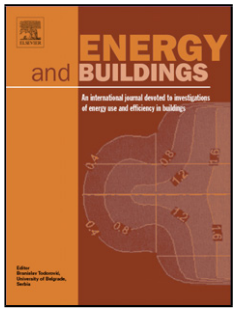

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On the assessment of urban heat island phenomenon and its effects on building energy performance: A case study of Rome (Italy)

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HIGHLIGHTS

- Assessment of the climatic conditions in Rome and its surroundings;
- Evaluation of the occurrence of the Urban Heat Island during the whole year;
- Test of the weather data differences by means of a well-known dynamic software;
- Impacts of UHI on cooling and heating energy demands.

Abstract – A wide variety of weather-data are readily available for simulating buildings energy performance by using dynamic software. However, climate change and its effects on buildings energy performance represent a critical issue, also considering the implications of climate change on human comfort. Starting from this, the present study aims at analyzing the climatic conditions in Rome and its surroundings, evaluating the occurrence of the Urban Heat Island (UHI) phenomenon. Therefore, meteorological data derived from two airports near the city and climatic data registered for two years in a central, densely-built zone of Rome were analyzed and compared. Furthermore, the differences among weather data were tested by means of a well-known and widely used dynamic software in order to evaluate the effects of different climatic boundary conditions on building energy performance, in terms of heating and cooling energy demands. The results highlight significant differences with regard to temperature, wind velocity and relative humidity, as a result of a prevailing UHI phenomenon in central Rome throughout the year. The simulations show an average increase of cooling energy demand of about 30% and an average reduction of heating energy demand of about 11%. Such differences give the rise for the investigation of the reliability of weather-data files commonly used in building simulations, in order to properly estimate the buildings energy demand under a sustainable city perspective.

Keywords: *urban heat island; weather data; dynamic simulation; summer cooling; winter heating; air temperature; relative humidity; wind velocity.*

1. Introduction

During the last years, the scientific community has been attracted by issues related to building energy performance and energy savings [1–7]. The importance of buildings energy savings comes from the need to reduce fossil fuels consumption and mitigate pollutant emissions, according to International Protocols and EU Directives [8,9]. Urban growth has impacted the energy performance of buildings and human comfort, among others, by changing the landscape, as buildings and other infrastructures substitute open land and vegetation. This growth leads to the development of the so-called Urban Heat Island (UHI) phenomenon, characterized by higher temperatures in the densely built areas than the ones of the rural surroundings. These temperature differences can range between 1°C to 3°C in cities with one million or more inhabitants [10]. The UHI phenomenon is expected to increase in intensity as a