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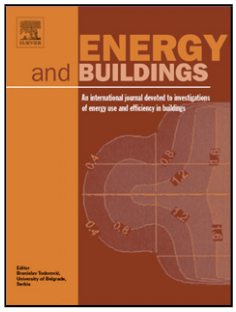


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# Optimization of roof solar reflectance under different climate conditions, occupancy, building configuration and energy systems

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## Highlights

- Office/residential building cool roof effect in Italian climate zones is optimized
- New procedure for cool roof design with varying key boundary conditions is proposed
- Optimum cool roof is mainly sensitive to climate, compared to use, insulation, HVAC
- Cool roof always minimizes annual HVAC energy need in cooling dominated climates
- In heating dominated climates more variables affect optimum roof solar reflectance

## Abstract

Cool roofs have been widely proved to represent an effective strategy for building thermal-energy performance improvement during the cooling season. However, their effectiveness along the whole year can be affected by building features and other boundary conditions. The present work aims at assessing the energy performance of high solar reflectance roof solutions in different climate zones, when implemented in a variety of building typologies. Therefore, an optimization study was carried out to select the optimum roof solar reflectance able to minimize building annual HVAC energy consumption. In this work, Italian climate zones were considered as case study conditions. The analysis was performed through dynamic simulation of validated standard ASHRAE building reference models. Moreover, the role of (i) type of HVAC system operating, (ii) presence and intensity of internal gains, and (iii) roof thermal insulation level was evaluated on the resulting optimum roof reflectance capability. Results show that the optimum roof solar reflectance varies under different climate conditions, mainly depending on heating or cooling dominated conditions.

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