



सत्यमेव जयते

Ministry of Power
Government of India

Achievements under Perform, Achieve and Trade (PAT)

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MAY 2017

BUREAU OF ENERGY EFFICIENCY

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Introduction

Under National Mission for Enhanced Energy Efficiency (NMEEE), the scheme of Perform Achieve and Trade (PAT) is a regulatory instrument to reduce specific energy consumption in energy intensive industries, with an associated market based mechanism to enhance the cost effectiveness through certification of excess energy saving which can be traded. Perform Achieve and Trade in its first cycle was designed to reduce the specific energy consumption (SEC) in energy intensive sectors under which 478 DCs from 8 sectors viz. Aluminium, Cement, Chlor- Alkali, Fertilizer, Iron & Steel, Paper & Pulp, Thermal Power Plant and Textile have been included. PAT cycle I has achieved an energy saving of 8.67 mtoe against the targeted energy saving of 6.68 mtoe which is about 30% over achievement and is equivalent to monetary savings of approx. Rs. 9500 crore. PAT is a multi-cycle scheme aimed to cover most of the energy intensive sectors of the economy.

Table 1: Minimum annual energy consumption & estimated no. of DCs in PAT Cycle 1 sectors

Sr. No.	Sector	Minimum annual energy consumption for the DC (tonne of oil equivalent)	No. of DCs	Annual Energy Consumption (Million TOE)	Energy Reduction Target For PAT Cycle -1 (Million toe)	Achievements /Savings (Million toe)
1.	Aluminium	7500	10	7.71	0.456	0.73
2.	Cement	30000	85	15.01	0.815	1.48
3.	Chlor-Alkali	12000	22	0.88	0.054	0.09
4.	Fertilizer	30000	29	8.2	0.478	0.78
5.	Iron & Steel	30000	67	25.32	1.486	2.1
6.	Pulp & Paper	30000	31	2.09	0.119	0.29
7.	Textile	3000	90	1.2	0.066	0.13
8.	Thermal Power Plant	30000	144	104.56	3.211	3.06
	Total		478	165	6.68	8.67

BRIEF ON PERFORM, ACHIEVE & TRADE (PAT)

I. Aluminium Sector

A. Introduction

In aluminium sector, to become a designated consumer the threshold limit is 7500 toe and in PAT cycle-I 10 designated consumers from Odisha, Karnataka, Jharkhand, Chhattisgarh, Maharashtra and Uttar Pradesh has been notified and their targets have already been notified.



B. Achievements under PAT Cycle-I

The achieved saving for aluminium sector is 0.730 Million TOE, which is around 60 % higher than the saving target notified for 10 aluminium sector DC's. For achieving this, DC's has invested 140 Crores in various Energy Conservation Measures. The saving detail is shown in below table :

Table 2 : Energy Savings in Aluminium Sector

S.No.	Sector	Notified DCs	Energy Consumption (MTOE)	Target (MTOE)	Achieved (MTOE)	0% increase
1	Aluminium	10	7.71	0.456	0.730	60%

C. Best Practices & Technology up gradation:

For achieving the target, Designated Consumer's has commissioned variety of projects; from this some are best practices that were commissioned during PAT cycle 1. The following are the list of best practices that was followed:

- Implementation of slotted anode in pots
- Reduction in Stub to Carbon voltage drop
- Eco-contact to reduce voltage drop at conductor joints
- Use of self-developed fuel "CRYSTAL" additive for dozing inside the furnace
- Intelligent soot blowing system
- Installation of VFD
- Installation of High efficient screw compressor

In addition from these technologies, behavior 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, Bokela modification etc.

II. Cement Sector

A. Introduction

Indian cement industry is one of the highly energy intensive industry which has a robust growth trajectory over the past decade. 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. In Cement Sector, to become a designated consumer, the notified threshold limit is 30000 TOE (tonnes of oil equivalent) of energy consumed per annum. Under PAT cycle-I, 85 Nos of Designated Consumers, located in various states have been notified and assigned mandatory energy reduction targets.



B. Achievements under PAT Cycle-I

The achieved saving for cement sector is 1.480 Million TOE, which is around 81.6 % higher than the saving targets notified for 85 DCs. **PAT has triggered energy efficiency in Cement sector and as a result the sector is currently global best.**

Table 3 : Energy Savings in Cement Sector

S.No.	Sector	Notified DCs	Energy Consumption (MTOE)	Target (MTOE)	Achieved (MTOE)	0% increase
1	Cement	85	15.01	0.815	1.480	81.6%

C. Best Practices & Technology up gradation:

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

- Installation of Waste Heat Recovery systems
- Installation of Vertical Grinding Mill
- Installation of VAM
- Installation of High recuperation efficiency hydraulic cooler
- Installation of High efficient screw compressor
- Provided baffle plate (guide plate) inside twin cyclone
- Increasing the usage of AFR in the Kiln.
- Increasing the number of stages of preheater
- Installation of High Efficiency 3rd Generation Air-Separator

III. Chlor Alkali Sector

A. Introduction

The size of Indian Chlor-Alkali sector at 3.3 Million tonnes is 4% of world market. In Chlor-Alkali sector, to become a Designated Consumer, the notified threshold limit is 12000 TOE of energy consumption per annum. In PAT cycle-I, 22 Designated Consumers, located across country have been identified and assigned mandatory energy reduction targets.



B. Achievements under PAT Cycle-I

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.

Table 4 : Energy Savings in Chlor Alkali Sector

S.No.	Sector	Notified DCs	Energy Consumption (MTOE)	Target (MTOE)	Achieved (MTOE)	0% increase
1	Chlor Alkali	22	.885	0.054	0.093	72%

C. Best Practices & Technology up gradation:

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

- Upgrading to 6th Generation (Zero gap type) Cell in Electrolyser.
- Installation of Back Pressure Turbine to eliminate throttling from HP to LP steam and recover power.
- Recovery of waste heat for process heating and/or power generation
- Feeding of 48% Caustic Soda Lye at 90° C directly to Caustic Concentration Unit from Caustic Evaporation Unit.
- Installation of VAM to recover waste heat from 48% CSL.
- Installation of Screw Chiller.
- Optimization of Electrolysers for current consumption by monitoring cell voltages and replacing membranes in time.

IV. Fertilizer Sector

A. Introduction

Fertilizer industry in India with the total production of about 38.6 million tonnes of fertilizer products is second largest producer of fertilizers in the world. In Fertilizer Sector, to become a Designated Consumer, the notified threshold limit is 30000 TOE of energy consumption per annum. In PAT cycle-I, 29 Designated Consumers, located in various states have been identified and assigned mandatory energy reduction targets.



B. Achievements under PAT Cycle-I

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 saving detail is shown in below table:

Table 5 : Energy Savings in Fertilizer Sector

S.No.	Sector	Notified DCs	Energy Consumption (MTOE)	Target (MTOE)	Achieved (MTOE)	0% increase
1	Fertilizer	29	8.2	0.477	0.78	64%

C. 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 MP Pre-decomposer for recovering heat from vapors of Decomposer, installation of Pre-concentrator before Vacuum Concentration Section, HP Urea Hydrolyser etc.

V. Iron & Steel Sector

A. 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 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.



B. Achievements under PAT Cycle-I

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.

Table 6 : Energy Savings in Iron & Steel Sector

S.No.	Sector	Notified DCs	Energy Consumption (MTOE)	Target (MTOE)	Achieved (MTOE)	0% increase
1	Iron and Steel	67	25.32	1.486	2.10	41%

C. 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:

- Use of 100% pellets as iron burden reduce coal consumption, improves better metallization of pellets, reduces fines generation and iron ore loss and improves work environment.
- High top pressure blast furnace also provides an ideal opportunity for recovering energy from the large volumes of pressurized top gas. TRT can be used to generate electricity from this high top pressure.
- Waste heat recovery from DRI process reduces massively the need for external fuel like coal for generating the same amount of electricity.
- Direct Rolling of hot continuous cast billet to produce TMT bars and therefore, completely avoided uses of furnace oil in reheating furnace.
- The major benefit from Coke dry quenching (CDQ) is recovery of waste heat to produce steam & power other than environmental benefit on dust, SOx and NOx emission reduction.
- Insulation of Hot surface in After Burning Chamber & Dust Settling Chamber in 500TPD kiln. Surface to be covered with Rockwool & GI sheet cladding to reduce hot surface temp from 150°C to 60°C.
- Commissioning of Blast furnace gas line to captive power plant to use surplus Blast furnace gas.

VI. Pulp and Paper Sector

A. Introduction :

The Indian paper industry accounts for about 3% of the world's production of paper. The pulp & paper sector has been categorized on the basis of raw material usage: 1. Wood based units 2. Agro based units 3. Recycled fibre based units 4. 100% market based pulp. Presently the share in production of paper from wood based raw materials, agro residues and recycled/waste paper is 31%, 22% and 47% respectively.



B. Achievements under PAT Cycle-I

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 saving detail is shown in below table :

Table 7 : Energy Savings in Pulp and Paper Sector

S.No.	Sector	Notified DCs	Energy Consumption (MTOE)	Target (MTOE)	Achieved (MTOE)	0% increase
1	Pulp & Paper	31	2.08	0.119	0.289	143

C. Best Practices & Technology up gradation:

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

- **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 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°F, 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 sootblower 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.

VII. Textile Sector

A. Introduction :

India's textile industry since its beginning continues to be predominantly cotton based with about 65 percent of fabric consumption in the country being accounted for by cotton. In Textile sector, to become a designated consumer, the threshold limit is 3000 TOE of energy consumption per annum. In first PAT cycle I, 90 designated consumers from various states have been identified for which the target was notified in 2012.



B. Achievements under PAT Cycle-I

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

Table 8 : Energy Savings in Textile Sector

S.No.	Sector	Notified DCs	Energy Consumption (MTOE)	Target (MTOE)	Achieved (MTOE)	0% increase
1	Textile	90	1.2	.066	0.129	95%

C. Best Practices & Technology up gradation:

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

- Adoption of premier energy efficient motor with proper sizing in ring frame and open end spinning machine.
- Use of variable speed drives in humidification plants and optimization of blade angle and their types matches with efficient operation, approach for direct drive instead of belt drive.
- Installation photo cells for speed frames.
- Installation of synthetic flat belts for spinning ring frame.
- Optimization of suction pressure of Pneumofil in open and ring frame.
- Replacement of T8 tubelight with led tubelights.
- Replacement of CFL and HPSV and with Led lights and street Lights.
- Conversion of V belt drive to flat belt drive.
- Use of electronic ballast in place of conventional electromagnetic chokes.
- Optimum pressure setting for compressor and avoid its misuse.
- Replace old inefficient boiler with efficient boiler with require matched capacity of plant.
- Reuse of condensate and recover heat from hot water.
- Maintain steam traps and system.

VIII. Thermal Power Plant Sector

A. Introduction :

Thermal power sector being one of the most energy intensive industries, was one of these 8 sectors, and contributed about 46% of the total savings target. With the threshold of 30000 tonnes of oil equivalent (TOE) energy consumption almost 88.6% of country's installed thermal power generating capacity (as of 2011) was 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.



B. Achievements under PAT Cycle-I

The thermal power sector in PAT Cycle-I achieved 3.06 million tonnes of oil equivalent (mtoe) against a target of 3.21 mtoe, which was a shortfall of 5% from the assigned target.. A total of 13 million tonnes of CO2 emission was reduced.

Table 9 : Energy Savings in Thermal Power Plant Sector

S.No.	Sector	Notified DCs	Energy Consumption (MTOE)	Target (MTOE)	Achieved (MTOE)	0% increase
1	Thermal Power Plant	144	104.56	3.211	3.06	-5%

C. Best Practices & Technology up gradation:

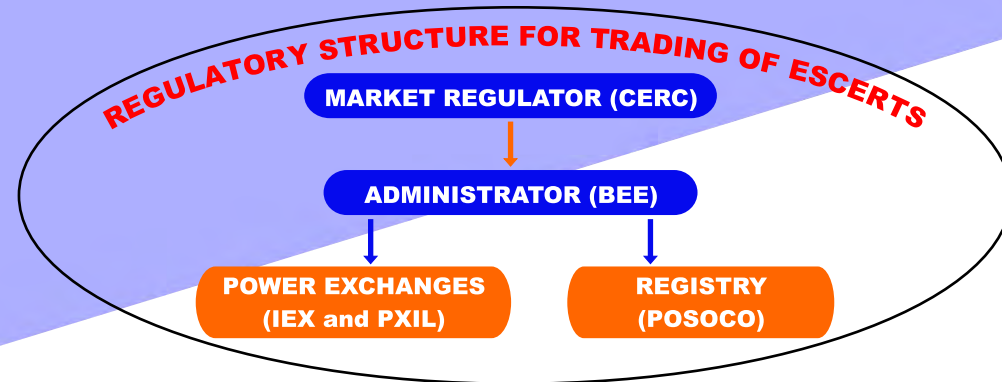
While most of the plants invested in least payback period option of saving in APC by changing to LED lamps, installation of VFDs and stage reduction in pumps as per need, others realised the need for advanced technology. Some of the significant energy-efficient technologies & best practices adopted by Thermal Power Plant Sector's Designated Consumers are outlined below:

- Use of washed coal
- Dynamic coal balancing
- Intelligent soot blowing system
- Installation of WHR and ST in gas based plants
- Installation of Vapour Absorption Machines(VAM)

TRADING OF ESCERTS

I. Introduction

Section 14A (1) of Energy Conservation Act 2001 gives power to Central Government to issue energy savings certificate to the designated consumer whose energy consumption is less than the prescribed norms and standards. Energy Conservation Rules, 2012 (PAT Rules 2012) notified on 30th March 2012 by Ministry of Power, has specified that the ESCerts to be issued/entitled to purchase will be in electronic form and tradable on Power Exchange. Thus, BEE developed PATNet portal for all the DCs through which they upload their forms and ESCerts can be electronically issued/entitled to purchase to them.



A. Trading Regulations for ESCerts

- Central Electricity Regulatory Commission (Terms and Conditions for Dealing in Energy Savings Certificates) Regulations, 2016 was issued by CERC on 27th May, 2016 and notified on 30th May, 2016. Important features of this Regulation are as follows:
 - Roles & responsibilities of Administrator, Registry, CERC and Power exchanges were defined.
 - Market price of ESCerts shall be discovered through bidding at power exchanges i.e. through closed double-sided uniform price auction.
 - Interested DCs to whom ESCerts have been either issued or are entitled to purchase by MoP have to register themselves with 'Registry' i.e. POSOCO to become eligible entity.
 - For trading in Power exchanges to the DCs have to get themselves registered with any of the exchange.

B. Procedure for Transaction of ESCerts

- BEE (Administrator) had developed the detailed procedure for transaction of ESCerts in consultation with POSOCO (Registry) and on 14th February 2017, the Procedures was approved by the Commission. Following are important features of Procedure:
 - Template of application form to become eligible entity for trading of ESCerts has been defined. Documents like PAN, TAN, CIN, etc. shall be required. DCs shall fill up application form through PATNet (where already DCs of PAT cycle I are registered).
 - Process of application scrutiny by Registry has been detailed.

C. Fee order for Transaction of ESCerts

- On 24th March 2017, CERC has approved the Fee order for transaction of ESCerts, with following details:
 - One time Registration Fee of Rs. 15000/- per eligible entity.
 - The Eligible Entities who have been issued ESCerts, shall pay an ESCerts Fee at the rate of Rs. 5/- per ESCert.
 - The taxes and duties on fees & charges shall be applicable as per the prevailing norms
- All payment to Registry shall be done only through ECS and no draft / cheque will be accepted. Transaction id of RTGS / NEFT has to be provided in the application form to become eligible entity. Bank account details shall be provided to the DCs separately.

D. Web page for Registry

- The above webpage is designed dedicatedly for Registry for Energy Saving Certificates. This webpage can be accessed through https://beenet.gov.in/UI_Forms/Registry/default.aspx and the links are also provided on homepage of BEE (<https://www.beeindia.gov.in/>) and PATNet (<https://beenet.gov.in>)

E. DC Dashboard PATNet Portal

The screenshot shows the DC Dashboard PATNet Portal. The 'Escerts Issuance' tab is highlighted. Below the navigation bar, there is a table with the following data:

DC Registration No.	DC Name	PAT Cycle	No. of ESCerts (Claimed)	No. of ESCerts (Approved by MoP)	Serial No. of Issued ESCerts	ELIGIBLE ENTITY REGISTRATION	CERTIFICATE OF REGISTRATION	Reason of Rejection / On Hold
TPP0014AS	Lakwa Thermal Power Station, Maibella, P.O. Sutfry, Sivasagar, Assam	2012-15	44634	44634	01-00266602-TPP0014AS-281116 to 01-00311235-TPP0014AS-281116	Registration Form	CERTIFICATE	COMMENT

- After clicking the tab of registration form in the above dashboard, designated consumer on PATNet portal has to fill the form for registration to become eligible entity. Subsequently the form will be submitted to Registry.

BUREAU OF ENERGY EFFICIENCY
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M & V Status Escerts Issuance Check Verification **Trading** Compliance Escerts Banked

DC Registration No.	DC Name	PAT Cycle	Opening Balance [No. of ESCerts]	Closing Balance [No. of ESCerts]
TFP0014AS	Laksh Thermal Power Station, Maibella, P.O. Sufry, Sivasagar, Assam	2012-15		

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- The above dashboard for Trading will display the opening and closing balance for No. of ESCerts.

F. Trading Period

- DCs shall submit the application for registration to Registry to become Eligible Entity within 15 days as per the date intimated by the Administrator.
- After receipt of application for registration, the Registry shall undertake scrutiny and inform the applicant (by email) within 7 working days.
- The applicant shall furnish the details as requested by the Registry within 7 working days so as to enable the Registry to undertake the registration of the applicant.
- The process of registration of the DC shall be completed within 15 working days from the date of complete information by the Registry.
- After registration, the Eligible Entities shall be allowed to undertake trading of ESCerts as per the procedure and bye laws of the power exchanges approved by the Commission.
- Trading of ESCerts is a continuous process which will happen on every Tuesday of every week.
- The DC shall furnish the status of the compliance to the Bureau (Administrator) in Form D by the end of one month from the completion of trading of the respective cycle.
- As per clause 8.6 of the procedure, the period for submission of form D is from 1st to 30th June of the year. This period has now been revised to 1st to 30th September for the year 2017, in which the DCs of PAT cycle I may submit Form D to BEE for compliance.