Chapter 5
Energy Losses in Construction Parameters in Multi-Family Dwellings in Madrid, Spain

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ABSTRACT

This paper focuses on the characterization of the residential building stock in the Madrid area. 151 Blower Door Tests have been carried out in multi-family dwellings built in different periods whose execution has been regulated by the UNE-EN 13829 standard. Through its quantification by an n50 value, average values of 5.8 renovations per hour have been obtained; in addition to detecting the main points where air infiltration occurs. These results are intended to lay the groundwork for finding solutions for infiltration, focusing on energy savings. By establishing a relationship between hourly renovations and the energy expenditure of the different

DOI: 10.4018/979-8-3373-2555-2.ch005

dwellings, the amortization of these improvements could be quantified. Many of the results obtained from current dwellings would not comply with the new requirements of the technical building code. In addition, the influence of several construction characteristics on permeability results was assessed.

INTRODUCTION

Building energy demand has become one of the most important concerns in the construction sector. The European Energy Performance of Buildings Directive (EPBD) is committed to achieve a highly efficient and decarbonized building stock, considering that almost 50% of the final energy consumption is used for heating and cooling, of which 80% is used in buildings, (European Parliament, 2018).

Concern about the airtightness of dwellings has been considered in the United States since before 1995, (Sherman, 1995). It is not surprising EU Member States have committed to reduce primary energy consumption by 20% by 2020. as energy consumption in residential and commercial buildings accounts for approximately 40% of total final energy consumption (Darvish et al., 2020), and 52% of the main heat losses in dwellings are due to ventilation, and therefore infiltration, becoming clear that improving airtightness is essential for enhancing energy efficiency in buildings, (Almarzouq & Sakhrieh, 2018).

Most of the energy is consumed by buildings. Buildings aimed at providing user comfort conditions are in an important position in terms of consuming energy. Considering the building life cycle, energy is an indispensable element for the building. There are differences in the increase in energy use in buildings and its global distribution. Recently, buildings that are self-sufficient within the framework of the building life cycle and independent buildings for energy have been designed and constructed, (Oh et al., 2017.

Energy efficiency regulations for buildings have been radically tightened over the last decade in Europe, and increased insulation requirements have greatly reduced heat losses through the thermal envelope. As a result, the impact of heat losses through the air has become proportionally larger in the energy demand of buildings, (Hong & Kim, 2022).

A recent study (Martín-Garín et al., 2020) puts the incidence of infiltration at between 20% and 50% of the total energy demand and warns of its impact on the airtightness of buildings. In the case of existing buildings, the wide range of energy renovation measures has increasingly included airtightness improvements, especially in cases where other actions are not feasible, such as in historic buildings. Many practitioners are incorporating airtightness analysis in their energy assessments due to its high impact on these types of buildings.