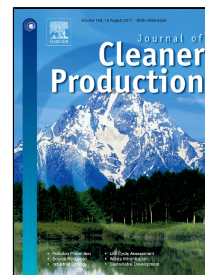


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The impact of renovation measures on building environmental performance: an emergy approach

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Abstract

Approximately 30-40% of the total natural resources that are used in industrialized countries are exploited by the building sector, and almost 40% of the world's consumption of materials converts into the built environment. Thus, improving the environmental performance of building sector could be crucial for reaching the sustainability of urban environment.

The main scope of this paper is to highlight the interest of building renovation as an adequate measure for improving building environmental performance in term of emergy and identify processes that cause significant environmental stress on a local ecosystem. To enable the comparison of all phases and processes for the studied system, an emergy evaluation was performed. A multi-apartment building located in the city of Šabac, Serbia, was used as case study. Several building renovation scenarios were considered, which include different measures for building envelope thermal performance improvements, as well as installation of local renewable energy heat production system. Different renovation timelines were also compared.

The overall results showed that 68% of the emergy flow is caused during the building operation phase, 24% during the construction phase and only 8% during the end-of-life phase. All renovation measures proved to be beneficial from the environmental point of view, and the use of additional materials and resources to conduct renovation measures considered did not have a negative impact on the building overall environmental performance. The effect of conducting renovation measures after the first decade of building lifetime improved the overall building environmental performance by almost 50% when compared to the same renovation measures conducted in the last decade of the lifetime (for all measures considered). Finally, based on the emergy indices analysis, it can be concluded that the application of building renovation measures improves the overall building environmental performance, enables higher efficiency in indigenous resource use, and lowers the pressure on a local ecosystem.

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