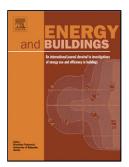
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# From urban climate to energy consumption. Enhancing building performance simulation by including the urban heat island effect

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#### 14 **ABSTRACT**

15 Cities are dissipative structures. As such, cities generate heat, a phenomenon known as urban heat island (UHI). Even though the UHI is one of the most relevant effects of 16 17 urbanization on urban climate, up-to-date methodologies to include it in the 18 estimation of buildings' energy consumption are still scarce. During the last 30 years, 19 different methods and software have been developed to measure a thermal building's 20 demand. Building performance simulation is commonly used to calculate heating and 21 cooling demand. However, such techniques do not adequately include the urban heat 22 island effect, which could have an extreme impact on a building's energy consumption. 23 In fact, building operation is doubly connected with the urban environment: on the one hand, buildings generate heat that warms up the environment, and on the other 24 hand, the urban environment alters building performance by the influence of UHI. In 25 this paper, a methodology to incorporate the UHI effect in building performance 26 simulation is proposed. Urban weather data were downscaled at the urban 27 28 morphology building level to estimate the cooling demand of different types of 29 residential buildings. The global energy penalty for the whole residential building 30 stock was estimated in four South American Pacific coastal cities. The results indicate 31 that when UHI is incorporated, an increase in energy demand between 15 % and 200 32 % can be expected. These results challenge the validity of current assessments 33 performed in absence of the UHI effect. At the same time, these results open up the discussion for the inclusion of urban planning measures aiming at reducing the UHI 34 35 effect on a building's energy demand.

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#### 37 KEYWORDS

Cooling demand; urban weather generator; GIS; spatial analysis; building
performance simulation; weather data, Antofagasta, Lima, Guayaquil, Valparaiso

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#### 41 HIGHLIGHTS

- 42
- 43 A methodology to downscale the urban climate to the building level is
  44 proposed.

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