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## **INFLUENCE OF DIFFERENT THERMAL INSULATION THICKNES ON BUILDING ENERGY CONSUMPTION**

**Abstract:** Today, one of the major research tasks is to improve building energy balance and to reduce building energy consumption. In this paper, the possibilities to decrease energy consumption of Serbian residential buildings are analyzed, through the variation of thermal insulation thickness. It is investigated the building with PV panels on the roof which generates the electricity for building needs. As the most unfavorable case due to energy consumption, the building with electrical space heating is investigated. The major aim was to determine the optimal values of thermal insulation thickness and the area of the PV array, in order to achieve the zero-net energy building (ZNEB). The buildings are simulated in EnergyPlus environment. Open Studio plug-in in Google SketchUp was used for buildings design, Hooke-Jeeves algorithm for optimization and GENOPT software for software execution control.

**Keywords:** Building; Thermal insulation thickness, PV panels, Energy consumption, Optimization;

## **1. INTRODUCTION**

In Serbia, the building sector consumes more than 50% of the consumed energy. Around 24% of the total building floor area is heated by electrical energy [1]. An intention of our country to become a member of EU obliges us to reduce energy consumption by 20% and to obtain 20% of total energy from renewable energy sources by 2020 [2]. To achieve these goals, some advanced energy concepts for built environment should be applied such as zero-net energy building (ZNEB) and positive-net energy building (PNEB).

By definition, ZNEB produces all energy it consumes during year, PNEB produces more energy than it consumes during year, and negative-net energy

building (NNEB) produces less energy than it consumes during year [3]. The “zero-net” concept means that yearly the excess electrical energy supplied to the electricity grid balances the amount received from the electricity grid. The “positive-net” concept means that yearly the excess electrical energy supplied to the electricity grid is higher than the amount received from the electricity grid. The “negative-net” concept means that yearly the excess electrical energy supplied to the electricity grid is lower than the amount received from the electricity grid [4].

From renewable energy, the building may usually produce electrical energy by the PV array on its roof. The generated electricity may feed either the building or the electricity grid. The main task for building design is to minimize the energy









