Theoretical Review on Green Building
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Abstract:
A building which uses less energy, water and natural resources, create less waste and is healthier for the people living inside compared to a standard building is called Green Building. Green building is not new. Humans has been building with local materials such as mud, straw, wood, and stone, and using renewable energy from the sun, the wind, and water for thousands of years. Conventional buildings have a substantial impact on health and wellbeing of people generating waste, and emit greenhouse gases throughout their life cycle which can be 50, 75, or more years. Green building design aspects involve site planning, building envelope design, building HVAC design, indoor environmental quality (thermal, visual comfort, and air quality), use of ecological sustainable and highly recycled and renewable materials. World shortage of power, water and environmental factors are the factors, encouraging building industry's focus on green building. Buildings annually consume more than 20% of the electricity used in India reducing operating cost, enhance marketability and increases productivity. The design of the building which is economic, social, environmental and renewable elements, benefit to all stakeholder owner, general public, and business community. The united states of green building council (USGBC) announced the result of research by Dodge Data and Analytics in the World green building trends 2018 Smart Market Report. The survey shows that global green building activity has significantly increased in 19 countries over the next three years and almost half of the total respondents say they expect to build more than 60 percent of their projects as green buildings by 2021.besides, the Building owners were so excited that 57% of them planned to make the majority of their projects green by 2021.

Keywords: Natural resources, Standard living, Renewable Energy, Environmental Quality, Reducing Cost.

I. INTRODUCTION:
A green building, also known as net zero energy building (NZEB), is a building with zero net energy consumption, meaning the total amount of energy used by the building over a year is equal to the amount of renewable energy created on the site, or in other renewable energy sources elsewhere. These building contribute less overall greenhouse gas to the atmosphere than normal convection buildings.

They do consume non-renewable energy and produce greenhouse gases at times. Most of the green buildings get their energy from grid, and return the same amount. Buildings that produce a surplus of energy over the year may be called “energy-plus buildings” and the buildings that consume lightly more energy than they produce are Called “near green energy buildings” or ultra low energy building”. Energy is usually harvested on site through technologies like solar, wind, while reducing the overall use of energy and lighting technologies.

The green building consumption principle is viewed as a mean to reduce carbon emissions and reduce dependence on fossils fuels and although green buildings remain uncommon even in developed countries, they are gaining importance and popularity. The goal of the green buildings becoming more practical as the costs of alternative energy technologies and decrease the costs of traditional fossil fuels increase. From the day one of the occupancy of the green building the energy savings could range from 20-30% and water savings around 30-50% which include both tangible and non tangible benefits.

II. USE OF SIMULATION IN GREEN BUILDINGS AND TERMS USED IN SIMULATION
Representing the imitative functioning of the one system or process by means of the functioning of another. Becoming a day to day design tool for low energy buildings it took 10 years for building simulation to move from being a single user per office or even per company basis. UK consulting engineers expanded their services to incorporate energy efficient design advice. Building simulation lead the way to identify if performance based targets could be achieved and also become a key component for the Hospital and Schools PFI/PPP programmes. Over the next ten years building simulation will be becoming more sophisticated. For example simulation at hourly time steps considering too long and hence are not suitable for capturing the dynamics of buildings. Placing much greater emphasis in operating building simulation tools at very short time steps i.e. as short as a few minutes in order to fully capture the dynamics of buildings at a low energy and sustainability standards tighten both in terms of government regulations and building rating systems such as BREEAM and LEED. No matter how complex and specialized equipment and systems are employed in buildings to reduce energy and carbon emissions the building simulation facilitates both the design and operation of these systems. Operational Model gathers information from low cost systems. Over the next ten years building simulation tools at very short time steps i.e. as short as a few minutes in order to fully capture the dynamics of buildings at a low energy and sustainability standards tighten both in terms of government regulations and building rating systems such as BREEAM and LEED. No matter how complex and specialized equipment and systems are employed in buildings to reduce energy and carbon emissions the building simulation facilitates both the design and operation of these systems. Operational Model gathers information from low cost systems.
continuous optimization of the building. Hence building simulation use evolves a major component in both the design and operation of extremely low energy buildings, and ultimately to smarter buildings and more importantly Smarter Cities.

III. ENERGY SIMULATION & BUILDING MODELING

Presents a simple methodology for estimating hourly electrical and fuel energy consumption of a green building by applying a series of predetermined coefficients to the monthly energy consumption results from electrical and fuel utility bills. The advantage to have predetermined coefficients is that it relieves the user from the burden of performing a detailed dynamic simulation of the building. Providing the coefficients to the user which are obtained by running EnergyPlus Benchmark Models simulations; thus, the simulation process is transparent to the user. Applying the methodology to a hypothetical building placed both in Atlanta, GA, and in Meridian, MS, in both the cases, errors obtained for the estimated hourly energy consumption is mainly within 10%. The main purpose of this large effort is to reduce the effects of greenhouse emission, climate change to head for a sustainable society. To meet the high level of demand for sustainable buildings, the most important decisions regarding a building's sustainable features are made during the design and preconstruction stages. Based on the different sustainability analyses, BIM (Building Information Modeling) can be used for accessing the impacts of various design alternatives on the building performance and durability so that designers can make more rational decisions environmentally. Shanghai Center, the tallest building in China, has benefited a new BIM-based lifecycle data management approach that has helped the project achieving a material waste rate of 4% comparing with the average level of 10% in China. Providing early alerts of construction waste to contractors, and a real-time BIM and System Dynamics based methods was proposed for minimizing construction waste generated due to rework, lack of coordination, and poor integration of building subsystems during the construction process. A similar BIM-based system was developed. BIM provides four major functions on energy performance analyses and evaluations, which are

1) A whole structural energy analysis
2) Detailed analyses for different energy conservation
3) A feasible evaluation of renewable energy

IV. BUILDING ORIENTATION

The practice to face a building maximizing certain aspects of its surroundings, such as street appeal, to capture a scenic view, for drainage considerations, etc. For developers and builders, designing and building a new home to take advantage of the warmth of the Sun will increase the home's appeal and marketability.

BUILDING ORIENTATION-1
AZIMUTH: NORTH-EAST (Existing, 180°)

On the above north angle degrees, the maximum cooling load that was recorded in the month of March ranges from 13-15 kWh.m² month⁻¹(kilo watt hour per square meter per month) and during the months of July, August and September the minimum of 2 kWh.m⁻²month⁻¹ was recorded. Cooling loads fell drastically from the month of May and ranges from 14 kWh.m⁻²month⁻¹ to 6 kWh.m⁻²month⁻¹. The fall is because of the onset of rains which results the temperatures to fall. The total cooling load recorded was 102.07 kWh.m⁻²a⁻¹ (kilowatt-hours per square meter per annum) with the north angle at 0° and 180°.

BUILDING ORIENTATION -2
AZIMUTH: ROTATION BY 90°, i.e.270°

With the north angles above, the pattern so observed was annual cooling loads reduced by 0.99 kWh.m⁻²a⁻¹ to a value of 102.18 kWh.m⁻²a⁻¹. The cooling load value at 90°/270° is similar to the load at the 0°/180°. The difference in loads being so small that one cannot confidently recommend an orientation of north/south over east/west winds.
V. BUILDING MATERIALS

People living in the industrialized countries spend as much as 90% of their time indoor. Although this environment is fraught with problems from energy and health perspectives, so new materials and methodologies are needed to solve many of these problems. 40% of the global use of primary energy is use by today's buildings. Materials play a central role in new paradigms of buildings can lead to massive energy savings and can be instrumental in improving the air quality as well as providing a platform for renewable energy technologies and sinks for greenhouse gases. Building Materials presents the state-of-the-art in materials science and. The symposium will be devoted to new materials, and combinations of materials and methodologies, with applications in buildings for improved comfort and energy savings, based on bulk crystals, thin films, nanowires, quantum dots, heterostructures, nanoparticles, etc.

VI. TURNING GREYWATER INTO ELECTRICAL ENERGY IN BUILDINGS

Greywater is the wastewater which is generated from domestic activities such as laundry, bathing and dishwashing. It can be recycled to use in landscape Irrigation and Constructed wetlands. Greywater differs from water which is designated from the toilets sewage or black water to indicate it contains human waste. The typical average greywater flow which is close to 65% of the total wastewater produced can be obtained by taking the total household use per person and subtracting the amount used by toilets and leaks. We are introducing, grey water (wastewater) of a building complex by conducting a vertical sewage plumbing system which is dammed at the end. Whenever the greywater is conducted to the vertical plumbing system and accumulated behind of the dam, a micro power plant is made by locating a micro hydro turbine after the dam. The greywater which is accumulated behind the dam makes it possible that greywater reach a proper height so a proper head for the turbine. Greywater after reaching to an ideal height, flow controllers open a vessel which conducts greywater to the turbine. The micro turbine generates electrical power according to the height of the building and its habitancy (amount of water which is used and amount of greywater which produced).

AAC BLOCKS (Autoclave Aerated Concrete)

Nowadays as an alternative to red bricks AAC blocks or Autoclave Aerated Concrete (AAC) blocks are widely used. AAC blocks are prepared from cement, sand, lime, water and additives. Fly ash is used instead of sand as fine aggregates in manufacturing of AAC blocks. On the other hand, Red bricks are made from topsoil, and hence its continuous production has lead to depletion of fertile topsoil which ultimately leads to huge loss of agricultural land. AAC Blocks requires less fuel in its transportation as they are lightweight blocks which are easy to handle and transport. Similarly for high RCC framed structures they help in saving structural steel and thus decreasing the cost of construction also providing good thermal insulation properties as compare to red bricks and hence aid in energy conservation. Although they have high initial cost but over the long run are more economical as compare to red bricks and these blocks do not use fertile soil, they are eco-friendly building materials.

BAMBOO

India being the world’s 2nd largest producer of bamboo and Moso Bamboo, is the primary species used in construction which grows up to 119 cm in 24 hours and 24 m high in 40 to 50 days. It has been found by different research that some bamboo species have tensile strength same as mild steel at yield point due to the presence of Cellulose, which is the main component present in bamboo imparting mechanical properties.

Some specific properties of Bamboo are as given below:

- Specific gravity - 0.575 to 0.655
- Average weight - 0.625kg/m
- Modulus of rupture - 610 to 1600kg/cm²
- Modulus of Elasticity - 1.5 to 2.0 x10⁵kg/cm²
- Ultimate compressive stress - 794 to 864kg/cm²
- Safe working stress in compression - 105kg/cm²
- Safe working stress in tension - 160 to 350 kg/cm²
- Safe working stress in shear - 115 to 180 kg/cm²
- Bond stress - 5.6kg/cm².

But bamboo can only be used for single story building although it is three times cheaper than steel and it is environment friendly also. Bamboo reinforcement technique can be used for both main and distribution reinforcement therefore, steel reinforcement is considered as Smart and Eco friendly construction materials.

SELF HEALING CONCRETE

Cracks in concrete are a common phenomenon due to the relatively low tensile strength. Durability of concrete is impaired by these cracks since they provide an easy path for the transportation of liquids and gasses that potentially contain harmful substances. If micro-cracks grow and reach the reinforcement, not only the concrete itself may be attacked, but also the reinforcement will be corroded. Therefore, it is important to control the crack width and to heal the cracks as soon as possible. Since the costs involved for maintenance and repair of concrete structures are usually high, this research focuses on the development of self-healing concrete. Self-healing of cracks in concrete would contribute to a longer service life of concrete structures and would make the material not only more durable but also more sustainable.

VII. COMMON CONSTRUCTION PROBLEMS

ENERGY LOSS THROUGH HEAT AND TRANSFER

Wasted energy being one of the most common construction problems the Architects and contractors are tasked with creating a facility that can optimize energy use. This can be especially difficult when dealing with heating and cooling units as doors are frequently opened, letting in outside air. Windows can also be a source of energy loss, allowing the air through them to seep in the cracks or gaps.
FINANCIAL RISK
Forum by the consensus of the construction industry executives involve the financial risks pertaining to green construction represented the greatest area of concern. Moreover the additional costs associated with the design, construction and ownership of green buildings may prove to be too costly. Besides it also affect the ability of different construction company to complete projects on time within a specified budget. Out of so many issues some examples of the financial risk issues discussed includes the cost for justification of building green during an economic slowdown, the availability of reasonably priced insurance, the availability and cost of surety bonds, commodity price volatility and the cost of LEED certification process to name a few.

PROBLEMS WITH CONSULTANT/SUBCONSULTANTS AND CONTRACTORS
The executives of construction industry involved in the Marsh study agreed that an area of concern was that many of the consultants/sub consultants & subcontractors are not experienced and skilled in green construction. The groups concern was that the lack of experience results in problems obtaining LEED certification, delays and improper material specifications.

AVAILABILITY OF MATERIALS
The homeowners who live closer to larger cities may have no difficulty for finding green building materials, but the selection may be scarce in other areas. Many material requires special ordering, which could increase the overall cost. In addition, some materials may only be available through Internet orders, which include a cost for shipping and handling too.

STRUCTURAL ORIENTATION
Green building demands structural positioning opposite of other neighborhood homes in order to best optimize sun exposure, causing friction among neighbors. In addition, differences in structural orientation will affect natural daylight entering the building structure: along with these there may be a need to install more overhangs, blinds, or shades. Another drawback of a green building is that the inhabitants cannot increase or decrease the inside temperature, because air cooling components like natural ventilation cannot be controlled manually.

DELAY IN CONSTRUCTION
In some cases, green buildings might take a lot more time in getting ready, thus, the builders or home owners may not go for it, who want the building to be ready in a specific time frame. In few cases when the construction materials are ordered on the Internet and are being shipped from some faraway place, it can take days for them to reach the site causing over delay to the project complication.

In case if the recycled materials that are sometimes used in the construction are not available immediately then the builder might have to stop work on the project. Many of these, particularly high initial costs and unavailability of materials, will be encountered in the near future, as such buildings become more and more popular. In the end, it is advised that professionals who have a LEED (Leadership in Energy and Environmental Design) certification are consulted, when constructing green buildings, so that all the legal issues concerning them can be taken care of.

VIII. FUTURE TENDS IN GREEN BUILDING
- To run the HVAC efficiently, usage energy-efficient windows, which lock in air and block outside air from entering.
- To reduce the amount of water used which can be achieved by installing low-flow toilets or urinals, which use no more than 1.6 gallons of water with every flush
- Our architectural and engineering education lack emphasis on sustainable design. It needs to encourage the development of technical skills such as energy simulation, passive solar and day-lighting design, and make them part of the way the building designed.
- Due to the green building movement which enabled a wonderful market transformation in the country which results, most of the materials are today available within the country.
- Although at the initial stages the incremental cost has been experienced between 12-18 percent but now the incremental cost has been reduced to 5-8 per cent.
- The markets have so transformed in the last 10 years that the Building-owners, developers, architects and consultants switching to a value proposition in designing green.
- According to such market analysis it can be predict that during the next few years green buildings are well poised to grow at 50-60 per cent annually.

IX. CONCLUSIONS
The most common and dangerous problem of carbon dioxide and sulphur gases emissions reduction into the atmosphere becomes more important due to the fact of the global climatic change. As per various estimates, housing stock consumes 30-40% of all the energy resources, as the result, it is possible to get carbon dioxide atmosphere emission reduction due to energy consumption reduction. In the field of design and construction the problem of housing stock energy efficiency improvement becomes a trend which in the nearest future will be transformed to the task of applied research and study. The objective of such an exploration is to design buildings with zero energy consumption or close, which is planned to construct on the site. The novelty of such construction is to perform an integrated approach of the house design, which will be entirely autonomous and independent from the urban networks.

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X. REFERENCES
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