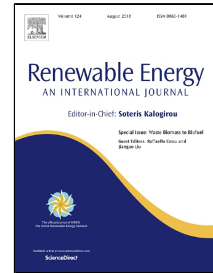


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How outdoor microclimate mitigation affects building thermal-energy performance: a new design-stage method for energy saving in residential near-zero energy settlements in Italy



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1 **How outdoor microclimate mitigation affects building thermal-energy**
2 **performance: a new design-stage method for energy saving in residential**
3 **near-zero energy settlements in Italy**

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12 **Abstract**

13 Key research effort was dedicated toward zero-energy buildings. Recent interest is switching from
14 single-building to inter-building scale, to enhance the whole district economic-environmental
15 sustainability. This upscaling opens the doors to further optimization strategies thanks to outdoor
16 microclimate mitigation aimed at reducing winter thermal losses and summer overheating. This work
17 proposes a novel design-stage replicable method for multiscale microclimate improvement correlated to
18 building thermal-energy analysis in a residential near-zero-energy district in central Italy. Cool surface
19 installation and conscious greenery design in the outdoors were used in the district of single-family
20 houses. Therefore, a microclimate simulation was performed to elaborate realistic weather files to be
21 used in the second-stage dynamic thermal-energy simulation at building level, in order to evaluate the
22 impact of the local microclimate on building thermal-energy performance and renewables' production.
23 Microclimate analysis demonstrated how local conditions affect outdoor comfort and that they may be
24 considered in the same way as traditional energy-efficiency improvement early-stage design strategies at
25 building scale, being able to reduce building energy need for HVAC up to 10% in the studied conditions.
26 Therefore, new potentialities of inter-building scale analyses for energy efficiency enhancement and
27 renewable energy exploitation are expected while downscaling microclimate assessment toward building
28 thermal-energy performance.

29 **Keywords:** Microclimate mitigation; Dynamic thermal-energy simulation; Near Zero Energy
30 Settlement; Energy efficiency; Urban Heat Island; Inter-building effect.

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