ARCHITECTURE
Follows the SUN

PRESENTED BY
Prof. Dr. Arvind Krishan
FINITE DYNAMIC ECOSYSTEM – INFINITE SOLAR ENERGY
REGENRATIVE NATURAL RESOURCE
Determinants of Sustainability

Mother Earth
Dynamic Eco-System

Solar Spectrum
Engine that drives Planet Earth
PRIMAL ENERGY
SOLAR ENERGY CONVERSION

• SOLAR ENERGY CREATES LIFE
• FOSSIL FUEL IS STORED SOLAR ENERGY
• SOLAR ENERGY GENERATED CONVECTION:
  ➢ Creates wind patterns on planet earth.
  ➢ Creates ventilation in buildings.

• SOLAR ENERGY GENERATED HYDROLOGICAL CYCLES:
  ➢ Creates water flow on the planet.
  ➢ Water distribution and availability for habitation.
TRADITION
A Laboratory for study
TWO INDIAN DESERT
- HABITAT FOOTPRINTS

JAISELMER HOT DRY - Compact

SPITUK LEH - Open
INDIGENOUS HUMAN HABITAT INDIA
A Product of evolution in response to ecological context

Jaisalmer (Hot dry desert India)
(Max. +52 C)

Leh (Cold dry desert India)
(Min. -30 C)
DRY HOT HABITAT - JAISELMER

THE STREET: MUTUAL SHADING
TRADITIONAL WATER COLLECTION - GARSAGAR
EMERGING SCENARIO
GLOBALISATION OR STERILISATION?
Single Most Contributing Factor

CHINA

BAHRAIN

INDIA
WOULD THIS BE CONSIDERED AS HUMAN ACHIEVEMENT OR FOLLY?

WHY ARE WE CREATING REDUNDANCIES?
ENERGY SCENARIO: THE IMPERITIVES

DEMAND & WASTE MUST BE MINIMISED

Annual electricity consumption in Indian Buildings
(Source CMIE 2001)

1.0 kwh (SAVED) = 1.67-1.83 kwh (GENERATED)
= 2.3 for Indian condition
ERA OF SCARCITY

• WHEREAS THE 20\textsuperscript{TH}. CENTURY WAS AN ILLUSION OF ENERGY ABUNDANT CENTURY

• WE NOW LIVE IN AN ERA OF SCARCITY
CONCEPTUAL FRAMEWORK FOR AN ECO-SETTLEMENT

AN OPTIMUM BASIS FOR HUMAN EXISTANCE
THERE IS NO SUSTAINABILITY WITHOUT EQUITY

Ghetto of the Poor

THIN LINE SEPERATES THE TWO

Ghetto of the Rich

Source Photo: Prof. Mike Jenks
Venezuela
HABITAT PATTERNS

NIGHT TIME IMAGE OF PLANET EARTH

CITIES

COVER 1% EARTH SURFACE
• CONSUME 75% OF TOTAL WORLD ENERGY
• EMIT 80% OF TOTAL WORLD CO2
• Source: UNEP REPORT 2005

IN WAKE OF THE CITY LIIES WASTE

IS CITY A MISTAKE ?
ASIAN CONDITION

• PRESENT WORLD POPULATION: 6.5 + Billion

• PROJECTED WORLD POPULATION 2030: 10 + Billion
• Projected India + China Population @ 40%: 4.0 + Billion
• Projected Urban Population @ 75 to 80 %: 3.2. + Billion
  India + China

• Delhi Present Population: 16 + Million
• Delhi Projected Population 2035: 48 + Million
UNENDING CITY

TOKYO

Photo source: Prof. Yuichiro Kodama
Kobe Design University
Architect, Dr.Eng

BEHMOTH IN-HUMAN CITY
VERTICAL CITY

HONGKONG

Photo Source: Prof. Michal Wolf

PIGEON HOLE CITY
CONSUMING CITY

LOS ANGELES – AUTOMOBILE CITY
• MUST WE CREATE AN URBAN TRAP?
• A NIGHTMARE 21ST. CENTURY
• IS THIS THE FUTURE OF HUMANITY AND THIS PLANET?
CURRENT TRENDS
INDIA

Gurgaon: Automobile City

- Highly resource intensive
- Very in-efficient land-use
- Culturally sterile
- Very high energy demand
FUNDAMENTAL QUESTIONS?

• FOOTPRINT OF HABITAT?

  ➤ Compact or Open?
  ➤ Why is linear geometry based patterns imposed?

  ➤ Why must motorised transport (car etc.) govern habitat pattern?
WALKING CITY
Idyllic City

AUTOMOBILE CITY
Consuming City

HABITAT - BUILT FORM

- High Density
- Mixed Use
- Short distance origin and destination patterns, highly dispersed throughout the city


- High Density Commercial Use Core
- Commercial, Retail and Industrial Land Use separated and dispersed throughout metropolitan area
- Long distance origin and destination patterns highly dispersed throughout the metropolitan area

Possible future Information City – urban villages / nodes (walking oriented) linked by quality public transport, Urban Agriculture an integral part of city.
The ridge is made up of micaceous rock and quartzite rock, which are both very hard.

SECTION B8 HYDROLOGY STUDY
A comparative study of water level map of 1960 and 2002 shows in Rajender nagar the water level which was at 10 to 15m below ground level has gone down to 20 to 30 mts below ground water level.
In NDICC the water level which was at 5 m bgl has gone down to 10 to 15 mts bgl.

SECTION B6 SOIL STUDY
In the Rajender nagar area the first Layer of clay and kankar extends to depth of 4m bgl. This is followed by quartzite formation. The fractured and jointed layers of the formation acts as water bearing formation.
In the NDICC the first Layer of clay and sand extends to depth of 3m, which is followed clay inter mixed with Kankar 6m below ground level. This is followed by layer of sand between 8 to 10m. This is followed by weathered and fractured quartzite, which extends up to 40m bgl. This is followed by partially fractured quartzite, which extends to greater depths.

SECTION B6 RIDGE PLATE STUDY
Coupled with the settlement pattern, the geological characteristics, such as depth of alluvial soil, play a crucial role in determining the magnitude of rise.
The Narain-Patel Road section and the Yamuna River - bed section, extending till NOIDA and Faridabad, are more vulnerable to damage even by a moderate earthquake because they are on alluvial soil upto 200m deep. These regions face a very grave problem of soil liquefaction during an earthquake. Moreover, earthquakes are amplified by alluvial soils.
The Ridge is comparatively safe as it has a rocky base AT 15m.

SEISMIC STUDY
Delhi is located in zone IV which has fairly high seismicity where the general occurrence of earthquakes is of 5.5 magnitude, a few of magnitude 6-7 and occasionally of 7.5 magnitude. Delhi thus lies among the high-risk areas.
This region is characterized by several dominant features such as the Delhi - Haripura ridge, the Aravali - Dharali fault, the Sishtoma fault, the Malhura fault and the Malsuada fault.
Two major lineaments namely Delhi-Haripura ridge and Delhi-Malsuada fault pass through the territory both having potential of producing earthquakes of magnitude upto M8.5-VIII which are possible to cause major damage. The risk of M7.5 may be assumed for these earthquakes.

HYDROLOGY STUDY
The falling ground water level in Delhi has become a matter of serious concern. At some places in south and south west Delhi, the water level has gone below the 20-30 meter mark below the land surface. The quality of underground water is deteriorating and in several places it has been found to be unfit for human consumption.

Hydrology
Surface water is also scarce in the region, as water slopes down towards Yamuna on eastern side and all other ponds have been filled up for surface construction. Here western and southern areas undergo maximum weathering and erosion.
AUGMENTATION OF GROUNDWATER
In Rajender nagar area the rainwater can be diverted to a depth of 15 to 20 mts. By doing this the rainwater will under go a natural filtration in the subsoil before it reaches the main aquifer. The recharge water in the recharge well should be of 15 to 20 mts bgl depth.
In NDICC area the rainwater can be diverted to the weathered and fractured quartzite formations.
NATURAL WATER FLOWS:

• The natural water flows in the site are key determinants of the interventions.
• These points on the site are kept free from built interventions to retain water flows from the ridge to the site and also to retain intra-site flows.
• These are the lines which determine the path of the aqueducts, which brings in water from the catchments on the ridge to the site.
Summing up urban level, sector level, and unit level

GREEN FINGERS - WATER FINGERS

The natural crevasses of the ridge have been transformed into green fingers which brings in the ridge vegetation into the site as these are also the lines of natural water flow.

At the ground level, the water passes through root zone treatment system which relieves the water of some undesired chemicals. This enhances both the ground ecosystem and water cycle.

The water harvested at the higher levels of the ridge flows into the site by means of wind scooped aeroaqueducts which aerates and purifies the water.

This system incorporated also defies the previously hard edge of the religiously active Mandir Marg and lets the ridge flow into the site with all its assets in the form of bio-diversity, water resource and for the average good Samaritan - a feeling of goodness in the greens.

WATER CIRCULATION SYSTEMS

The CENTRAL GREEN WEB acts as a water catchment directing the flow towards the service pits, where it is aerated and purified. It has two major components:

THE RAINWATER CHANNELS: This directs the water all along the web in the form of a closed loop falling on the same contour level, thereby becoming a temporary water storage. This further feeds water to the service pits located at various strategic positions which further purifies the water by aerating it and removing some dissolved entities and chemicals before re-feeding it to the system.

THE ROOT-ZONE GREENS: This zone is a contoured network of greens running all along the web. This is to purify the water before reaching the service pits. This is done at the macro level - by indigenous vegetation which runs on low water and have a spreadout root system preventing erosion and also by root zone plants which help in eating away dissolved chemicals.

The other merits of the Central Green Web are:

A GREEN BINDING: the whole settlement.

HOMOGENISES GREEN DISTRIBUTION: promotes social equity

A UBQUITOUS PEDESTRIAN AND CYCLING REALM ALL ALONG THE GREEN: promotes walkable neighbourhood concept, reduces vehicular dependency, indirectly promoting the natural water cycle.

SERVICE PITS

The service pits are sunken treatment facilities for rainwater, sewage and related waste. Each pit suffices operation for one sector of about 7,000 people and are strategically located at the lowest contour points of the respective sectors. The reason behind sinking the service areas is:

1. Increasing pipeline slope of gravity based systems reduces water requirement for flushing down sewage (a 5% increase of the conventional slope reduces requirement of water by 10%)
2. Hidden from direct vision
3. Easier maintenance of sterile environs
4. Reduces possibility of surface contamination

SYSTEMS FOR WATER TREATMENT

ROOTZONE TREATMENT
AERATION
UBQUITOUS AERATED WATER MOVEMENT

SYSTEMS FOR SEWAGE TREATMENT

SEGREGATION
SOAKAWAYS
ABSORPTION IN OTHER ECOSYSTEMS

Urban Design Moves

Section through Mandir Marg
POSSIBLE BUILT FORM WITH URBAN AGRICULTURE
Tokyo 2050 : Fibercity
Prof. OHNO Hidetoshi
ENERGY - RESOURCE FLOW ECOLOGICAL FOOTPRINT: MODEL

ARCHITECTURAL DESIGN
- Climatic Parameters
  - Quantitative – Qualitative Environment
    - Air Temp.
    - Humidity
    - Ventilation
    - Day light
- Embodied Energy
  - Minerals
  - Metallic products
  - Organic & Inorganic chemicals
  - Petroleum products
  - Forest products

MODIFIED ENVIRONMENT
- Local
- Regional
- Global
- Air
- Water
- Land
- Flora & Fauna

PRIMARY ENERGY
- Heating
- Cooling
- Electrical
- Transportation
- Mechanical

FOSSIL FUEL
- Coal, Petroleum etc.

REUSE
- Mixed Refuse
- Salvaged material
- Garbage

EMISSIONS
- CO₂
- CFC
- Waste
- Heat
- Sewage
- Garbage

WASTE PROCESSING
- Landfill
- Incinerate
- Sewage Treatment

Energy Extraction

Ecological footprint: Community, City, Region / Country
CAN WE CONVERT THE ENVIRONMENTAL CRISIS INTO AN OPPORTUNITY

?

A NEW LANGUAGE OF ARCHITECTURE

FOR A NEW ERA
OUR WORK IS NOT BASED ON ANY PRE-CONCEIVED NOTION OF ARCHITECTURE

• IT EVOLVES BASED ON LAWS OF NATURE

ARVIND KRISHAN
PERCEIVED SUN PATH

SUN PATH IS DYNAMIC & CURVILEANER
WHY DO WE DESIGN BUILDINGS AS CUBOIDS?
SOLAR ENVELOPE

- Entire building envelope a: Solar Receptor, Collector, Converter, Dissipater
  - A SOLAR ENVELOPE

- SOLAR ENVELOPE CAN BE DESIGNED WITH COMPONENTS RESPONDING TO:
  - Produce direct energy through PV.
  - Distribute day-light, within the building, creating a healthy day-lit environment and in open spaces.
  - Create ventilation: Solar Chimneys
  - To cool or heat the building, when coupled with earth tunnels using the thermal inertia of the earth and Trombe walls, in innovative approaches.
PEDA Office Chandigarh
PEDA OFFICE
CHANDIGARH
Building Envelope in response to Solar geometry and Renewable Energy Systems Integration

PEDA Office
PEDA Office Chandigarh, India –
A New Language of Sustainable Architecture
HYPERBOLIC PARABOLOID SHELL ROOF
Energy Efficiency of a Reference Thermosyphon Collector (Solar Chimney)
Architecture – Structure Symbiosis
FASCINATING ARCHITECTURE - PEDA Office
Day lit Working Environment
Fascinating Architecture
Performance of Downdraught evaporative cooling system in Hot & dry Climate: The PDEC system in Punjab Energy Development Agency Building (PEDA), Chandigarh, India

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ABSTRACT: Downdraught evaporative cooling is an alternative to conventional air-conditioning. It is an energy efficient, cost effective and environment friendly system, which can significantly reduce the carbon emission from the building. This paper investigates the contribution of a PDEC system in the atrium and their adjacent office spaces in the PEDA building. The system passively cools the hot dry out-door air and circulates the air throughout the building. Hot dry air is exposed to water at the top of the tower, as water evaporates into the air inside the tower, the air temperature drops and the moisture content of the air increases, the resulting denser and cooled air drops down and out from the opening in the lower part of the tower towards the neighboring spaces because of the negative pressure created at the top of the tower. Its performance is always dependent upon the wet bulb depression (the dry and wet bulb temperature difference) hence the greater the depression the greater the potential and this is investigated by thermal analysis software (TAS). The result shows that, evaporative cool towers work best with open floor plans that permit the air to circulate throughout the building without any obstacles and the atrium space is working properly with application of PDEC system by getting 10-12°C lower than ambient temperature, which also helps to cool the neighboring south office space to maintain a comfortable space to work.

Keywords: Downdraught evaporative cooling, PDEC, Wet bulb depression

1. INTRODUCTION

1. SITE MICROCLIMATIC ANALYSIS

The comfort temperature varies during whole year, but the maximum comfort temperature in summer varies from 29 °C to 31 °C when external temperature varies from 40 °C to 45 °C. Hence we need to design the building to achieve comfortable temperature by keeping the highest or hottest week of the year in mind to avoid the overheating.

The solar radiation has been taken in to consideration by strategic positioning and orientation of each element of every façade of the building block for whole year.

Wind direction generally lies along the NE-SW axes. The prevailing direction is North-east due to the proximity of the Himalayan range towards the north-east. The wind speed hovers at about 1.5 m/s. During the monsoons, however, the direction reverses to the south-east with an increase in speed to about 2.3 m/s. wind speed and direction has taken in to consideration while designing the wind tower and building openings, for uniform air movement.

2. CONTEXT & DESIGN STRATEGIES

To minimize dependency on fossil-fuelled energy sources the 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.

The Seasonal changes: two months of hot-dry; hot-humid (two months) and cold period (two months) require strategies of design that allow for 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 over-heated period extends from mid-April to mid-August. To achieve an architectural design that effectively responds to the diverse and often conflicting requirements of a composite climatic context is indeed a challenge. An attempt has been made in this design to develop a built form that responds to the solar geometry in its complete three-dimensional configuration and enables both cooling and heating. Air has been proposed as a medium to create a naturally cooled and heated environment. A unique floating slab system has been designed to allow free and quick movement of air. The envelope of the building is expected to act as a shell to eliminate or allow heat gain when required, permit a good distribution of daylight and enable effective ventilation. These strategies are reflected in the building's architectural configuration.

The Office complex building for PEDA at Chandigarh, India was built in 1991 by the architect Arvind Krushan. It is a project aimed at demonstrating an architectural design developed in response to elements of nature: Sun, wind, light and the utilization of Passive Solar Systems.
1. THERMAL PERFORMANCE DURING SUMMER

Summer time heat gain from the south is eliminated by a series of triangular plan configurations of a solid wall having no openings. Openings occur in the form of single quadrant domes, created over double height cut-outs occurring between successive triangular apaxes in plan. Landscaping, the roof of the first level of the building cuts off heat gain from the roof over a major area of the building. All other exposed areas of the roof eliminate heat gain by adequate insulation and earth cover. Heat gain in summer from the west exposure is eliminated by minimizing openings and providing a cavity wall.

Figure 9: Southern elevation of PEDA Office Complex.

2. BUILDING ELEMENTS

SHELL ROOF

The roof forms the critical element of the building design since it attracts the maximum solar heat gain. However, it can be used as an element to generate efficient daylight distribution. The hyperbolic paraboloid double curved surface responds naturally to solar geometry cutting off solar heat gain due to summer sun and allowing penetration of solar heat gain for winter.

Operation: Night

The tower area so designed that the top part provides large heat storage capacity, and at the same time has a large surface area for heat transfer. The tower and the internal walls of the airflow passages absorb heat during the day, and release it at night, warming the cool night air in the tower. Warm air moves up creating an upward draft and is exhausted through the openings. The pressure difference thus created pulls the cool night air through the doors and windows into the building. In the absence of wind, the tower acts as a chimney. The nocturnal radiation through the roof and the external walls bring about further cooling. In the presence of wind, the cool night-time air enters the tower and forces itself down into the structure, though it is warmed slightly during the process, sufficient cooling can be achieved due to forced circulation. Again cooling due to nocturnal radiation adds to this process.

Figure 11: LHS: Detail of wind tower, RHS: Onsite photographs of Atrium.

WIND TOWER

Operation: Day

The hot ambient air coming in contact with the cool top part of the tower is cooled. It becomes cold and dense, and sinks through the tower and into the living spaces, replacing the hot air. In the presence of wind, the air is cooled more effectively and flows faster down the tower and into the living area. It must be noted that the temperature of the tower soon reaches that of the ambient air and hence, in the absence of wind, the downward flow ceases. The tower then begins to act like a chimney. Operation of the tower depends greatly on the ambient fluctuations like the wind velocity, air, temperature changes, etc.

Figure 10: Upper Fig.: Solar envelope - Sun position & Lower Fig.: hyperbolic paraboloid roof having solar shell

SOLAR CHIMNEY

The office complex derives much of its daylight through the use specifically designed solar chimney which act as light and ventilation wells. At places as per climatic requirement, these solar chimneys have been modified into vaults. The requirement is to minimize heat gain in summer, to have moderate heating in winters and act as ventilating (out let) shafts. This natural ventilation process is augmented by solar chimneys and wind tower. The chimney is designed at higher than the roof level and in the southern wall. Absorption of heat from the sun is enhanced by using glazed surfaces and heat plate at the top. Direct gain warms air inside the chimney causing it to rise out the top and drawing air in from the bottom to maximize natural ventilation.

Figure 13: Detail Section of a solar chimney

1. SPATIAL CONFIGURATION & BASE CONDITION

The northern wing mostly houses computer labs, a library etc. with most of the floor area being left for circulation and the southern wing is occupied with workstations, cabins, and amenities for the general working staff and a suspended steel bridge is connected to both the wings through the atrium.

Figure 14: Ground floor plan of PEDA Office Complex.

DAYLIGHTING AND ELIMINATING OVERHEATING

On the southern exposure, direct openings have been completely eliminated. Daylight is received through spanning the series of triangular-shaped spaces that are formed by the solid southern wall. The domes have been designed to eliminate glare and heat. Since the deepest point in the office is within 10 meters from the dome, a good daylight condition is ensured in the office. The shell roof over the central atrium has been designed to admit daylight without glare, thus creating an ambience of diffuse daylight. Offices with northern exposure receive daylight from northern openings.

Figure 17: Illuminance levels on south office

Figure 15: Upper fig.: Day time ventilation strategy, Lower fig.: Night time ventilation strategy
1. METHODOLOGY

Thermal comfort and comfort zone in the context - Comfort zone temperature varies due to fluctuation of external temperature, in summer it varies from 24 °C to 29 °C and in highest temperature week, it may go to maximum 31 °C.

1. Onsite measurement - Spot temperature measurements were taken on day 115 in the atrium and south zone office space during afternoon 12 o clock (cloudy sky) and evening 5 o clock (having rainfall). 50% of wall windows were open, occupancy in the whole building — 40.

Without PDEC system indoor atrium temperature is 8-9°C lower than ambient temperature due to cloudy sky condition & performance of the building envelope.

2. Computer simulation through TAS on basis of base condition - without PDEC system as wind tower and solar chimney are not functioning. Hence simulation is based on the base condition without evaporative cooling system, wall window open 50% during occupied hour.

3. Manual calculation of cooling load, Q value and the fraction value (Q/Qmax), required airflow rate and air change per hour.

4. Computer simulation through TAS on basis of base condition - (case 1): Base condition with night ventilation - in summer during occupied hour all the lower part of the wall windows are closed and open during night for night time ventilation. With PDEC system having one wind tower.

5. (Case 2): Night ventilation active with PDEC system having three wind towers.

6. Simulation through PHDC Airflow tool; Evaluate the temperature, humidity and airflow rate.

7. (Case 3): Night ventilation active with PDEC system having six wind towers.

Figure 20: TAS model having one wind tower

Figure 18: Upper Fig. Onsite measurements on spot points. Lower Fig. Measured Temperature chart

Figure 19: TAS model without wind tower

Figure 21: TAS model having three wind towers

Figure 22: TAS model having six wind towers

2. RESULT (HOTTEST DAY – DAY 161)

The comfort temperature range varies from 24 °C to 31 °C and relative humidity range varies from 30 to 80 %. Required airflow rate as from manual calculations can be 3.5 m3/sec. Hence, the airflow rate can be achieved in all the cases, as required airflow rate is very low due to low occupancy and equipment gain. Good thermal mass of the building helps the building to perform in extreme conditions. Appropriate building design and orientation having properly placed building elements minimize the solar minimize the intense solar gain, PDEC system can be used to make the building a favorable place to work. From the overall result it can be concluded that the temperature, relative humidity and airflow rate increase from case 1 to case 3 which leads to unsuccessful result. Hence the central atrium space in between neighboring offices is working properly having PDEC system with one tower and it would be the best option to work with. From all the cases it can be concluded that ground office space also getting comfortable temperature during summer.

Comparing the results with wet pad, sprinkler and micronizer, the favourable and best indoor environment can be achieved through micronizer having better nozzles.

Figure 24: Testing through PHDC Airflow tool (tower having micronizer)

1. CONCLUSION

Evaporative cool towers work best with open floor plans that permit the air to circulate throughout the building without any obstacles. From the TAS result, it can be concluded that, the atrium space is working properly with application of PDEC system by getting 10-12°C lower than ambient temperature, which also helps to cool the neighboring south office space to maintain a comfortable space to work. From all evidences, PEDC can be said to function as a passive solar complex. Overall, the building performs well for the whole of the year except the peak summer period which can be improved through the evaporative cooling system. Hence Without any major changes in building profile and structure, existing wind tower and solar chimneys can be modified to incorporate the PDEC system, which can perform better during hot and dry summer days.

2. ACKNOWLEDGEMENTS

The authors would like to thank Professor Arvind Krishan, Architect of the PEDC for giving relevant information and his kind permission to publish his project.

3. REFERENCES


CONCLUSIONS

- Evaporative cooling towers work best with open floor plans that permit the air to circulate throughout 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.

- From the TAS result it can be concluded that the atrium space is working properly with application of PDEC system by getting 10-12° C lower than ambient temperature, which also helps to cool the neighboring south office space to maintain a comfortable space to work.

- From all evidences Punjab Energy Development Agency (PEDA) office building can be called as a passive solar complex. Overall the building performs well whole of the year.
5 STAR RATING 2010

BASED ON ACTUAL PERFORMANCE

14 kwh /sq.m/per year

BUREAU OF ENERGY EFFICIENCY
GOVT. OF INDIA

Only 5 Star building in country
PEDA builds first solar building in city

Tribune : Jan 2004

Building that runs on solar power

Tribune : May 2004

Round table discussion
ROLE OF REGULATION


Canadian GHG increased 24.1% between 1990 to 2008
Source: UNFCC (April 2011)

CANADIAN GREEN HOUSE

Figure 1
Projected Growth in Greenhouse Gas Emissions and the Kyoto Target

Source: Prof. Michelle Addington
Harvard / Yale
Figure 5-51: Incompatible measures in LEED-H (prescriptive pathway for EA) and their associated credits
CRITICAL QUESTIONS:

- Has it been established beyond doubt that such measure, protocols, ratings etc. actually deliver a sustainable building / project?

- Has it been established beyond doubt that in-compatibility of measures / parameters actually lead to a sustainable building?

- Has it been established beyond doubt that buildings rated under different rating systems as ‘Platinum / gold…. ‘Stars.’” Etc. are actually appropriate examples of sustainable buildings, that can / should be followed / replicated?

- Is it not true that in order to satisfy higher ratings as per these rating systems expensive materials i.e, ’low E glass ’ etc. leads to getting higher rating.

It would therefore be mandatory that these measures should not be taken on their face-value. Regime of ‘Regulatory Measures’ be questioned.

REAL CHALLENGE THEREFORE IS TO ACHIEVE GOOD MEANINGFUL ARCHITECTURE AND NOT JUST FOLLOW THESE EXERCISES OF FILLING UP VOLUMES OF PER-FORMA.
CRITICAL INPUTS

• STRONG KNOWLEDGE BASE

• INGENUITY
A Strong Knowledge Base: Is the Key
CLIMATE RESPONSIVE ARCHITECTURE CRA 1.0
SOFTWARE FOR DESIGN DECISIONS

Selections From Matrix For Design Of: house

1 / 2: Land Form And Land Form Orientation
3: Vegetation
4: Water Bodies
5: Street Widths And Orientation
6: Open Spaces And Built Form
7: Ground Character
8: Planform
9: Plan Elements
10: Orientation
11: S / V Ratio
12: Roof Form
13: Fenestration Pattern
13: Fenestration Configuration
14: Fenestration Orientation
15: Controls
16: Roof Materials
17: Wall Materials
18: External Colors And Textures
19: Internal Materials
20: Internal Finishes

Large width to height allows sun and light.
CLEAR
Comfortable Low Energy Architecture
Web based Teaching and Professional packages

• Prof. Fergus Nicol    University of East London
• Prof. M. Santamorius  University of Athens
  • Prof. Arvind Krishan   CASA
  • Prof. Ashok Lall    TVB

http://learn.unl.ac.uk/~asia/website/index.html
MY INSPIRATION

SEA SHELL

SPIDER WEB

BEE HIVE

NATURAL HABITAT
How Do Termites Stay Cool Without A/C?
PHOTOSYNTHESIS V/S PHOTOVOLTAIC

- USES SOLAR SPECTRUM
- CONVERTES INTO CHEMICAL ENERGY
- CONVERTES CO2 TO O2
- NATURAL CARBON SEQUESTRATION
- CREATES WATER
- NATURAL COOLING THROUGH EVAPO-TRANSPIRATION LEAF TEMP 4°C LESS
- WASTE CONVERTS TO NITROGEN AS FOOD FOR TREE / PLANT

- USES SOLAR SPECTRUM
- CONVERTES INTO ELECTRICAL ENERGY 10% - 15%
- 90% WASTED
- CONVERTES INTO HEAT LOWERS CELL EFFICIENCY
- CREATES URBAN HEAT ISLAND + 4°C TO AMBIENT
- AS WASTE IS NEITHER RECYCLABLE NOR BIO-DEGRADABLE
TO MY MIND

GOOD MEANINGFUL
ARCHITECTURE
EVOLVES AT MEETING POINT:
WHEN ART BECOMES SCIENCE AND
SCIENCE BECOMES ART

ARVIND KRISHAN
AT THIS POINT

LOFTY BECOMES MUNDANE
&
MUNDANE LOFTY

ARVIND KRISHAN