Green Building Materials - The Way towards Sustainability
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Abstract:
Globally buildings are responsible for a huge share of energy, electricity, and water and materials consumption. The building sector has the greatest potential to deliver significant cuts in emissions at little or no cost. Buildings account for 9 billion tones of CO² annually. If new technologies in construction are not adopted during this time of rapid growth, emissions could double by 2050, according to the United Nations Environment Program. Green building practices aim to reduce the environmental impact of building. Buildings account for a large amount of land. The International Energy Agency released a publication estimated that existing buildings are responsible for more than 40% of the world’s total primary energy consumption and for 24% of global carbon dioxide emissions and Buildings generate up to 35 per cent of all greenhouse gases, 35 per cent of landfill waste comes from construction and demolition activities, and 70 per cent of municipal water is consumed in and around buildings and use15% of the world’s fresh water resources. It’s clear that making buildings greener can have a significant impact on larger environmental goals.

The main objective of this paper is to highlight the rising need of Green Building materials in today’s world and its importance as a part of green building designing and construction.

Keywords: Green Buildings, benefits, goals, CO² emission, green material.

I. INTRODUCTION

The built environment makes a significant contribution to environmental degradation. Buildings including construction, operations and deconstruction impacts, use approximately: 15% of the world’s fresh water resources; 40% of the world's energy; and produce approximately 23-40% of the world's greenhouse gas emissions. The analyst forecast global market to grow at a Compound Annual Growth Rate (CAGR) of 6.7% which is expected to drive the industry to a value of $4,759.4 billion by the end of 2018. Although buildings are a large contributors of greenhouse gases, To prevent the worst effects of global climate change and minimize other negative environmental impacts, it is therefore important to address the environmental impacts of buildings. In fact, energy efficiency reductions in the construction and operation of buildings, offers one of the single most significant opportunities to reduce man’s impact on climate change. Green buildings can reduce their consumption of energy to less than half of what a conventional building does, with similar reductions in potable water usage, runoff to sewer and solid waste. Green building can have a really significant impact on resource consumption and on combating global warming. A related, but broader concept, of sustainable buildings, has also emerged. These buildings not only aim to minimize negative environmental impacts but also aim to support beneficial social and economic change such as improved health, education and employment in local communities.

II. GOALS OF GREEN BUILDING MATERIALS

The basic goal of green building is: attractive, comfortable, affordable shelter that does no harm to the Earth in its manufacture, or its use. This overarching goal is driven by four further goals:

- Reducing impacts on the Earth from constructing buildings and their materials;
- Reducing impacts which arise during occupancy;
- Reducing the impact of the structure at the end of its life and;
- Creating a more desirable human experience.

Countries with green building activity above the global average of 24 percentage include south Africa, Singapore, India, Germany and Mexico, Green building continues to double every three years.
III. BENEFITS TO GREEN BUILDING
Green building is not a simple development trend; it is an approach to building suited to the demands of its time, whose relevance and importance will only continue to increase. The benefits to green building are manifold, and may be categorized along three fronts: environmental, economic, and social.


Economic Benefits like Energy and Water Savings, Increased Property Values, Decreased Infrastructure Strain, Improved Employee Attendance, Increased Employee Productivity, Sales Improvements, Development of Local Talent Pool (green buildings use on average 26% less energy, emit 33% less carbon dioxide, use 30% less indoor waste and send 50% - 70% less solid waste to landfills and incinerators, according to the us green building council (USGBC)

TABLE.I. COST BENEFIT ANALYSIS FOR GREEN BUILDINGS

<table>
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<tr>
<th>Green building benefits</th>
<th>26%</th>
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<td>33%</td>
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Social Benefits like Improved Health, Improved Schools, Healthier Lifestyles and Recreation. However, the winning option was to refurbish the old house, because the carbon investment of doing this was just eight tones CO²e, and even the highest-specification new build could not catch up this advantage over the 100-year period. Once cost was taken into account, refurbishment became dramatically the most practical and attractive option, too.

IV. ADAPT NEW TECHNIQUES AND MATERIALS IN THE GREEN BUILDING CONSTRUCTION
Traditionally green building aims to be sustainable by aiming for low carbon emissions, typically by being energy efficient. Adapted Energy-efficient techniques include Passive solar, Passive cooling, Active solar, Earth shelter, Energy devices: Heat pumps, Photovoltaic panels, Cob – earth/straw mix sculpted into walls; earth bricks; Rammed earth systems; Ceramic structures; Earth ships –earth-sheltered structures made of soil-filled tires, Isolative materials Plant materials like Stressed straw panels etc..<br>

V. PROPERTIES OF SUSTAINABLE MATERIALS
The material chosen for construction must, in addition to functional efficiency, fulfill some or more of the following criterion; Reduce air, land and water pollution, reduce material use, material durability and life span, energy conservation material, recyclable products, biodegradable and eco friendly.

FIGURE.2. PROPERTY CIRCLE OF GREEN ATERIAL MATERIALS IN GREEN BUILDING
New materials and methods are developed as smart, sustainable upgrades of traditional materials, as they effectively deal with the natural elements. Green materials is an important step in designing a green building to be more efficient and energy saving. They are low in embodied energy and eco friendly. They are:

Masonry-
These are the conventional and potential eco-friendly materials available in market today. They are Aerated light weight concrete blocks, Lacto blocks, Rice husk, Earth bags, Adobe Cob, Thatch, Brush, Cast-in-situ fly ash walls, Stabilized mud fly ash bricks, Rammed earth. Papercrte, Plastic bricks, Straw bales, CLA blocks, Rock, GFRG panels, Monolithic cement construction system these are alternative to fired bricks, cement concrete blocks stone dust instead of sand and local available stone

Plastering
These materials are alternative to cement, sand, plaster of Paris and gypsum. Calcium silicate Plaster, Cement Plaster, Earth plaster, Phosphor-gypsum Plaster, Use of Fiber reinforced clay plaster

Roofing and Ceiling
Instead of ferrous/non-ferrous sheets, tile these are the alternative green materials. Like Green roof, Fiber Cement, Slate tiles, Clay tiles, Recycled metal, Forest Stewardship Council
Flooring, Paving and road work

Other than conventional building materials, like wood, stone, ceramic, concrete, vitrified and marbles the following are eco-friendly and economical. Fly ash/pulverized debris blocks/industrial waste blocks, Lime-pozzolana concrete paving blocks for all outdoor paving, Terrazzo flooring, Bamboo, Cork, FSC wood flanks, salvaged wood flanks, Natural or recycled carpets, Tire rubber recycled into indoor flooring.

Tiles

Ceramics are made from 100% natural and plentiful raw materials that are usually found in close proximity to the factories, thus reducing fuel consumption and transportation costs. It is durability, recycled content, indoor air quality (non-vitrified), Mosaic, Terrazzo, Recycled wood flooring, recycled glass flooring are alternative to vitrified, granite, imported marble.

Water supply, sanitation and Plumbing material

Green building encourages innovative water-saving strategies that help projects use water wisely. Project teams can follow an integrated process to begin assessing existing water resources, opportunities for reducing water demand, and alternative low flow fixtures. Effective strategies include:

- Concrete pipes, drains etc made using recycled concrete aggregate (RCA)(more than 60% recycled material),plastic drain and soil pipes made using R CA (50%-100%),cast iron RCA pipes (up to 96%), Un plasticized polyvinyl chloride(UPVC), Use polymer plastic for hot and cold systems, Use precast cement concrete and high strength un-plasticized Polyvinyl Chloride (UPVC).
- vacuumed toilets .High efficiency toilet model uses no more than 1.28 gallons of water per flush (gpf) or use dual flush toilets or installing a Composting toilets, which uses little to no water for flushing
- Showerheads- Showering accounts for up to 20 percent of the average household’s indoor water use. You can cut your shower water use by as much as 70 percent by switching to an ultra-low-flow showerhead.
- Faucets-If you have inefficient faucets (which use more than 2.5 gallon per minute(gpm), either replace them with high-efficiency faucets that have a flow rate of no more than 1.5 gpm or add a water-saving aerator or flow restrictor to the existing faucets , waterless urinals
- Use dishwashers and washing machines with low water requirement

Insulation material

Insulation in buildings is assuming tremendous importance and has a potential to reduce energy consumption to an extent of 5-8%. AAC blocks for exterior walls, air cavity walls, ceiling insulation, Extruded polystyrene (XPS), Expanded polystyrene (EPS) in wall and roof insulation, insulating bricks from rick husk ash, wall insulation with Recycled news paper (cellulose), Recycled blue jeans, wool and spray foam, cotton insulation.

Windows, doors and openings

Instead of using high embodied energy materials like steel, aluminum, glass, R.C.C.,PVC and stone and wood; Use Low-emittance and energy efficient windows and smart glass, Ferro Cement and Pre-cast Reinforced Cement Concrete (R.C.C.), Lintel, chajja and jails, bamboo reinforced concrete frames, EPS composites and door shutters, Hollow recycled steel, aluminum channels and components, laminated hallow composite shutters, double glazed windows with high performance glass, these are alternative to timber, aluminum and steel material etc.,

Paints, adhesives and sealants

Green paints benefits many ways like Clean air, reduce ozone depletion, minimal health risk, low operation and maintenance (O&M) cost Soy-based sealants, Low volatile organic compounds (VOCs) or classified zero-VOC paints, wood finishes, and caulks Natural Paints, Non-toxic stains, milk paint, Use water based paints instead of solvent based, Use of cement paint/Epoxy resin Paint for external surface.

Wood

These are the conventional and potential eco-friendly materials available in market. They are Renewable timber from plantations with species having not more than 10 years cycle or timber from government certified forest/plantation or timber from salvaged wood, timber from trees such as poplar, rubber and eucalyptus plywood should be phenol banded and not urea bonded, Medium Density Fiber Board (MDF), bamboo plywood, bagasse board, coir composite board, bamboo mat veneer, Fiber reinforced Polymer board etc.,

RCC and steel systems

Recycled steel forms and reinforcement bars, sand and aggregate from pulverized debris or sintered fly-ash cellular concrete and mortar, pre-cast slabs. Faswal is a great alternative foundation materials, concrete reinforced with timber, bamboo or natural fibers, light weight concrete, foamed concrete, and green concrete

Miscellaneous materials

Electrical fixtures, solar hot water heaters, eco friendly kitchen counter tops, energy efficiency air-conditioners, energy efficiency lighting like Light Emitting Diode(LED), renewable energy devices/systems like solar, bio gas etc.,

VII FUTURE SCOPE

Green building reduces the impact on environment and indirectly helps to reduce the global warming effects. Green buildings and the concept of smarter living offers tremendous opportunity for changing an average person’s lifestyle. As the general public becomes more aware of the benefits of green buildings, developers will get creative and find new ways to brand, market
and sell green buildings, hence creating a conductive atmosphere
for the sector to grow exponentially.

VIII. CONCLUSION

The main objective of this paper is to highlight the rising need
for “GREEN” material which is socially, economically benefits
for construction industry and human health. Green construction
material reduces side effects on environment, to make efficient
sustainable structure as well as will lessens the environmental
pollution content, and like greenhouse gas emission, resource
depletion, soil pollution, health hazards, ozone depletion etc.
Hence there is an urge to use the eco-friendly materials for the
better tomorrow and healthy life of coming generation.

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