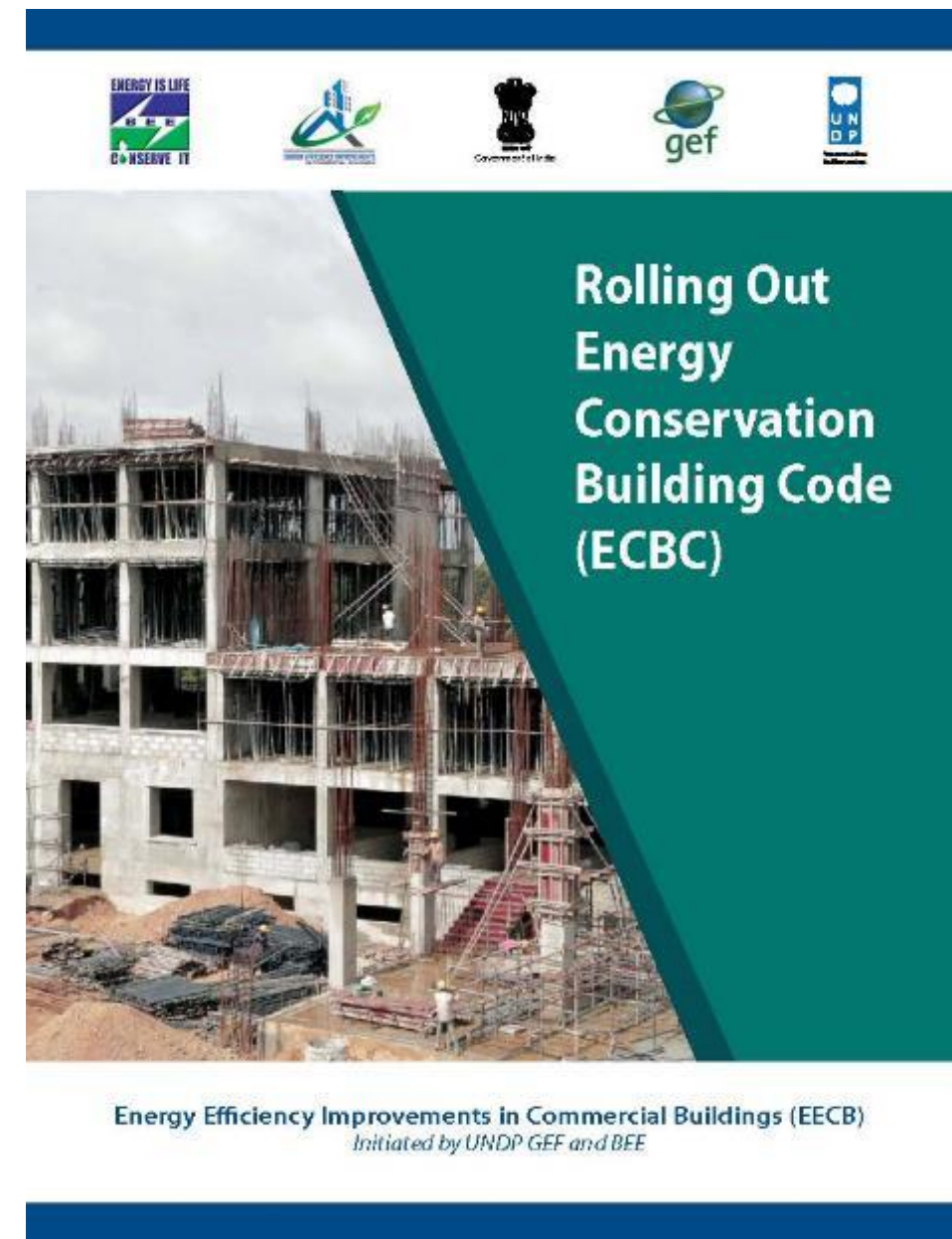


# UNDP GEF BEE Project: Energy Efficiency Improvements in Commercial Buildings (EECB)



5<sup>th</sup> Regional Workshop on ECBC Implementation in States

# Key points

- » Buildings contribute to 35 to 40% of commercial energy use globally and (31% in India), hence GHG emissions as well.
- » Buildings consume 365 Billion Units in India (Total is 1100 BU)
- » Energy efficiency in buildings can save at least 25% of energy, i.e. 91 BU of electricity annually translating to 74 million tCO<sub>2</sub> and 11 billion USD annually
- » India is going to build 2 to 3 times existing building stock by 2030
- » UNDP-GEF-BEE worked on three fronts (i) institutionalizing ECBC, (ii) Training and (iii) demonstrating ECBC compliant buildings

# International action

1. There are about 40 UNDP-GEF projects on buildings energy efficiency Globally.
2. Malaysia has voluntary codes covers envelop, lighting, HVAC. Though not mandatory, it is being implemented.
3. Russia: Mandatory. Code covers envelope, fenestration, insulation. buildings must have documentation – Energy Passport (must at design and occupation phase). 6.3 Million tCO2 reduced, aims to reduce 62 million tCO2.
4. China: Mandatory. HVAC and Building envelope. Compliance 53% in design and 21% in construction
5. France: Mandatory. Insulation, HVAC. For all new and existing buildings. 2007-2011: reduced 6.3 million tCO2, 2007-2012 reduced 9 million tCO2. ahead of schedule.
6. Croatia: Mandatory (for both residential and non-residential). HVAC, building materials, etc. 52% of all public sector buildings are compliant – reduced 18 million USD.
7. Turkey. Mandatory. Envelope, insulation. 20% energy reduction aimed.
8. Brazil. Mandatory. HVAC, water heating, lighting, electric power, building envelope. Expected reduction in GHG is 1.56 Million tCO2.
9. India has ECBC at National level consisting of (i) Building envelope (walls, roof, etc.), (ii) Heating, Ventilation and Airconditioning (HVAC), (iii) Service Water Heating, (iv) Lighting, and (v) Electrical Power. Implementation yet to happen. 10 states notified ECBC. Too early to assess impact on ground

S.no	State/UT	ECBC Amemdment	ECBC Notifica tion	Notificatio n in state bye-laws	Notificati on at Municipa lities	Enforc ement	Sched ule of Rates -PWD	ECBC Cell	Training & Capacity Development	Energy Simulation Software
1	Andhra Pradesh	✓	✓	✓	✓	✓		✓	✓	*
2	Arunachal Pradesh	✓							✓	
3	Assam	✓								
4	Bihar	✓						EU		*
5	Chandigarh UT									
6	Chhattisgarh	✓						✓	✓	✓
7	NCT of Delhi	✓						*		*
8	Goa									
9	Gujarat	✓								
10	Haryana	✓	✓	✓				✓		✓
11	Himachal Pradesh	✓						✓		
12	Jammu and Kashmir									
13	Jharkhand									
14	Karnataka	✓	✓				✓	✓	✓	✓
15	Kerala	✓						✓	✓	*
16	Madhya Pradesh	✓						EU		*
17	Maharashtra	✓						EU	✓	*

S.no	State/UT	ECBC Amendm ent	ECBC Notificati on	Notificatio n in bye-laws	Notificati on at Municipali ties	Enforc ement	Sched ule or Rates-PWD	ECBC Cell	Training & Capacity Developemet	Energy Simulation Software
18	Manipur									
19	Meghalaya									
20	Mizoram									
21	Nagaland									
22	Odisha	✓	✓					EU		*
23	Puducherry UT	✓	✓							
24	Punjab	✓	✓					✓	✓	✓
25	Rajasthan	✓	✓							
26	Sikkim									
27	Tamil Nadu	✓								
28	Telangana	✓	✓	✓	✓	✓		✓	✓	*
29	Tripura									
30	Uttar Pradesh	✓						✓		✓
31	Uttarakhand	✓	✓							
32	West Bengal	✓	✓							

Tasks related to mainstream ECBC	Responsibilities		
	Central Government	State Government	Local Government
<b>1. ECBC Code Development and Updating</b>	Bureau of Energy Efficiency (BEE)		
<b>2. ECBC ADOPTION</b>			
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
<b>3. ECBC IMPLEMENTATION</b>			
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

# ECBC Implementation Process

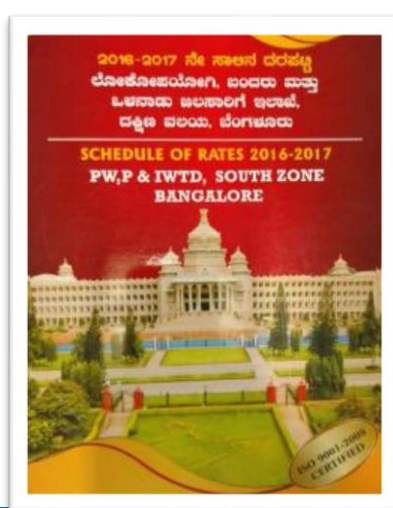
Tasks related to mainstream ECBC	Responsibilities		
	Central Government	State Government	Local Government
<b>4. ECBC ENFORCEMENT</b>			
Institutionalize mechanisms for enforcement and compliance checking in ULBs & Electrical Inspectorate		State Electrical Inspectorate	ULBs
Set-up of robust Monitoring 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



Particulars	Rate
01. SITE CLEARANCE AND GRADING	100
02. SITE WORKS (FOUNDATION, CURBING, PAVEMENTS)	100
03. SUB-BASES (SAND, BITUMEN, GRAVEL, ETC.)	100
04. BASE AND SURFACE COURSES	100
05. CONCRETE PAVEMENT	100
06. GEOMETRIC AND REFINEMENTS	100
07. TRAFFIC SIGNALS, MARKINGS, BATTER SIGN APPOINTMENTS	100
08. BRICKS - FULL FOUNDATION	100
09. BRICKS - WALL FOUNDATION	100
10. BRICKS - OPEN FOUNDATION	100
11. BRICKS - SUB STRUCTURE	100
12. BRICKS - CONCRETE SUPERSTRUCTURE	100
13. BRICKS - ROOF TRUSS ROOF AND PROTECTIVE ROOFING	100
14. BRICKS - ROOFING	100
15. BRICKS - ROOFING WITH INSULATION	100
16. BRICKS - ROOFING WITH INSULATION AND PROTECTIVE ROOFING	100
17. BRICKS - ROOFING WITH INSULATION AND PROTECTIVE ROOFING	100
18. BRICKS - ROOFING WITH INSULATION AND PROTECTIVE ROOFING	100
19. BRICKS - ROOFING WITH INSULATION AND PROTECTIVE ROOFING	100
20. BRICKS - ROOFING WITH INSULATION AND PROTECTIVE ROOFING	100

## 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

# Present levels of EPI in different type of buildings and in different climatic zones

Type	Warm & humid	Composite	Hot & Dry	Moderate	Simple average
Office building, less than 50% Air-conditioning	101	86	90	94	93
Office building with more than 50% Air-conditioning	182	179	173	179	178
Shopping mall	428	327	273	257	321
BPOs	452	437	-	433	440
Hotels – upto 3 star	215	201	167	107	173
Hotels – above 3 star	333	290	250	313	297
Hospitals	275	264	261	247	262
Institutes	150	117	106	129	126

# ECBC compliant buildings

- » Support 62 buildings to become ECBC compliant cumulating to over **2.5 million m<sup>2</sup> [vis-à-vis our target of 1.47 m m<sup>2</sup>]**
- » 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 m<sup>2</sup>
- Energy Performance Index (EPI) before adopting ECBC: 97 kWh/m<sup>2</sup>.year
- EPI after adopting ECBC: 62 kWh/m<sup>2</sup>.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 tCO<sub>2</sub> 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 <sup>2</sup>	Composite	Hospital category	Under construction and ECMs implemented
5	Chhattisgarh Samvad Office building, Naya Raipur, Chhattisgarh – EPI 78; area 10541 m <sup>2</sup>	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 <sup>2</sup> )	EPI Existing Design to EPI ECBC Case in kWh/m <sup>2</sup> .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 CO<sub>2</sub> emission reduction:

**5,840 T CO<sub>2</sub>**

# New set of buildings

No.	Project Name	City	State	Building Typology	Area (mt <sup>2</sup> )
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**

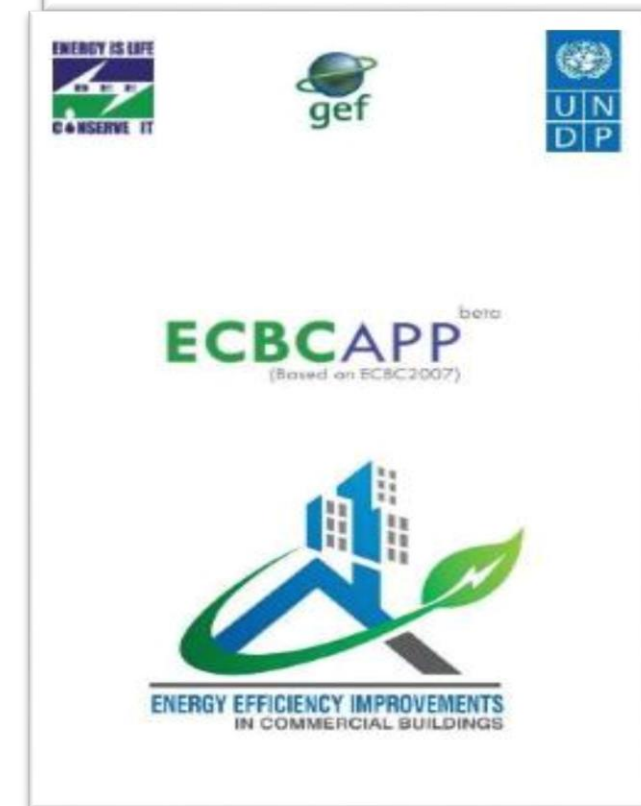


# New set of buildings (TA only)

No.	Project Name	City	State	Building Typology	Area (mt <sup>2</sup> )
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
<b>Total Area</b>					<b>1,589,506</b>
<b>Total Area (million)</b>					<b>1.59</b>

# 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 8 months

S.No.	Activities	Status
1	Technical assistance to 60 selected buildings [few more welcome] including few existing buildings	37 EEMBs are identified for providing technical assistance
2	Implementation of Energy Monitoring Information System (EMIS) based on learning from Pskov region in Russia	International expert has been engaged to assist with adaptation of EMIS and BEP to India context
3	Implementation of Building Energy Passport (BEP) based on Croatia experience	
4	Inclusion of building energy efficiency in the academic curricula of architecture and engineering	Work has to be initiated
5	Support states and cities in preparing notification of ECBC, bye-laws to include ECBC, guidelines to do enforcement of ECBC	<ul style="list-style-type: none"> <li>- ECBC Cell established in Himachal Pradesh on April 10, 2017.</li> <li>- Roaster of experts will be identified to support states and cities for ECBC implementation</li> </ul>

# Thank You!

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