

Green Building Materials & the Information about Solar Energy in Green Buildings

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Abstract— In India various tremendous environmental problem are rising in construction industry due to leading urbanization. Increase in demand of houses which lead to consumes more energy, resources and raw materials which are responsible for the rise in carbon content in air and which are harmful to environment and human health. Nowadays we are facing various environmental impacts due to which we need to build with more sustainable materials which will lead to reduction of impacts on environment. In cities like Pune we are already noticing the change in weather patterns, hotter summers, shorter winters, insufficient monsoons. So taking the preservation of the city's ecology and finite energy resources seriously is now more than important. Developers need to find better, more sustainable methods of designing their buildings in order to reduce their negative environmental impact. Therefore it is need of an hour to use more sustainable materials and locally available materials which are eco-friendly and a lead for better tomorrow. Considering to all this impacts this paper consist a five green construction materials with their advantages, disadvantages, durability and economical aspects in construction industry which can be an effective alternate material for conventional materials. The perceived long-term potential of solar energy, combined with the capital intensity and cyclical nature of the industry, led to large electronics, oil and engineering companies buying entrepreneurial firms in successive generations. These firms became important drivers of innovation and scale, but they also found solar to be an industry in which achieving a viable business model proved a chimera, whilst waves of creative destruction became the norm.

Key words: Cost Efficiency of Green Materials, Durability, Ecofriendly Construction Materials, Energy Efficiency, Solar Energy & Sustainability

I. INTRODUCTION

Buildings are actually responsible for maximum resource consumption therefore green building is only solution to the present trend of construction. Green building is described as people with healthy, comfortable and safe living, working and activities of the space, while the building full life cycle (material production, construction planning, design, construction, operation and maintenance) process to achieve efficient use of resources (energy, disabilities, the water, materials) with minimum impact on the environment of buildings, also known as sustainable building envelope.

Establishment of institution by Formation of IGBC, TERI launch of LEED India the Government to encourage and BEE and TERI-GRIHA Sustainability in India (Source: "A Review of Green Building Movement Timelines in Developed and Developing Countries to Build an International Adoption Framework" - SinemKorkmaz, DuyguErten, Matt Syal, Varun Potbhare).

The green building uses locally available building materials which are energy efficient, sustainable, and durable. Looking at the availability of local material lime is one of such material which reduces the internal room temperatures by 4 to 5o C as compare to cement in plastering work. Using lime in building it absorbs carbon rather than emitting which also lead to reduce hazardous impact on environment.

The development of solar energy on a commercial basis turned out to be a lengthy process whose progress was primarily shaped by the price and cost of alternative conventional energy sources. Solar was especially vulnerable to the price of competitor sources of energy as it emerged as the most expensive renewable energy. Innovation was driven by visionary entrepreneurs, all of whom faced the problem that PV solar was a highly capital-intensive and technologically-complex product. This led them to seek investments from large established firm in cognate industries, especially electronics and petroleum, and to rely on public policy to facilitate the growth of the industry. This reliance on large firms and governments was to turn out to be problematic.

A. Why Green?

Experts and scientists from the world around have implored citizens of the planet to make it their personal goal to improve the environment we live in. Fossil fuels are being depleted at an accelerating rate, the atmosphere is getting proliferated with dangerous toxins and the world is becoming a more difficult place to live in. This is not the legacy that we should leave behind for our latter generations.

The environmental benefits of building green include the protection of ecosystems and biodiversity, improved air and water quality, less waste flowing into streams, and the conservation of natural resources. Green buildings can also result in lower operating costs because they typically use less energy and materials and improved indoor air quality, which improves the health of occupants

B. Materials

As the energy required for manufacturing of cement and other construction material is more so it is major contributor to the consumption of our total energy source. Using such materials described below with their benefits towards environment. Following are the materials which we have selected looking in to their local availability, benefits, cost and durability.

C. Lime

Lime is our chief material which replaces the cement in building construction. It gives the good air quality by absorbing the carbon and emitting oxygen in the atmosphere. By looking at the ancient construction we can make it out the durability of lime in terms of quality and life of it as it get strengthen by time to time . The cost comparison of lime and cement is, cost of lime Rs.7.5/kg. And that of lime is Rs.6/Kg.

Life span of lime building is much more as compared to cement building.

D. Sand Lime Bricks

Sand Lime Bricks replaces the conventional bricks in the market of construction industry. The main constituents of sand lime bricks are sand, lime, fly ash, water. Using sand we can achieve the adhesiveness to hold the particles together. Its brittleness helps us to recycle it and reuse in other works. Cost of conventional brick is Rs.5/ brick and that of sand lime brick is Rs.8/ brick but sand brick is more durable than conventional brick.



Fig. 1: Sand Lime Bricks

E. Eco-Friendly Tiles

An Eco-friendly tile replaces the conventional flooring and uses less energy in their production. It is cheap as compare to the conventional tile. They are available as per the client requirement in various patterns and also easy to place. This tile improves performance of indoor environment quality.



Fig. 2: Eco-friendly tile

Tiles are replaced by the eco-friendly tiles. Eco-friendly tiles are cheap in cost as compared to regular tiles; these tiles are manufactured on the construction site so that its transportation charges are reduced. Cost of regular tiles (Ceramic) is Rs.40 and that of eco-friendly tiles is Rs. 35.

F. Colored Lime Plaster

Though low VOC (Volatile Organic Compounds) paints are available but by using coloured lime plaster as paint it reduces the painting for whole structural life. It is maintenance free, washable and water proof. Its shine and glossiness increases as the time passes. It gives better aesthetics look than conventional painting work. Regular paints are replaced by coloured lime plaster. This is very cheap and long lasting as compared to regular paints. Cost of regular paint is Rs.10/sq. ft. and cost of coloured lime plaster goes Rs. 35/sq. ft. including three coats of plaster.



Fig. 3: VOC (Volatile Organic Compounds)

G. Reflect Sol Glass

Reflect sol glass gives better indoor quality than the normal clear glass. It keeps the inner temperature cool in hotter summers which reduce the energy consumption. This glass reduces the solar heat gain but allows the optimum lighting through the day which reduce electricity load. It is a good resistant of U.V rays which reduces the cause of skin retention of occupants. It also gives privacy as compare to the normal clear glass. The regular glass is replaced by the reflectsol glass and the cost comparison of the glass is reflectsol glass is 20% high costs as compared to normal glass. But the advantages of reflectsol glass are more and its life span is also more.



Fig. 4: Reflect sol glass

H. Solar Homes

The first engineered passive solar houses of the modern era were built in Germany after World War I, when the Allies occupied the Ruhr area, including most of Germany's coalmines. From the 1930s the American architect George F. Keck experimented with the basic principles of passive solar houses. He designed the all-glass "House of Tomorrow" for the 1933 Century of Progress Exposition in Chicago, and noted that it was warm inside on sunny winter days prior to the installation of the furnace. Following this, he gradually started incorporating more south-facing windows into his designs for his clients. In 1940 he designed a passive solar home for real estate developer Howard Sloan in Glenview, Illinois. Named the "solar house" by the Chicago Tribune, the Sloan House became first house to carry this name. Sloan continued to build numerous passive solar houses, which contributed to the emergence of a "solar house" movement in the 1940s. During the 1930s researchers at the Massachusetts Institute of Technology (MIT) also experimented with solar home designs that incorporated pumps and storage devices. MIT's Solar house was completed in 1939 to demonstrate how the sun could heat houses in the winter, and MIT researchers also conducted experiments to judge the possibility of solar-powered air conditioning and energy generation. In 1938, Godfrey Lowell Cabot, the Boston industrialist and pioneer aviator, gave a gift to MIT to be used specifically for "the art of converting the energy of the sun to the use of man." In the United States interest in energy efficiency emerged during the Second World War when potential energy shortages became an issue. In addition, technology advances in the glass industry allowed homebuilders in cold climates to use larger window area. In 1945, the Libby-Owens-Ford Glass Company, which in the previous decade had been experimenting with double glazing windows in order to retain heat, initiated a large scale solar house project after receiving numerous letters from

prospective home buyers interested in energy efficient houses. The company planned to build solar houses in 48 states and selected local architects to design these houses, using a jury composed of editors, university deans and other key personalities in the building industry. The project was launched but encountered harsh criticism. Purdue University engineering professor F.W Hutchison, conducted extensive experiments on these constructions and concluded that passive solar houses “may be net money losers in terms of heating costs”, in the end, the solar house movement failed to create a community of solar architects or to launch a widespread solar house movement after 1947. Instead, with the boost of “all electric houses”



Fig. 5: Solar Homes

I. A New Solar Boom and Bust

The decade after 2000 saw a remarkable boom in solar energy, only be followed by a spectacular bust for many corporations engaged in it. The boom was driven by a renewed bout of government subsidization of solar energy as concerns about, and evidence of, climate change mounted. In Europe, the example of the German Renewable Energy Sources Act and its feed-in tariff program was followed by Spain, Italy, France and several other countries. In Spain, where the level of support became the most generous, there were feed-in tariffs, government investment subsidies and soft loans, and regional authority subsidies often covered between 15 per cent and 50 per cent of total investment. Many large cities in Spain have approved regulations requiring the obligatory installation of solar PV on new buildings and some regional energy plans prioritized the use of PV. By 2009 the share of electricity generated by solar in Spain was the highest in the world. There were also new US policies to support solar. A slow rise in environmental concerns began under the Presidency of George Bush beginning in 1989. This continued during the Clinton Administration between 1993 and 2000, although there were few concrete measures to support renewable energy beyond an increase in gasoline taxes. Clinton’s successor, George W Bush, quietly installed solar systems in the White House in 2002, and three years later the Investment Tax Credit allowed businesses to invest in solar power projects and receive a tax credit for up to 30 per of the expense. As a short-term remedy to the almost annual reauthorization quest for the ITC, the Emergency Economic Stabilization Act of 2008 extended the 30 per cent solar investment tax credit for eight years to 2016, and removed the prohibition against utility company use of the ITC, thus allowing them to take advantage of the credit. There was also substantial support at the state level for solar energy. In 2007 the state of California also launched the California Solar Initiative, which offered substantial incentives to get solar panels on domestic roofs. It was joined by a group of

other states, including New Mexico, Colorado and Arizona, and less sunny states such as Massachusetts and Pennsylvania.

1) How can we use solar energy?

We can use solar energy either to provide heat or to generate electricity.

Solar hot water systems could be used to supply up to 70% of household hot water in the UK; in sunnier climates, virtually all domestic hot water could be provided for. The main cost for solar hot water systems is the installation itself, although they can be incorporated into new buildings with minimal overhead cost. The largest installed capacity is found in China, where solar hot water collectors are a cost-effective means for easing the rising demand placed upon conventional energy generation. The use of solar heat in commercial and industrial environments is also feasible but much less widespread.

2) Solar electricity can be generated directly using photovoltaic (PV) panels

These panels are suitable for use on roofs and are now manufactured in sufficient quantity that the electricity generated in some favorable locations has almost reached grid parity (the point where the cost of photovoltaic electricity matches the residential grid price). The growth in photovoltaic manufacturing has been driven by government incentives that subsidize the cost of electricity and drive technological innovation. First generation PV panels are made from silicon wafers at relatively high cost. They represent the industry standard, delivering efficiencies between 12-20% and are particularly durable. Second generation PV devices are made by depositing a thin film of semiconductor directly onto glass, metal foil or plastic, reducing the cost of materials but resulting in a loss in efficiency (usually to 10% or less) when manufactured over large areas. All plastic, flexible solar cells have the possibility of very low manufacturing cost, but the efficiency (4%) and lifetime (typically one year of operation) need to be improved. Third generation PV devices, currently under development, aim to improve the efficiency of solar conversion towards the thermodynamic efficiency limit of 86.8%. Currently, the highest efficiencies achieved are around 40%, with very high costs. Nevertheless, these technologies are used in terrestrial concentrator solar power plants and used to power modern communication satellites.



Fig. 6: Solar electricity can be generated directly using photovoltaic (PV) panels

II. BENEFITS OF BUILDING GREEN

Various benefits from green buildings are discussed below-

- The immediate and most tangible benefit is the reduction in operating energy and water costs right from day one, during the entire life cycle of the building.
- Energy costs can be reduced by 25% - 30% in green buildings.
- A number of peoples are now seeing green building rating as a tool to enhance marketability.
- Green buildings provide financial benefits that conventional buildings do not. These benefits include energy and water savings, reduced waste, improved indoor environmental quality, greater employee comfort/productivity, reduced employee health costs and lower operations and maintenance costs.

1) Energy

Energy is a substantial and widely recognized that cost of building operations that can be reduced through energy efficiency and related measures that are part of green building design.

III. CONCLUSION

By using solar energy systems purposes like save electricity, cooking by solar cooker, solar heater etc. are achieved. By using the materials like Lime, Sand Lime Bricks, Reflect sol glasses, Coloured Lime Plaster, tiles etc. we can reduce operating energy and water costs right from first day & till during the entire life cycle of the building. The cost can be reduced in green buildings and it provides financial benefits that conventional buildings do not. It also helps in energy savings, reduction in waste and improve indoor environmental quality.

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