Department of Industrial and Management Engineering
Indian Institute of Technology Kanpur

Forum of Regulators

5th Capacity Building Programme for Officers of Electricity Regulatory Commissions
18 – 23 Oct., 2012

MARKET FOR ENERGY EFFICIENCY:
IMPLEMENTING THE PAT SCHEME

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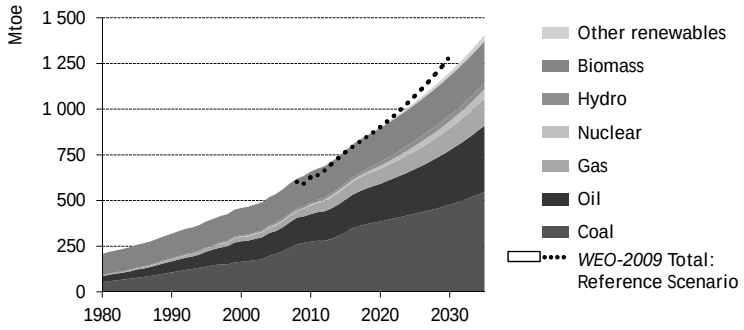
Bureau of Energy Efficiency
Ministry of Power

India Primary Energy Demand

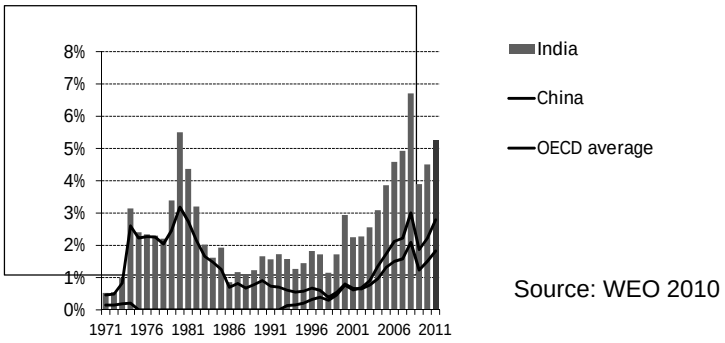


Total primary energy demand in India grows at 3.1% per year on average in 2008-2035, an overall increase of 127%

Source: WEO 2010

India's Oil Import

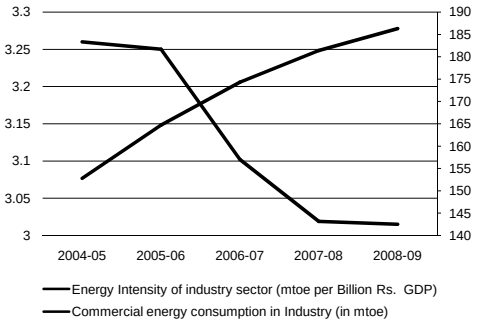
Historic expenditure on net imports of oil as a share of GDP at market exchange rates (with a projection for 2011)



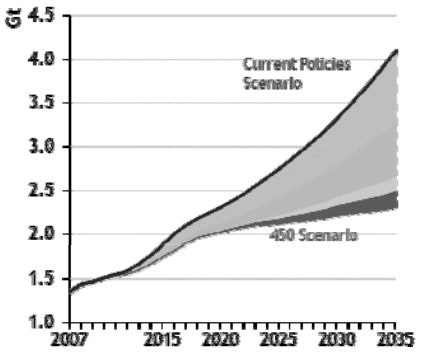
Source: WEO 2010

Energy Profile - India

Energy Intensity - Industrial Sector



India – CO_2 Emission Reduction



Share of cumulative abatement between 2010-2035	
Efficiency	51%
Renewables	32%
Biofuels	1%
Nuclear	8%
CCS	8%

Source: IEA

NATIONAL MISSION for ENHANCED ENERGY EFFICIENCY (NMEEE)

- The National Action Plan on Climate Change was released by Honorable Prime Minister of India in June 2008
- The Action Plan Outlines **8 Missions** including National Mission on Enhanced Energy Efficiency (**NMEEE**)

Chronology of NMEEE

- **30th June 2008** : Hon'able PM releases the National Action Plan of Climate Change
- **24th August 2009** : PM's council on Climate Change approves NMEEE in principle
- **May 2010** : Cabinet approves the financial outlay
- Amendment to EC Act, 2001 passed in both houses of parliament for operationalization of this mandatory scheme

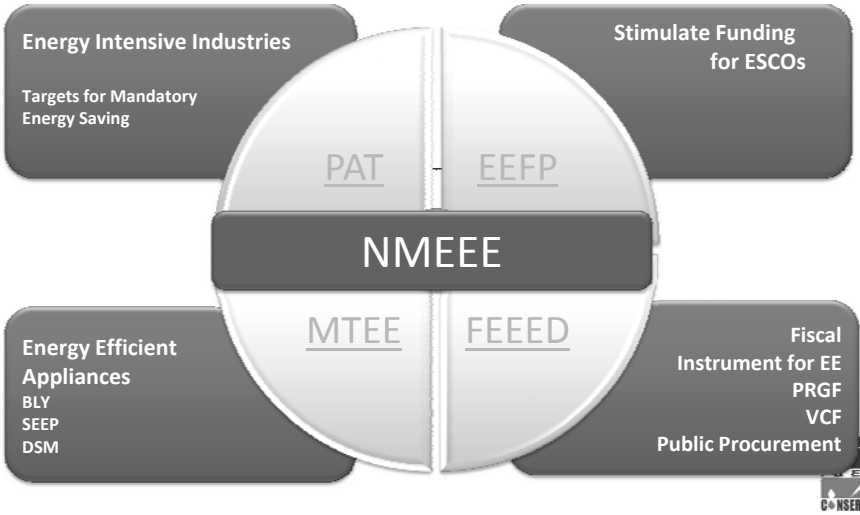
MISSIONS UNDER NAPCC

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

THE MISSION GOALS

- Market-based approaches to unlock energy efficiency opportunities, estimated to be about Rs. 74,000 Crores
- By 2014-15:
  - Annual fuel savings in excess of 23 million toe
  - Cumulative avoided electricity capacity addition of 19,000 MW
  - CO_2 emission mitigation of 98 million tons per year

NMEEE – FOUR INITIATIVES



Perform, Achieve & Trade (PAT) Mechanism

- The market based mechanism to enhance the cost effectiveness in improving the Energy Efficiency in Energy Intensive industries through certification of energy saving which can be traded

Reward over achiever | Market Based Mechanism | **Penalize under performer**

Stakeholders

Administrator	Designated Consumers	Auditing Agencies	Market Place
• Set target and compliance period	• 8 sectors Thermal Power Plant, Steel, Cement, Fertilizer, Pulp & Paper, Textile, Aluminium, Chlor-alkali	• Independent • Monitor, verify and certify	• Transaction of energy efficiency instrument

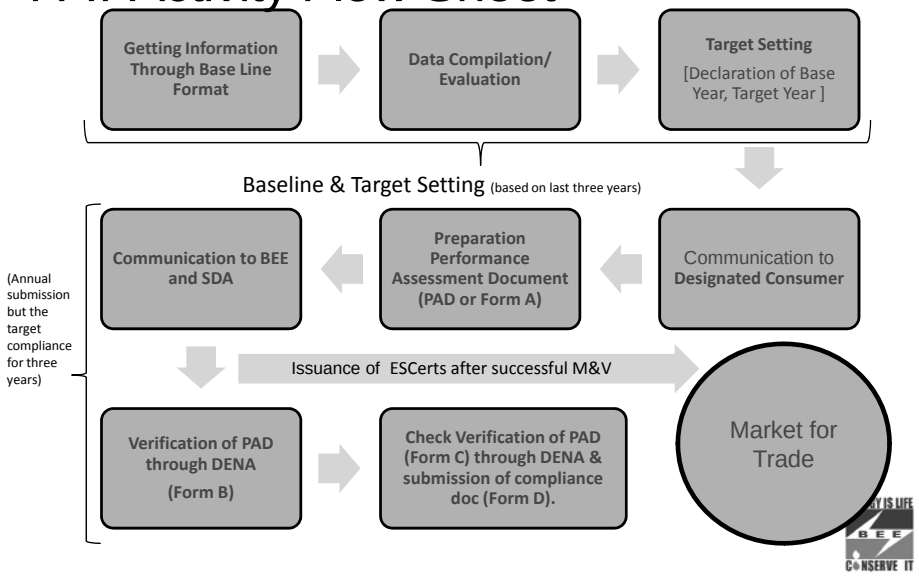
Processes Involved

Set Targets	Monitoring & verification of targets by Designated Energy Auditors (DENA)	Trading of ESCerts
• Setting targets on the basis of current specific energy consumption • Set compliance period • May take into account Location, Vintage, Technology, raw materials, product mix etc.	• Check if designated consumer has achieved targets • Underachievement: Obligations to buy ESCerts or pay penalty • Overachievement: Issuance of ESCerts for banking for later use or trade	• Participation by Designated consumers on platform provided by Power Exchanges • Symmetrical flow of information

PAT steps

Constituted PAT Steering committee	Prepared PAT Consultation document	Conducted stakeholder consultation workshop
Draft Mechanism for overall structure for PAT	Collected Baseline Data	Developed rules for implementation of PAT based on consultation workshops
Approval of NMEEE including PAT scheme by Cabinet	Constituted Sector Technical Committees for the formulation target setting methodology	Notified rules and targets for Designated Consumers

PAT Activity Flow Sheet



PAT Scheme : Background & Scope

- Covers 478 designated consumers in 8 sectors
- All DCs consume about 165 mtoe energy
- Targets would be given to all DCs to achieve the same within a time frame
  - Achievement > Target ⟹ ECScerts
  - Achievement < Target ⟹ Purchase ECScerts / Penalty
- National Target = 6.6 mtoe at the end of 1st PAT Cycle (by 2014-15)

List of DCs

Industry Sector	Annual Energy Consumption Norm to be DC (mtoe)	No. of Identified DCs
Aluminum	7500	10
Cement	30000	84
Chlor-Alkali	12000	22
Fertilizer	30000	29
Pulp & Paper	30000	31
Power	30000	140
Iron & Steel	30000	74
Textiles	3000	90

Estimated Energy Consumption in DCs

Sector	MTOE
Power (Thermal)	104.56
Iron & Steel	28.25
Cement	14.50
Fertilizer	8.20
Aluminium	7.73
Paper	2.09
Textile	1.17
Chlor-Alkali	0.85
TOTAL	**167.35**

About 70% of DCs Contribute 97% of Total Consumption

About 30% of DCs contribute rest 3% of Total Consumption

Approach for Setting Targets Depends upon the Objective of the Scheme

SN	Sector	No. of Identified DCs	Reported Energy Consumption	Share of Consumption	Apportioned Energy reduction
			(MTOE)	(%)	(MTOE)
1	Iron & Steel	74	28.25	44.99%	1.588
2	Cement	84	14.50	23.09%	0.815
3	Fertilizers	29	8.20	13.06%	0.461
4	Aluminium	10	7.73	12.31%	0.435
6	Paper & pulp	31	2.09	3.33%	0.117
6	Textile	90	1.17	1.86%	0.069
7	Chlor-Alkali	22	0.85	1.35%	0.048
	Sub Total	**340**	**62.79**	**100%**	**3.53**
8	Power (Thermal)	140	104.56	100%	3.10
Total		**480**	**167.35**	**100%**	**6.63**

Target Calculation Methodology

Processing

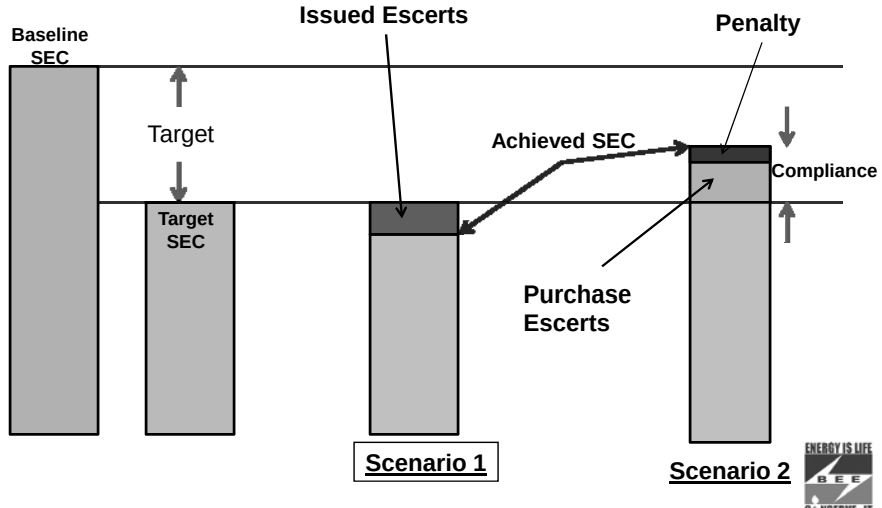
Processing: With CPP

Plant No	Average Production (Tonne)	Baseline GtG SEC (kcal/kg)	Baseline GtG SEC (TOE/MT)	Total Energy Cons.	Relative SEC	Target %	Target SEC	Saving at Target Yr	Sectoral Target (TOE)	Estimated X	Estimated Target (%)	Target SEC (TOE/MT)	Estimated Energy Saving (TOE)
71	7907	8508	0.85	6702	1.00	x	0.84	67.02	**5292.47**	3.18	3.18	0.82	213.07
77	9097	8880	0.88	8029	1.04	x	0.87	83.80			3.32	0.85	266.47
59	7309	11280	1.13	8228	1.33	x	1.11	109.09			4.22	1.08	346.82
73	4480	11675	1.17	5220	1.37	x	1.15	71.63			4.36	1.11	227.73
24	4444	14195	1.41	6282	1.67	x	1.39	104.81			5.30	1.34	333.22
77	4409	15184	1.52	6695	1.78	x	1.49	119.48			5.67	1.43	379.87
79	4183	15551	1.56	6510	1.85	x	1.53	118.99			5.81	1.47	378.30
70	5691	17129	1.71	9753	2.01	x	1.68	196.36			6.40	1.60	624.27
68	3776	18055	1.81	6826	2.12	x	1.77	144.86			6.75	1.69	460.54
66	3955	20415	2.03	8027	2.40	x	1.98	192.61			7.63	1.87	612.35
74	2557	21001	2.10	5361	2.47	x	2.04	132.33			7.85	1.93	420.71
69	3020	21620	2.16	6512	2.54	x	2.10	165.48			8.08	1.98	526.10
50	2545	22961	2.30	5863	2.70	x	2.24	158.23			8.58	2.11	503.05
				90007.927	5.88%			**1664.68**			0.1869412		**5292.47**

Processing: Without CPP

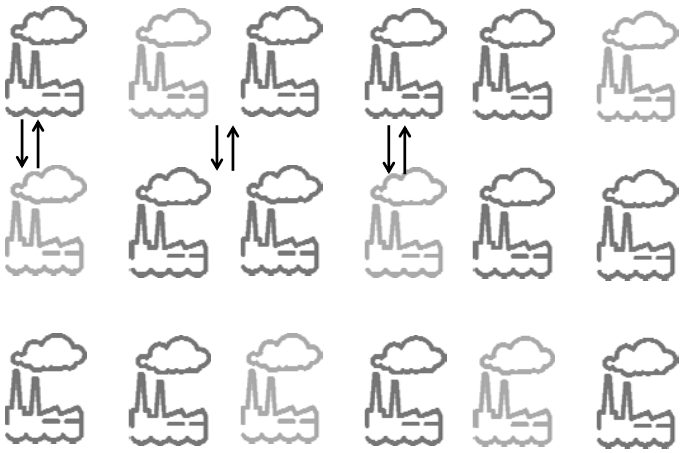
99	7279	13070	1.29	9371	1.00	x	1.27	93.71	2372.6388	2.62	2.62	1.25	245.32
78	3857	13855	1.39	5344	1.06	x	1.37	56.65			2.78	1.35	148.30
67	3435	15080	1.51	5180	1.15	x	1.49	59.77			3.02	1.46	156.46
18	2406	26300	2.64	6363	2.01	x	2.59	128.18			5.27	2.51	335.58
17	2700	52677	5.22	14093	4.03	x	5.01	568.00			10.55	4.67	1486.97
				40351	5.88%			**906.31**					**2372.64**
			TOTAL	130359									TOTAL 7665.10

Concept of Target, Compliance, ESCerts & Penalty



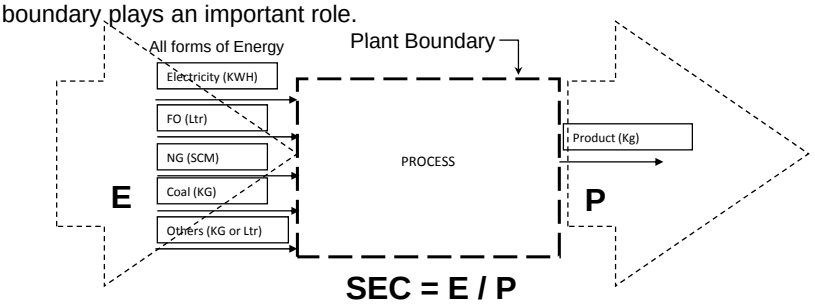
Trading of ESCerts

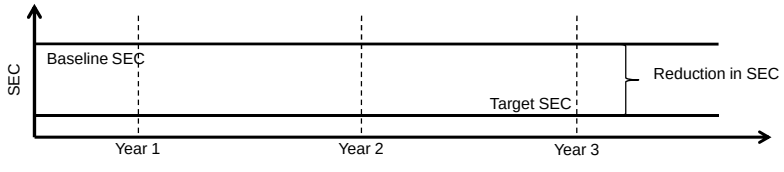
Trading of ESCerts



Specific Energy Consumption

- As the SEC is calculated on a Gate-to-Gate concept, the definition of plant boundary plays an important role.



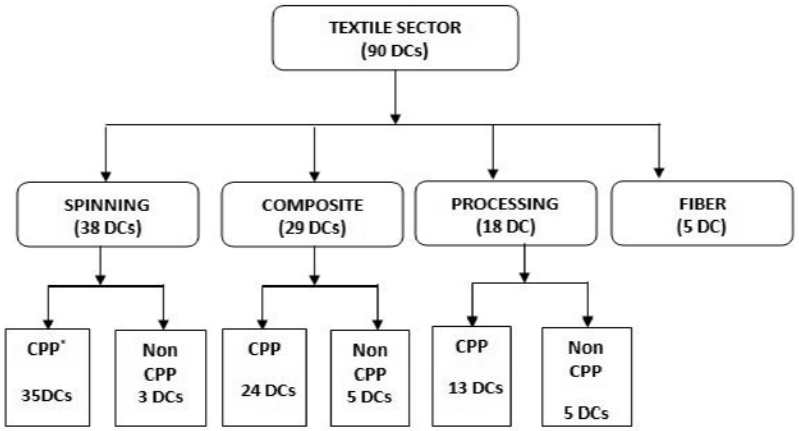


General Rules for Establishing Baseline

- Definitions:
  - Baseline Year : 2009-10
  - Baseline Production (P_{base}) : Avg. of 2007-8, 2008-9 & 2009-10
  - Baseline SEC (SEC_{base}) : Avg. of 2007-8, 2008-9 & 2009-10
  - Baseline CU% (CU_{base}) : Avg. of 2007-8, 2008-9 & 2009-10
  - Target SEC (SEC_{target}) : SEC as estimated in 2014-15
  - Target : % reduction from SEC_{base}
- Estimation of Energy Saving (MTOE) :

$$P_{base} (SEC_{base} – SEC_{target})$$

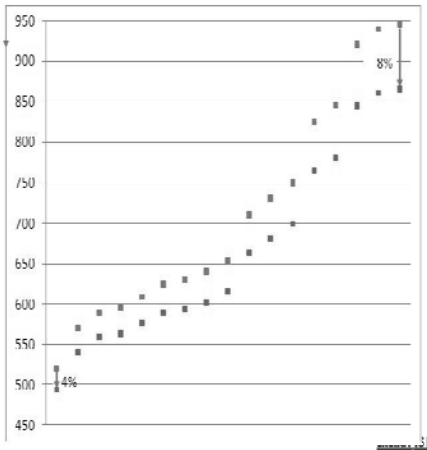
Grouping of DCs



* Captive Power Plant

Target is Plant Specific …… Less for Energy Efficient & High for Energy Inefficient Plant

- **Covers units using about 165 million toe/year**
  - Gate-to-gate specific energy consumption, collectively, to be about 5.5% less in 2013-14 than it was in 2008-09
  - Less efficient units have larger SEC %-reduction targets – so that the collective SEC reduction is 5.5%
- **Energy Savings Certificates (and penalties) would be based on difference between the achieved SEC & the target SEC and the base year Production**



Major Points

- Target: In % of Specific Energy Consumption
- ESCerts: in toe
- For ESCerts or Penalty:
  - (Baseline Production) x (% change in SEC)

Example

- SEC in baseline: 10 toe/unit of production
- Baseline Production: 10000 units
- Target: 4% reduction in SEC
- SEC at the end of 2014-15: 9.6 toe/unit prod
- For ESCerts or Penalty:
  - Reduction requirement: 4000 toe
  - Case1 (Achieved SEC = 9.8): -2000 toe (Penalty)
  - Case2 (Achieved SEC = 9.4): +2000 toe (ESCerts)

Market Design

- ESCerts are issued
  - When energy efficiency improvements surpass targets
  - With 1 mToE = 1 ESCert
  - Banking of ESCerts allowed during each cycle
    - 1st cycle ESCerts to 2nd cycle
    - 2nd cycle ESCerts to 3rd cycle

Advanced ESCerts

- Baseline, SEC(b) = 10 toe/t
- Target, SEC (t) = 7 toe/t
- Achieved after year 1, SEC (a) = 8.5 toe/t
- Production = 10000t

- **AFTER YEAR 1**
- ESCerts =[(SEC(b) – (SEC (b)– SEC (t))/3) – SEC(a)] x 80% x prod
  = ((10 – (10-7)/3) – 8.5)) x 0.8 x 10000
  = (9-8.5) x 8000 = 4000 ESCerts

Revised Target = SEC(t) – (ESCerts/Prod)
= 7 – (4000/10000) = 6.6 toe/t

Penalty Calculation

P = Wc x Pc + Wo x Po + Wg x Pg + We x Pe

Where-

P =Price of one metric ton of oil equivalent(1mtoe);
Pc=Price of F-grade coal declared by Ministry of Coal;
Po=Price of fuel oil as declared by Ministry of Petroleum & Natural Gas;
Pg=Price of gas as declared by Ministry of Petroleum & Natural Gas;
Pe=Price of electricity;
Wc= Weightage of coal;
Wo= Weightage of oil;
Wg= Weigtage of gas;
We=Weigtage of grid electricity

The value of per metric ton of oil equivalent of energy consumed is
Rupees 10154 for the year 2011-12

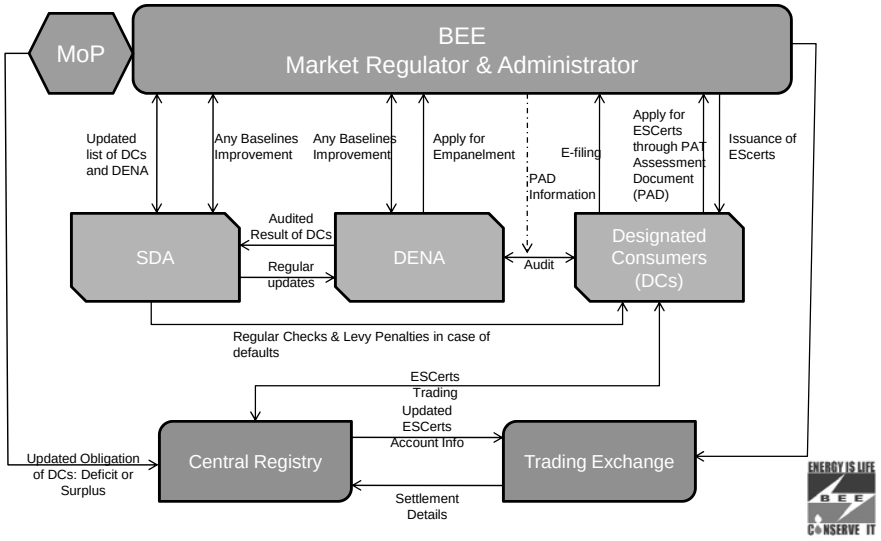
Market Design

- Designated Consumers are obligated to improve energy efficiency
- Energy Efficiency Targets are %-age reduction in SEC expressed in Absolute Savings terms
  - Various plants in an industry clustered on the basis of different parameters like technology etc
  - Each DC will get an energy efficiency improvement percentage target
  - The target would be converted into absolute energy saving target (in mToE terms) on the basis of plant capacity
  - The absolute energy saving target (obligations) would be applicable for a compliance period of three years
- Designated consumer can meet target by
  - Undertaking energy efficiency measures themselves
  - Buy ESCerts from someone else

Market Design

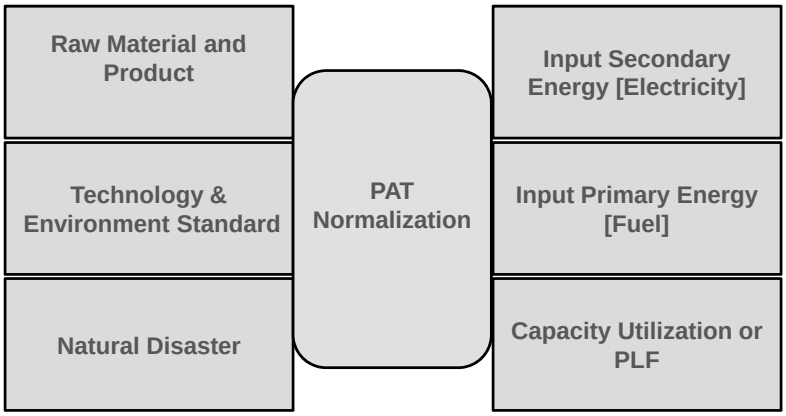
- Compliance and Reporting
  - Total compliance period of 3 years (march 2015)
  - Designated Consumers would undertake energy efficiency measures and submit annual reports
  - If submitted annual reports show over-achievement, ESCerts to be issued for level of over-achievement
  - Provision of annual reporting along with penalties in case of non-compliance
  - After period of 3 years, a complete gate-to-gate measurement to be undertaken for verifying SEC and plant capacity for each DC
  - BEE would appoint Designated Energy Auditors (DENAs) for M&V
    - DENAs would be organizations, which meet minimum capability norms
    - DENAs would be accredited and empanelled by BEE
- BEE will initiate compliance checks on dip-check basis on both DC and Accredited Energy Auditor
- In case of non-compliance State Designated Agencies to levy penalties on DC

Institutional Design



NORMALIZATION FACTORS

Normalization Area



Input Primary Energy

[Fossil Fuel]

- Fuel Linkage and Quality of Fuel
- Use of Biomass and Waste Fuel
- Non Availability of Fuel
- Re-Cycling
- By Product used as Fuel

Plant has to maintain the relevant documents to justify their cause

Input Secondary Energy

[Ex: Electricity, Steam]

- Purchased from Grid
- Through Captive Power Generation
- Through Waste Heat Recovery
- Export to Grid
- Renewable Energy

Capacity Utilization and PLF

[Poor Performance]

- Fluctuation due to Scheduling
- Effect due to Market Demand
- Non-availability of fuel or Raw Material

Raw Material & Product

[Quality, Output Type]

- Quality of Raw Material
- Output Product Change
- Production Semi-finished Product
- Input Semi-finished Product

Environmental Standards and Natural Disaster

[Gov policy]

- Change in Standards
- Change in Government policy

- Natural disaster
- Rioting or social unrest

IMPLEMENTATION PHASE

Stakeholders

Administrator	Nodal Agency	Implementer	State Administrator	Verifier
MoP/ Central Govt.	Bureau of Energy Efficiency	Designated Consumer	State Designated Agency	Accredited Energy Auditor

ROLE OF DC

1. Preparation of scheme for implementation of efficient use of energy and its conservation

Every Designated Consumer, within three months (30th March,12 - 30th June,12) of the issue of notification under sub-rule (6) of rule 4 shall submit a scheme to State designated agency with a copy to Bureau, which may include: -

- ✓ **Action Plan containing inter- alia, a brief description of identified energy saving measures to comply energy consumption norms and standards by the target year.**
- ✓ **The estimated cost of each identified energy saving measures.**
- ✓ **Implementation plan to achieve energy consumption norms and standards through implementation of energy saving measures or through purchase of energy savings certificates.**

Role of DC

2. **Procedure for Monitoring and Verification**

- preparation and maintenance of quarterly and yearly data reports by the designated consumers for following:
  - on the performance of plant and production processes;
  - on the outcome of internal field audits of plant and production processes
  - regarding a year-wise report on production achieved, energy consumed, and specific energy consumption achieved, specific energy consumption reduction achieved, measures adopted for energy conservation and quantity of energy saved

Role of DC

3. Assessment of Performance

- Every DC within three months of the conclusion of the target year from the baseline year shall submit to the SDA with a copy to the Bureau, the performance assessment document (PAD) in Form 'A', duly verified together with certificate in Form 'B' given by the Accredited Energy Auditor (AEA).

- The DC within 3 months after the end of first or second year of the cycle may submit PAD in Form 'A' to the SDA with a copy to BEE for issuance of proportionate energy saving certificates covering the performance for a period not less than one year from the date of notification specifying the energy consumption norms and standards duly verified together with form 'B' given by AEA along with documents mentioned in sub-rule(1).

Role of AEA for verification of Form 'A'

- Shall assess the correctness of the information provided by the designated consumer regarding the compliance with energy consumption norms and standards.

- Shall report the results of assessment and his opinion along with the supporting documents.

- In case the AEA records a positive opinion in his report, BEE shall consider that all the requirements with regard to the compliance with energy consumption norms and standards, entitlement about issue or liability to purchase energy savings certificate have been met.

Role of SDA

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

Recommendation for issue of energy savings certificates

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

Procedure for issue of ESCerts

- Central Govt. after receiving recommendation from Bureau issue ESCerts of desired value to DC within 15 working days.
- ESCerts shall only be in electronic form
- 1 ESCerts= 1 toe
- The DC who has been issued energy savings certificates may sell them through the power exchange.
- ESCerts issued in current cycle shall remain valid till compliance period of next cycle.
- ESCerts purchased by DC for compliance shall after their submission to Bureau stand expire.

Accredited Energy Auditor for Verification and Check Verification

Registered under Partnership act 1932 or Company act 1956 or any other legal entity competent to sue or to be sued shall be entitled to undertake verification or check verification process if it:

- Has at least 1 AEA
- Has 3 energy auditors
- Has expertise of field studies
- Has minimum turnover of 10 Lakh rupees in at least one of previous 3 years or in case of newly formed organization, a net worth of 10 Lakh rupees.

- Bureau shall invite applications from the firms for the work of verification and check verification
- Selected applicants shall be issued a certificate of empanelment and unique identification number.

Obligation of AEA

- AEA shall constitute a team comprising team head and other members including experts.
- A person who was employed in DC within previous 4 yrs shall not be eligible
- Any firm or company or other legal entity who was involved in energy audit in any DC within previous 4 yrs shall not be eligible for such DC
- AEA shall ensure team members must be impartial & free of potential conflict of interest
- AEA shall have documented system for preparing the plan for verification or CV which should contain the task required to carried out in each type of activity, in terms of man days.

Obligation of AEA

- The name and Bio data of team members shall be provided by AEA to concerned DC in advance
- Team shall be provided by AEA with concerned documents indicating their full responsibilities with limitations to concerned DC
- AEA shall ensure the confidentiality of all information & data obtained or created during verification or check verification
- AEA shall submit the check verification report together with certificate in Form-C to Bureau.

Check Verification

The Bureau may on its own or receipt of a complaint within 1 yr from date of submission of compliance report or within six month from the date of issue of ESCerts whichever is later shall initiate action for review of compliance report which includes:

a) Issuing a notice to DC and AEA asking for comment within 10 working days.

b) Within 10 working days from receipt of comment, Bureau shall after taking into consideration the said comments, decide to undertake or not to undertake review and the Bureau shall record the reasons in writing for its decision;

Check Verification

If Bureau decides to take review:

- it shall appoint an AEA who has not performed the verification functions with respect to the concerned DC to conduct the check-verification.
- on a complaint, the said check-verification shall be carried out at the cost of the complainant.
- The said accredited energy auditor shall assess and verify that the activities performed by the DC for compliance with the energy consumption norms and standards are in accordance with these rules.
- The DC shall furnish full and complete data, provide necessary documents and other facilities required by the AEA for the purpose of performing the function of check-verification under these rules.

Check Verification

- The AEA in-charge of check-verification function shall report the results of his assessment in a check-verification report to BEE.
- If he has a positive opinion, it shall be concluded that all the requirements have been met.
- If he has a negative opinion the effect of such opinion on the energy consumption norms and standards, issue or purchase of energy savings certificate, the liability of the AEA giving the verification report and amount of the unfair gain gained by the DC as a result of such verification report shall be calculated by the AEA conducting the check-verification.
- The AEA in-charge of check-verification shall submit his report with due certification in Form 'C' to the Bureau and the concerned State Designated Agency.

Amount Payable by DC

- Value of amount payable by DC shall be as worked out in report PLUS 25% of such value because of unfair practice used by DC
- Amount of toe of energy specified because of unfair gain
- Cost of check-verification

Details provided by Bureau to SDA

- No. of ESCerts wrongfully obtained by DC
- No. of ESCerts which DC was liable to purchase for non-compliance
- Details of misrepresentation & unfair gain due to misrepresentation.
- Cost of check verification

Penalties Proceedings (After Check Verification)

Within 2 month from data of receipt of Form C

shall initiate:

- Action to recover from DC the loss to central Govt. by unfair gain
- Penalty proceedings against persons mention in report under intimation to BEE
- Register complaint for unfair gain if DC doesn't pay penalty & loss to exchequer in specified time

Timeline & activity chart of DC

	Mandatory		Voluntary	
Submission of Form 1	Once in a year	30th June	NA	NA
Submission of Form A (Performance Assessment Document)	Once in 3 years	30th June 2015	Before Compliance year	30th June
Submission of Form B (Verification by DENA)	Once in 3 years	30th June 2015	Before Compliance year	30th June
Issuance of ESCerts	Once in a year	Aug 2015	Before Compliance year	Aug
Submission of Form D (Performance Compliance Document)	Once in 3 years	30th Nov 2015	NA	NA

THANK YOU