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Green Roofs Energy Performance in Mediterranean Climate

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ABSTRACT

This paper quantifies green roofs energy savings which is a challenging topic, namely in Mediterranean climate with distinct heating and cooling seasons. The thermal behavior of a green roof case study in Lisbon, Portugal, was assessed through an experimental campaign during heating and cooling periods of the year of 2013. These experimental results were then used to calibrate a building energy simulation in EnergyPlus. After validation, the numerical model was used to compare the energy performance of intensive, semi-intensive and extensive green roofs. The three green roof types lead to similar heating energy needs but extensive green roof solution shows higher cooling energy needs than semi-intensive and intensive ones, of 2.8 and 5.9 times more, respectively. Furthermore, the performance of each type of green roof and different insulation properties was compared to traditional roof solutions. With no thermal insulation, extensive green roofs require 20% less energy use than black roofs and show a similar annual behavior than white roofs. Semi-intensive and intensive green roofs energy use is 60-70% and 45-60% lower than black and white roofs, respectively. Well insulated roofs do not take full advantage of evapotranspiration cooling effects, which is particularly noticeable when comparing with high reflective white roofs.

Keywords: green roofs, heating and cooling energy performance, experimental campaign, building energy simulations, EnergyPlus, Mediterranean climate.

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