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A Case Study on Conversion of Conventional Building to Green Building

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ABSTRACT

Rapid industrialization, increasing population, infrastructure development and destruction of natural resources lead to construction of green building. Green building is a structure that is environmentally responsible. Green building is also known for its sustainability and high performance. The increased demand of living and working places due to population explosion, construction industry grows rapidly. It causes severe impact like different types of pollution, leads to global warming and ozone depletion. It adversely affects the human welfare as well as natural habitats. The concept of sustainable development can be traced to the energy crisis and environmental pollution. The green building movement in the U.S originated from the need and desire for more energy efficient and environment friendly construction practices. Green building brings together a vast array of practices, techniques and skills to reduce and ultimately eliminates the impacts of buildings on the environment and human health. The green concept and techniques are aimed to achieve energy efficiency, effective waste management and consideration of natural resources and minimum use of fossil fuels. Construction methodology based on these concepts promotes to the health and well-being of the individual and the society at large. These buildings consume minimum energy, water and other resources during the entire life cycle.

Keywords: Protected Nature, Water Consumption, Waste Reduction, Electricity, Passive Design

INTRODUCTION

Thermal comfort studies on traditional residential buildings of Pune that is known for its use of natural and passive methods for a comfortable indoor environment are under progress. Passive methods of achieving thermal comfort inside the buildings are the best solution to provide a healthy and energy efficient indoor environment. The people are forced to depend on such systems because, majority of the buildings are designed without giving adequate importance to passive methods for controlling the indoor environment. In many cases, failure to provide the required thermal conditions has resulted in discomfort, ill health and productivity loss.

However, water, particularly of drinking water quality, is becoming increasingly scarce in most of the populated regions of the planet. The pressure is on to reduce water demand by reducing wastage, to reuse or recycle as much as possible, and to look at other means of minimizing our impact on the water environment.

Past study:

R B Yasinta, C Utomo1 and Y Rahmawati (2020), studied cost of planning, operational and maintenance cost and residual cost are part of the Life Cycle Cost (LCC). LCC is the total cost of a building over its lifetime and includes the cost of planning, design, operation, maintenance, minus the residual value. At present, most building are only concerned with initial capital cost such as land, projects and construction cost without regard to the operational and maintenance cost of the building. This does not happen if you apply the concept of green building. Emphasis on initial cost by using green building materials has a small operational cost. While conventional building that do not apply the concept of green building result in higher energy use cost and also lower sustainable level (such as higher carbon emissions). Cost analysis have been carried out in previous studies, such as the Weerasinghe and Ramachandra study who analyzed the cost differences in applying green building and conventional building using survey methods, LCC analysis and sensitivity analysis.

According to Ramakrishna Nallathiga, AbhijeetRaipure, Prateek Ate, Ankit Singh (2021), most of the literature concerning green buildings in the Indian context merely focuses on the environmental sustainability aspects viz, energy consumption, water efficiency, thermal comfort and greenhouse gas emissions as well as other technical aspects as case studies. However, international literature sheds lighter on the developments. Here, life cycle assessment approach, which is extensively applied in the environmental aspects of green building, can be a useful tool for habitat sustainability, but not studied much in the Indian context. New rating tools are developing rapidly worldwide and India also adopted them, but more studies are required to further improve and apply these new rating tools and also assist in decision making for real estate investors as well as developers. Also, the awareness of green buildings (underlying concept) and their benefits in long term are not fully known to people.

METHODOLOGY

Green building refers to both a structure and the using of processes that are environmentally responsible and resource-efficient throughout a building's life-cycle: from sitting to design, construction, operation, maintenance, renovation, and demolition. In other words, green building design involves finding the balance between homebuilding and the sustainable environment

Study of Green Building Considering Certain Points

1. Reducing Environmental Impact
2. Goals of Green Building
3. Life Cycle Assessment
4. Energy, Water, Material Efficiency
5. Waste Reduction
6. Cost of Payoff

Green Building Parameters

1. Efficiency of site selection and planning
2. Water Management
3. Energy Efficiency
4. Materials Efficiency
5. Indoor Environmental Quality
6. Innovation

Two Primary Rating Systems in India

1. GRIHA (Green Rating for Integrated Habitat Assessment)
2. IGBC (Indian Green Buildings)

LEED-INDIA Approach for Green Building

CONVENTIONAL RESIDENTIAL BUILDING

1. Energy Consumption
2. Water Consumption
3. Quantity Of Waste

Water Demand Of Household for Urban Region

Domestic water Demand: This includes water which is required for use in private residences, apartment houses, etc., for drinking cooking, bathing, washing of clothes, and other household chores. As per IS1172-1971, the domestic water consumption under normal conditions in an Indian city is 135 liters per head per day.

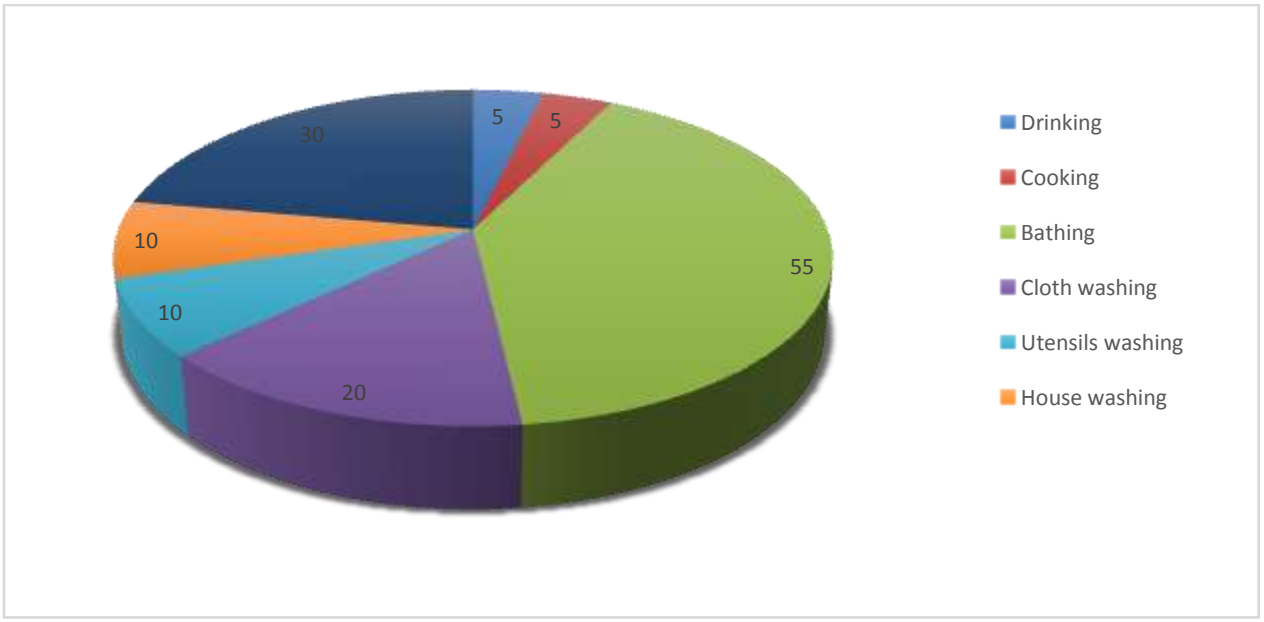
Under ordinary conditions (as per IS 1172:1993) the minimum domestic water demand for a town with full flushing system should be taken at 200 I/h/d although it can be reduced to 135 l/h/d for economically weaker sections and LIG colonies (Low Income Group) depending upon prevailing conditions.

The value of water supply given as 150 to 200 liter per head per day may be reduced to 135 litre per head per day for houses for Medium Income Group (MIG) and Lowe Income Groups (LIG) and Economically Weaker Section of Society (EWS), depending upon prevailing conditions and availability of water. Out of the 150 to 200 litre per head per day, 45 litre per head per day may be taken for flushing requirements and the remaining quantity for other domestic purposes.

The components of domestic water demand are (per capita/per day)

(a) Drinking - 5 litre
(b) Cooking - 5 litre
(c) Bathing - 55 litre
(d) Cloth washing - 20 litre
(e) Utensils washing - 10 litre
(f) House washing - 10 litre
(g) Flushing of water closets -30litre

Total = 135 litre/day/capita



Pie chart of Domestic water use.

CONVERSION TO GREEN BUILDING

1. Rain Water Harvesting
2. Collecting Rain Water for Lawn Irrigation Systems
3. Stages in Rainwater Harvesting

i) Collection Stage
ii) Distribution Stage
iii) Storage Stage

4. Components of Rainwater Harvesting Plant

i) Catchment
ii) Gutters and Down take pipes
iii) Filters and first flush devices
iv) Storage tanks
v) Delivery systems

5. Grey Water

✓ Reducing the need for fresh water. Saving on freshwater use can reduce household water bills, but also has a broader community benefit in reducing demands on public water supply.
✓ Reducing the amount of water entering sewers or onsite treatment systems. Again this can benefit the individual household, but also the broader community.

6. Passive Design

i) Orientation
ii) Overhangs and Shading
iii) Insulation
iv) Thermal Mass

RESULT

Item	**Non-Green**	**Green**
Rainwater Harvesting Plant	Not Present	Present-4
Solar Energy	Not Present	Present-5
Grey water Treatment Filter	Not Present	Present-4
Passive Design Overhangs and Shading Cooling Tunnel	Not Present	Present-1
Sustainable site	Not Present	Present-8
LEED Point	3	23

❖ **Comparison of Green Building and Non-green Building**

✓ Points acquired by the converted building, as per LEED Certification = 23 points Point calculation as per LEED Certification is not completed since
✓ LEED Panel does not reveal the LEED Certification process.

Even though the initial cost of implementation of green buildings is high, it will prove to be cost effective in future. It also guarantees an eco-friendly means of livelihood.

Model Representation of Green Building

CONCLUSION

- ✓ The study concludes that may be as much as 40-50% energy saving is possible in green building.
- ✓ Green Buildings focus solely on environment.
- ✓ Consumes less energy, water use, use of natural resources, creates less waste.
- ✓ It may require high initial investment depending upon the availability of resources.
- ✓ It may take longer time for assessment, planning and construction.
- ✓ Indoor air temperature may vary.

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