

Chapter 7

Green and Smart Buildings: A Key to Sustainable Global Solutions

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ABSTRACT

Buildings across the world consume a significant amount of energy which is equivalent to one third of total primary energy resources available. This has led to lots of challenges with regard to supplies of energy, energy resources quick depletion, increase in building service demands, improvised comfort lifestyle along with time increase spend in builds; this all has increased the energy consumption. Even the global sustainability is also pushing the implementation of green buildings in the real world. Researchers and scientists have been working on this issue for a very long time, but still the issue is prevalent. The aim of this chapter is to present comprehensive and significant research conducted to date with regard to green buildings. The chapter provides in-depth analysis of design technologies (i.e., passive and active technologies) that lay a strong foundation for green building. The chapter also highlights the smart automation technologies which help in energy conservation along with various performance metrics.

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CONCEPT OF SMART BUILDING

The temperature of the earth is increasing continuously and this effect is known as Global warming, which is caused by the emission of greenhouse gases (Pachauri & Reisinger, 2008). The buildings are also the one of the major provider to worldwide carbon emissions, accounting for about 40% of the world's total carbon footprint (Janda, 2009). Majorly, in developed nations, commercial buildings alone represent close to 20 percent, about half of the total.

Commercial buildings are also costly. After salaries, buildings are one of the biggest operational expenses for organizations. Energy plays a significant part in this. (Michaels, 2019)

A more efficient building portfolio can improve the value of real estate assets, help the bottom line, cut emissions, and bolster the corporate image. So, there is acute need of building that can work intelligently i.e. smartly. A Smart Building minimizes energy and water consumption; minimizes waste and maximizes recycling; provides healthy living conditions and promotes environmental performance.

Smart Buildings are termed as “Digital Extensions” to all sorts of engineering and architectural activities. Smart Building is termed as structure facilitating automated processes to automatically control all sorts of building's operations like: Security, Lightning, Air conditioning, Heating, Ventilation, etc. A Smart building makes use of sensors, actuators, and microchips to manage everything. The utilization of sophisticated hardware facilities improvement in asset reliability, performance and in turn reduces energy utilization. The following points highlight the benefits of smart buildings:

1. **Predictive Maintenance:** Sensors can detect all sorts of technical performance of the building and can automatically activate the maintenance procedures in case of any sort of malfunction.
2. **Energy Saving:** Data sent by the sensors can be carefully analyzed, doing prompt actions for temperature and lighting settings.
3. **Effective Monitoring:** With smart buildings, all the equipment's can be effectively monitored and can be replaced on time, making maintenance highly cheap and effective.
4. **Optimized Site Cleaning:** All sorts of presence sensors can optimize cleaning operations. The data sensed by sensors can alert facility manager to undertake all cleaning operations whenever or wherever required.
5. **Redesigned Space:** Sensors enable easy identification of the overused and underused area of the building and can recommend some adjustments by making use of modern techniques like Artificial Intelligence and Machine Learning.

PROGRESSION FROM INTELLIGENT TO SMART BUILDINGS

Evolving definitions of Smart Buildings have been developed since the 1980s. Various researchers defined Intelligent Building as being:

“A building which totally controls its own environment”. This seems to imply that it is the technical control of heating and air conditioning, lighting, security, fire protection, telecommunication and data services, lifts and other similar building operations that are important – a control typically given to a management computer system. Such a definition for a conventionally Intelligent Building does not suggest user interaction at all.

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