Analysis of Upgradation of a Convectional Building into Green Building

Keval N Pathak[1] Dr S K Jaiswal[2]
[1]M. Tech Scholar [2]Professor
[1,2]Department of Civil Engineering
[1,2]BIT Durg, C.G., India

Abstract— The phenomenon of global warming or climate change has led to many environmental issues including higher atmospheric temperatures, intensive precipitation, and increased Greenhouse gaseous emission and of course increased indoor discomfort condition. Researchers worldwide collectively agreed that one way of reducing the impact of global warming is by implementing Green Roof Technology which integrates vegetation, growing medium and water proofing membrane on top of the roof surface. This study emphasized to first analysis a convectional Building than upgrade it to a Green Building by the use of some Eco- Friendly materials. In addition to this by the use of some smart electrification work we can also conserve an ample amount of energy in a Convectional Building. Than by the use of different agencies which would provide checklist for Green Building we can rate a Convectional Building which is been upgraded into a Green Building..The objectives of this research were is Reduction in the indoor temperature of the room contributes reduction in energy consumption in the building.

- By the use of smart electrification an ample amount of energy can also be conserved.
- By the use of eco- friendly materials and waste products an ample amount of money can also be saved.
- Although by the up gradation of convectional building the initial cost will be high because of the use of some special material such as solar panel, rain water harvesting system but their application will return 10 times of what we invested

Key words: Green building, global warming, rain water harvesting system

I. INTRODUCTION

The term of the Green Building approach is more comprehensive, focusing on the environmental footprint of a building over its life cycle, from initial design and construction to operations during the building's useful life and the term "Green Building" refers to environmental friendly practices from building design to the landscaping choices. Green building applies not just to products but to construction strategies, building design and orientation, landscaping, building operations, maintenance, and more. The less impact a building has on human health and the environment, the more green it is.

A Green Roof is a roof of a building that is partially or completely covered with vegetation and a growing medium, planted over a waterproofing membrane. It also includes additional layers such as a root barrier and drainage and irrigation systems. The use of "green" refers to the growing trend of environmentalism and does not refer to roofs which are merely colored green, as with green roof tiles.

Also known as "living roofs", green roofs serve several purposes for a building, such as absorbing rainwater, providing insulation, and helping to lower urban air temperatures. There are two types of green roofs: Intensive roofs, which are thicker and can support a wider variety of plants but are heavier and require more maintenance, and Extensive roofs, which are lighter than an intensive green. The term "green roof" is generally used to represent an innovative yet established approach to urban design that uses living materials to make the urban environment more livable, efficient, and sustainable. Other common terms used to describe this approach are eco roofs, and vegetated roofs. Green Roof Technology (GRT) is the system that is used to implement green roofs on a building.

1) Strength to bear the added weight.
2) Seal the roof against penetration of water, water vapour and roots.
3) Retain enough moisture for the plants to survive periods of low
4) Precipitation, yet are capable of draining excess moisture when required.
5) Provide soil-like substrata to support the plants
6) Maintain a sustainable plant cover, appropriate for the respective climatic region.
7) Offer a number of hydrologic, atmospheric, thermal and social benefits
8) for the building, people and the environment
9) Protect the underlying components against ultraviolet rays and thermal degradation.

II. METHODOLOGY

To achieve the goal of our research work, different material can be used and analyse time to time for each material which are used.

A. Materials Used in Green Building

1) Flyash:

Flyash is a waste by-product from coal-fired power plants. It is a pozzolanic material, very much like the pozzolan clay, created by volcanic activity, used by the Romans in their early forms of concrete. Flyash affects the plastic properties of concrete by improving workability, reducing water demand, reducing segregation and bleeding, and lowering heat of hydration. It increases concrete strength, reduces permeability, reduces corrosion of reinforcing steel, increases sulphate resistance, and reduces alkali-aggregate reaction. In short, it not only pays economic and environmental benefits, but it also improves the quality of concrete. It's only real drawback is a slightly slower setting time. Flyash concrete has been catching on with the rapid growth of the green building movement in the past several years.

2) Plastics:

Plastics play a major role in building. Next to packaging, the construction industry is the second biggest consumer of plastics, representing 22 percent of plastic resin sales. The positive contribution of plastics cannot be denied: they offer relatively durable low-maintenance products; their light

weight reduces shipping energy; foamed plastics are typically the insulations with the highest R-value; plastic caulks, foams, and house wraps are crucial in sealing buildings; plastic resins are used in engineered wood and plastic wood helps displace old-growth and arsenic-treated wood. But they have their down-sides, negatives on the environmental scorecard.

3) Solar Panels:

A solar cell also called a photovoltaic cell is an electrical device that converts the energy of light directly into electricity by the photovoltaic effect. It is a form of photovoltaic cell which can generate electricity without any external voltage source. Material Used For Solar Cells:- Solar Panel are manufactured using these kind of semiconductor material which are as follows:-Silicon, Germanium, Cadmium

The operation of a photovoltaic cell requires 3 basic attributes:-

- The absorption of light, generating either electron-hole pairs or exactions.
- The separation of change carriers of opposite types.
- The separate extraction of those carriers to an external circuit.

Solar Cell is usually connected electrically. They are encapsulated as the module. These modules usually have sheets so glasses and these glasses are generally placed front side where sun light falls. These glasses allow the light to pass through it and also protect the semiconductor wafers which are very soft ant sensitive. They can be damaged by external pressure or rain or wind flow. The cell are to be connected in series for much production of electricity.

The panel is installed on the roof of their houses or in their kitchen any open place next to the house where sun light is available.

4) Flooring:

Finished flooring is available in a wide range of materials and styles. The decision about the type of flooring (e.g., carpeting versus tile) is generally determined by the program of the building. However, within each category of flooring are materials that can be judged for toxicity, embodied energy content, and other environmental factors.

Traditional wool carpeting, while non-toxic and made from a renewable resource, has not been able to compete economically with cheap petroleum products. The majority of carpeting and carpet sold today is made from petrochemicals. Not only is petroleum a dwindling natural resource, but the final products can continue to emit volatile gases long after installation, becoming a health hazard to building occupants. The health risk is compounded when petroleum-based adhesives are used to install the backing and carpet.

Natural fiber carpet cushions can be made of jute felt: recycled burlap or virgin jute fiber with some animal fibers (camel or cashmere) added for softness and resilience. Jute is a renewable crop material, with a very little energy required in the growth and manufacturing process. It biodegrades upon disposal, and can be recycled. Coatings help protect the fiber from mildew growth. The material has a higher density and longer life than comparable synthetics.

Another available carpet cushion is made from recycled, ground-up tire rubber. The disposal of automotive tires in landfills creates an environmental and health hazard. By reusing the rubber from tires, landfill waste is reduced, as is the need for new petroleum products. Tires are also being used to make floor tiles and interlocking pavers. The natural resilience of rubber makes this flooring ideal for health facilities and areas where people stand a lot. The material is slip-resistant and meets American with Disabilities Act safety guidelines.

Linoleum, a product made of linseed oil, compressed cork and wood flour, resin binders, and pigments, is a low-tech and low-energy alternative to vinyl. Because linoleum is made of natural, non-toxic materials, any VOCs it emits are primarily from the oxidation of the linseed oil; these are classified as fatty acids. The raw materials of linoleum are primarily from natural, renewable resources that are cultivated without endangering the environment. Ceramic tile is another flooring material noted for its long life, even in high-traffic areas. It is nontoxic, stain-resistant, and inert when discarded in landfills. Glazed and unglazed tile can be made using recycled glass as filler, which allows the firing temperature to be lowered.

5) Plumbing:

Water conservation issues and overburdened septic systems have led to a re-examination of our traditional plumbing methods. There have been three areas of focus: reducing fresh water use; recovering and reusing grey water; and reducing the amount of sewage entering the municipal waste stream. Several recent toilet designs have emphasized low water consumption.

6) Vacuum:

Assisted toilets also have the advantage of being able to flush horizontally or upward, allowing maximum flexibility in the routing of pipes. Because no slope is required, as in gravity systems, floor to floor spacing can be reduced, again saving materials. Venting stacks are also eliminated. Two parts compose the system: the bowl and a vacuum tank or pump. One vacuum tank can serve several fixtures, or even several buildings. The atmospheric pressure causes the "flush" when the valve to the vacuum tank is open. Sewage can then be stored for discharge at off-peak times. Other toilet systems route the sewage to a central holding tank, where it is composted. Consequently, there is no burden on municipal water treatment facilities. The compost can be used as lawn fertilizer; tanks incorporate odour-control devices.

7) Ventilation:

Energy recovery ventilators are designed to bring in fresh air and exhaust stale air, while recovering up to 85% of the energy that was used to heat or cool the outgoing air. The incoming and outgoing airstreams are prevented from mixing by an energy transfer disc that moves heat from one stream to the other. Moisture is removed and released by a silicon coating on the disk (unlike humidifiers, there is no drain pan and thus no bacterial growth). In winter, the ventilator can use electricity to pre-warm air; even without electricity, it recovers enough heat to warm incoming air up to 60% of room temperature.

B. Smart Electrical Appliances

1) Motion Sensors:

Energy is increasingly expensive and in short supply. Therefore, it makes sense for every business and residential consumer of power to conserve energy through efficient

usage. Since lighting is a large part of the daily energy consumption, automating the lighting switches of a home or office is the most obvious step towards energy efficiency and conservation. Turning off lights when not in use is often overlooked amidst the hustle and bustle of everyday life. Integrated Motion Sensors offer an energy saving that provides both convenience and lower electricity bills. Every switch offers green opportunity, please switch to Motion sensors to achieve this quick payback opportunity Build Track brand of Motion Sensors are designed to serve every day energy efficiency saving in an easy manner. They are as follows:-

2) Compact Fluorescent Light Bulbs:

A CFL bulb is a type of fluorescent bulb that screws into a standard light socket, such as a lamp or ceiling light fixture. CFLs use much less energy and last up to 10 times longer than standard light bulbs. A CFL bulb is made of glass, a ceramic and metal base, a luminous powder called phosphor, and a small amount of mercury Manufacturers report that the amount of mercury contained in a CFL bulb is five milligrams, which is less than two ten-thousandths of an ounce. The mercury could be in the form of an invisible vapor or in a bead the size of the period at the end of this sentence. A mercury fever thermometer contains about 100 times more mercury than a CFL bulb. The amount of mercury vapour that is released from one broken bulb is not enough to make anyone sick. However, it is best to avoid any exposure to mercury. We recommend that you ventilate the room air to the outdoors by opening a window or a door and leave the room for a few hours before cleaning up the broken bulb.

C. Insulated Concrete Forms (ICF)

These are stackable blocks of expandable polystyrene which are filled with concrete and re-bar as needed. They are strong and extremely well insulated cutting down on energy costs greatly. They also get rid of the necessary wood formwork traditionally used in poured concrete forms. However, the polystyrene is a fossil fuel based product and could contain VOCs. These are extremely harmful to a person's health. There is an ICF made from recycled wood chips called "Durisol", and this would be the best choice for an ICF wall.

1) Low VOC Paint:

The name says it all. Low VOC is better for the environment and everyone's health. However this label is misleading. In order to be considered "Low VOC", the paint must contain less than 250 grams per liter of the compound. However many companies count the grams per liter before the pigment is added, which has a large amount of VOC in it as well. So these really aren't what they claim to be. The best option for paint is a Zero VOC paint.

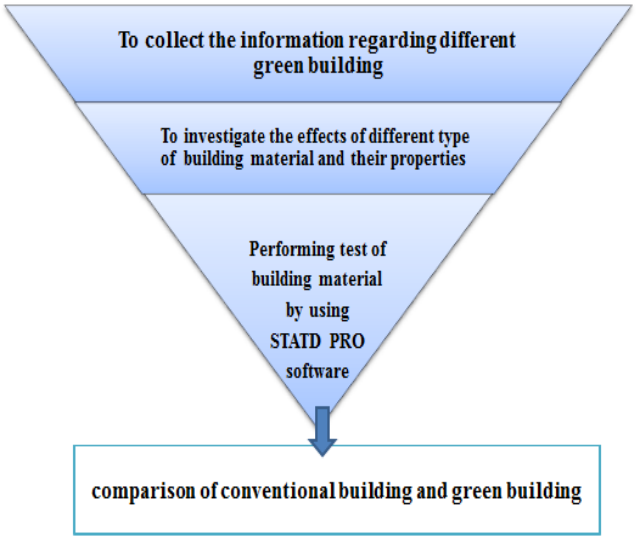
2) Recycled Denim Insulation:

This material is 100% recycled. So what couldn't be green about that? First, the insulation value is extremely poor (about equal to that of fiberglass). Second, it causes vapour barrier issues. Third, mice love to live inside of it. Finally, in most cases the blue jeans used for the insulation are shipped all over the country, wasting fuel and negating the "greenness" of the product.

3) Structurally Insulated Panels (SIPS):

These are wall panels comprised of rigid foam insulation sandwiched between two pieces of oriented strand board. They can have insulative values up to R-60. This high value saves energy and money. However, they are usually not made of green materials. Some companies are now using bio-based materials, but others still used expanded polystyrene, which as in ICF can contain VOCs and be a

The following step to be follow for design procedure



III. ANALYSIS AND DESIGN PROCEDURE

The social benefits for Upgrading a Convectional Building into Green Building is been stated as :-Sustainability in the buildings sector is too often perceived only through its environmental aspects, namely energy and water efficiency, or reduction of related GHG emissions. Policy makers, experts and business leaders have started addressing these issues through policy instruments, innovative technologies and demand-management programs. While the environmental benefits of these initiatives are well-established, the potential for sustainable buildings to contribute to social and economic objectives is still generally overlooked or poorly understood. Although addressing the environmental impact of buildings is crucial to sustainability in the built environment, sustainable building policies and programs can have an even greater impact on social and economic development. Opportunities exist for governments at all levels to achieve broader economic and social objectives through sustainable building initiatives. These opportunities include: contributing to poverty eradication, creating and maintaining green jobs, increasing urban integration, improving quality of life in urban and rural areas, enhancing economic opportunities, and achieving significant financial savings.

A. Rating System and Criteria

1) Sustainable Sites

- discourages development on previously undeveloped land
- minimizes a building's impact on ecosystems and waterways
- encourages regionally appropriate landscaping
- controls storm water runoff
- rewards smart transportation choices

- reduces erosion, light pollution, heat island effect and construction-related pollution
- Water Efficiency
- goal is to encourage smarter use of water inside and out
- water reduction, which is typically achieved through more

2) Energy and Atmosphere

- commissioning
- energy use monitoring
- efficient design and construction
- efficient appliances, systems, and lighting
- use of renewable and clean sources of energy, generated onsite or off-site

3) Materials and Resources

- encourages the selection of sustainably grown, harvested, produced, and transported products and materials
- promotes reduction of waste as well as reuse and recycling
- takes into account reduction of waste at a product's source
- Indoor Environment Quality
- promotes strategies that can improve indoor air as well as providing access to daylight and views and improving acoustics
- Locations and Linkages
- encourages homes being built away from environmentally sensitive areas
- instead, being built in infill, previously developed, and other sites
- rewards homes built near already-existing infrastructure, community resources and transit
- encourages access to open space for walking and physical activity and time spent outdoors

4) Awareness and Education

encourages homeowners and real estate professionals to provide homeowners, tenants, and building managers with Projects that use new and innovative technologies and strategies to improve a building's performance beyond what is required by LEED credits or green building considerations that are not specifically elsewhere in LEED rewards projects using a LEED Accredited Professional to ensure a holistic, integrated approach to the design and construction phase Regional Priority. USGBC's regional councils, chapters and affiliates have identified the environmental concerns that are locally most important for every region of the country, and six LEED credits that address those local priorities were selected for each region.

- a project that earns a regional priority credit will earn one bonus point in addition to any points awarded for that credit.

B. Analysing a Convectional Building (G+2 structure) via Staad Pro

For fulfills all our needs author conclude their design using STAAD PRP software and find out the floor plan for ground, first floor and second floor given in the fig 4.1 and 4.2.

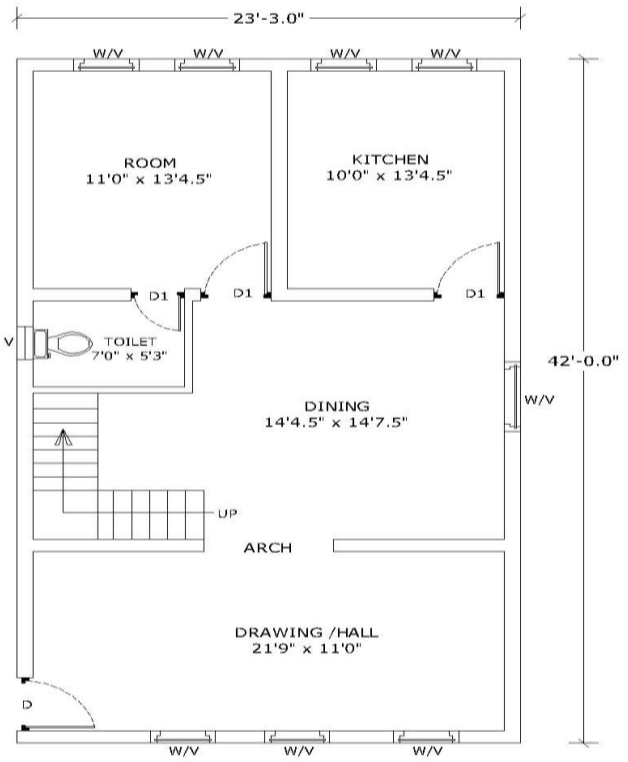


Fig. 3.1: plan of ground floor

Governments at all levels struggle to cover rising operational costs, as their financing options are becoming increasingly limited. A focus on sustainable buildings presents multiple actions and policy options that can be employed to address escalating social needs from changing demographics, such as the growing demand for housing and public education.

Two crucial trends will impact governments over the coming decades: unprecedented population growth and rapid urbanization. The world population hit five billion people in 1987. In 1999, it hit six billion. It is projected that by 2030 there will be eight billion people, and Governments will face a severely increased demand for housing, schools, hospitals, commercial spaces and associated infrastructure. Most of this population growth and related construction will occur in developing countries, many of which are already facing scarcity in water, energy and other resources. Urban development needs to plan for these upcoming challenges, as a delayed response will further strain governments, resources and may severely challenge their ability to provide access to water, electricity and other necessities.

more than nine billion by 2050 (UN, 2001). More than half of the global population currently lives in urban areas, and that percentage is expected to increase to 80 per cent by the year 2050.

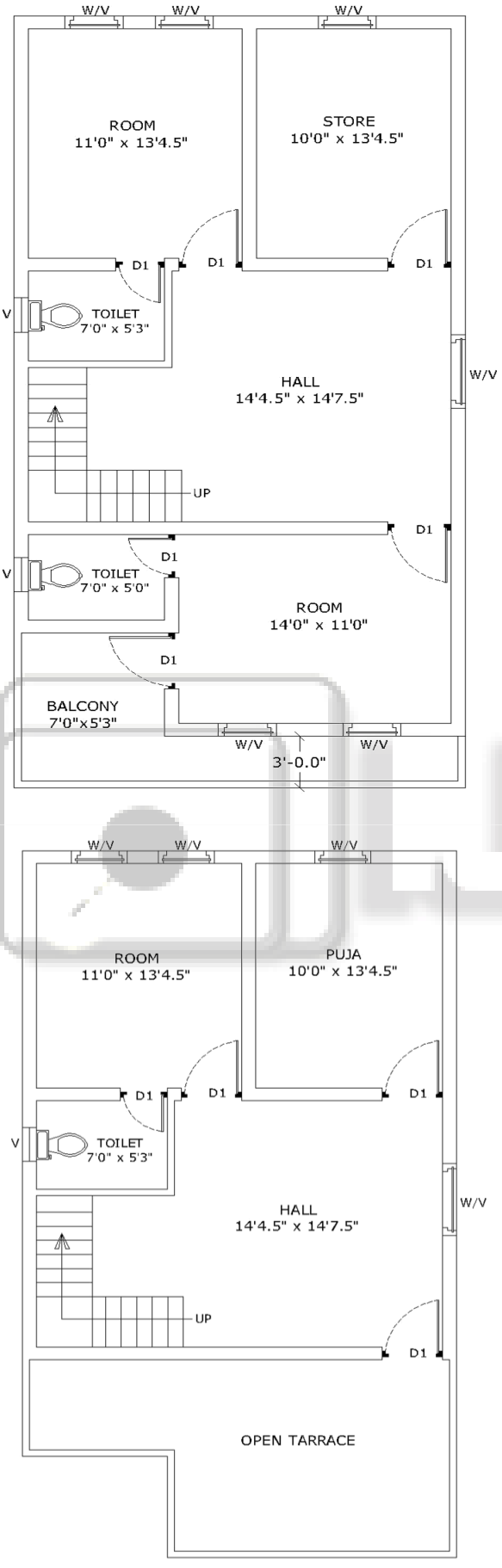


Fig. 3.2: plan of first and second floor

Providing for social needs will require comprehensive policy action, greater resource efficiency and capitalizing on the known technologies and sustainable building practices that will provide cost savings, better shelter, job growth and an improved ability to sustain lives and livelihoods. Sustainable built environments—buildings, infrastructure and cities—not only create the physical foundation for sustainability, but can also be the drivers of greener economies.

IV. RESULT AND DISCUSSION

As we are Upgrading Convectional Building into Green Building certain Financial aspects are to be considered which are as follows:-

S.NO	ITEM	RATE	AMOUNT	REMARK
1	Solar Panel	264 per square feet	Rs 50000	As energy required
2	Green Water Harvesting		Rs 18322	Details Are in Methodology
3	Flooring	200	Rs 100000	As per floor area
4	Plumbing	100000	Rs100000	Per unit cost
5	CFL	200	Rs 4400	Per rooms 2 CFL
6	Motion Sensor	1000	Rs 22000	As per rooms
7	Vitrified Tiles	600	Rs 300000	As per 500square Ares
	Total		Rs 594722	

The minimum necessary materials to upgrade an conventional Building into Green Building is been mentioned above. Although the initial cost for the upgrading a Convectional Building is bit too high but by the application of the above mentioned material their returns are priceless.

Through this Up gradation many positive changes in many areas we can observe in the building which is as follows:-

- Energy Usage
- Water Conservation
- Insurance Benefits
- Low Maintenance

A. Major Financial Benefits for building Green an Existing Building:

The greening of the existing built environment can reduce operating and maintenance costs, optimize capital expenditures, increase efficiency, extend the life of buildings and building systems and minimize negative impacts on the environment in terms of energy and water use, consumption of natural resources, and pollution. Lower operating costs and easy maintenance of green buildings can also contribute to lower vacancy rates and higher property values.

Energy consumption represents 30% of a typical commercial office building's operating costs. Energy is the largest controllable cost of operations for commercial buildings and improved energy efficiency has a direct and

significant payback for project stakeholders. The India EPA estimates that if the energy efficiency of commercial and industrial buildings improved by 10 percent reduces greenhouse gas emissions equal to the emissions from almost 30 million vehicles. Residential buildings account for 22 percent of total energy and 74 percent of water consumed in the India.

Green home remodeling can provide a healthier indoor environment, reduce operating costs and reduce negative environmental impacts. By taking advantage of pre-existing water, sewer, and road infrastructure, green home remodeling can increase energy and water conservation, enhance indoor air quality, and reduce material waste and resource consumption. Major Financial Benefits for building Green A New Building:-

Key financial benefits of new green construction generally relate to lower operational costs, and may include lower energy, waste and water costs, lower maintenance costs, and increased productivity and health. The latter, while difficult to measure/ prove, have come to be regarded as the holy grail of green building given that labor costs for most businesses comprise the overwhelming majority of costs. Building green also presents opportunities for incentives to offset any higher initial (capital) costs and may result in increased occupancy rates and rental rates, insurance discounts and higher property value. While the data remains thin on these potential benefits, they have generated much interest among real estate companies. New green building valuation tools and metrics -- such as the Green Building Underwriting Standards -- should help to standardize this financial data, providing better opportunity for analysis and attainment of these benefits.

The Green Building Underwriting Standards were completed by the Capital Markets Partnership, an Indian Standards Institute Accredited and Audited Standards Developer. According to the Construction Marketplace Smart Market Report, commercial green buildings have demonstrated an 8-9% decrease in operating cost, a 7.5% increase in building value and a 6.6% return on investment improvement.2 According to the Greening of Corporate America Smart Market Report, commercial green buildings experience a 3.5% occupancy ratio increase and a 3% rent ratio increase.3 In a comparison of ENERGY STAR buildings and market comparable in the first quarter of 2008, ENERGY STAR buildings achieved 3.6% higher occupancy rates.

ENERGY STAR qualified homes use substantially less energy for heating, cooling, and water heating, delivering Rs12000 to Rs14000 in annual savings. There are currently over 1 million ENERGY STAR qualified homes in the India and in 2010, families living in these homes saved more than In addition to offering financial advantages, building green provides environmental and social benefits such as protecting biodiversity and ecosystems, improving air and water quality, reducing waste, conserving natural resources and enhancing occupant comfort and health.

V. SUMMARY AND CONCLUSION

In recent days the whole world is facing many major problems such as global warming, greenhouse effect and uncertainty in climatic behaviour which affect the human beings vastly. Global warming resulting from the increase of greenhouse gas emissions is making earth warmer. In Chhattisgarh, the environment of Raipur city is very warm in summer as compare to other cities due to increase in concrete structures and consequently decrease in green areas. So green building approach is very beneficial and gives effective result to reduce the environmental temperature of Raipur city in summer.

To control and reduce the global warming and greenhouse effect the construction of green building plays an effective role. The followings are the advantages of green building:-

1) It absorbs CO2 from atmosphere and reduces the greenhouse effect.
2) The plantation will also give pleasant look to the building and surrounding areas.
3) The collective effective of several buildings with green roof can reduce the “Heat island” effect in urban areas, improve the air quality and reduce the dust and other airborne particles.
4) By providing green roofs, insulated cavity walls and tiles on the outer face of the wall, we will reduce the indoor temperature about 50C to 70C.
5) The rain water harvesting system will increase the ground water level which will be utilized in the period of demand.
6) A green building with water harvesting system utilize the natural energy to reduce temperature and increase ground water level hence it saves the additional cost required for mechanical means to reduce temperature.
7) Tiles on the outer face of the wall will reflect sun rays therefore reduce indoor temperature of building.
8) By the provision of tiles on the wall, we will reduce yearly painting or distempering charges of the wall.
9) Tiles protect the wall from the seepage during heavy rainfall.

In this way we can say that a green building with water harvesting system will give effective performance to reduce temperature and control the global warming and greenhouse effect.

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