



Solar Energy Measurement in Čačak, Central Serbia

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Abstract: This paper presents data on measurement of actual solar radiation in Čačak, the administrative centre of the Moravica District in Serbia (43.89°N, 20.35°E). The measurements from a meteorological station that was installed in the city during May 2017 is used in this research. This station is the first meteorological station in the Moravica district, which is set up according to World Meteorological Organization standards and is networked into the system of meteorological stations of the Republic of Serbia. Global solar radiation and sunshine duration were measured and analysed. High resolution, real-time solar radiation and other meteorological data were collected and processed. Daily and monthly average solar radiation values were calculated from the one-minute average recorded values. The results of this research show that Čačak has extensive solar energy resources that can be developed as a significant source of energy in the city and the region. The paper also presents the activities proposed for the popularization of the solar energy use in the city, which are provided in the Environmental Protection Strategy for the City of Čačak, which is in the process of adoption.

Keywords: Global radiation, Weather station, Solar sensors, Solar utility activities in Čačak.

1. Introduction

With rapid economic growth and improvement in living standards, there has been a marked increase in energy use for many developed and developing countries. The development and deployment of sustainable energy technologies across the globe continues at a growing pace, and of the various options available, solar energy remains among the most promising. The effects on global and environmental air quality of pollutants released into the atmosphere from fossil fuels in power plants provide strong arguments for the development of renewable energy resources. Solar energy is the most important renewable energy resource in the world and has a large potential of green energy and could be the world's main energy source by 2050.

Solar radiation data is the input for all solar energy generation systems. Measuring solar irradiance provides knowledge to make important decisions on future energy yield, efficiency, performance and maintenance. Solar energy modelling focuses upon the level of solar radiation incident at a given location on the earth's surface. This is simply a function of the level of solar intensity reaching the top of the earth's atmosphere; the transmission of radiation through the earth's atmosphere and; the location and orientation of collecting surfaces on the earth's surface with respect to the position of the sun with time [1]. Weather patterns and other atmospheric conditions which scatter incoming rays also affect the rate at which solar energy reaches the earth's surface. The summation of the amount of solar energy arriving at a unit of area (1 m²) during 1 h is called the solar radiation or insolation.

Various global and European studies have been carried out in order to estimate solar energy potential [2,3]. This estimation relies on different factors among which solar radiation is considered essential). The use of (meteorological) satellite data and/or interpolation methods are the most typical approaches for the determination of solar radiation and were used, for instance, in the Heliosat method and Meteonorm database, respectively [4,5].

The solar energy potential is 16.7 % of all usable renewable energy potential in Serbia. The solar energy potential in Serbia is about 30 % higher than in Central Europe and solar radiation intensity is among the highest in Europe. Average daily solar energy on a horizontal surface during winter is between 1.1 kWh/m² in the north, and 1.7 kWh/m² in south, and during the summer between 5.4 kWh/m² in the north and

