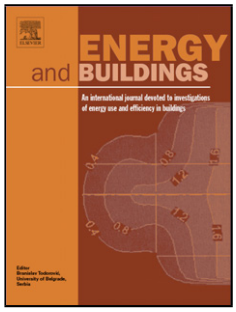

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Title:
Case study investigation of the building physical properties of seven different green roof systems

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Abstract:
Green roofs help to regulate the urban climate not only by evapotranspiration but also because of their insulating effects leading to reduced energy demand in summer and winter. Microclimate models as ENVI-met allow to calculate effects of green roofs and their contribution to climate change adaptation. Most models are based on generalized assumptions concerning evapotranspiration, albedo, heat flux and u-value of green roofs. Building physics software as ArchiPHYSIK lacks of available data concerning green roofs. This paper provides a detailed description of seven different green roof systems (differing in thicknesses, materials and construction layers) and their insulating performance over a period of 15 months. This shall allow researchers to choose more specific data for their work and improve the accuracy of green roof simulations and energy efficiency calculations.
The results show clearly, that green roofs, as "living dynamic systems" respond differently on climatic framework conditions. The calculated u-values range from 0.944 W/m^2.K – measured for a 12 cm thick one layer green roof – to 0.299 W/m^2.K of a 30 cm thick two layer green roof. The tested green roofs have been selected to be able to analyze the influence of different materials, construction types and thicknesses on insulation performance. Apart from construction thickness, water capacity of growing layer and drainage material, their pore volume and the application of drainage boards have been identified as relevant factors.

Keywords:
Building greenery
Green roofs
Building physics
Heat flux
U-value

1) Introduction

The European Union defined the energy efficiency of buildings as strategic target and released a directive on the energy performance of buildings in 2010 [27], knowing that the energy consumption of buildings correlates with global warming and is linked to the so called heat island effect as shown by Santamouris (2014) [1]. Especially the energy demand for cooling will increase, even in moderate areas like Austria [2]. From 2020 onwords near zero energy buildings are demanded for all new buildings within the EU. This draws the attention to every component of buildings connencted to their energy demand, also green roofs.
The Green Infrastructure Strategy, published by the European Commission in 2013 [22] promotes plants as a relevant measure to adapt cities to climate change, also meaning that green roofs help to reduce urban heat island effects (and risks of flooding [3]) – especially suitable on flat building surfaces [4, 5]. Additionally, green roofs derive multiple positive