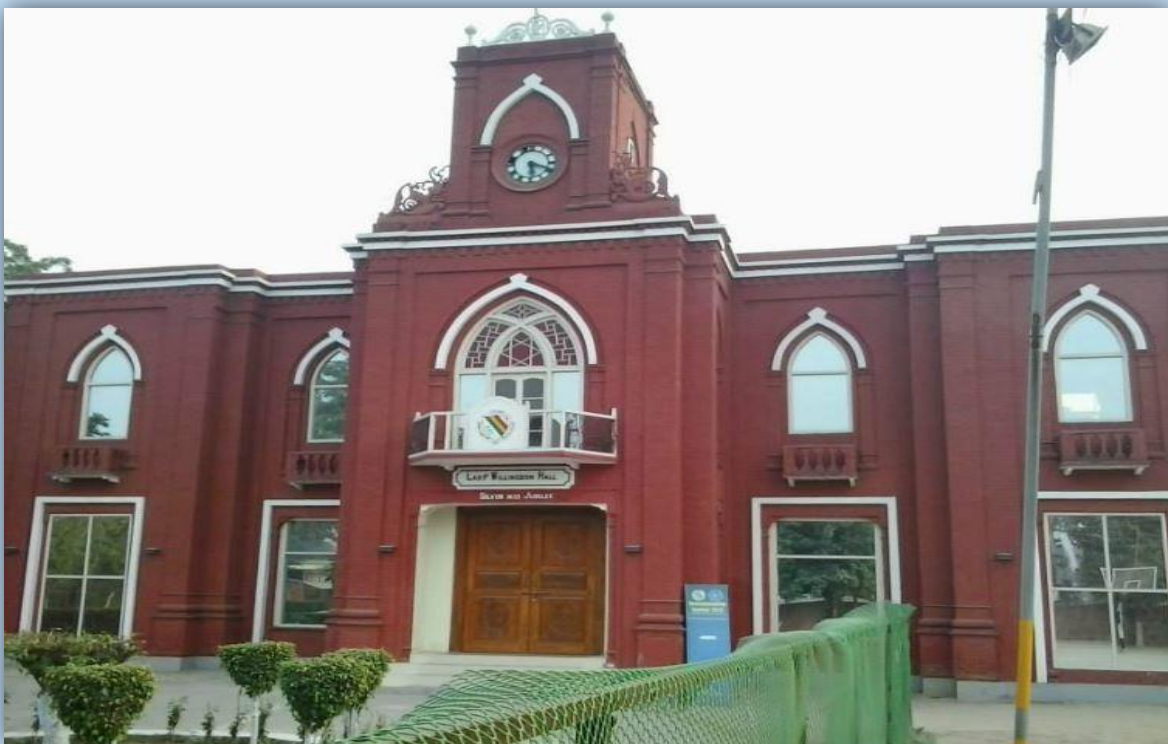
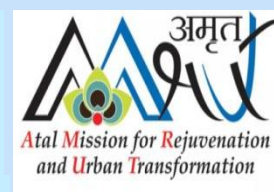




Energy Conservation & Green Buildings (Initiatives by Government of Punjab)



ECBC COMPLIANT BUILDING OF CMC HOSPITAL IN SMART CITY LUDHIANA





ECBC COMPLIANT MODEL OF UPCOMING OFFICE BUILDING OF PSPCL IN PATIALA

Multistoried Integrated Corporate Office, PSPCL, Patiala is an upcoming office building. The building will be new headquarters for Punjab State Power Corporation Limited and Punjab State Transmission Limited. The building has seven floors which contains offices, conference rooms, auditorium and other general facilities. The total built up area of the project is around 22,800 sq. m. It is a 7 storied building i.e. G+6 type.

ECBC Compliance Specs of Multi-storied Integrated Corporate Office, PSPCL, Patiala

Building Type : Office Building
Climate Zone : Composite
Area : 22, 800 m²
Conditioned Area : 14,820 m²
Occupancy Type : Day Time

HVAC Specifications

Chiller - AHU System
5300 TR water-cooled centrifugal Chillers
COP - 6.1 (ECBC - 5.8)

Lighting Power Density

Building Area Method
Proposed LPD - 3.9 W/m² (ECBC - 10.8)
Fixtures - LED
Occupancy Sensors - in corridors, toilets, offices and conference rooms

Piping and ductwork

System Description: 20 mm thick Nitrile Rubber
R value of insulation: 0.38, Thickness of insulation 13 mm.

Building Envelope

Opaque wall : Innermost - 10 mm Plaster + 115 mm AAC Blocks + 25mm PUFF Panel + 115 mm AAC Blocks + 6 mm Plaster

U-value, W/m²K: 0.33 W/m²K (ECBC - 0.44)

Assembly thickness : 316 mm:
Roof Assembly:

Topmost - 10mm Heat reflective tiles + 75 mm Portland Cement Concrete + 150mm RCC + 50 mm XPS insulation + 600 mm air gap 50 mm + 9.5 mm Gypsum Board False Ceiling

U-value, W/m²K: 0.39 (ECBC - 0.4)

Assembly thickness : 907 mm
Glazing type 1 DGU(Double Glazed Unit)

U-value, W/m²K: 1.87, SHGC: 0.2, VLT: 28%

Glazing type DGU(Double Glazed Unit)

U-value, W/m²K: 1.88, SHGC: 0.2, VLT: 27%

Exterior Lighting Details
Fixtures with minimum efficacy of 80 lumens/watt.

Energy Conservation in Buildings

Need for Sustainability in Buildings:

As per various reports of the United Nations Environment Programme, buildings use about 40% of global energy, 25% of global water, 40% of global resources. Buildings emit approximately 1/3 of all GHG emissions and produces up to 40% of annual solid waste. The building sector employs more than 10% of our workforce. With urbanization increasing in the world's most populous countries, building sustainability is essential in achieving sustainable development.

Also, existing buildings represent significant energy saving opportunities because their performance level is frequently far below current efficiency potentials. In developing countries, new green construction yields enormous opportunities. Building sustainability practices, in both existing and new construction, shall result in healthier and more productive environments.

Government of Punjab is a strong supporter of environmental friendly sustainable development in the State. Government of Punjab offers an additional 5% FAR free of charge and other incentives like rebate in property tax for projects rated as per the suitable Green Building Rating. The PUDA (Building) Rules have been amended vide Gazette notification dated 29 June, 2018 to provide for a separate chapter (Part-VIII) regarding the Green Buildings and Sustainability whereby provisions of water conservation and management, energy efficiency, waste management and solar energy utilization are given. The incentive has resulted in wider adoption of green building design, construction and operation practices in Punjab. The developers & the owners of the projects are motivated to develop their projects on the Green Building Concepts. We are glad to share that hundreds of projects are going Green with different rating programs for Green Buildings.

The Government of Punjab has taken several initiatives in Energy Conservation:

- Punjab ECBC was approved by State Cabinet on 25.05.2016 and the code has been notified by Department of New & Renewable Energy through Notification dated 24.06.2016 under the Energy Conservation Act, 2001 for its mandatory use to bring energy efficiency and its conservation in buildings or building complexes.
- Punjab ECBC is applicable to buildings or building complexes that have connected load of 100kW or greater or contract demand of 120kVA or greater or having conditioned area of 500m² or more.
- With the support of BEE under UNDP-GEF-BEE project, Punjab ECBC Cell consisting two Engineers and one Architect has been established in PEDA Office for preparation of necessary documents, day-to-day interaction with all stakeholders to help them for proper implementation of Punjab ECBC in the state.
- Department of Local Govt. vide Notification dated 19.10.2016 notified "The Punjab Municipal Green Building Incentives Policy – 2016" Green Policy and provided incentive of 15% rebate in property tax for Punjab ECBC Compliant Buildings. In addition, 5% FAR free of cost has also been facilitated for construction of green buildings (GRIHA, IGBC & LEED). The incentive shall be applicable to the Residential and non-Residential buildings on plot sizes above 100 sq.m. (120 sq. yds.)
- Punjab Government Gazette notified on dated 29.06.2018 included Punjab Urban Planning and Development Building Rules 2018 notified vide Notification No. G.S.R.43/P.A.11/1995/ Ss.43 and 180/2018, dated 12th June, 2018, in the state of Punjab and prepared by Department of Housing & Urban Development where provisions of Punjab ECBC are being included for further reference of Implementation of Punjab ECBC in the state. Also, the renewable energy parameters have been included as mandatory requirements in the Common Building Bye-Laws.
- Advisory Committee has been formulated consisting Nodal Officers from concerned departments / organizations.
- PEDA prepared a building plan approval system for Punjab ECBC Implementation. The approval procedure of Punjab ECBC has been consented with the nodal officers of Advisory Committee.
- Department of PWD B&R constituted a committee of Chief Engineers / Chief Architect to put forward the ways and means for smooth implementation of Punjab ECBC completely and collectively.
- Punjab ECBC Cell, PEDA conducted more than 64 Interactive sessions with all the concerned building departments for awareness, implementation of Punjab ECBC in the state.
- More than 650 professionals and Govt. officials have been trained during the Interactive sessions where complete information of Punjab ECBC shared with all concerned officials.
- For capacity building of stakeholders about Punjab ECBC, one day, two days and three days training programs have been organized in the State of Punjab. Total 41 Capacity Building Training Programs have been completed including Municipal Corporations, other ULBs and all other major Stakeholders. More than 1500 professionals have been sensitized and trained for implementation of Punjab ECBC.
- PEDA has organized Workshop-cum-Exhibition on Energy Efficient Building Materials / Products for Implementation of Punjab ECBC in the state of Punjab.

ECBC Compliant Buildings in Punjab

S. No.	Name of Building	Location	Type of Building	Built-up Area	Owner-ship
1	Mankind	Zirakpur	Hospital	1,510.2 m ²	Private
2	Mehar	Zirakpur	Hospital	4,000 m ²	Private
3	PGI	Sangrur	Hospital	50,000 m ²	Government
4	PSPCL	Patiala	Office	22,800 m ²	Government
5	Workshop_IKG-PTU	Kapurthala	Institute	2,960.14 m ²	Government
6	BISA	Ludhiana	Office	5000 m ²	Government
7	CMC College	Ludhiana	Hospital (Alteration)	77,613 m ²	Private
8	G3S Building	Jalandhar	Multi-family Residential	19,230.74 m ²	Private
9	IIT	Ropar	Office (New Building)	Area- 1,50,000 m ²	Government
10	Stadium_IKG-PTU	Kapurthala	Recreation (New Building)	Area- 3,591.17 m ²	Government

Status of Construction: All the above buildings are under construction.

List of Green Certified Buildings in Punjab

S. No.	Project Name	Ownership	Type Of Building	Built-up Area (Sq.m)	Rating Type	Project Status
1	Integrated Office for Airports Authority of India (AAI) & Bureau of Civil Aviation Security (BCAS), Amritsar	Govt.	Commercial	2,461	SVAGRIHA	Ongoing
2	Green Villa project at Plot D-08, AIPL Dream City, Amritsar	Pvt.	Residential	795	SVAGRIHA	Ongoing
3	Central University of Punjab, Bathinda	Govt.	Institutional	9,88,605	GRIHA LD	Ongoing
4	Proposed International Terminal at Chandigarh Airport	Govt.	Airport	52,000	GRIHA	Ongoing
6	BHEL Residential Building, 433 Industrial Complex Goindwal Sahib Distt Tarn Taran	Govt.	Residential	799	SVAGRIHA	Ongoing
7	Indian Institute of Science Education and Research, Mohali	Govt.	Institutional	2,36,141	GRIHA	Ongoing
8	Officers' flats for NABARD, Sector 66, Mohali.	Govt.	Residential	7,833	GRIHA	Ongoing
9	Agri Food Cluster Campus of National Agri-Food Biotechnology Institute (NABI), Sector 81, Sahibzada Ajit Singh Nagar.	Govt.	Institutional	30,670	GRIHA	Ongoing
10	Construction and Development of Centre of Innovative and Applied Bio Processing (CIAB),	Govt.	Institutional	7,823	GRIHA	Ongoing
11	Indian Institute of Technology, Rupnagar	Govt.	Institutional	2,37,776	GRIHA LD	Ongoing
12	Exotic Grandeur, Zirakpur	Pvt.	Residential	26,050	GRIHA	Ongoing

*Please note all the project in Punjab are under construction and yet to be provided with provisional rating

S. No	Project	Address and Contact	Type Of Building	Built-up Area (sq. ft)	Rating
1	Max Super Speciality Hospital	Mansa Road, Bathinda-151001	Tertiary Care Hospital	1,85,000	Gold
2	SRL Laboratory	Dera Baba Jaimal Singh Beas	Laboratories	29,500	Gold

3	Max Super Speciality Hospital	Phase-6, Mohali	Tertiary Care Hospital	1,85,000	Gold
4	Ranbaxy Office Building Complex, Mohali	Plot No-8a, Industrial Estate, Ph-III	Office Building	51,947	Gold
5	Indian School of Business	Sector-81, Mohali - 140306	Institutional	5,59,468	Gold
6	Godrej Eternia, Chandigarh	Plot No. 70, Industrial area, Ph-1	Commercial	6,18,619	Platinum

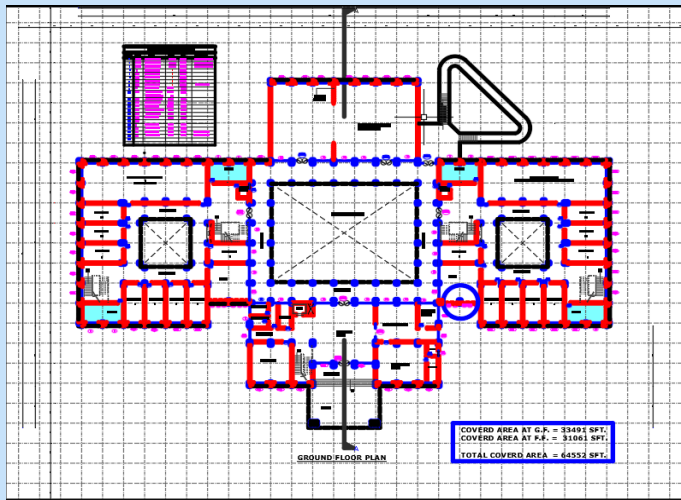
S. No.	Project Name	Location	Type Of Building	Built-up Area (Sq.m)	Rating Type	Project Status
1	Deutsche Bank Ludhiana Branch	SCO-9-10, Green Park Avenue, Canal Colony, Pakhowal Road	Commercial	4,600	LEED-CI v2009	Certified
2	DLF IT Park Chandigarh, Kishangarh	Phase - 1, Kishangarh, Chandigarh - 160101,	Commercial	6,44,149	LEED-EB:OM v2009	Certified
3	IFFCO B.S. Nakai Bhawan	Plot No 2 B&C, Sector 28-A, Chandigarh - 160002,	Commercial	41,565	LEED-EB:OM v2009	Certified
4	Taj Swarna	Plot No. C-3, Outer Circular Road, Opp. Basant Avenue, Amritsar, Punjab-143001	Hotel	2,26,661	LEED-NC v2009	Certified
5	Maharaj Jagat Singh Medical Relief Society Beas	Dera Baba Jaimal Singh Beas, Beas, Amritsar - 143201	Commercial	29,493	LEED India NC	Certified
6	Max Super Specialty Hospital, Mohali	Near Civil Hospital, Chandigarh Road, Phase-6, Mohali-160055	Hospital	1,80,230	LEED India NC	Certified
7	Max Super Specialty Hospital, Bathinda	Mansa Road, Bathinda-151001	Hospital	1,86,871	LEED India NC	Certified
8	Ludhiana Trade Tower	Pakhowal Rd, Feroze Gandhi Market, Feroz Gandhi Market, Jila Kacheri Area, Model Gram, Ludhiana, Punjab 141001	Commercial	4,650	LEED-CS v2009	Currently Registered
9	Godrej Eternia	Plot No. 70, Industrial Area, Phase-I, Chandigarh - 160002	Residential	6,18,619	LEED India CS	Currently Registered
10	ELANTE : Mixed Use Development Project Comprising of Retail Mall, Hotel & Office	Purv Marg, Industrial Area Phase I, Chandigarh - 160002	Commercial	1,07,000	LEED India CS	Currently Registered
11	Punjab Municipal Bhawan	Plot no.3, Sec-35A, Chandigarh.	Office	2,00,000	IGBC	Registered

PEDA Building, Chandigarh Solar Passive Complex : BEE (5 Star) Rated under "Govt. Building

Scheme "SALIENT FEATURES

1. Orientation has been developed in response to the solar geometry.
2. Floating slabs and cutouts to allow free and quick movement of air.
3. Single envelope with outer-walls as cavity walls.
4. Light vaults to admit day light without glare.
5. Insulated roofing to avoid penetration of heat from the roof.
6. Solar Power plant of capacity 25Kwp to meet the basic requirement of electricity in the complex.
7. Shell roofing on central atrium to admit daylight without glare and heat coupled with defused lighting through glass-to-glass solar panels.
8. Water bodies for cooling the complex in the hot dry period.
9. Landscape horticulture to minimize air pollution, sound pollution and filter/cool the entry of air.
10. Scientifically designed workstations.





Borlaug Institute for South Asia, Ludhiana

Building Type : Institute
 Climate Zone : Composite
 Area : 5,997 m²
 Conditioned Area : 4,497 m²
 Occupancy Type : Day Time

HVAC Specifications

VRV System
 EER - 0.32

Lighting Power Density

Building Area Method
 Proposed LPD - 10 W/m² (ECBC - 14)
 Fixtures - LED
 Occupancy Sensors - in corridors, toilets, Labs and conference rooms

Piping and ductwork

System Description: 20 mm thick Nitrile Rubber
 R value of insulation: 0.38, Thickness of insulation 13 mm.

Exterior Lighting Details

Fixtures with minimum efficacy of 80 lumens/watt for fixtures >100 W.

Borlaug Institute for South Asia, Ludhiana

Borlaug Institute for South Asia is an upcoming administrative and research building at BISA Farm, Ladhoval, Ludhiana. The total built up area of the project is around 64,552 sqft. The total plot area is 512 acres. The building is of two floors i.e. G+1 type.

Building Envelope

Opaque wall (South & West): Innermost - 12mm Plaster + 115mm Perforated Bricks + 55mm rock wool insulation + 115mm Perforated Bricks + 12mm Plaster

U-value, W/m²K: 0.425 W/m²K (ECBC - 0.44)

Assembly thickness : 309 mm:

Opaque wall (East & North): Innermost - 12mm Plaster + 115mm Perforated Bricks + 30mm Air gap + 115mm Perforated Bricks + 12mm Plaster

U-value, W/m²K: 1.113 W/m²K (ECBC - 0.44)

Assembly thickness : 284 mm:

Roof Assembly: 50mm Cement Screed + 100mm R.C.C Slab + 70mm Rock wool insulation + 300mm Air gap + 12.5 Gypsum board

U-value, W/m²K: 0.216 (ECBC - 0.4)

Assembly thickness : 232.5 mm

Glazing type 1 DGU(Double Glazed Unit)

U-value, W/m²K: 1.6, SHGC: 0.2, VLT: 27%

In addition to ECBC which is a mandatory compliance in the Buildings having connected load of 100kW or greater or contract demand of 120kVA or greater or having conditioned area of 500 m² or more, GoP is also promoting Green Buildings.

Green Building movement in India Definition of a Green Building: "A Green Building is one which uses less water, optimises energy usage, conserves natural resources, generates less waste and provides healthier spaces for occupants as compared to a conventional building."

The green rating programs are aligned with various National codes & Standards such as, NBC, ECBC, MoEF's Environmental Impact Assessment, Pollution Control Boards, ISHRAE, etc. Various Ratings broadly cover the following aspects:

- Sustainable Architecture and Design
- Site Selection and Planning
- Water Conservation
- Energy Efficiency
- Building Materials and Resources
- Indoor Environmental Quality
- Innovation

Benefits of Green Buildings

The various possible tangible and intangible benefits in green buildings are as follows:

Tangible:

- ❖ 20 - 30% savings in electricity consumption as compared to a conventional building
- ❖ Similarly, 40 - 50% savings in water consumption
- ❖ Reduction of 8000 - 12000 Tons of CO₂ emissions per million sq. ft of building
- ❖ About 3 MW saving in connected electrical load per million sq. ft of building
- ❖ Segregation of consumer waste to facilitate easy handling by municipalities
- ❖ Lower operational expense, especially of common utilities
- ❖ Re-use of treated waste water from every building to reduce load on municipal water handling plants

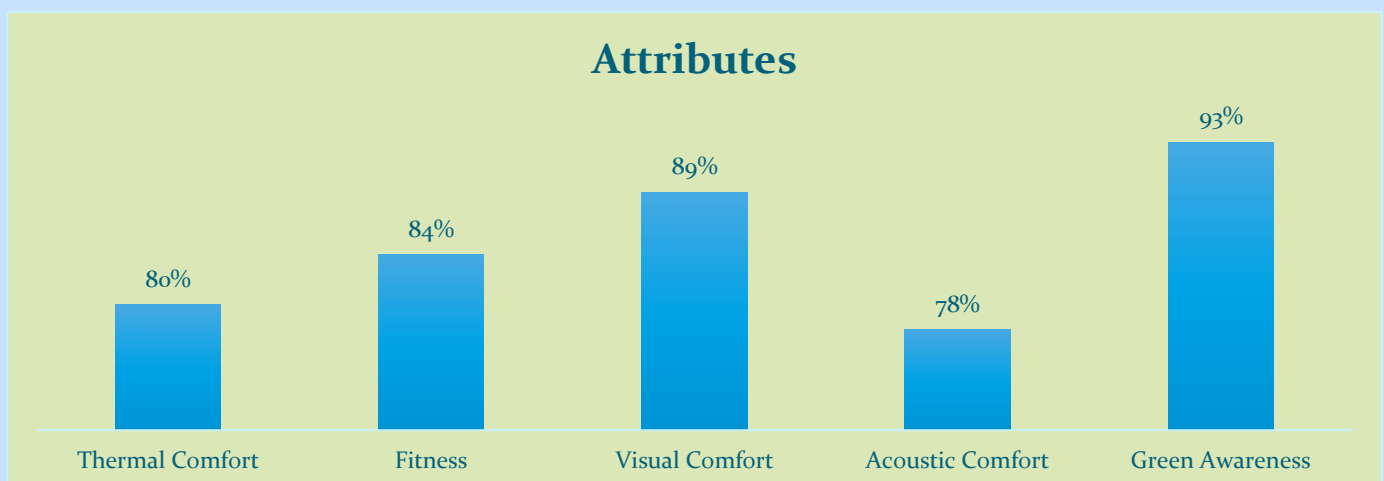
Intangible:

- ❖ Enhanced air quality, day lighting and ventilation in the buildings – no sick building syndrome
- ❖ Health & well being of the occupants is of primary importance
- ❖ Conservation of scarce national resources
- ❖ Open landscaped areas which act as lung spaces
- ❖ Heat island mitigation

Impact of Green Buildings on Occupants Wellbeing

To understand the occupant experience on living in green buildings, IGBC conducted a study on the wellbeing aspect in IGBC rated green buildings. The study indicates that green buildings have supported healthier and happier living in several ways. Various attributes such as thermally comfortable environment, optimum illumination & noise levels, greenery within the built environment, ergonomically designed spaces, have significantly contributed in providing a comfortable working environment to the users occupying them.

Key highlights of the reports are:



Some of the Key Projects Certified by CII IGBC in Punjab

D – Mart, Zirakpur, Punjab (Gold Rated)



Promoter : Avenue Supermarts Limited
Built Up Area : 38233 Sq.ft
Building Use : Retail Store
Energy Saving : 2,41,691 kWh/ Year ; All LEDs, Efficient Building Envelope; Efficient Equipments

Water Savings: 10,96,095 Litres/Annum; Efficient Fixtures, RWH, 10 KLD STP

C&D Waste Diverted: 17.9 Tonnes

IEQ: Fresh Air through TFA; Indoor Air Quality Test before Occupancy, Low VOC Paints

Homeland Heights, Mohali, Punjab (Platinum Rated)



Promoter : Homeland Buildwell Pvt. Ltd.
Site Area : 4.6019 ACRE
Built Up Area : 909002.535 Sq.Ft.
Building Use : 24 hours being a Residential Society

Energy Management :
Energy Efficient LED Lighting, Energy Efficient regenerative drive/V3F Frequency lifts.

Water Management :
Recycled water by STP reused for flushing & Landscaping and Rainwater Harvesting System Resource Management :

Low VOC Paints, Waste Management, High SRI painted Roofs

Kataria Hospital, Punjab (SILVER Rated)



Promoter : Dr Tony Kataria
Built Up Area : 19,000 Sq.ft
Building Use : Hospital
Efficient Water Fixtures, Lighting fixtures, 20 KLD STP,

Manav Mangal Smart Wonder School, Zirakpur (Platinum Rated)



Promoter : Manav Mangal Group
Built Up Area : 1,71,761 sq. ft
Building Use :
Key Green Features :
Effective rainwater harvesting
Energy Efficient lighting fixtures and appliances
Organic waste management by 100%

Max Super Speciality Hospital, Mohali, Punjab (GOLD Rated)



Promoter : Max super specialty hospitals
Site Area : 3.49 acre
Built Up Area : 179158 sq ft
Building Use : Hospital

Key Green Features:
50% reduction in potable water by using STP
22% energy cost reduction.

96.73% waste has been diverted from landfills, 100% of the landscape water requirement is met by treated water from the STP plant.

Max Super Speciality Hospital, Bathinda, Punjab (GOLD Rated)



Promoter : Max super specialty hospitals
Site Area : 4.64 acre
Built Up Area : 185778 sq ft
Building Use : hospital
Key Green Features:

- Water use has been reduced by 43.25% through grey water reuse
- 27% energy cost reduction
- 62.40% of the total project's materials, by cost were extracted, harvested or recovered within 800 km of the project site

Ranbaxy Office Building, Punjab GOLD Rated



Promoter : Ranbaxy laboratories ltd
Site Area : 3.87 acre
Built Up Area : 51947 sq ft
Building Use : office building

Key Green Features:
50% of parking spaces have been provided with open grid paver system
water use has been reduced by 33.65 % through use of efficient plumbing fixtures
28.6% energy cost reduction

Sat Paul Mittal School, Ludhiana, Punjab Gold Rated



Promoter : Sat Paul Mittal School
Site Area : 3.06 acres
Built Up Area : 132935 sq ft
Building Use : School

Key Green Features:

More than 25% of site area is dedicated for landscape, Universal Accessible design – Differently Aabled toilet and ramps are integrated in design



Tynor Orthotics Factory, Mohali, Punjab (Gold Rated)



Promoter : Tynor Orthotics P Ltd.
Site Area : 2.5 acres
Built Up Area : 1.45 lac sq ft
Building Use : Manufacturing Facility
Cum office

Key Green Features :

*Energy efficient Air-conditioning system, 30%
Reduced tonnage of air conditioning
Good green cover with Drip Irrigation system
50% reduction in effort in material movement.
Least No. and size of Windows in south and west side of building , instead ventilators designed to increase illumination
North and North east side of the Building is having full glass facade allowing maximum illumination and 90% reduction in direct sunlight
Most efficient Solar power generation system of approx 190 KW
Eco-friendly materials like AAC blocks, VOC free paints, low water consumption faucets etc.
Recycling of curing water.*

Salient Features of Punjab Municipal Bhawan Complex, Plot no. 3, Sector 35-A, Chandigarh



• Fully landscape site with native & adaptive plants	• 90% LED Fixtures being procured
• Energy efficient building envelope, Double glazed	• Motion sensors for energy saving in lighting
• Most of the spaces are naturally lit	• Rain Water Harvesting
• Composting of wet waste	• Solar Water Heating System
	• Ban on use of Plastic bottles/ glass

CONTACT DETAILS OF KEY PERSONS FOR ECBC AND GREEN BUILDING CERTIFICATION

PEDA	Punjab Energy Development Agency Solar Passive Complex, Plot No. 1&2, Sector 33-D, Chandigarh Pin Code: 160022 Contact No. 0172-266338228 Fax: 0172- 2662865 Email id: ed@peda.gov.in
Development of Housing and Urban Development	Chief Town Planner, PUDA Bhawan, SAS Nagar, ctppunjab@gmail.com
Department of Local Government & PMIDC	PUNJAB MUNICIPAL INFRASTRUCTURE DEVELOPMENT COMPANY Punjab Municipal Bhawan (Department of Local Government) Plot No. 3, Sector 35 A, Dakshin Marg, Chandigarh-160022 Emailed: tpw.lg.pb@gmail.com , gm.pmidc@gmail.com , Mtp.pmidc@punjab.gov.in
The list of certified ECBC Expert/Design Professionals is available at the following link- https://beeindia.gov.in/sites/default/files/ECBC%20Expert%20Professionals%20%26amp%3B%20Firms.pdf	

Indian School of Business, Mohali, Punjab (GOLD Rated)



ISB Mohali Green Specs:

Site Area	: 70 Acres
Built Up Area	: 656485 sq ft
Building Use	: 24x7 hrs, Mixed Use
Water Management	: Zero discharge STP, Geothermal Supported HVAC, Low flow water efficient fixtures
Resource Management	: Use of eco - friendly and sustainable material
Landscape Strategies	: Fully landscape site with native & adaptive plants
Screening / Glazing Strategies	: Energy efficient building envelope. Most of the spaces are naturally lit, double glaze units. 90% LED Fixture

Sustainable-Operations

Energy and Atmosphere

- Optimal use of daily light
- 90% LED light fixtures
- Basement lighting through Solar PV (1 lac units)
- Solar & heat pumps for water heating in Housing (no electric geysers)
- Efficient HVAC System (BMS- automation) and natural air circulation
- Geothermal system
- Energy efficient motors for elevators (20% better)
- Awareness campaigns on energy saving
- Automated lighting system.

Sustainable - Operations

Water Efficiency

1. Low flow rate plumbing fixtures
2. 100% recycling of STP water
3. Geothermal system for air-conditioning which uses no water
4. Centralized Launderette
5. Rain Water Harvesting (modular system)
6. Drip irrigation
7. Horticulture watering post 5 PM in summers
8. Native plants & biodiversity
9. Mini forests.

Miscellaneous Points

1. Power consumption reduced from 0.82 to 0.63 units per sqft.
2. Per capita water consumption reduced from 260 to 172 lpd
3. Organic farming
4. Continuous technology upgrade
5. Solar-the way ahead- cost down to around Rs 4 per unit
6. Paper & waste recycling
7. Poly free campus
8. Green jobs