

DYNAMIC SIMULATIONS OF THERMAL BEHAVIOR OF CONVENTIONAL AND GREEN ROOFS

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Abstract: Green roofs are used to cover buildings with a layer of vegetation above the watertight layer of the roof structure. This paper analyzes the application of green roofs at an office building in the city of Belgrade in order to reduce the energy for heating the building when compared with the conventional thermal insulated roof type. The application of two basic types of green roofs, extensive and semi-intensive, with different thicknesses of thermal roof insulation was analyzed. The thermal behavior of the object was realized using dynamic simulations through the DesignBuilder - energy modeling program. The results of the research show the positive effects of the green roofs when compared to the conventional roof from the aspect of heating energy savings. The obtained results show that it is necessary to increase the application of green roofs in the future because they have a positive impact on increasing the energy efficiency of the building as well as improving the microclimate in the cities.

Key words: green roof, dynamic simulations, energy modeling, energy savings

1. INTRODUCTION

The human population and worldwide economy is growing continuously. By changing the Technology can assist to extend the planet's resources more, and make the global sustainable. Sustainability is a well-designed connection, which included and adapted ecology and technology. In a sustainable world, there is a balance between the public's need on nature and nature's capability to meet that need [1].

A modern green roof, or a living roof, is roof that is partially or completely covered with vegetation and a growing medium. Green roofs can provide public benefits for the city, community, and private benefits for the building owner. Some public benefits include [2]:

- Improved Storm Water Management – The plants and soil can retain storm water. In urban areas, this assists in decreasing combined sewer overflows,
- Reduced “urban heat island” effect – A green roof reduces the level of absorbed heat in dense concrete areas,
- Extended life of the roof – Protects the roof from weather, reducing maintenance costs,
- Reduced heating and cooling costs – Provides extra roof insulation. And reduction in the building's overall heating and cooling costs,
- Aesthetics – Makes the building attractive from aerial view, and provides building users a green space,
- Improved air quality – Plants can absorb carbon dioxide and other pollutants.
- Space for local food production.

Rooftop greening is a valuable strategy in order to make buildings more sustainable.

Green roofs types are generally identified as: extensive, semi-intensive and intensive [3]. A basic parameters and differences between mentioned types of roofs are given in Table 1 [4].

Table 1: Basic characteristics of green roofs

	Extensive	Semi-intensive	Intensive
Plant options	Sedum, moss, grass	Sedum, moss, grass, flowers, shrubs	Sedum, moss, grass, flowers, shrubs, trees
Soil Depth (cm)	5÷13	13÷20	>20
Maintenance	Minimal	Occasional / Routine	Routine
First Cost	Low	Medium	High

This paper investigates the benefits of the building energy consumption required for heating by comparing semi-intensive type of green roofs, and conventional roofs with different thicknesses. Semi-intensive green roofs require a bit more maintenance since the plants tend to need pruning, irrigation, and fertilization. However, maintenance requirements are generally no more than would be expected for sidewalk planters [4].

