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OPTIMIZATION SOLAR DOMESTIC HOT WATER SYSTEMS

Abstract: *In Serbia, it is customary to use electrical energy for heating of domestic hot water (DHW). As around 70% of electrical energy is produced by using coal with high greenhouse emission, it is beneficial to environment to use solar energy for heating of DHW in solar DHW system (SDHWS). During SDHWS operation, different SDHWSs generate different amounts of heat from solar energy, obtain different amounts of avoided electrical energy, avoided energy, and avoided fossil energy. These investigations use computer code EnergyPlus. The used weather data are from the meteorological station. In this paper, a use of Hooke-Jeeves algorithm is reported to obtain the maximum amounts these of performances for different SDHWS use as a function of number of optimum positions of the solar collector in SDHWS during year for Belgrade, in Serbia.*

Keywords: *Optimization; SDHWS; Simulation; Solar collector; avoided energy;*

1. INTRODUCTION

During the first years of the twenty-first century, extensive efforts have been undertaken to alleviate global warming of the earth caused by emission of CO_2 into atmosphere. These emissions are generated by intensive burning of fossil fuels to satisfy the growing energy needs of humanity. When part of energy needs is satisfied by using non-polluting energy sources such as solar energy, the emissions may be mitigated, and they are thus used instead of fossil fuels. Furthermore, another important advantage of the usage of solar energy is that it does not pollute the environment with nitrogen oxides and sulfur dioxide.

In Serbian households, the high amount of DHW is used for shower, tap, cloths-washing and dish-washing machines. It is customary to use electricity for heating of DHW. Considering the fact that around 70% of electricity is produced by using coal with high greenhouse emission, it is highly important and the most rewarding to use solar energy for DHW heating instead of electrical energy. Accordingly, in Serbia and worldwide, the most rewarding application of solar energy is when it replaces electrical energy for heating of DHW in households [1,2]. In addition it is important to have a high efficiency of conversion of solar energy to heat. As a result, the highest amount of avoided exergy is achieved.

In this paper, Hooke-Jeeves algorithm is used to obtain the maximum amounts of these performances for different SDHWS as a function of number of optimum positions of the solar collector in SDHWS during year for the city of Belgrade, Serbia. Also, it has been calculated the reduction of the solar fractions, as well as a deficit avoided exergy in the case when the solar collector are not at its optimal position [3,13].

2. SIMULATION SOFTWARES

In this investigation, simulation, and optimization are performed by using two separate software packages. The research of these installations was performed by using simulation by EnergyPlus and optimization by using Hooke-Jevees method. In this investigation, the Hooke-Jevees method was used to optimize energy flows in SDHWS. In this investigation, the solar collector slope angle is optimized to obtain the highest solar fraction. In this study, the building energy simulation software

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