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# OVERHEATING RISK ASSESSMENT IN PASSIVE ENERGY RENOVATIONS IN SPAIN

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**Abstract** – The regulations of the European Union (EU) demand the improvement of the energy efficiency of buildings. Following this, thermal insulation-based passive energy renovations can reduce the energy demand of buildings. Thus, increasing the thermal insulation of the envelope has shown many improvements by reducing the energy loss in heating energy demand dominant areas. Consequently, national regulations of Member States, like the National Building Code (NBC) of Spain, require high thermal insulation levels for renovation processes. In addition, many high-performance labels demand thermal insulation above mandatory levels, like EnerPhit (the renovation label by Passivhaus). Nonetheless, renovations based on thermal insulation may affect the thermal comfort of buildings, depending on outdoor climatic conditions. The influence of adding thermal insulation on the possible increase in temperatures of residential spaces is still uncertain and requires analysis, given the risk of overheating. Based on this hypothesis, the objective of this study is to assess the influence of thermal insulation-based passive renovation on the overheating risk of residential spaces, focusing on the different climatic conditions of Spain. For this, the study evaluates the thermal conditions under different renovation scenarios on one residential multi-family archetype typical from the 70s and 80s, without any insulation. To this end, the research follows a three-staged methodology. First, the study identifies and defines one archetype, 12 climatic zones of Spain (following NBC) and 12 passive renovation strategies: four types of renovation strategies (façade exterior insulation, roof insulation, window replacement and the combination) in three efficiency levels (basic level, NBC required level and EnerPhit required level). Second, the study performs the Building Performance Simulation (BPS) of the parametric combination of all the climatic conditions and renovation strategies, analyzing the indoor operative temperature. Finally, the study evaluates the overheating hours based on the thermal comfort model by the Chartered Institution of Building Services Engineers (CIBSE). The evaluation shows the increase or decrease of overheating hours under different climatic conditions, renovation types and thermal insulation levels. These results indicate that the climatic zone is a key factor in assessing the overheating risk. Therefore, the study identifies the critical climatic zones of Spain with high overheating risk, which require more in-depth analysis to avoid overheating on energy renovations.

**Keywords** – *BPS (Building Performance Simulation); Climate; Energy renovation; EnerPhit; National Building Code (NBC); Thermal Comfort; Thermal insulation*

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