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HEAT RECOVERY VENTILATION IN SPANISH APARTMENTS: COSTS, BENEFITS, AND FEASIBILITY

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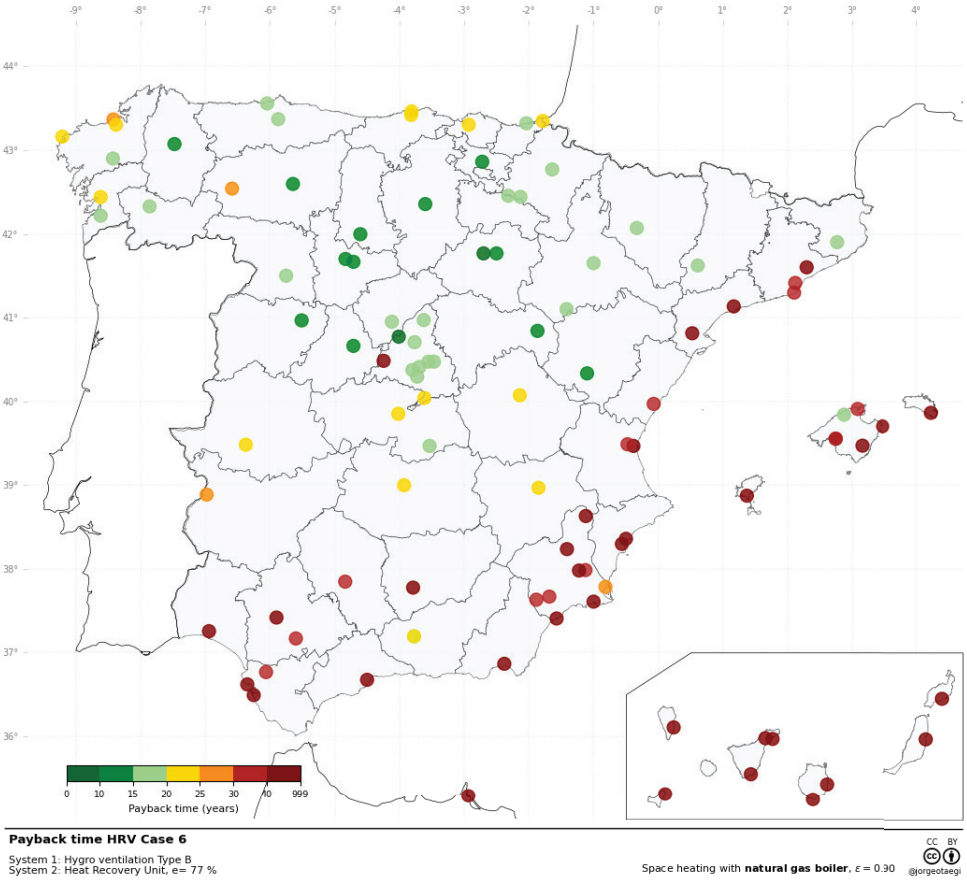
Abstract – Mechanical ventilation systems with heat recovery (HRV) are increasingly promoted as a key measure to improve indoor air quality and reduce energy losses in residential buildings all over Europe. HRV is often mandatory in modern national regulations and green building certification systems or labels. In southern European countries like Spain, HRV systems are often included in new dwellings, required indirectly by building code in the coldest climatic zones. However, the economic viability of HRV systems depends greatly on climate and ventilation rates. This study evaluates the profitability of mechanical heat recovery ventilation in apartment buildings in Spain, considering variations across its diverse climatic zones. The analysis used regional climate data to quantify energy savings attributable to HRV systems and compared them with the alternative cost of heating, using an LCOE approach, which also accounted for initial installation costs, operating expenses, and energy price trends. To do so, a constant flux ventilation rate according to CTE DB-HS 3 was considered, with 5 apartment typologies, in 104 locations in all 50 provinces of Spain. Results reveal that HRV systems demonstrate limited economic viability in most regions of Spain. In colder inland regions, the payback time for HRV systems was adequate, whereas in warmer Mediterranean and southern climates the investments turned out to be not amortizable, underscoring a strong climate-dependency in their economic feasibility. In milder coastal areas like the northern coast of Spain and the Basque Country, results showed payback times over 20 years. These findings are presented graphically, highlighting the geographical differences in payback times under current market conditions in the building typologies. Beyond economic factors, this paper acknowledges the benefits of HRV systems, like improved thermal comfort in winter, filtration of exterior air and the potential reduction of overall building energy demand, but contextualizes them in the broader framework of energy efficiency. Additionally, the potential benefits of demand controlled ventilations are discussed. This paper aims to guide policymakers, architects, engineers, and homeowners in making informed decisions about HRV adoption. Future work could incorporate life-cycle cost analyses and dynamic energy modeling to capture broader implications and refine the assessment of HRV systems in new residential developments and retrofits.

Keywords – Energy efficiency; energy policy; heat recovery ventilation; LCOE (Levelized Cost of Energy); mechanical ventilation; nZEB (Nearly Zero Energy Building); payback period; thermal comfort



Results of payback time of scenario 6 for heat recovery ventilation in peninsular Spain and the Balearic and Canary Islands, using a natural gas boiler for space heating.

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