4	8	1	1	19	1	2	1	47
Uttarakhand	0	0	0	1	1	0	0	1	0	0	0	0	3
West Bengal	0	0	0	1	1	0	5	1	14	1	3	1	27
Total	13	125	24	44	30	37	100	133	191	18	16	6	737



C. The Central Electricity Regulatory Commission (Terms and Conditions for Dealing in Energy Savings Certificates) Regulations, 2016.

CENTRAL ELECTRICITY REGULATORY COMMISSION NOTIFICATION

Mumbai, the 27th May, 2016

No. L-1/97/ 2016.— In exercise of powers conferred under sub-section (1) and clause (y) of sub-section (2) of section 178 read with Section 66 of the Electricity Act, 2003 (36 of 2003), paragraph 5.9 of the National Electricity Policy, sub-Rule (4) of Rule 12 and clause (b) of Rule 13 of the Energy Conservation (Energy Consumption Norms and Standards for Designated Consumers, Form, Time within which, and Manner of Preparation and Implementation of Scheme, Procedure for Issue of Energy Savings Certificate and Value of Per Metric Ton of Oil Equivalent of Energy Consumed) Rules, 2012 notified by the Ministry of Power, Government of India vide G.S.R.269(E) dated the 30th March 2012, for the development of market in energy for exchange of transferable and saleable Energy Savings Certificates and all other powers enabling it in this behalf, the Central Electricity Regulatory Commission hereby makes the following regulations, namely:

1. Short title, commencement and extent of application

1. These regulations may be called the Central Electricity Regulatory Commission (Terms and Conditions for Dealing in Energy Savings Certificates) Regulations, 2016.
2. These regulations shall come into force from the date of their publication in the Official Gazette.

2. Definitions

- (1) In these regulations, unless the context otherwise requires,
 - (a). "Act" means the Electricity Act, 2003 (36 of 2003);
 - (b). 'Administrator' means the Bureau of Energy Efficiency;
 - (c). 'Banking and extinguishment of ESCerts' means banking and extinguishment of ESCerts as provided in the PAT Rules, 2012, as amended from time to time
 - (d). 'Bureau' means the Bureau of Energy Efficiency, a statutory body established by the Government of India, under sub-section (1) of Section 3 of the Energy Conservation Act, 2001 (52 of 2001)
 - (e). 'Commission' means the Central Electricity Regulatory Commission (CERC) referred to in sub-section (1) of section 76 of the Electricity Act, 2003;
 - (f). 'Cycle' means a period as specified in PAT Rules, commencing from the 1st day of April of the starting year and ending on the 31st day of March of the target year. The first Cycle would cover a period of 3 years commencing from the 1st April, 2012 and ending on the 31st March, 2015;
 - (g). 'Designated Consumer' means any consumer notified by the Central Government under clause (e) of section 14 of the Energy Conservation Act, 2001 and for which a target is (a) notified under the Statutory Orders issued by the Government of India from time to time ;
 - (h). "EC Act" means the Energy Conservation Act, 2001 (52 of 2001);
 - (i). 'Eligible entity' means any designated consumer registered with Registry who has been issued or deemed to have been issued ESCerts and desire to sell or purchase such ESCerts for compliance with the energy consumption norms and standards specified under clause (g) of section 14 of the EC Act.

- (j). 'Energy Conservation Rules' means the Energy Conservation (Energy Consumption Norms and Standards for Designated Consumers, Form, Time within which, and Manner of Preparation and Implementation of Scheme, Procedure for Issue of Energy Savings Certificate and Value of Per Metric Ton of Oil Equivalent of Energy Consumed) Rules, 2012 and as amended from time to time;
- (k). 'ESCerts' means the Energy Savings Certificates issued by the Central Government in the Ministry of Power to the designated consumer under sub-section (1) of section 14(A) of EC Act, 2001
- (l). 'Market' means a forum / platform where buyers and sellers , buy or sell ESCerts through a Power Exchange 'MoP' means the Ministry of Power;
- (m). 'Power Exchange' means the power exchange as defined in Power Market Regulations of the Commission.
- (n). 'Power Market Regulations' means the Central Electricity Regulatory Commission (Power Market) Regulations, 2010 as amended from time to time ;
- (o). 'Registry' means the agency designated by Government of India in the Ministry of Power to perform such functions as defined in these regulations with respect to ESCerts.

Provided that NLDC operating under Power System Operation Corporation Limited (POSOCO) , shall function as registry for ESCerts, as notified by Government of India in the Ministry of Power vide Notification No. 10/4/2015 dated January 05, 2016, unless the Ministry of Power decides otherwise
- (p). 'Target Year' means the third financial year from the starting year during which a designated consumer shall achieve compliance with the energy consumption norms and standards prescribed under clause (g) of section 14 of the EC Act;
- (q). 'Transaction of ESCerts' means Sale or purchase of ESCerts under the Perform, Achieve and Trade (PAT) scheme on Power Exchanges, and includes delivery of ESCerts.

2. Save as aforesaid and unless repugnant to the context of the subject matter otherwise requires, words and expressions used in these regulations and not defined, but defined in the Act or EC Act or any other regulations of this Commission or any other rules issued by the Ministry of Power, Government of India shall have the meaning assigned to them respectively in the Act, or EC Act, or such other rule or regulation applicable to the Bureau.

3. Objective

The objective of these regulations is to define a framework for dealing in Energy Savings Certificate through Power Exchanges

4. Scope

These regulations shall be applicable to ESCerts offered for transaction on Power Exchange(s) including contracts in ESCerts as approved by the Commission in accordance with the provisions of Power Market Regulations.

5. Registry

The functions of the Registry shall be to undertake :

- (1). Registration of Eligible Entity;

- (2). Maintaining records of ESCerts viz., issuance, dealing, etc;
- (3). Dissemination of information in coordination with the Bureau;
- (4). Assistance in development of IT Platform for maintaining database of ESCerts;
- (5). Signing of Non-Disclosure Agreement with the Administrator; and
- (6). Any other function, as assigned by the Commission in consultation with the Bureau, after assessment of the prevailing market conditions.

6. The Commission to issue directions

The Commission may, from time to time issue directions to the Administrator and the Registry in regard to the discharge of their functions related to transaction of ESCerts.

7. Functions of Administrator

For the purpose of transaction of ESCerts issued under the EC Act, the Bureau shall act as the Administrator and subject to provisions of these regulations, it shall

- (a). Define detailed procedure for the following, in pursuance of the Energy Conservation Rules in consultation with the Registry:
 - (i) Interface activities between Power Exchanges and Registry, Administrator and Registry and Registry and Designated Consumer (s);
 - (ii) Registration of eligible entities; and
 - (iii) Dealing, transfer and other residual matters.

Provided that the Bureau shall undertake public consultation on the proposed procedure, seek the approval of the same from the Commission and issue detailed procedure after the approval of the Commission.
- (b). provide assistance to the Commission in the matters involving transaction of ESCerts on Power Exchanges.
- (c). disseminate relevant market information to all stakeholders
- (d). monitor to ensure that transaction in ESCerts takes place in a transparent manner, and report instances of noncompliance of these Regulations to the Commission
- (e). provide relevant information regarding Designated Consumer(s) to the Registry
- (f). adhere to all compliance under EC Act pertaining to ESCerts
- (g). signing of Non-Disclosure Agreement with the Registry
- (h). coordinate with the Software developer/agency who maintains the IT portal
- (i). intimate the Registry regarding the extinguishment of ESCerts from the accounts of the concerned Eligible Entity; and
- (j). coordinate with the Power Exchanges and Registry for smooth interface for transaction of ESCerts; and
- (k). discharge such other functions as may be assigned under these Regulations.

8. Value and Validity of ESCerts

The value and validity of ESCerts shall be as specified in the Energy Conservation Rules.

9. Eligible Entity

The following entities shall be eligible for dealing in ESCerts on Power Exchanges, namely,-

- (a). Eligible entities issued ESCerts in electronic form in a cycle period for achieving specific energy consumption less than the energy consumption norms and standards notified by the Central Government for the cycle period, under Energy Conservation Rules, and subsequent cycles, who have held such certificates in Registry accounts;

- (b). Eligible entities whose specific energy consumption are more than the prescribed energy consumption norms and standards specified for a cycle period and subsequent cycles and who wish to comply with the prescribed energy consumption norms and standards using ESCerts in lieu of implementing energy conservation and energy efficiency improvement measures;
- (c). Any other eligible entity, as permitted in the EC Act and on subsequent intimation by the Bureau to the Commission, shall be allowed to enlist for participating in dealing of ESCerts on Power Exchanges by the Commission, from time to time.

- (1) Power Exchanges shall permit only the Eligible entities to place either buy or sell bids subject to confirmation of availability of ESCerts by the Registry during the transaction.

10. Dealing in the Certificates

- (1). Unless otherwise specifically permitted by the Commission by order, the ESCerts shall be dealt only through the Power Exchange and not in any other manner.
- (2). The ESCerts issued to eligible entities by the Government on the recommendation of the Bureau may be placed for dealing in any of the Power Exchanges by the ESCerts holder, and such ESCerts shall be available for dealing in accordance with the rules and byelaws of the Power Exchanges.
- (3). The frequency of transaction of ESCerts, through Power Exchanges, shall be on monthly basis or in such periodicity for all registered and eligible entities as per the procedure approved by the Commission.
- (4). All ESCerts shall be dealt at Power Exchanges as per the provisions of EC Act, 2001, PAT Rules and these Regulations.
- (5). Power Exchanges shall obtain prior approval of the Commission, on the rules and byelaws including the eligibility criteria, transaction process, ESCert price discovery mechanism and process of interaction between exchange and Registry which inter-alia shall include the following
 - a. all eligible entities who intend to participate in the transaction of ESCerts on Power Exchange shall register themselves with the Registry and the Power Exchange;
 - b. The ESCerts issued to the eligible entity may be placed for dealing in any of the Power Exchanges as the ESCerts holder may consider appropriate and such ESCerts shall be available for dealing in accordance with the rules and byelaws of such Power Exchange ;
- (6). In any dealing session, an eligible entity shall not place sale bids in excess of total ESCerts held in its Registry Account.
- (7). The Registry shall cross-check the cumulative sale bids placed on Power Exchanges with availability of ESCerts in respective Registry account(s) and in case breach of this sub-regulation is noticed, the Registry shall intimate the Power Exchanges to treat such eligible entities as defaulter and any bid submitted by such eligible entity shall not be considered by the Power Exchange for the purpose of price discovery. The bids submitted by such bidders shall become void and ineffective if the total sale bids submitted by eligible entity on both the Power Exchanges are more than the available ESCerts in the Registry account.
- (8). Eligible entities with more than three cases of default specified in sub-regulation 10(7) in a cycle shall be barred from transaction of ESCerts for next six months, notwithstanding any penalty due to be imposed as per the provisions of the Energy Conservation Act, 2001.

- (9). The Power Exchanges, on receipt of confirmation report shall-
- aggregate all the buy bids and the confirmed sell bids and determine the market clearing price and the market clearing volume and the transaction results shall be published on the website of the concerned Power Exchange;
 - send reports for dealing confirmation and financial obligation, invoices including financial settlement i.e. pay-in and pay-out shall be generated by the Power Exchanges for the executed transaction and shall be sent to respective members;
 - share with the Registry after every dealing session, information on the volumes transacted by Eligible entities, including details of purchase of ESCerts. On successful transaction on Power Exchange, the Registry Accounts of the Eligible entities shall be updated whereby the sellers' accounts shall be debited and the buyers' accounts shall be credited.
 - The matching mechanism on Power Exchanges for ESCerts transaction shall be closed bid double-sided auction.

11. Pricing of Certificate

- (1). The denomination of one ESCert as mentioned in the Energy Conservation Rules shall be equal to energy consumed in terms of one metric Ton of Oil Equivalent (mtoe).
- (2). The market price of ESCerts shall be as discovered through the process of bidding at the respective Power Exchange.

12. Fees and Charges

The Commission in consultation with the Bureau may from time to time determine, by order, the fees and charges payable by the Eligible entities to the Registry for the purpose of meeting the cost and expense towards the management of Registry and software platform.

13. Market Oversight

The primary responsibility of monitoring of ESCerts market shall be with the Administrator and it shall be the duty of the Administrator to bring to the notice of the Commission instances of non-compliance of these Regulations, for suitable action by the Commission.

14. Power to Relax

The Commission, may by general or special order, for reasons to be recorded in writing, and after giving an opportunity of hearing, to the parties likely to be affected by grant of relaxation, relax any of the provisions of these regulations on its own motion or on an application made before it by an affected party.

15. Power to issue directions

If any difficulty arises in giving effect to these Regulations, the Commission may on its own motion or on an application filed by any affected party, issue such directions as may be considered necessary in furtherance of the objective and purpose of the Regulations.

T. ROUT, Chief (Legal)
[ADVT.III/4/Exty./150/(118)]