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## Techno-Economic and Environmental Analysis of Carbon Capture in Constructed Buildings Using Natural Means: Alignment with Omani Vision 2040 and the SDGs

Khadija Al Balushi

German University of Technology in Oman (GUtech), PO Box 1816, 130 Muscat, Oman  
khadija.albalushi@gutech.edu.om

### Abstract

This study presents a techno-economic and environmental analysis of carbon capture in constructed buildings using natural means, focusing on its alignment with Oman Vision 2040 and the Sustainable Development Goals (SDGs). Using OpenLCA data analysis, a comparison was conducted between conventional and green buildings. The research identified the net cost and added value of both conventional and green buildings. The economic analysis revealed that while the initial investment in green building technologies and materials may be higher, the long-term benefits, such as reduced energy consumption and operational costs, contribute to cost savings over the building's lifespan. Additionally, the added value of green buildings, including improved indoor air quality, enhanced occupant comfort, and positive environmental impact, further strengthens their economic viability. The results showed that the conventional building emitted approximately  $4.9 \times 10^{11}$  kg of CO<sub>2</sub>, while the green building released only 3236 kg of CO<sub>2</sub>. This significant difference highlights the environmental benefits of implementing sustainable practices in construction. Aligned with Oman Vision 2040 and the SDGs, the findings underscore the importance of incorporating sustainable practices in the construction industry. By reducing carbon emissions and promoting energy-efficient design, the construction sector can contribute significantly to the country's environmental goals and create a more sustainable future. The results of this research highlight the potential for adopting carbon capture technologies in the construction industry, not only in Oman but also in other regions facing similar sustainability challenges. Future studies can build upon these findings by exploring additional aspects of sustainable construction and evaluating the long-term environmental and economic benefits in more detail.

**Keywords:** Carbon Capture, Constructed Buildings, Conventional Buildings, Environmental Analysis, Green Buildings, Life Cycle Cost Assessment, Natural Means, Oman Vision 2040, Sustainable Development Goals (SDGs)

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