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Green Building and Implementation of Renewable Energy Sources

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Abstract: ***Green building is not just a matter of assembling a collection of the latest green technologies or materials. Rather, it is a process in which every element of the design is first optimized and then the impact and interrelationship of various different elements and systems within the building and site are re-evaluated, integrated, and optimized as part of a whole building solution. By blending the right mix of green technologies that cost less with green technologies that cost the same or slightly more, it is possible to have a very green building project that costs the same as a conventional one. Often the key to a cost effective green building and site design lies within the interrelationships and associated cost and performance trade-offs that exist between different building systems. It is also paramount to separate the role of the different participants in ensuring that the building consumes minimal resources during its life cycle and that it poses a minimal threat to the environment by minimizing the ecological footprint. The main aim of this project is to add various renewable energy sources to green building and create a 3D model on Autodesk Revit Architecture.***

Keywords: Green Building, Revit Architecture, Suzlon One Earth, Micro Hydroelectric Power Plant.

I. INTRODUCTION

A green building depletes as little of the natural resources during its construction and operation. It involves design and construction practices that reduce the negative impacts of the buildings and its occupants on the environment. One of the most inspiring definitions of a green building is as follows – "A Green Building should create delight when entered, serenity and health when occupied and regret when departed." The aim of a green construction is- Minimize the demand on non-renewable resources, Maximize the utilization efficiency of these resources when in use, Maximize reuse and recycling of available resources and Utilization of renewable resources. BIM software Revit Architecture is used in project for making model of society which will work on principle of green building and renewable energy sources. In project there is introduction of micro hydroelectric power plant for residential buildings (society).

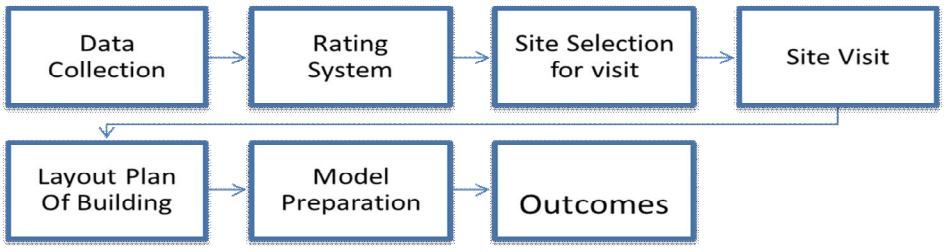
II. AIM & OBJECTIVES

The main aim of this project is to adopt a comprehensive methodology to reduce the development footprint in buildings and to add renewable energy sources plants in green buildings.

Objectives are as followed:-

1) To study the concept and principles of green buildings
2) Analysis of the energy sources and infrastructure of green building
3) To implement Micro Hydro Electric Power plant and also other renewable energy sources.

III. METHODOLOGY



1) *Data Collection:* The data collection is the first stage in implementing this study on reduction of footprints. Detailed collection of data is done in this stage. Details include the evolution of Green Movement in the World and also in India, the need for Green Buildings, the advantages of Green Buildings over Normal Buildings, the projected costs, case studies.
2) *Rating Systems:* A thorough study on the rating systems is done in this stage. The role of the Indian Green Building Council, the Leadership in Energy and Efficient Design (LEED), LEED Rating System – credit requirements, proposals, pre-requisites etc are observed and studied.
3) *Site Selection For Visit:* In case for site selection we needed Green building infrastructure so we selected Suzlon One Earth, Hadapsar, Pune. It is one of the best green building construction in India, which is platinum rated green building by LEED. Through these site we get know about implementation of renewable energy sources in buildings. And sustainablmaterial use in green buildings.

Fig.1 Suzlon One Earth

4) *Site Visit:* Suzlon One Earth, Pune on 22/03/2022
5) *Layout Plan Of Building:* Prepared layout of society which we were going design in software called Revit Architecture.
6) *Model Preparation:* We prepared model of society in Revit Architecture 2D as well as 3D. We implemented renewable sources in it. Design is as followed:

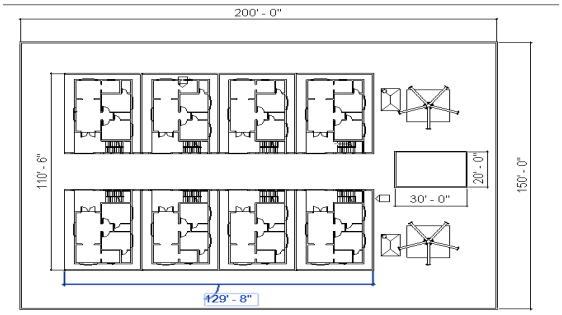


Fig. 2 Society Layout 2D

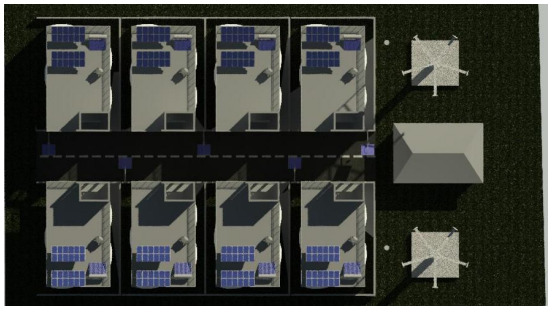


Fig. 3 Top View 3D

A. Design Considerations Of Micro-Hydro-Electric Power Plant for Project

Energy is one of the most fundamental elements of our universe. It is inevitability for survival and indispensable for development activities to promote education, health, transportation and infrastructure for attaining a reasonable standard of living and is also a critical factor for economic development and employment. In the last decade, problems related to energy crisis such as oil crisis, climatic change, electrical demand and restrictions of whole sale markets have a risen world-wide. These difficulties are continuously increasing, which suggest the need of technological alternatives to assure their solution. Hydro-electric power is a form of renewable energy resource, which comes from the flowing water. To generate electricity, water must be in motion. When the water is falling by the force of gravity, its potential energy converts into kinetic energy. This kinetic energy of the flowing water turns blades or vanes in a hydraulic turbines, the form of energy is changed to mechanical energy. The turbine turns the generator rotor which then converts this mechanical energy into electrical energy and the system is called hydro-electric power station. The first hydro-electric power systems were developed in the 1880's. According to the international energy agency (IEA), large-scale hydro-electric plants currently supply 16% of the world's electricity.

However, such kind of projects requires tremendous amounts of land impoundment, dams and flood control, and often they produce environmental impacts. Micro-hydro-electric power plants are one of an alternative source of energy generation. They are the smallest type of hydro-electric energy systems. They generate between (5) and (100) Kilowatt of power when they are installed across rivers and streams.

For working of micro hydroelectric power plant in residency we are going to supply corporate water supply to the turbines with decline slope in ground so that the velocity of water will increase which will help the turbines to spin faster. As for rainy season we will divert the rain water through the turbine and then after it will be harvested and stored in tanks. So the energy will be generated even in heavy rain.

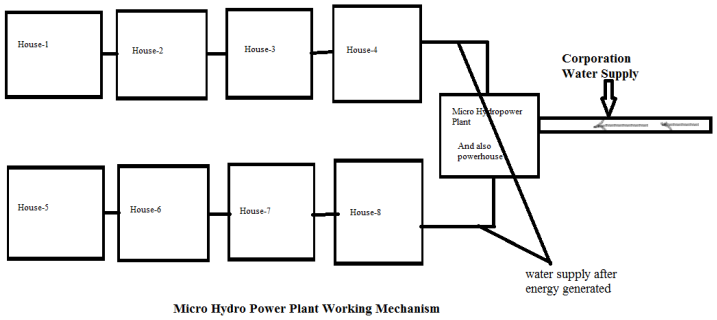


Fig. 4 Micro Hydroelectric power plant working

B. Storage of Energy

We will be aslo constructing power house to maintain the voltage supply of electricity to all residencies in society. And every house of society will have there own small batteries storage to maintain Solar energy supply.

IV. LITERATURE REVIEW

A. Case Study On Suzlon One Earth, Pune

Suzlon One Earth is a 100% renewable energy campus. Campus for world's largest integrated wind turbine manufacturers. Plot area – 45,392 sqm, Built up area- 70,865 sqm, Capacity – 3000 employees. The building structure of "Suzlon-one earth" is totally based on ancient vastu Shastra (100% vastu) with planning design principles on the base of air, water, fire, space, earth.

Total cost of construction is about 405 Crores. Total area of Suzlon is 10.7 hectares (22 acres). Out of that 8 lakhs sqm, built up area is 6 lakhs sqm above ground level and 2 lakhs sqm below the ground. Suzlon - One Earth consists of "a global village" set up. A million square feet of ground plus two levels in a 10.4-acre urban setting achieved a LEED Platinum and Teri Griha 5 Star certification with 8% of its annual energy generated on-site through photovoltaic panels and windmills with a total incremental cost of about 11%. There are no other LEED certified buildings with this level of certification and on-site renewable energy that have achieved this kind of cost efficiency. With 92 % (4 MW) being consumed by the project is 'sustainable energy' making this a Zero Energy Project!

B. LEED :- (Leadership in Energy and Environmental Design)

This Guidebook was commissioned by the District of Columbia Department of Real Estate Services (DRES) in order to assist DRES's Project Managers as well as external Architecture and Engineering service providers and Contractors with achieving LEED Certification as required by the District of Columbia Green Building Act. It is intended to provide guidance, to facilitate the LEED process and to assist project teams in making sound economic and environmental decisions for LEED projects. It is not intended to replace the LEED Reference Guides, which are all essential tools when designing and building a project under the LEED Rating System, nor is it intended to replace the services of a sustainable design consultant, should the project scope or complexity benefit from outside expertise. This Guidebook is intended to provide greater insight into the LEED process specifically for projects located in the District of Columbia. The Leadership in Energy and Environmental Design (LEED) Rating System was developed by the United States Green Building Council (USGBC) and the term "LEED" is trademarked. It should not be used to describe projects that are not Registered with the USGBC, Certified by the USGBC or not intending to pursue LEED Certification. All LEED-related materials, such as the LEED Reference Guides, are copyrighted and should not be copied or distributed without permission from the

USGBC. At the time of publication of this Guidebook, the LEED Rating Systems referred to are: • LEED for New Construction and Major Renovations v2.2 • LEED for Commercial Interiors v2.0 • LEED for Core and Shell v2.0 • LEED for Existing Buildings: Operations and Maintenance • LEED for Schools • LEED for Homes Current LEED Rating Systems will be updated in 2009

Name of the Project	Location	Built-up Area (sq ft)	Rating Achieved	Increase in Cost (%)	Payback Period (years)
CII-Sorabji Godrej GBC	Hyderabad	20,000	Platinum	18	7
ITC Green Centre	Gurgaon	170,000	Platinum	15	6
Wipro	Gurgaon	175,000	Platinum	8	5
Technopolis	Kolkata	72,000	Gold	6	3
Spectral Services Consultants Office	Noida	15,000	Platinum	8	4
HITAM	Hyderabad	78,000	Silver	2	3
Grundfos Pump	Chennai	40,000	Gold	6	3

Table. 5 Green Buildings in India

Materials and Construction, Smart and Novel Building Envelope Design, Technologies in Sustainable Buildings, Building

V. SCOPE OF PROJECT

Sustainable Integration of the Natural and Built Environment Innovative Technologies and Integrated Systems for High Performance Buildings, Sustainable Building Integrated Renewables such as Solar and Wind Energy, Social and Economic Sustainability, Thermal or electrical energy storage in buildings, High Performance Acoustic and Thermal Insulation mitigation of the Heat Island Effect: Green and Cool Roofs, Advanced Daylight Systems and Lighting Performance, Smart Monitors and Intelligent Building Controls, Indoor Environment Quality, Health and Thermal Comfort and Human Perception .

VI. RESULT & CONLUSION

The total energy generated through the renewable energy sources will be enough to run whole society/community.
The electricity generated by the solar panels will be 300 watts per day by one panel. And solar panels will provided to each house of society. By the micro hydropower plant the energy generated will be 5-100 kWh daily when there will be flow to the water supply. And in rainy season the rain water will be also diverted to the micro hydropower plant, so as it will generate the electricity in rainy season when the sun will be not at its peak. And by the wind turbine the energy generation is very high i.e. 1 MW, but when the condition will be fulfilled like wind flow will be more than the 12 miles per second. But even the slow wind will also generate the energy. And a high capacity power house will be built in the society to manage the power supply.
Total Society will run renewable energy source there will be no harm to environment. Sustainable material used in construction will help to reduce the pollution and harm to environment. And also there will enough insulation & lighting due glazed windows. The ecological footprint will get reduced. Global warming will be reduced. Change to get affected many diseases get reduced. Harvesting rain water in order to reduce deal with water scarcity in dry period. Solar panels, Micro Hydroelectric power plant and wind turbines help to produce necessary amount of electricity for household purposes. LEED point increased after converting the selected residential building into green building.

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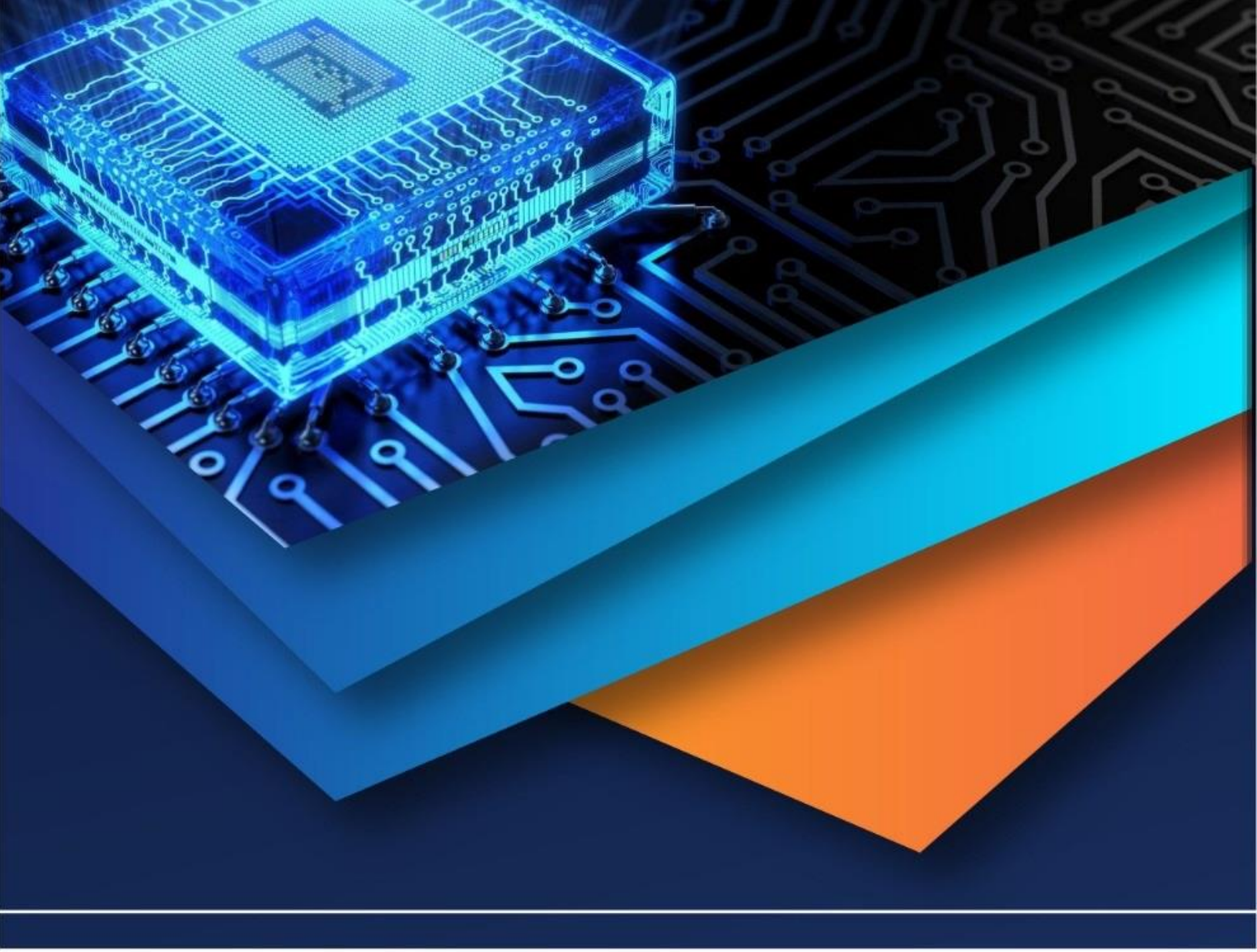

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