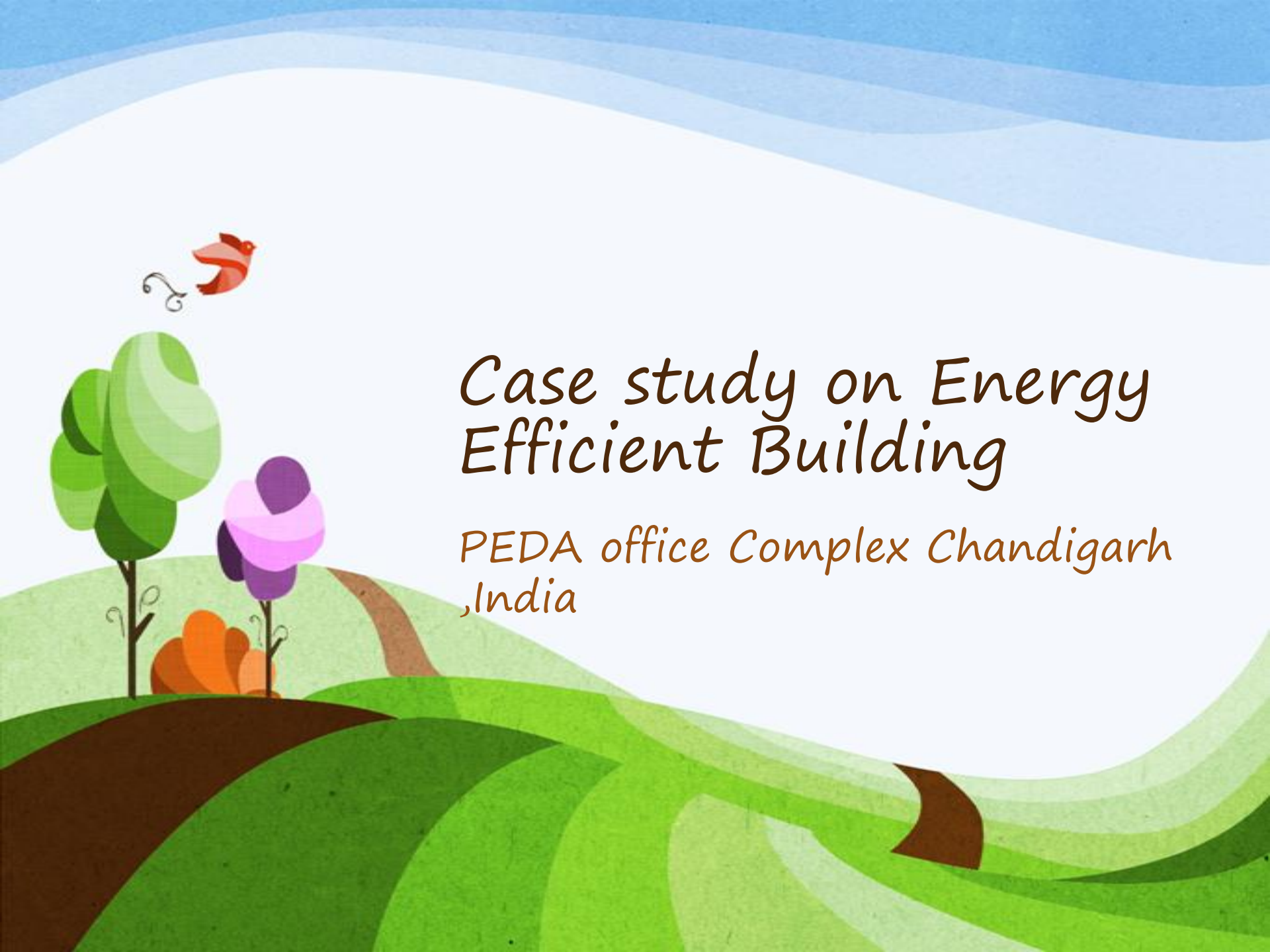


A stylized, colorful illustration of a landscape. The foreground features rolling green hills with dark brown soil patches. On the left, there are three stylized trees: a tall green one, a shorter purple one, and a small orange one. A red bird is flying in the upper left. The background consists of light blue and white wavy bands representing the sky.

Case study on Energy Efficient Building

*PEDA office Complex Chandigarh
,India*

PEDA Office Complex at Chandigarh ,India

- *Introduction:-*

- ❖ **Location:**

Solar Passive Complex sector
33D, Chandigarh (Latitude 30°N)

- ❖ **About :-**

Chandigarh the modern and planned city designed by Le-Corbusier, lies in the plains at the foot of the Lower Himalayas, is the capital of Punjab and Haryana.

Punjab Energy Development Agency (PEDA), Chandigarh is a state nodal agency responsible for development of new & renewable energy and non-conventional energy in the state of Punjab.



PEDA OFFICE COMPLEX



FRONT VIEW OF PEDA OFFICE COMPLEX

PEDA Office Complex at Chandigarh ,India

- *Introduction:-*

❖ **PEDA** – Solar Passive Complex, Chandigarh is a unique and successful model of Energy Efficient Solar Building, designed on solar passive architecture with the partial financial support of Ministry of New & Renewable Energy, GOI and Dept. of Science, Technology, Environment and Non-conventional Energy, Govt. of Punjab. It is setup at Plot No. 1 & 2, Sector 33-D, Chandigarh.

❖ **Site Area** : 1.49 acre (268ft. x 243 ft.)

❖ **Total covered area** : 68,224 Sq.Ft. including 23,200 Sq.Ft. Basement.

❖ **Architecture style** : Sustainable architecture



ENTRANCE OF PEDA COMPLEX



SIDE VIEW OF PEDA COMPLEX

PEDA Office Complex at Chandigarh ,India

- *Site Analysis*

LOCATION: PEDA Office ,Solar Passive Complex
sector 33D,Chandigarh .

COUNTRY : INDIA

STATE : PUNJAB

TIME ZONE : IST(UTC+05:30)

COORDINATES : Latitude 30°N

GEOGRAPHY

ELEVATION : 350M

CLIMATE : COMPOSITE

MAX.SUMMER TEMPERATURE : 44°C

MIN. WINTER TEMPERATURE : 5°C

ANNUAL AVG RAINFALL : 1110.7MM

❖ **Context & Site microclimatic analysis**

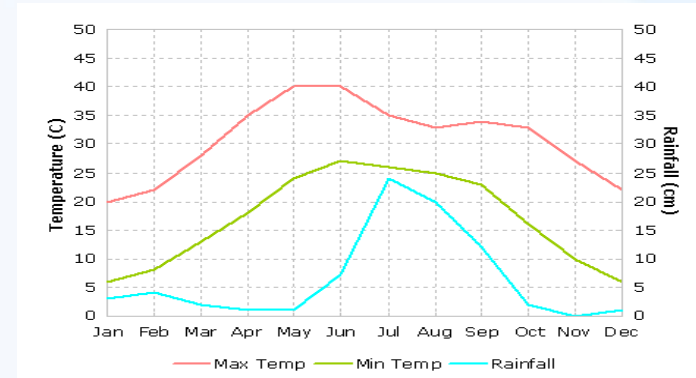
Architectural building design needs to respond to the composite climatic context of the site. The final design solution needs to satisfy the diverse and often conflicting conditions of a hot-dry, hot-humid, temperate and cold period of Chandigarh.

PEDA Office Complex at Chandigarh ,India

• Site Analysis

❖ The climatic conditions:

- Two months of hot-dry,
- Hot-humid (two months) and
- Cold period (two months)
- Occasional hazy sky hot winds in summer,
Low humidity in summer & high in monsoons
cold winds in winter and strong wind in
Monsoons.



Temperature and rain fall variation

❖ Require strategies of design :

- Cooling in the hot dry period,
- Natural ventilation in the hot-humid period and
- Heating in the cold period.
- Cooling remains as the predominant requirement since the total overheated period extends from mid-April to mid-August.

PEDA Office Complex at Chandigarh ,India

- *Architectural analysis*

❖ **Building : PEDA Office Complex**

❖ **Architect: Prof. Dr. Arvind Krishan**

❖ **Architectural Design: Sustainable Architecture**

➤ This building has a 3 Dimensional form responding to solar geometry i.e., minimizing solar heat gain in hot dry period and maximizing solar heat gain in cold period.

➤ Overlapping floors at different levels in space floating in a large volume of air, with interpenetrating large vertical cut-outs enclosed within an envelope. These are integrated with light wells and solar activated naturally ventilating, domical structures.



ENTRANCE OF PEDA OFFICE COMPLEX



ENTRANCE OF PEDA OFFICE COMPLEX

PEDA Office Complex at Chandigarh ,India

- *Architectural analysis*

- ❖ **Daylight:**

- On the south western facade, dome shaped concrete structures have horizontal and vertical intersecting fins with glass fixed in the voids to allow natural light with reduced glare.
 - These allow indirect light to enter the building in summers and direct sunshine in winters.
 - The atrium is covered by a lightweight shell roofing of 10 cm of high-density EPS (extruded polystyrene) sandwiched between high-grade FRP (fibre-reinforced plastic) sheets and reinforced with steel; specifically angled to allow sun in winters and block in summers.



SOUTHERN VIEW OF PEDA OFFICE COMPLEX



ATRIUM VIEW OF PEDA OFFICE COMPLEX

PEDA Office Complex at Chandigarh ,India

- *Architectural analysis*

- ❖ **Maintaining thermal comfort:**

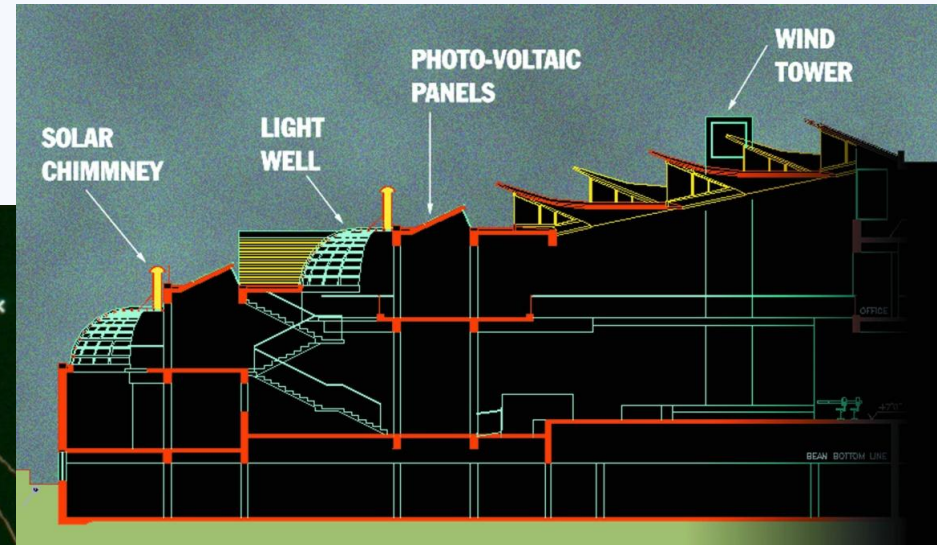
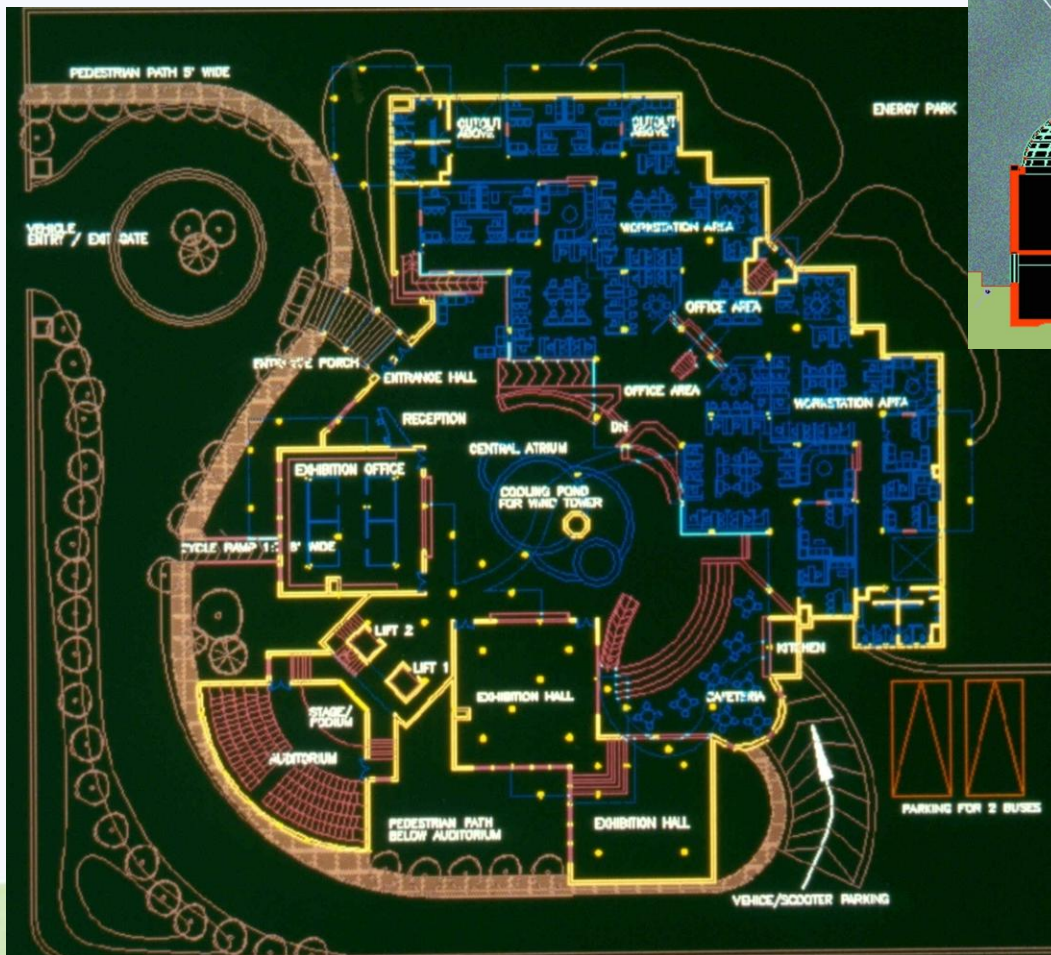
- The envelope attenuates the outside ambient conditions and the large volume of air is naturally conditioned by controlling solar access in response to the climatic swings during summer and winters.
 - The large volume of air is cooled during the hot period by a wind tower, integrated into the building design, and in cold period this volume of air is heated by solar penetration through the roof glazing generating a convective loop.
 - The thermal mass of the floor slabs helps attenuate the diurnal swings.



Day light in internal space
of PEDA

PEDA Office Complex at Chandigarh ,India

- Architectural analysis

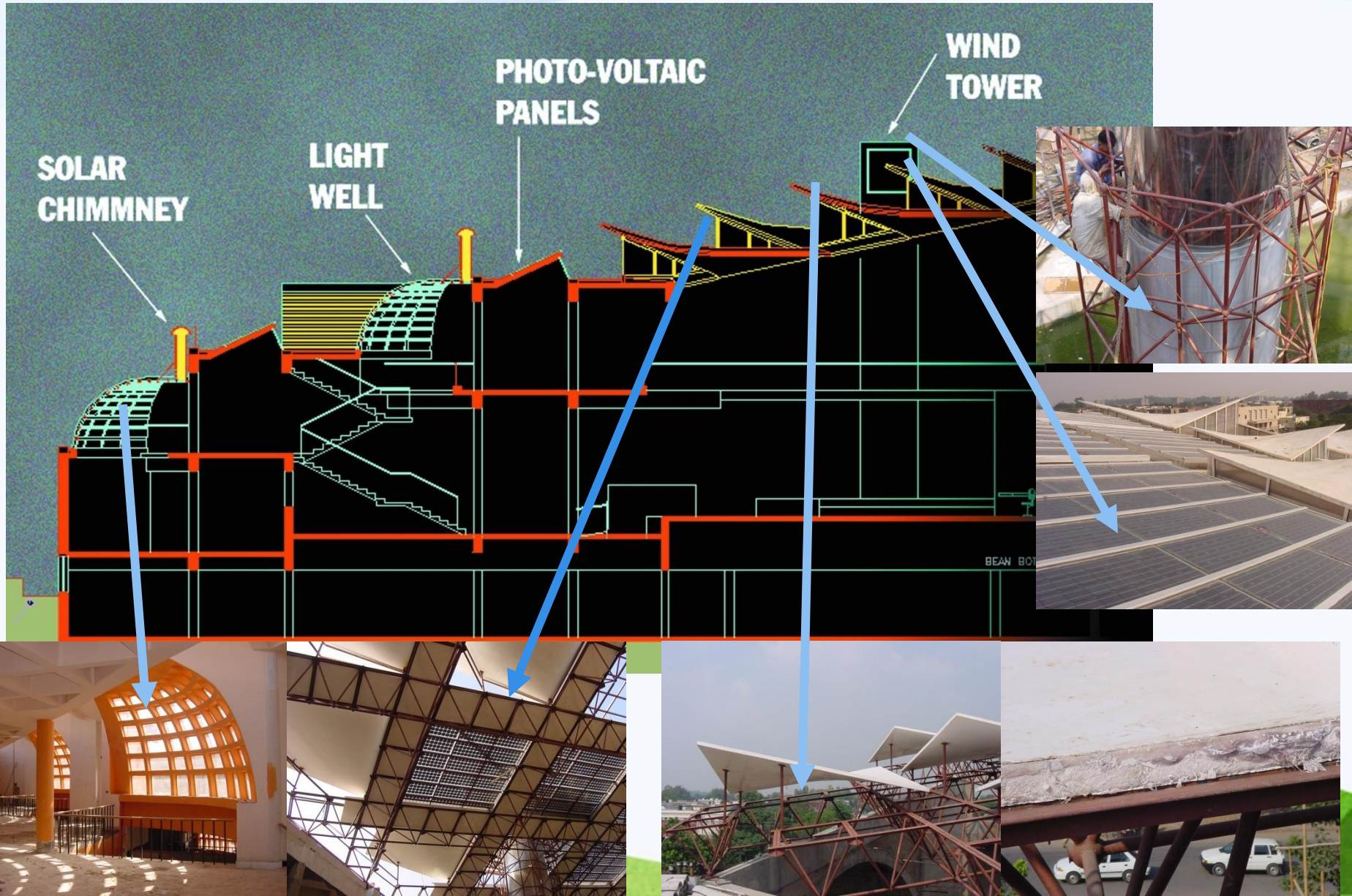


SECTION OF PEDA COMPLEX

GROUND PLAN OF PEDA COMPLEX

PEDA Office Complex at Chandigarh ,India

- Architectural analysis

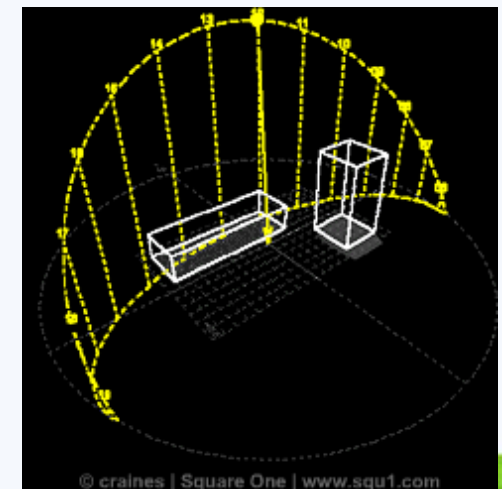
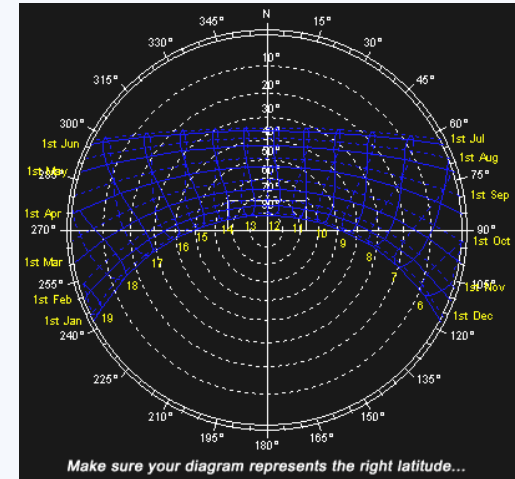


PEDA Office Complex at Chandigarh ,India

- Salient design Feature of Solar Passive Complex in context of green Building

❖ Orientation

- Solar Passive Complex has been developed In response to solar geometry i.e. minimizing solar heat gain in cold period.
- The building envelope attenuates the outside ambient conditions and the large volume of air is naturally conditioned by controlling solar access in response to the climatic swings



SUN PATH DIAGRAM

PEDA Office Complex at Chandigarh ,India

- *Salient design Feature of Solar Passive Complex in context of green Building*

❖ **Unique Shell Roofing on Central Atrium :**

- The Central atrium of the complex having main entrance, reception, water bodies, cafeteria and sitting place for visitors constructed with hyperbolic shell roof to admit daylight without glare and heat coupled with defused lighting through glass to glass solar panels.



SPACE FRAME STRUCTURE

- The roof is supported with very light weight space frame structure.



HYPERBOLIC SHELL ROOF

PEDA Office Complex at Chandigarh ,India

- *Salient design Feature of Solar Passive Complex in context of green Building*

❖ **Solar Power Plant:**

25Kwp building integrated solar photovoltaic power plant has been set up to meet the basic requirement of electricity in the complex



PHOTOVOLTAIC PANEL ON ROOF

❖ **Water Bodies:**

The water bodies with waterfalls and fountains have been placed in the central atrium of the complex for cooling of whole the complex in the hot and dry period.



WATER BODIES AROUND WIND TOWER

PEDA Office Complex at Chandigarh ,India

- *Salient design Feature of Solar Passive Complex in context of green Building*

❖ **Light Vaults:**

The vertical cut outs in the floating slabs are integrated with light vaults and solar activated naturally ventilating, domical structures in the south to admit day light without glare and heat.



SOUTHERN VIEW OF PEDA OFFICE COMPLEX



SOLAR SHELL OR LIGHT VAULT

PEDA Office Complex at Chandigarh ,India

- *Salient design Feature of Solar Passive Complex in context of green Building*

❖ **Cavity Walls:**

- The complex is a single envelope made up of its outer walls as double skin walls having 2" cavity in between.
- The cavity walls facing south and west are filled with further insulation material for efficient thermal effect.



❖ **Unique Floating Slab System:**

The system of floating and overlapping slab with interpenetrating vertical cut outs allow free and quick movement of natural air reducing any suffocating effect.



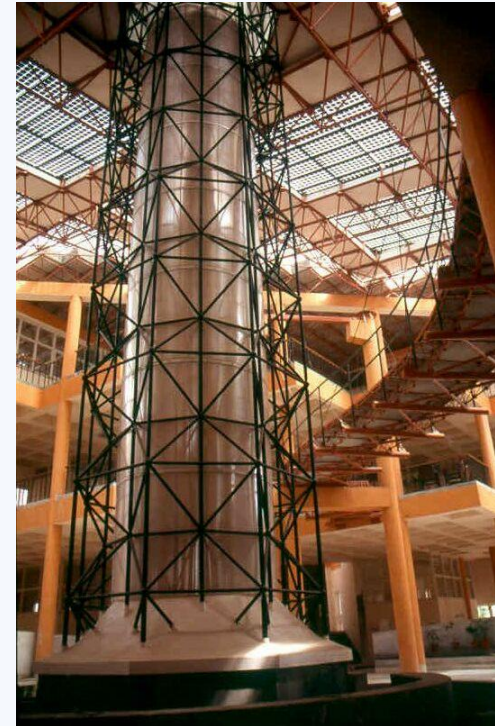
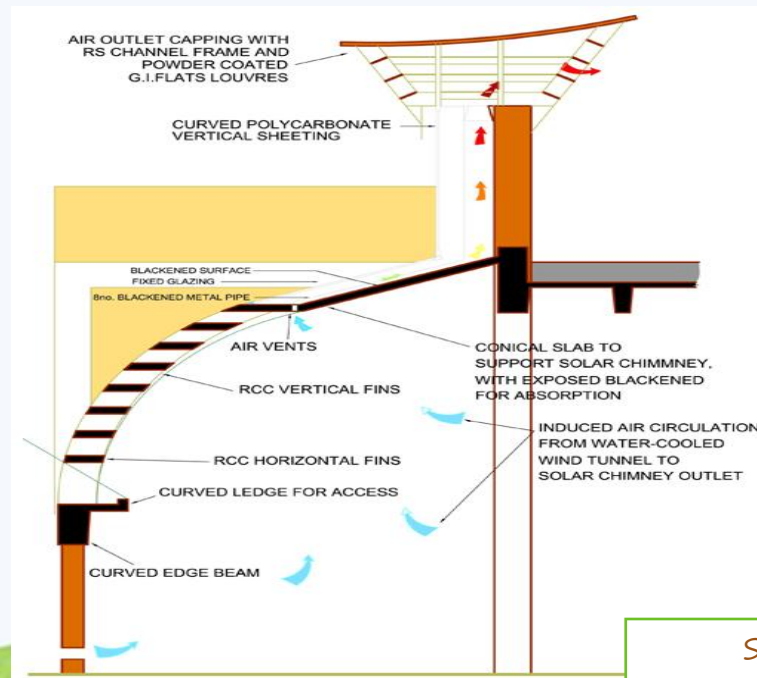
UNIQUE FLOATING SLAB SYSTEM

PEDA Office Complex at Chandigarh ,India

- Salient design Feature of Solar Passive Complex in context of green Building

❖ Wind Tower coupled with Solar Chimneys:

The wind tower centrally placed coupled with solar chimneys on the domical structures for scientific direct & indirect cooling and scientific drafting of used air.



WIND TOWER

SOLAR CHIMNEY

PEDA Office Complex at Chandigarh ,India

- *Salient design Feature of Solar Passive Complex in context of green Building*

❖ Insulated Roofing:

All the roofs have been insulated with double insulation system to avoid penetration of heat from the roof.



INSULATED ROOF

❖ Auditorium:

A unique auditorium scientifically designed to control heat penetration, light & sound distribution is placed in the north under the shade of main building.



AUDITORIUM OF PEDA COMPLEX

PEDA Office Complex at Chandigarh ,India

- *Salient design Feature of Solar Passive Complex in context of green Building*

❖ **Big Exhibition Centre:**

The complex is having a proper designed exhibition centre for display of renewable & non-conventional energy devices / equipments.



EXIBITION IN PEDA COMPLEX

❖ **Unique Workstations:**

Scientifically designed and fully equipped unique workstations have been made for the employees having comfortable environment, good ergonomics with sufficient natural light and air.



WORKSTATION IN PEDA COMPLEX

PEDA Office Complex at Chandigarh ,India

- *Conclusions*

- ❖ Evaporative cooling towers work best with open floor plans that permit the air to circulate through out the building without any obstacles.

- ❖ Good thermal mass of the building helps the building to perform in extreme conditions. Appropriate building design and orientation having properly placed building elements reduced or minimize the solar gain in summer.

- ❖ Elements like light Vault, Solar chimney, Hyperbolic parabolised atrium roof help to minimize the solar gain.

PEDA Office Complex at Chandigarh ,India

5 STAR
RATING 2010

BASED ON
ACTUAL PERFORMANCE
14 kwh /sq.m/per year.

BUREAU OF
ENERGY EFFICIENCY
GOVT. OF INDIA

Most Energy Efficient Building in
the country

