

## **Holistic Approach to Assess the Potential of Using Traditional and Advance Insulation Materials for Energy Retrofit of Office Buildings**

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**Abstract :** Improving the energy performance of existing buildings can be challenging, particularly when facades cannot be modified, and the only available option is internal insulation. In such cases, the choice of the most suitable material becomes increasingly complex, as in addition to thermal transmittance and capital cost, the designer needs to account for the impact of the intervention on the internal spaces, and in particular the loss of usable space due to the additional layers of materials installed. This paper explores this issue by analysing a case study of an average office building needing to go through a refurbishment in order to reach the limits imposed by current regulations to achieve energy efficiency in buildings. The building is simulated through dynamic performance simulation under three different climate conditions in order to evaluate its energy needs. The use of Vacuum Insulated Panels as an option for energy refurbishment is compared to traditional insulation materials (XPS, Mineral Wool). For each scenario, energy consumptions are calculated and, in combination with their expected capital costs, used to perform a financial feasibility analysis. A holistic approach is proposed, taking into account the impact of the intervention on internal space by quantifying the value of the lost usable space and used in the financial feasibility analysis. The proposed approach highlights how taking into account different drivers will lead to the choice of different insulation materials, showing how accounting for the economic value of space can make VIPs an attractive solution for energy retrofitting under various climate conditions.

**Keywords :** vacuum insulated panels, building performance simulation, payback period, building energy retrofit

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