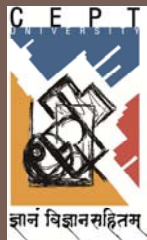


Energy Conservation Building Code (ECBC)

Introduction to ECBC

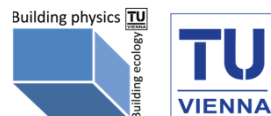


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Implementation of Energy Conservation Building Code

Chandigarh, Dec 3-4, 2012



Introduction to ECBC

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- **Introduction to ECBC**
- **Significance of ECBC**
- **ECBC Scope**
- **ECBC Compliance Process**
- **Administration and Enforcement**

Introduction to ECBC

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- ECBC sets minimum energy efficiency standards for design and construction of commercial buildings
- ECBC encourages energy efficient design or retrofit of buildings so that
 - ▣ Does not constrain the building function, comfort, health, or the productivity of the occupants
 - ▣ It has appropriate regard for economic considerations
- Addresses local design conditions and helps improve existing construction practices
- Emphasis on Integrated Building Design approach
- First generation code – ease of use and continuous improvement

BACKGROUND: Energy Conservation Act 2001

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- Government of India - creation of Bureau of Energy Efficiency (BEE)
- Powers and Functions of BEE vis-à-vis ECBC
 - Prescribe ECBC for efficient use of energy
 - Take suitable steps to prescribe guidelines for ECBC
 - Link Energy Performance Index (from the EC Act) to the ECBC Prescriptive Compliance Approach in order to facilitate the implementation of the Code
*[On Page 5, clause (j) of the EC Act, 2001 currently reads:
"energy conservation building codes" means the norms and standards of energy consumption expressed in terms of per square meter of the area wherein energy is used and includes the location of the building]*
- Power of State Government:
 - The State Govt., in consultation with BEE, may
 - amend ECBC to suit the regional and local climatic conditions with respect to use of energy in the buildings
 - direct the owner or occupier of a building (if notified as a Designated Consumer) to comply with the provisions of ECBC



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ECBC and NAPCC

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Prime Minister's National Action Plan on Climate Change (NAPCC)

- National Solar Mission
- National Mission for Enhanced Energy Efficiency
- **National Mission on Sustainable Habitat**
 - Promoting Energy Efficiency in the Residential and Commercial Sector
 - **The Energy Conservation Building Code, which addresses the design of new and large commercial buildings to optimize their energy demand, will be extended in its application and incentives provided for retooling existing building stock.**
 - Management of Municipal Solid Waste
 - Promotion of Urban Public Transport
- National Water Mission
- National Mission for Sustaining the Himalayan Ecosystem
- National Mission for a Green India
- National Mission for Sustainable Agriculture
- National Mission on Strategic Knowledge for Climate Change

SOURCE: Prime Minister's Council on Climate Change (2008), National Action Plan on Climate Change, Government of India, New Delhi



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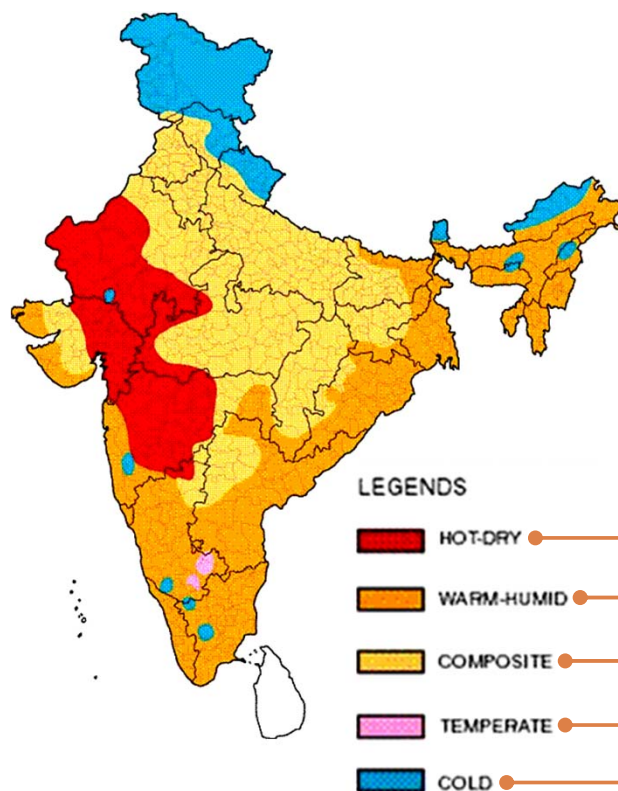
Development of ECBC

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- Broad Stakeholder participation
 - ▣ Building Industry, Manufacturers, Professionals, Govt. Agencies etc.
- ECO-II facilitated the development of ECBC
 - ▣ ECBC committee of experts
- An extensive data collection was carried out for construction types and materials, glass types, insulation materials, lighting and HVAC equipment
- Base case simulation models were developed
- The stringency analysis was done through detailed energy and life cycle cost analysis
- A stringency level for each code component was established

Climate Zones in India

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High temperature • Low humidity and rainfall • Intense solar radiation and a generally clear sky • Hot winds during the day and cool winds at night

Temperature is moderately high during day and night • Very high humidity and rainfall • Diffused solar radiation if cloud cover is high and intense if sky is clear • Calm to very high winds from prevailing wind directions

This applies when 6 months or more do not fall within any of the other categories • High temperature in summer and cold in winter • Low humidity in summer and high in monsoons • High direct solar radiation in all seasons except monsoons high diffused radiation • Occasional hazy sky Hot winds in summer, cold winds in winter and strong wind in monsoons

Moderate temperature • Moderate humidity and rainfall • Solar radiation same throughout the year and sky is generally clear • High winds during summer depending on topography

Moderate summer temperatures and very low in winter • Low humidity in cold/sunny and high humidity in cold/cloudy • Low precipitation in cold/sunny and high in cold/cloudy • High solar radiation in cold/sunny and low in cold/cloudy • Cold winds in winter

ECBC and Other Programs

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Program	Organization	Compliance Required	Building Type	Building With	Scope	Linkage to ECBC
ECBC	Ministry of Power/BEE	Voluntary	Commercial	Connected Load \geq 500kW Contract Demand \geq 600kVA	Energy Efficiency	NA
LEED-India	CII-Green Business Center	Voluntary	Commercial/ Institutional	-	Sustainable design/green building	Refers to ECBC for energy efficiency credits
GRIHA	MNRE	Voluntary	Residential/ Commercial/ Institutional	-	Sustainable design/green building	Refers to ECBC for energy efficiency credits
Environmental Impact Assessment (EIA)	Ministry of Environment and Forests	Mandatory	Commercial/ Residential	Applicable to Large Projects	Environmental Impact	ECBC and Environmental Clearance requirements are related

Significance of ECBC

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- Regulates building thermal performance & energy use according to climate zone
 - Encourages climatic responsive building design
- Encourages use of daylighting, shading, natural ventilation, solar energy etc.
 - Energy efficiency strategies appropriate for India
- Focuses on energy performance of buildings rather than green building design
 - Material properties, water use, building site etc. not regulated
 - Green Building Design standards will refer to ECBC for energy performance

ECBC and Energy Savings

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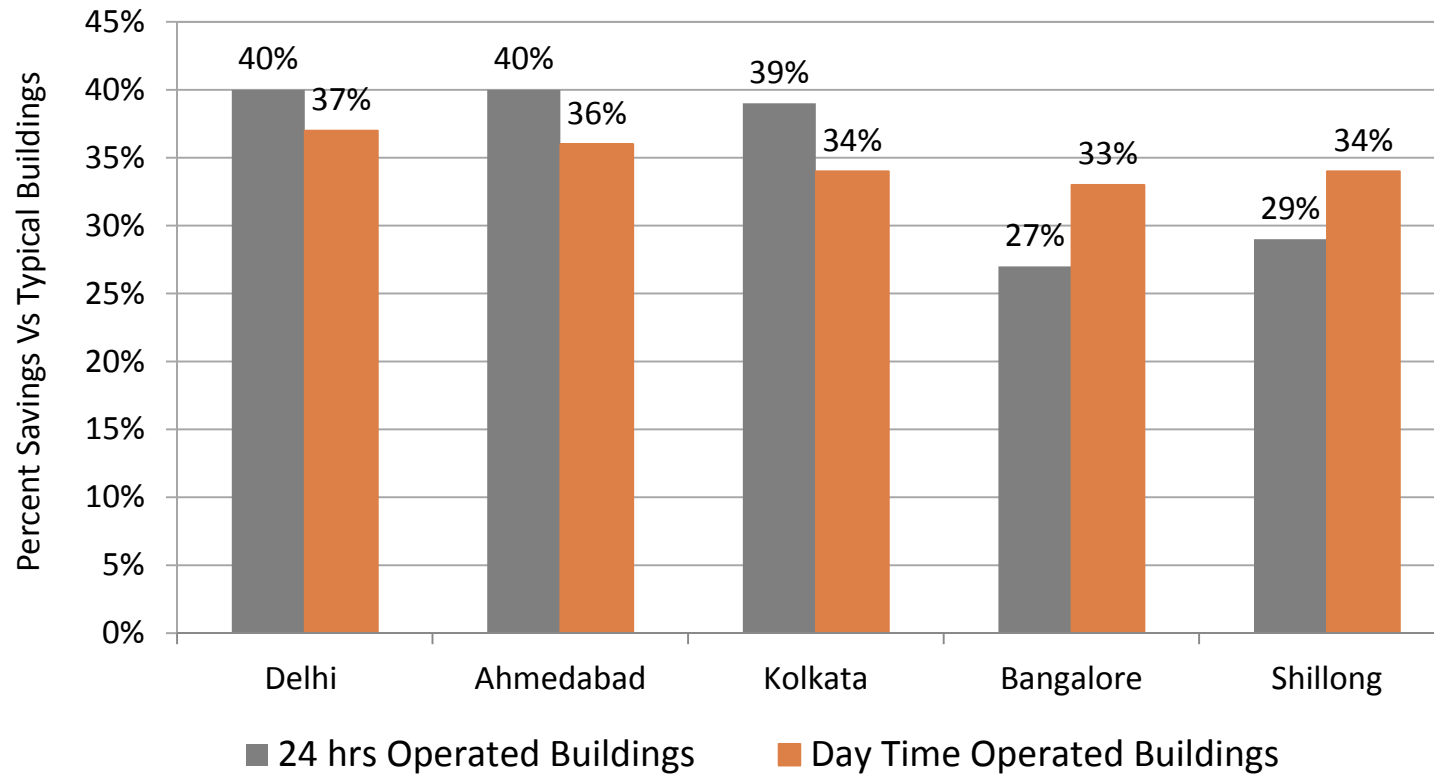
- Average energy use for lighting and HVAC
 - A typical “Class A Office” building consumes 150 kWh/m²/year.

Number of Buildings	Building Type	Floor Area (m ²)	Annual Energy Consumption (kWh)	Benchmarking Indices	
				kWh/m ² /year	kWh/m ² /hour
OFFICE BUILDINGS					
145	One shift Buildings	16,716	20,92,364	149	0.068
55	Three shifts Buildings	31,226	88,82,824	349	0.042
88	Public Sector Buildings	15,799	18,38,331	115	0.045
224	Private Sector Buildings	28,335	44,98,942	258	0.064
10	Green Buildings	8,382	15,89,508	141	-
HOSPITALS					
128	Multi-specialty Hospitals	8721	24,53,060	378	13,890
22	Government Hospitals	19,859	13,65,066	88	2,009
HOTELS					
89	Luxury Hotels (4 and 5 Star)	19,136	48,65,711	279	24,110
SHOPPING MALLS					
101	Shopping Malls	10,516	23,40,939	252	0.05642

- Mandatory enforcement of ECBC shall reduce the energy use by 30-40% to 120-160 kWh/m²/year
- Nationwide Mandatory enforcement of ECBC will yield energy saving of 1.975 billion kWh in the 1st Year itself

ECBC and Energy Savings

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$$\text{NATIONAL ENERGY SAVINGS} = \text{CODE STRINGENCY} \times \text{LEVEL OF COMPLIANCE} \times \text{ADOPTION RATE}$$

SOURCE: ECBC Impact Analysis done by IECC under USAID ECO-III Project, New Delhi



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Impact of ECBC Compliance

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- Market Development for EE products
 - Building Insulation
 - Energy Efficient Windows (Glass and Frames)
 - High-Efficiency HVAC Equipment

- Improved Design Practices
 - Lighting and Daylighting
 - Natural Ventilation/Free-Cooling Systems

- Improved Building Performance

- Lesser addition of Power Generation Capacity

- Lower HVAC Loads, reduced energy consumption and costs

ECBC Scope

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- **New Buildings with**
 - Connected load in excess of 100kW
 - or
 - Contract demand in excess of 150 kVA

- **Also applies to Additions and Major Renovation**
 - When addition + existing building area > 1000 m²
 - Renovated portions and systems of a 1000 m or larger building

ECBC Scope

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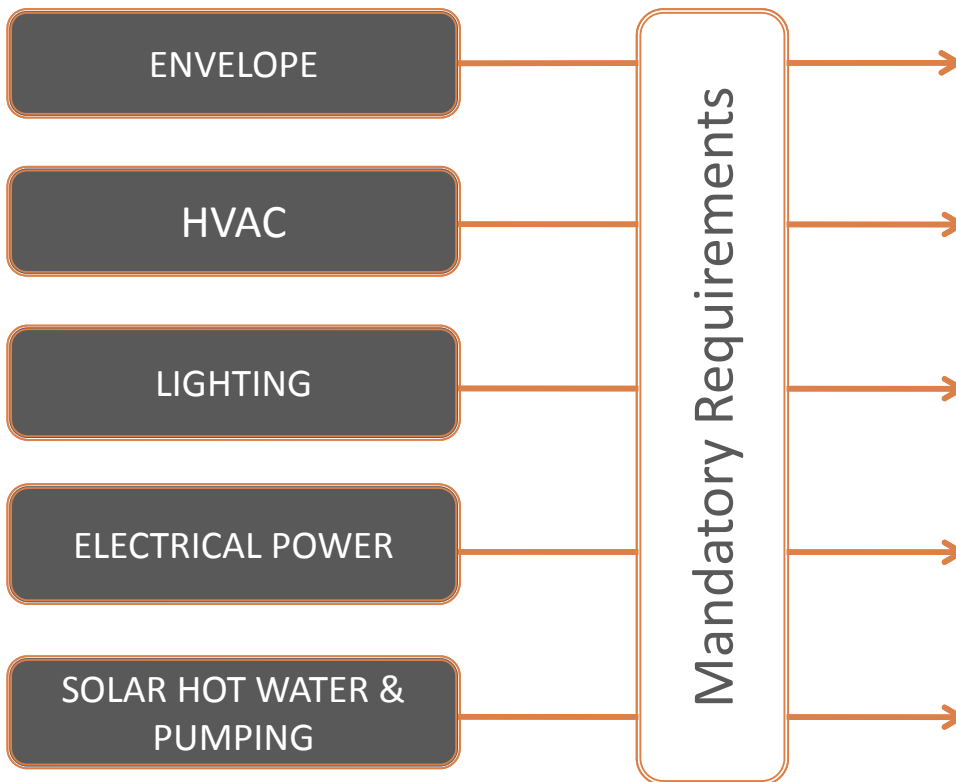
- **Applicable building systems**
 - Building Envelope
 - Mechanical systems and equipment, including HVAC
 - Service hot water and pumping
 - Interior and exterior lighting
 - Electrical power and motors

- **Exceptions**
 - Buildings that do not use either electricity or fossil fuels
 - Equipment and portions of building systems that use energy primarily for manufacturing processes
 - Safety, Health and Environmental codes take precedence

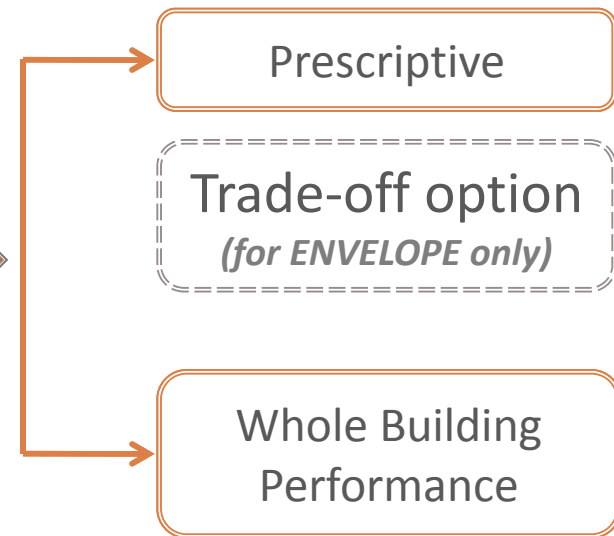
ECBC Compliance Process

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Applicable BUILDING SYSTEMS



COMPLIANCE APPROACHES



Required for ALL Compliance Approaches

Compliance Approaches

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- **PRESCRIPTIVE**
 - Each building/system component should have specific performance value
 - Requires little energy expertise; provides minimum performance requirements; no flexibility

- **TRADE-OFF**
 - Applies to Building Envelope ONLY
 - Component performance value can be less BUT Overall performance of the envelope complies with ECBC
 - Allows some flexibility through the balance of some high efficiency components with other lower efficiency components

- **WHOLE BUILDING PERFORMANCE**
 - Allows flexibility in meeting or exceeding energy efficiency requirements by optimizing system interactions
 - Component and Systems Modeling: Envelope, Lighting, HVAC
 - Physical Processes: Day lighting, Heat-flow, Airflow

Compliance Approaches

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Approaches	Mandatory Provisions of ECBC	Flexibility	Expert Knowledge	Linear Approach	Use of Energy Simulation
PRESCRIPTIVE	Required	Low	Low	Yes	No
TRADE-OFF	Required	Medium	Medium	No	May be
WHOLE BUILDING PERFORMANCE	Required	High	High	No	Yes

Administration and Enforcement

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		1		2	3		4		5	
	Programming	Schematic Design	Design Development	Construction Documents	Plans Check	Bidding & Negotiation	Construction Management	Commissioning	Field Inspection	Acceptance
Design Team	X	X	X	X	X	X	X	X	X	X
General Contractor						X	X	X	X	X
Building Department					X				X	
Owner	X	X	X	X	X	X	X	X	X	X

1. Understand requirements of the ECBC and apply to building design
2. Construction documents submitted with the permit application contain ECBC compliance information that can be verified (Compliance Forms and Checklists)
3. Building officials verify through plans that building is ECBC compliant
4. Plans & specifications are followed to ensure ECBC compliance
5. Commissioning & Operations and Maintenance Guidelines provided to building operators

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