

# Punjab Energy Development Agency (PEDA)



## Punjab Energy Conservation Building Code (Punjab ECBC)

“Energy Efficiency in Buildings”

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# ECBC and Punjab ECBC

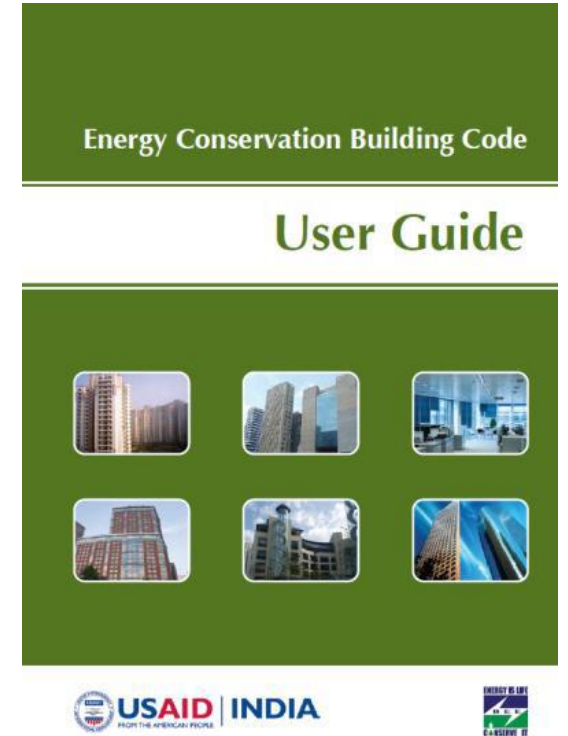
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# ECBC Introduction

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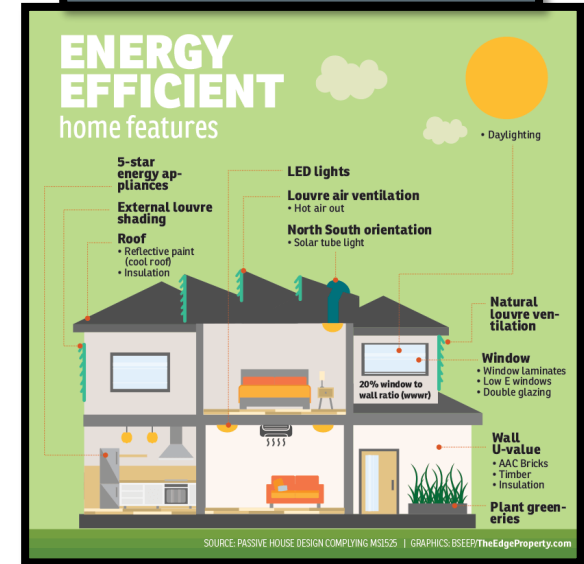
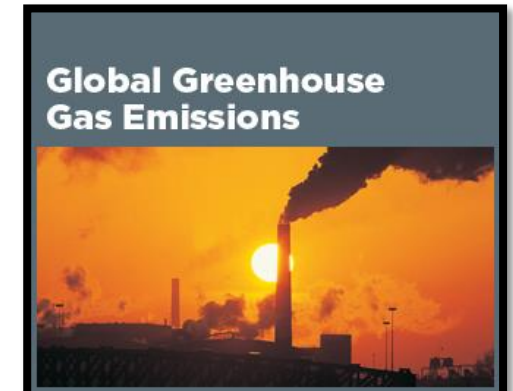
- ❖ ECBC, Energy Conservation Building Code is a document that specifies the energy performance requirements for all commercial buildings that are going to be constructed in India and is mandated by EC Act, 2001.
- ❖ The Energy Conservation Act 2001 empowered the central government to prescribe an Energy Conservation Building Code (ECBC). ECBC was launched in May 2007 developed by an Expert Committee, set up by India's Bureau of Energy Efficiency (BEE).



# Why Energy Efficiency?



- ❖ Energy Efficiency will reduce the increasing demand of energy consumption.
- ❖ Contribute to serious environmental and economical problems because of excessive consumption of energy and other natural resources.
- ❖ Help to control global emissions of greenhouse gases.
- ❖ Energy efficiency reduces costs, energy imports and pollution.
- ❖ **Energy Conservation** and **Renewable Energy** are said to be the “twin pillars” of a sustainable energy which leads to Energy Efficiency.



# Punjab ECBC Notification

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- ❖ Punjab ECBC – Punjab Energy Conservation Building Code
- ❖ Govt. of Punjab issued the Notification on **24th June 2016** for mandatory use of Punjab ECBC for the Energy Efficiency and its Conservation in the buildings or building complexes in the state of Punjab.
- ❖ Punjab ECBC has been notified and is now mandatory in the state of Punjab for upcoming buildings or building complexes.

# Objective & Scope

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- ❖ The Objective of Punjab ECBC is to provide **Minimum Requirements for Energy Efficient Design and Construction of Buildings** and their systems.
- ❖ The Punjab ECBC is applicable to buildings or building complexes that have-
  - **Connected Load in excess of 100kW OR**
  - **Contract Demand in excess of 120 kVA**
  - **Recommended for all buildings with conditioned area >500m<sup>2</sup>**

# Building Covered in Punjab ECBC

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Commercial Buildings

Office Buildings

Group Housing  
Complexes

Malls

Educational  
Buildings

IT Parks

Hospitals

Hotels

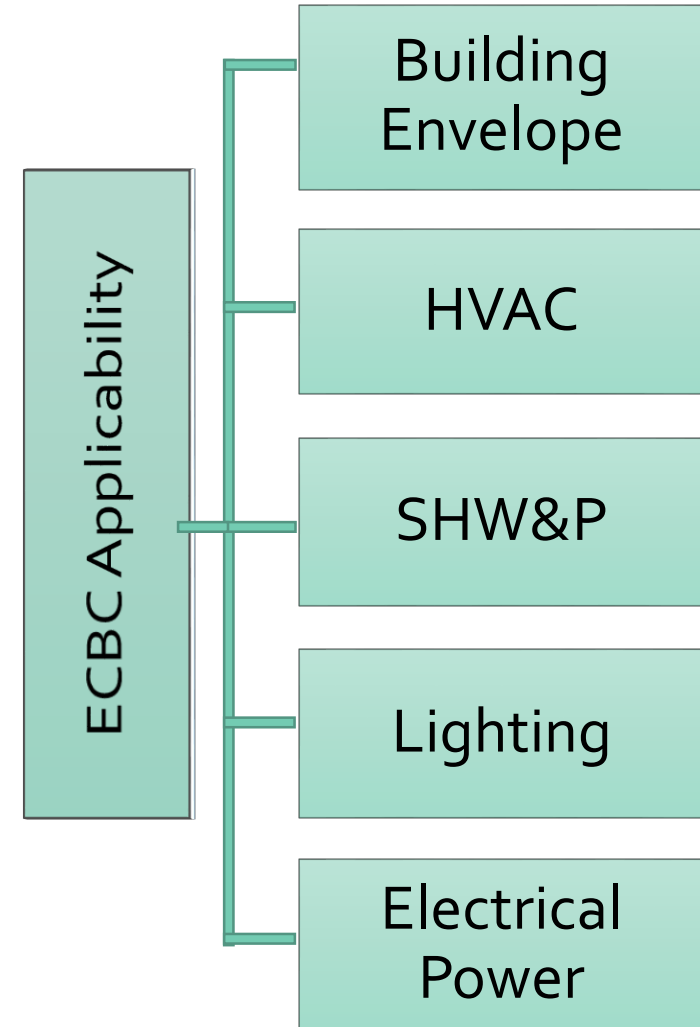
Govt. Buildings

# Applicable Building Systems



The provision of the Punjab ECBC applies to:

- ✓ Envelope of building
- ✓ Heating, Ventilation and Air Conditioning (HVAC)
- ✓ Service Hot Water and Pumping
- ✓ Lighting
- ✓ Electrical power





# Why ECBC?

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- ❖ Estimates based on simulation models indicate ECBC compliant buildings can use 40 – 60% less energy than conventional buildings.
- ❖ At the lowest estimate, this implies an annual saving of nearly Rs. 6 billion; with new rates for commercial establishments, this amount would be far higher.
- ❖ It has been estimated that the implementation of ECBC for commercial buildings with connected load above 100kW, will lead to energy savings to the tune 65 Million units which can supply electricity to 40,000 rural families for a year without additional installation of power plants, at current rate of commercial growth in cities.



# ECBC Compliance



Make **Mandatory use of ECBC in Govt./Private Buildings and Building Complexes in state**

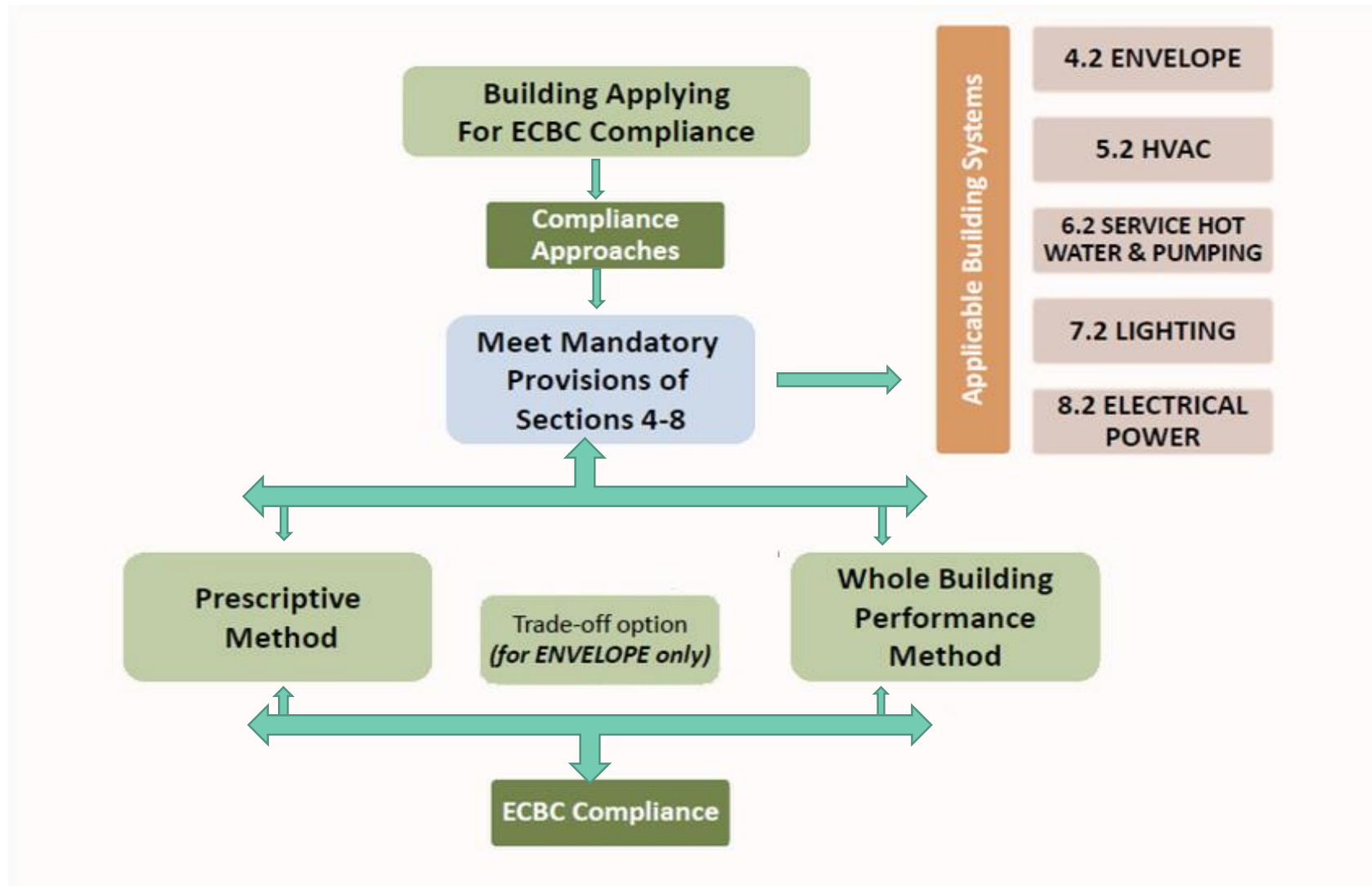
Provision of ECBC shall be integrated for **Effective Implementation in Building Bye-Laws, Specifications, Manuals, by Concerned Authorities and Local Bodies.**

After 6 months of Notification (Jan 2017), Building plans sanctioned by Govt. departments/Municipal Corporations/Councils/Panchayats or other authorities, **Without ECBC Implementation shall not be Allowed**

All the line departments like PUDA, Local Govt, PWD B&R, WSS, Architecture and other Authorities should make a **circular in their departments to ensure the Implementation of ECBC**

The concerned departments will **designate Nodal Officer to monitor and report the progress of enforcement of State Government Decisions** to Department of New & Renewable Energy, Govt. on quarterly basis.

# Steps to meet ECBC Compliance



# Mandatory Requirements

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## Building Envelope

- Fenestration
- Opaque
- Building Envelope Sealing

## HVAC

- Natural Ventilation
- Minimum Equipment Efficiencies
- Controls
- Piping and Ductwork
- System balancing
- Condenser

## SHW&P

- Solar Water Heating
- Equipment Efficiency
- Supplementary Water Heating System
- Piping Insulation
- Heat Traps
- Swimming Pools
- Compliance Documentation

# Mandatory Requirements

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## LIGHTING

- Lighting control
- Exit signs
- Exterior Building
- Ground Lighting

## ELECTRICAL POWER

- Transformers
- Energy Efficient motors
- Power Factor correction
- Check metering & monitoring
- Power Distribution Systems

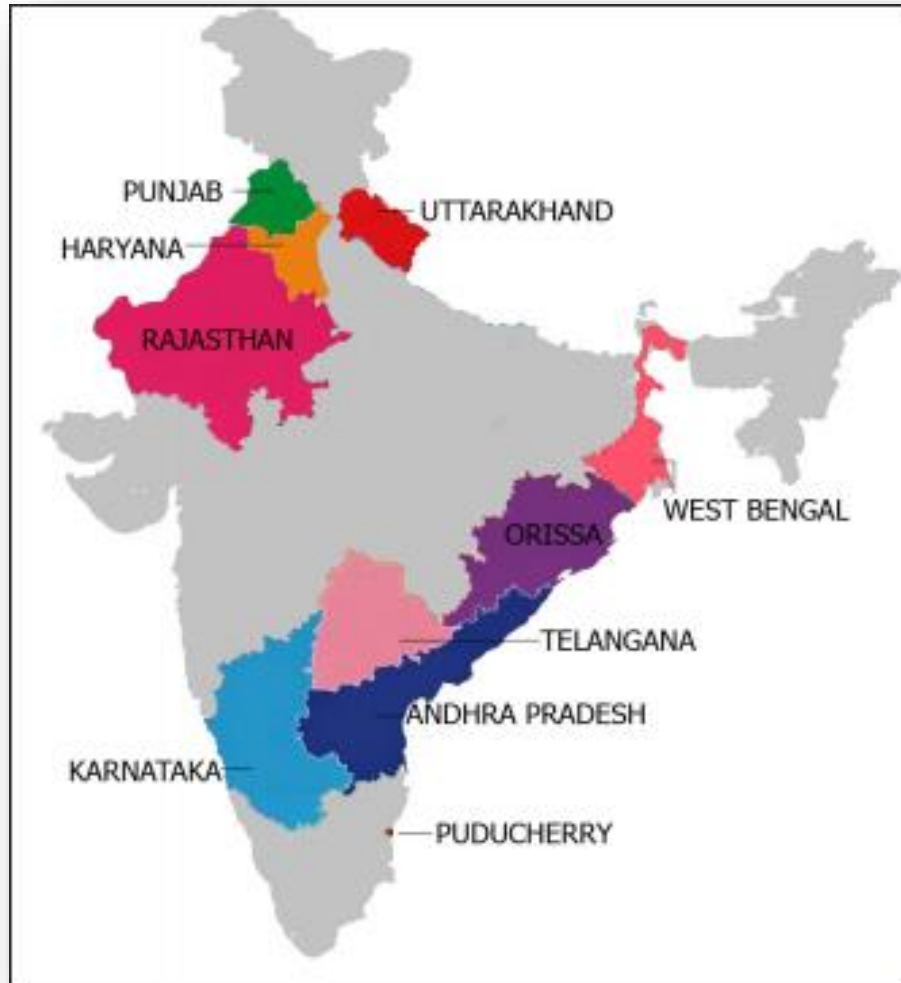
# ECBC Amended States



## ECBC Amendment (20): –

Odisha, Punjab,  
Karnataka, Rajasthan,  
Andhra Pradesh, Telangana, Uttarakhand,  
UT of Puducherry,  
Uttar Pradesh, Kerala,  
Gujarat, Tamil Nadu,  
Haryana, Chhattisgarh, Maharashtra,  
West Bengal, Himachal Pradesh, Bihar, Madhya  
Pradesh,  
Assam, Goa

# ECBC Notified States



States completed ECBC notification (10) :

- Odisha
- Punjab
- Karnataka
- Rajasthan
- Andhra Pradesh
- Telangana
- Uttarakhnd
- UT of Puducherry
- Haryana
- West Bengal

# Impact of ECBC Compliance

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- ✓ Lesser addition of power generation capacity
- ✓ Lower HVAC load
- ✓ High Energy-Efficiency HVAC System
- ✓ Improved Building Performance
- ✓ Natural Ventilation/Free Cooling System
- ✓ Building Insulation
- ✓ High Efficient windows
- ✓ Market Development for Energy Efficient products.



# Challenges for ECBC Implementation

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- Less knowledge on technical aspects of ECBC.
- 'Whole Building Performance' and Building Simulation Approach of ECBC, training is required.
- Higher Initial cost is a barrier, which is not practically in implementation.
- Enforcement and Monitoring are major challenges, and can add significantly to costs.
- Need to address the large stock of Existing Buildings and to improve their energy performance.

# Steps to Improve ECBC Implementation

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- Awareness Sessions, Capacity Building, Accreditation, Credibility
- Feedback Mechanisms and Decision processes to enable constant monitoring and adjustments are essential.
- Monitoring - at different stages of implementation (Through CEA)
- ECBC with Adequate and Credible information, people and organizations can make investments with paybacks of 2-5 years.
- Technological involvement from different expertise.



# Punjab ECBC Cell

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# ECBC Cell and their Functionaries

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- ❖ ECBC Cell has been established and made functional from October 2016 in PEDA Office, Chandigarh.
- ❖ The main objective of the Cell is to make the awareness among the people of Punjab.
- ❖ Regular Interaction with Govt. departments for proper Implementation of Punjab ECBC.
- ❖ Discussion and Co-ordination with stakeholder departments to carrying out the activities for the mandatory use of ECBC code.
- ❖ To support the Local Authorities involved in the building sanction in amending their bye-laws.
- ❖ To arrange and support the Capacity Building programmes among the Architects, Engineers, Consultants, Contractors and other Stakeholder Departments.

# Available Support for ECBC Facilitation

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**Step-1:** Provide Information to ECBC Cell, SDA about Upcoming Non-Residential Building Projects above 100kW connected load.

**Step-2:** Provide List of Project Co-ordination Team to ECBC Cell OR Intimate Project Team to Coordinate with ECBC Cell.

**Step-3:** The team members of ECBC cell will guide the Project Team for Implementation of ECBC to make their building Energy Efficient.

**Step-4:** ECBC cell will provide Compliance Checklist Forms and List of Empanelled ECBC Consultants to project team, and stakeholders etc.

**Step-5:** ECBC Cell will assist in verifying ECBC compliance forms received from the Certified Energy Auditor/ECBC Empanelled Consultant for further building sanctioning approval.



# **Support by ECBC Cell in Interactive Session & Capacity Building Programmes**

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# Summary Overview

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- Total No. of Interactive Sessions conducted	-	22
- Total No. of Officials/Participants attended Punjab ECBC Interactive Sessions	-	<b>190</b>
- Total No. of Capacity Building Programmes conducted	-	9
- Total No. Participants attended Capacity Building Programmes	-	<b>650</b>

# Participation in Interactive Session

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## Major Departments Involved-

- Department of Architecture (Punjab), Chandigarh
- Department of Town & Country Planning, S.A.S. Nagar, Mohali
- Department of Local Government, Chandigarh
- Department of PWD (B&R) (Elect.), Chandigarh
- Punjab PWD (B&R) (Bldg.), Chandigarh
- Department of Water Supply & Sanitation, Chandigarh
- Punjab State Power Corporation Limited (PSPCL), Patiala
- Punjab Urban Development Authority (PUDA), S.A.S Nagar, Mohali
- Private Architects- Chandigarh, Panchkula, Mohali
- Municipal Corporation, Mohali
- Municipal Council, Zirakpur



# Brief Summary of Interactive Session



Summary of Punjab ECBC Interactive Sessions			
Date	Department	No. of Attendees	Location
16.01.2017	Department of Architecture	4	PEDA Office
17.01.2017	Deptt of Local Govt.	12	Local Govt. Office
18.01.2017	PWD B&R Bldgs.	4	#221 (ECBC CELL), Sector 11A, Chandigarh
19.01.2017	PWD B&R Elect.	8	#221 (ECBC CELL), Sector 11A, Chandigarh
24.01.2017	Deptt of Town and Country Planning	28	PUDA Bhawan
30.1.2017	PMIDC	4	PMIDC Office
7.2.2017	Privates Architects (Planner Groups, Creative Consortium, Chandigarh)	4	#221 (ECBC CELL), Sector 11A, Chandigarh
16.2.2017	PGI	7	PGIMER, Chandigarh
17.2.2017	Privates Architects & Chitakara College (By Design, Chandigarh)	4	#221 (ECBC CELL), Sector 11a, Chandigarh

# Glimpses of Interactive Session



# Capacity Building Programmes



❖ Planned 37 Programmes

❖ Phase-II is being planned

❖ Completed 9 Programme in Phase-I

Summary of Punjab ECBC Capacity Building Programmes		
20.01.2017	NITTTR Chd	Capacity Building Program
23.01.2017	PIT Mohali	Capacity Building Program
13.02.2017	Giani Zail Singh College, Bathinda	Capacity Building Program
20.02.2017	Indo Global College, Ropar	Capacity Building Program
27.02.2017	Ambuja Knowledge Centre, Bathinda	Capacity Building Program
06.03.2017	Ambuja Knowledge Centre, Jalandhar	Capacity Building Program
18.03.2017	LPU Jalandhar	Capacity Building Program
27.03.2017	CT University Jalandhar	Capacity Building Program
08.04.2017	ITPI, Chandigarh	Capacity Building Program



# Glimpses of Capacity Building Programmes





# Steps Undertaken by Govt. of Punjab for ECBC Implementation

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# Punjab ECBC Advisory Committee

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- ❖ A Punjab ECBC Advisory Committee meeting have been formulated with the Nodal Officer from every Stakeholder departments for Implementation of Punjab ECBC in the state.
- ❖ The Objective of Punjab ECBC Advisory Committee is to conduct regular meetings, coordination, feedback, inputs for proper implementation of Punjab ECBC.
- ❖ 2 meetings have been conducted till the date.



# Notification by Department of Local Government, Punjab

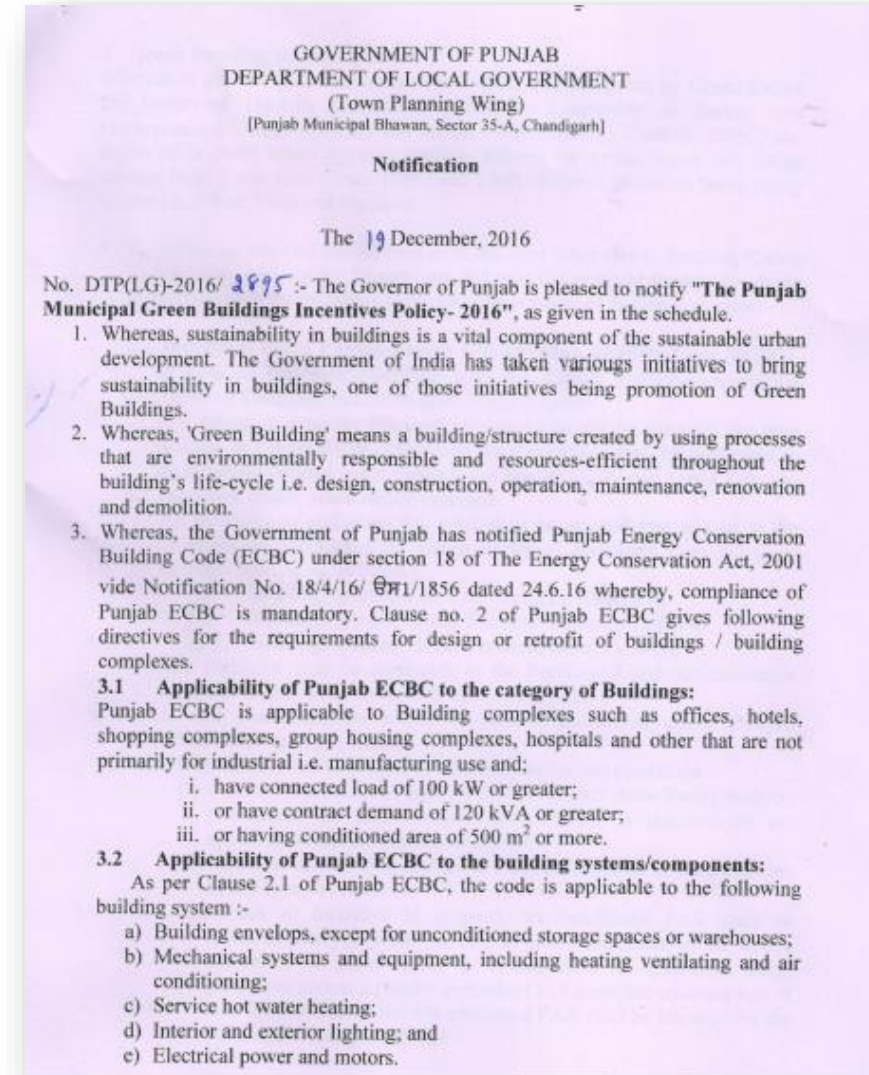


- ❖ Department of Local Government, Punjab released a Notification on 29<sup>th</sup> December 2016 under 'The Punjab Municipal Green Buildings Incentives Policy – 2016' where Incentives for Punjab ECBC Compliance are being provided.

Punjab is the first state in India where incentives are being provided for ECBC Compliant Buildings

**Incentives – 15% Rebate in Property Tax for Punjab ECBC Compliance**

**Incentives for Green Building – 5% Extra FAR for GRIHA, IGBC & LEED**



# Notification by Department of Housing & Urban Development, Punjab



- ❖ Department of Housing and Urban Development, Punjab released a Notification on 29<sup>th</sup> October 2013 under **Section 180(2)(i)** where provisions for use of Punjab ECBC included.

**“The use of Punjab Energy Conservation Building Code as notified under Energy Conservation Act, 2001 shall be applicable while approving the building plans for construction of buildings.”**

**PART III  
GOVERNMENT OF PUNJAB  
DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT  
NOTIFICATION  
The 25th October, 2013**

*No. G.S.R.54/P.A.11/1995/Ss 43 and 180/2013.- In exercise of the powers conferred by section 180 read with sub-section (2) of section 43 of the Punjab Regional and Town Planning and Development Act, 1995 (Punjab Act, 1995 (Punjab Act No. 11 of 1995), and all other powers enabling him in this behalf, the Governor of Punjab is pleased to make the following rules namely:-*

**RULES**

**PART VI  
PUBLIC HEALTH, WATER SUPPLY, SEWERAGE AND  
DRAINAGE**

- Section 180(2)(i) 49. Solar water heating:-** (1) Solar water heating system and Compact Fluorescent Lamps (CFLs) shall be provided as per the Notification No.2/123/05-STE(3) 370 dated 20 January/8th February 2006, or as per the provisions of Renewal Energy Systems and Punjab Energy Conservation Building Code (PECBC) or as notified by the Government from time to time.
- (2) Provision of Renewal Energy Systems (Solar Water Heating Systems, Solar Photo Voltaic System) and use of Punjab Energy Conservation Building Code as notified under Energy Conservation Act, 2001 shall be applicable while approving the building plans for construction of buildings.
- (3) An incentive of 50 percent refund of building scrutiny fee shall be permissible on completion of the building on production of certificate from competent authority of PEDDA (Punjab Energy Development Agency).



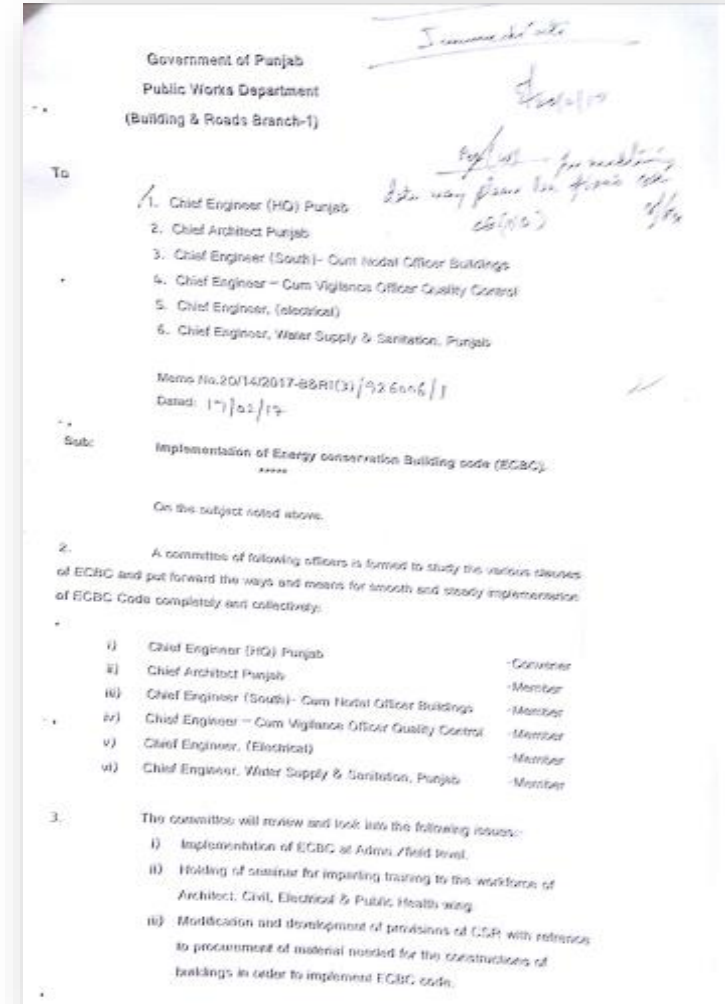
# Committee Formulation by Principal Secretary, Govt. of Punjab



- ❖ Govt. of Punjab, PWD B&R constituted a committee to study the various clauses of ECBC and put forward the ways and means for smooth and steady implementation of Punjab ECBC completely and collectively.

The committee will review-

1. Implementation of ECBC at Admin/Field Level.
2. **Modifications and development of provisions of CSR with reference to procurement of materials needed for construction of buildings in order to implement ECBC Code.**
3. Holding a seminar for imparting training to workforce of Architect, Civil, Electrical & Public Health wing.



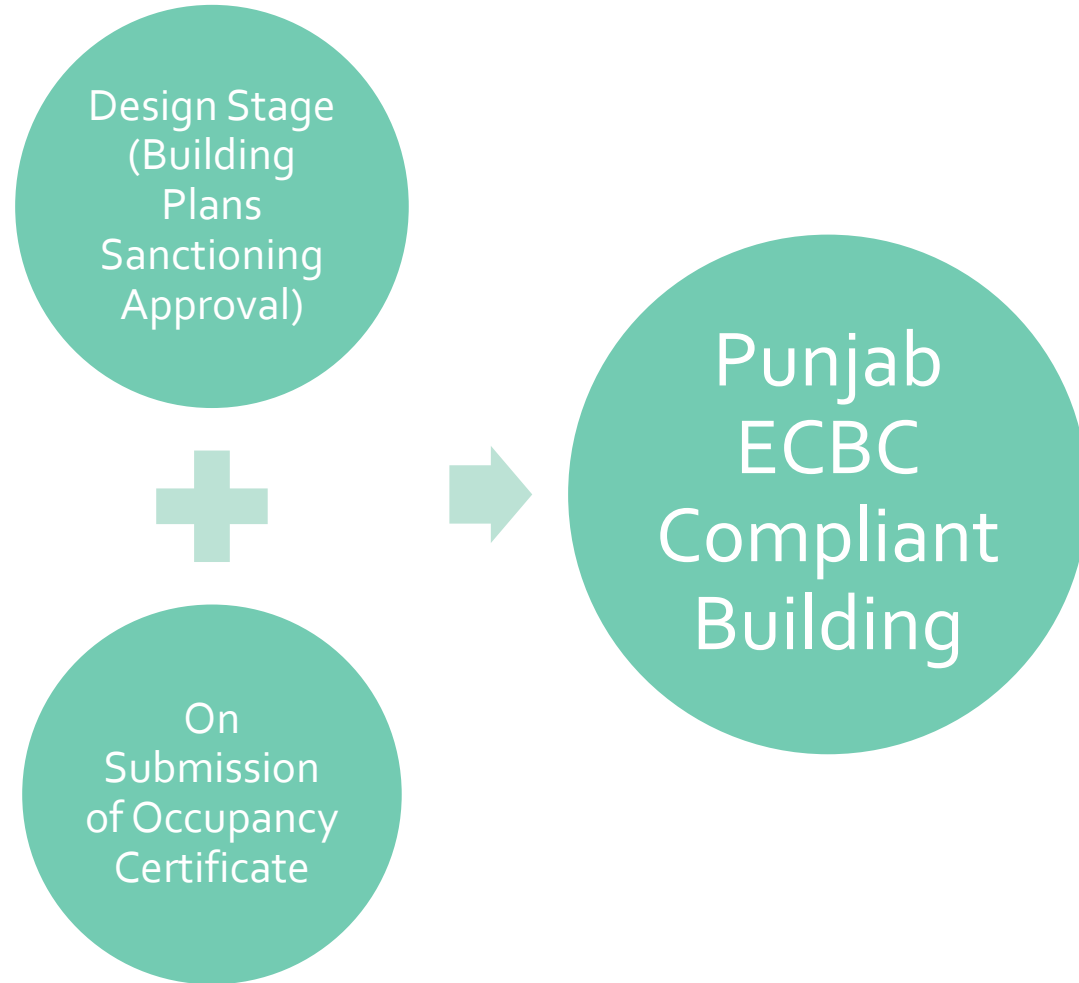


# Punjab ECBC Implementation Process

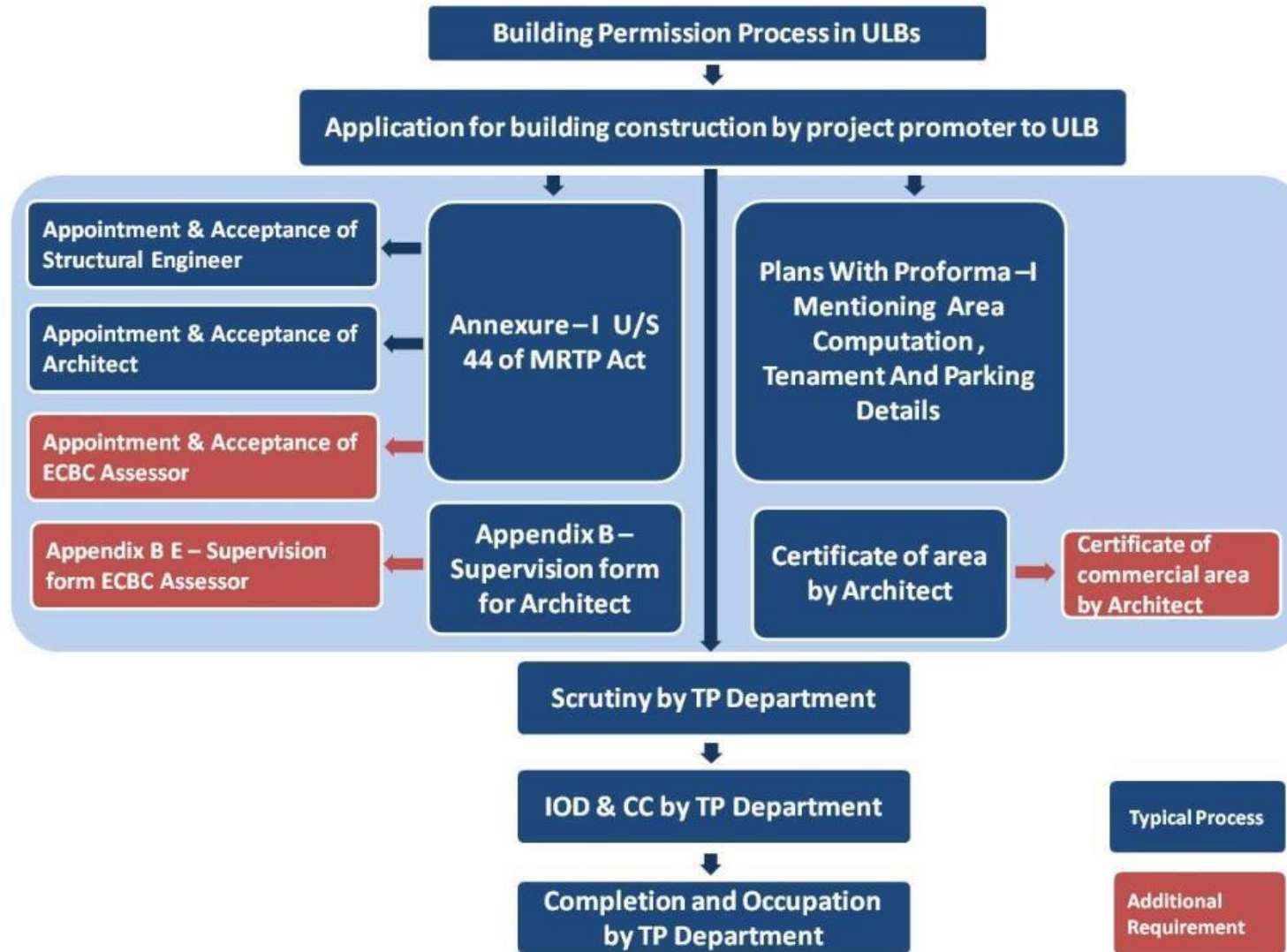
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# Steps for ECBC Compliance Process

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# ECBC In Building Approval Process



# Various Responsibilities & Available Support

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## How the process will take place for ECBC Compliance?

- Architect will submit the plans to Competent Authority.
- The approval should only be provided when the ECBC Compliance forms would be submitted along with supporting documents.
- Supporting Documents – Compliance Forms, Calculation Sheets, Certificate of ECBC Empanelled Consultant

## Non-Compliance of Punjab ECBC-

- Occupancy Certificate will not be Issued for non-compliance of Punjab ECBC in the upcoming buildings in the state of Punjab.

## Available Support-

- ECBC Empanelled Experts, ECBC Master Trainers, ECBC Professionals, ECBC Cell, Architects

63 – ECBC Empanelled Experts/Consultants

122 – ECBC Master Trainers

# ECBC Compliance Forms



Appendix F: PECBC Compliance Forms

### 15. APPENDIX G: PECBC Compliance Forms

#### 15.1 Envelope Summary

##### Envelope Summary

The Purjab Energy Conservation Building Code 2013 Compliance Forms

**Project Info**

Project Address: \_\_\_\_\_ Date: \_\_\_\_\_  
 For Building Department Use

Applicant Name: \_\_\_\_\_  
 Applicant Address: \_\_\_\_\_  
 Applicant Phone: \_\_\_\_\_

**Project Description**

New Building  Addition  Alteration  Change of Use

**Compliance Option**

Prescriptive  Envelope Trade-Off (Appendix D)  Whole Building Performance

Hospital, hotel, call center (24 hour)  Other building types (daytime)

**Vertical Fenestration Area Calculation**

Total Vertical Fenestration Area (rough opening) divided by Gross Exterior Wall Area times 100 equals % Vertical Fenestration

**Skylight Area Calculation**

Total Skylight Area (rough opening) divided by Gross Exterior Wall Area times 100 equals % Vertical Fenestration

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Appendix F: PECBC Compliance Forms

#### 15.2 Building Permit Plans Checklist

The Purjab Energy Conservation Building Code 2013 Compliance Forms

**Project Address** \_\_\_\_\_ **Date** \_\_\_\_\_

The following information is necessary to check a building permit application for compliance with the building envelope requirements in The Purjab Energy Conservation Building Code 2013.

Applicability (see sec. 4.3)	Code Section	Component	Information Required	Location on Plans	Building Department Notes
			<b>MANDATORY PROVISIONS (Section 4.2)</b>		
	4.2.1	Fenestration rating			
	4.2.1.1	U-factor	Specify whether per 4.2.1.1 or default in Appendix C		
	4.2.1.2	SHGC	Specify whether per 4.2.1.2 or default in Appendix C		
	4.2.1.3	All weather	Specify whether per 4.2.1.3 or default in Appendix C or ADM/AS		
	4.2.2	Roof envelope	Indicate roofing, underlayment, and weather wrapping		
	4.2.3	Sealing			
			<b>PREScriptive COMPLIANCE OPTION (Section 4.3)</b>		
	4.3.1	Roof	Indicate R-value on roof sections		
	4.3.2	Roof/ceiling	Indicate minimum reflectance and emittance on plans		
	4.3.3	Wall cavities	Indicate R-value on wall sections		
	4.3.4	Vertical fenestration	(1) Indicate U-factors on fenestration schedule. Indicate whether area is used or not used. If values are default, then specify frame type, glazing and gas with U-value. (2) Indicate SHGC or SC on fenestration schedule. Indicate whether area is used or not used. If values are default, then specify frame type, glazing and gas with U-value. (3) Indicate a percentage of solar film area used for solar control.		
	4.3.5	Skylights	(1) Indicate U-factors on fenestration schedule. Indicate whether area is used or not used. If values are default, then specify frame type, glazing and gas with U-value. (2) Indicate SHGC or SC on fenestration schedule. Indicate whether area is used or not used. If values are default, then specify frame type, glazing and gas with U-value.		
			<b>BUILDING ENVELOPE TRADE-OFF OPTION (Section 4.4)</b>		
			Provide calculations		

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Appendix F: PECBC Compliance Forms

#### 15.4 Mechanical Permit Checklist

The Purjab Energy Conservation Building Code 2013 Compliance Forms

**Project Address** \_\_\_\_\_ **Date** \_\_\_\_\_

The following information is necessary to check a building permit application for compliance with the mechanical requirements in The Purjab Energy Conservation Building Code 2013.

Applicability (see sec. 4.3)	Code Section	Component	Information Required	Location on Plans	Building Department Notes
			<b>MECHANICAL CHECKLIST</b>		
			<b>HEATING, VENTILATION AND AIR CONDITIONING (Chapter 6)</b>		
	6.2.2	Equipment efficiency	Provide equipment schedule with type, capacity, efficiency and energy recovery		
	6.2.3	Controls	Indicate thermostat with high setback, 8 different day types, and 2-hour manual control		
	6.2.3.1	Temp. & humid. control	Indicate temperature control with 1°C differential minimum		
	6.2.3.2	Control zone, fan	Indicate fan speed control, zone, and variable speed drive to control fan		
	6.2.4.1	Piping & insulation	Indicate R-value of insulation		
	6.2.4.2	Outdoor air intake	Indicate R-value of insulation		
	6.2.4.3	Outdoor air intake	Indicate R-value of insulation		
	6.2.5	System balancing	Specify system balancing		
			<b>PREScriptive COMPLIANCE OPTION (Section 6.1)</b>		
	6.1	Indicate whether project is compliant with PECBC Prescriptive Option. See Appendix Section 6.1 Table			
	6.5.1	Economizer			
	6.5.1.1	Air economizer	Indicate 100% capacity or schedule		
	6.5.1.2	Indirect evaporative	Indicate capacity for cooling season		
	6.5.1.3	Free cooling	Specify area		
	6.5.2	Vapor barrier			
	6.5.2.1	Piping for leaks	Indicate whether flow capacity on schedule		
	6.5.2.2	Insulation valves	Indicate low-voltage automatic isolation valves		
	6.5.2.3	Vapor barrier	Indicate whether specification		
			<b>SERVICE VENTS HEATING AND COOLING (Chapter 6)</b>		
			<b>MANDATORY PROVISIONS (Section 6.2)</b>		
	6.2.1	Solar heat rejection	Provide calculations to verify capacity to meet 20% demand		
	6.2.2	Equipment efficiency	Provide equipment schedule with type, capacity, efficiency and energy recovery		
	6.2.3	Piping insulation	Indicate R-value of insulation		
	6.2.4	Heat traps	Indicate heat traps on drawings of products manufacturers		
	6.2.5	Pool covers	Provide cover material color for pools		
	6.2.6	Pool cover 24°C	Provide R-2.1 insulation		

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Appendix F: PECBC Compliance Forms

#### 15.3 Mechanical Summary

The Purjab Energy Conservation Building Code 2013 Compliance Forms

**Project Info**

Project Address: \_\_\_\_\_ Date: \_\_\_\_\_  
 For Building Department Use

Applicant Name: \_\_\_\_\_  
 Applicant Address: \_\_\_\_\_  
 Applicant Phone: \_\_\_\_\_

**Project Description**

New Building  Addition  Alteration  Change of Use

**Compliance Option**

Prescriptive  System  Prescriptive  Whole Building Performance

Hospital, hotel, call center (24 hour)  Other building types (daytime)

The following information is required to be incorporated with the mechanical equipment schedules on the plans. For projects without plans, fill in the required information below.

**Cooling Equipment Schedule**

Equip ID	Brand Name	Model No.	Capacity kW	Total UA	OSL/CFM or EER/100	SEER or EER	IPV	Location

**Heating Equipment Schedule**

Equip ID	Brand Name	Model No.	Capacity kW	Total UA	OSL/CFM or EER/100	Input kW	Output kW	Efficiency

**Fan Equipment Schedule**

Equip ID	Brand Name	Model No.	Total UA	SP	kW	Flow Control	Location of Service

PLANS ENERGY CONSERVATION BUILDING CODE 88

Appendix F: PECBC Compliance Forms

#### 15.5 Lighting Summary

The Purjab Energy Conservation Building Code 2013 Compliance Forms

**Project Info**

Project Address: \_\_\_\_\_ Date: \_\_\_\_\_  
 For Building Department Use

Applicant Name: \_\_\_\_\_  
 Applicant Address: \_\_\_\_\_  
 Applicant Phone: \_\_\_\_\_

**Project Description**

New Building  Addition  Alteration  Change of Use

**Compliance Option**

Prescriptive  System  Prescriptive  Whole Building Performance

Hospital, hotel, call center (24 hour)  Other building types (daytime)

Alteration Exceptions (check box, if appropriate)  Less than 50% of the volume area new and installed lighting fixtures is being increased

**Maximum Allowed Lighting Wattage (Interior, Section 7.3)**

Location (Room/room no.)	Occupancy Description	Allowed Watts per m <sup>2</sup> or ft <sup>2</sup>	Area in m <sup>2</sup> or ft <sup>2</sup>	Allowed A Area

\*\* Document all exceptions

**Proposed Lighting Wattage (Interior)**

Location (Room/room no.)	Fixture Description	Number of Fixtures	Wattage/ Fixture	Watts Proposed

**Total Proposed Watts may not exceed Total Allowed Watts for Interior**

**Maximum Allowed Lighting Wattage (Exterior, Section 7.4)**

Location	Description	Allowed Watts per m <sup>2</sup> or ft <sup>2</sup> per luminaire	Area in m <sup>2</sup> or ft <sup>2</sup> per luminaire	Allowed Watts (m <sup>2</sup> or ft <sup>2</sup> )

**Total Proposed Watts may not exceed Total Allowed Watts for Exterior**

PLANS ENERGY CONSERVATION BUILDING CODE 90

Appendix F: PECBC Compliance Forms

#### 15.6 Lighting Permit Checklist

The Purjab Energy Conservation Building Code 2013 Compliance Forms

**Project Address** \_\_\_\_\_ **Date** \_\_\_\_\_

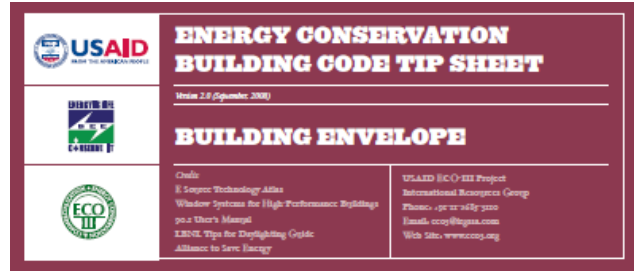
The following information is necessary to check a building permit application for compliance with the lighting requirements in The Purjab Energy Conservation Building Code 2013.

Applicability (see sec. 4.3)	Code Section	Component	Information Required	Location on Plans	Building Dept. Notes
			<b>LIGHTING (Chapter 7)</b>		
			<b>MANDATORY PROVISIONS (Section 7.3)</b>		
	7.2.1	Lighting Controls			
	7.2.1.1	Automatic shut-off	Indicate automatic shut-off locations or occupancy sensors		
	7.2.1.2	Space control	Provide schedule with type, indicate locations		
	7.2.1.3	Daylight control	Provide schedule with type and features, indicate locations		
	7.2.1.4	Exit lighting control	Provide photoluminescent or autonomous time switch		
	7.2.1.5	Additional control	Provide schedule with type, indicate locations		
	7.2.2	Exit signs	Indicate R-value maximum		
	7.2.3	Exterior building glazing lighting	Indicate minimum efficacy of 60 lumens/Watt		
			<b>PREScriptive INTERIOR LIGHTING POWER COMPLIANCE OPTION (Section 7.3)</b>		
	7.3	Indicate whether project is complying with the Purjab Prescriptive Option (7.3.2.1) in the Interior Lighting Schedule			
	7.3.2	Building area method	Provide lighting schedule with wattage of lamp and luminaire, number of fixtures, document all exceptions		
	7.3.3	Space fraction method	Provide lighting schedule with wattage of lamp and luminaire and number of fixtures. Document all exceptions		
	7.3.4.1	Luminaire wattage	Indicate on plans		
			<b>PREScriptive EXTERIOR LIGHTING POWER COMPLIANCE OPTION (Section 7.4)</b>		
	7.4	Exterior lighting power	Provide lighting schedule with wattage of lamp and luminaire and number of fixtures. Document all exceptions		
			<b>ELECTRICAL POWER (Chapter 8)</b>		
			<b>MANDATORY PROVISIONS (Section 8.2)</b>		
	8.2.1	Transformer	Provide schedule with transformer losses		
	8.2.2	Motor efficiency	Provide equipment schedule with motor capacity, efficiency		
	8.2.3	Power factor correction	Provide schedule with power factor correction		
	8.2.4	Check metering	Provide check metering and monitoring		

PLANS ENERGY CONSERVATION BUILDING CODE 91



# ECBC Resources



A well-designed building envelope not only helps in complying with the Energy Conservation Building Code (ECBC) but can also result in first cost savings by taking advantage of daylighting and correct HVAC system sizing. This document acts as a primer on better envelope design practices and steps needed to comply with ECBC.

**T**he building envelope refers to the exterior facade, and is comprised of walls, windows, roof, skylights, doors, and other openings. The envelope protects the building's interior and occupants from the weather conditions and other external elements. The design

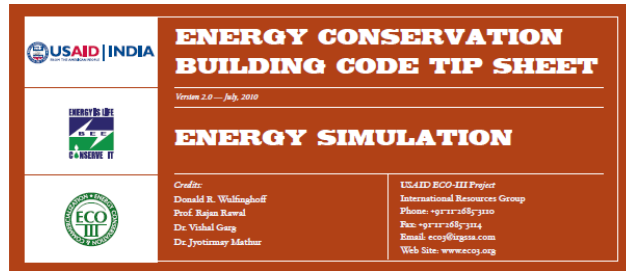
Secondly, to maintain thermal comfort and minimize internal cooling/heating loads, the building envelope needs to regulate and optimize heat transfer through roof, walls, windows, doors, and other openings. Effective insulation of roof and walls, appropriate selection of glazing and

**Passive Solar Design Strategy**  
Architects should pay attention to the following basic design elements in an effort to reduce the energy consumption in small commercial building that can be operated without Central HVAC System.

- ✓ ECBC Tips Sheets
- ✓ ECBC User Guide
- ✓ ECBC Notifications
- ✓ ECBC Incentives
- ✓ ECBC App



**ENERGY EFFICIENCY IMPROVEMENTS  
IN COMMERCIAL BUILDINGS**

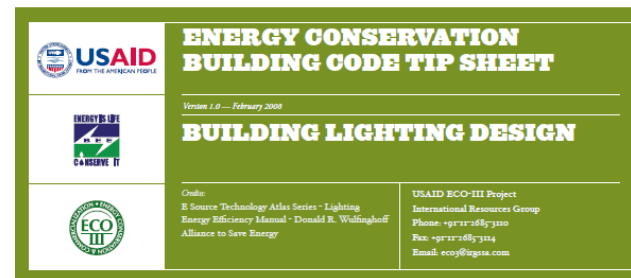


Energy simulation is a computer-based analytical process that helps building owners and designers to evaluate the energy performance of a building and make it more energy efficient by making necessary modifications in the design before the building is constructed. Use of energy simulation software is necessary to show compliance with Indian Energy Conservation Building Code (ECBC) via "Whole Building Performance Method." This Tip Sheet helps in understanding the basic concepts and processes involved in carrying out building energy simulation.

**I**n the last few years, commercial buildings have emerged as one of the fastest growing sectors in India. This phenomenon, combined with the expectations to create more comfortable indoor environmental

internal heat gains, etc. For example, a designer may decide to have large glazed façade for better aesthetic value and to increase the amount of daylight entering the building. This can lead to reduced lighting load but may increase the cooling

Technological advancements in computer software have provided several tools that can help the designers to predict and analyze the energy performance of a building with good accuracy and with substantial reduction in effort. Such



Lighting is a major energy consumer in commercial buildings. Heat generated from electrical lighting also contributes significantly to the energy needed for cooling of buildings. ECBC prescribes the amount of power for lighting, specifies types of lighting controls, and defines situations where daylighting must be used. This document (primarily adapted from E Source Technology Atlas - Lighting and Energy Efficiency Manual) provides guidance towards the design of ECBC compliant lighting systems in commercial buildings.

**I**n commercial buildings, lighting typically accounts for 20-40% of total energy consumption. Lighting is an area that offers many

the years, illumination standards have increased radically along with efficiency of lamps (Fig. 1). Modern offices require better illumination, specific activity-

of intimacy; corporate boardrooms call for lighting that reinforces a feeling of importance and success while adapting to audio-visual presentations; retail outlets



# Building taken-up for Punjab ECBC Compliance

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# Ongoing Building – PSPCL, Patiala



## Multistoried Integrated Corporate Office Complex

- Punjab State Power Corporation Limited (PSPCL)
- Patiala
- Architect: Planners Group, Chandigarh

**Punjab Energy Conservation Building Code Compliance**

# Building Information

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- Built-up Area/Covered Area = 22881.2 square feet
- Conditioned Area – 20838.9 sqm
- Contract Demand - 2550 kVA (Revision Required)
- Basement + Ground + Six Floors
- Plot Area – 24745 sqm
- Office Building with Training Block
- Solar PV Capacity - 80 kVA (Roof PV) + 150 kVA (Parking Roof PV) (Revision Required)
- Address: PSPCL, Shakti Vihar, Patiala 147001

# Area Details

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Floor	Area (sqm)
Basement	546.6
Ground Floor	3744.7
First Floor	3604.9
Second Floor	3871.4
Third Floor	3707.8
Fourth Flor	3183.9
Fifth Floor	3180.9
Sixth Floor	1587.5
Roof Area	4047.5
Ground Coverage Area	3744.7
Parking Area	11136.0

# Project Team Details

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Consultant	Name	Firm
Architect	Mr. Vikram Malik	Planners Group
HVAC Consultant	Mr. Anuj Agarwal	Ambience Consultants
Electrical Consultant	Rattan Lal	Sunrise Power Consultants
Plumbing Consultant	Selection in Process	Selection in Process
Civil Contractor	Rajesh Kumar Singla, Praveen Kumar	Praveen Kumar Consultants
Green Building Consultant	Selection in Process	Selection in Process
Structural Consultant	Pankaj Chopra	Chopra Consultancy Engineers
Landscape Consultant	Mr. Vikram Malik	Planners Group
Fire Fighting	Mr. Anuj Agarwal	Ambience Consultants

# Drawings & Calculations Received

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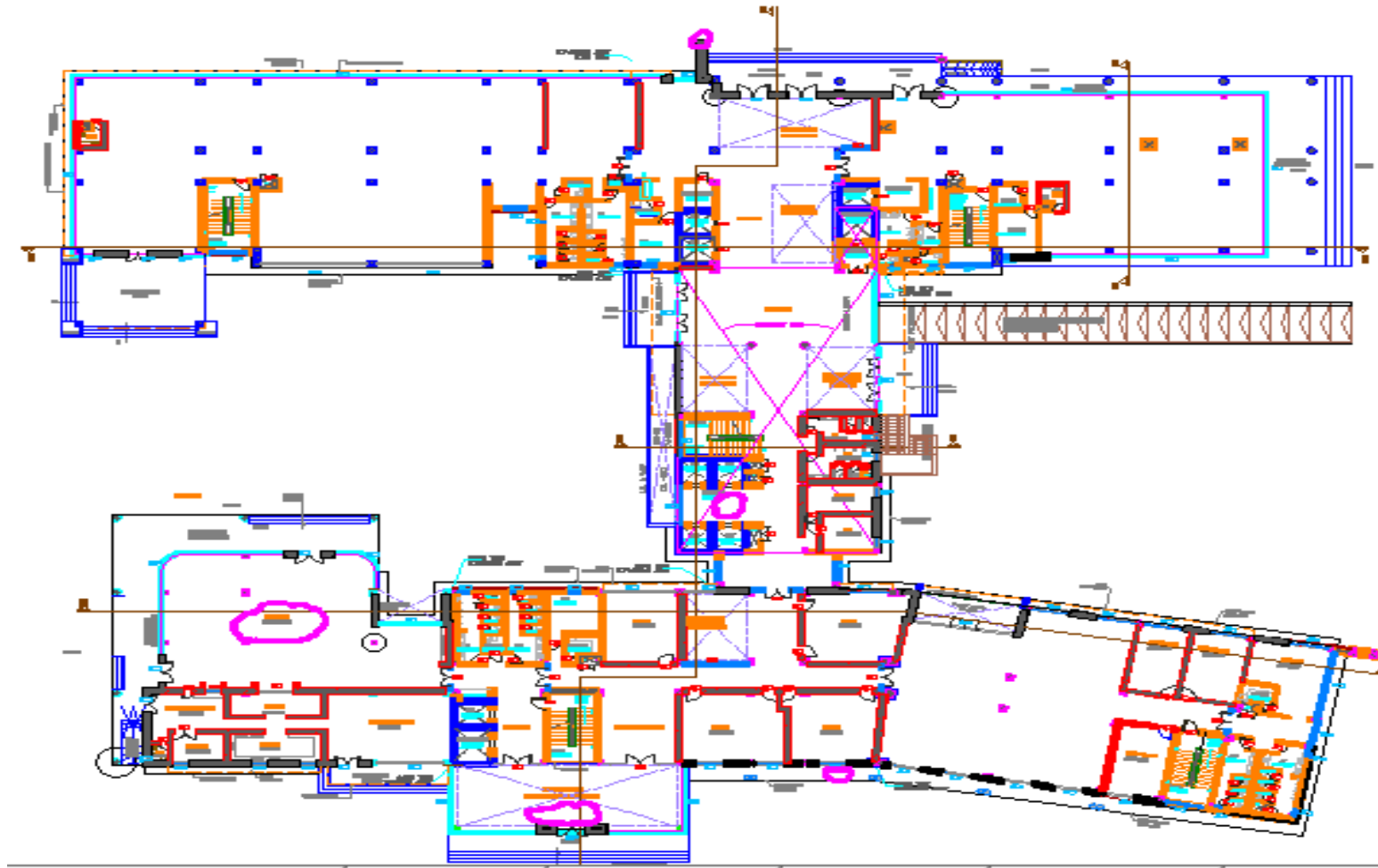


## Received and Guided

- Floor Plans
- Site Plan
- Elevations
- Sections
- Overall Wall Assembly Section
- Overall Roof Assembly Section
- WWR Calculation
- U Value Calculation
- M-Factor Calculation - Awaited

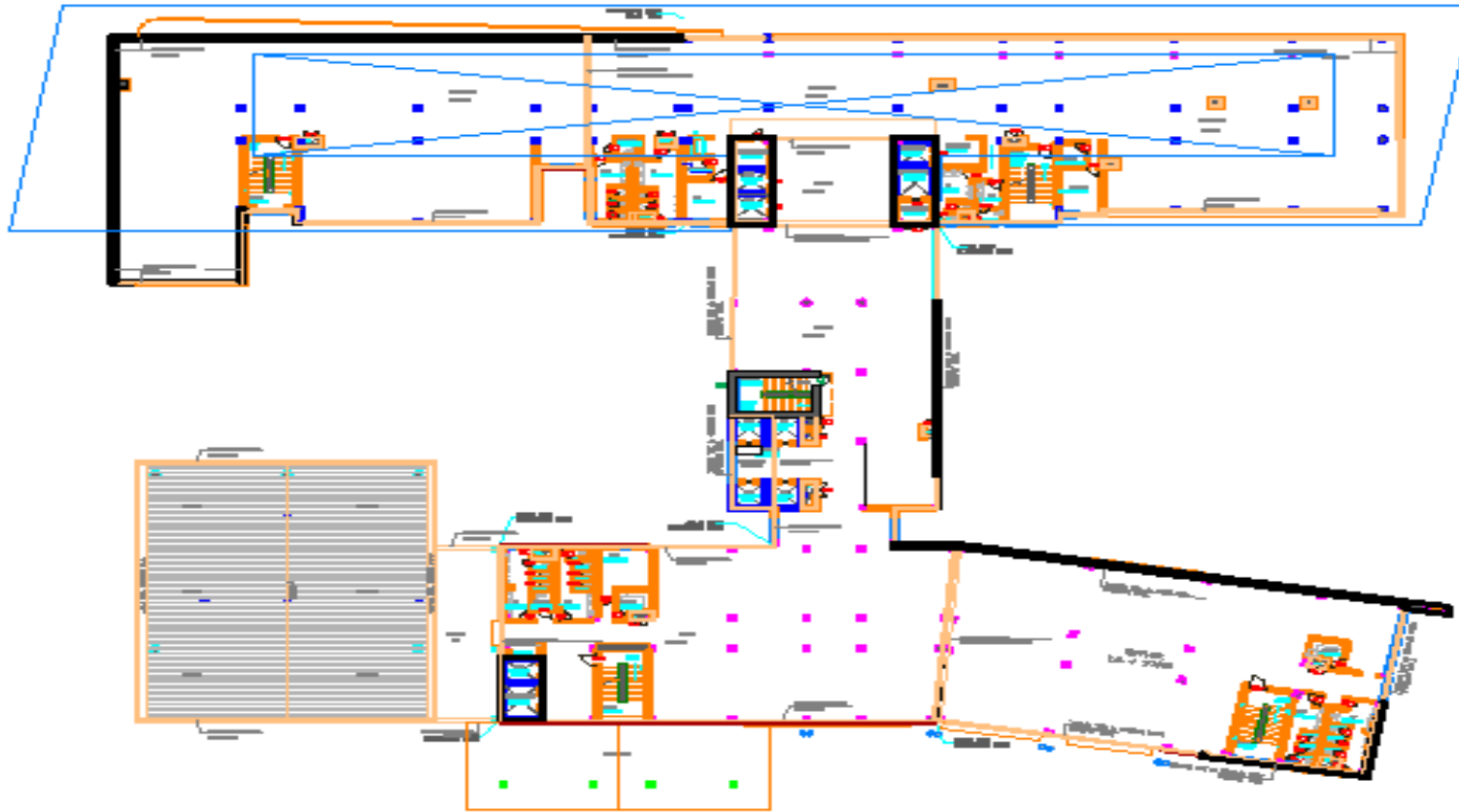
# Ground Floor Plan

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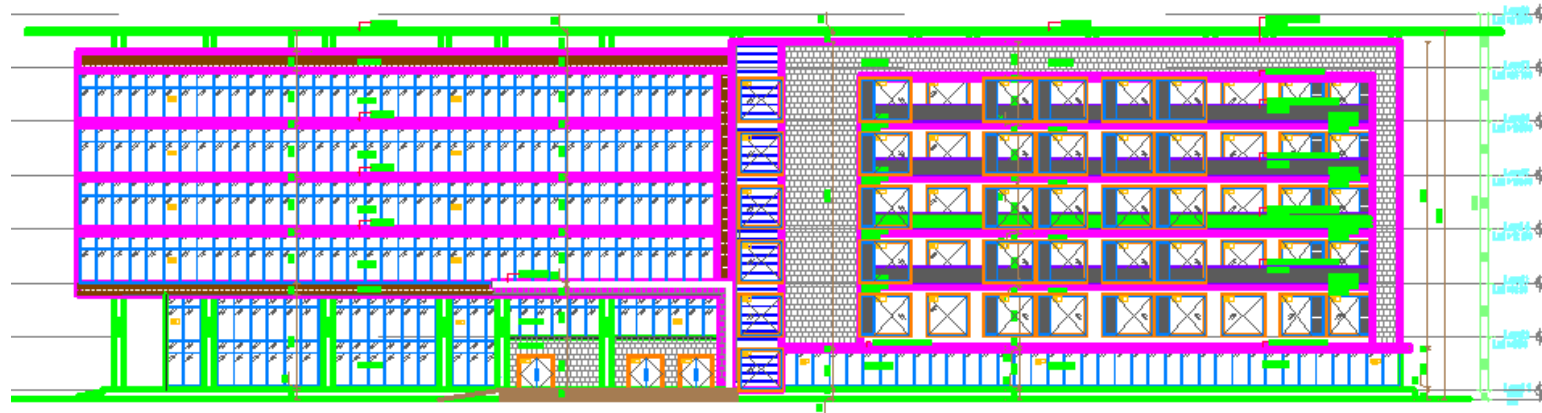
# Roof Plan

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# Elevation & Section Plan



Elevation Plan



Section Plan

# ECBC Cell Advise for Punjab ECBC Compliance



Sr. No.	Initial Proposed	After ECBC Cell Advise
1	Wall: <ul style="list-style-type: none"> <li>○ 25 mm PUFF Panel</li> <li>○ Double Brick Wall – AAC Blocks</li> </ul>	Already Meets Prescriptive Requirement
2	Roof: <ul style="list-style-type: none"> <li>○ 50 mm Glass wool</li> <li>○ 150 mm RCC Slab</li> </ul>	Roof: <ul style="list-style-type: none"> <li>○ 50 mm PUFF Spray</li> <li>○ 150 mm RCC Slab</li> </ul>
3	Roof Surface without High SRI Tiles	Roof with High SRI Tile
4	Glass not decided	Two type of Glass with SHGC of 0.2 and 0.23
5	Projection Factor Not Considered for Compliance	Projection Factor Considered for the Glass having SHGC of 0.23. Calculation is Awaited.
6	WWR 48%	Already Meets Prescriptive Requirement
7	Lighting with LED fixtures	Recommended to maintain uniform Lighting with proper LPD Design
8	Chiller	Chiller below 300 tons with 5.4 COP at least
9	Option (Geothermal/Cooling tower)	Any options would be suitable. The pumps used for circulation should be VFD integrated.



# **Recommended Building Materials for Punjab ECBC Compliance**

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# Opaque Construction (Wall)

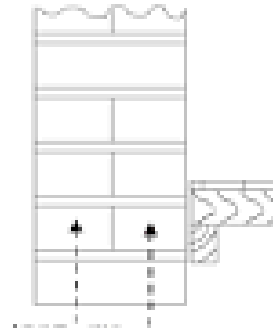


## OPAQUE WALL

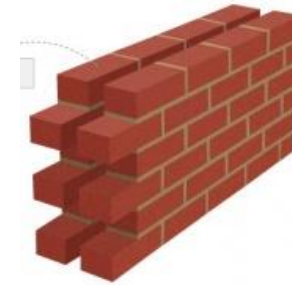
- The wall thickness, materials and finishes can be chosen based on the heating and cooling needs of the building.



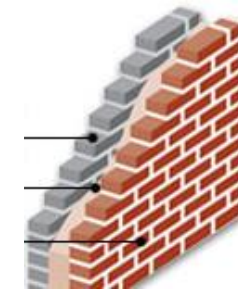
Shading wall



Double Brick Wall



Cavity Wall



Insulated Wall



Curtain Wall

## ECBC Requirements for Opaque Walls

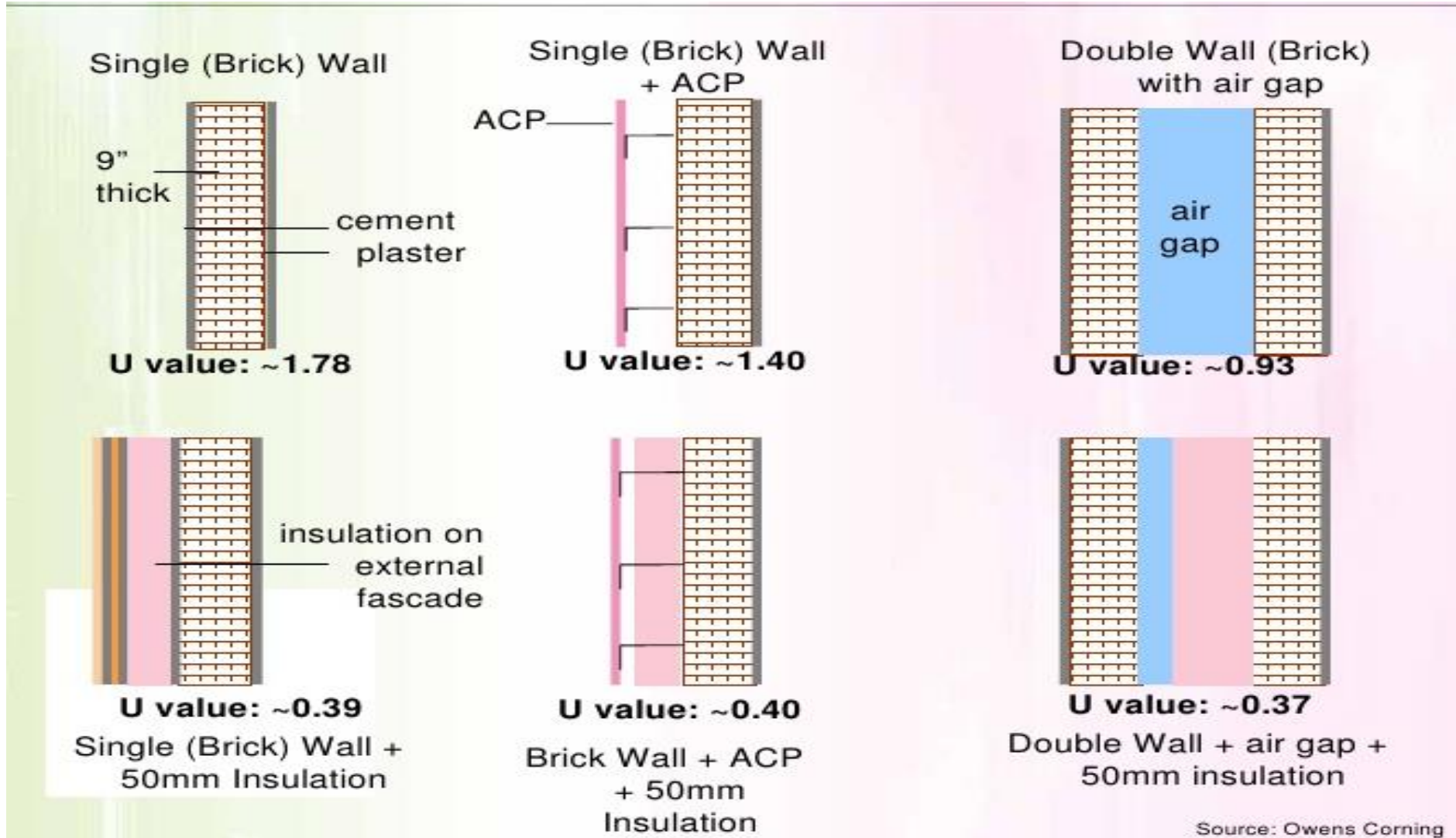
Opaque walls shall comply with either the maximum assembly U-factor or the minimum insulation R-value .

**Table 4.2: Opaque Wall Assembly U-factor and Insulation R-value Requirements**

Climate Zone	Hospitals, Hotels, Call Centres (24 Hour)		Other Building Types (Daytime)	
	Maximum U-factor of the overall assembly (W/ U-0.440)	Minimum R-value of insulation alone (m <sup>2</sup> -°C/W)	Maximum U-factor of the overall assembly (W/ m <sup>2</sup> -°C)	Minimum R-Value of insulation alone (m <sup>2</sup> -°C/W)
Composite	U-0.440	R-2.10	U-0.440	R-2.10

**Note:** Punjab is covered by Composite climate zone only. For information on other climate zones, please refer relevant tables of ECBC

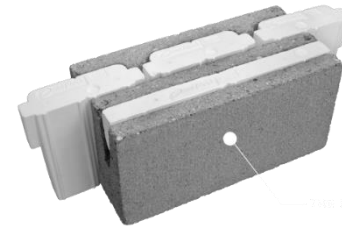
# Opaque Construction (Wall)



# Recommended Techniques for Wall



- Thermal performance of walls can be improved by following ways:
  - ❖ Increasing Wall Thickness
  - ❖ Providing Air Cavity between Walls and Hollow Masonry Blocks
  - ❖ Applying Insulation on the External Surface.
  - ❖ Use Fly Ash Bricks, AAC Blocks, etc.
  - ❖ Applying Light Colored distemper on the Exposed side of the Wall.
  - ❖ Applying Solar PV on Exterior Façade of the Wall.
  - ❖ Provide Hanging Garden on the East-West side of a building is beneficial in a Composite Climate.



Thermal Insulated bricks



AAC Block



Hollow Block



Fly Ash Clay Brick

Sample U-Value Calculation for Wall for Punjab ECBC Compliance

	LAYER	BRAND	THICKNESS (L) (mm)	L/1000	THERMAL CONDUCTIVITY (K)-W/MK	REFERENCE	RESISTANCE (L/k)	U VALUE (1/R)
<b>Option 4</b>	Surface Film Resistance (Rsi)					ECBC User Guide	0.1	
	Cement Plaster	On Site	12	0.012	0.750	ECBC User Guide	0.016	
	Insulation PUFF Spray	Lloyd	25	0.025	0.023	Lloyd Data Sheet	1.087	
	AAC Blocks	Biltech	225	0.225	0.160	ECBC User Guide	1.406	
	Cement Plaster	On Site	12	0.012	0.750	ECBC User Guide	0.016	
	Surface Film Resistance (Rse)					ECBC User Guide	0.04	
	<b>Total Thickness</b>			<b>274</b>				<b>2.665</b>

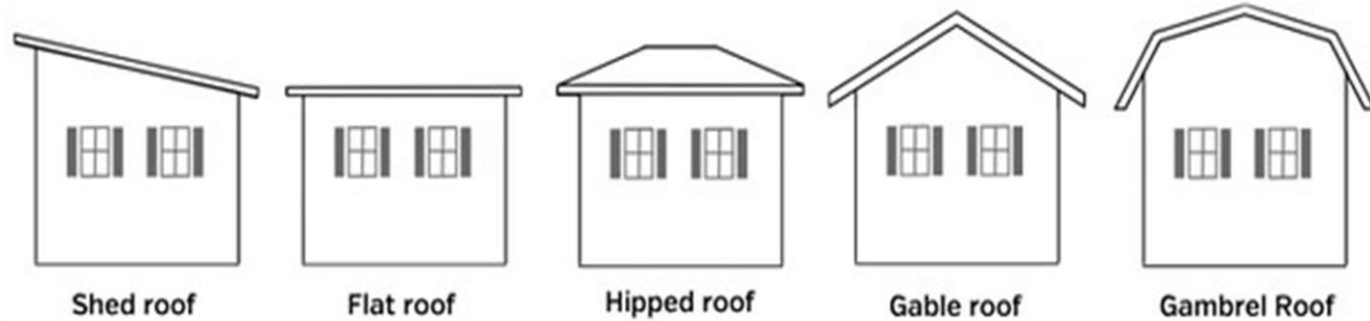




# Opaque Construction (Roof)

## Roof

- It also denotes the framing or structure which supports that covering.



## ECBC Requirements for Opaque Roof

Roofs shall comply with either the maximum assembly U-factor or the minimum insulation R-value.

**Table 4.1: Roof assembly U-factor and Insulation R-value Requirements**

Climate Zone	24-Hour use buildings Hospitals, Hotels, Call Centers, etc.		Daytime use buildings Other Building Types	
	Maximum U-factor of the overall assembly (W/ m <sup>2</sup> -°C)	Minimum R-value of insulation alone (m <sup>2</sup> -°C/W)	Maximum U-factor of the overall assembly (W/ m <sup>2</sup> -°C)	Minimum R-Value of insulation alone (m <sup>2</sup> -°C/W)
Composite	U-0.261	R-3.5	U-0.409	R-2.1

# Opaque Construction (Roof)

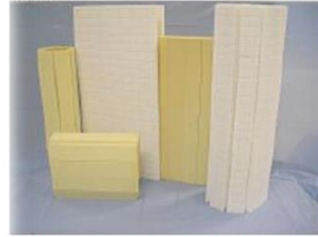


Brick Bat Coba



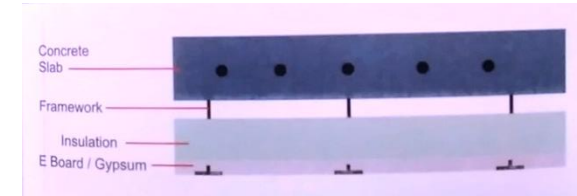
(source: [www.smallfvingarts.com](http://www.smallfvingarts.com))

Expanded Polystyrene Slabs



(source: [www.directindustry.com](http://www.directindustry.com))

Polyurethane/ Polyisocyanurate Slabs



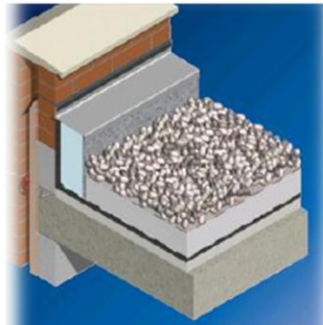
Roof under deck insulation



Roof over deck insulation



Foam Concrete



(source: [www.img.archiexpo.com](http://www.img.archiexpo.com))

Extruded Polystyrene Slabs



Coated Roof



Green Roof

# Recommended Techniques for Roof

- Thermal performance of roof can be improved by following ways :
  - ❖ Apply Insulation on Roof (Underdeck/Overdeck)
  - ❖ Use light colored Roofs having high SRI (Solar Reflectance Index) value
  - ❖ Covered with Highly Reflective tiles.
  - ❖ Covered with Solar PV.
  - ❖ Covered with Green Roof.



SRI Paint



Broken China Mosaic

Sample U-Value Calculation for Roof for Punjab ECBC Compliance

Roof Assembly									
	LAYER	BRAND	THICKNES S (L) (mm)	L/1000	THERMAL CONDUCTIVITY (K)- W/MK	REFERENCE	RESISTANC E (L/k)	U VALUE (1/R)	
Option 1	Surface Film Resistance (Rsi)					ECBC User Guide	0.13		
	White Tile	Thermatek	8	0.008	0.236	Thermatek	0.034		
	Cement Screed	Onsite	50	0.050	1.208	ECBC User Guide	0.041		
	Insulation PUFF Spray	Lloyd	60	0.060	0.023	Lloyd Data Sheet	2.609		
	Mother slab (RCC)	On Site	100	0.100	1.411	ECBC User Guide	0.071		
	Cement Plaster	On Site	12	0.012	0.750	ECBC User Guide	0.016		
	Surface Film Resistance (Rse)					ECBC User Guide	0.040		
	<b>Total Thickness</b>			<b>230</b>				<b>2.941</b>	<b>0.340</b>

# Glass



## Glazing Area

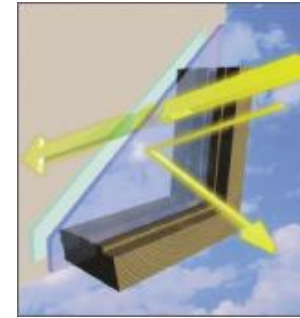
80-90% of the total area and therefore the most important part to address for achieving energy efficiency .

## Frame

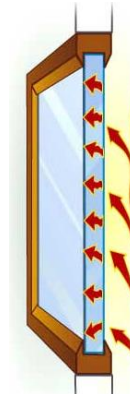
Important to optimize the overall energy efficiency of the window .

- Proper location, sizing, Glazing, Frames and shading form
- Proper location, sizing, Glazing, Frames and shading form

## Window



SPECTRALLY SELECTIVE COATINGS



HEAT-ABSORBING TINTS



LOW-EMISSION COATINGS

## ECBC Requirements for Vertical Fenestration

Vertical fenestration shall comply with the maximum area weighted U-factor and maximum area weighted SHGC requirements.

**Table 4.3: Vertical Fenestration U-factor and SHGC requirements (U-factor in  $W/m^2\cdot^{\circ}C$ )**

Climate	Maximum U-factor	WWR $\leq$ 40%	40% $<$ WWR $\leq$ 60%
		Maximum SHGC	Maximum SHGC
Composite	3.30	0.25	0.20

See Appendix C clause 11.2.1 for Default values of Unrated Fenestration





# Recommended Techniques for Glass

## GLAZING

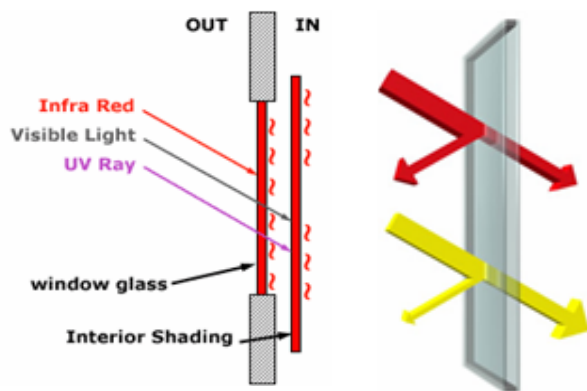
- Single Glazing with High Performance Coating
- Double Clear Glazing
- Double High Performance Glazing

## FRAME

- UPVC Frame
- Aluminum Frame With Thermal Break

## UPVC Window

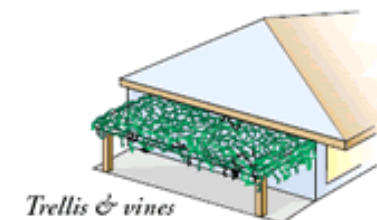
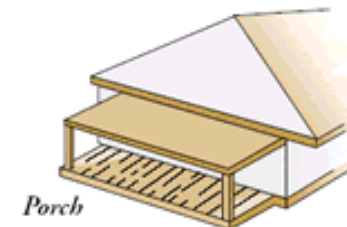
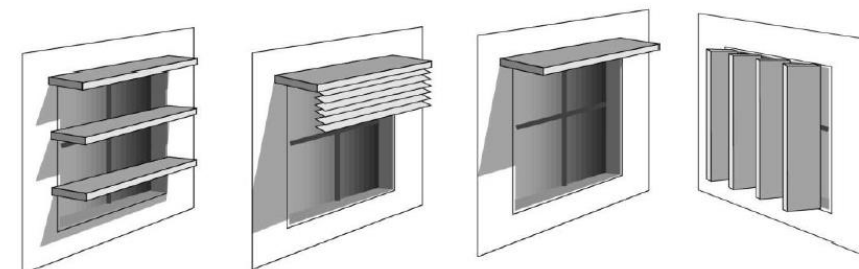
- Single Glazing
- Double Glazing
- High Performance Single Glazing
- High Performance Double Glazing



Solar Control Interior Shading



Movable Louvers/ Barriers



Fixed Overhangs/ Louvers



# Recommended Techniques for Lighting

---

- ❖ Provide Automatic Lighting Controls
- ❖ Internal and External Lighting Controls
  - ❖ Occupancy Sensors
  - ❖ Daylight & Motion Sensors
  - ❖ Astronomical Time Switch & Photo sensors
- ❖ Maintain Minimum LPD (Lighting Power Density)
- ❖ Separate Controls for Separate Lighting
- ❖ Recommended to use LED fixtures
- ❖ Energy Efficient Lighting Applications





# Latest Energy Efficient HVAC Technologies

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1. VRV/VRF (Variable Refrigerant Volume/Variable Refrigerant Flow)
2. Chiller and Other Centralized Air-Conditioning Systems
3. District Cooling Systems
4. Radiant Cooling Systems
5. Geothermal Cooling
6. Thermal Energy Storage
7. Boilers
8. Unitary Heat Pumps
9. Earth Air Tunnel
10. Chilled Beams

and so on.....

Maintain Minimum  
Equipment Efficiencies

Minimum BEE rated 3-Star  
Window/Split ACs

Automatic  
Controls

Provide Natural  
Ventilation





# Ongoing & Upcoming Buildings

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# Ongoing Buildings for ECBC Compliance



Client Name	Project Name	Location	Built-Up Area (SQ.FT.)	Type of Building	Status
Punjab State Power Corporation Limited (PSPCL)	Multistoried Integrated Corporate Office Complex	Patiala	2,46,190	Office	5 meetings have already been conducted with Architects & concerned Departments.
IK Gujral-Punjab Technical University (IKG-PTU)	Residential Quarters & Group Complex	Kapurthala	12,35,412	Building Complex	Compliance forms are being prepared.
PGIMER	Satellite Center	Sangrur	5,00,340	Hospital	Site meeting have been conducted with Contractor, Consultants & Architects
IIT, Ropar	Administrative Blocks & Hostels	Ropar		Institute & Building Complex	Building information details with Compliance forms are being prepared.
CMC Ludhiana	Christian Medical College and Hospital	Ludhiana	7,76,134	Hospital	Punjab ECBC Compliance forms submitted. Supporting documents are being prepared.

# Upcoming Buildings for ECBC Compliance



Department of Town & Country Planning, Punjab  
O/o Nodal Officer cum Senior Town Planner, Patiala.

Report regarding ongoing Projects for compliance of Punjab Energy Conservation Building Code (ECBC) in the state of Punjab.

Information of ongoing Projects in the Jurisdiction of STP office Patiala.				
Sr. No.	Name of Subject/ Location of CLU	Purpose	Area	Date of Disposal CLU Issued
1.	Seth Bihari Lal Memorial Educational Trust, Dr. Mela Ram Road Street No. 3, MCBZ-3-04617, Bathinda.	Institute	5.0766	vide letter no. 2647-STP(P) dt. 05.12.2016
2.	Guru Kirpa Traders Vill. Kheri Godian, Distt. Patiala.	Industry	58-28 Acre	vide letter no. 2755-STP(P)/SP-327 dt. 09.12.2016
3.	Mahinder Singh Anand S/o Ajit Singh Anand vill. Tepla & Shambu Kalan Teh. Rajpura, Distt. Patiala.	Industry	15.0221 Acres	vide letter no. 2938-STP(P)/ dt. 23.12.2016
4.	Sahid Bhagat Singh Charitable Education Society, VPO. Sekhan distt. Barnala.	Institute	2.2149 Acres	vide letter no. 113-STP(P) dt. 11.01.2017
5.	Sh. Anil Kumar Sapra S/o Sh. J.L. Sapra M/s BJMS Logistics Park H.No:1626, Sector-18 D, Chandigarh	Industry	29 Bigha 11 Biswa	vide letter no. 511-STP(P) dt. 03.03.2017
6.	Sh. Manoj Kumar Vill. Harigarh Distt. Patiala.	Industry	12K-2M	vide letter no. 518-STP(P) dt. 03.03.2017
7.	Sh. Neeraj Kumar S/o Sh. Kewal Mohan M/s Talent Industries Village Gehri Buter, Tehsil Sangat, Distt. Bathinda.	Industry	4.698 acre	vide letter no. 525-STP(P) dt. 03.03.2017
8.	Sh. Naib Singh Grover, M/s Satgur Education Society At village Bhokra, Distt. Bathinda.	Institution	2.01 acre	vide letter no. 539-STP(P) dt. 03.03.2017
9.	M/s Indo Swift, Village Shambo Kalan, Tehsil Rajpura, PTA	Godown (Industry)	15.3715 Acre	vide letter no. 614-STP(P) dt. 15.03.2017
10.	Sh. Karan Kansal S/o Sh. Ashok Kansal, Village Gheri Buter, Distt. Bathinda	Industry	43 kanal 9 marla	vide letter no. 676-STP(P) dt. 24.03.2017
11.	Fr. Joseph Chandu Kulathumkal S/o Sh. Chandu K. Panah Religious Educational & Charitable Trust (Regd.), H.No-23-B, R-Block, Dilshad Garden, East Delhi.	Institution	5.3019 acres	vide letter no. 691-STP(P) dt. 24.03.2017
Information of ongoing Projects in the Jurisdiction of STP office Ludhiana.				
12.	M/s Eminent Inc, Through its Partner Sh. Inderpal Singh S/o Sh. Amar Singh Vill. Daad Teh. & Distt. Ludhiana.	Commercial (Hotel)	2000 Sq. Yds.	Vide Memo No. 523-STP(L)/TW-12-A, dt. 13.12.2016
13.	Sh. Shashi Chopra S/o Sh. Guru Dutt Chopra. Prop M/s Anand Vihar Sagar Dhaba, (Kotakpura, Faridkot)	Commercial (Dhabha)	1403.17 Sq. Yds.	Vide Memo No. 5522-STP(L)/TW-12-A, dt. 26.12.2016

14.	M/s Vishav Namdhari Sangar (Regd) through sh. Gursewak Singh, Authorize Signatory, Vill. Raiyan, Teh. Kum Kalan Distt. Ludhiana.	Institutional (GNM & Nursing College)	3.104 Acres	Vide Memo No. 994-STP(L)/TW-12-A, dt. 01.03.2017
15.	Sh. Ashwani Kumar S/o Sh. Ramesh Kumar, Vill. Guruarsahal, Distt. Ferozepur.	M/s Star Villa Resorts	1.99 Acres	Vide Memo No. 1136-STP(L)/TW-12-A, dt. 14.03.2017
16.	M/s. EMME Infratech Pvt. Ltd. Through Director. Sh. Anmol Singh S/o Sh. Narotam Singh Vill. Daad Teh. & Distt. Ludhiana.	Institution Purpose (+2 Level School)	5.39 Acres	Vide Memo No. 2398-STP(L)/TW-12-A, dt. 30.03.2017
17.	M/s Jindba Processors Private Limited through Sh. Gurbakshish Singh S/o Sh. Sardara Singh, Vill. Mangli Uchi, Tehsil Sahnewal, Distt. Ludhiana.	Industrial (Textile Unit)	10.92 Acres	Vide Memo No. 2442-STP(L)/TW-12-A, dt. 31.03.2017
18.	M/s Arizona International Through Sh. Gurbakshish Singh S/o Sh. Sardara Singh Vill. Katani Khurd, Sub Teh. Kum Kalan, Distt. Ludhiana.	Industrial (Textile Unit)	16.635 Acres	Vide Memo No. 2442-STP(L)/TW-12-A, dt. 31.03.2017
Information of ongoing Projects in the Jurisdiction of DTP office Amritsar.				
19.	Daibir Kaur Memorial Education Charitable Trust, Housing Board Colony, Sector-3, Ranjit Avenue, Amritsar.	Institutional	17310.50 Sq. ft.	-

  
Nodal Officer-cum-  
Senior Town Planner,  
Patiala

# Proforma for Buildings Information



- ❖ This proforma have been circulated to all concerned departments for providing upcoming building information.
- ❖ If any support will be required to make the buildings Punjab ECBC Compliance, proforma with the complete building information will be required.
- ❖ Punjab ECBC Cell will facilitate the project team to make their buildings ECBC Compliant with filing of compliance forms.

S. No.	Description	Project Details
1	Name of Building	
2	Location with Address	
3	Building Type (Hotel/Mall/Hospital/Building Complex/Retail/IT/Office)	
4	Project Type (New Building/Addition/Alteration/ Change of Use)	
5	Building Area	Plot Area (sq. ft.) - Built-up Area (sq. ft.) -
6	No. of Floors in Building	
7	Owner's Details	Name of Owner - Owner's Address - Owner's Contact Number - Owner's Email Id -
8	Architect Details	Name of Architect - Architect Address - Architect Contact Number - Architect Email Id -
9	Project Comes Under (Corporation/Council/Committee/ Authority/Nagar Panchayat) with Address	Name - Address -
10	Any other Information related to the building	
11	Name & Contact Number of the Nodal Officer In-charge	

# A Way Forward

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- Implementation of Punjab ECBC in design and construction of upcoming buildings in the state of Punjab.
- Every Stakeholders (Architects/Builder/Consultants/Contractors/Engineers) should provide extending support to make ECBC Compliant Buildings.
- To maintain regular mechanism for ECBC Implementation in the state.

**\*\*\*\*\*Energy Efficiency!!\*\*\*\*\***

# Any Queries?

*Thank  
you*



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