Sustainable Planning and Architecture

Lecture 7

GREEN BUILDING

Defining the future with intention.

Lot of people think this is a green building just because it painted in green. But it is not.

It is the operational cost and the weights been used that makes a Building in green building.

WHAT IS GREEN BUILDING?

"It is the practice of increasing efficiency with which buildings use resources-energy, water and materials-while reducing building impacts on human health and the environment."

As we know the air which surrounds is within a building are a closed environment is directly related are directly connected to the health and well being. So we have to maintain such standards to have good indoor air quality, to have good respiration and which is all impacted by this green building design, which reduces the resources such as energy, water and materials.

"GREEN BUILDING TECHNOLOGY SHOULD REACH ALL"

CONCEPT

- Is the aim of this green building design .The concept is gaining importance in various Countries, including India. These the some of the rating systems are develop to create awareness and to make people to get its reach from technicians to normal lay man community to know about the importance and significant of green building design.
- These buildings that ensure that waste is minimized at every single stage during the construction and operation of the

building, resulting in low costs, according to experts in the technology. So as we saw in the previous presentation, this not only improve the health and increase energy efficiency but also ensures that ways and materials recycle are reuse in every states of its operation that is the concept which is been adopted to make it as a green building or green building material.

- The technique associated with the 'Green Building' include measures to prevent erosion of soil, rainwater harvesting, use of solar energy, preparation of landscapes to reduce heat, reduction in usage of water, recycling of waste water and use of world class energy efficient practices. So, a green building concept cannot be definite or cannot be fixed just for the building are a build sector. It can also be adopted for the entire side. Such as using good landscaping or predicting and usage of solar energy and preventing from soil erosion and using reduced amount of water and recycling of waste water etc.
- A similar concept is natural building, which is usually on a smaller scale and tends to focus on the use of natural materials that are available locally. So, as we saw the previous presentation this point acts about the transportation charge, which is involve while transporting the building material from the from the factory to the usage society.

HOW TO MAKE GREEN BUILDING?

A green building is a structure that is environmentally responsible and resources efficient throughout its life-cycle. So it's not just from producing are its usage. It is actually calculated like a life-cycle assessment from the way this manufacture from being the buy product to the end product, which again recyclable. These objectives expand and complement the classical building design, concerns of economy, utility, durability and comfort. So, just because we are doing the green building does in mean we are compromising

on the comfort looks are utility so durability of the building we are also taking care of all this aspects and making the building actually better compare to the regular conventional once.

IMPORTANCE OF GREEN BUILDING

- Nowadays, we should make a way to maximize our natural resources to get some relief since pollution is everywhere plus the Global warming that we are all experiencing. The lot of service being taken around the world, which says the temperature is been increasing from point .89 degree Celsius or 1 degree Celsius through wards some for the pass for two, three takers. Which is solve due to what we are impacting from the building sector? So, we have to start reacting to it from now. So we have to depend more and renewable energy resources available abundant in nature and Non-renewable energy is expensive and unsafe but did you know that through green building we can save a lot of energy actually. We have to make our buildings more dependent on renewable energy sources.
- Before that, let's define first the meaning of green building(known also as green construction is the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building's life-cycle: from siting to design, construction, operation, maintenance, renovation and deconstruction. As we said in the previous slide not only takes care of creating a structure but it also being studied for a whole life –cycle assessment.
- The importance of this is it lessen the consume of energy and pollution as well because the more we use non-renewable energy the higher the risk of pollution. So, let for example there is a building which is using lot of air conditioning. The building has to been designed in a way. It catches the prevailing wind

directions the windows should be phase to the prevailing wind directions. To make use of the existing wind, which is a renewable energy so second, and first school buildings delighting is very essential and we have to make it so that the desk level is at least being minimum 300 lucks level to reduce the usage of conventional electric sources.

WHY GREEN BUILDING?

Now the global concern is due to global warming this climate change which results in floods, drops and increasing temperature which results in melting of ice gracious, which increasing sea water levels. As we seen these picture this was in 1884 and this is in 2009.

Blue is cool and red is hot. This means we are being increasing global warming, since 1884 to 2009 as shown this picture.

THREATS OF CLIMATE CHANGE

These are some of the results which will happen the climate is changing global warming is happening which results in thinks like floods, tsunami earthquake, fire, others and severe winter storm, hurricane, tornado, tornado and flood, severe storms. These are the natural calamities. Which is being formed because of climate change and global warming? So, again these are some of the thinks which being again listed.

ROOT CAUSE

So, what is the root cause of this type of climate change which is being happening? Is recently is energy consumption. So, whatever we are using energy this producing certain amount of hazarder's gasses which is increasing the green house effect and increasing the temperature eventually which changes the climate.

This is due to green house gas emission and which is due to environmental pollution.

SUSTAINABILITY AND BUILDING SECTOR

So, 50% of materials resources taken from nature are building related. So, whatever natural resources that we see around as 50% is being rusty just being of the building sector alone. And over 50% of national waste production comes from the building sector.

As a building in an individual it may seem to be a small number but, when you look at this problem globally. It is 50% of the entire ways has been produced globally just from a building sector. So, we need to consider this type of sustainable usage, which can be leg when a resource from a forest and then it's been construct as a building and the waste has been usable for again recycle or reusable. So, it does in provide hazarder to the earth that we live.

MOST POLLUTION AND ENERGY CONSUMING SECTOR

As we seen this short which is less the major three sector which is been reducing more energy consumptions. Which is building, transportation and industry. When you see from the year 1950's the building sector which is been growing more which is more becoming more polluting and more energy consumption even compare to the industrial sector and transportation sector. So, as you see industry contributes just 25% and transportation to 27% but building contributes almost to 48% of this pollution and energy consumption.

- That way using 40% of global energy consumption is building related.
- 50% of global green house emission is due to buildings.

Since, the building are becoming more and more the appliances that

We use and difference materials that we using electronic materials that way using to keep the building with in comfort level is emitting lot of carbon oxide and other gasses which is hazarded, which is accounting to 50% of global green house emission effect.

Would you to continue like this---?

- Unknowingly, architecture and building community is responsible for almost half of green emission annually.

BUILD GREEN BUILDING or SUSTAINABLE HABITAT

So, this using green building sustainable aspect is like from the start of design not only just usage of materials but from the starting to analyze the climate and the usage and the usage pattern of a building and appliances which will go with in the building all can account to reduction and usage of energies. For example, when you designing a building for a audio virtual room or something level.

Lot of electronic devices goes with in the room which cannot be neglected and lot of heat producing in the room is already high due to the availability of such appliances. So, the motor capacity of the room heater which is been install in a colder climate much less. Since, when the heat produce by the appliances is high it compensates to which can be produced by the room heater.

- The objective is to evolve a strategy to reduce energy use in building so as to reduce energy costs and green house gas emission into the earth's atmosphere.
- A green building is designed, constructed and operated to minimize the total environmental impacts while use comfort and productivity.

So, while a green building design has been consider. You should consider also to reduce the impact on global level also to individual level we need to consider producing good and comfortable virtual and thermal comfortable environment for the end user's of that space.

GREEN-NESS IS AN ACCOUNTABILITY PROJECT

- Government body and policy guidelines responsible for assessing sustainability in building sector in India: or
- NBC, 2005 is the national building code.

- ECBC, 2007.

These are two body which is been develop by government of India to asses this type of green buildings and to give certification to this type of green building and to reduce the impact on the environment.

- Local byelaws prevalent building rating systems in India.
- **GRIHA**: Green rating for integrated habitat (National Rating System). It's developed specifically for India because there is lot of different rating system which is been developed globally. But, that does not work for Indian climate or Indian culture and usage. It's works for on different usage of most western and American life styles. So, greha is specially develop for India to use our methods of life style to consider this assessment and rating system of the buildings.
- **LEED**: leadership in energy and environmental design.

So, LEED is also develop it made globally and it was started an American body and then it's been followed even in India as a certification program for different building.

GREEN BUILDING CONCEPT

1. Sustainable site planning
2. Building design optimization
3. Energy performance optimization
4. Renewable energy utilization
5. Water and waste management
6. Solid waste management
7. Sustainable building materials and construction technology
8. Health, well being and environmental quality

So, these are on a bigger picture when you design a green building. So, these are the aspects has to be consider and this will be taken in to account while giving a building assessment or giving a building certification is green or not. So, these are the points,

GREEN BUILDING RATING SYSTEM

- A green building rating system is an evaluation tool that measures environmental performance of a building through its life cycle. So, even from starting of the site plan to design product usage, metical usage and even after that a post occupants evaluation is made which shows how much people are comfortable and how this technique's which put into actually beneficial to the building sector. By maintaining their energy builds on comparing them to the conventional building of a same size and same usage pattern.

- Each criterion has pre-assigned point sand sets performance benchmarks and goals that are largely quantifiable. So, this certification program has works and different criteria's. When covers all this points that we saw in the previous slide delighting natural renewable energy sources, sustainable energy planning, ways management, recyclability, reusability and everything. And these work on there are some goals and some benchmark to which the building to has to meet to get that type of certification.

SUCCESSFUL INTERNATIONAL RATING PROGRAMS: LEED which is leadership in Energy and Environmental Design (LEED) was developed and piloted in the US in 1998 as a consensus-based building rating system based on the use of existing building technology. So, it was developed in 1998 by US body to give a building a rating the main aim was to reduce energy usage. So, that will meet up to that target.

- The rating system addresses specific environmental building related impacts using a whole building environmental performance approach.

The Indian Green Building Council has adapted LEED system and has launched LEED India version for rating of new construction.

So, as we told before this lead construction assessment system developed for a US body. So, it works on different life style and usage methods but for India it since snidely different we'll been developed lead India version which takes a to account the same some of the redefined strategies to create building assessments.

Indian Green Council (IGBC) has launched several other products for rating of different typologies including homes.

So, this IGBC also is an Indian body which has developed lot of difference certification programs. Like greha other certification programs like MBC and all that. Which takes into account all the strategies to give a certification. This is not just for public building or building life huge offices or IT complexes it can also be done for an individual resident level.

CASE STUDY

CII SOHRABJI GODREJ BUILDING

Now, moving on to the case study for a lead building. It is "cii sohrabji godrej building" which is located in Hyderabad.

CLIMATE

- It remains fairly warm most of the year.
- Receives less rainfall in the monsoon.
- Temperatures come down in the months of December and January and the nights become quite cool in and around the Hyderabad city. So, there is lot of diurnal variation happening even within a day. During hot sun radiation

temperature goes very high and during the night it becomes very cold.

- During the summer months, the mercury goes as high as 42 C while in winters the minimum temperature may come down to as low as 12 C. So, important to maintain the building without any fluctuation from 42 to 12 C it has to maintain with in comfort level to reduce the energy usage. So, first the climate is been asset for that,

TEMPERATURE AND RELATIVE HUMIDIT

- During the summer months, temperature goes as high as 42C while in winters the minimum temperature may come down as low as 12C. So, as you see how the temperature increases and reduces. It can suddenly go up to 42C the lot of sun when it is the cold an night it eventually comes down the diurnal variation.

- Humidity in the morning is very high exceeding 80 percent from July to September. In the dry months of March, April and May, humidity is generally low with an average of 25 to 30 percent. It's true. This is both are interconnected. So, when there is lot of son that lot of variation increases a temperature due to lot of radiation the water content in the air gets vaporised because of which the humidity level comes down. So, when there is no sun humidity is high. When there is high sun humidity is less. So, that's what happens in different months as they as shown. This is a short which source the humidity level which is going up and down from somewhat a cold of months.

GREEN ARCHITECTURE

This follows a green architecture. Which has benefited?

- Economical
- Energy-saving
- Environmental-friendly
- Sustainable development
- Sohrabji godrej green business centre in Hyderabad. It's a commercial building which consists of office buildings, research labs and conference rooms.

So, this is the site which is closed to the main road which lessons the transportation and it's very close to all public amenities that are present around the site.

GREEN BUSINESS CENTRE

This is the outlooks. It uses solar PV cells and roof tops to trap maximize the solar energy and wind towers catches high since has the height goes higher. The speed of the wind is usually very high so, it catches the wind and opening is made in such a way it catches the traps the prevailing winds and its take down and it is been process and has been used ventilating for this building and roof garden are used lot of spaces reduce the radiation level. Since places like sathen of India has lot of radiation on the roof level. So, to reduce the radiation penetrating inside the building and increasing the air conditioning cost. Roof garden has been adapted and different water body's to maintain the water level in the site.

- Water efficiency
- Sustainable site
- Energy efficiency
- Materials & resources
- Indoor environmental quality

These are some of the strategies, which is been maintained and met up to the mark of this leas certification program.

WIND PATTERNS

So, this is green building centre has two to three wind towers. It is important to know the wind patterns and study them to use it effectively. As shown in the image, two wind patterns which was been studied.

Formation of positive and negative pressure zones when wind flows around rectangular and circular bodies. So, as you seen if a structure is rectangle the wind flow's like this and gets in different direction and it forms positive pressure and negative pressure either sides.

When it is a circular structure the wind moves more gradually on all the side creating a less of pressure zone. The pressure coefficient cp can be used with the velocity to calculate positive and negative pressure wind pressure loads.

So, planning of this green business centre has,

- Central courtyard
- Roof garden – protects heat penetration, cuts down heat-island effect. So, heat island effect is a lot of concrete structure. Concrete has good capacity of trapping in heat and cold both. So, it can trap lot of heat and it can emit most of it inside the building to reduce such heat island effect roof garden has been adopted.
- High performance glazing to bring in natural light while minimizing heat ingress. A views special coatings and food to gasses on the external surfaces so, when the solar radiation falls due to the reflective layers which has been

applied most of the solar radiation gets bounced back and only very less solar radiation gets increased.

- Usage of light glazing and vision glazing.

- Jail (perforated) wall for bringing in natural light as well as ventilation. So, this is jail pattern which is developed in muhal architecture over a century which is been adapted in this design as well to bring in natural light and ventilation and lot of energy saving appliances and systems which has been used like solar energy, upvc cells that we just saw and this is like a side plan. Which has central courtyard and different block and roof gardens?
- Energy saving system.

COURTYARDS

The courtyards act as “light wells”, illuminating adjacent work areas. When the light is not sufficient, sensors trigger the deployment of efficient electric lights. Dimmers automatically control the illumination levels, turning the light off when they’re unnecessary. Also, occupancy sensors prevent a light from being switched off at an unoccupied workstation.

Courtyards like a light well which brings in light because there is no courtyards their own be light penetrating within a building. So, created a central courtyards like well to bring in light and this light has been what in to the adjacent in to the work spacing and the work spaces are arranged in away. It surround the courtyards and they we are used building automation system like dimmer system and occupancy control which senseless the light level if it is a very cloudy days or a winder season when there is a high amount of clouds will be formed the light level is usually very less. So, this type of sensor works on the basis of lucks level. So, if the lucks level set for

example, if 300 lucks level if it reduces the lights automatically gets turn down and when there is sufficient light the dim light automatically goes off.

So, this is a good automating system which reduces the energy use and it also has occupancy sensor. So, when the leaver room if you an after few seconds when there is no occupancy the senses there is no people inside it automatically switch is off. Which is also reducing the energy usage in the building? So, these are some of the courtyards images which as how the light is been pot in by the structure and how green is used.

ROOF GARDEN

- Absorbing heat and radiating it into the building. This is minimized through the roof gardens covering 55% of the total roof area. So, as we said before in climates like Hyderabad lot of radiation which falls on a horizontal plan. So, horizontal comes on the roof lets completely reduced by using the 55% of the roof area.
- Rain water harvesting. And the rain water harvesting has been employed.
- Seepage into the ground have been installed in pedestrian areas and parking. So, this are some of the rain water system which is been used in the roof.

NATURAL LIGHTING

So, different lighting scenarios is use like light cells where the work area I s much further inside light cell bounds in the natural lights and brings in the into the work space. Similarly the other techniques are used.

Natural light deflection systems can direct light deep into the room and ensure better natural lights provisions. So, as you see,

REFLECTIVE GLASS

- This material will most significant reduce penetration of radiating from the reflecting side to the non-reflecting side (penetrating of 11-37% of total striking radiation).

So, this is for reflective glazing when the reflective is used almost 11-37% of the total radiation that's falling on the glazy can be reduced.

- Such glazing is used in this building where it is desirable to maintain eye contact with the outside as well as to prevent penetration of radiation and in areas where it is hot most days of the year.

This is like a reflective panel which reflects most of the radiation and only less gets absorbed less gets transmitted inside the work space.

USAGE OF LIGHT GLAZING AND VISION GLAZING

- The double glazed glass will just allow the diffuse sunlight to pass through and radiate the solar radiation back. It is located in the western direction because the sun's rays are highly radiant when it is setting. So, as we know sathen part of India as lot of haze radiation on the western direction. So, this type of reflective glazing has been used in the western radiation. So, this some of the pictures.

DOUBLE GLAZED GLASS

- This consists of two sheets of glass with space in between, sometimes filled with air or other gases or vacuum.
- Variations in thickness have a certain effect, up to a certain limit, on the percentage of radiation allowed to penetrate and on the thermal conductance of the composition.
- The main advantage of this type of cross-section is its ability to reduce heat transfer from one pane to the other, both by the conduction and by radiation. So, the double glazing is to glaze on a certain limit with which filled with air or some other gases

which since there is air gravity it reduces the solar radiation which has been penetrated falling on the external surface.

USE OF TRADITIONAL JALLI

So, this is a JALLI which has been used,

- JALLIS or lattice walls are used to prevent glare and heat gain while ensuring adequate day lighting and views. The JALLI, used in many historic buildings such as the Tajmahal, gives definition and an aesthetic appeal to a space.

SOLAR SYSTEM

- Harvesting of solar energy-20% of the buildings energy requirement is catered to by solar photovoltaic. The solar PV has an installed capacity of 23.5KW average is 100-125 units per day. So, on a daily basis it provides 100-125 units which almost reduce 20% of the energy demands for this entire building. So, this is some of the pictures and system which has been adapted for this building.