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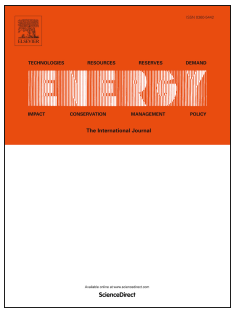

Environmental impact assessment of building envelope components for low-rise buildings

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ENVIRONMENTAL IMPACT ASSESSMENT OF BUILDING ENVELOPE COMPONENTS FOR LOW-RISE BUILDINGS

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Abstract

The selection of building envelope components has a high impact on all the lifecycle phases of a building, from the environmental and energy perspectives, and plays a significant role in the design of sustainable buildings. This paper presents an environmental impact comparison of four different building structural systems widely used in the construction of energy efficient houses in Central Europe: reinforced concrete, brick, cross-laminated timber, and timber-frame panel construction. The basic properties of wall and roof components were determined according to the thermal transmittance equivalent, where their environmental performance using a lifecycle approach was assessed. The study reveals the environmental impacts of individual structural systems and alternative thermal insulation materials, as well as their impact share on environmental performance of building envelopes.

Based on the comparison of selected components, this study demonstrates that there is a significant potential for improving the environmental potential of low-rise buildings, by selecting suitable components and materials, sustaining the energy performance of the building. The comparison of envelope components draws attention to the critical materials, representing guidelines for the optimization of environmental impacts of building envelope components for sustainable low-rise buildings, especially considering the design phase.

Keywords: building envelope components, environmental impact, global warming potential, acidification potential, primary energy

NOMENCLATURE

Acronyms

GHG	greenhouse gas
GWP	global warming potential
LCA	life cycle assessment
RC	reinforced concrete
B	brick
B30	30cm brick
B38	38cm brick
CLT	cross-laminated timber
TF	timber-frame panel
EPS	expanded polystyrene insulation
XPS	extruded polystyrene insulation
RW	rock wool insulation
WF	wood fibre insulation
ETICS	external thermal insulation composite system
PENRT	primary energy content of all non-renewable resources