Energy Efficiency in India –

Challenges & Lessons

In-session Technical Expert Meeting on Energy Efficiency
ADP, Bonn, 13th March 2014

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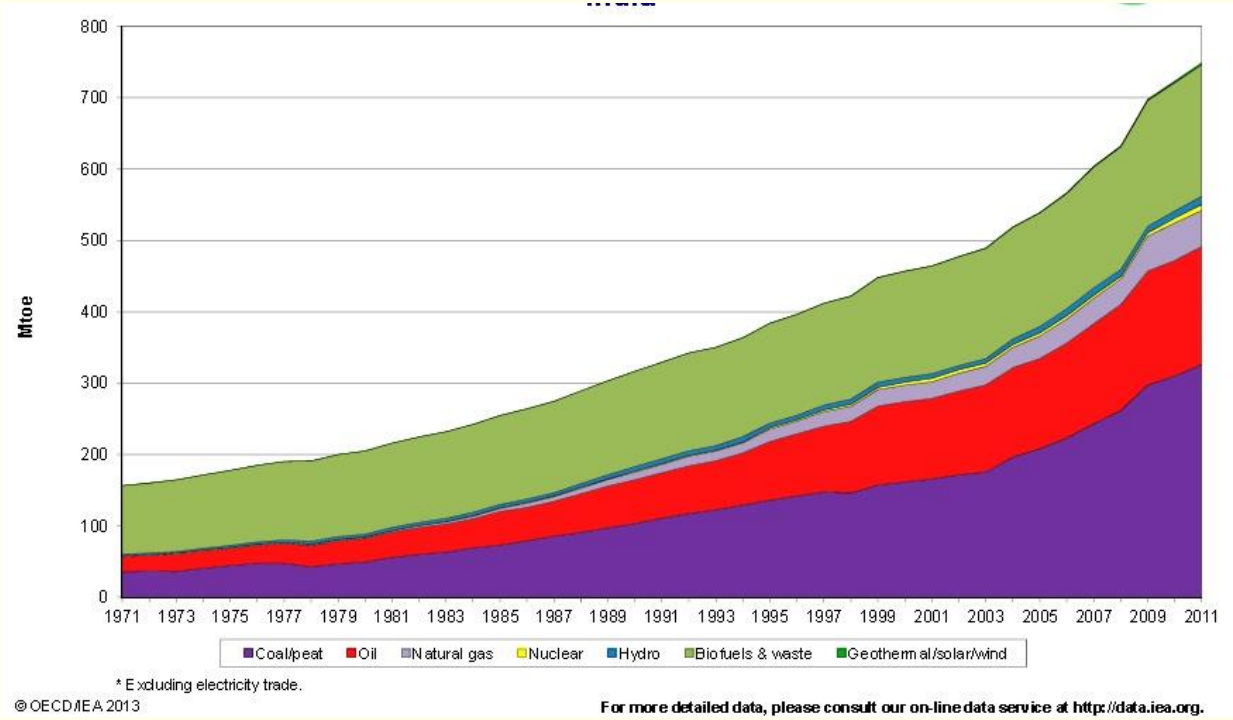
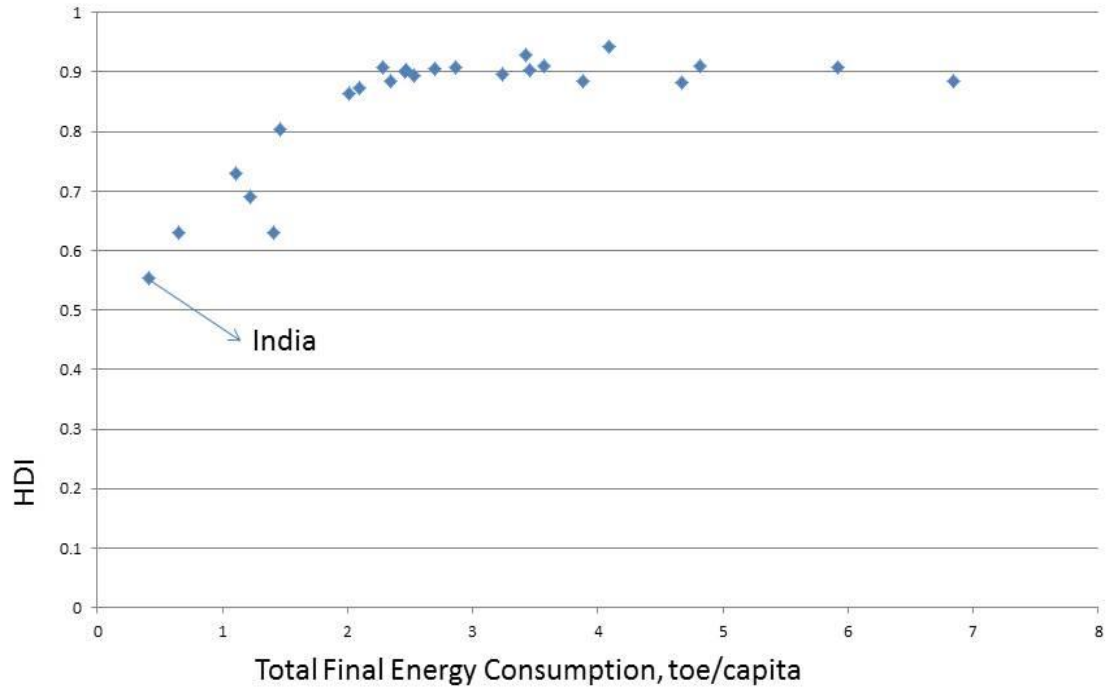
Energy demand in India will increase by a factor of 1.5 to 2.5 by 2030



- Energy supply and consumption in India was about 819 and 493 mln toe in 2011
  - Per capita supply was about 0.6 toe
  - Per capita consumption was 0.4 toe
- Supply is expected to grow to 1200 mln toe (IEA) to 1700 mln toe (India Integrated Energy Policy) by 2030

How much energy is required ?



Source: Data for 25 countries from Human Development Report, 2013
International Energy Agency, Key World Energy Statistics: 2013

- A minimum energy consumption of 2.3 toe/year/cap is needed today to achieve HDI of 0.9
- Countries which "develop" later achieve transition at lower levels
- Probable that transition may occur at 1.5 toe in the future
- Enhanced energy efficiency is essential to enable early transition

Energy efficiency in India – the context

- Energy prices are high in India
  - Industrial and commercial consumers pay electricity and petroleum product prices that are amongst the highest in the world
  - Household consumers pay electricity and petrol prices that are highest in the world relative to their incomes
  - Energy intensity of the economy has declined by 30% between 2000 and 2011; about half due to energy-efficiency improvements.

- Energy efficiency reduces costs, energy imports, GHG emissions, and pollution, but penetration is limited because:

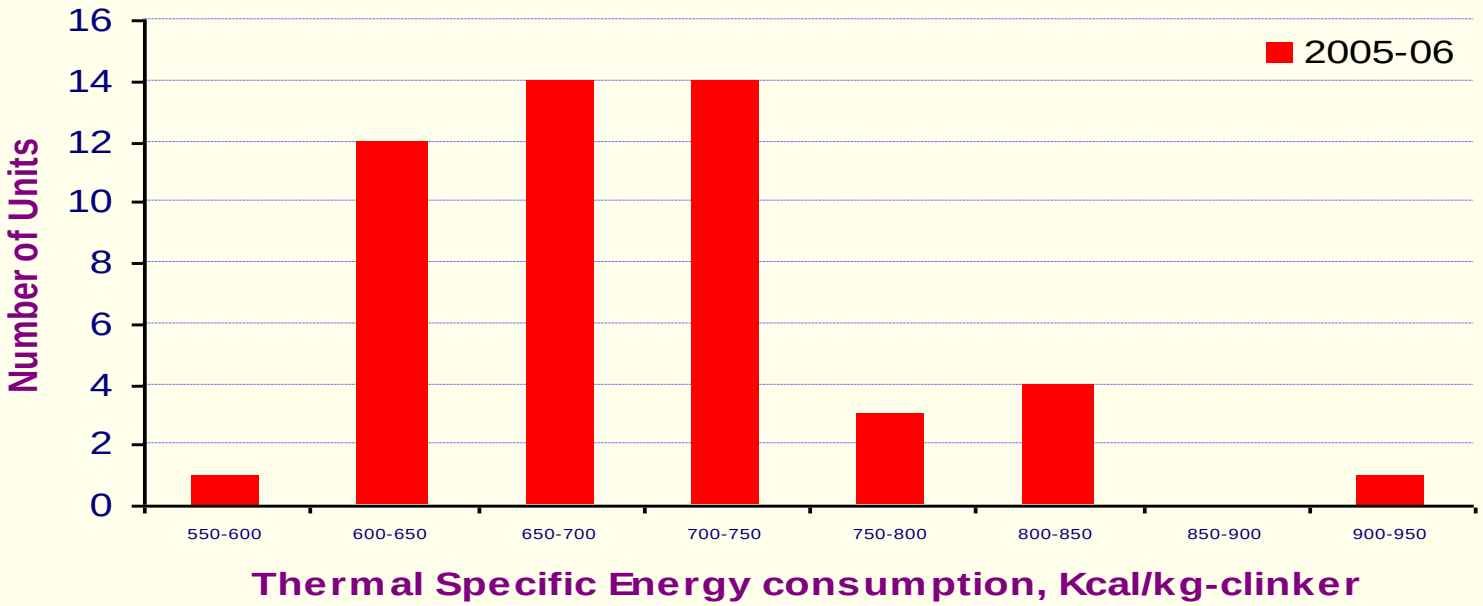
- High first costs deter users, especially households
- New technologies are perceived as being risky
- Costs and benefits accrue to different people, especially in the case of buildings

Regulatory Framework for energy efficiency in India

- Energy Conservation Act, 2001
  - Created Bureau of Energy Efficiency
  - Appliance standards and labeling
  - Energy consumption norms, and energy-use reporting requirements for energy-intensive industrial units
  - Energy Conservation Building Code for commercial buildings
  - Certified Energy Managers and auditors
- National Action Plan for Climate Change, 2008
  - National Mission on Enhanced Energy Efficiency provides mandate for market-based mechanisms to promote energy efficiency
  - National Mission on Sustainable Habitat seeks to incorporate energy-efficiency requirements in building byelaws

Industries:

Huge Diversity in Specific Energy Consumption within industrial sectors

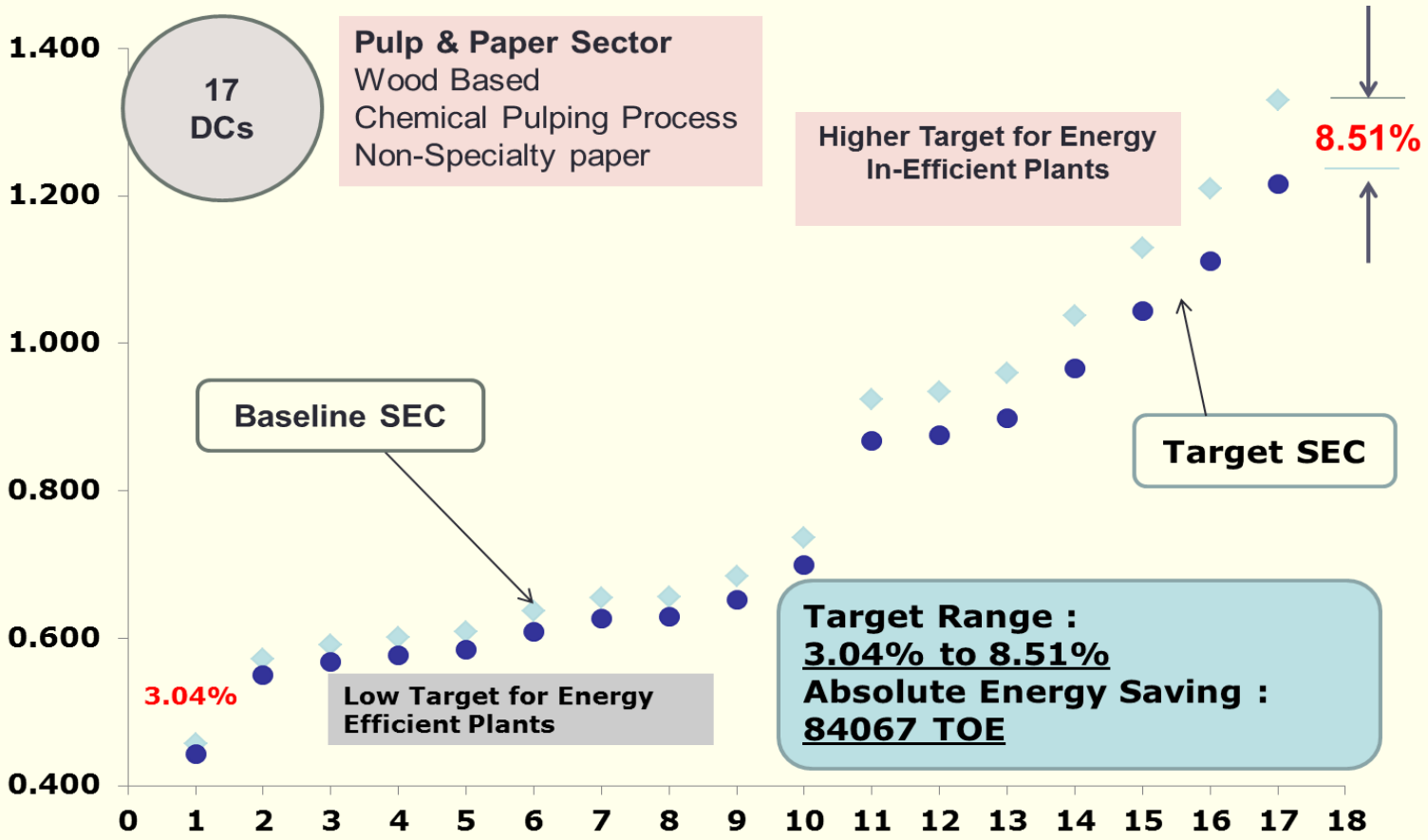


- Large bandwidth in specific energy consumption in all sectors
- In almost every sector, the most energy-efficient unit is also amongst the most efficient units in the world

Perform Achieve and Trade

- Specific Energy Consumption (SEC) targets mandated for 478 units in 8 energy intensive sectors
  - The sectors are: Aluminum, Cement, Iron & Steel, Chlor Alkali, Thermal Power Plants, Fertilizer, Pulp & Paper, and Textiles
  - They account for one-third of fossil-fuel consumption
  - Targets are less (in % terms) for efficient units; more for less-efficient units
  - Targets to be accomplished in 2014-15; new cycle with new targets after that
- Energy Savings Certificates will be issued for excess savings; can be traded and used for compliance by other units
- Financial penalties for non compliance
- Baseline conditions have changed; normalization factors being developed

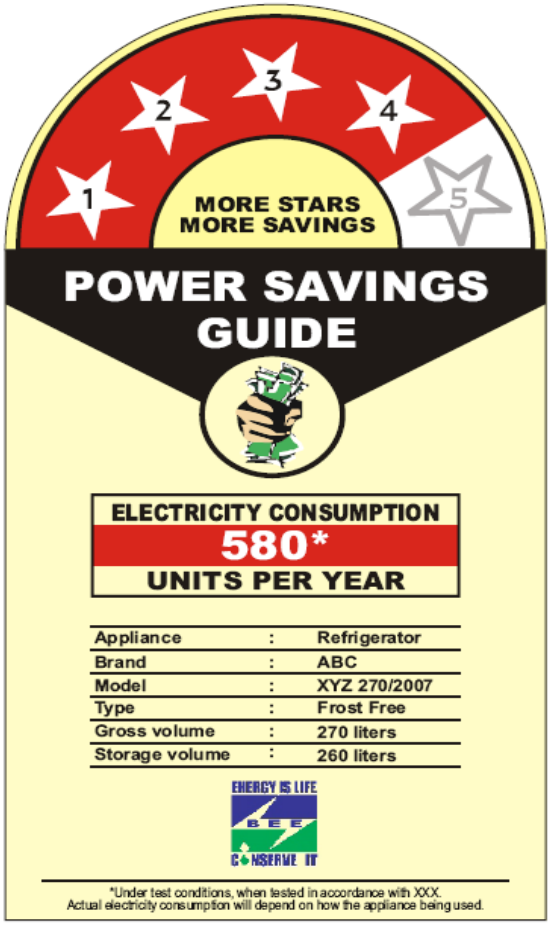
Huge spread in Specific Energy Consumption within sectors



Target is Plant Specific …… Less for Energy Efficient and more for Inefficient Plants

Appliances: Labels built up as a "brand"

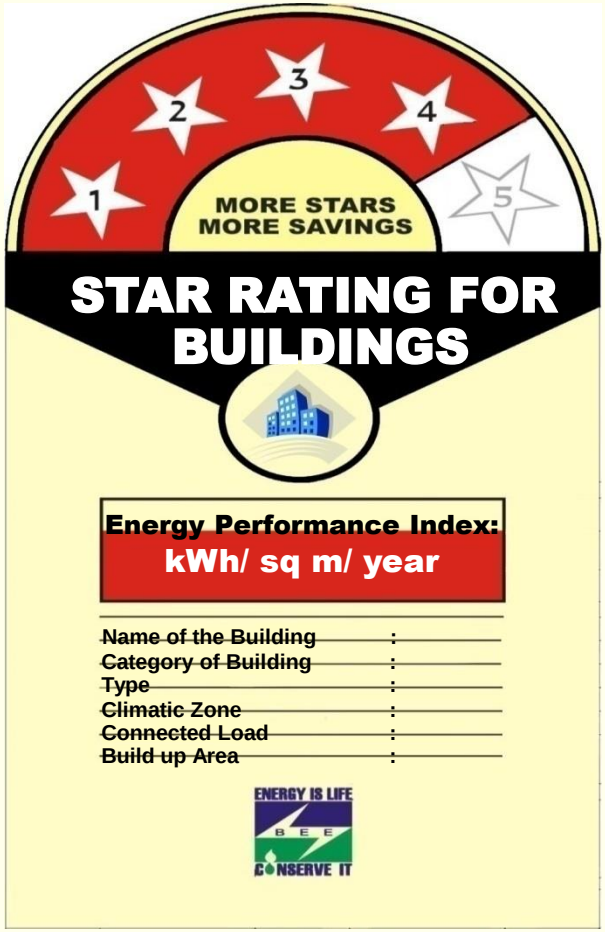
- Every New appliances includes with a endorsement/voluntary labeling participative process
- Voluntary labels for refrigerators and air conditioners introduced in December 2006
- Aggressive advertising and outreach promoted labels as a brand of superior products – manufacturers piggybacked on label advertising
- Labeling became mandatory for four products (where market transformation was well under way) from 7th January, 2010
- Voluntary labels in place for eleven other appliances
- Refrigerator and air conditioner standards and labels tightened periodically
- Labeling seldom works if payback period is more than 5 years; maximum sales is of products with 2-3 years payback
- Independent accredited labs for check testing of labeled products



Buildings:

New buildings have huge potential – which very difficult to achieve

- Approximately two-thirds of the buildings that will exist in 2030 are yet to be built
- Energy Conservation Building Code (ECBC) issued in 2007 to guide design of new commercial buildings – where there is largest scope for efficiency improvements
- ECBC has to be notified by states, and incorporated into building byelaws and enforced by municipalities; currently seven states (out of 35) have notified it; enforcement mechanisms are being strengthened
- ECBC-compliant buildings use less-than-half the energy used by conventional buildings; incremental costs have reduced from 20% in 2007 to less than 5% now

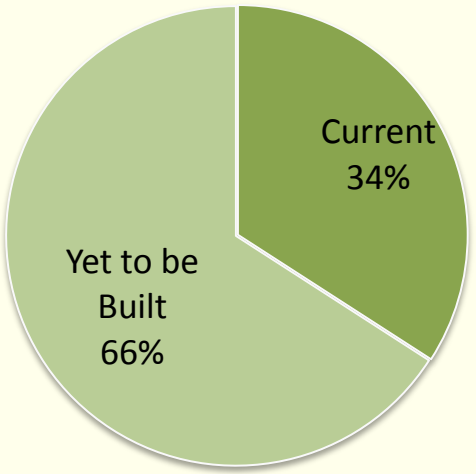


Growth in the Commercial Building Sector

Commercial Buildings Floor Area - Growth Forecast

- Currently, ~ 659 million m2 (USAID ECO-III Internal Estimate Using MOSPI, CEA and Benchmarked Energy Use data)
- In 2030,~ 1,900 million m2 (estimated)*
  - 66% building stock is yet to be constructed

Year: 2010



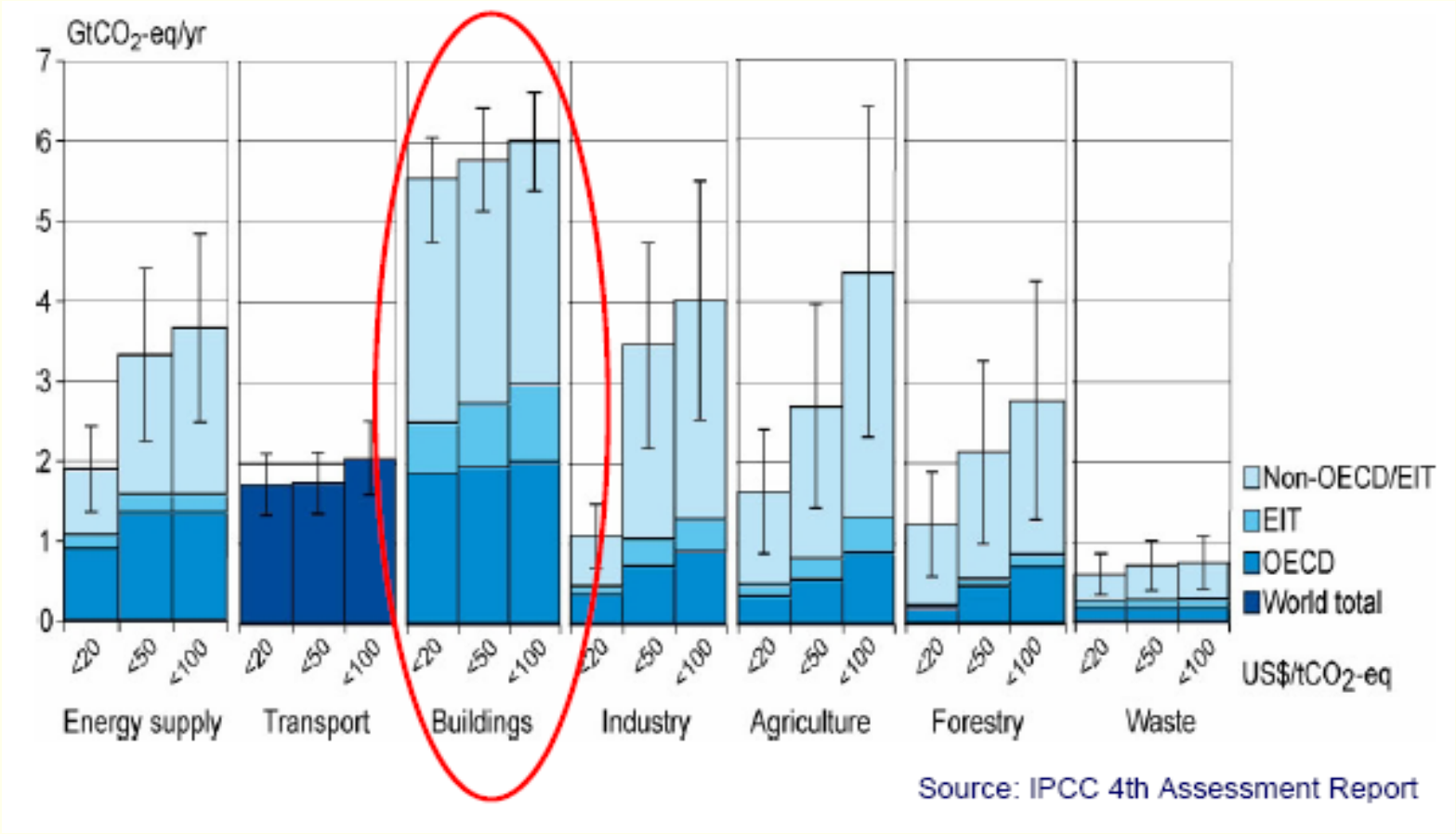
1,900 million m^2

Year :2030

* Assuming 5-6% Annual Growth

GHG Emission Reduction Potential

Saving potential of 40% in end use energy in the building sector and potential to save about 60 Billion units annually



SEEP – Major Aspects

- **Background**
  - Currently, 30 million ceiling fans are sold in India every year, with an average energy rating of 70 W; best in market is 50 W with sales of less than 3% (price of an fan is $24-30)
  - Market forces and the star labeling programme have not been able to move the market
- **Goals & Approach**
  - Enable accelerated introduction of super-efficient fans with rating of less than 35 W (currently there is a limited supply at a price of $40-45)
  - Incentive of upto $8 for each superefficient fan sold
  - Resources for incentive provided from the Budget and a loan from the Clean Technology Fund
  - Independent agency for testing and verification of sales
  - Current goal is 7 million super-efficient fans
- **Potential Technologies for Super Efficient Fans:**
  - High Efficiency Induction Motor: Brushless DC Motor – based on rare earth magnet or Ferrite Magnet, or Hybrid Magnets
  - Replacement of 1 SE fan will result into saving of around 70-80 kWh per annum

Energy Efficiency Financing Models & Public Procurement

- Fiscal instruments to facilitate energy efficiency projects implementation have been developed:

- **Partial Risk Guarantee Fund (PRGF)**

✓ Debt guarantee to Financial Institutions for ESCO (Energy Service Companies) investments (up to US$ 0.55 million or 50% of loan, whichever is less)

- **Venture Capital Fund (VCF)**

✓ Equity investments in ESCO projects (up to US$ 0.36 million or 15% of equity, whichever is less)

- **Public Procurement:** Initially the appliances which have been considered for public procurement include Split air conditioners (usage more than 1000 hrs./year), ceiling fans & water heaters (all 5 Stars) and frost free refrigerators (4 Stars). This is expected to save 250 MW of Power .

Energy Savings Achieved

- Target has been surpassed, but pattern of savings is very different from that originally estimated

Year-wise breakup of targeted avoided capacity during IX plan & Target achieved

Sl.No.	Schemes	Target for XI Plan (in MW)	Achieved during XI Plan (in MW)
1	Standards & Labeling	3000	7766
2	Energy Conservation Building Code & Existing Buildings.	500	14
3	Bachat Lamp Yojana	4000	324
4	SDA Strengthening Programme		1065
5	DC & SMEs	500	2
6	Agriculture & Municipal DSM.	2000	1
7	EC Awards		1664
TOTAL		**10000**	**10836**

Total savings under 11th plan (in million toe): 59.21

Challenges & Lessons

- Difficult to predict outcomes of programmes; feedback mechanisms and decision processes to enable constant monitoring and adjustments are essential
- Benchmarking – of use patterns and energy performance of technologies - is very country specific; enabling it is an essential first step
- Human and institutional capacity to measure, analyse and to integrate into mainstream sectors is limited; this is further confounded by multi-level governance regimes
- National and international programmes to strengthen capacity around policy, technological or commercial transactions is important
- Enforcement and monitoring are major challenges, and can add significantly to costs; public policies need to rapidly convert technological opportunities into "branded products"; targeted outreach programmes can be very effective
- Higher first cost is a barrier; with adequate and credible information, people and organizations can make investments with paybacks of 2-5 years; higher payback periods require incentivization