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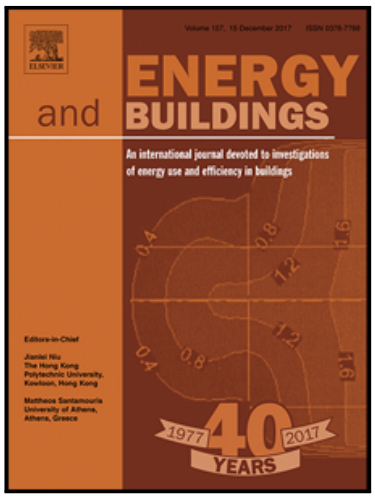

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ACCEPTED MANUSCRIPT

Life Cycle Assessment of Magnesium Oxide Structural Insulated Panels for a Smart Home in Vancouver

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Abstract

Two major trends are changing the face of the construction industry. Sustainability concerns are driving innovations to improve building's energy efficiency while advances in prefabrication are improving buildings' speed, cost, and quality. As new materials and techniques emerge, their overall environmental impact must be evaluated using techniques such as life cycle assessment (LCA). This paper reports a life cycle assessment (LCA) of an innovative magnesium oxide structural insulated panel (MgO SIP) used for a high-performance smart home in Vancouver. The LCA compares the environmental impacts across six indicators for the MgO SIPs, traditional SIPs, and traditional stick-frame construction across the life cycle phases of raw material extraction, manufacturing, transportation, construction, and operation. The results show that the MgO SIPs do not outperform conventional alternatives notably due to the long-distance transportation of materials. However, further LCA of hypothetical scenarios demonstrates that MgO SIPs have a great potential to become more environmentally friendly than the conventional alternatives by sourcing MgO domestically, implementing local or onsite manufacturing, and designing the MgO SIPs without oriented strand board. Although the results are context-dependent, the investigation of hypothetical scenarios offer insight to improve the environmental performance of this innovative product.

Keywords: life cycle assessment; LCA; low energy house; smart home; structural insulated panel; SIP; Magnesium Oxide; MgO; stick-frame

1. Introduction

Society's increasing concern for sustainability creates a demand for improved energy performance of homes, resulting in concepts such as low energy houses, zero energy houses and passive houses. Meanwhile, the building sector is realized its environmental impacts. One of the prevailing environmental analysis techniques is Life cycle Assessment (LCA), which is an attempt to measure potential impacts of building products and components [1]. The ISO 14040 standard states that LCA addresses the potential environmental impacts of products and services, both embodied and consumed, from extraction to final disposal [2] and it can help decision-

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