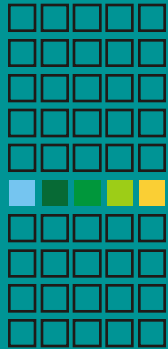


15 April 2010



Roadmap for Energy Efficiency in Buildings

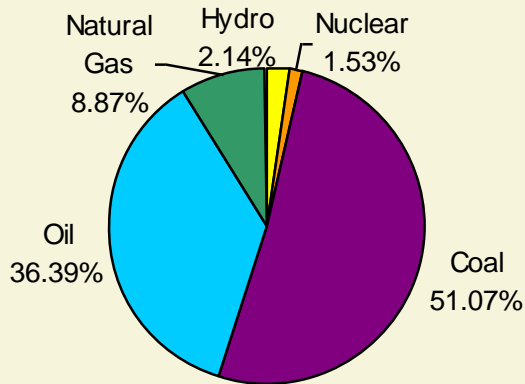
Saurabh Yadav

Bureau of Energy Efficiency
Government of India

Indian Energy Sector

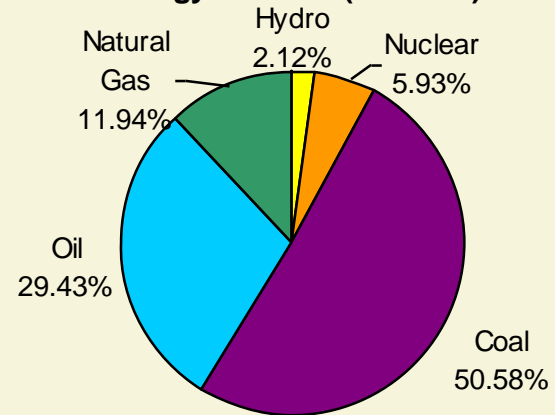


Total Primary Commercial Energy Demand (2003-04)



327 Mtoe

Total Primary Commercial Energy Demand (2031-32)



1858 Mtoe

Energy requirement to increase at a CAGR of 6.4% (2004-2032) and coal to remain the mainstay

Energy Efficiency Potential and Outcome



Energy Conservation potential assessed as at present (IEP) (15% by DSM and 25% overall)

20000MW

Verified Energy Savings :

📅 During X Plan period

877 * MW

📅 During 2007-08 and 2008-09

2127 MW

📅 Target for 2009-10

2600 MW

-Target for XI Plan period (5% reduction of energy consumption)

10000 MW

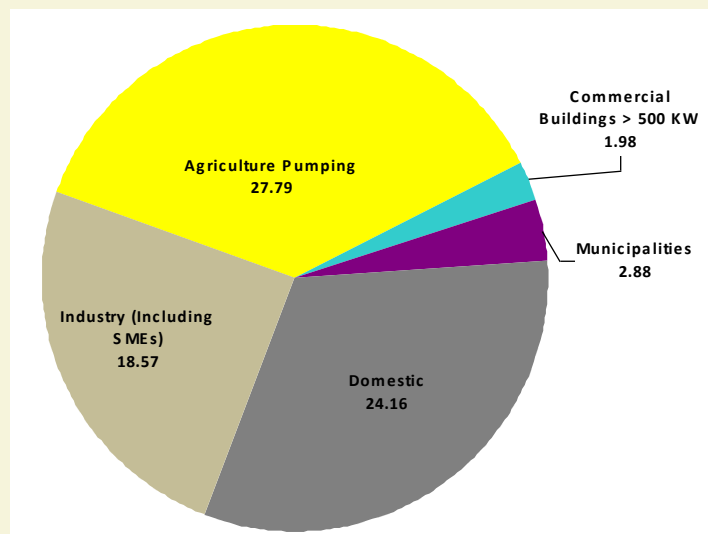
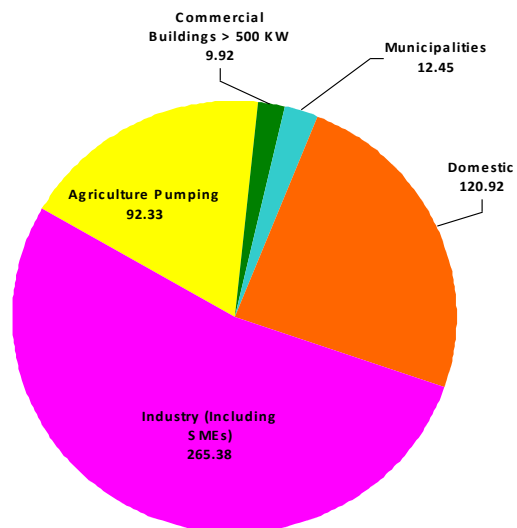
** Only as indicated by participating units in the National Energy Conservation award scheme, for the previous five years.*



Electrical Energy Consumption and Conservation Potential



S. No.	Sector	Consumption (KWh)	Saving Potential (KWh)	% Savings
1.	Agriculture Pumping	92.33	27.79	30.09
2.	Commercial Buildings/ Establishments with connected load > 500 KW	9.92	1.98	19.95
3.	Municipalities	12.45	2.88	23.13
4.	Domestic	120.92	24.16	19.98
5.	Industry (Including SMEs)	265.38	18.57	6.99
	Total	501.00	75.36	15.04



Growth Profile of Indian Commercial Sector



- Demand for OFFICE SPACE in India is driven by the increasing share of the services sector in the Indian economy
 - Office space supply shifting from Central Business Districts to secondary centers (office and IT parks)
 - Modern office buildings in newly developed areas enable the higher quality standards that are essential for IT services
 - All India office market
 - 70% by IT Services companies (more than 7000 No.) in India
 - 15% by financial service providers & pharmaceutical sector
 - 15% by other sectors
 - Office stock must increase nearly 20 million sf/year in New Delhi, Mumbai, Bangalore to keep pace with growing demand
 - Conservative estimate (for India): Approx. 55 million sf/year
- SHOPPING CENTRES/MALLS
 - By the end of 2008, space of 79 million sf in 257 centers are estimated in 15 largest cities of India



ENERGY IS LIFE
BEE
CONSERVE IT



Typical Building Energy Use



Average Energy Consumption

HVAC	55%
LIGHTING	14%
Electronics	27 %
Others	4%



Energy Conservation Building Code



- ECBC covering the following components prepared:
 - Building Envelope (Walls, Roofs, Windows)
 - Lighting (Indoor and Outdoor)
 - Heating Ventilation and Air Conditioning (HVAC) System
 - Solar Hot Water Heating
 - Electrical Systems
- ECBC finalized after extensive consultation
- Voluntary introduction of ECBC in May 2007; mandatory after capacity building and implementation experience
- Impact of ECBC - Reduced Energy Use for buildings
 - National Benchmark $\sim 180 \text{ kWh/m}^2/\text{year}$
 - ECBC Compliant building $\sim 110 \text{ kWh/m}^2/\text{year}$



ONGOING INITIATIVES ON ECBC



➤ **CAPACITY BUILDING / TRAINING**

- 25 training programmes/ workshops involving about 1500 professionals have been conducted till date

➤ **PANEL OF ECBC EXPERT ARCHITECTS**

- Support to Government Agencies for ECBC like MH&FW, NPTC and Haryana

➤ **Baseline survey of Government buildings**

- Survey completed in 27 States and 712 Government Buildings. Wide Variation on the energy use found 50-700 units /sq.mt/Year .
- A potential saving of energy in Government buildings of around 1.2 billion units annually resulting in avoided capacity of 137 MW.



ONGOING INITIATIVES IN ECBC



➤ **DEVELOPMENT OF TECHNICAL REFERENCE MATERIAL**

- Tip sheets on envelope design, lighting, HVAC and energy simulation have been developed

➤ **CURRICULUM DEVELOPMENT**

- 20 architectural/ engineering colleges have committed to develop architectural and engineering courses for energy efficient and sustainable building design.

➤ **ECBC PROGRAMME COMMITTEE**

- To facilitate development of ECBC compliant building design
- Credible implementation of few demonstration project
- Setting up compliance and evaluation procedures by creating appropriate institutional mechanism .

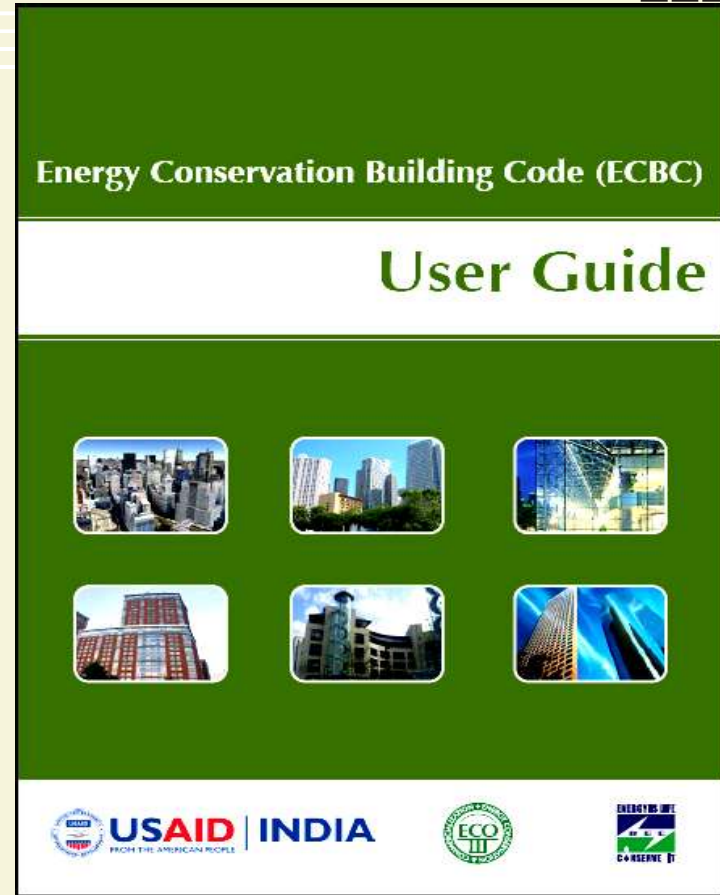


ECBC User Guide



➤ Contains information related to

- Purpose
- Scope
- Administration and enforcement
- Building envelope
- Heating, ventilation, & air conditioning
- Service water heating & pumping
- Lighting
- Electrical power
- Appendixes
 - A: ECBC definitions, abbreviations, and acronyms
 - B: whole building performance method
 - C: climate zone map of India
 - D: Supplemental material
 - E: Comparison of international building energy standards
 - F: References
 - G: ECBC compliance forms



ECBC User Guide



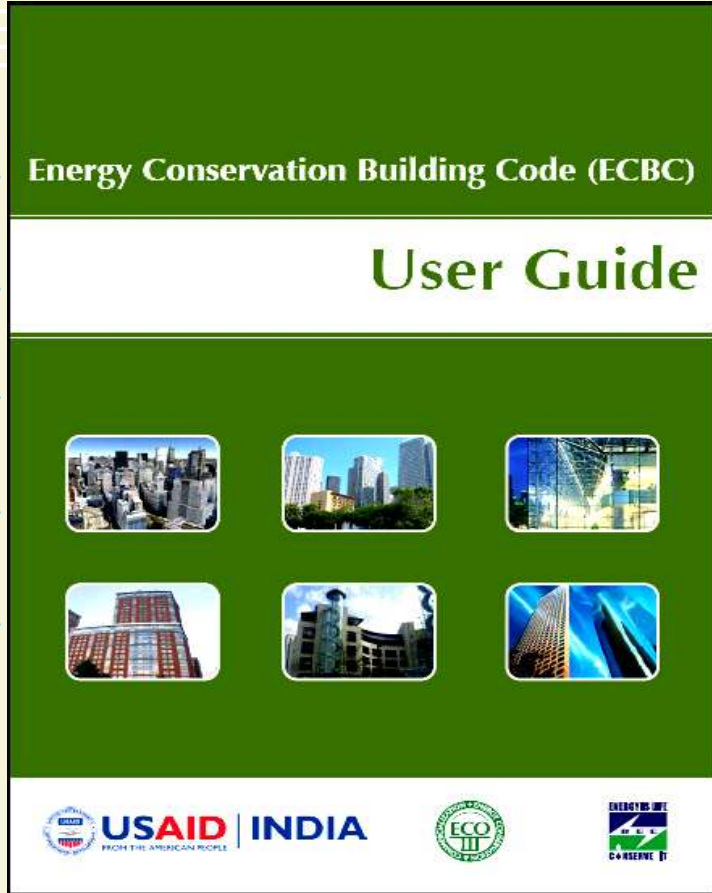
Administrative Guidance

Technical Guidance

Compliance/ Checklist

Case Studies/Examples

References



Why is User Guide Important?



- ECBC Compliance & Implementation
 - Prescriptive option
 - Tradeoff option
 - Whole building performance option
- Fills essential gaps in ECBC (revised version - 2008)



Why is User Guide Important?

Building System

Envelope

HVAC

Lighting

Electric Eqpt & Systems

Service Hot Water and Pumping

Compliance Options

Mandatory Provisions
(required for most compliance options)

Prescriptive Option

Trade Off Option

Whole Building Performance

Energy Code Compliance



ECBC – Tasks ahead



➤ **Promotion of ECBC**

- Conducting atleast 5 workshops in each climatic zones
- Workshop with manufacturers

➤ **Prototype buildings**

- ECBC architects to come up with design prototyres for various building types, climatic zones etc.

➤ **Amendment of Building By-laws**

- Review of state by laws by ECBC expert architects for incorporating ECBC provisions

➤ **Capacity building**

- Broaden the existing database of existing ECBC expert architects

➤ **Situation Analysis of ECBC compliant buildings**

- Database of ECBC compliant buildings in India



ECBC – Tasks ahead



➤ **Compliance tools**

Developing compliance procedures based on:

- i) Component based (prescriptive)
- ii) System- based approach
- iii) Whole building approach

➤ **Compliance Test procedures**

set up a mechanism for check testing of compliance for ECBC compliant buildings at various stages:

- Design Stage
- Construction Stage
- Completion Stage



Energy Efficiency in Existing Buildings/ facilities



- There is vast scope for energy efficiency improvement in buildings/ existing facilities.
- Energy Audit Studies have revealed a savings potential to the extent of 40% in end use such as lighting, cooling, ventilation, refrigeration etc.
- Audits identify the Energy baselines in existing facilities along with Energy Efficiency Measures.



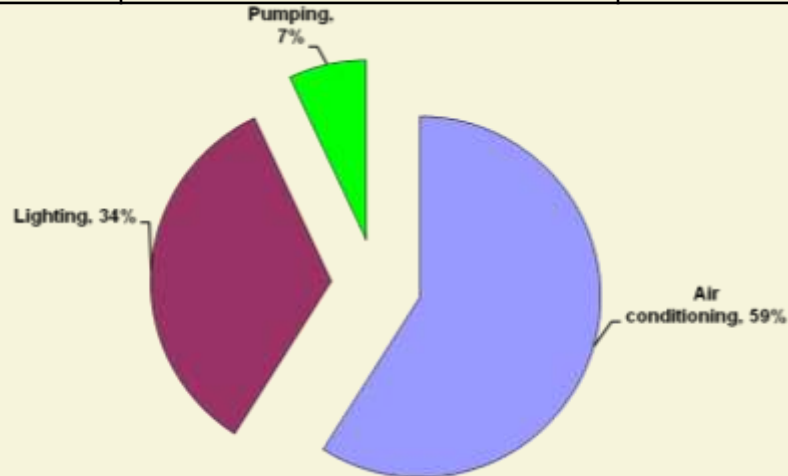
Energy Efficiency Improvements at Rashtrapathi Bhawan



EEMs at Rashtrapati Bhawan



Energy Saving Measure	Electricity savings (kWh/ year)	Savings in lakh Rupees per year
Air conditioning	5,54,266	35.3
Lighting	3,25,028	20.7
Pumping	54,140	3.45
Total	9,33,434	59.45



ONGOING INITIATIVES



- An exercise for expanding the number of existing ESCOs through an open invitation and evaluation process was taken up by BEE.
- In order to create a sense of credibility amongst the prospective agencies that are likely to secure the services of an ESCO as well as the financial institutions, a process of rating ESCOs was taken up through CRISIL and ICRA.
- Rating was carried out in terms of success in implementation of energy efficiency projects based on performance contracting, availability of technical manpower, financial strength, etc.
- 80 ESCOs empanelled with BEE after accreditation by CRISIL/ ICRA. 50 of the 80 accredited ESCOs are at levels 1 to 3 (Above Average)



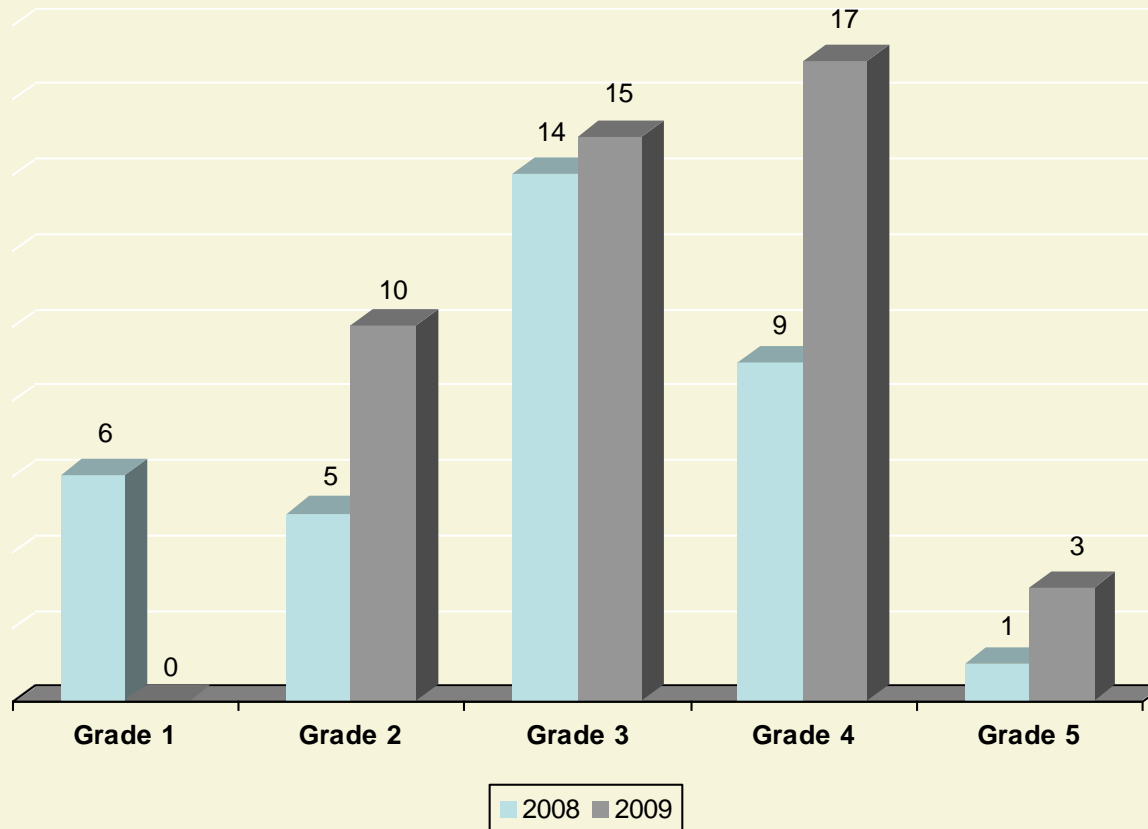
Grading Scale



ICRA / CRISIL-BEE Grading	Definition	Score
GRADE 1	Very High	85 and above
GRADE 2	High	70-84
GRADE 3	Good	55-69
GRADE 4	Below Average	40-54
GRADE 5	Poor	0-39

ESCO Grading Distribution

55 per cent of the graded entities have above average execution capability in 2009 against 70 per cent in 2008.



STAR RATING FOR OFFICE BUILDINGS



- Large potential for energy savings both in government and commercial office buildings.
- The regulation, promotion and facilitation of energy efficiency in commercial buildings is one of the key thrust areas of BEE.
- Energy Conservation Building Code (ECBC)
 - specifies standards for new, large, energy -efficient commercial buildings.
- Energy Service Companies (ESCOs)
 - upgrade the energy efficiency of existing government buildings through retrofitting on performance contracting mode.



SCHEME FOR RATING OF BUILDINGS



- The Star Rating Program for buildings is based on actual performance of the building in terms of specific energy usage (kWh/sq m/year).
- This programme would rate office buildings on a 1-5 Star scale with 5 Star labeled buildings being the most efficient.
- Five categories of buildings - office buildings, hotels, hospitals, retail malls, and IT Parks in five climate zones in the country have been identified.
- Office buildings in the following 3 climatic zones for air-conditioned and non- air-conditioned:
 - Warm and Humid
 - Composite
 - Hot and Dry
- It will be subsequently extended to other climatic zones and building types.



BANDWIDTHS- LESS THAN 50% AIR CONDITIONING



Composite

EPI(Kwh/sqm/year)	Star Label
80-70	1 Star
70-60	2 Star
60-50	3 Star
50-40	4 Star
Below 40	5 Star

Warm and Humid

EPI(Kwh/sqm/year)	Star Label
85-75	1 Star
75-65	2 Star
65-55	3 Star
55-45	4 Star
Below 45	5 Star

Hot and Dry

EPI(Kwh/sqm/year)	Star Label
75-65	1 Star
65-55	2 Star
55-45	3 Star
45-35	4 Star
Below 35	5 Star



BANDWIDTHS- MORE THAN 50% AIR CONDITIONING



Composite

EPI(Kwh/sqm/year)	Star Label
190-165	1 Star
165-140	2 Star
140-115	3 Star
115-90	4 Star
Below 90	5 Star

Warm and Humid

EPI(Kwh/sqm/year)	Star Label
200-175	1 Star
175-150	2 Star
150-125	3 Star
125-100	4 Star
Below 100	5 Star

Hot and Dry

EPI(Kwh/sqm/year)	Star Label
180-155	1 Star
155-130	2 Star
130-105	3 Star
105-80	4 Star
Below 80	5 Star



Bandwidths for the BPOs



- BPOs, which primarily focus on providing service to IT related activities such as application management and application development, data centre operations or testing and quality assurance.
- BPOs may have varied hours of operation e.g. 24x7/ 24x5, 18x7, 16x7 or 16x5 etc.
- Those BPOs having a connected load of 100 kW and above and a minimum built up area of 500 Sq m would be considered for BEE star rating scheme
- Average Annual Hourly Energy Performance Index (EPI) i.e. **(AAhEPI) in (Wh/hr/sqm/)** will be considered for rating the BPO.
- This programme targets BPOs located within the following 4 climatic zones ie (Warm and Humid, Composite, Hot and Dry, Temperate)



Bandwidths for the BPOs



Climatic Zone - Composite

Average Annual hourly EPI AAhEPI (Wh/hr/Sqm)	Star Rating
45-40	1 Star
40-35	2 Star
35-30	3 Star
30-25	4 Star
Below 25	5 Star

Climatic Zone - Warm and Humid

Average Annual hourly EPI AAhEPI (Wh/hr/Sqm)	Star Rating
50-45	1 Star
45-40	2 Star
40-35	3 Star
35-30	4 Star
Below 30	5 Star

Climatic Zone - Hot and Dry

Average Annual hourly EPI AAhEPI (Wh/hr/Sqm)	Star Rating
35-30	1 Star
30-25	2 Star
25-20	3 Star
20-15	4 Star
Below 15	5 Star

Climatic Zone - Temperate

Average Annual hourly EPI AAhEPI (Wh/hr/Sqm)	Star Rating
40-35	1 Star
35-30	2 Star
30-25	3 Star
25-20	4 Star
Below 20	5 Star

Present status of the Scheme & Future Initiatives



- **158** applications have been received under day use office building category.
- **92 Buildings** have been found eligible for issue of a star Label under this scheme till date . (RBI, SBI, ADB ,CPWD, Railways, kalpataru)
- **22** applications have been received under BPO category, out of which 12 BPO buildings found eligible.
- Bandwidths for IT buildings , Hospitals , Hotels and Shopping Malls under development .



Label



Energy Performance Index:

kWh/ sq m/ year

Name of the Building : _____
 Category of Building : _____
 Type : _____
 Climatic Zone : _____
 Connected Load : _____
 Build up Area : _____





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