International Cartographic Association
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Cartographic Visualization of Energy Savings in Buildings for Compliance with the Spanish nZEB Standard

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Keywords: urban planning, energy efficiency, GIS, building renovation, thematic map.

Abstract:

The concept of nearly zero energy buildings (nZEB) and the role of the building envelope in achieving energy savings (García-Ballano et al., 2020) are key to advancing climate neutrality in the built environment (Directive 2010/31/EU, 2010). This evaluation relies on geospatial variables that can be obtained from public data sources such as cadastral records and population and housing censuses (Martín-Consuegra et al., 2018). Variables such as building age, typology, location by climate zone, and the surface area of facades and roofs allow for accurate estimations of the energy savings potential from retrofitting building envelopes to meet nZEB standards.

While each country defines its own nZEB criteria, a common challenge arises in estimating the energy-saving potential of a city's building stock due to the detailed, time-consuming calculations required at the building level. To support effective public policy and urban planning, it is essential to quantify this potential and spatially identify areas with the greatest opportunities for energy savings—similar to how urban vulnerability is analyzed (Joshi et al., 2022), , including assessments of the feasibility of short-, medium-, and long-term interventions (Ruiz-Varona & Alfaro-Santafé, 2017).

This study applies a validated calculation methodology (Javier García-Ballano et al., 2022) to several Spanish provincial capitals located in different climate zones but governed by the same national energy efficiency regulations (the Technical Building Code). This approach enables comparisons of energy savings potential not only across individual buildings, blocks, and sectors within a city but also between cities. A key output of this approach is the generation of detailed cartographic visualizations that display spatial patterns of energy-saving potential across urban areas. These maps enable policymakers and urban planners to make informed, place-based decisions by clearly identifying priority areas for intervention, optimizing resource allocation, and aligning retrofit strategies with climate goals.

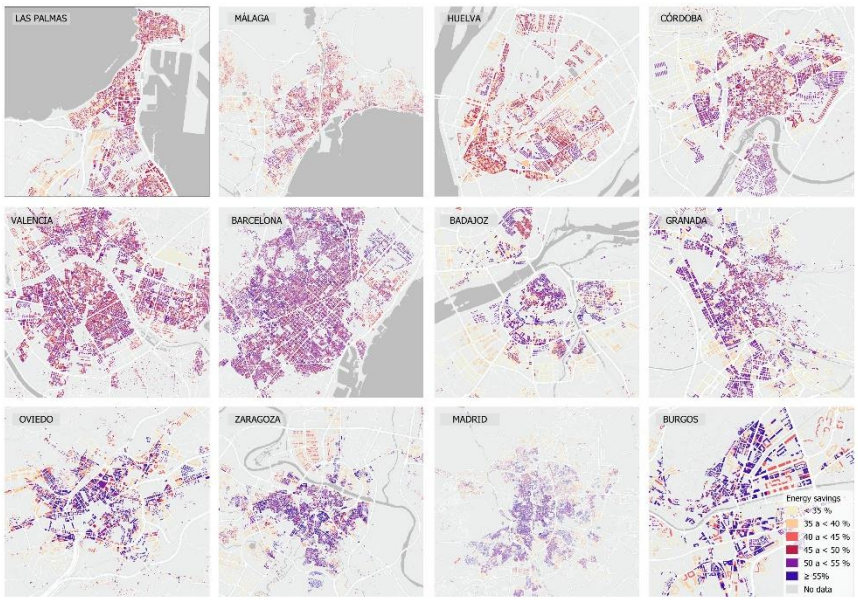

Figure 1. Example of visualization of energy savings of the building envelope in housing units to comply with nZEB standard.

The resulting cartography provides, on the one hand, precise knowledge of the current state of the housing stock regarding the potential passive measures that can be applied in specific sectors of the city and across the urbanized territory. On the

other hand, it enables the integration of this information with other variables, such as material resources and socio-economic factors, which are typically overlooked in multilevel intervention studies aimed at achieving climate neutrality in cities.

Acknowledgements

This research is supported by the Department of Science, University and Knowledge Society, Government of Aragón, Spain, Arquitecturas OpenSource (S04_23R).

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