Energy Efficiency Initiatives

in

India

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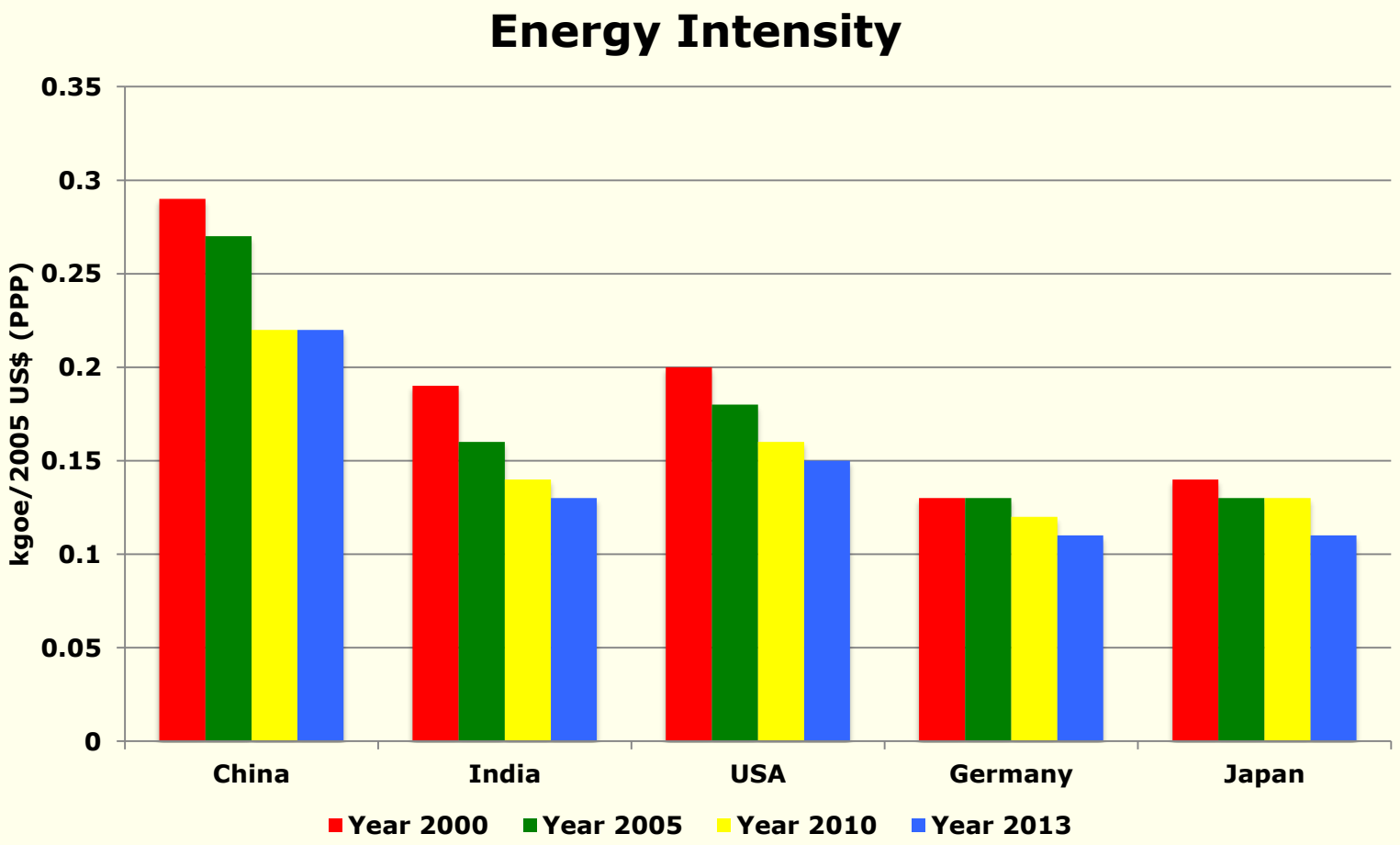
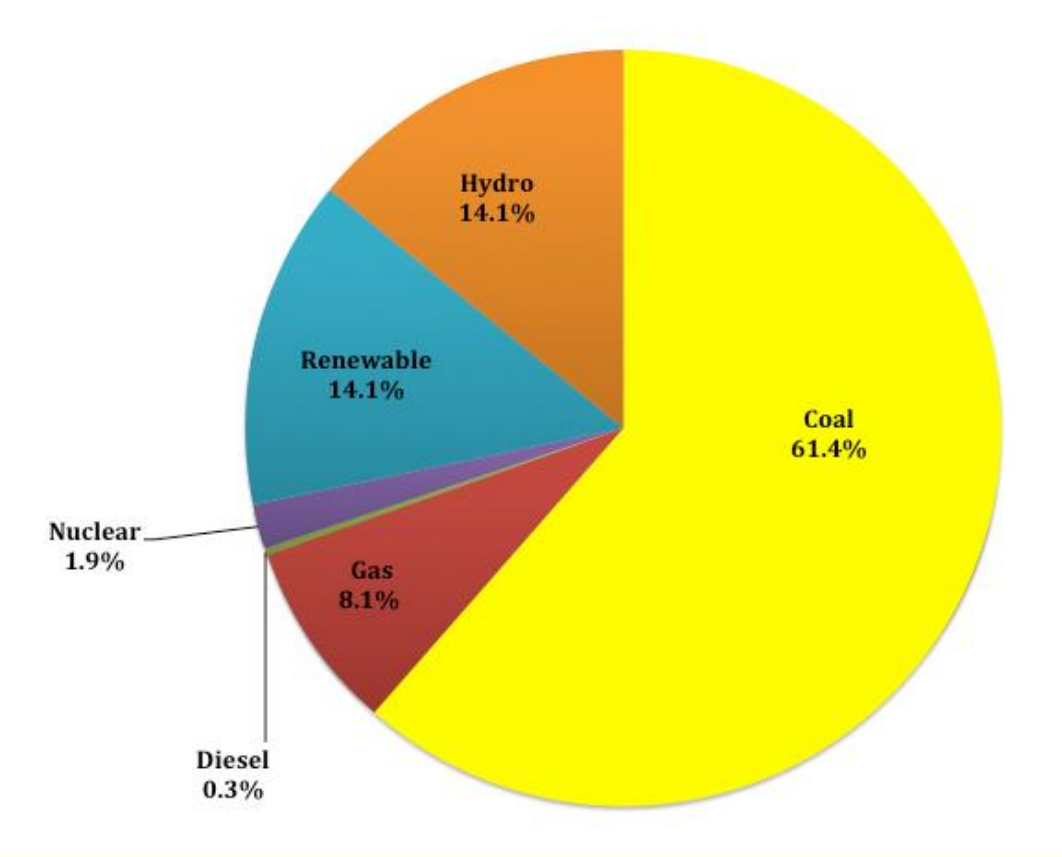
Energy Intensity Continues To Decline

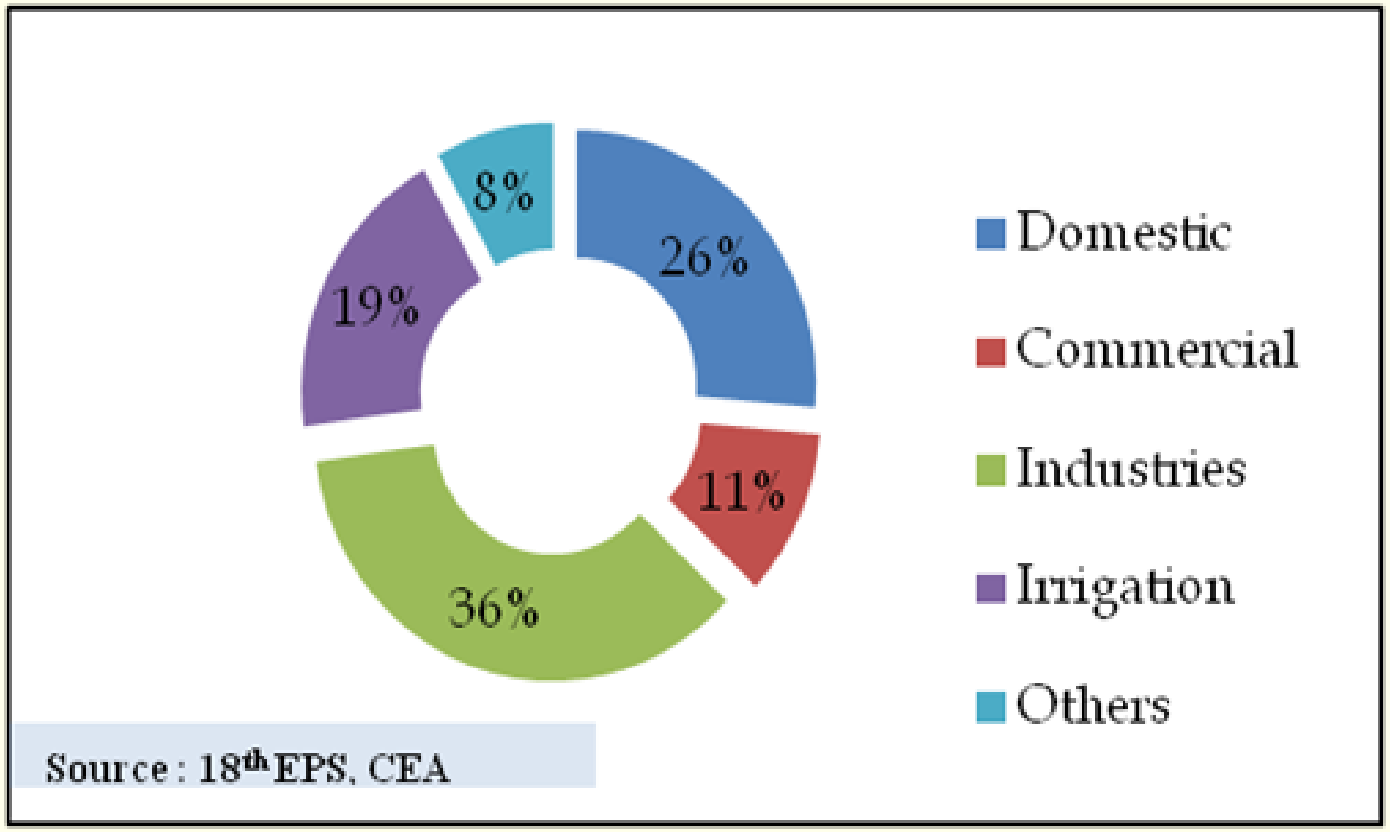


India's Installed Power Generation Capacity



Total Installed Capacity: 303 GW

Sectoral Electricity Consumption



Energy Efficiency – The Indian Experience

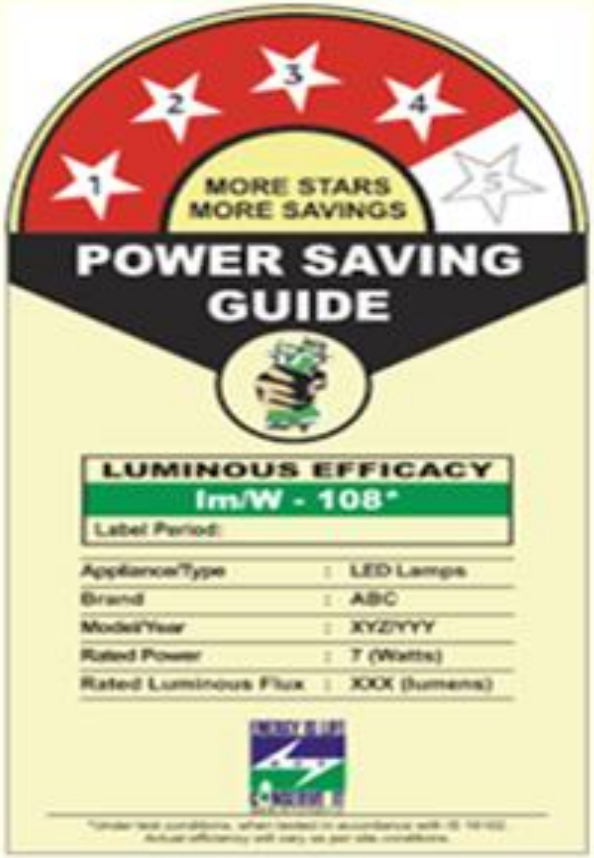
- Energy efficiency makes economic sense
- Yet, there are unexploited opportunities
- Public policy aims to address these opportunities through:
  - Information on energy performance
  - Standards
  - Promoting demand side management and performance contracting
- Market-based mechanisms
- Public policy have led to real and verified savings

Regulatory Framework for Energy Efficiency in India

The **Energy Conservation (EC) Act 2001 provides the legal framework for promoting energy conservation and energy efficiency activities which include**:

- Standards and Labels for appliances & equipment
- Energy Conservation Building Code (ECBC) for commercial buildings.
- Energy Consumption norms for energy intensive industries
- Demand Side Management (DSM) programme for existing building, streetlights, agricultural pumping and SMEs.
- Certification of Energy Auditors and Managers

“Labels” being built up as brand



Standards & Labeling of Appliances

- Standards and labeling – 21 appliances – 7 mandatory – tubular fluorescent lamp, room air conditioner, frost free refrigerator, distribution transformers, Ceiling Mounted AC, Color Television, Direct Cool Refrigerator.
  - Average efficiency increases:

	2007	2013
Air - conditioner (EER)*	2.3	3
Refrigerator (kWh/l/year)#	1.93	1.28

- Energy consumption standards for motor vehicles notified
- Savings of 33 GW as on date since 2007 (based on 2007 baseline).

* EER – Energy Efficiency Ratio

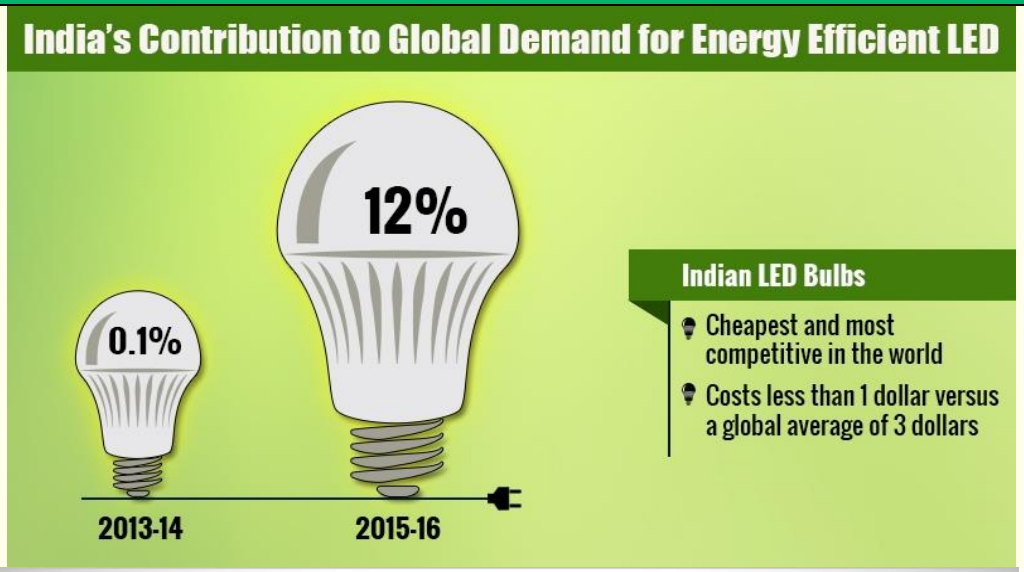
#(kWh/l/yr) - units per litre per year

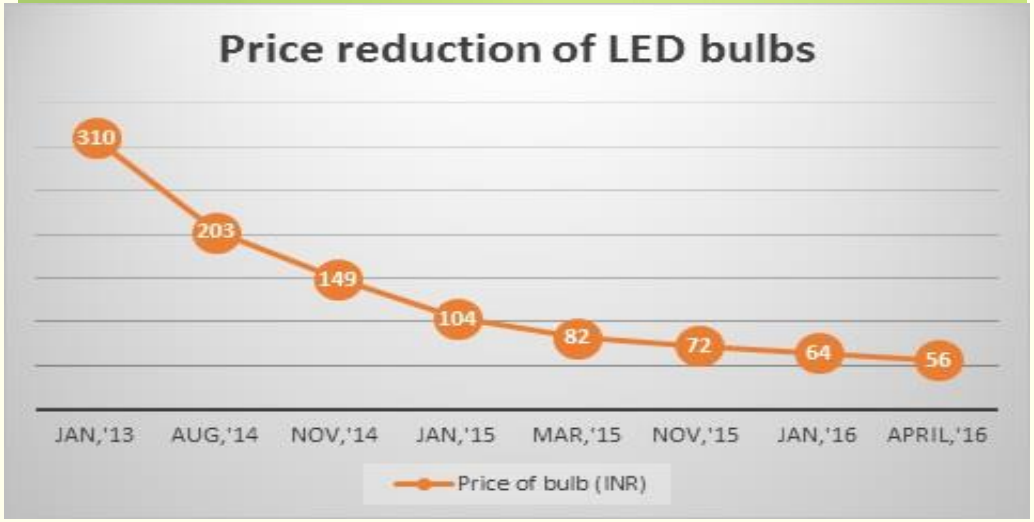
Demand Side Management - Lighting

- Facilitate market transformation towards energy efficient lighting
- Lighting sector accounts for about 20% of the total electricity consumption in India.
- Approach is a business model based on initial investment by EESL, and monthly repayments by utilities
- Project pipelines for 100 cities for domestic energy-efficient lighting, and 100 cities for street lighting
- Bulk procurement of LED bulbs by EESL has led to price reduction of 7W LED bulb from about Rs.310 per bulb in February, 2014 to Rs.55 per bulb in March, 2016.

Hon'ble Prime Minister launched LED based efficient lighting for households and street lights on 5th January 2015

Market Aggregation - outcomes

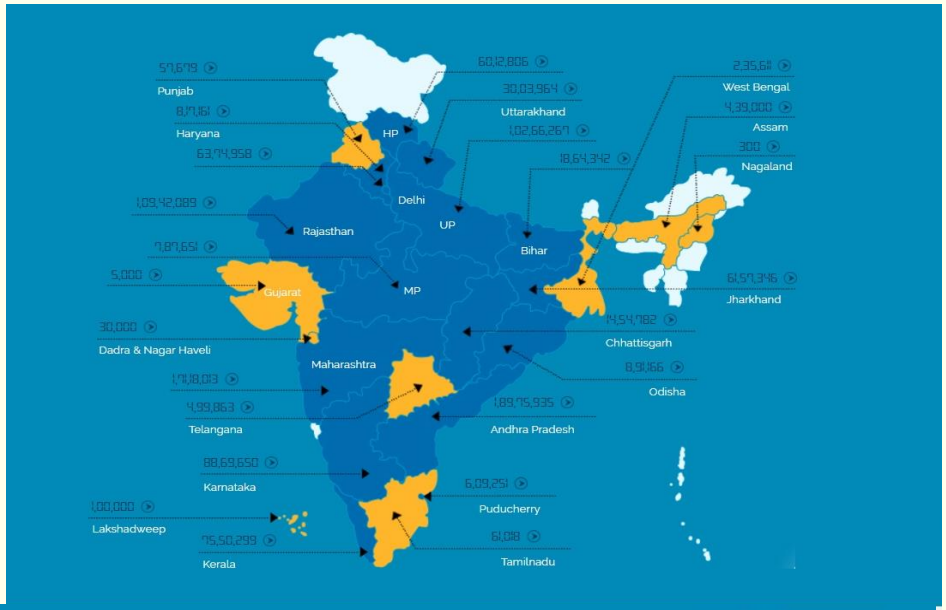




- Share of LEDs in Indian lighting market increased from less than 1% to 15% in 1 year
- Retail prices reduced by 1/3rd in one year. Bulk prices reduced by over 80% in 2 years
- Average price last year ~$ 5-7 – now between $ 1.5 - $ 4
- Domestic manufacturing increased significantly
- New jobs created – almost 25,000 in one year

Innovative Real Time Monitoring and information dissemination

Real time monitoring on web enabled platform
Each transaction recorded to ensure transparency
Information about information centres tagged on google map for consumers
Information about technical details of LEDs provided
Any local requirements could be added on
Mobile APP for iPhone and Andriod



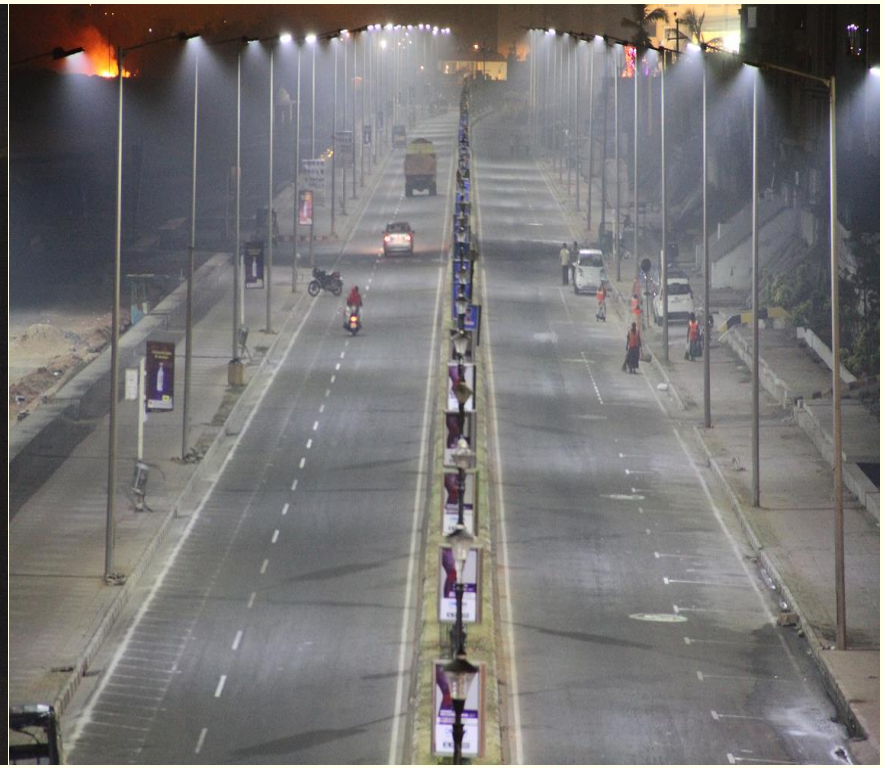
EESL – Street Light Business Model

- Standardization of retrofits to match the necessary output in buildings/ municipalities/ agriculture sector
- One time demonstration to validate outputs and energy savings
- Aggregation and transparent procurement to drive down costs
- Trunkey implementation and maintenance over the contract period
- IT enabled real time monitoring of energy consumption and O&M
- Capacity building of municipal staff in best international practices
- Service Level Agreement (SLA) for enhanced performance

Street Light SLA

- Conventional Street Lights replaced by smart LED street lights - Entire investment made by EESL – no capital cost to ULBs
- 50% energy savings guaranteed 7 years maintenance part of the project
- Back to back technical arrangements with technology suppliers to ensure O&M and replacements over project period.
- Payments to EESL less than savings in energy and maintenance cost. ESCROW/ LCs to cover payment risks
- Centralised Control and Monitoring System (CCMS) for measuring consumption, monitoring faults and remote operations
- Strong quality control – fault rate < 2%
- Uptime of lights >95%, fault rectification in 72 hours
- Social audit in every project to assess in social impact

Street Light – increased illumination



- Actual electricity bill reduced by 45% in the last one year as compared to the previous year
- Light levels have improved between 70-100%
- High levels of public satisfaction – social audit conducted

Super Efficient Equipment Programme (SEEP)

- **Focus on LED Lighting**
  - Encouraged cities and villages to procure and install LED lights
  - Notified LED standards – first in the world
  - Repeated bulk procurement of streetlights and bulbs

- **Super Efficient Fans**
  - Deployment of 2 million Super-efficient fans in the Indian market by 2017
  - SEEP proposed an incentive of Rs. 500 for each fan sold that has a rating of 35 W, or less.
  - The program is now being revisited in light of success of demand aggregation model used for LEDs

Energy Conservation in Industry

- A wide bandwidth of energy efficiencies occurs in almost all industry sectors
- This creates a differentiated potential for energy savings
- Trading of savings allows maximum cost-effective savings as plants with "low-cost savings" exceed their "mandated" savings for trading them with other plants which are unable to meet their targets
- "Perform, Achieve & Trade" mechanism introduced for 621 industrial units which have to meet SEC reduction targets
- National Target :
  - PAT Cycle – I: 6.686 million tonnes of oil equivalent (mtoe)
  - PAT Cycle – II: 8.869 million tonnes of oil equivalent (mtoe)

Energy Conservation in Industry
PAT Cycle I – Targets & Achievements

S. No	Sector	No of DCs	Annual Energy Consumption (Million toe)	Target Reduction (Mtoe)	Actual Savings (Mtoe)	% Increase
1	Aluminium	10	7.71	0.46	0.73	59%
2	Cement	85	15	0.82	1.44	76%
3	Chlor- Alkali	22	0.88	0.05	0.13	100%
4	Fertilizer	29	8.2	0.48	0.83	73%
5	Iron & Steel	67	25.3	1.49	2.1	41%
6	Paper & Pulp	31	2.09	0.12	0.26	117%
7	Textile	90	1.2	0.07	0.12	71%
8	Thermal Power Plant	144	105	3.21	3.06	-5%
	Total	478	165.38	6.686	8.67	29%

Impact - PAT Cycle I (8.67 Million toe)

- **1.25%** of total primary energy supply in India
- **2.38%** of total energy consumed by Industries
- **5.24%** of total energy consumed by PAT industries
- **21 million tonnes** of Coal (6600 Rakes)

Reduction of 31 million tonnes of CO_2 against target of 24 million tonnes of CO_2

Energy Conservation in Industries
PAT Cycle II

Sr No	Sector	Nos	Energy Consumption	Target 2018-19
1	Aluminium	12	10.66	0.57
2	Cement	111	21.43	1.12
3	Chlor- Alkali	24	1.77	0.101
4	Fertilizer	37	8.25	0.45
5	Iron & Steel	71	40.44	2.14
6	Paper & Pulp	29	2.68	0.15
7	Textile	99	1.48	0.087
8	Thermal Power Plant	154	120.16	3.13
9	Refinery	18	18.50	1.10
10	Railways	22	1.39	0.033
11	Discom	44		
	Total	**621**	**226.76**	**8.869**

PAT Cycle II (2016-19)

Baseline Year: 2014-15
Assessment Year: 2018-19

Total Energy Consumption from 11 sectors is 227 mtoe

National Target = 8.869 mtoe at the end of PAT Cycle II

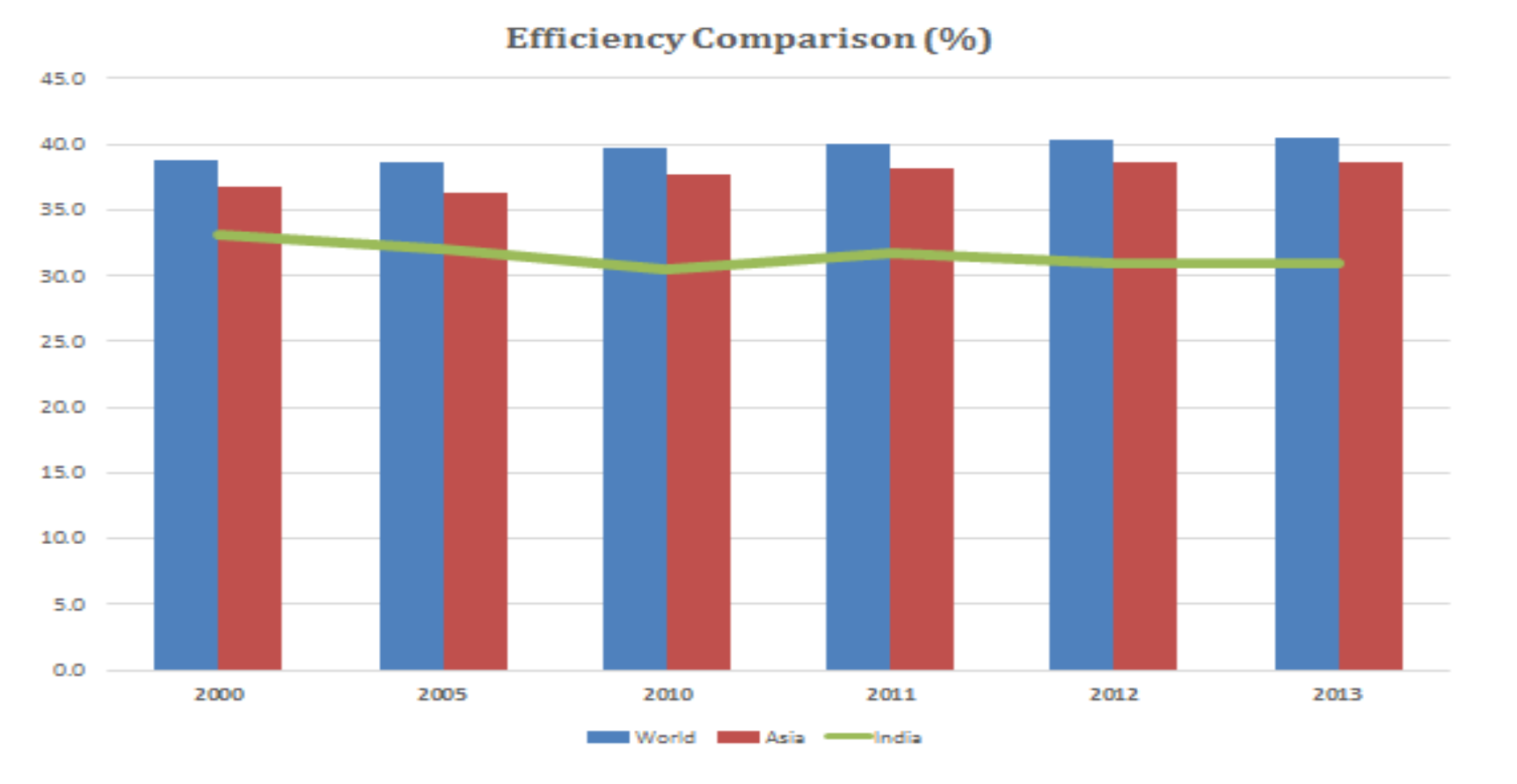
Impact - PAT Cycle II – 17.53 million toe
(Including PAT Cycle – I)

- **2.09%** of total primary energy supply in India
- **3.69%** of total energy consumed by Industries
- **7.72%** of total energy consumed by PAT industries
- **43 million tonnes** of Coal (13,500 Rakes)

Reduction of 62 million tonnes of CO_2 against target of 55 million tonnes of CO_2

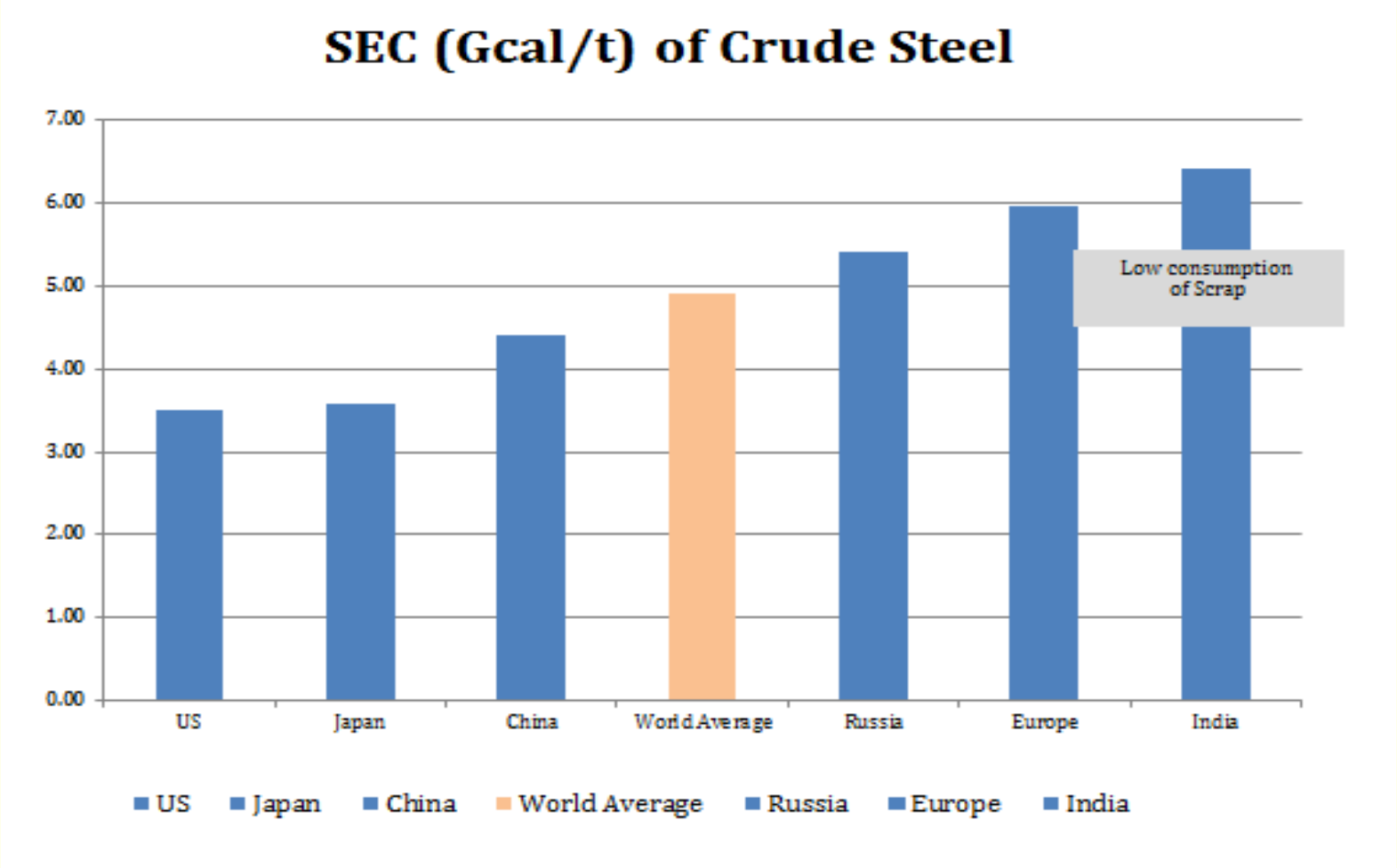
Energy Conservation in Industry : Benchmarking

Thermal Power Plant



Energy Conservation in Industry : Benchmarking

Iron & Steel Sector



Energy Conservation Building Code

- ECBC
  - Minimum energy efficiency standards
  - Applicable to large commercial buildings
  - (connected load of 100 kW/contract demand of 120 kVA and above)

- ECBC prescribes standards for:
  - Building Envelope (Walls, Roofs, Windows)
  - Lighting (Indoor and Outdoor)
  - Heating Ventilation and Air Conditioning (HVAC) System
  - Solar Hot Water Heating
  - Electrical Systems

While ECBC developed at Central level by BEE, its enforcement lies with the States

ECBC – Status of adoption by States

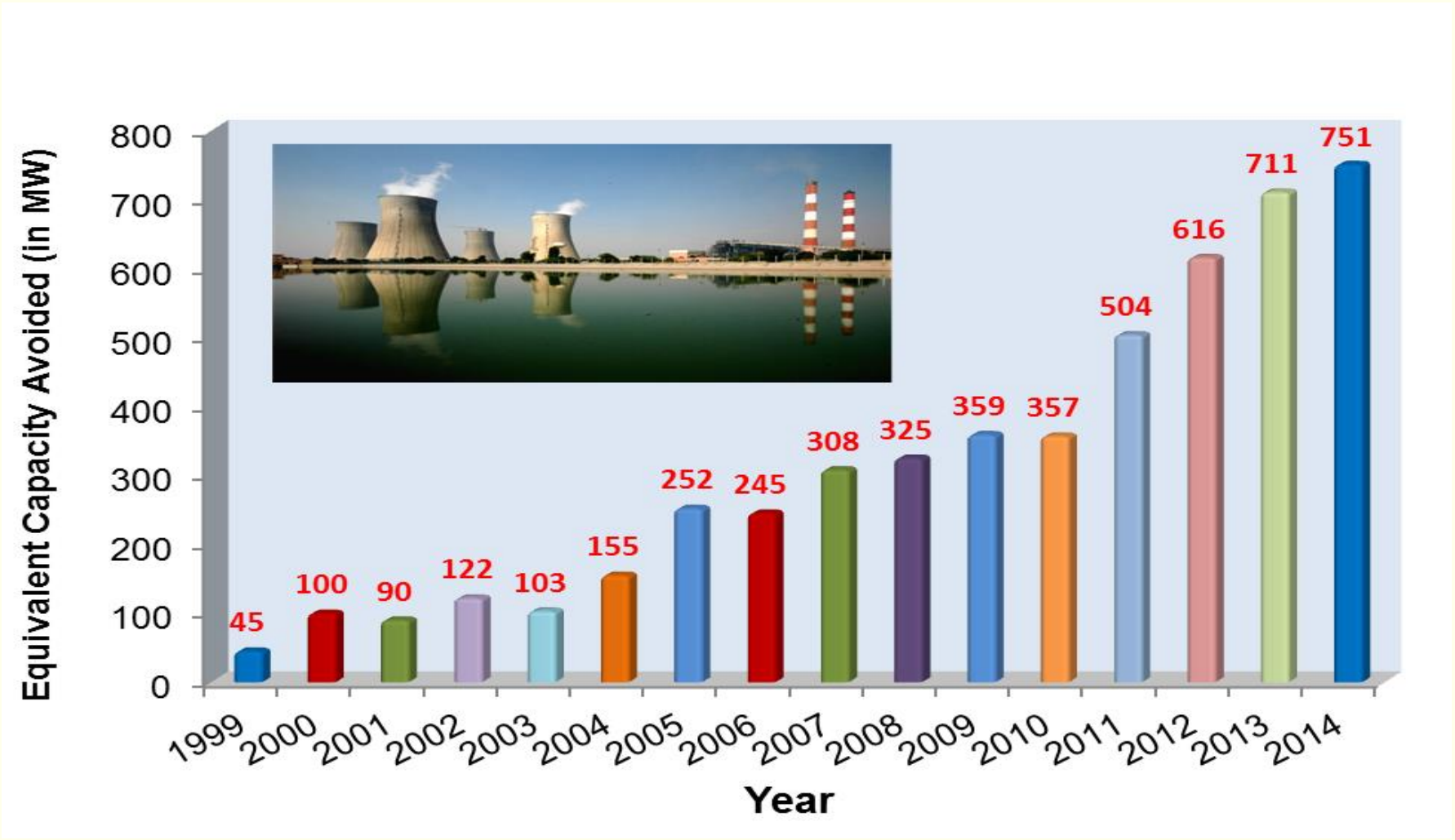
States notified ECBC

States in process of notification

Outreach

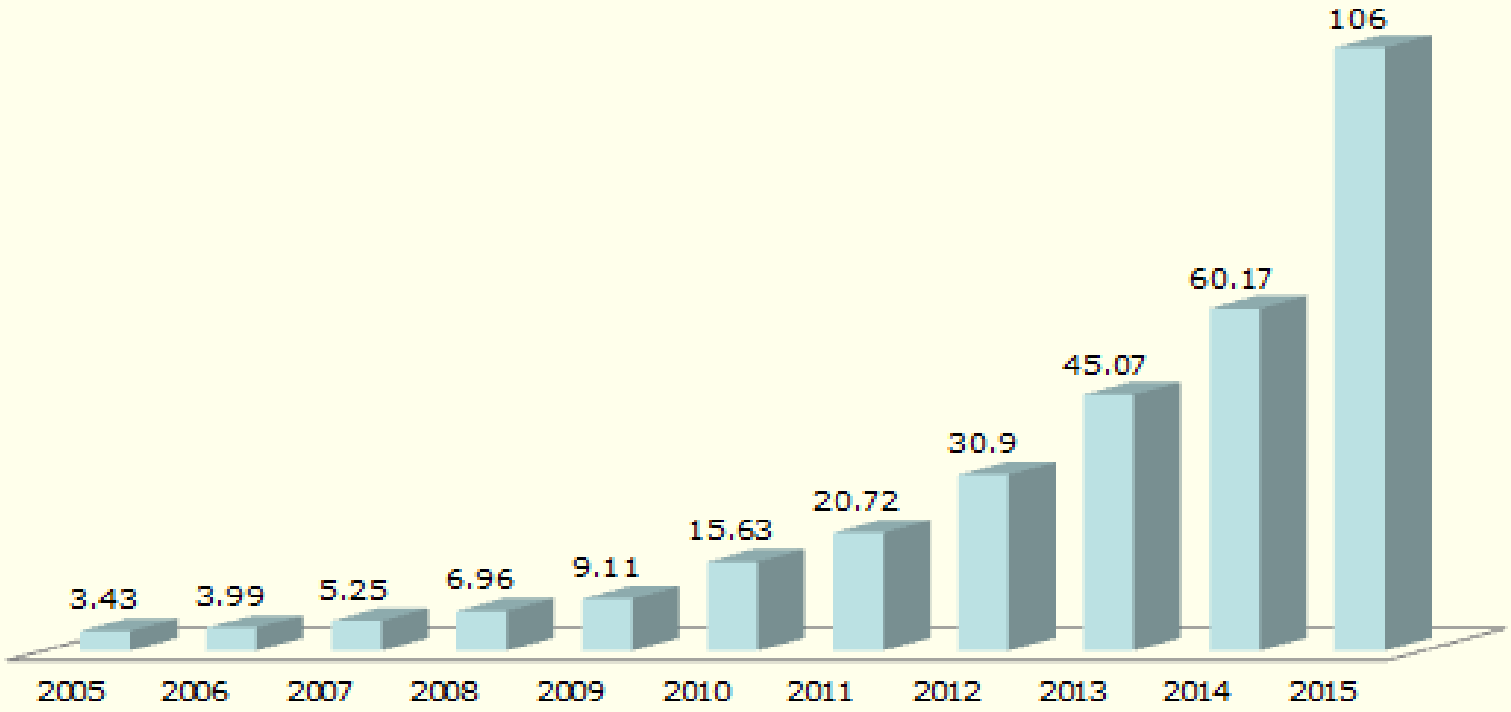
- National Energy Conservation Awards: Recognizing improvements in energy efficiency in industries, buildings, appliances since 1999.
- National children's Painting competition on energy Conservation: Children of classes 4 to 6 and classes 7 to 9 in schools across the country participate to illustrate their ideas on energy conservation since 2005.
- Advertisements on electronic and print media to promote information about BEE energy star labels.
- Launch of efficient household lighting program by Hon'ble Prime Minister on 5 January 2015
- Weekly 15 minute Radio programme highlighting benefits of star labelling and energy efficiency portfolio for consumers
- TV advertisements advocating day-to-day energy conservation practices in workplaces, schools and households
- Hon'ble Minister of State (I/C) for Power, Coal and New & Renewable Energy launched the following at the National Energy Conservation Day, 14 December 2014:
  - Energy Savers Portal for schools.
  - Consumer awareness campaign for energy efficiency
  - Interactive session with students from schools across the country through video conference

National Energy Conservation Awards



Annual National Painting Competition

Students Participated in the Painting Competition



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