

# Smart and Sustainable Buildings and Infrastructure

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## **Abstract**

*The climate change and reduction of carbon emission has necessitated to go for alternative construction technologies to address these issues and hence the need for the adaptation of green building technologies. The Smart cities project in India and all other major projects in infrastructure, buildings, energy, social and economic infrastructure, industry and habitations, all look for leveraging technology to carbon emission standards and climate change commitments. The SDG-2030 also contribute to comply to resource conservation, provision of basic amenities, quality and wellbeing of human life, waste management, pollution free, sustenance and livelihood, adoption of renewable energy, all lead to smart and green approaches. There is no escape from urbanisation, global warming and climate change, for which India need to be prepared , with proactive and advance action, to counter the adverse impact of climate change and hence its imperative that India has integrated all infrastructure , policies and programmes, development and economy, waste management, and livelihood with green technology and approaches, through citizen awareness, participation and empowerment.*

**Keywords:** Climate Change, Carbon Emission, Green Building Technologies, Smart Cities, SDG-2030.

## **Introduction**

The construction technology has come of age, but face numerous challenges at present compared to its journey over centuries. The construction industry is surmounted by carbon emission, energy intensive, water stress, waste generation, liveability, communication, accessibility and transportation and a host of related issues. The 21<sup>st</sup> century building technology is aspiring to adopt green technology to overcome these problems and aim for smart and sustainable infrastructure. The COP21, 2015, targets emissions from buildings to the extent of 80-90 per cent lower by 2050, than they are today

According to the World Green Building Council (WGBC), green building, has it's own uniqueness, with minimal negative impacts, climate compatible, protect natural resources, and improve quality of life of people. Gartner stipulates green building technology with smart utilities for power, waste and water. Several countries have committed to net zero carbon

operation by 2030 and also making efforts to promote net zero carbon operation in other countries by 2050, through green building technologies.

According to Cook and Das(2007), the Green Building Technology is integrated with all construction activities slowly but steadily, creating *smart environments*. Agarwal et al(2011) observed smart buildings, going beyond traditional, centralized building management systems, optimize input resources. Ye et al.(2010), came out with energy use awareness, due to climate change and Co2 emissions.

The Intergovernmental Panel on Climate Change (IPCC) stress the need for use of alternate construction materials and adaptation to renewable energy like solar, for brining climate neutral structures by 2050. IPCC estimated that about 75 per cent of the building are energy inefficient, and expect to nuetralise the scenario by green building technology measures by 2050. Thus smart green building technology is expected to improve convenience and accessibility, inclusion and quality of life.

## **2. Objectives:**

The broad objectives of the study are primarily as under:

- 1) Smart and sustainable buildings and infrastructure; and
- 2) Green Building Technology;

## **3. Material and Methods:**

The Green Building Technology emphasise on sustainable concrete, which reduces carbon emission through solar tiles, paper insulation, triple glazed windows, waste conversion to wealth, environmental compatibility, optimum use of resources, use of alternative building materials, structure design efficiency, energy efficiency, water efficiency, materials efficiency, and waste and toxic reduction.

Use bamboo in place of steel, as ecofriendly method, efficient technologies, easier maintenance, improved indoor air quality, and water conservation, are some of the critical aspects of the green technologies. Fuirther there are Green Building Codes such as National Building Code(NBC), Bureau of Indian Standards(ISI), Energy Conservation Building Code(ECBC), Bureau of Energy Efficiency(BEE), Environmental Impact Assessment(EIA), the guidelines of Ministry of Environment & Forestry(MoEF), Govt of India, and Indian Green Building Council (IGBC).

The Indian Green Building Council has evolved a Green Building Rating System for the Residential, Commercial, Factory Buildings etc, and also various levels of certification, for best practices, performance, excellence and leadership, with different levels of Certification.

The Green Building System design, maintenance and construction has positive impact on environment and natural resources, use minimal nonrenewable energy, minimal emission of pollution, and use of waste materials, by reusing and recycling them. The net benefit of green building technology provides sustainable Biodiversity and Ecosystems, improve air and Water Quality, Reduce Waste Streams, and Conserve Natural Resources.

The present-day construction of have greater temperature control systems, and require high electricity consumption. The Govt of India's Light House Building Projects (LHPs), widely use innovative green building technologies, both affordable and comfortable, compatible to climatic zones of India, disaster resilient, aims to build enhance thermal comfort in affordable housing, 1000 type designs, with sustainable building materials and construction technologies.

The Sustainable construction technologies used in green construction adopt renewable solar power, biodegradable materials, green insulation, cool roofs, sustainable resource sourcing, low energy house and zero energy building design, low emitting materials, electrochromic smart glass, water efficiency technologies, sustainable indoor environment technologies, self-powered buildings, passive house approach, technologically efficient, rammed earth brick, and prefabrication or modular construction

## **Results and Findings**

The green technology hubs in new Smart Cities , coming up in India, are brining turnaround in construction technologies, with a transformational environment, with economic, social, and with a citizen centeric approach, which are liveable, sustainable, and brings positive environmental impact, with climate complaint. The Indian Smart Cities have seven smart pillars namely governance, City planning and design, Urban utilities, Urban mobility, Shelter, Economic development, and Social development. The Smart City Projects starts with transportation and waste management, with online operation of mobile office, e municipal services, and citizen participation.

Most of ongoing and future government infrastructure and buildings, have an element of green smart building technologies, and these are rapidly being adopted, in airports, railway, roads, waste management, renewable energy projects, academic and research institutes, new Government Housing Programmes, and the like.

Some of the Best Practices integrating alternative building materials, conservation of nature, protection of environment, and architecture and traditional eco systems, from Auroville and Laurie Backer Architecture, could also from a part of sustainable smart green building technology in India, Green Rameswaram Vivekananda Kendra Natural Resources Development Project, Eco Technology of MSSRF, Development Alternatives Green technologies, Sustainable Technologies of IISc Bangalore, are few early adopters of Green Building Technologies in India.

In addition other Research Centres in India promoting green building technology in the country are ITC Green Centre, Gurgaon, Suzlon One Earth, Pune, Patni (i-GATE) Knowledge Center, Noida, Olympia Tech Park, Chennai, CRISIL House, Mumbai.

The CII Indian Green Building Council(IGBC), Bangalore, provides technology guidance to builders, architects, contractors, Institutes, Organisations, Industry etc, for green building technologies.

The Government of India, provides lucrative incentives for the development and environment conservation for a greener India, tax incentives for industry and organisations, advocates use of local and environment friendly construction material in buildings, urges construction sector to work with the governments in promoting green and smart building technology in all constructions, to comply to carbon emission and climate change commitments.

## Conclusion

With climate change, global warming, carbon emission, extreme climatic events, it's imperative that the building technology is green and environmentally friendly, brining a balance between earth's eco system and human livelihood and sustenance. Renewable energy use, waste to wealth through circular economy, reversing greenhouse gas emission activities, adopting to green building technologies.

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