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## INFLUENCE OF OPTIMAL HEATING SYSTEM CHOICE ON ENERGY SAVING AND DECREASE OF NEGATIVE ENVIRONMENT IMPACT

**Abstract:** In this paper an analysis of the multi-criteria optimization, in Design Builder software, was performed. The analysis is oriented towards the process of achieving, processing, and choosing an optimal solution of heating system for a specific house. Optimization criteria and parameters of use are presented in the paper. For the created object, intended for testing, a minimization of CO<sub>2</sub> emission, minimization of building and installation costs, while maximizing energy efficiency was performed. A choice of the optimal heating system has also been done, depending on previously set goal functions. Variables chosen are only the systems which are considered to have the largest influence on the optimization process. Using a Pareto optimum specific values of the most suitable model were achieved. This approach has perspective for analysis and prediction of energy efficiency behavior of a housing unit, in order to have their exploitation benefit the overall living comfort.

**Keywords:** energy efficiency, exploitation, comfort, thermal comfort, optimization, Design Builder

## 1. INTRODUCTION

Designing and building of housing units is at a high level today. Housing units are being built which are comfortable for living, energy efficient, and easy to build. In order to achieve this in the design phase a large number of factor must be taken into consideration which influence the three aforementioned parameters. An appropriate choice of all these factors which influence building and exploitation of housing units can be made by implementing multi-criteria optimization. Beside optimization, implementation of renewable energy sources in building housing units should be made to minimize the negative impact and converge towards a zero-net consumption.

In order to achieve the best effects, researchers have used multi-criteria optimization. One of the most important criteria is most usually the heating system. In order to achieve the best thermal comfort in a house the type of heating system is very important, [1]. Bojic and Kostic [2] have experimented with ventilation systems using COMIS software. With heating efficiency aside from ventilation and heating systems a large part is played by

the floorplan layout of interior walls, [3]. The goal of these types of experiments is to have a house approaching zero-net emissions as much as that is possible, considering external conditions, [4]. A very important aspect for achieving good results is adapting the house to the climate region based on planning the use of electricity [5, 6]. The combination of these parameters in single-criteria or multi-criteria optimization is possible through the use of Design Builder, [7].

For the purposes of this research two house models were created. One model had an optimized heating system with the addition of PV panels and solar collectors while the other model was optimized for exploitation. Both models were chosen to be representative of the building style in Serbia. Models are created in Design Builder software and optimized using multi-criteria optimization.

## 2. PROBLEM STATEMENT

This research is based on a real project for a house, therefore it has its use in practical applications. The base motivation for this paper













