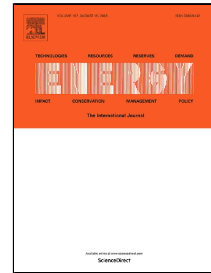


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Thermal Performance and Embodied Energy of Standard and Retrofitted Wall Systems Encountered in Southern Europe

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Abstract:

This paper presents a comparative study on the thermal performance and embodied energy of traditional and contemporary walling systems. Three types of building elements were examined: vernacular adobe load-bearing walls, and contemporary thermally insulated infill walls composed of either fired clay bricks or drywall panels. Their behaviour under thermal loads was investigated by means of heat flux analysis using 3D Finite Element (FE) models. The embodied energy was estimated using data from literature. In addition, alternative refurbishment solutions for improving the thermal performance of each system were examined. According to the outcomes obtained, contemporary masonry systems have lower thermal transmittance compared to traditional constructions. However, adobe walls are capable of providing thermal comfort by efficiently controlling temperature fluctuations, mainly due to their higher thermal mass. The results also highlight the low embodied energy of traditional earthen structures; this is attributed to the simple production and construction processes adopted, as well as to the exclusive use of local raw materials. Most of the refurbishment solutions hereby considered result to significant upgrade the systems' original thermal performance.

Keywords: *exterior wall systems, energy retrofitting measures, heat flux analysis, time lag, embodied energy, decrement factor*

Highlights:

- Comparative study of the thermal performance of external wall systems
- Efficiency of different practicing thermal upgrading solutions examined
- Brickwork and drywall systems have lower thermal performance compared to adobe wall
- Traditional adobe wall has substantially lower embodied energy and higher time lag
- Retrofitting solutions can upgrade the thermal performance of existing wall systems

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