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Net Zero Energy-Green Building

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Abstract: As we see around us, we humans for our comfort and leisure have almost destroyed maximum of its natural resources and in turn lead to pollution which is destroying the nature. These habits have already lead to diseases and plagues which kill the natural habitat (ecosystem) and in turn leading to a chain of self-destruction started by our own deeds. The time has come where we humans need to realize the need to stop this mess so that the future generations can live in peace. Construction industry throughout its lifecycle is a major consumer of resources and a major cause of pollution in return, roughly 4% to 5% of the total world pollution. The growth in this Industry is leading to the growth in pollution so we need to search for improved methods of construction to reduce its impacts on the environment.

I. INTRODUCTION

In the hope of enhanced standard of living and better job opportunities, people from villages migrate to cities which is increasing the no of cities and construction industry. Due to this there is tremendous use of resources and increased pollution. The formation of our planet is dated to be around 4.6 billion years ago which if we take on a scale of 46 years we have emerged just 4 hours ago and our industrial revolution is just 1 minute old in which we have almost exhausted 50% of our resources present on this planet.[2]

A 'green' building doesn't only include in one phase but in its design, construction and operation reduces or eliminates negative impacts and creates positive impacts, on our environment. Green buildings helps in preserving natural resources and improve our quality of life. The aim of this research is to know about the various rating systems and to spread awareness about the various materials, methods and techniques of construction to reduce its impact on the environment. The various things discussed in this research would be materials that are considered to be waste and are disposed in nature and can replace the existing materials which are produced, the techniques of construction which reduces the energy, water and other resource consumption, and the technologies which would help in generation of energy requirement, waste disposal and water regeneration.

II. GREEN RATING SYSTEM

To monitor and motivate green construction, many countries have developed their own green rating systems. The major Green Rating Systems that are globally recognized are L.E.E.D. (Leadership in Energy and Environment Design), GRIHA (Green Rating for Integrated Habitat Assessment), BEE (Bureau of Energy Efficiency) etc.

A. LEED

LEED is a certification given to green building on the basis of its design, construction and operations, the certification is provided by the Green Building Certification Institute by a third party inspection and verification on the standard points, the process includes registration of the project on various combinations such as Building design and Construction (BD+C), Operation and Maintenance (O+M), Interior Design and Construction (ID+C), Neighborhood development (ND), LEED Recertification (BD+C & ID+C), LEED Zero (O+M & ND), LEED City etc. on the basis of type of certification and area of building the registration fees are determined generally 1 to 6 percent of the total project cost which accounts to about 2% increase in the Square foot cost of the project, The points given are on the basis of sustainability, resource conservation, Water conservation etc. during the various processes the points vary between 0 to 100 if the building score points above 40 it is eligible or certified under LEED the various range are 50-59 Silver Rating, 60-79 Gold Rating and above 80 Platinum rating.

B. GRIHA

This rating System was developed in INDIA by the energy and resource institute with the help of the ministry of new and renewable energy, it is the national rating system in INDIA. The rating is given on the basis of four major factors those are Sustainable Site plan, Water management during and after construction, use of low energy materials and energy optimization and occupants comfort. On the basis of this points the buildings are rated as 1 to 5 star in sustainability. The various certification are SVAGRIHA, Pre-certified SVAGRIHA, GRIHA, Pre-certified GRIHA, GRIHA for affordable housing, GRIHA for day school and GRIHA for large development and Cities, these projects have many incentive programs established by both the state and central government and the details are available on the official website of GRIHA.

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III. PLANNING AND DESIGN OF GREEN BUILDING

As we all know planning plays an important role in both designing and construction of green building. In planning stage the decisions are to be made about three phases of construction i.e. Pre-construction Phase, Construction Phase and Post- Construction Phase. In the pre-construction phase the various things to be considered are design, material to be used and its availability, permissions, funding etc. Design has a very significant role in construction of green building, there are many points to be taken into consideration while designing a building such as the sun path, wind directions, cavity walls, green belts, swimming pools, height of floors, position of rooms, materials to be used etc. In the construction phase the technique's to be used should be energy efficient and use less water. Even the materials used for construction should be ecofriendly and should not leave a mark on the future for example, use of wood paper and other degradable materials rather than plastic and other composite metals. The post construction phase includes maintenance and operational.

IV. MATERIALS

The various materials that are used in construction are Cementitious materials, Aggregate, Sand, Bricks & Blocks, Glass, Paints, wood etc.

Cement when is produced generates CO_2 when replaced by other materials directly reduces the impact on environment, the materials that can be used for its replacement are Fly Ash, Silica Fumes, GGBS etc. all these materials are a byproduct and considered as waste which when used here reduces its deposition in nature and also helps save money.

River sand due to over extraction has caused damage to the aquatic life the excessive use of diesel pumps have polluted the rivers and also destroyed the natural aquatic ecosystem of the rivers, to stop this we need to stop extracting sand and start producing it or replace it with other materials which are considered as waste. Some of the materials that can be used to replace river sand are Bottom Ash, Quarry Sand, Copper Slag, Spent Fire Bricks etc. these are byproducts in the process of extraction of metals and need to be disposed of which in turn leads to pollution. Aggregates can be replace with Recycled concrete masonry, Foamed glass aggregates can be used for thermal insulation and is a light and rigid material which gives high strength.

Traditional bricks spoil the upper most soil layer to conserve this layer of soil these can be replaced by AAC Blocks which are light in weight, fire resistant, act as a thermal insulator and are easy to use. The other method that can be used is gypsum based wall panels or infill wall system these are almost 8 to 10 times lighter that the convention brickwork and also 5 times faster in construction than the traditional ones.

V. TECHNOLOGIES

To generate electricity, purify water and treat water and waste technology plays an important role. Technology's such as wind turbines, Solar panels pavegens, ECOSTP, RO Plants, Bio filters work together to make a Net zero energy building and to convert waste into useful material.

A. Electricity

The various technologies that can be used to generate electricity are by wind (AVX1000, wind trees, wind turbines), mechanical force (Piezo electricity), Solar rays (Solar Panels, Solar Sphere, Solar windows) etc. the best outcome is received from Solar panels and wind turbines and are mostly used worldwide, the remaining methods do not produce much electricity and are quite expensive, Solar panels can be easily purchased and installed and do not require much maintenance whereas wind turbines are a bit complicated and need timely maintenance for its proper functioning. Other electricity generation techniques can be used in places where less electricity is required such as wind trees in side of roads which will give good aesthetic looks and even produce electricity for street lamps, similarly pavegens (piezoelectric panels) can be used in jogging tracks or dancing floors in malls and clubs to produce electricity for lighting the area.

B. Water

The main source of water is rain other sources are wells, bore wells, Government water supply bodies and private tanker water supply agencies, Except for this even reclaimed water could sum up to or be used for many household need. Rain water can be stored in tanks like people used to do in previous generations found in many caves and forts in the western region in India.

This water needs to be treated before it can be consumed so water filters play an important role generally RO water filters are suitable for treating this water, if not houses have to be fitted with separate water filters for drinking water and this water may be directly used for other processes by simple chlorination and filtration, the water obtained from bathrooms and sink by primary treatment can be reclaimed and used for flush tanks and gardening purposes, if the amount of water is less this waster can be treated

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in solid immobilized filters which is a set of seven layers of rock sand soil and this water can be then used for gardening purposes and the soil from this SIMF is very fertile and can be used as a manure for plants, if the flow is for a bigger building then an Eco-STP can be set up which consist of four stage treatment and consist of four tanks in each stage this works completely on the law of gravity water is allowed to stay stagnant which allows the heavier particles to settle and the lighter once to float after passing through these chambers it is passes through solid filters with algae types bacteria which eats the minute particles and in the last stage this water is then passed through soil with plants on top which absorber the remaining particles which even pass through these and then the water can be used for gardening and other activities other than consumption.

C. Waste

Waste can be classified into many types the one that is produced in house is known as domestic waste and can be separated and treated before disposing it. The two main classification that can be done at home is wet and dry waste, the waste or garbage consist of bottles, cans, paper, vegetable waste, newspaper, magazines, leftover food etc. the waste that can be recycled is to put in a dry waste bin where it can be sent for recycling after proper sorting by professionals except for which the other waste such as vegetable waste, Food leftovers is to be kept in wet waste bins where this is then put in shredders and can be used as an excellent manure for backyard gardens.

VI. CALCULATIONS FOR REQUIREMENTS

A. Electricity

1) Average electricity used per household=200KWA per month
2) Total no of Flats=16 (Assumed)
3) Total electricity requirement= 16Flats X 200 KVA X 12 Months
=38400KWA per year

B. Water

1) Average water requirement per capita per day=200 Lit/day
2) Average people per flat = 4 persons
3) Total water requirement= 16Flats X 4 Persons X 200 Lit X 365 Days
= 46,72,000 Liters per year

VII. CONCLUSION

In this study we learnt the existing rating systems for green building and the various funding's provided by the government in the form of monetary help and incentives while purchasing these houses. We also learnt the various aspect considered during the rating process (sustainability, water conservation, energy usage and operation or comfort of living). The next study was about the importance of planning and design in the various stages of construction along with the materials that can be replaced by greener materials without affecting the strength of a building. The highlight of the study was technologies which can be used to generate electricity, treat waste and help reclaim water. These concepts explain that construction of a green building or making a net zero energy building is a difficult and expensive task, but on a long run can help regain more profits than what is invested.
The run to achieve perfection in this field is to long but as said small steps together make large difference, this research is made in a hope of attaining a step closer to perfecting the concepts of green building.

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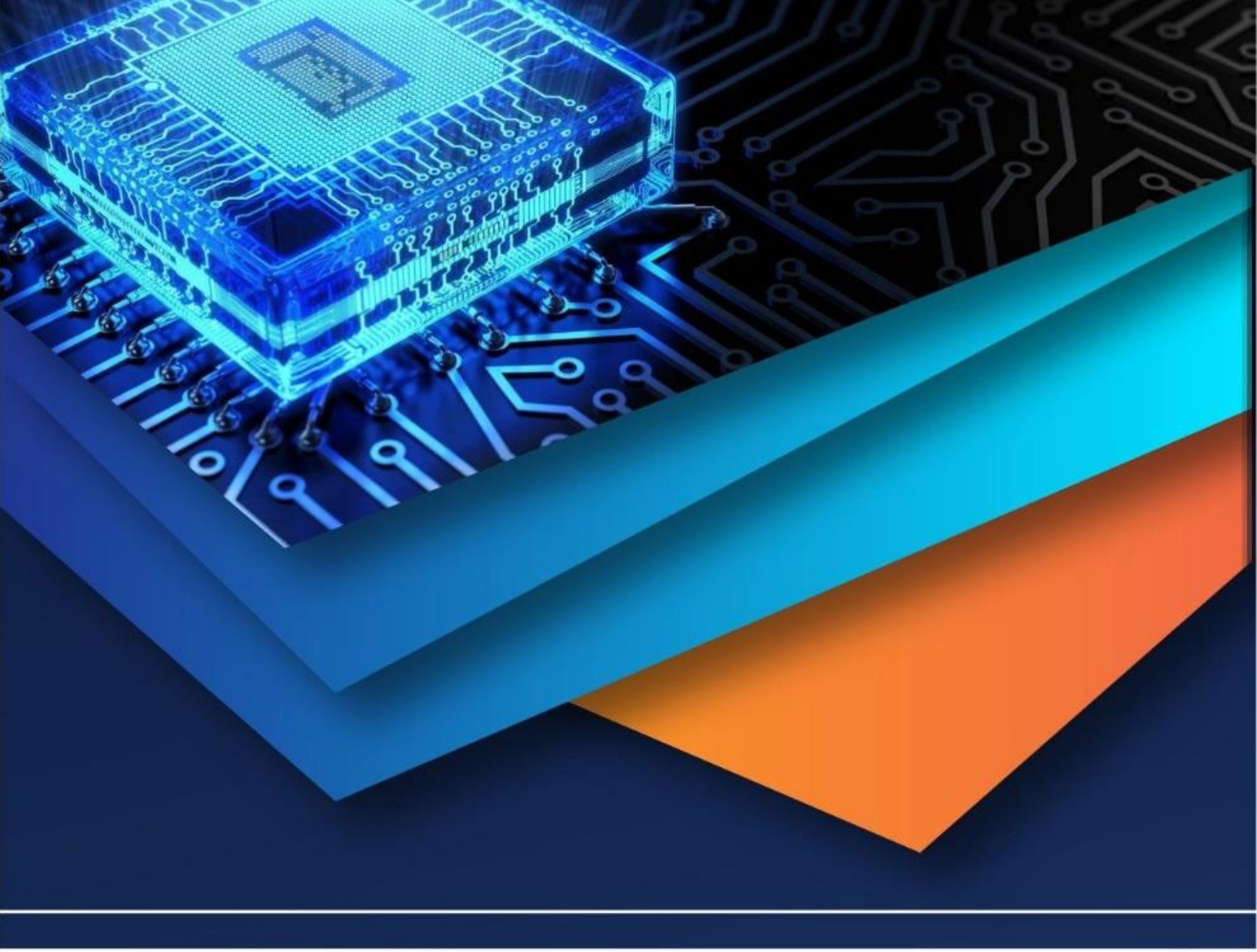

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