



Coimbra, Portugal

Roadmap II (2024)

**Overcoming Energy Renovation Barriers and
Facilitating the Supply of Renewable Energy
Services in Single-Family Homes**



Co-funded by
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Area characteristics

The Intermunicipal Community of the Coimbra Region is an administrative division in Portugal, established in October 2013, and since January 2015, it has been classified as a NUTS3 subregion of the Centro Region, covering the same geographical area. The city of Coimbra serves as the main urban center and administrative seat of the intermunicipal community. With a metropolitan population of approximately 435,000 inhabitants distributed over an area of 4,335.57 km², Coimbra plays a significant role in the regional development of central Portugal. Its strategic location and historical significance contribute to its influence in various sectors, especially the third sector, including education, healthcare, and commerce.

Situated at an elevation of 40.19 meters above sea level, Coimbra has a warm Mediterranean climate. The city's annual average temperature is 16.78°C, slightly below the national average. Coimbra experiences moderate rainfall, with an annual precipitation of approximately 92.11 mm, spread across 105 rainy days per year. The warm season lasts from late June to mid-September, with temperatures often exceeding 25°C, reaching peak averages of 29.64°C in August. In contrast, the cooler season extends from mid-November to early March, with January being the coldest month, where temperatures range between 5°C and 14°C. The city also experiences seasonal variations in heating and cooling demands, with 1,136.5 heating degree days and 114.4 cooling degree days recorded in 2022. These climatic conditions influence the region's energy consumption patterns and urban planning strategies.

Population characteristics

The Municipality of Coimbra, located in Portugal's Centre Region, has a population of approximately 135,000 inhabitants, characterized by a significantly aged demographic, with an ageing index of 203.9—higher than both the national average (157.4) and the EU27 average (132.3). As a predominantly service-oriented city, Coimbra's economy is driven by the health sector, with hospitals, universities, and schools playing a crucial role in employment and economic activity. The region has a relatively well-educated population and reasonable purchasing power compared to other cities and rural areas. However, energy poverty remains a pressing social issue, particularly affecting vulnerable groups such as the elderly living in inefficient housing in the historic downtown and social housing residents in the city's outskirts.

The REVERTER Pilot will focus on assisting the most disadvantaged households, particularly in a suburban social housing area near the city center, targeting around 150 citizens facing higher risks of poverty, including single parents—especially women—unemployed individuals, ethnic minorities, and large families. The Coimbra Urban Area, with over 100,000 residents, is the largest urban conglomeration in the pilot region. Census data from 2011 to 2021 indicates a shift towards smaller households, with an increase in one- and two-person households, while larger households have declined. In economic terms, the region's GDP in 2020 was approximately €7,856 million, with a GDP per capita of over €18,100, equivalent to 60% of the EU27 average, and an unemployment rate of 6.3%, below the national rate of 8.1%.

Housing characteristics

The residential building stock in Portugal is predominantly composed of structures built before 1980, accounting for 53.5% of the total, a period characterized by poor energy performance due to the absence of thermal insulation. Buildings constructed between 1961 and 1980 are particularly noted for their high energy-saving potential, as they were built before the first thermal building code was enacted in 1990. The Coimbra region's architectural landscape reflects a mix of historical styles and modern developments, with traditional buildings made of stone, brick, and timber coexisting alongside the newer high-rise



structures built between the 1960s and 1990s. Many of these older buildings, particularly in the city center, suffer from poor structural conditions, high seismic vulnerability, and low energy efficiency. In contrast, the expansion of the city during the 1960s-90s led to the construction of new districts with multi-story apartment buildings that, while providing much-needed housing, also share the energy inefficiencies of their era. Most of the multi-family buildings from the 1970s and 1980s are constructed with reinforced concrete structures, rendered and painted façades, and pitched roofs with ceramic tiles, further emphasizing the need for retrofitting and energy performance improvements.

The Coimbra Pilot focuses on addressing these challenges, particularly in the city's social housing sector, which consists of 854 dwellings owned and managed by the municipality. These buildings, built before the 1990 thermal regulations, lack insulation and suffer from poor energy efficiency. While some minor renovations, such as façade repainting, have been undertaken, significant potential for energy retrofitting remains. The Pilot will develop two roadmaps—one for buildings and another for individual dwellings—targeting the most vulnerable households, particularly those at risk of energy poverty.

Energy poverty status

The results of the social survey confirm existing data and literature on the characteristics of the building stock in the Coimbra region. Most respondents live in buildings constructed between 1960 and 2010, predominantly with concrete structures and low insulation (75%). The majority of dwellings are apartments (67%), followed by detached (24%) and semi-detached houses (9%). In terms of space, 72% of homes have two or three rooms, while around 20% have more than three rooms. Regarding windows, 60% are double-glazed, and only 9% are triple-glazed, yet just 47% of homes have frames with thermal cuts, which affects their insulation performance. Additionally, 92% of households have shutters, with external shutters (77%) being more common than internal ones (16%). These findings highlight the region's predominant construction trends and the need for improvements in insulation and energy efficiency, particularly in older buildings that still lack modern thermal solutions.

Indoor comfort and climatization systems also present significant disparities. While radiant floor heating and central heating systems provide the best thermal comfort, only 8.4% of households have solar systems, and just 1.3% have radiant floor heating. Heating is mainly powered by electricity (55%), followed by natural gas and biomass (15.3% each), with local and portable heating solutions such as heat recovery units, open fireplaces (64%), electric resistance heaters (18%), and heat pumps (13%) being the most common. Air conditioning is present in 43% of homes, mainly as single-room units (60%), while central and portable systems account for 17% and 23.4%, respectively. Interestingly, the survey found no clear correlation between income and self-reported thermal comfort, with higher-income households reporting the highest discomfort levels due to extreme indoor temperatures, while lower-income households reported better perceived comfort. This reflects cultural attitudes toward heating and cooling, where such expenditures are often deprioritized in household budgets. Traditional coping strategies, such as using extra blankets in winter or opening windows in summer, remain widespread, particularly among the elderly, reinforcing the need for awareness campaigns and targeted interventions to improve energy efficiency and overall living conditions.

According to REVERTER's social survey, 88% of respondents' winter energy bills account for less than 10% of their income, while 12% spend more than this threshold. However, among lower-income households (earning less than €800 per month), 29% allocate over 10% of their income to energy expenses, with more than 95% of them struggling to pay their bills. Additionally, 8.4% of surveyed households reported having failed to pay their energy bills in the last 12 months, a rate higher than Portugal's official statistic of 4.5%



and the EU average of 6.2%, indicating a growing trend of energy debt. Despite energy costs taking up a significant share of household income, only 10% of respondents admitted to cutting other essential expenses. Among those who did, the most affected areas were transportation (37.6%), medical treatments, including medicines and consultations (31.3%), reducing heating hours (28.8%), and lowering thermostat settings to minimize heating costs (32.3%). These findings highlight the financial strain on vulnerable households and the difficult trade-offs they must make to manage their energy expenses.

Willingness to participate in energy retrofit actions

The results of the REVERTER survey indicate that 10% of households benefit from the social energy tariff, while 50% are ineligible. However, 40% of respondents were unaware of the tariff, suggesting a gap in information. Regarding energy efficiency support programs, only 9.6% successfully received aid, while 55% did not apply—23% were unaware of such programs, and 9% were ineligible. Awareness of one-stop shops was particularly low, with 50% of respondents unaware of their existence and 42% not applying for them. Other identified support mechanisms include renewable energy communities, incentives for solar PV and thermal systems, and limited municipal aid for building renovations. The most cited barriers to accessing support programs were excessive bureaucracy, uncertainty about home improvements, and the complexity of the application process, followed by concerns over low subsidy amounts and unclear energy cost savings.

Analysis by tenure type and education level in the REVERTER survey reveals that the social tariff primarily benefits social housing residents, aligning with eligibility criteria. However, energy efficiency support programs are more commonly accessed by homeowners without bank loans rather than by those in greater financial need, likely due to financial constraints and education levels affecting engagement. Respondents with higher education, particularly technological degrees, showed more interest in energy efficiency programs, while lower-income and less-educated individuals were more likely to receive subsidies but less inclined to apply for additional support. Willingness to invest in home renovations was also low, with 22% unwilling to allocate any funds and some citing reasons such as renting, limited retirement income, or high upfront costs. A few respondents indicated willingness to make one-time payments between €500 and €5,000, but only if they could ensure a payback period of five years. These findings highlight financial and informational barriers that hinder energy efficiency improvements and the need for simplified procedures and tailored financial support.

Renovations triggered by REVERTER

REVERTER is expected to drive the renovation of privately rented houses in the five-year period following the project's completion (2026–2030). This will be achieved through the establishment and operation of physical and digital one-stop shops, home visits by REVERTER Ambassadors and local facilitators to energy-poor households, and awareness-raising and training activities aimed at strengthening their knowledge of energy renovation solutions. These efforts will ensure that vulnerable households receive the necessary guidance and support to improve their living conditions and energy efficiency.

According to initial estimates outlined in Section 3, Impact Calculation Table of D1.4 – Extract of the Project Data from the LIFE KPI Webtool, approximately 1,800 households in the Coimbra region will be engaged through information campaigns, home visits, and social engagement events. Of these, around 272 households are expected to visit the physical and digital one-stop shops, with approximately 15% (41 households) expressing interest in upgrading their homes within the next five years. This includes 32 multi-

family building (MFB) units—spread across four buildings with eight households each—and nine single-family homes (SFH), contributing to the long-term impact of REVERTER in fostering energy-efficient housing renovations.

The contribution of the REVERTER project to single-family homes (SFH) under Roadmap II is summarized in Table 1. As all the buildings involved are social housing units owned by the Municipality, the investment required for their renovation is entirely funded by public resources.

Table 1. Contribution of REVERTER project to the implementation of the specific roadmap for the renovation of SFH in the period 2026-2030.

Impacts Roadmap II	Energy poor households- Single-family homes-(SFH)
Number of newly renovated buildings	9
Resulted cumulative final energy savings (GWh)	0.071
Resulted cumulative primary energy savings (GWh)	0.176
Resulted cumulative CO₂ reduction (ktn CO₂)	0.0107
Resulted employment impacts (person-years)	0.00004
Resulted cumulative multiple benefits (million €)	0.00275
Required new investments (million €)	0.059

The REVERTER project

The REVERTER stands for Deep RENovation roadmaps to decrease households VulnERability to Energy poveRty. The REVERTER project is funded under the LIFE Programme with under the Grant Agreement No 101076277.

9 Roadmaps

The roadmaps are tailor-made to the characteristics of the building stock, the characteristics of the vulnerable households and the climate conditions, to cover a sufficiently cohesive group of cases that will allow for a larger-scale rollout and replication of the proposed actions for the effective analysis and tackling of the problem. The roadmaps will target the worst-performing homes first (“worst first” principle), will cope with split-incentive dilemmas and will address market, information and behavioural failures through the creation of “one-stop shops” (OSS) in 4 countries as defaults for the enrolment of vulnerable households in subsidised energy efficiency improvement programmes for buildings.

