

ENERGY CONSERVATION IN BUILDINGS AND ECBC - 20017

By

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National Impact Potential

- Commercial buildings construction in 2017-18 is 95 million sqm and energy use is 19.5 BU
- Potential savings is 4.3 BU, 3 Million MT OF CO2
- The average energy use (lighting and HVAC) for typical commercial building is 200 kWh/sq. meter/year.
- Mandatory enforcement of ECBC shall easily reduce the energy use by 30-40% to 120-160 kWh/sq. meter/year.

What are Energy Conservation Building Codes?

The purpose of the Energy Conservation Building Code is to provide minimum requirements for the energy-efficient design and construction of buildings.

It does not constrain the building function, comfort, health, or the productivity of the occupants

The Code is applicable to buildings or building complexes that have a connected load of 100 kW or greater or a contract demand of 120 kVA or greater and are intended to be used for commercial purposes.

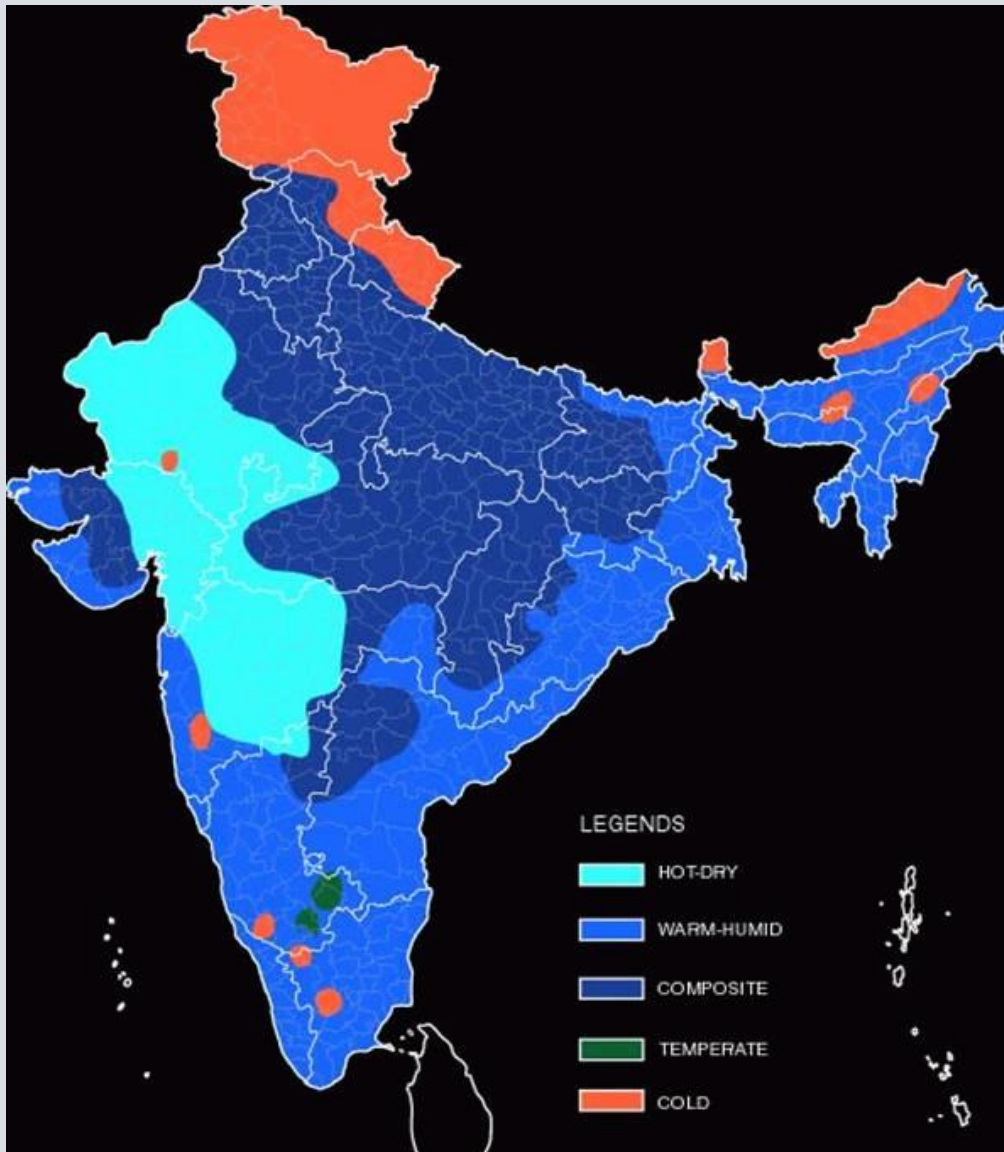
Applicable Building Systems

- **Applies to New Construction and** existing building after additions or alterations changes its connected load to 100 kilo-Watt (kW) or above or a contract demand of 120 kilo-Volt Ampere (kVA) or above
- **Building components included**
 - **Building Envelope (Walls, Roofs, Windows)**
 - **Lighting (Indoor and Outdoor)**
 - **Heating Ventilation and Air Conditioning (HVAC) System**
 - **Service Water Heating and Pumping**
 - **Electrical Systems (Power Factor, Transformers)**

Encourage Environmentally Sensitive Design

- The most cost effective way to meet the ECBC requirement would be to design buildings with appropriate regard to climate and sun.
- A design not sensitive to sun and climate will have to invest more to meet the minimum ECBC standard
- This will encourage environmentally sensitive design and architecture

Addressing Climate Zones Variations



1. Five climate zones
2. Composite (Delhi)
3. Hot Dry (Ahmadabad)
4. Hot Humid (Kolkata),
5. Moderate (Bangalore)
6. Cold (Shillong)

Definitions

(d) “built-up area” means the total covered areas on all floors of a building from the basement to all storeys covered by walls and parapet measured at the floor levels excluding parking.

{n} “energy performance index” means annual energy consumption of a building in kiloWatt-hours per square meter of the area of the building.(excluding unconditioned basement, parking)

(o) “energy performance index ratio” means the ratio of the energy performance index of the proposed building to the energy performance index of the standard baseline building;

s) “proposed design” means the computerised design of a building consistent with the actual design of a building which complies with all the mandatory and prescriptive requirements of the Code either through prescriptive or whole building performance method;

(t) “standard baseline design” means the standard design that complies with all the mandatory and prescriptive requirements of the Code and has the same built-up area of the proposed building;

Mandatory Provisions

4.2. Fenestration components- U-Factor, Solar Heat Gain Coefficient, Visual Light Transmittance, Daylighting, Building Envelope Sealing.

Skylights- Area is restricted to a Maximum of 5% of the gross roof area

5.2. Ventilation, Minimum Space Conditioning Equipment Efficiencies, air and hydronic balancing(throttling restriction), Controls, Piping and Ductwork

Solar Water Heating equipment should provide for:

(a) at least 20% of the total hot water design capacity if above grade floor area of the building is less than 20,000 m²

(b) at least 40% of the total hot water design capacity if above grade floor area of the building is greater than or equal to 20,000 sqm

Mandatory Provisions Contd....

6.2 Automatic Lighting Shutoff, Exit Signs Internally-illuminated exit signs shall not exceed 5 Watts per face

7.2 Maximum Allowable Power Transformer Losses

Voltage drop for feeders shall not exceed 2% at design load.

Voltage drop for branch circuit shall not exceed 3% at design load

Motors shall comply with the following:

(a) Three phase induction motors shall conform to Indian Standard (IS) 12615 and shall fulfil the following efficiency requirements of IE 2 (high efficiency) class

Diesel Generator (DG) Sets, Uninterruptible Power Supply (UPS), BEE star rated DG sets

Check-Metering and Monitoring, Power Factor to be maintained

Mandatory Provisions Contd....

Maintain power factor at the point of connection at 0.97

The power cabling shall be sized so that the distribution losses do not exceed 3% of the total power usage

Renewable Energy Generating Zone (REGZ)

(a) A dedicated REGZ equivalent to at least 25 % of roof area or area required for generation of energy equivalent to 1% of total peak demand or connected load of the building, whichever is less, shall be provided in all buildings.

Prescriptive Requirements

4.3 Roofs and Opaque External Wall, Vertical Fenestration assembly and Skylights shall comply with the maximum assembly U-factor.

Maximum allowable Window Wall Ratio (WWR) is 40%

Minimum allowable Visual Light Transmittance (VLT) is 0.27

5.3. Chilled and condenser water pumps shall meet or exceed the minimum energy efficiency requirements, Variable Flow Hydronic Systems, Variable Speed Drives

- R value for insulation of refrigerant piping
- Gas and oil fired boilers shall meet or exceed the minimum efficiency requirements specified

6.3 The installed interior lighting power for a building or a separately metered or permitted portion of a building shall not exceed the interior lighting power allowance.

Compliance mechanism

1. Mandatory provisions prescribed in 4.2, 5.2, 6.2 and 7.2 should be complied with
2. All the prescriptive requirements prescribed in cl 4 to 7 should be complied with. However, Building Envelope Trade-Off Method is acceptable when the building envelope complies with the prescriptive requirements if the Envelope Performance Factor (EPF) of the Proposed Building is less than the EPF of the Standard Building.
3. Whole Building Performance Method prescribed in cl 9 is an alternative to the Prescriptive Method compliance path contained in §4 through §7 of this Code. However, the mandatory requirements shall be met.

Compliance Approaches

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graph TD; A[Compliance Approaches] --> B[Mandatory Provisions 4.2, 5.2, 6.2, 7.2]; B --> C[Prescriptive method (Building Envelope Trade - off option)]; B --> D[Whole Building Performance Method]; C --> E[ECBC Complied]; D --> F[ECBC Complied];
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Mandatory Provisions 4.2, 5.2, 6.2, 7.2

Prescriptive method
(Building Envelope
Trade – off option)

Whole Building
Performance
Method

ECBC Complied

ECBC Complied

Building Envelope

Conventional Building

External Wall

230 mm brick work plastered on both sides
U-Value=1.985 W/m²K

Roof

150 mm concrete roof slab + 100 mm brick coba + roof tiles finish
U-Value=2.43 W/m²K

Glass

Single clear 6 mm glass
U-Value=5.7 W/M2k , SHGC=0.85
Light transmittance=89%

EPI:

240 kWh/m² per annum

ECBC Building

External finish + 115 mm brick wall + 50 mm expanded polystyrene insulation+ 115 mm brick wall + internal plaster
U-Value=0.51 W/m²K

150 mm concrete roof slab + 50 mm fibre glass insulation + 100 mm brick coba + roof tiles finish
U-Value=0.56 W/m²K

Double glazed low emissivity glass

U-Value=1.6 W/m²K, SHGC=0.40,
External shading designed to reduce SHGC to 0.25 and Light transmittance to 62%

EPI:

208 kWh/m² per annum

10% reduction after building envelope optimisation

Lighting

Base Building	ECBC Building
LPD = 20 W/m ²	LPD achieved is less than 10 W/m ² T5 Tube lights and LEDs have been used.
EPI = 240 kWh/m ² per annum	EPI = 168 kWh/m ² per annum
30% reduction after building envelope + lighting optimisation	

HVAC

Base Building	ECBC Building
Chiller efficiency = 1.21 KW/TR	Chiller efficiency = 0.74 KW/TR Water cooled screw chiller has been used
EPI = 240 kWh/m ² per annum	EPI = 133 kWh/m ² per annum
45 % reduction after building envelope + lighting + HVAC optimization	

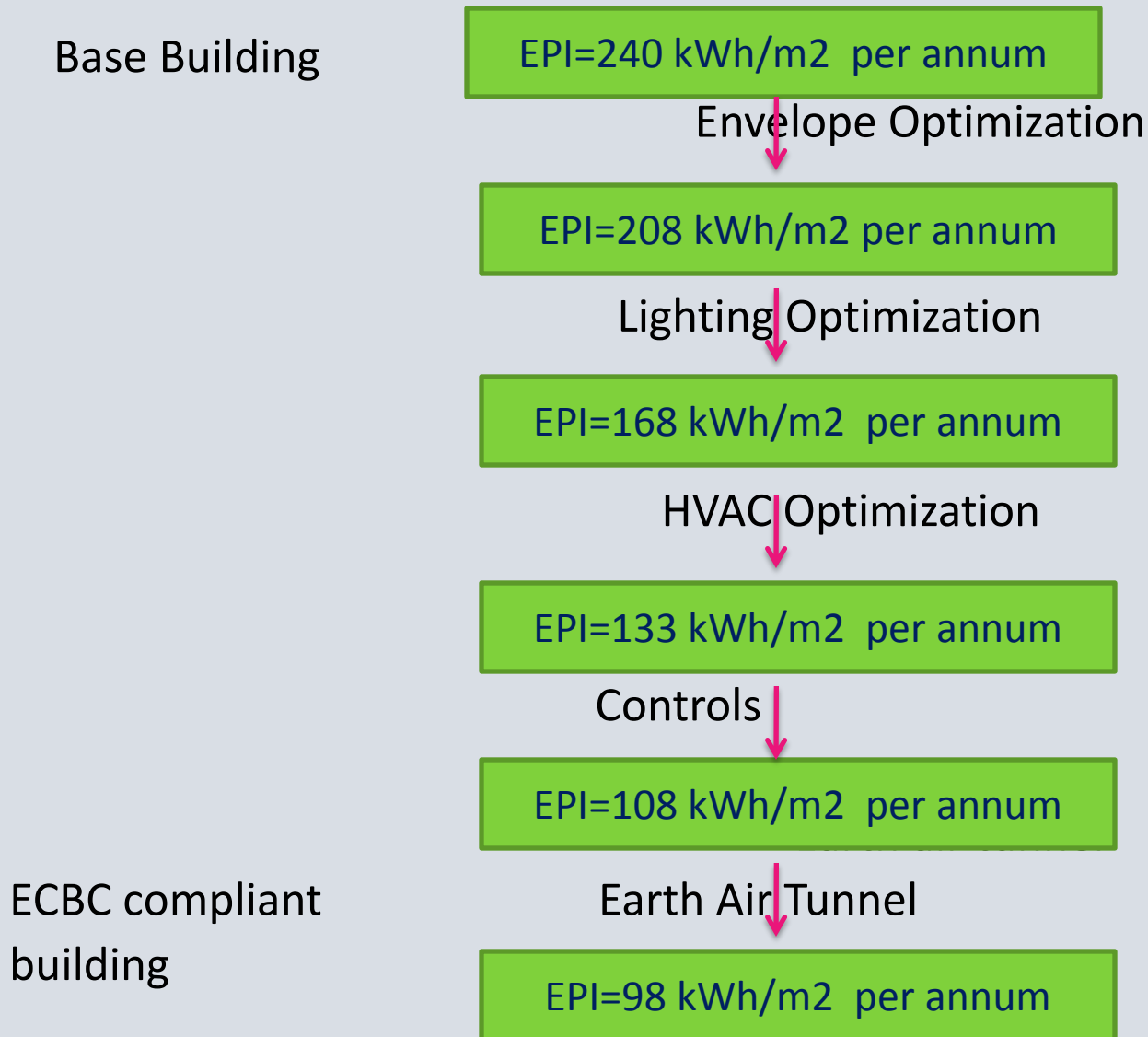
Controls

Base Building	ECBC Building
None	Integration of daylight controls with artificial lighting
EPI = 240 kWh/m ² per annum	EPI = 108 kWh/m ² per annum
54% reduction after building envelope + lighting + HVAC optimization + controls + EAT	

Integration of Passive Strategy

Base Building	ECBC Building
None	Integration of EAT with HVAC
EPI = 240 kWh/m ² per annum	EPI = 98 kWh/m ² per annum
58% reduction after building envelope + lighting + HVAC optimization + controls + EAT	

Energy Savings Achieved through ECBC interventions



Implementation of ECBC

Energy Conservation Building Code Rules, 2018 w.e.f 13.02.2018.

Compliance of building to ECBC

- Every owner who intends to erect or re-erect a building or make alterations or additions in any building under these rules shall submit to the concerned authority having jurisdiction, an application in Form I
- Empanelled Energy Auditors (Building) shall scrutinise and issue certificate of approval to the authority for the issue of permit to construct the building and SDA
- The owner shall give notice and start construction which will be verified by the Empanelled Energy Auditors (Building) and a certificate will be issued based on which the authority shall issue occupancy certificate.
- Energy performance of the building shall be monitored and verified by the State Energy Conservation Building Code Implementation Committee of the concerned State

Implementation of ECBC Contd...

- In case of difficulty in compliance of EPI within three years, State Energy Conservation Building Code Technical Grievances Redressal Committee decide take the case from the owner and empanelled auditor and issue recommendation to the authority. This process shall continue till the EPI is achieved.
- State, shall constitute –
 - State Energy Conservation Building Code Implementation Committee headed by Chief Secretary comprising of all stakeholders including a nominee from Bureau to review the implementation process and nominate Energy Conservation Building Code Technical Grievances Redressal Committee headed by an officer of the Urban Development Department of the State, with other members, not exceeding four.

Implementation of ECBC Contd...

Bureau of Energy Efficiency (Manner and Intervals of Time for Conduct of Energy Audit of Commercial Buildings or Establishments) Regulations, 2018 w.e.f 21.02.2018

- Accredited Energy Auditor shall visit and undertake audit in prescribed forms and submit report of recommendation and implementation in the prescribed forms
- Every new designated consumer specified by notification under clause (e) of section 14 of the Act shall have its first energy audit conducted by an accredited energy auditor within eighteen months of such notification.
- The interval of time for conducting and completion of subsequent energy audits shall be three years from the last date of submission of the previous energy audit report by the accredited energy auditor.

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Thank
You!