



# The Effect of Green Buildings Sustainability on Residential Buildings: A Descriptive Study of Gulf Countries

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**ABSTRACT**

The urban landscape primarily consists of residential buildings, making green sustainable buildings an effective strategy for shaping them. This study uses a descriptive methodology to investigate sustainable green buildings in residential structures, focusing on Gulf countries. Recommendations emphasize responsive design, adaptability to local climates, and materials, as well as prioritizing sustainable waste disposal and reuse programs.

**Keywords:**

Sustainability, Green Building, Residential Buildings, Climate Change, Gulf Countries.

**Introduction**

Green Buildings aim to minimize external energy reliance and produce adequate energy for intended use, promoting ecological sustainability. Sustainable buildings focus on people, planet, and profit, while green buildings prioritize environmental sustainability.

The optimisation of energy efficiency is a critical component of green building design, encompassing a range of strategies such as limiting heat transfer, adhering to LEED guidelines, optimising elevator usage, cultivating surfaces, promoting water resource efficiency, implementing wastewater recycling, and facilitating waste recycling.

Sustainable design and green building are gaining prominence in design and construction to reduce environmental degradation and improve urban livability. These buildings prioritize energy efficiency, cost reduction, and a secure environment. Green sustainable building can enhance well-being, reduce legal

liabilities, and increase property value. Green building regulations aim to address climate change by improving harmony between buildings and their surroundings. Sustainable practices can enhance health outcomes and resource efficiency throughout the building's lifespan, including construction, renovation, operation, maintenance, and dismantling. The emergence of zero-energy buildings is attributed to the implementation of sustainable design practises, whereby a collaborative effort among architects is employed to attain energy autonomy. This methodology decreases the utilisation of renewable energy sources and holds significant economic implications. The implementation of zero buildings results in the reduction of non-renewable energy sources, thereby decreasing energy usage in the building sector. In addition, they attend to environmental hazards, conserve the natural surroundings, and safeguard individuals from illnesses and contaminants. The development of zero-energy buildings surpasses the standards set by LEED,

thereby ensuring complete energy self-sufficiency as well as encouraging sustainable development.

The Green Building Standards encompass a set of guidelines that incorporate process-oriented prerequisites to guarantee that every sustainable design and operational opportunities are thoroughly evaluated, and that performance standards are attained in a cost-effective manner.

- 1) The process of selecting a location involves directing the energy production unit towards uninterrupted exposure to the sun's rays and ensuring a flat topography.
- 2) This research investigates the impact of local ownership on design.
- 3) The architectural design of the building favours simpler and less intricate shapes, which facilitates their isolation with greater ease.
- 4) The examination of wind patterns, comprehension of cardinal directions, and strategic orientation of structures towards optimal wind flow are crucial considerations in architectural design.

### Methodology

The objective of this study is to elucidate the operational procedures involved in implementing green sustainable buildings in residential structures, with a particular focus on nations with arid climatic conditions. Additionally, the study seeks to evaluate the anticipated outcomes of adopting the green sustainable building approach in residential buildings and its ecological implications. The researcher intends to employ a descriptive methodology to address the research problem. Assuming that the study population comprises of residential structures situated within the territories of the three nations in the Arabian Gulf.

### Results

An assessment is being conducted on the ecological footprint of a standard detached dwelling, commonly referred to as a villa, in Saudi Arabia. The project has been customised

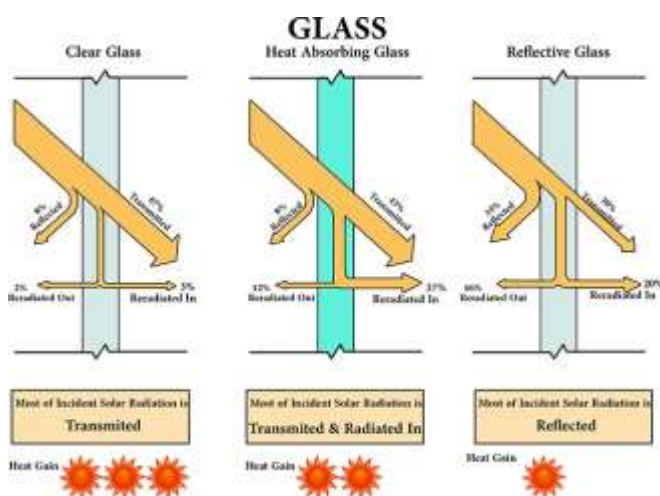
to suit the unique characteristics of the Saudi Arabian context and has been subjected to comparative analysis with other residential edifices across the globe. The residential property comprises a typical, single-family, cemented abode spanning across a total floor space of 387 square metres. The primary building component employed in the construction process is cement, while the framework and base are reinforced with concrete, and insulation is provided by extruded polystyrene. The construction process of the villa encompasses various stages such as soil preparation and excavation, maintenance and replacement, and the ultimate phase of end-of-life.

The FIFA World Cup is a worldwide phenomenon that exhibits the most exceptional football players on a global scale. The nation of Qatar had set its sights on hosting the event in 2009, with a particular emphasis on sustainable development and the implementation of carbon-neutral hosting practises. The Qatar National Goals for 2030 delineates ambitious environmental commitments, while the 2022 FIFA World Cup endeavours to expedite sustainable development and undertakings. The World Cup of FIFA Sustainability Strategy was developed through a collaboration between FIFA and Qatar. This initiative involves a comprehensive evaluation of the environment, identification of strategic priorities, and the formulation of intentions, projects, and strategies. The Sustainability Strategy for the 2022 FIFA World Cup endeavours to advance sustainable development and safeguard the environment in Qatar. The approach centres on the implementation of enduring construction methodologies, reduction of carbon footprint, enhancement of atmospheric purity, mitigation of refuse generation, and preservation of water resources.

The Masdar city in Emirates project aims to reduce the reliance of the city on traditional energy sources such as water and power by utilising solar thermal collectors, rooftop solar panels, and the geothermal resources available within the city. Masdar City is considered a

prime example of environmental conscientiousness due to its unwavering commitment to sustainable construction methods and utilisation of renewable energy sources. The urban center's projected populace of 40,000 individuals can be sustained by its 10 megawatts solar energy array, in conjunction with rooftop solar panels and wind-based equipment. The energy management approach implemented in Masdar City involves the utilisation of natural lighting, insulation, low-power lighting, and intelligent infrastructure.

The traditional communities in the Gulf region were constructed in a manner that aimed to reduce the amount of open space, enhance solar shading, and protect inhabitants from the harsh effects of direct sunlight. The creation of a shaded environment was achieved through the implementation of various techniques, including form-space scale, alley width, open social areas, and covered alleys. Passive cooling techniques encompass various strategies such as shading, glazing, insulation, and green roofing. The provision of optimal shade through the day is facilitated by shaded areas, whereas heat gain and loss are mitigated by glazing systems. Insulation serves the purpose of preserving indoor thermal comfort by reducing heat transfer and limiting heat gain in the summer months. The implementation of green roofing, whether in the form of intensive or extensive systems, has been shown to effectively mitigate heat transfer into residential spaces,



while concurrently facilitating oxygen

production and mitigating the impact of urban heat islands on ambient temperature.

Green buildings can be advantageous for the Arab Gulf nations as they have the potential to curtail energy consumption, pollution, water usage, and waste generation, thereby leading to a reduction in operational costs. The utilisation of sustainable steel building and renewable energy sources is a significant factor in the creation of environmentally conscious and energy-efficient structures. Illustrative instances comprise of the collection of rainwater, employment of smart lighting systems, utilisation of natural ventilation techniques, and deployment of heat pumps. Emerging green trends encompass the establishment of carbon-neutral communities, the promotion of public transportation, the development of car-free towns, and the implementation of self-sufficient urban design.

Saudi Arabia prioritizes environmentally sustainable construction methods to reduce per capita CO2 emissions and electricity usage. The UAE and Saudi Arabia are the top countries in the Gulf Cooperation Council region, with a higher number of green buildings certified. However, Saudi Arabia's green buildings certification is lower than its GCC counterparts. The state of Qatar has set a goal to decrease the amount of emissions generated by buildings and to encourage the adoption of environmentally-friendly building codes that prioritise energy efficiency. Notwithstanding, the edifices persist in discharging pollutants, thereby posing a challenge to the fulfilment of the Nationally Determined Contributions of the Paris Agreement. In order to mitigate pollution levels, Qatar may adopt uncomplicated measures such as the integration of programmed brightness and climate control systems, the installation of solar cells and smart metres, and the utilisation of smart metres to monitor energy consumption. The implementation of these measures is contingent upon the provision of energy subsidies and top-down enforcement. In order to register a tenancy agreement, proprietors of privately rented residences are

required to remit a fee. Additionally, an assessment of the property's energy efficiency rating can be conducted by an authorised Ministerial department prior to registration of the tenancy agreement. It is possible to levy premiums and discounts on properties with lower energy efficiency, whereas fees ought to escalate gradually for properties with higher energy efficiency. In the short term, the implementation of subsidy reforms may prove to be beneficial. Additionally, the utilisation of energy performance certificates can be employed for extant structures and during the process of home sales. The executive branch of the Qatari government possesses the ability to enact legislation or advocate for its implementation, thereby rendering additional regulations obligatory. The adoption of LEED® certified constructions for new buildings may be a favourable option for Qatar, given their established track record, feasibility, and expeditious implementation, thereby facilitating swift improvement of new constructions. In order to guarantee adherence, it is recommended that building regulations be instituted in a mandatory fashion from a hierarchical perspective, while also pledging to uphold the World Green Building Council's Promoting Net Zero initiative.

UAE is a prominent contributor to carbon emissions, necessitating the implementation of sustainable development strategies aimed at mitigating energy consumption and carbon dioxide discharge. The construction sector, which demands significant resources, plays a vital role in the nation's gross domestic product and ecological stability. The Emirates Ecological Group is a distinguished non-governmental organisation in Dubai, dedicated to advancing environmentally sustainable practises and setting benchmarks for environmental excellence. In order to effectively execute eco-friendly construction mandates by 2014, it is imperative for the municipal authorities of Dubai to address pertinent issues, launch a comprehensive promotional initiative, and provide inducements and compensatory measures. The construction industry in UAE is

robust and boasts a highly skilled workforce. However, the primary driving force behind the implementation of green projects is the reduction of energy and water consumption. In order to surmount hindrances, it is recommended that the legislative body furnish administrative advancements, curtail administrative expenditures, and offer uncomplicated credit options. It is recommended that the government provide subsidies for online educational programmes such as Estidama and Masdar, with the aim of stimulating interest among designers and augmenting the market demand for ecologically sustainable projects. It is imperative to address market deficiencies such as inadequate skilled labour and unreliable neighbouring market accessibility for pragmatic advancements.

### **Recommendation and Future Studies**

The author puts forth the subsequent recommendations:

- 1) Expanding the ambit of sustainability endeavours and enabling transformative measures.
- 2) Extensive cooperation and participation.
- 3) provision of funds for scientific research and artistic pursuits.
- 4) The integration of policy and engagement in sustainable practises.

The researcher proposes the following recommendations for future studies:

Consequently, forthcoming quantitative investigations may endeavour to extrapolate these findings to examine them with a more substantial and statistically significant sample. The pursuit of pragmatic strategies to integrate sustainability issues into virtual machine operations without imposing obligations on VM providers or conflicting with clients' other priorities remains a crucial area of investigation. This is because VM has the potential to deliver sustainability benefits, and it is imperative to explore ways to harness this potential.

It is imperative to assess the current level of sustainability knowledge among all stakeholders, encompassing customers and end users, within the GCC countries. The current

state of sustainability consciousness in the GCC region appears to be lacking, as evidenced by the findings of the study and the limited application of sustainable practises. Therefore, it is imperative to examine the underlying reasons for the current state of affairs and the reluctance to adopt sustainable practises, as well as explore potential avenues for improvement. In light of the aforementioned, the act of prioritising sustainability serves as a testament to our unwavering commitment towards safeguarding natural resources for posterity, while simultaneously augmenting the market value of the constructed environment.

### Conclusion

Green buildings prioritise environmental sustainability and aim to minimise their reliance on external sources of energy. They prioritise the well-being of people, the planet, and profitability. The implementation of green buildings has the potential to improve the overall health and satisfaction of occupants, mitigate potential legal risks, and augment the monetary worth of the property. The emergence of zero-energy buildings can be attributed to the implementation of sustainable design principles, which aim to curtail the consumption of renewable energy sources while simultaneously fostering positive health outcomes. The standards for Green Building encompass prerequisites that are process-oriented in nature, aimed at promoting sustainable design and providing opportunities for operational sustainability. The objective of this research is to assess the operational protocols associated with the execution of environmentally sustainable constructions in residential edifices, with a particular emphasis on nations characterised by arid climatic conditions. The research encompasses a villa situated in Saudi Arabia, the Masdar city located in the Emirates, and conventional communities present in Qatar. The implementation of green buildings in Arab Gulf nations can yield benefits such as decreased energy usage, pollution, consumption of water, and waste generation. This can result in lowered operational costs. The

current trends in sustainability encompass the development of carbon-neutral communities, the promotion of public transportation, the establishment of car-free towns, and the implementation of self-sufficient urban design. Qatar has the potential to mitigate pollution through the adoption of uncomplicated measures, including the integration of programmed brightness and climate control systems, installation of solar cells, and utilisation of smart metres for energy consumption monitoring.

### References

1. Alhazmi, H., Alduwais, A. K., Tabbakh, T., Aljamlani, S., Alkahlan, B., & Kurdi, A. (2021). Environmental Performance of Residential Buildings: A Life Cycle Assessment Study in Saudi Arabia. *Sustainability*, 13(6), 3542. <https://doi.org/10.3390/su13063542>
2. Cochrane, L., & Al-Hababi, R. (2023). Sustainable Qatar. *Gulf Studies*. <https://doi.org/10.1007/978-981-19-7398-7>
3. Sanguinetti, A., Meier, A., Dessouky, N., & Outcault, S. (2019). Developer-driven sustainable communities: lessons from a case study of The Sustainable City in Dubai. *Environment*.
4. Global Alliance for Buildings and Construction Report, (2019).
5. Sankaran, Venkatanarayanan & Chopra, Dr. Ashok. (2020). Creating Global Sustainable Smart Cities (A Case Study of Masdar City). *Journal of Physics: Conference Series*. 1706. 012141. 10.1088/1742-6596/1706/1/012141.