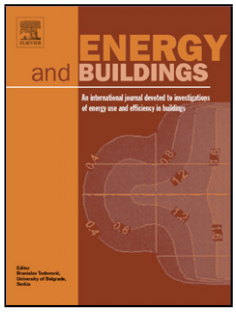

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Micro- Climate Adaptation of Whole Building Energy Simulation in Large Complexes

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Highlights

- Large scale building thermal simulation
- Energy impact of micro- climate change
- Building complex energy efficiency
- Future climate change adaptation in buildings via simulation

ABSTRACT

The purpose of this study was to evaluate the cooling demand during a summer day over a large city area before and after bioclimatic interventions in outdoor spaces by using whole building thermal simulation. This kind of interventions ultimately leads to a microclimatic change in a city. Prediction of microclimate data for a whole day in a large area due to changes in outdoor spaces is time and cost demanding. A model for prediction of hourly microclimatic data in a region for a whole day by employing Fourier analysis of past (measured) and future (simulated from a CFD analysis) microclimate data of a limited period (sunlight hours) was also developed. The whole building energy simulation software TAS-EDSL was applied for a quite large built space (~ 500m χ 500m), for simultaneous simulations in all buildings in the area, and took into account detailed building construction data, mutual shading between buildings and local climatic conditions. In this context, strategies and practices that a building complex should follow in the future in relation to climate change could be investigated. Simulation estimations of cooling loads of building spaces were related to buildings' age, orientation and height. Main outcome of the study was the ability to assess building energy performance due to exterior micro- climate improvement, simultaneously, for about 200 buildings.

Key Words: thermal simulation, climate change, building complex

1. INTRODUCTION

Urban environment contributes to climate change mostly in relation to the energy consumed within building complexes rather than its microclimate. However, climate conditions in cities are mostly governed by the urban characteristics rather than the planetary or zonal climate [1]. In specific, rehabilitations in open urban spaces, mainly, influence the microclimate of a city but not the global climate trends [2-3].

Simulation tools must be employed in order to depict the present situation around the external areas and inside the building envelope, usually during the warmest or the coldest day. Material identification, construction configuration and building complex with shading and radiation exchange must also be taken into account in the simulation process. If a new configuration of materials and bioclimatic techniques as water surfaces and green roofs are used in the outdoor space, this would also improve the energy consumption of the inner spaces [4] of the urban complex. Whole building energy simulation in building complexes, before and after the outdoor