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XXX Međunarodno savetovanje



energija



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ENERGETIKA 2014.

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Dynamic Simulation and Analysis of Retrofit and Behavioral Change Impacting the Energy Consumption of School Buildings

ABSTRACT

There are a lot of important factors that influence building energy consumption. The building energy saving effect is an integrated acting result, it has a relationship with thermal characteristics of the building envelope, ventilation ways, efficiency of heating system, and the increasing range of energy saving rate will be different as the energy saving measures are different. In this paper, dynamic simulation software DesignBuilder has been used to model and to simulate a typical 1970s Serbian primary school in order to examine the impact of different retrofitting measures and school schedule time on heating energy consumption. In terms of retrofitting study, various energy efficiency measurements have been considered such as improving levels of insulations and heating system's efficiency. For the pupil schedule influence study, two different user patterns have been defined such as full-time and part-time work. Results of dynamical simulation of single and combination of different retrofitting scenarios show that the heating energy consumption could be reduced up to 45 %.

Keywords: Energy modeling, Dynamic simulation, Energy efficiency, School building.

1. INTRODUCTION

Energy consumption is continually increasing throughout the world and a large proportion of this can be associated with non-domestic buildings. Schools usually have a high level of energy consumption due to their considerable heating requirements and high electricity usage for lighting and equipment. Investment in building and technology, as well as more conscious user behavior, can lead to considerable energy savings. At the beginning of 2009/2010 in the territory of the Republic of Serbia there are 1711 registered primary and secondary schools, while in Čačak region there are 19 primary and 8 secondary schools. Čačak is a city in central Serbia. It is the administrative center of the Moravica District of Serbia. Čačak is also the main industrial, cultural, educational and sport center of the district. In the 2010 census, the city had a total population of 73891.

A rational use of energy in school buildings has to be promoted, for the huge potential of energy-saving from the improvement of installations, and for the different reasons: school buildings have high energy consumption, especially with regards to lighting and heating and the size of that consumption is so high to

justify an investment [1]. Also, the cultural and the educational impact is interestingly and extremely important and school buildings are places suitable for the adoption and the application of simple and reliable technologies. School buildings may have not dishomogeneous scenarios which need different solutions in the same building, because of different external light exposure, different window fittings in the same building and different room end uses (classrooms, laboratories).

In order to contribute to global initiatives for reducing energy consumption through energy efficiency increase, Serbia has adopted a set of related national regulations and invested in several large energy-efficient projects targeting the sector of public buildings. Primary schools in the Čačak typically consume 182.16 kWh/m²/year of energy [2]. There have been numerous studies into the energy consumption of schools and school energy performance benchmarks, and benchmark data is readily available for schools in most European countries for the last few decades [3-7]. Primary schools in the UK consume 119 kWh/m²/year of energy, in French primary school's average energy consumption is 197 kWh/m²/year, Greek schools consume 57 kWh/m² while Irish primary schools consume

