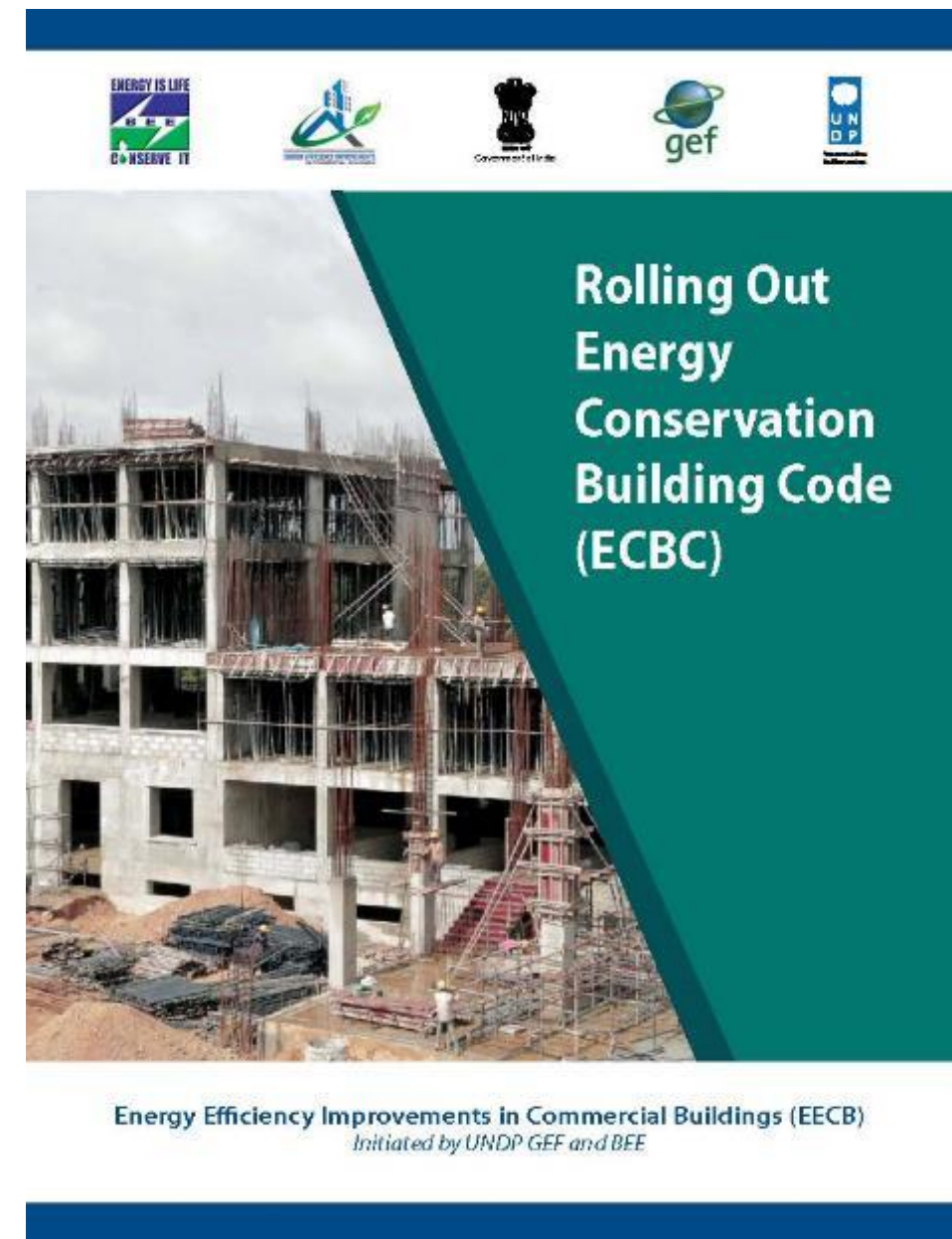


UNDP GEF BEE Project: Energy Efficiency Improvements in Commercial Buildings (EECB)



Regional Workshop on ECBC Implementation in States

“There are **known knowns**. These are things we know. There are **known unknowns**. There are things that we know we don’t know. But there are also **unknown unknowns**. There are things we don’t know we don’t know.”

- Donald Rumsfeld

What is a Building?

A Building is an **Environmental Separator**

- » Control heat flow
- » Control airflow
- » Control water vapor flow
- » Control rain
- » Control ground water
- » Control light and solar radiation
- » Control noise and vibrations
- » Control fire
- » Control contaminants, environmental hazards and odors
- » Provide strength and rigidity
- » Be durable
- » Be aesthetically pleasing
- » Be economical

Introduction

Buildings are designed for **PEOPLE**, and for specific **TASK**

» The building needs to keep people *comfortable, efficient, healthy*.

» *Energy Efficient design* seeks to create buildings that keep people *comfortable* while minimizing *Energy Consumption*.

» Comfort categories:

- Thermal comfort
- Visual Comfort
- Air Quality
- Acoustic Comfort



www.autodesk.com/sustainabilityworkshop

Energy Transfer in Buildings

Laws of Thermodynamics

- » **ZEROTH** Law – $A=B$ and $B=C$ therefore $A=C$
- » **FIRST** Law – Conservation of Energy
- » **SECOND** Law – Entropy
- » **THIRD** Law – Absolute Zero

2nd Law of Thermodynamics

“In an isolated system, a process can occur only if it increases the total entropy of the system”

- *Rudolf Clausius*

2nd Law of Thermodynamics

- » **Heat** Flow is from Warm To Cold
- » **Moisture** Flow is from Warm To Cold
- » **Moisture** Flow is from More To Less
- » **Air** Flow is from a Higher Pressure to a Lower Pressure
- » **Gravity** acts Down

Energy Conservation Building Code

ECBC sets **minimum** energy efficiency standards

- » Building Envelope
- » Heating, Ventilation and Air Conditioning
- » Service hot water and pumping
- » Lighting
- » Electrical power

*Voluntary introduction of ECBC in May 2007; **mandatory** in progress in different States*

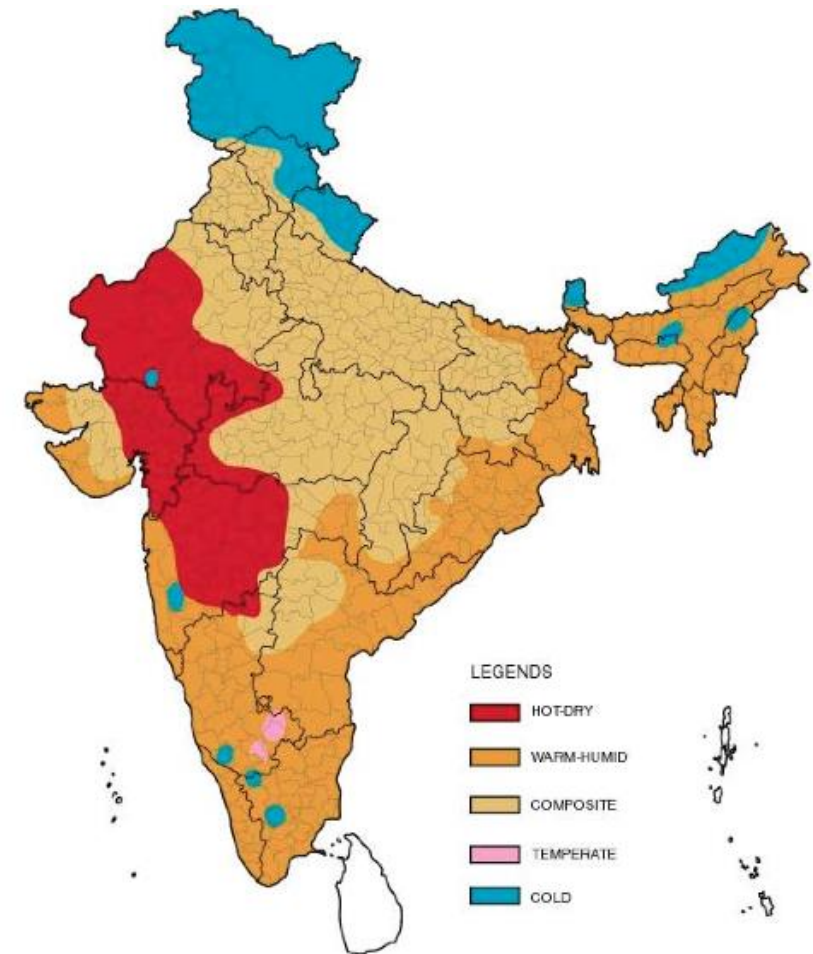
*While the ECBC has been developed by BEE, its **enforcement lies with the State governments and urban local bodies** through notification within their states as per their regional requirements*

Climate Zones

Places with similar patterns of combinations of these climatic factors over time, are said to belong to the same climate zone

» Based on these factors our country can be divided into five climatic zones.

- Hot and Dry
- Warm and Humid
- Temperate
- Cold
- Composite



SOURCE: Bureau of Indian Standards, National Building Code of India 2005, Part 8 Building Services, Section 1 Lighting and Ventilation

Tasks related to mainstream ECBC	Responsibilities		
	Central Government	State Government	Local Government
1. ECBC Code Development and Updating	Bureau of Energy Efficiency (BEE)		
2. ECBC ADOPTION			
Set-up ECBC committee to implement code		State Designated Agency (SDA)	
Review the ECBC and customization of code to suit regional and climatic conditions		SDA	
Define criteria of applicable building types		SDA	
Make legal notification in the state gazette for mandatory implementation of code		SDA or State Urban Development Department (UDD)	

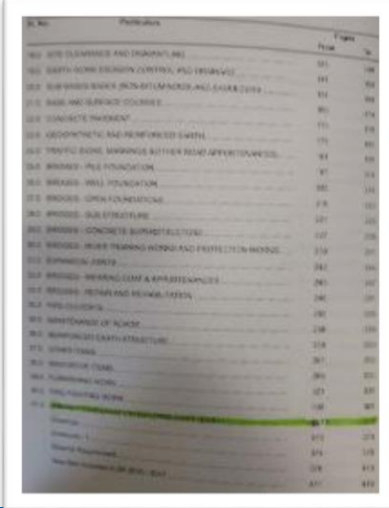
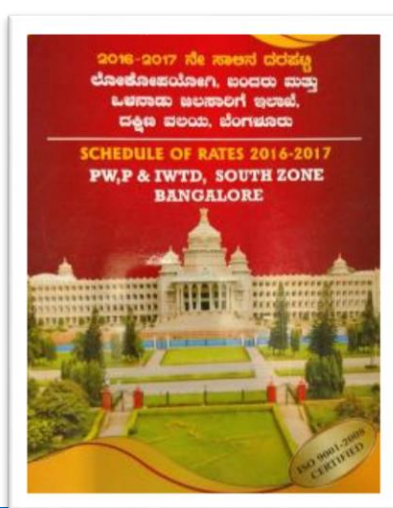
Tasks related to mainstream ECBC	Responsibilities		
	Central Government	State Government	Local Government
3. ECBC IMPLEMENTATION			
Develop enabling mechanisms and processes for mainstreaming ECBC	BEE	SDA and UDD	Urban Local Bodies (ULBs)
Revision of Schedule of Rates (SoR)	Central Public Works Department (CPWD)	Public Works Department (PWD)	
Revision of State General Development Control Rules/ ULB's Building Bye-Laws		SDA & UDD	ULBs
Develop ECBC implementation Rules e.g. Third Party Assessor (TPA) Model	BEE	SDA and UDD	ULBs
Use public online tools/ endorse third party simulation software to show compliance	BEE	SDA	ULBs
Develop technical capacity of building sector stakeholders	BEE	SDA	ULBs

Tasks related to mainstream ECBC	Responsibilities		
	Central Government	State Government	Local Government
4. ECBC ENFORCEMENT			
Institutionalize mechanisms for enforcement and compliance checking in ULBs & Electrical Inspectorate		State Electrical Inspectorate	ULBs
Set-up of robust Monitoring and Verification (M&V) system	BEE	SDA	ULBs

ECBC code progress – two examples

Karnataka

- » 2014: Issued ECBC notification
- » 2014/2015: New government projects started to make them ECBC compliant
- » 2014: Developed of state roadmap/action plan for ECBC implementation
- » **2016: Revision of Schedule of Rates (SoR) to include energy efficient materials and technologies**
- » 2016: Revision of ULB's building bye laws to include ECBC provisions
- » 2017: Awareness and training programmes in the state



Greater Hyderabad Municipal Corporation

- » 2011: Chief Secretary set up Technical committee on ECBC lead by Principal Secretary, Municipal Admin with members from SDA, DISCOM
- » 2012: Tech committee revised by-laws to include ECBC
- » 2014: Notification issued strengthening ECBC in by-laws, TPA empaneled by SDA and GHMC
- » 2015: Tech committee at GHMC set up including Chief City Planner
- » Ongoing: Approval by Building Construction committee [includes Mayor
- » **2016: ECBC included for compliance check along side fire safety, etc. included in Online approval process**
- » Ongoing: ECBC as part in occupancy certificate

Training on ECBC (1 day, 2 day, Master Trainers)

S.no.	State/UT	1 Day Workshop	2 Day Training	Total	Master Trainer
1	Andhra Pradesh	240	181	421	13
2	Arunachal Pradesh	61	121	182	
3	Assam			0	1
4	Bihar	81	117	198	1
5	Chhattisgarh	51	101	152	1
6	National Capital Territory of Delhi union territory			0	39
8	Gujarat			0	9
9	Haryana	70	100	170	3
13	Karnataka			0	5
14	Kerala	429	324	753	3
16	Madhya Pradesh	30		30	2
17	Maharashtra	30	30	60	23
22	Odisha	25	32	57	
23	Puducherry union territory	45		45	
24	Punjab	190	54	244	
25	Rajasthan	60		60	6
26	Sikkim	25	25	50	
27	Tamil Nadu		319	319	8
28	Telangana	166	140	306	
29	Tripura	125		125	
30	Uttar Pradesh	50	30	80	1
31	Uttarakhand	90	30	120	2
32	West Bengal	35		35	5
	Total	1803	1604	3407	122

ECBC compliant buildings

- » Support 62 buildings to become ECBC compliant cumulating to over **2.5 million m² [vis-à-vis our target of 1.47 m m²]**
- » 37 new buildings signed up in January to receive Technical assistance from EDS.
 1. Evaluate and endorse building design drawings, specifications for code compliance, Assess baseline EPI based on building simulation,
 2. provide guidance and recommendations to align with ECBC and monitor construction progress
 3. Review as-built drawings and equipment,
 4. confirm compliance to code,
 5. Verify performance data and demonstrate 15% reduction on baseline EPI

[Buildings to sign up through a MOU. Limited financial assistance to establish **monitoring & verification system** and ensure purchase of ECBC compliant building material]

KK Guest House

- Built-up area: 19,875 m²
- Energy Performance Index (EPI) before adopting ECBC: 97 kWh/m².year
- EPI after adopting ECBC: 62 kWh/m².year
- Overall Project Construction Cost : ₹ 80 Crore
- Additional Cost: ₹ 2.28 Crore
- Reduced cost due to optimised design: ₹ 68.7 Lakh
- Incremental Cost: ₹ 1,6 Crore (2% of the project construction cost)
- Payback Period: 3.8 years
- 570 tCO₂ per year

Ongoing Demonstration Projects

S.NO.	Building	Climatic Zone	Category	Status
1	Roads and Bridges Development Corporation, Kochi, Kerala	Warm and Humid	Shopping Mall	Feasibility prepared and approved by building owner; the project is downsized
2	Academic Block in SMS Medical College, Jaipur, Rajasthan – EPI 98	Composite	Institutes & IT parks category	Under construction
3	K.K. Guest House, Bangalore, Karnataka	Temperate	Hotel category	Under construction and ECMs implemented
4	Dhanvantri OPD block, SMS Hospital, Jaipur, Rajasthan – EPI 305; area 14,813 m ²	Composite	Hospital category	Under construction and ECMs implemented
5	Chhattisgarh Samvad Office building, Naya Raipur, Chhattisgarh – EPI 78; area 10541 m ²	Warm and Humid	Office building	Under construction and ECMs implemented
6	UPERC, Lucknow, UP	Composite	Office building	Under construction and ECMs implemented
7	Hubli Court Complex, Karnataka	Warm and Humid	Office building	Under construction and ECMs implemented
8	Medical College, Tumkur, Karnataka	Warm and Humid	Institute category	Feasibility report prepared and accepted by building owner.
9	Medical College, Bagalkote, Karnataka	Warm and Humid	Institute category	Feasibility report prepared and accepted by building owner.
10	Medical College, Haveri, Karnataka	Warm and Humid	Institute category	Feasibility report prepared and accepted by building owner.
11	Medical College, Chitradurga, Karnataka	Warm and Humid	Institute category	Feasibility report prepared and accepted by building owner.
12	D.C. Office complex at Mysore, Karnataka	Warm and Humid	Institute category	Feasibility report prepared and accepted by building owner.
13	Energy Management Centre, Trivandrum, Kerala	Warm and Humid	Office building	Under construction and ECMs implemented
14	CREDA building, Naya Raipur, Chhattisgarh	Composite	Office building	Under construction and ECMs implemented

ECBC Cell assistance for Karnataka PWD Buildings

S.no	Building	Location	Climatic Zone	Category	Area (m ²)	EPI Existing Design to EPI ECBC Case in kWh/m ² .year (savings %)	Incremental Cost in Lakh INR
1	Government Engineering College	Yelburga	Warm and Humid	Institute	34,220	107 to 63 [42%]	128
2	500 Bed Mysore Hospital	Mysuru	Warm and Humid	Hospital	39,715	227 to 110 [52%]	162
3	Multi-Purpose Parking Lot	Mysuru	Warm and Humid	Parking	27,390	29 to 22 [26%]	36
4	Lokopayogi Bhavana	Kalaburagi	Hot and Dry	Office	14,770	141 to 80 [44%]	65
5	Teacher's Academy	Dharwad	Warm and Humid	Institute	18,650	96 to 75 [22%]	68
6	DC Office	Mysuru	Warm and Humid	Office	29,010	123 to 89 [32%]	60
7	Mini-Vidhan Soudha	Shimoga	Warm and Humid	Office	2,925	60 to 34 [43%]	14
8	Yadgir Insitute of Medical Sciences	Yadgir	Hot and Dry	Institute	31,300	93 to 75 [20%]	146
9	Auditorium Template	Bengaluru	Moderate	Recreational	1,150	154 to 91 [41%]	4
10	Multi-Purpose Hall	Chitradurga	Warm and Humid	Assembly	1,736	120 to 104 [14%]	7
11	Multi-Purpose Hall	Bidar	Hot and Dry	Assembly	1,736	124 to 107 [14%]	7

Calculated Incremental Cost:

0.8 – 4.0% of construction cost

Simple Payback Period:

1 - 4 years

Cumulative Expected Annual Energy Saving:

7,117 MWh

Cumulative Annual CO₂ emission reduction:

5,840 T CO₂

New set of buildings

No.	Project Name	City	State	Building Typology	Area (mt ²)
I	Composite				397,810
1	Municipal Corporation Office	Sonipat	Haryana	Institutional	20,557
2	AIMS	Faridabad	Haryana	Hospital	247,379
3	Iskcon Temple	Dwarka	Delhi	Religious	18,103
4	UNDP India Headquarter	New Delhi	Delhi	Office	5,000
5	Ford Foundation	New Delhi	Delhi	Office	2,417
6	Raipur Township School	Raipur	Chattisgarh	Educational	9,019
7	Unnati	Greater Noida	Uttar Pradesh	Office	3,500
8	VCL Group Corporate Office	Gurugram	Haryana	Office	1,835
9	AIPL Business Park	Gurugram	Haryana	Commercial	90,000
II	Warm and Humid				536,399
10	KPCL Corporate Office, Bengaluru	Bengaluru	Karnataka	Office	17,821
11	KPCL Corporate Office, Raichur	Raichur	Karnataka	Office	8,446
12	BIC Office, Bangalore	Bengaluru	Karnataka	Office	4,420
13	TERNA International School	Mumbai	Maharashtra	Educational	21,025

New set of buildings

14	Nirlon Knowledge Park	Mumbai	Maharashtra	Office	165,000
15	52 Green Builders	Mumbai	Maharashtra	Commercial	4,650
16	Fluent Grid	Vishakhapatnam	Andhra Pradesh	Office	36,576
17	Esplanade by Forum	Bhubaneshwar	Odisha	Multiplex + Office	83,680
18	Priyamvada Birla Campus	Kolkata	West Bengal	Educational	60,895
19	Admerus R & D Labs	Hyderabad	Telangana	Office cum research lab	7,716
20	Gaudium School	Hyderabad	Telangana	Educational	44,600
21	ITC Kohinoor	Hyderabad	Telangana	Hospitality	81,570
III	Hot and Dry				119,431
22	CSE Institute	Alwar	Rajasthan	Institutional	4,070
23	Jaquar Flagship Office	Jaipur	Rajasthan	Office	6,970
24	Twin Star	Rajkot	Gujarat	Commercial cum Office	57,014
25	Blue Ski Commercial Office	Surat	Gujarat	Commercial cum Office	3,782
26	Pragya	Gandhinagar	Gujarat	Commercial	37,175
27	Ras Township School	Ras	Rajasthan	Educational	10,420

Total Area

1,053,640

Total Area (million)

1.05

New set of buildings (TA only)

No.	Project Name	City	State	Building Typology	Area (mt ²)
I	Composite				1,530,606
1	AIPL Joystreet	Gurugram	Haryana	Commercial	57,620
2	Ireo Mixed Use Commercial, Sector 61	Gurugram	Haryana	Mixed Use - Office +Hotel	130,700
3	Ascott-Ireo City Central	Gurugram	Haryana	Mixed Use - Retail	43,490
4	Ireo Mixed Use Commercial-Sector 58	Gurugram	Haryana	Mixed Use - Office +Hotel+ Retail	148,715
5	Wave Metro Mart	Noida	Uttar Pradesh	Commercial (Retail, Service Apartment and Offices)	416,944
6	Wave Parcel 3E	Noida	Uttar Pradesh	Commercial (Service Apartment and Offices)	141,542
7	Wave Parcel 3G	Noida	Uttar Pradesh	Commercial (Offices and SCO)	168,300
8	Wave Parcel 3DFH	Noida	Uttar Pradesh	Retail +Offices	208,850
9	Wave One	Noida	Uttar Pradesh	Commercial (Offices, Retail and SCO)	214,445
II	Warm and Humid				0
III	Hot and Dry				58,900
10	ITC Narmada	Ahmedabad	Gujarat	Hospitality	58,900
Total Area					1,589,506
Total Area (million)					1.59

Knowledge products

- » Quarterly **Newsletter** – EECB Update released
- » **Developed ECBC APP for mobile**
- » **Project website** (7000 users and 63000 Page views were recorded)
- » Anthology Book **“Energy Efficiency in Commercial Buildings: Learnings from India”** is in progress
- » Work on **Project videos** is in progress
 - (8 minute for screening during the events)
 - 2 minute for project briefing
 - 30 second for commercial and online outreach
 - **Case study videos**
- » UN Solution Exchange [Buildings sub community] to be used to connect stakeholders – there are 500 members, 250 messages sent in last 1 year



Next 6-9 months

1. Provide technical assistance to about 60 selected buildings [few more welcome] including few existing buildings
2. Learning from global experiences, Pskov region in Russia for EMIS, Croatia for Building energy passport. Switzerland actually reduced energy consumption to 25% of 1990 levels in one of the cities. It has set a policy to make 3% of existing buildings energy efficient every year
3. Enhance efforts to include energy efficiency in buildings in curricula
4. Support states and cities in preparing notification of ECBC, bye-laws to include ECBC, guidelines to do enforcement of ECBC,
5. Train municipal officials other stakeholders on ECBC.

“Knowledge becomes wisdom only after it has been put to **practical use.”**

- Unknown

Thank You!

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