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Title: A novel vertical greenery module system for building envelopes: The results and outcomes of a multidisciplinary research project

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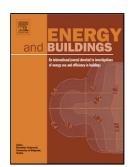
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ACCEPTED MANUSCRIPT

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Highlights

- A novel VGMS made up of recycled/natural and highly performing materials from the energy/environmental point of view, has been designed, prototyped and in lab/in field monitored through a multidisciplinary approach
- The technological issues, biometric parameters, and the acoustic, thermal and mechanical aspects were complimentarily investigated.
- - Thermal performance analyses showed interesting effect both during heating and cooling seasons
- An acoustic analysis demonstrated that the system acts well as a sound insulation system, and its high sound absorption could be exploited to reduce the urban canyoning effect

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abstract (max 200 words)

Vegetation in architecture can be considered a proper design strategy that is aimed at improving not only the performances of buildings, but also the outdoor climate. Different technological solutions have been proposed over the years to cover buildings with vegetation, i.e. green roofs, green walls and green balconies. A particular typology of green wall, which has recently been gaining high consensus among designers, is the vertical greenery modular system (VGMS). The positive impact of this type of technology on the performance of buildings is related to several factors, such as the façade orientation, the use of the building, climatic conditions, the type of plants, the substrates and wall assemblies, as well as mechanical and technological issues. A multidisciplinary approach is therefore needed, and different skills have to be joined together right from the early design phase in order to optimize and balance all the aspects that are involved. In this framework, a research project has been carried out in Turin (North West Italy), with the aim of developing a novel VGMS, constituted by a modular box covered with vegetation, made up of recycled/natural and highly performing materials from the energy/environmental point of view. After the design phase, the actual performance of the VGMS was assessed, through laboratory and long-term in field monitoring, and at the same time, the technological issues, biometric parameters, and the acoustic, thermal and mechanical aspects were investigated.

1- Introduction

Urban greening provides ecosystem services, and the role of green areas for the well-being of citizens is acknowledged throughout the world [1]. The positive effects of urban vegetation are also important at the built environment microclimatic performance level, due to climate change and pedestrian thermal comfort reasons [2]. The urban environment is characterized by particular conditions, in terms of light, water and nutrient supply, as well as particular temperature and pollution regimes. These aspects can represent a drawback for the development of plants and trees, especially if the purpose is to create urban greening with high aesthetic performances. Nevertheless, green roofs and green walls are the best examples of the extreme relationship between nature and technology in urban greening [3].

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