



# International Journal of Innovative Research in Science Engineering and Technology (IJIRSET)

*(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)*



**Impact Factor: 8.699**

**Volume 14, Issue 6, June 2025**

# A Review of Sustainable Development to Reduce Environmental Impact

Nemi Percy, Jeffrey Molavi

Student, Department of Built Environment, University of Maryland Eastern Shore, USA

Professor, Department of Built Environment, University of Maryland, Eastern Shore, USA

**ABSTRACT** The construction industry has recognized the urgent need to adopt sustainable design and constructability to mitigate the environmental impact of building projects. Sustainable design and green building aim to reduce resource consumption, minimize waste generation, and promote energy efficiency. The construction and building environment can play a pivotal role in reducing climate change by embracing and implementing sustainability principles and how to use contemporary technologies in the building sector. This paper addresses the key elements of green building, including energy monitoring, occupant engagement, intelligent building automation, predictive maintenance, renewable energy integration, and data analytics for energy efficiency enhancements, and highlights the benefits of adopting such practices in the building and construction industry.

**KEYWORDS:** Sustainability, Building design, Environmental impacts, emissions, Process.

## I. INTRODUCTION

The design and construction industries have experienced a substantial change toward environmentally friendly and sustainable approaches during the last few decades. This transition is embodied by the notion of green buildings, which aims to minimize environmental effects throughout a building's existence, from feasibility analysis, programming, schematic design, design development, construction documents, procurement, construction, and operation to final decommissioning. We must embrace a holistic approach to sustainability to close the environmental, social, and economic gaps and protect our planet, people, and economies.

In doing so, we should progress towards systemic changes that provide robust solutions to climate change, improve human health and equity, and regenerate the global economy. Therefore, it is necessary to investigate every possibility of reducing buildings' economic, social, and environmental impacts over their life cycle. Green building is one such concept that has been introduced to reduce the ecological burdens of buildings due to the perceived low carbon emissions, energy savings, and maximizing economic benefits

According to the World Commission on Environment and Development, sustainable development is defined as the capacity for development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Oxford University Press, 1987). In 2000, for example, the U.S. Green Building Council (USGBC) in Washington, D.C., launched its rigorous Leadership in Energy and Environmental Design (LEED) rating program. The Council evaluates LEED buildings and classifies awards points as Certified, Silver, Gold, and Platinum, among others, namely the UK's BREEAM (Building Research Establishment's Environmental Assessment Method) and Australia's Green Star. Certification assures prospective buyers and tenants that a building rated LEED is sustainable.

According to William Browning, a senior fellow at Rocky Mountain Institute in Colorado, integrating green principles into a building's planning and design process can generate 40% more savings and 40% better performance than simply adding green technologies to a traditionally planned and designed facility.

## II. LITERATURE SURVEY

Research on how air pollution affects health falls into two perspectives, which elaborate on the impact and outcomes of air pollution on people's health and the cost of defending against air pollution. Air pollution is caused

when harmful substances are released into the atmosphere due to both natural and human-made sources. While the natural sources include dust, pollen, volcanoes, and wildlife, human sources come from vehicle emissions, power plants, factories, and construction sites.

Over time, exposure to air pollution creates more severe health problems such as respiratory diseases, stroke, heart disease, cancer, and particularly lung cancer. Even though it's impossible to avoid polluted air altogether, occupants can take steps to protect themselves from its harmful effects through the following:

- Stayed informed - regularly checking the local air quality index (AQI).
- Reduce outdoor exposure - Limit outdoor activities when air pollution levels are high.
- Avoid polluted areas - Avoid busy roads and highways, especially during rush hours.
- Improve indoor air quality - ventilate the home, use air purifiers, and choose low-emission cleaning products.
- Don't smoke - smoking contributes to air pollution and increases the overall risk of health problems.

### III. METHODOLOGY

Our methodology is based on evaluating the benefits of environmental inputs from a new perspective compared to the traditional building system. The Edge- Deloitte Headquarters in Amsterdam, Netherlands: This innovative building showcases sustainable design features such as energy-efficient systems, bright lighting, and solar panels, making it one of the most sustainable office buildings in the world. At the individual levels, occupant comfort, air quality, and water quality improvement are mainly reflected in reduced healthcare costs. Medical professionals analysed it according to the morbidity of the two central air pollution-related diseases, respiratory and circulatory diseases.

### IV. ISSUES ON ENVIRONMENTAL IMPACT

The life cycle of a building and its performance must be considered to reduce the negative impact on the environment. Materials that are sustainable and free from harmful substances should be used when selecting materials for building projects. Sustainable approaches and practical considerations such as passive solar orientation can boost and improve heating and cooling performance, reduce energy costs, and increase the comfort of the occupants. Research and book data show that sustainable design and green building have everlasting benefits in operational and maintenance costs.

Investors and homeowners often assume that applying green-sensitive design and construction practices will increase the cost of projects. According to Michael Montoya, the author of "Green Building Fundamentals, 2nd edition", there are high-cost benefits associated with sustainable design and green building. Still, investors tend to focus on short-term capital costs because of a lack of quantifiable data on economic benefits and life-cycle cost implications of sustainability. The long-term costs of owning and operating a building should be the focus, even though some building and site systems may have higher initial costs but decreased life-cycle costs. On the contrary, building owners and developers are now realizing the cost benefits, such as

- Savings in capital cost investment.
- Reduction in operation costs.
- Increased investment returns.
- Increased occupants' productivity.
- More efficient resource usage.
- Marketing and revenue generation benefits

#### ii. Social Benefits:

In addition to the economic benefits, higher perceptions of beauty tend to be static and accommodate a fixed object to view. Several investors and occupants consider a sustainable design as visually beautiful, and it can open people up to its other green benefits. Green buildings with a whole appearance and greenery accents like walls or elevations made of plants hanging over the edges provide a fresher, beautiful appeal to the users. These buildings often feature unique architectural elements like green roofs and living walls, enhancing their aesthetic appeal and positively



contributing to the natural environment. Green roofs, for example, aid in managing stormwater and reducing the environmental impact on the building site and surrounding areas.

Another social benefit of incorporating sustainable design and green building is to enhance the occupant's comfort and health. The best way to promote the health and well-being of the users or occupants is to focus on indoor and air quality, thermal comfort, acoustic comfort, and lighting quality. Lack of indoor and acoustic comfort causes various health problems, such as allergies, asthma, headaches, fatigue, and sometimes cognitive impairment. Thermal comfort, which refers to the temperature and humidity of the indoor environment, is the key influencer of the performance of the occupants and the carbon footprint.

According to Montoya, in "Green Building and Fundamentals," Americans spend 90% of their time indoors, making indoor air quality critical to our health, comfort, and performance. Sustainable designers and green builders should incorporate air quality, ventilation standards, and guidelines to improve indoor air quality for building occupants and users. This should include conducting site analysis and building programs to identify sources of pollutants, ventilation needs, and the occupants' or users' expectations. An effective indoor design and program improve the overall quality of life and productivity.

Sustainable design and green building begin with site selection. Still, innovative growth strategies, such as building compactly and putting a mix of uses close together, can reduce the development impacts and enhance a community's health and economy. This can be implemented by using more efficient resources than the traditional (non-renewable resources, which raises the emissions footprint within a region. A project's location is so informed by its social context that a location-efficient site should be close to dense amenities such as shops, restaurants, schools, and primary services that connect the building to the community.

For more information about reducing strain on local infrastructure, the EPA's Tribal Green Building Toolkit (Revise: December 2023) is designed to help Tribal officials, community members, planners, developers, and architects develop and adopt building codes to support green building practices. Without building codes and with existing building codes, you can use this Toolkit as code references on:

- Land Use
- Materials and Resources Conservation
- Human Health: Radon, Mole, and other Hazardous Pollutants
- Energy Efficiency and Renewable Energy
- Water Access, Management, and Sanitation
- Resilience and Adaptability
- Code Implementation and Compliance
- Updating, Adapting, or Adopting Codes or Developing New Codes.

### iii. Environmental Benefits:

With the increasing emphasis on environmental conservation and the urgent need to address climate change, sustainable and green building practices cannot be underestimated in the modern world. Sustainable design and green building focus on conserving natural resources by using durable, recycled, and recovered materials, including reducing waste generated during the construction stages and demolition process. Furthermore, materials such as insulation from natural fibers, energy-efficient windows, and solar panels also reduced building energy consumption, leading to lower costs for the occupants.

By introducing water-efficient and integrating eco-friendly materials, techniques, processes, and practices, occupants can significantly reduce the carbon footprint of buildings and create a more sustainable future. Air quality improvement and management refers to the activities of regulations and codes undertaken to help protect human health and the environment from the harmful effects of air pollution. Introducing sustainable design focusing on air quality reduces the burden on medical insurance funds and patients.

Introducing green spaces into sustainable design helps maintain the local environment's ecological balance and supports the local ecosystems. When native plants and sustainable materials are used in green projects, they tend to minimize disruptions to natural resources and contribute to the overall health of the natural environment. It is essential to avoid introducing invasive species that could threaten the viability of native plants and weaken the local ecosystems by practicing xeriscaping.

According to Michael Montoya's "Green Building Fundamentals, 2nd edition", to mitigate this ecological damage, sites should be designed to:

- Preserve the natural site elements as much as possible.
- Incorporate native plant landscaping.
- Minimize site grading to limit disturbance.
- Minimize the building and landscape (such as the parking lot) areas.
- Provide open spaces that serve as habitat and promote natural biodiversity.

This study evaluated the benefits of environmental inputs from a new perspective compared to the traditional building system. The Edge- Deloitte Headquarters in Amsterdam, Netherlands: This innovative building showcases sustainable design features such as energy-efficient systems, bright lighting, and solar panels, making it one of the most sustainable office buildings in the world. At the individual levels, occupant comfort, air quality, and water quality improvement are mainly reflected in reduced healthcare costs. Medical professionals analysed it according to the morbidity of the two central air pollution-related diseases, respiratory and circulatory diseases.

## V. CONCLUSION

Sustainability and green building practices play a vital role in addressing environmental challenges, social challenges, and long-term cost benefits for construction investors or developers. We can create environmentally viable and socially equitable buildings by implementing design strategies, considering the benefits, and addressing social implications. Innovations in energy-efficient systems, renewable energy generation, and sustainable materials will continue to drive the construction and building industry forward.

## REFERENCES

1. <https://www.radioscientia.com/sustainable-construction-practices-building-a-greener-future/>
2. Celebrating World Green Building:
3. <https://gettingtozeroforum.org/celebrating-world-green-building-week-2021/>
4. Mercado Fernández, J. L. (2015). The Role of Energy Efficiency in the Private Housing Sector - The Case of Santiago de Chile. <https://core.ac.uk/download/236372748.pdf>
5. Restoration Resource Center Unlocking the sustainable potential of land resources: Evaluation systems, strategies, and tools. <https://old.ser-rrc.org/resource/unlocking-the-sustainable-potent/>
6. Various Technologies in Healthcare Waste Management and Disposal" by Wen Si Lee, Hamidi Abdul Aziz et al.. [https://engagedscholarship.csuohio.edu/encee\\_facpub/505/](https://engagedscholarship.csuohio.edu/encee_facpub/505/)
7. What are the health costs of air pollution, and what can we do about it? | NIH MedlinePlus Magazine. <https://magazine.medlineplus.gov/article/what-are-the-health-costs-of-air-pollution-and-what-can-we-do-about-it>
8. As 'ad, S. "Why Renewable Energy Gained Attention and Demand Globally?" Nature Environment and Pollution Technology, vol. 23, no. 1, 2024, pp. <https://doi.org/10.46488/NEPT.2024.v23i01.042>.
9. C. Kibert, "Sustainable Construction: green building design and delivery," Third Edition, 2016.
10. Montoya, Michael. Green Building Fundamentals: A Practical Guide to Understanding and Applying Fundamental Sustainable Construction Practices and the LEED Green Building Rating System. 2nd ed., Prentice Hall, 2011
11. Salem, Dina, et al." Post-Construction Stages Cost Management: Sustainable Design Approach." Alexandria Engineering Journal, vol. 57, no.4, 2018, pp. 3429-3435,
12. Sustainability Considerations of Green Buildings: A Detailed, <https://doi.org/10.1016/j.aej.2018.07.014>.
13. 2017). New Town Hall & Police Station Architectural Services [Tender documents: T38018480]. MENA Report, (), n/a.
14. Overview on Current Advancements and Future Considerations <https://www.mdpi.com/2071-1050/14/21/14393>

15. Bare Metal vs Virtual Machines vs Containers: The Differences. <https://firstfinger.io/bare-metal-vs-virtual-machines-vs-containers/>
16. What are the health costs of air pollution, and what can we do about it? | NIH MedlinePlus Magazine. <https://magazine.medlineplus.gov/article/what-are-the-health-costs-of-air-pollution-and-what-can-we-do-about-it>
17. Development of Hilly and Mountainous areas: A New Dimension Explored and Its Implications - Hill Post. <https://hillpost.in/2010/05/development-of-hilly-and-mountainous-areas-a-new-dimension-explored-and-its-implications/20256/>



INTERNATIONAL  
STANDARD  
SERIAL  
NUMBER  
INDIA



# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 9940 572 462  6381 907 438  [ijirset@gmail.com](mailto:ijirset@gmail.com)



[www.ijirset.com](http://www.ijirset.com)

Scan to save the contact details