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A comprehensive study on green roof performance for retrofitting existing buildings

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1 **A COMPREHENSIVE STUDY ON GREEN ROOF PERFORMANCE FOR RETROFITTING**
2 **EXISTING BUILDINGS**

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11 **Abstract**

12 Green roofs present a viable solution for increasing rainwater retention while improving the energy
13 performance of both new and existing buildings. Considering the widespread occurrence of
14 existing buildings, it is worthwhile to conduct an in-depth analysis of green roof feasibility for
15 retrofitting these buildings. In such cases, the first constraint is related to structural compatibility.
16 Therefore, the use of lightweight systems should be prioritized to minimize overloading of the
17 existing roof. Another possible constraint concerns the viability of green roofs. The main
18 advantages of green roofs are their energy savings and environmental benefits. In this study,
19 different green roof solutions were evaluated and their performance was compared against the
20 findings of previous studies. The analysis was carried out in the Mediterranean city of Catania, and
21 the results show that only green roof solutions with a load limit of 1.46 kN/m² are suitable for
22 retrofitting existing buildings. As regards the energy savings, energy consumption for cooling was
23 reduced by 31 to 35%, and during winter, energy consumption for heating decreased by 2 to 10%.
24 The environmental benefits were quantified during summer and compared to those of non-
25 vegetated roofs. The results show removals of 1.35 kg·m⁻²·y⁻¹ of CO₂ and 0.03 kg·m⁻²·y⁻¹ of NO₂.
26 Finally, the economic analysis indicates that the discounted payback time of the investment varies
27 from 13 to 18 years depending on the substrates and vegetation used on the green roof.

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