



Charting a Resilient Future: Climate Change as a Catalyst for Sustainable National Development
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EXPLORING PASSIVE COOLING STRATEGIES FOR MITIGATING CLIMATE CHANGE EFFECTS

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Abstract

The rise in global temperatures caused by climate change has intensified the need for sustainable cooling measures in building design. Although conventional air conditioning systems are effective, they account for high energy consumption and greenhouse gas emissions. Passive cooling methods, on the other hand, such as shading, natural ventilation, thermal mass, and evaporative cooling, offer a more sustainable approach by minimizing the use of mechanical cooling systems. The efficiency of passive cooling methods in preventing the effects of climate change on built environments is the focus of this study. The study explores various passive cooling methods in different climates, emphasizing their role in improving thermal comfort, energy efficiency, and sustainability. Through literature review and case studies, it examines real-world applications of passive cooling, featuring examples like the Eastgate Centre in Zimbabwe and the Dominican Chapel in Nigeria. These case studies demonstrate the effectiveness of passive cooling in mitigating urban heat stress and lowering energy consumption. The results of the research indicate that passive cooling strategies can reduce indoor temperatures by up to 15°C, while reducing the cooling energy demand by approximately 30% simultaneously. Various barriers to the widespread adoption of the strategies exist, however, including a lack of policy support, low levels of awareness, and high upfront costs. The research recommends integrating passive cooling design principles into building regulations, incentivizing their adoption, and facilitating education on climate-responsive design. Through the application of passive cooling principles, urban planners and architects can build climate resilience, promote energy security, and achieve sustainable urban growth. Passive cooling measures offer an effective means to reducing energy consumption and mitigating the impacts of climate change within built spaces. Empirical experience proves their effectiveness in enhancing energy performance and thermal comfort; however, challenges such as regulatory lags and substantial upfront costs are hindering mainstream adoption. Adoption of passive cooling methods into building codes and city planning is a necessary step for promoting sustainable design that is immune to climate risk.

Keywords. Bioclimatic design, Climate change mitigation, Energy efficiency, Passive cooling, Sustainable architecture