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an analytic method in energy-sensitive urban design

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Microclimatic performance of urban form: an analytic method in energy-sensitive urban design

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Abstract

Urbanised areas will remain the dominant consumers of energy in the coming decades. During the course of transformation of these areas – urban extensions, densification and requalification of existing urban areas - multiple opportunities emerge to integrate new and innovative design measures that create synergies between available energy resources, infrastructures and the spatial characteristics of the urban environment, with the purpose of reducing the energy demand.

In this so-called Energy Sensitive Urban Design approach, urban form characteristics can play an important role in the improvement of the energy performance. According to some studies, the relationship between urban form and building energy consumption accounts for one third of the total energy use. However, these studies largely neglect the microclimatic effects that the composition and configuration of the urban fabric creates, such as shading, alterations in wind patterns, elevated air temperatures, etc.

Therefore, a method has been developed that aims to analyse the impact of surrounding urban form on building microclimatic environment. It allows to examine, within complex spatial contexts, the environmental performance of morphological typologies based on quantitative variables.

In a first step, a set of morphological parameters describing openness to the sky, built density and roughness, are identified and related to microclimatic factors that affect energy use for heating and cooling at the building level. Secondly, the selected morphological parameters are used to analyse a district development masterplan in Zürich, Switzerland.

Thirdly, the case study area is modelled and simulated by using ENVI-met in order to predict the outdoor microclimatic performance in the specific climatic context. Lastly, the morphological parameters analysed in the first steps are correlated with the simulated microclimate data and, through comparison, conclusions are drawn regarding energy-sensitive urban form in the selected case study.