

# Green Building: Current Status and Sustainability

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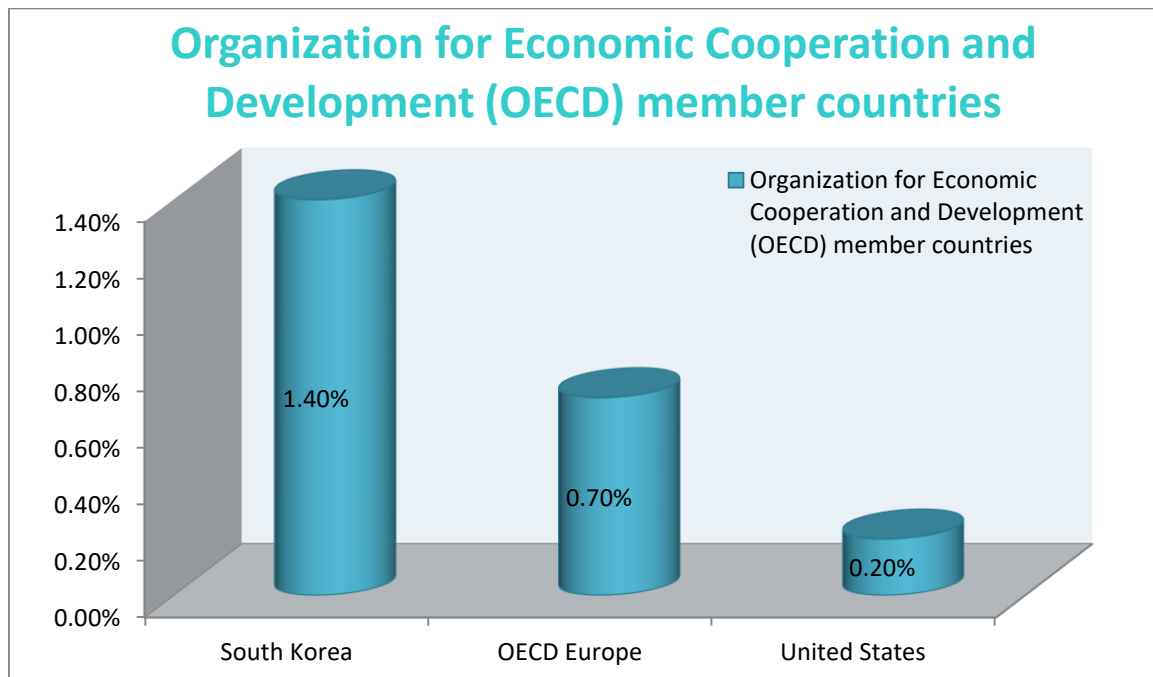
**ABSTRACT:** *Building sector consumes 70% of a nation's electricity as well as a large section of the energy, air, and waste produced in our ecosystem. Buildings have long been considered a largely static industry of an economy, with little variation in facilities or resources use patterns. Green houses, while more eye-catching from an environmental as well as wellbeing perspective, are much more expensive than conventional architecture and might not be defensible from a duty benefit standpoint, according to popular opinion. Buildings which are "green" and "sustainable" utilizes main resources like electricity, water, substances, as well as land more effectually than those which are simply designed to code. Green buildings usually lead to increased employee and student fitness, convenience, and efficiency by providing more natural light and better air quality. This article is a global study of green building, as well as a study of green building in an Asian developed country like India, to illustrate its resilience and problems in developing countries. Similar research could be completed in the future to better understand the state of green buildings in a given country, which could aid businesses in taking appropriate action.*

**KEYWORDS:** *Building, Construction, Energy, Green, Green Building.*

## INTRODUCTION

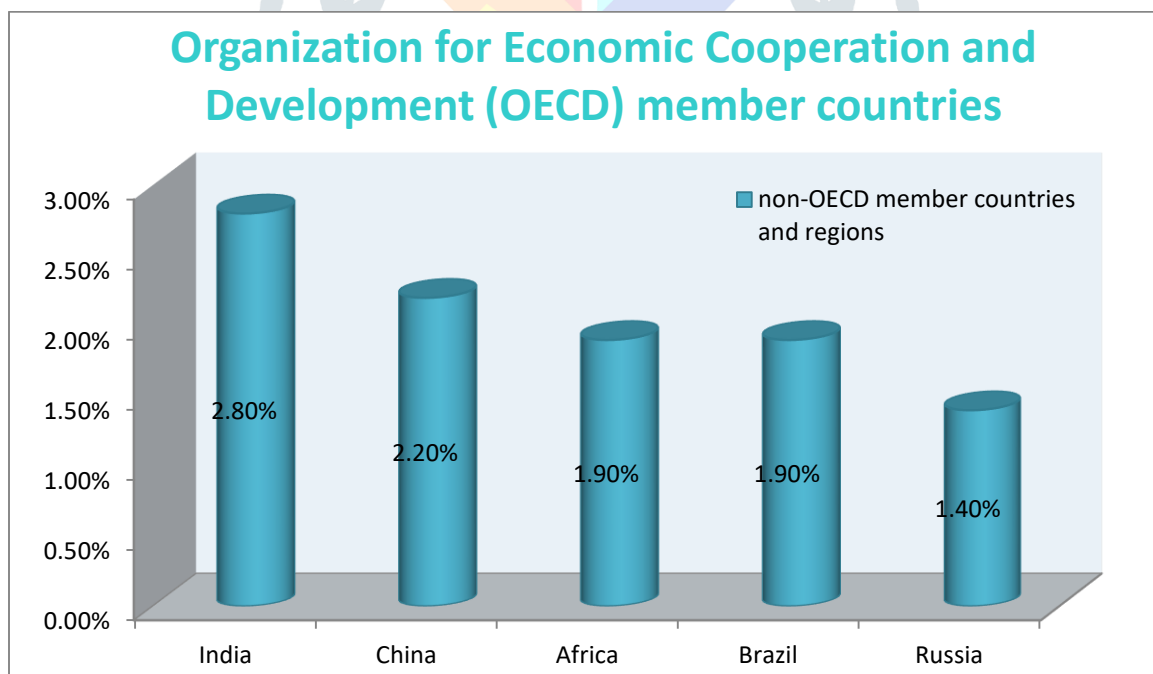
A 'green' structure is one which, through its design, growth, or operation, reduces or eliminates adverse impacts on atmosphere or natural habitat while still providing the ability to generate optimistic ones. Green infrastructures contribute to environmental protection while also enhancing our quality of life. Commonplace Buildings utilizes seventy per cent of the country's electrical energy and a wide portion of our economy's capital, water, or waste. Buildings have long been considered a largely static industry of the ecosystem, with little or no change in infrastructure and resource usage patterns. Green houses, while more eye-catching from an atmosphere and wellbeing perspective, and are much more expensive than the conventional architecture and might not be acceptable from either a cost-benefit perspective, according to popular opinion. Buildings which are "green" as well as "sustainable" use primary resources such as energy, water, ingredients, or land are more efficient than one that is strictly code-compliant. By offering more natural daylight and a better quality of air, green buildings usually result in increased worker and wellbeing of students, luxury, and also productivity.

The Green Building Council of United States, a nationwide non participation body, developed a Leadership Program within the Energy and Environmental Design (LEED) in order to establish a strategy and rating structure for green infrastructure and housings. Buildings are generally recognized as consuming a significant amount of water, wood, oil, and other resources. Buildings in the United States, for example, emit more CO<sub>2</sub> than any other region in the world, with the exception of China. From product conceptualization, construction, operation, maintenance, restoration, and demolition, green buildings are systems and processes that are environmentally sustainable and resource efficient. The contractor, the planners, the developers, and the client must collaborate together during the project. Green architecture goes beyond and beyond the conventional building design considerations of cost, utility, sustainability, and comfort. In the production process, the three facets of sustainability, including the environment, people, and profit, all must be considered. LEED (Leadership in Energy and Environmental Architecture) is a collection of rating systems introduced by the United States Green Building Board of Council for green building design, growth, operation, and maintenance. Two other credential structures that confirm the durability of buildings are the British BREEAM (Building Research Establishment Environmental Assessment Method) for the buildings and the large-scale schemes, also the DGNB System (Deutsche Gesellschaft für Nachhaltiges Bauen), that benchmarks the sustainability progress of buildings, enclosed areas, and regions. According to the International Energy Outlook 2017 (IEO2017) of EIA's, India will have the highest increase in building energy demand over 2040 across all regions of the world (Refer Figure 1 and Figure 2). In the Reference case of IEO2017, India's delivered energy demand for housing and industrial buildings is forecast to rise by 2.7 percent per year on average between 2015 and 2040, more than double the global average.



**Figure 1: Average annual change in buildings energy consumption in OECD nations.**

The World's Green Building Council is acting along the World Bank in order to promote sustainable infrastructure in developing markets across the EDGE (Excellence in Design for Greater Efficiencies) Industry Conversion Program as well as certification, and has currently organized investigation or research regarding the effect of green buildings upon their customers' well-being and productivity. Other tools include Green Building Index (GBI) of Malaysia, Australia's Global Sustainability Assessment System (GSAS), and the Global Sustainability Assessment System (GSAS) of Middle East[1]. BIM is a tool for constructing and handling virtual representations of a location's physical and temporal characteristics.



**Figure 2: Average annual change in buildings energy consumption in non-OECD nations.**

Building information models (BIMs) are documents that can be accessed, exchanged, or connected to assist in the decision-making process for a building or other constructed resources (necessarily and not often in proprietary setups and also consisting proprietary data). Individuals, businesses, and government agencies use current BIM resources to plan, create, construct, and maintain a variety of external infrastructures, for instance water, waste, electricity, coal, telecommunications utilities, highways, ports, bridges, tunnels, and railways. Though latest technologies are gradually being implemented to highlight the ongoing practices while constructing greener

infrastructure, the overarching aim of green infrastructures is to minimize the effect of the urban atmosphere on human wellbeing and the existing ecosystem by a factor of ten:

- Making the best use of electricity, water, and other services
- Enhancing workforce satisfaction and protecting resident health (see safe building)
- Reducing waste, noise, and also environmental degradation

Natural building is a relatable concept, but it is mostly carried out on a smaller scale and emphasizes the use of locally available natural materials. Green architecture and sustainable building are two other related topics. Sustainability is described as approaching the requirements of current generations without jeopardizing future generations' capability to visit their own. While few green building schemes do not fix retrofitting residential properties, others do, particularly through government-sponsored power renovation programs. Green building principles can easily be applied on both refit and new construction projects. In a 2009 survey, the US General Services Department discovered 12 sustainably designed structures that are less expensive to repair and perform better in terms of energy quality. In addition, renters were more fulfilled with the structure of the building as a whole than they were with conventional commercial buildings. There are facilities that are environmentally friendly[2].

### 1. *Green Buildings in India:*

The real estate and construction industry in India is booming, rising at a rate of nine percent in contradiction of the global average of 5.5 percent and contributing an average of 6.5 percent to GDP. Urbanization is accelerating, and by 2050, it is expected that two-thirds of the world's residents will be breathing in these cities. Furthermore, according to a report via United Nations, India is predicted to change into the world's most populous country by 2028, putting enormous pressure upon energy mandate. The Indian Green Building Movement has erupted in Hyderabad after the CII-Sohrabji Godrej Green Supply chain Centre building and was provided the leading and prominent Platinum certified green building sailor by the States by the US Green Building Council outside of the United States [6]. The Indian government and relevant parties are promoting green buildings through a market-driven voluntary deployment mode strategy, which has reduced costs to the extent where a Certified Sustainable Construction can now be built all at the similar value like a regular building.

A plenty has been finished via India in phrases of green homes but loads nonetheless require to be carried out. Authorities is spotting the environmental elements of the development region and is considering several policy projects with by outlining the Nations' wide building Code, Bureau of electricity performance and voluntary inexperienced constructing score structures that include Green Ranking Integrated Habitat evaluation (GRIHA), evolved by means of energy and aid Institute and Ministry of Latest Renewable power, as well as Management in Energy and Environment Design, functioned via the India's Green Building Council (IGBC), affiliation for growth, expansion and studies of sustainable habitats for minor stand-alone structures; the Eco-Housing ranking device advanced for Pune; also the famous person score Programme for homes of the Agency of electricity efficiency[3].

The Green Building Assembly of India rates houses, townships, special industrial zones factories, and ecosystems (IGBC). The governments and private companies own the plurality of India's certified green architecture, and housing demand is poor. The European Commission published an article entitled "Smart Cities & Communities" in 2011, emphasizing the importance of striking a balance among prosperity and ecology, as well as the need for collaboration between environmental protection and digital technology development. India's Prime Minister, Mr. Narendra Damodardas Modi, has also mentioned that the two ideas of "smart cities" as well as of "green economy" must be combined. India has a vast way to go in order of development, with about 60% of the construction yet to be done. It can be summarized as follows, building on previous work:

- It is widely acknowledged that green buildings will lead to long-term sustainability.
- Stakeholders play an active part in the implementation of green building strategies in view of concerns and challenges.

- The government has been described as the most influential stakeholder, with the ability to control other stakeholders' green initiatives.
- An integrated approach to developing a 'policy-mix' for sustainability growth by green building adoption is needed.

## 2. *Issues of Green Building:*

- As people become more conscious of the benefits of sustainable development and as their concerns about the environment develop, green building is becoming more common.
- The growing perception of green building is a result of the global climate change crisis.
- Rapid urbanization is driving up electricity consumption, with 60 percent of the world's inhabitants projected to live in cities by 2030, necessitating the adoption of sustainability strategies.
- Green construction practices provide developers and lawmakers a cost-effective way to minimize development's harmful environmental impacts while also helping to strengthen stakeholder connections such as public image, neighborhood outreach, and education[4].

## 3. *Challenges of Green Buildings*

Green building adoption hurdles in developed countries must be identified with greater urgency. External drivers, company drivers, estate drivers, operation drivers, and personal drivers, as well as external drivers, company drivers, estate drivers, construction drivers, and specific drivers, all have an impact on the decision to go sustainable and its approval level. You should first understand the challenges in order to find a solution. The following are major roadblocks that have been identified: Economic and financial obstacles, political and institutional barriers, behavioral and cultural barriers, knowledge barriers, and ability barriers are all examples of barriers. The lack of credit resources to pay initial costs, the risk of expenditure, a lack of demand request, and a considerably higher price were all cited as major roadblocks to green building development in Malaysia[4]. Financial, governmental, technological, cultural, and market barriers to green building adoption were found in Saudi Arabia. Challenges were classified into three groups by an author:

- Opportunity for builders,
- Inventory intelligence, and
- Procurement.

A lack of awareness, a lack of environmental architecture training and schooling, higher expenses, special supplies, legislation and guidelines, a lack of presentation, a lack of infrastructure, and a lack of competition, as per a few other academics, are all major hurdles in Asia.[5]. The following challenges have been adopted by the study:

- Technological difficulties during the construction period, as well as high renewable appliance proposal and energy-convertible material costs;
- Absence of information and understanding regarding green buildings;
- Absence of incorporated ACCEPTED MANUSCRIPT building guidelines and bye-rules in the green context;
- Absence of integrated ACCEPTED MANUSCRIPT building protocols and bye-rules within the green context.

## 4. *The Benefits of Green Buildings:*

The evidence that sustainable walls have many benefits is increasing all around the globe. They are one of the many critical instruments for fulfilling a host of worldwide goals, like fighting climate change, promoting sustainable and stable societies, and stimulating economic development. Highlighting these profits and promoting a growing data base to prove them is at the sentiment of what we are doing as a complete organization. There are three types of green building benefits: environmental, physical, and social. To show these benefits, we've assembled a list of evidences and figures from a number of third-party outlets[6].



#### 4.1.Environmental:

Sustainable buildings have important benefits to our environment and the planet. Green buildings may help to improve the ecosystem (at the household or community scale) by causing their own energy or enhance biodiversity, as well as reducing or removing adverse effects on the environment by consuming less water, oil, or environmental assets.

##### 4.1.1. At A Global Level:

In contrast to other major emitters, the construction industry has the highest potential to reduce greenhouse gas production significantly. Direct developments in homes, like energy storage, fuel switching, as well as sustainable energy usage, are expected to secure as many as eighty-four gigatons of carbon dioxide by 2050 – UNEP, 2016. The building sector has the potential to secure fifty percent or more energy by 2050, assisting in keeping global weather patterns below two degree celsius – United Nations Environment Program, 2016[6].

##### 4.1.2. At A Building Level:

Green buildings in Australia that won the Green Stars Award have already been originate to emit sixty-two percent less green house gases and fifty-one percent less drinkable water than dwellings designed to meet industry minimal requirements. Green buildings that are certified by the Green Building Council of India secure forty to fifty percent on energy as well as twenty to thirty percent on liquid as compared to traditional housing within India. Green dwellings that have won Green Star award at South Africa were revealed to conserve between thirty and forty percent energy and carbon dioxide each year, as well as between 20 and 30 % water supply, when opposed to the industrial norm. Green constructions that have received the LEED authorization in the United States and other nations were reported to use twenty five percent less energy as well as eleven percent less water as compared to non-green dwellings[7].

#### 4.2.Economic:

Green walls have an amount of strategic or financial profits that benefit a diverse group of people. And also, all included cost reductions on service bills for occupants or families (via energy and aqua efficiency); minimal construction charges and better land values for property developers; amplified vacancy rates or repair costs for property holders; and employment creation after viability of groundbreaking 2013 study of World Green Building Code's.

#### 4.3.Social:

In addition to environmental and economic gains, green building has been shown to have important social consequences. Majority of the benefits are linked to the wellbeing and satisfaction of individuals who serve and live within agriculture is the process.

- Syracuse University Center of Excellence / SUNY Upstate Medical School / Harvard T.H. Chan School of Public Health, 2015. Employees in green, nicely-ventilated workplaces had a one hundred one percent of improvement in cognitive notches.
- As per an American Academy of Sleep Medicine, employees along with the workplaces with windows spend forty-six minutes longer each night on average.
- According to Park and Yoon (2011), improvised indoor air level that is low Carbon Dioxide and contaminant concentrations, and good ventilation rates) will result in efficiency changes of up to 8%.

### 5. The Case of Business for Green Building:

#### 5.1.At Global Level:

European Commission, 2015. Global energy efficient policies could secure an expected €280 to €410 billion while spending energy which is equivalent to about twice the total power demand of the United States).

### 5.2. At a Country Level:

According to The Group of Delphi and the Green Infra, the green housing industry in Canada produced \$23.45 billion GDP and approximately three lakhs of full-time occupations in the year of 2014. Green building were projected to create more than 33E10 million of employments by 2018, referring to the Green Building Council of US and Booz Allen Hamilton.

### 5.3. At a Building Level:

Green structures, whether recent or upgraded, grasp a seven percent rise within asset valuation over traditional buildings, as per the building owners. Our Better Places for People initiative aims to design buildings that are not only environmentally friendly, but which help people live cleaner, happier, and more prosperous lives. The Council of Green Buildings of World and the Green Infra Council of South Africa collaborated on a project to create a structure that will empower complex social and economic challenges to be incorporated into every green building ranking system within the world[5].

Status of Green Building in India With numerous projects, India is slowly but steadily developing an infrastructure to sustain green buildings.

- The Indian Green Building Council was founded via Confederation of Indian Industry (CII) in the year of 2001 with the aim of enabling a "Sustainable Built Environment for All."
- The IGBC currently has 4452 green construction ventures registered for a total footprint of over 4.79 billion square feet. By 2022, the Council has set a lofty goal of facilitating 10 billion square feet of certified green building footprint.
- India has signed the COP21 climate change agreement and intends to cut its greenhouse gas emissions per unit of GDP by 33-35 percent through 2030, as compared to 2005 levels.
- In 2016, India was ranked third in the world for Leading in Environmental Energy Design (LEED) accredited buildings via the US Green Building Council (USGBC).
- In the United States, eight states and city governments have additional FAR (floor-to-area ratio) for green buildings.

India's green building footprint is projected to rise at a pace of 20% y-o-y, resulting in numerous niche opportunities for suppliers of building materials and solutions, backed by environmental legislation and increasing awareness. Green building materials are becoming more common in India, according to the Council of Architecture:

- Insulated Concrete Forms (ICF), Structural Insulated Panels (SIPs), fabricated timber, and even straw bales can all be used to provide a solid and long-lasting building frame.
- Insulation materials include cellulose, cotton, linen, polyurethane, polystyrene, and isocyanurate.
- Roofing materials: steel, slate/stone, plastic and rubber composites
- Natural clay coat; low- to no-volatile organic composite colors, stains and layers; natural fiber carpet made of linen, cotton, bamboo, or cork; and paperless drywall for interior finishing

Furthermore, ways to increase energy efficiency, water management, waste treatment, indoor air quality, and other fields are emerging as major business opportunities. Green buildings are unmistakably here to linger in India, a market with enormous growth opportunities in the coming years.

## DISCUSSION

### 1. How Can We Make Our Buildings Green:

A 'green' structure is the one that, through its design, growth, or operation, reduces or eliminates adverse impacts of our ecosystem and natural habitat while still providing the ability to generate optimistic ones. Green structures contribute to environmental protection while also enhancing the quality of life. These typical structures consume seventy percent of the country's electricity and huge section of the resources, water, as well as waste produced within our economy. Dwellings have historically been thought a widely static segment of the nation, with little modification in construction or capacity use patterns. A structure can be turned green in a number of ways. There are some of them:

## 2. *Taking an Intelligent Approach to Energy:*

- Reducing power usage over the lifecycle cycle of a structure, making new as well as renovated buildings extra comfortable and cost-effective to manage, and assisting property owners in being truly energy intensive.
- Integrating green and low-carbon solutions to meet a building's energy requirements after inbuilt and natural efficiencies have been maximized.

## 3. *Safeguarding Water Resources:*

- Investigating strategies to improve the quality and regulation of drinking and polluted material, as well as enhanced water storage for long-term indoor use and actually lowering water use in homes.
- Considering the impact of structures and their surrounds on storm water and sanitation arrangements, safeguarding that they aren't overworked or unable to perform their functions.

### *Minimizing Waste and Maximizing Reuse:*

- Using smaller, more robust materials and producing less waste, and planning for demolition leftover retrieval and reuse to account for a building's end of life level.
- Promoting reuse and recycling by building occupants.

## 4. *Promoting Health and Well Being:*

- Bringing in fresh air, providing decent indoor air value by ventilation, and eliminating chemicals products which emit hazardous or poisonous discharges.
- Using ordinary light and viewpoints to ensure structure occupants' convenience and appreciation of their environments while also lowering lighting energy consumption.
- Creating both the ears and the eyes. Auditory range and appropriate sound insulation are vital in educational, health, and residential buildings to aid focus, recuperation, and peaceful enjoyment of the space.
- Ensuring that people sense safety with their daily atmosphere by using passive architecture and building maintenance as well as control technologies to create the ideal indoor temperature.

## 5. *Keeping our Environment Green:*

- Identifying that our built landscape should conserve biodiversity, and ensuring that the diversity in wildlife as well as land value are protected or improved, such as through remediating and expanding on degraded land or establishing new green places.
- Investigating how to increase the productivity of our cities by introducing agriculture into them.

## 6. *Creating Resilient and Flexible Structures:*

- Familiarizing with our changing world and providing resistance to disasters such as floods, hurricanes, and fires so that our structures can withstand the elements and keep people and their possessions secure.
- Creating adaptable and dynamic spaces, expecting improvements in the use over a period and eliminating the requirement to demolish, restore, or substantially renovate structures in order to save them from being redundant.

## 7. *Connecting Communities and People:*

- Creating assorted environments that complement and enhance cities, deciding whether a structure will enhance to its sense in terms of optimistic socio - economic effects, and including surrounding people in the design process are all important considerations[7].

- Taking into account transit and duration to destinations when building, minimizing environmental impacts of private transport, and cheering environmentally friendly choices like walking and cycling.
- Investigating the prospective of "intelligent" and "knowledge media" networks to enhance our communication with the globe around us, such as intelligent electricity grids that recognize where and when to move electricity.

#### 8. *Considering all Stages of a Building's Life-Cycle:*

- Attempting to minimize environmental impacts while increasing socio-economic benefits over a life process of a structure that is from proposal, building, process and conservation, to restoration and ultimate demolition).
- Assuring that embodied investment is minimized, such as the power or aqua used for production and move the building's materials, resulting in truly low-impact buildings.
- Any house, whether it's a residence, an apartment, a school, a hospital, a community center, or something else, will be a green building whether it has the features mentioned above[6].
- It's worth noting, though, that not all sustainable buildings are or should be the same. Multiple nations and their statess have different climates, traditions, and practises, as well as different architectural types and ages, as well as different cultural, fiscal, and social urgencies, both of which affect their method of green construction.
- That is why World's Green Building Councils encourages its associate Green Building Councils as well as their member organizations to seek green buildings that are ideally tailored to their respective markets in individual countries and across continents.

### CONCLUSION

In contrast to their industrialized counterparts, the bulk of Asian economies also have a long approach to go in terms of energy conservation policies. Green building practices are widely agreed and strictly applied in Taiwan, Japan, South Korea, Singapore, China, and Hong Kong. Standards are being established in India, but implementation plans need to be strengthened. The research focuses on the green building situation in India. The study has clearly demonstrated how, in the face of a multitude of ecological concerns and threats, a country's government should create a "strategic blend" with other stakeholders in order to pave the way for long-term growth. India will have constructed sixty percent of its basic components by 2030, and in case the foundations of these advanced urban cities are sustainable, India will soon become a global player. In this article, we looked at green building around the world and in a developed Asian country like India to see how sustainable it is and what problems it faces in developing countries. Similar research could be completed in the future to better understand the state of green buildings in a given country, which could aid businesses in taking appropriate action.

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