Evaluating Whole Life Cycle Carbon Impacts of Affordable Net-Zero Energy Housing in South Africa

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SUMMARY

This study explored the energy and environmental sustainability impact associated with affordable net-zero energy housing (ANZEH) in South Africa. The research sought to provide insights into the challenges, opportunities, and implications of integrating net-zero energy housing into the affordable housing sector. South Africa has a combination of insufficient affordable housing stock, unstable electricity supply, and economic challenges, creating an opportunity for alternative building strategies to alleviate these challenges. The research employed an exploratory mixed-method approach rooted in the philosophical foundations of realism. Qualitative data was procured through 4 in-depth semi-structured interviews conducted with 3 sustainability professionals and 1 affordable housing specialist. Quantitative modelling utilised One Click LCA and the Edge App to estimate the life cycle carbon emissions of an affordable net-zero energy house. The findings showed that by integrating conventional building practices with innovative methods, the Whole Life Cycle Carbon Emissions (WLCCEs) of a house can be significantly reduced, exceeding sustainable building regulation requirements. The results demonstrated a potential 94% reduction in WLCCE, with 100% operational carbon emission savings and a 32% increase in embodied carbon emissions primarily driven by the use of photovoltaic panels. However, the operational carbon emission savings far exceed the embodied carbon emission gains. Furthermore, South Africa's landscape may not be conducive to net-zero embodied energy houses, suggesting that developers and households should prioritize reducing operational carbon emissions. These findings contribute to the fields of affordable and sustainable housing, aiding to facilitate informed decision-making towards a more sustainable and affordable South African residential sector.
