

Economic Importance of Green Buildings

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Abstract

Due to rapidly growing urbanisation, increasing affordability by some sections of people, the overall attitude of financial institutions and other factors, India faces substantial construction activities in all domains, be it residential, commercial, or industrial. As an approximate estimate, nearly forty % of energy consumption is expected to be in the construction of building activities alone. Thus, houses are significant consumers of energy right from operation, construction, and maintenance. Hence it is essential that such policies be implemented, especially in the building sector, to minimise non-renewable energy consumption. In that place, schemes for renewable energy be encouraged and implemented. Hence the concept of green building is gaining very high momentum and popularity, and the government is also providing many incentives for constructing and maintaining green buildings. In this paper, attempts have been made to evaluate the economic importance of green buildings and how the construction of green buildings may reduce environmental costs.

Keywords: Green Building, LEED, GRIHA

Introduction

A green Building uses up natural wealth to a minimum degree during operation and construction, minimises the requirement of energy based on fuel based on fossil and encourages the use of recycled and reused materials, renewable energy, and energy-efficient appliances and devices. Therefore, promoting and implementing the concept of green building has become a primary concept of modern construction (Darko and A Chan, 2016). "The concept of green building is created to mitigate harmful impacts towards the environment (USGBC 2016)." The word green is the concept of renewable, sustainable, and eco-friendly (USGBC 2016).

In a research paper by Alsulaili et al. (2020), In Kuwait, the green building concept was introduced to save water and energy and use of green materials for sustainable building. Using LED lights and sensors, they found that light consumption was reduced in green buildings by nearly 86 %, and an annual cost saving was nearly 54%. It was also found that there was a reduction in CO₂ and greenhouse gas emissions.

In the USA, two hotels, namely The Proximity Hotel in the USA (North Carolina) and Bardesson Hotel in the USA (California), have implemented various criteria for green building to enhance water consumption efficiency (Ahn & Pearce, 2013). They found that there was a nearly 34% decrease in the consumption of drinkable water.

The Government of India has suggested certain norms, and the buildings complying with those certain norms, primarily related to the green building concept, will be classified according to the

degree of fulfilling the norm, and income tax and holding tax rebates would be provided to them. In the case of LEED-certified green buildings, a 100 % income tax on assets may be claimed by the developer of the green building. Even the Indian Government is providing low-interest loans to green-certified buildings. Several states of India, like Maharashtra and Punjab, are supporting green building through rebates in holding tax sops. Green building takes care of use of water conservation in the form of rainwater harvesting system, waste management, and energy conservation such as using solar water heater, solar pump, rooftop PV system, recycling waste product for procurement of energy, utilising CFL bulb etc., for making it energy efficient as wells controlling devices for pollution.

Concept of green Building: -

The concept of the green building can be explained as a building which operates satisfactorily and consumes optimal energy, especially renewable, consumes a reduced amount of water, preserve natural resources, and produce less waste. It should have a place for comfortable and healthy living producing minimum environmental pollution, and must be completely eco-friendly. Moreover, it must have arrangements for water harvesting for water conservation and recharging the groundwater.

Now much interest has been aroused among engineers, architects, environmentalists, and economists to design fully self-energy sufficient buildings, that is, zero-energy buildings.

A Net Zero Energy Building (NZEB)

A Net Zero Energy Building has zero annual net energy consumption. NZEB produces their own energy for heating and lighting purposes. Individual homes may use various micro-generation technologies, such as solar cells, wind turbines, biofuels etc., which may be utilised for space heating, cooking etc. NZEBs are typically connected to the electricity grid to handle changes in demand and supply of electricity and can export excess electricity to the other grids. Net Zero Energy buildings are becoming increasingly popular to reduce greenhouse gas emissions and use less energy.

As it has already been explained, modern Indian buildings are significant energy consumers at various stages of building construction, operation, maintenance, and other utilities. The growth in the building sector is taking by leaps and bounds, and serious attempts have been witnessed towards the concept of clean, eco-friendly green buildings. In this regard, the government of India is encouraging the concept of green building as a part of the well-planned policy to lessen the burden of energy based on fossil fuels and to come across the highly rising demand for energy requirements. Further, it also plans to come across the demand by promoting renewable energy sectors because renewable sources are the only sustainable energy alternatives for the future of India and the whole world.

Many big industrial houses from India and abroad are taking a keen interest in the development of solar power plates. India has a prominent place in the power generation from wind turbines which is approximately 41.66 GW. Temples in Tirupati, situated in Andhra Pradesh (India), have been using renewable energy together with traditional ones for energy requirements. Solar energy is being utilised in the temple premises for cooking and lighting purposes. In addition, Windmills supply some proportion of the power toward the power requirement of the town. Nearly 40-45 % of the energy required by Tirumala Tirupathi Devasthanam meets from non-conventional energy sources. In addition, water recycling plants have been fabricated to purify all waste water in the temple's garden.

Much research is being carried out worldwide, including in India, and the production of advanced thin film solar panels and solar installation on the water is in progress. The World Bank also is very keen to partner. In India, green building is an essential factor for renewable sector development. Several companies in India have started to make

solar inverters. Sunshine is available to us as a gift by nature, but converting the abundant energy to solar power is not cost-effective. At present, India has installed nearly 100 GW of cumulative grid-interactive renewable energy capacity and a solar power generation potential of nearly 750 GW. Solar power generation has a bright future, and some scientists hope that solar power should be an alternative source of energy by 2040.

Regarding its cost-effectiveness, Some scientists declare that solar power cost has decreased drastically over the years due to extensive research on this topic. The cost of solar cells was around 100 US Dollars per watt in 1980, but at present, the cost is around 1.5 US Dollars per watt. According to scientific prediction, the minimum estimated cost of solar cells would be 0.5 USD per watt in 2035, and the story goes onwards.

Green Building elements

Green building construction follows a few principles of environmental sustainability, which fulfil the preservation of diversity, reuse and recycling materials and reduce waste and use of eco-friendly materials used in buildings (Morelli, 2011). According to a study by Samad (2021), instead of cement and aggregate used in conventional buildings, green building material, which is Rice Husk cement concrete hollow block (CGH Block), meets the various criteria of green building. In the case of the construction of conventional walls, clay bricks are used, but Mirasa and Chong (2020) suggested an interlocking brick system for achieving the goals of green building. Conventionally in roof construction, concrete roof tiles are used, but in green buildings, rice husks are suitable for meeting the requirement of green buildings (Mohammad et al., 2020)

Singh (2006) studied 200 residential buildings in the state of Uttaranchal in India. He indicates that the use of wood was on a large scale in houses and was quite satisfactory. It was also safe and easy for maintenance and preservation as building materials. The use of wood was found to have less energy consumption and less pollution than other conventional building materials.

Advantages of Green Building

There are many advantages of green buildings over conventional buildings. The architectural design of green buildings is much different from conventional buildings, and it is termed passive architecture. It considers all climatic conditions, such as relatively low energy requirements in all seasons. Thus, it

helps minimise extra energy to heat even in winter and cool in summer. Green Building keeps the environment quite comfortable throughout the year. The green building consumes nearly 40-60 % of lesser electricity, benefiting energy-deficient countries like India.

Mainly due to the adaptation of specific passive architecture and less energy requirement, there is low carbon dioxide emission, so pollution is decreased. It saves water requirements using various other fixtures and a rainwater harvesting system.

In the case of green buildings, waste generation is relatively low by taking on waste management which is why the government is encouraging the construction of green buildings.

Classification of green buildings:

Currently, there are many green building rating systems in the world, but two prominent rating systems are enunciated: LEED and GRIHA. The LEED rates building as platinum, gold, silver etc., as per the quality of greenness the building achieves.

However, in India, most construction agencies, including CPWD, follow the GRIHA rating system. The GRIHA is a framework for certifying the design and construction of green buildings. This rating system is suitable for Indian conditions as it is in harmony with the National Building Code 2003 and another Indian standard. The main objective behind adopting this rating system for the greenness of buildings lies in evaluating the environmental performance of a building holistically. Thus, it attempts to promote a definite standard for green building.

GRIHA classify or rates the green buildings as one star, two stars, three stars, four stars and five stars depending upon the points it has earned by fulfilling the criteria of green building.

GRIHA has 100 points distributed across 34 criteria in the GRIHA rating system. GRIHA rating system contains core mandatory criteria and a few optional criteria. A project has to fulfil the entire mandatory criteria to deal with certification. Further, the housing project has to score points based on criteria provided by the rating system. Certification (1 star to 5 stars) is granted based on points earned. Buildings that keep scoring 50 to 60 points get one star, building that scores 61 to 70 points get two stars, building that scores 71 to 80 points get three stars, and building that scores 81 to 90 points will get five stars, respectively. A building scoring 91 to 100 points will get five stars rating.

The followings are the main criteria of the GRIHA rating system.

(a) Site Selection and Site Planning contains nine criteria and 22 points, in which preserving and protecting landscape contain the maximum point (5) in this category.

(b) Building Planning and Construction contain 22 criteria and 76 points in which Optimise energy performance of building within specified comfort limits contains maximum points (12) (c) Building Operation and Maintenance contains two criteria and 2 points in which operation and maintenance contain the maximum point (2) in this category. The total points are 100. Additional 4 points may be provided for innovations. However, it should be counted in the total score. (MNRE, GoI)

Nowadays, the Ministry of New and Renewable Energy (MNRE), Government of India, is placing great importance on providing promotional schemes to encourage the green building program. National Advisory Council and Technical Advisory Committee have been constituted to provide technical advice and direction to the national rating system of India. The MNRE further revised the scheme's requirements to exempt the first one hundred Government or public sector buildings from paying the scheduled registration cum rating fee. Green building rating system motivates stakeholders; today, several countries have their own rating standards for green building. India is also experiencing a boom in green building projects.

Few Conceptualised Models of Green Building:

In order to develop green building concepts, research is done worldwide nowadays. In this regard, some researchers have suggested some conceptual models. Some of them are mentioned below.

Model 1: Performance Indicator Model was proposed by Shi & Xie (2009). A fuzzy QFD approach has been adopted to assess green construction alternatives. This model deals with green constructions, which are essential elements of green building. Tam et al. (2004) proposed the management performance indicator model. They suggested six indicators of green performance in the context of management of operations, including management skills, training in green building concepts, environmental protection programmes, and environmental training.

Model 2: The Path of Achieving Sustainable Development model was propounded by Lombardi (2001). This model aims at enunciating different steps for achieving SD goals. In this regard, he has suggested three main aspects to be considered.

1. Environmental Protection: It should preserve the natural environment and try to prevent adverse environmental effects.
2. Second facet is about social well-being. It emphasises human contentment, safety and, finally degree of comfort to the dwellers.
3. According to this model, economic progress should also be computed to ensure SD goals.

Model 3: This model was forwarded by Ahmad and Andut (2018). Green building stakeholders must be facilitated to invest in green building projects. Accordingly, the stakeholders should be made to fully understand the concepts, benefits, and updated practices of green building construction. In addition, according to this model, moderators will assist and make available help to the construction stakeholders. Moderators must explain the challenges and problems associated with the construction of green building projects. (Ahmad & Andut,2018, Ahmad,2016)

Conclusion:

The concept of green building aims mainly at maximum reduction of non-renewable energy use and encourages sustainable development and use of renewable energy. In fact, energy saved is energy generated.

There is a constant warning by environmentalists and geologists that the alarming rate with which fossil fuels are being consumed, it is feared that all the coal reserves may get emptied shortly, bringing a total collapse of the dazzling modern civilisation.

Transmission loss minimum in the system: - The country suffers several million rupees due to losses in transmission of power from thermal power stations due to long distances cable it has to cover. If the construction of zero-energy buildings is encouraged and complemented, the loss of several million cores will be saved in addition to other advantages. This transmission loss is an unnecessary burden on the exchequer of our country, and thus, loss due to the transmission will be minimised. Green buildings have an amazing effect on environmental pollution. It is already established that Wind, solar, Biomass, and other renewable energy are hundred per cent eco-friendly and tend to preserve the ecosystem's equilibrium.

Moreover, if the ecosystem gets destabilised, the very existence of humankind will be endangered. What does such high-growth industrial and technological advancement mean when the whole creation is on the verge of collapse due to alarming greenhouse gases? Rising environmental pollution is already characterised by frequent natural disasters like Tsunami, Katrina, volcanoes, earthquakes, and epidemics. Due to high pollution, ambient temperature has risen, climatic changes are badly experienced, and overall life seems to be at stake. At this juncture of time, the concept of green buildings and various encouragement given to it by various methods is the most effective way if we want the planet Earth on which we survive to be made safe for us and the coming generations to live and flourish. Water scarcity is also a significant problem that the modern world is experiencing. The concept of green building, which promotes the fabrication of water harvesting systems in all buildings, will help recharge the groundwater sufficiently. From many areas of South Bihar, a significant amount of lowering of the water table is being reported occasionally, especially during the summer, causing great hardship for irrigation and drinking water to the residents. The green building concept will open a golden horizon for generating solutions to the water scarcity problem. Thus, the construction of green buildings will be an excellent advancement for sustainable development.

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