Deep REnovation roadmaps to decrease households VulnERability to Energy poveRty

Project No. 101076277

Annex to Deliverable 3.4 - Renovation roadmaps

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Annex VII: Roadmap - Multi-family buildings in Riga

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Executive summary

The REVERTER roadmaps aim to combat energy poverty by deep renovating dwellings occupied by vulnerable households. The roadmaps were developed considering the conclusions and policy recommendations that resulted from analysing the best practices and the different characteristics and conditions of the targeted countries. To this end, the roadmaps are tailor-made to the characteristics of the building stock, the characteristics of the vulnerable households, the legislative framework, and the climate conditions of each pilot. At the same time, they intend 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. Moreover, the roadmaps target the worst-performing homes first (worst first principle) and promote the most cost-effective energy efficiency and RES interventions (best-possible principle) to ensure that the economic, energy, climate, and social benefits triggered by the implementation of the required energy efficiency and RES interventions are maximised.

The aim of the Roadmap "Multi-family buildings in Riga" is to help tackle energy poverty in vulnerable households living in multi-family buildings (MFBs) in Riga through the deep renovation of the building stock.

The Roadmap provides a pathway for local, regional and national authorities to upgrade in total around 3,800 MFBs, by 2050 giving focus both on landlords and tenants. The total area of the buildings to be renovated is around 10,400 thousand m^2, 2,100 thousand m^2 of which are occupied by energy-poor households. The abovementioned figures were calculated considering that 20% of the households are affected by the phenomenon of energy poverty (for details refer to Section 2). To estimate the renovation costs three different renovation schemes were modelled and analysed. The building envelope insulation with EPS has the best performance on the examined indicators, followed by building insulation with mineral wool, and meets or exceeds the targets for deep renovation. The holistic approach of building envelope upgrades also extends the life span of the building because the main building envelope components are fixed and encapsulated to protect them from damages associated with sharp temperature swings and other factors influenced by severe weather conditions.

Focusing specifically on renovations triggered by REVERTER (i.e. till the end of the project and 5 years beyond project-end) through the establishment and operation of the physical and digital one-stop shops, visits to homes of energy-poor households by REVERTER Ambassadors and the awareness-raising and training activities, it is estimated that 13 MFBs will be retrofitted (3 MFBs during project implementation and 10 MFBs five years after the completion of project). The overall impacts of the project are summarised in Table ES1, while the allocation of the total investments to public and private investments triggered by the project is presented in Table ES2.

Table ES1. Contribution of the REVERTER project to the implementation of the specific roadmap for the renovation of MFBs during the implementation of the project and five years after the end of the project (2025-2030).

Impacts	Energy-poor households - Multi-family houses- Apartments (MFB)
Number of new renovated buildings	13
Resulted cumulative final energy savings (GWh)	0.55
Resulted cumulative primary energy savings (GWh)	0.49
Resulted cumulative CO_2 reduction (ktn CO_2)	0.16
Resulted employment impacts (person-years)	21.39
Resulted cumulative multiple benefits (million €)	0.006
Required new investments (million €)	1.38

Table ES2. Allocation of the total investments to public and private investments triggered by the REVERTER project (million €) in the period 2025-2030.

Period	Roadmap	Energy poor households	Share	Public funds	Private (own) funds	Total
2025-2030	**Energy-poor households Multi-family houses- Apartments (MFB)**	**Category I**	80%	0.55	0.55	1.10
		Category II	20%	0.25	0.03	0.28
		Total	**100%**	0.80	0.58	1.38

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1 Introduction

1.1 Analysis of the main objectives of the renovation roadmap

The aim of the building renovation roadmap is to ensure the alleviation of energy poverty in the Riga pilot. The confrontation of energy poverty will be achieved through the energy renovation of the building stock.

The compilation of the building renovation roadmap should accelerate the renovation of the multi-family building stock until 2050, while the focus will be given to both landlords and tenants.

1.2 Main energy, environmental and climate change legislative and policy framework at national level

The National Energy and Climate Plan (NECP), which was submitted in the end of 2019, defines the policy framework for the energy upgrade of the building stock. The plan outlines the desired situation for 2030.

Desired situation in 2030:

- In the building
- stock, the average consumption of thermal energy for heating is at least 30% less than in 2020;
- At least 2000 multi-apartment residential buildings and at least 5000 private houses have been renovated, non-emission RES technologies have been installed in them, or they are connected to the CSA;
- Improvement of energy efficiency of state and local government buildings is ensured;
- A long-term solution for improving the energy efficiency of the housing stock has been developed and implemented.

The Ministry of Economics (EM) is responsible for undertaking the legislative obligations for the energy performance of buildings. The national building code, known as the National Building code LBN 002-19 (LBN 002-19), underwent amendments in June 2019. LBN 002-19 establishes minimum requirements, specifically maximum U-values for building elements, as well as criteria for energy losses and gains across the entire building envelope. Consequently, existing buildings or units undergoing major renovations can achieve optimal energy savings with minimal cost impact.

For existing buildings undergoing renovation, the minimum energy performance requirements are met when the building: (a) satisfies all minimum criteria for existing buildings, and (b) the calculated annual heating energy consumption is less than or equal to that of the reference building, while the building is classified at least as Class “C”. Exceptions

are permissible only if a technical report demonstrates that meeting these standards is not technically, functionally, and economically feasible.

The definition of Nearly Zero-Energy Buildings (NZEB) for existing buildings is outlined in Law No. 222. “Methods for calculating the energy performance of buildings and rules for certification of the energy performance of buildings”. The building can be classified as NZEB if it confirms to all subsequent requirements:

- the energy consumption of the building for heating does not exceed the level indicated for a Class A buildings;
- the primary non-renewable energy consumption of the building for heating, hot water supply, mechanical ventilation, cooling and lighting (applicable to non-residential buildings) does not exceed for Class A buildings;
- installed engineering systems conform to the ecodesign requirements and the energy labelling Class A or higher, if the corresponding energy labelling requirements have been laid down in laws and regulations;
- minimal requirements for indoor climate conditions are met regarding indoor temperatures in summer and in winter as well as adequate ventilation rates.

Details on the energy performance of a building and recommendations for enhancing its efficiency are incorporated into the Energy Performance Certificate (EPC), which remains valid for a duration of 10 years. The EPC becomes mandatory upon the completion of the construction of a new building, after a comprehensive renovation or during the sale of a building.

1.3 Identification of the key stakeholders including the procedures for their engagement

The implementation of the envisaged building renovation roadmap requires the involvement of various bodies and authorities, which are illustrated in Figure 1. The mapping of the involved bodies and authorities pinpoints that the development of a governance mechanism, which will facilitate the communication and cooperation of the entities involved, is imperative.

The identified bodies and authorities represent different administrative and social levels with completely different priorities and aspirations. The cooperation of these stakeholders is crucial in identifying the energy poor households facilitating their participation in the planned policies and measures and collecting the necessary data to evaluate both the implemented policies and measures and the evolution of the energy poverty phenomenon at national, regional and local level.

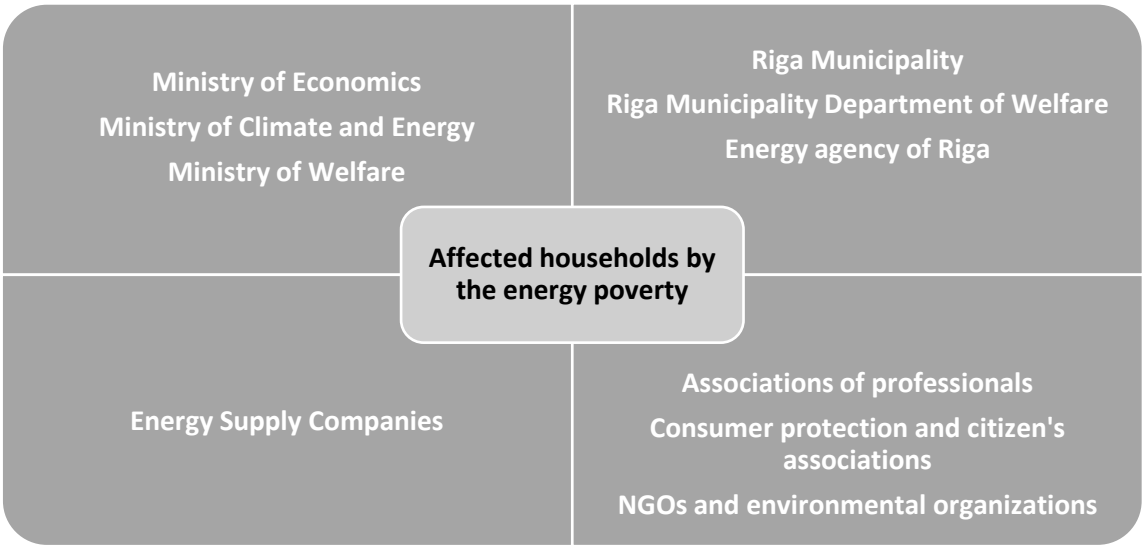

Figure 1. Overview of the involved stakeholders into the preparation of the building renovation roadmap.

Different means will be utilised in order to conduct the foreseen consultation activities, such as indicatively:

- Organizations of a workshop with the participation of the identified stakeholders to discuss the main provisions of the building renovation roadmap.
- Organisation of a workshop with the participation of the identified stakeholders to discuss the received comments during the consultation procedure.

2 Analysis of the current levels of energy poverty in the pilot area

The analysis in Riga pilot about the energy poverty rates was based solely on data from Eurostat's EU SILC survey, which were downloaded by the Portal of the Official Statistics of Latvia. The EU SILC survey microdata (at the household level) was available for the years 2017-2021. From the dataset, the observations selected were those that referred to Riga region (variable reg) and urban territory (variable laupil).

According to Figure 2, the share of the population living in a dwelling with a leaking roof, damp walls/floors/foundation within the Latvian pilot area is lower than the national share by nearly 3.5-6%. Similarly, the share of the population with arrears on utility bills is lower in the pilot area than at the country level (Figure 4), with the difference decreasing over time, from 2.5% in 2017 to 1% in 2021. Conversely, the share of the population not being able to keep home adequately warm is higher in the pilot area compared to the national average (Figure 3), with the discrepancy gradually decreasing from 6.8% in 2017 to 2.5% in 2021.

In general, it appears that the consensual EP indicators are improving so much in the pilot area as nationally, while also the discrepancy between the two levels is significantly smaller over the years.

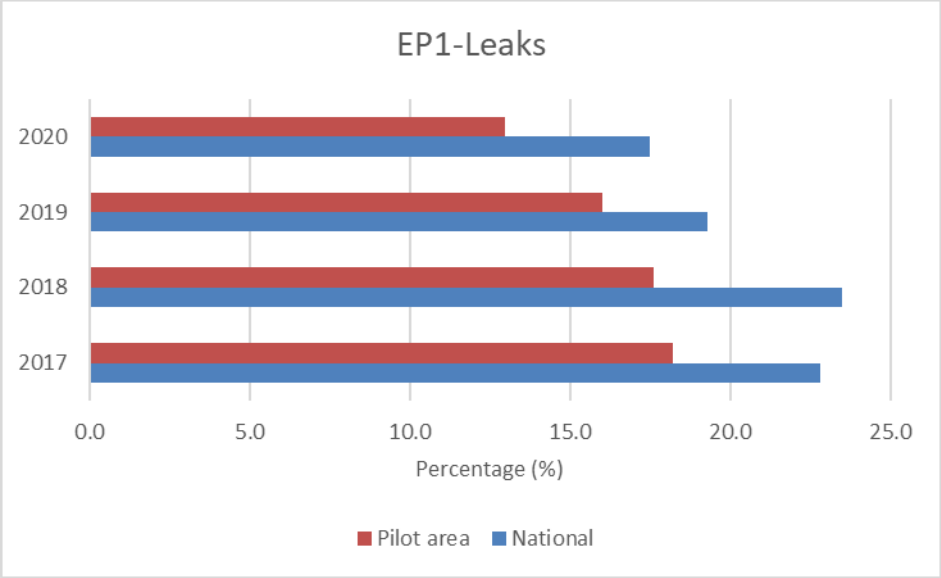

Figure 2. Share of total population living in a dwelling with leaks.

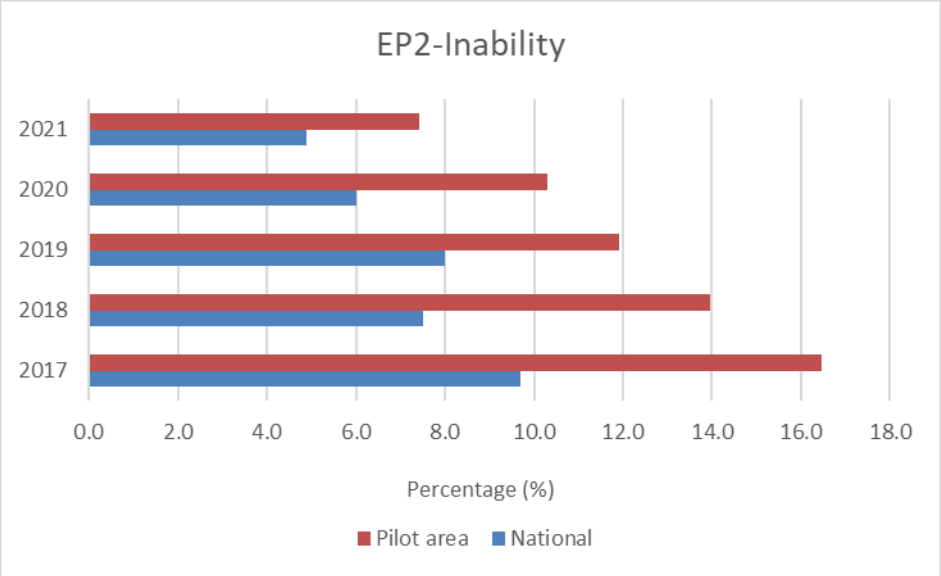

Figure 3. Share of population not able to keep home adequately warm.

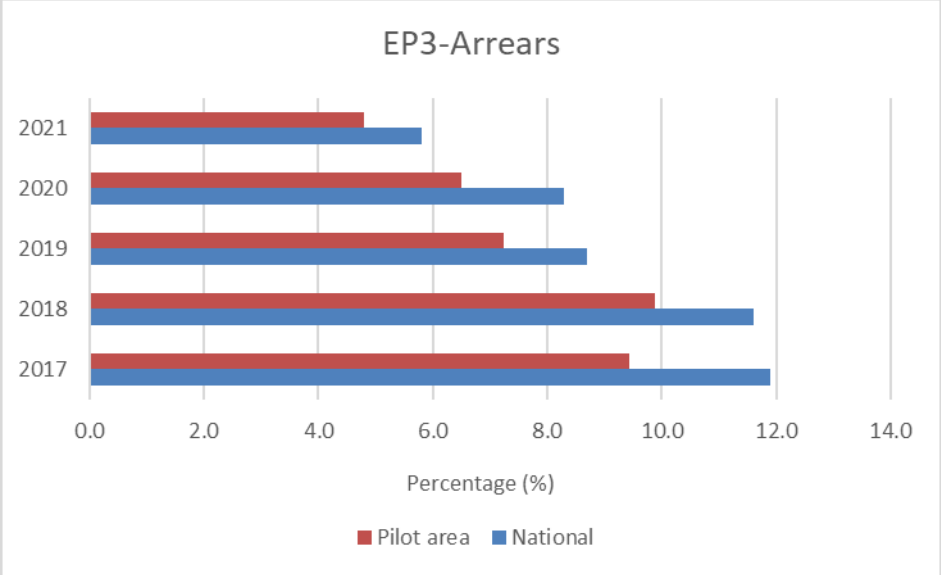

Figure 4. Share of population having arrears on utility bills.

EP4 to EP12 were only examined at the pilot area level, as not being official indicators. Figure 5 reveals that the share of the population that has fallen behind on its utility bills only once decreased from 3.5% in 2018 to 0.9% in 2021. Figure 6 shows that the percentage of the population that has had arrears on their utility bills two or more times is significantly higher than the case of falling behind only once and it decreased from 7% in 2017 to 3.9% in 2021.

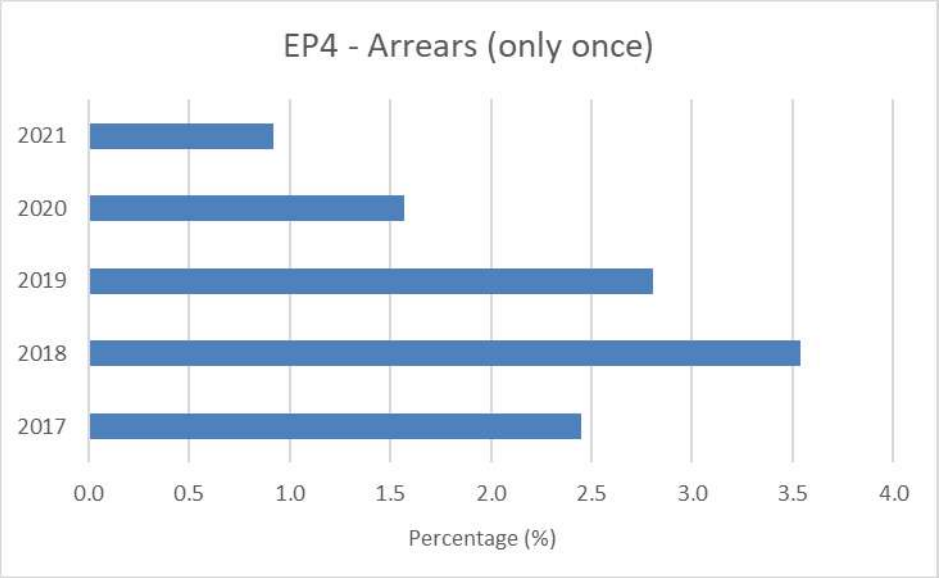

Figure 5. Share of population having arrears on utility bills only once in the past 12 months.

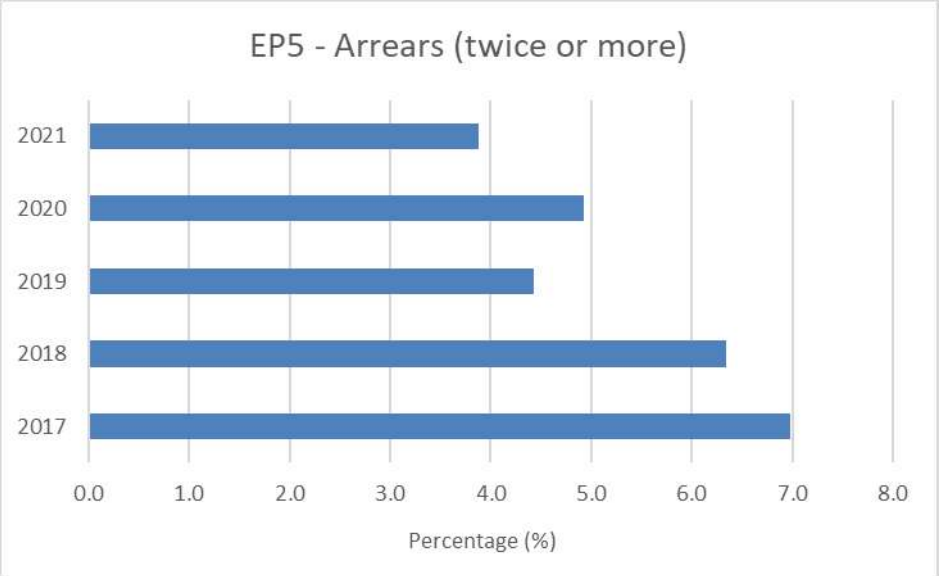

Figure 6. Share of population having arrears on utility bills twice or more in the past 12 months.

The results of the Weighted Composite Indices (WCI1, WCI2, WCI3) reflect the better condition of the energy poverty problem over the years. Indicatively, as regards the WCI1 (Figure 7), the share of the population not experiencing EP issues increased from 65.8% in 2017, to 76.7% in 2020, while the share of the population experiencing severe EP issues (i.e., WCI1 equals to 1) decreased from 1.2% in 2017 to 0.6% in 2020. Similar results derive from Figures 8 and 9, regarding WCI2 and WCI3, respectively.

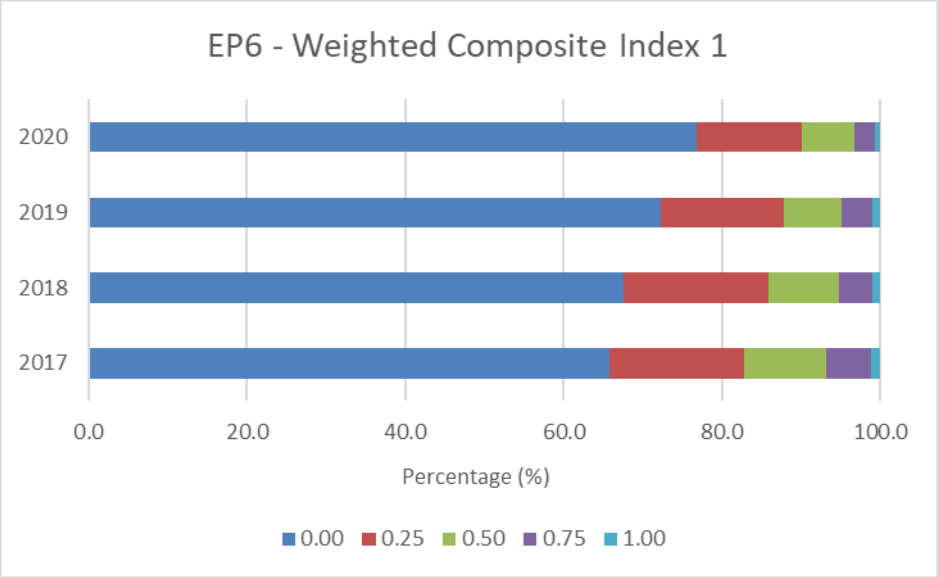

Figure 7. Share of population at EP according to WCI1.

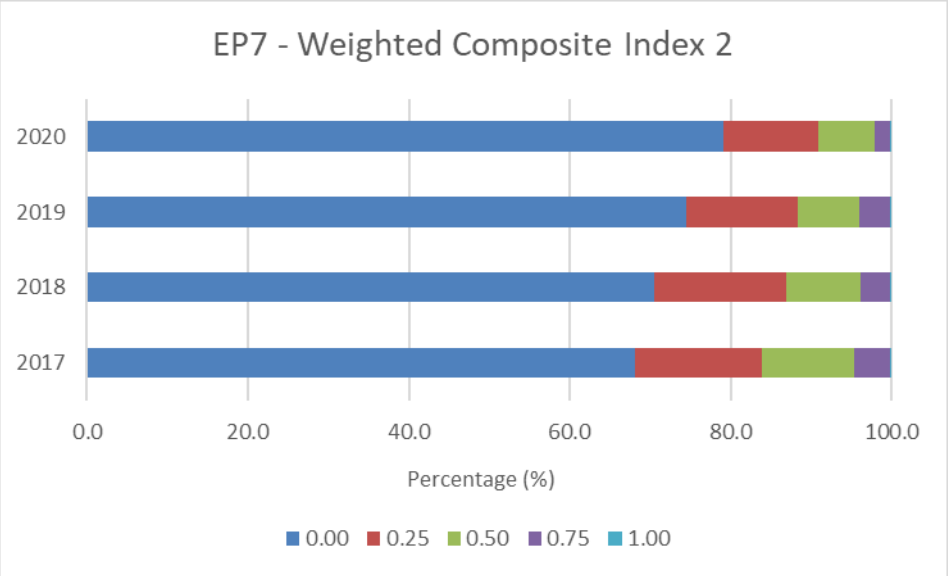

Figure 8. Share of population at EP according to WCI2.

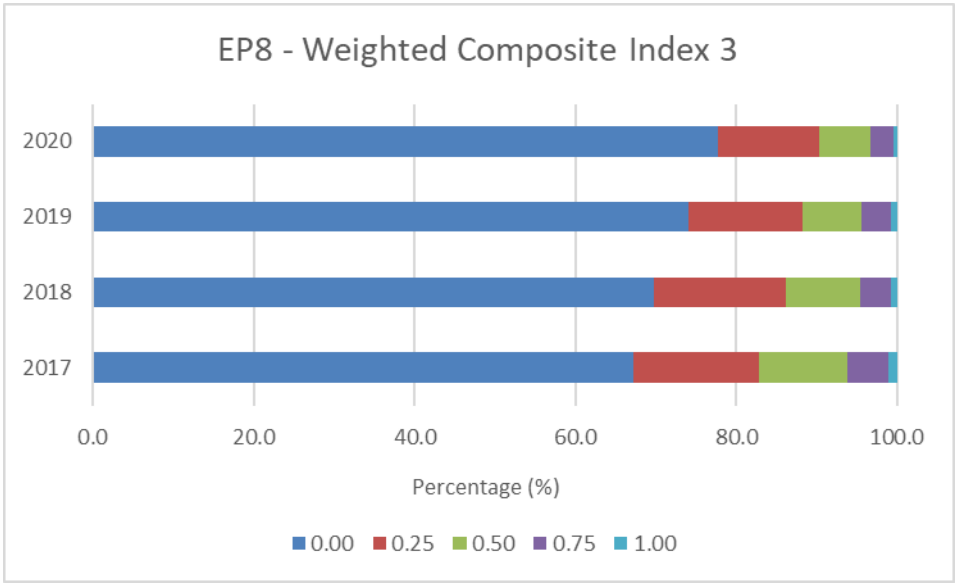

Figure 9. Share of population at EP according to WCI3.

The Simple Composite Indices (SCI1, SCI2 and SCI3) also reveal a better condition of the energy poverty problem over the years. As shown in Figures 10, 11 and 12, the share of the population not experiencing EP issues increased from 2017 to 2020 for all the 3 SCIs, while that experiencing severe EP problems (classes 2 and 3) decreased. Indicatively, as regards the SCI1, the EP rate for class 2 decreased from 7% to 3.8% between 2017 and 2020 (a percentage reduction of 45.7%) and for class 3 from 1.2% to only 0.6% (a percentage reduction of 50%).

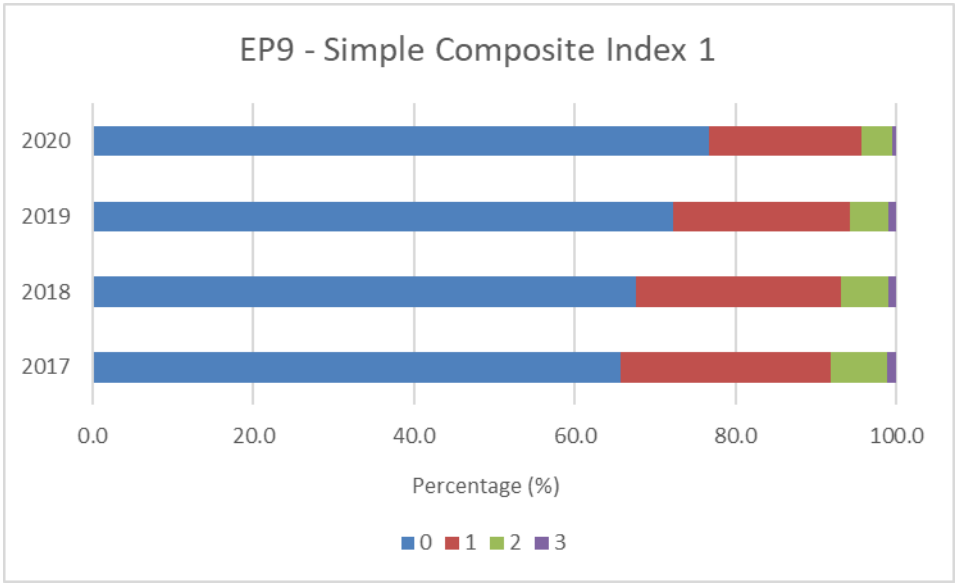

Figure 10. Share of population at EP according to SCI1.

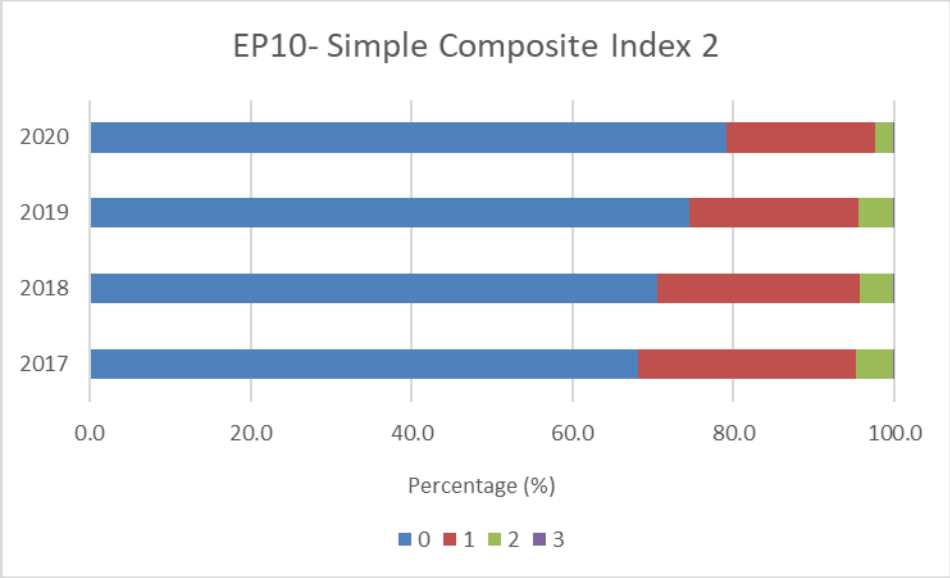

Figure 11. Share of population at EP according to SCI2.

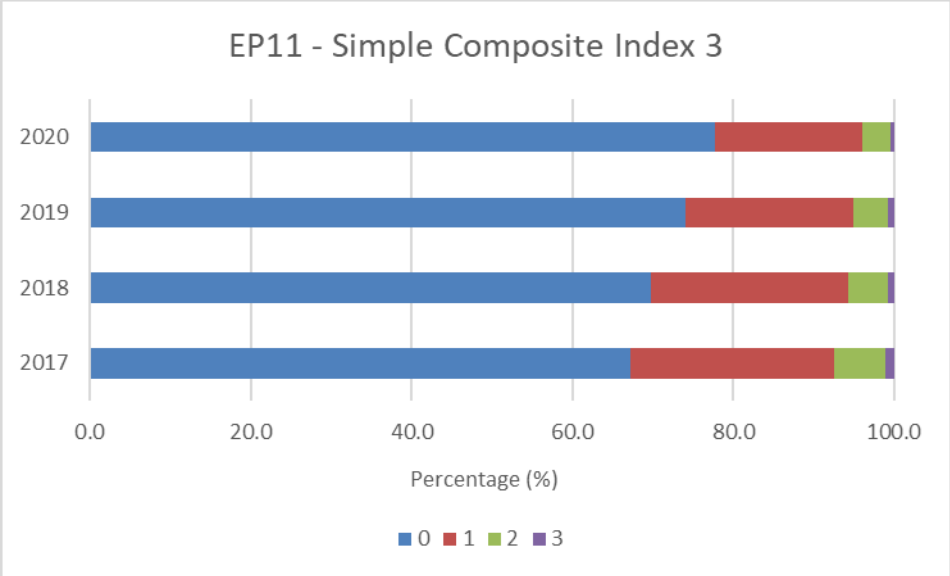

Figure 12. Share of population at EP according to SCI3.

Finally, as shown in Figure 13, the share of the population experiencing any type of EP within the pilot area, i.e., inability to keep home warm, arrears on utility bills or leaks, damp walls/floors/foundation is steadily decreasing over time. This indicator shows high percentages as, practically, all individual EP indicators are taken into consideration.

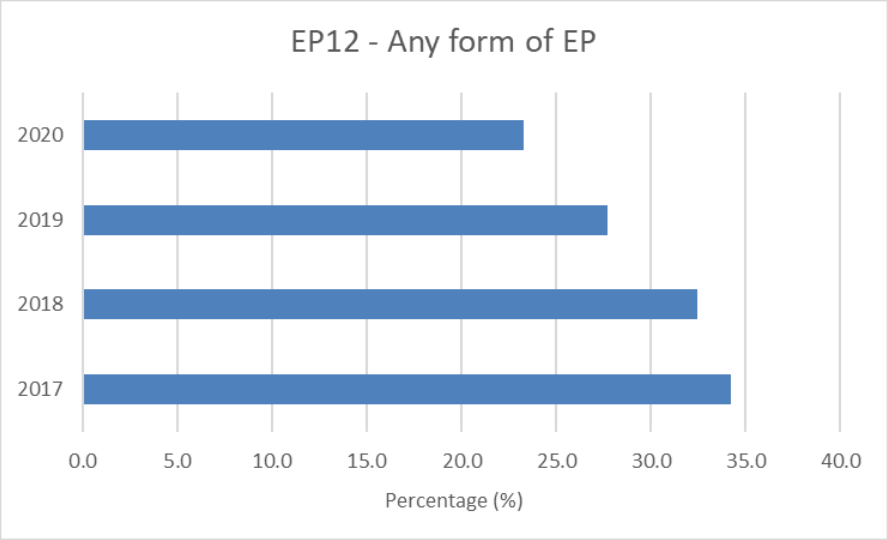

Figure 13. Share of population at EP according to EP12.

Below, certain housing characteristics and living conditions of households are examined in relation to the above investigated indicators, to explore the effect of these characteristics on EP vulnerability in the pilot area.

As shown in Figure 14, households living in large buildings do not experience EP problems (leaks, inability to keep home adequately warm, arrears on utility bills), apparently, due to their higher incomes on average. On the contrary, households living in semi-detached or terraced houses and those living in small buildings face higher problems with leaks, with those living in small buildings facing also the highest difficulty in keeping their apartments adequately warm. Finally, households living in detached houses are the ones that face higher problems with arrears on utility bills.

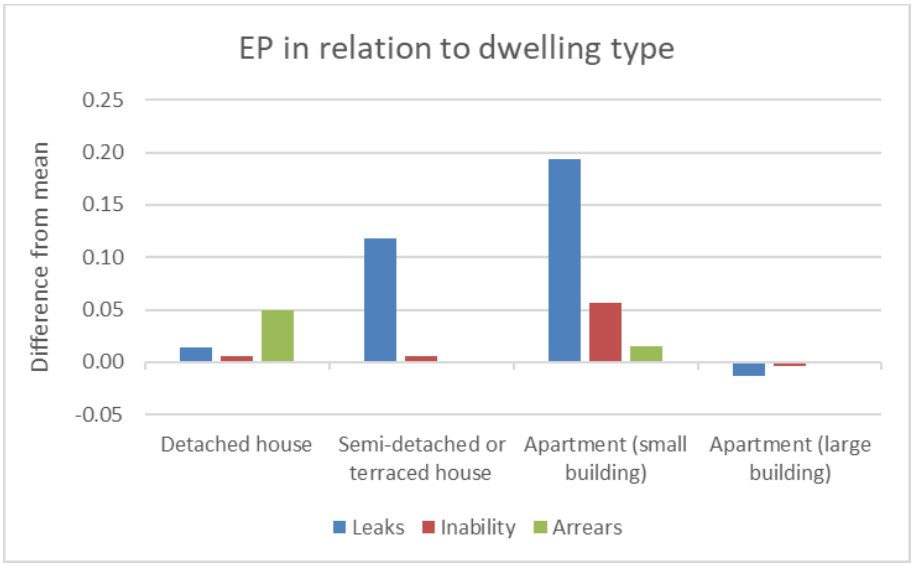

Figure 14. Leaks, inability to keep house warm and arrears on utility bills in relation to dwelling type.

The dwelling size is also related to the three basic EP indicators (leaks, inability to keep home adequately warm, and arrears on utility bills). As shown in Figure 15, households living in houses with one room present the highest EP rates compared to the average rate, followed by those living in 2-rooms houses. On the contrary, households living in larger houses (3, 4, 5 or more rooms) present lower EP rates compared to the average, probably due to the higher incomes of these households. It should be noted, though, that households living in large houses (5 or more rooms) seem to face problems with arrears on their utility bills.

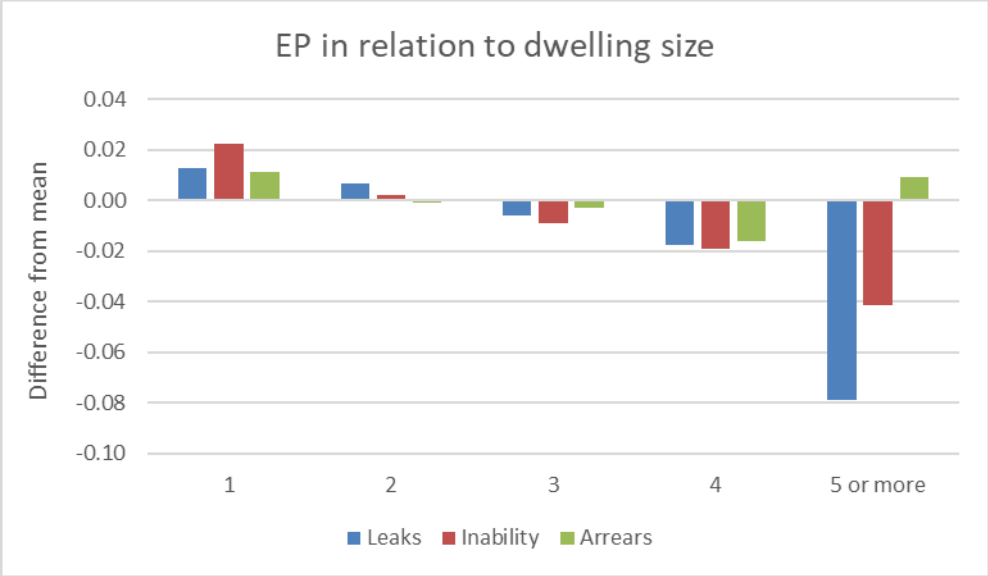

Figure 15. Leaks, inability to keep house warm and arrears on utility bills in relation to dwelling size.

As regards tenure status, tenants who pay rent at reduced rate seem to be more prone to energy poverty, followed by tenants who pay rent at market rate (Figure 16). It is also noteworthy that among all groups, those living at free accommodation status are the most vulnerable ones in terms of keeping their home adequately warm. On the other hand, owners seem to face less EP problems with respect to the average rate.

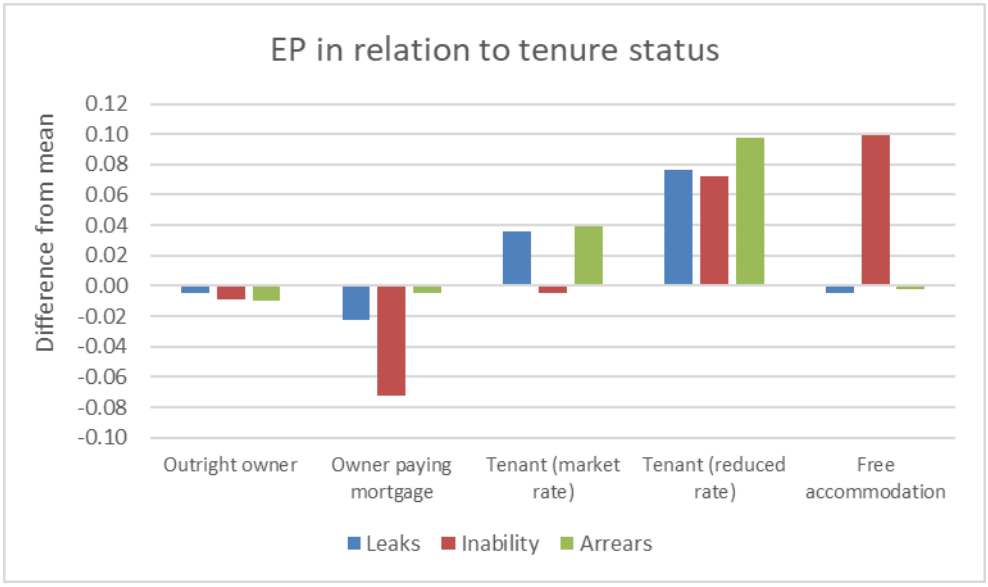

Figure 16. Leaks, inability to keep house warm and arrears on utility bills in relation to tenure status.

The level of difficulty in terms of making ends meet is related to the three EP indicators examined. Specifically, Figure 17 shows that households experiencing great difficulty in making ends meet present higher EP rates of up to 20% versus average rates. On the contrary, households that can easily (fairly easily up to very easily) make ends meet present quite lower EP rates (up to 12%) compared to average rates.

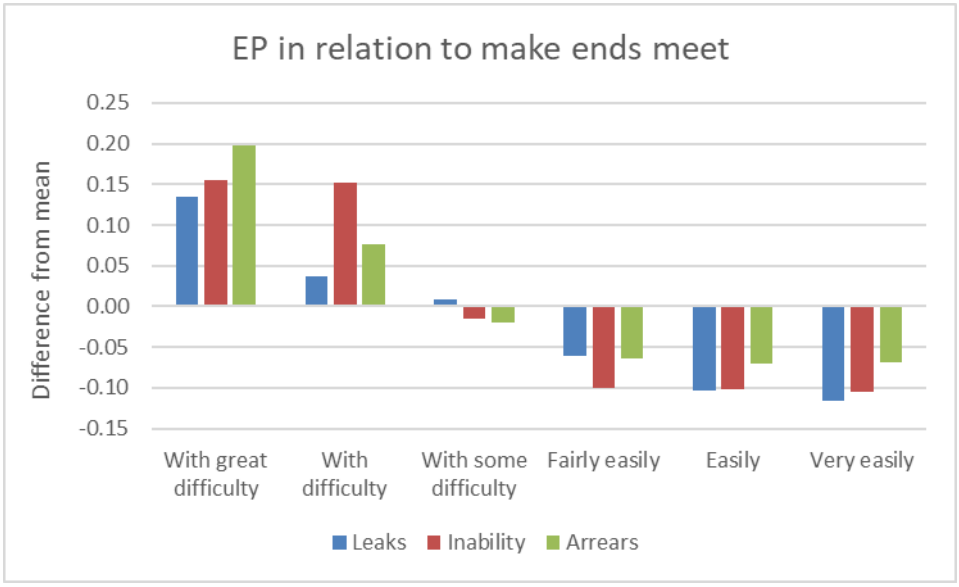

Figure 17. Leaks, inability to keep house warm and arrears on utility bills in relation to the level of difficulty in making ends meet.

Similar trends are observed in the case of complementary EP indicators. Indicatively, households living in small buildings, followed by those living in semi-detached or terraced houses (Figure 18), households living in a one- room home (Figure 19), tenants that pay rent at reduced rate (Figure 20) and households experiencing difficulty to make ends meet (Figure 21) present higher rates of all EP indicators compared to the respective average rates.

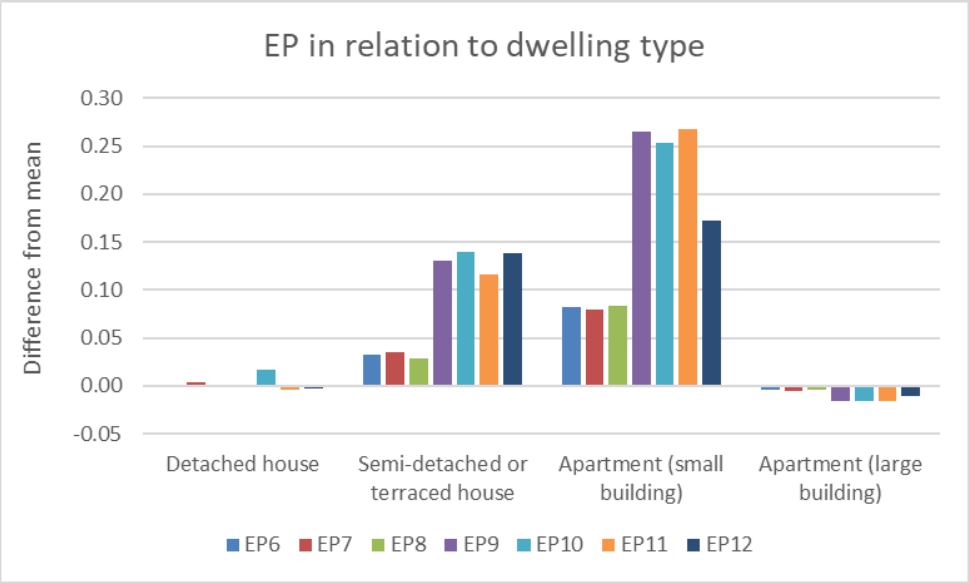

Figure 18. Complementary EP indicators in relation to dwelling type.

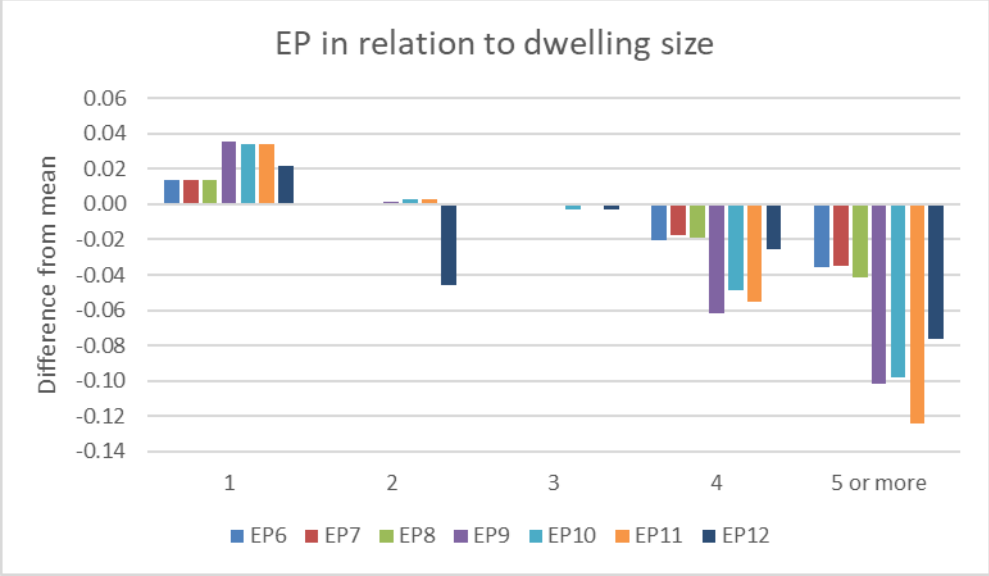

Figure 19. Complementary EP indicators in relation to dwelling size.

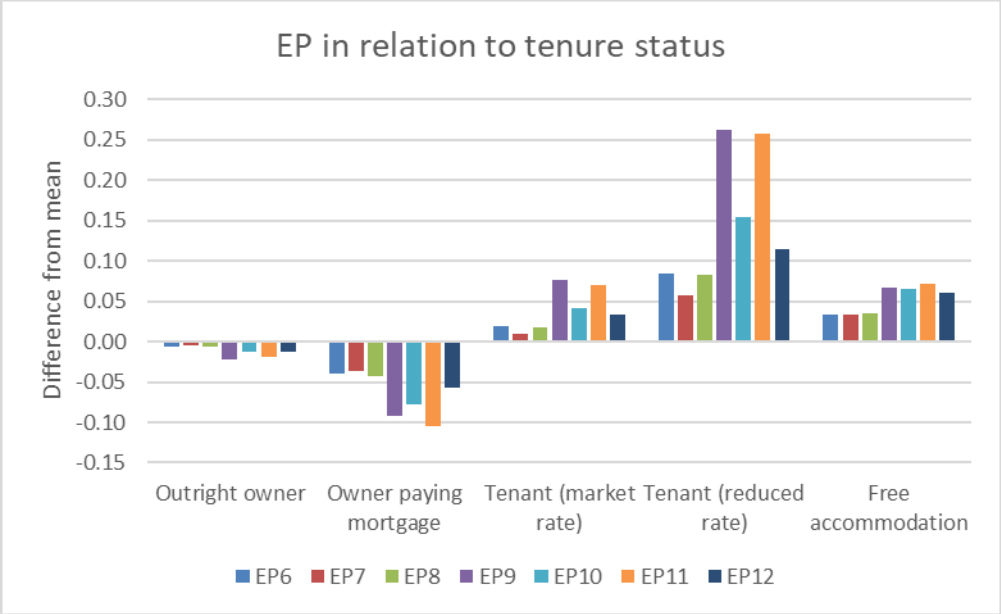

Figure 20. Complementary EP indicators in relation to tenure status.

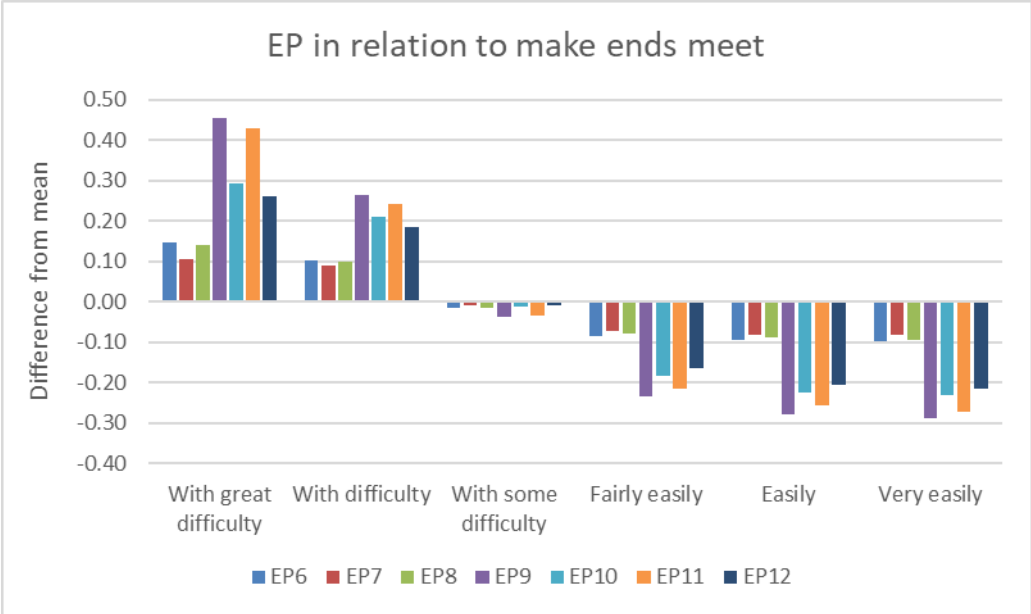

Figure 21. Complementary EP indicators in relation to the level of difficulty in making ends meet.

3 Analysis of the conditions in the pilot area

3.1 Area characteristics

The capital of Latvia, Riga, founded in 1201, is located in the central part of Latvia, on the southern coast of the Gulf of Riga of the Baltic Sea. Although the area of the city of Riga occupies only 0.5% of the total area of Latvia, the city is home to a third of the total population of Latvia, making it the largest city at the level of both Latvia and the Baltic States.

The territory of Riga city municipality is divided into:

- **6 administrative-territorial units**: Centre district, Kurzeme district, Northern district, Vidzeme suburb, Latgale suburb, Zemgale suburb;
- **58 neighbourhoods** (see Figure 22).

Figure 22. Map of Riga neighbourhoods.

Riga has a high share of green areas. According to the Riga Territorial Plan for 2030, the city is characterized by 41% of natural areas, of which 16% of water and 25% of greenery and natural areas. The average monthly outdoor air temperature in Riga is summarised in Figure 23.

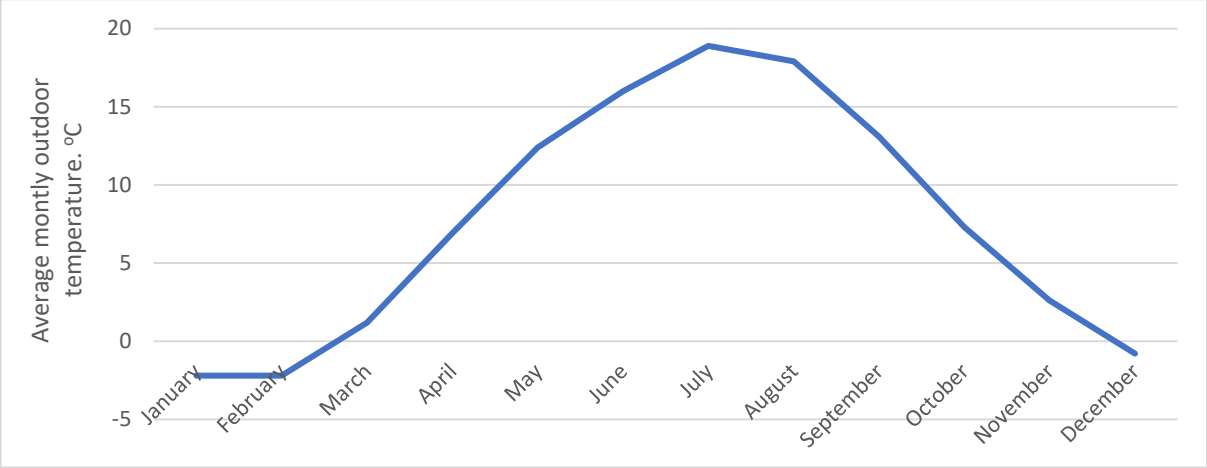

Figure 23. The average monthly outdoor air temperature in Riga.

The coldest months typically are January, February and December. According to the Latvian National Building Code on average, there are 192 heating days, with an average outside air temperature of 1.1°C, which for an indoor air temperature of 20°C, would equate to 3,630 degree-days. The average outside air temperature for the coldest five days in a year is -9.5°C, with absolute minimal temperatures reaching approximately -20°C.

3.2 Population characteristics

Since 1991, Riga, like most areas of Latvia, has seen a gradual decline in the number of inhabitants (i.e., the population has decreased by 32%). This is partly explained by the decrease in birth rates and the resettlement of the population in near proximity to the capital. At the beginning of 2021, the population of Riga city reached 621,120 people.

Riga is characterized by a multinational composition of the population; the city is mostly inhabited by residents of Latvians (47.2% in 2021) and Russians (36% in 2021). In 2020, the largest number of inhabitants is concentrated in the microdistricts of Soviet-era apartment buildings – Purvciems (55,024 inhabitants, 9%), Kengarags (45,783 inhabitants 7%) and Imanta (43,835 inhabitants 7%). The other neighbourhoods are below 4% (see Figure 24).

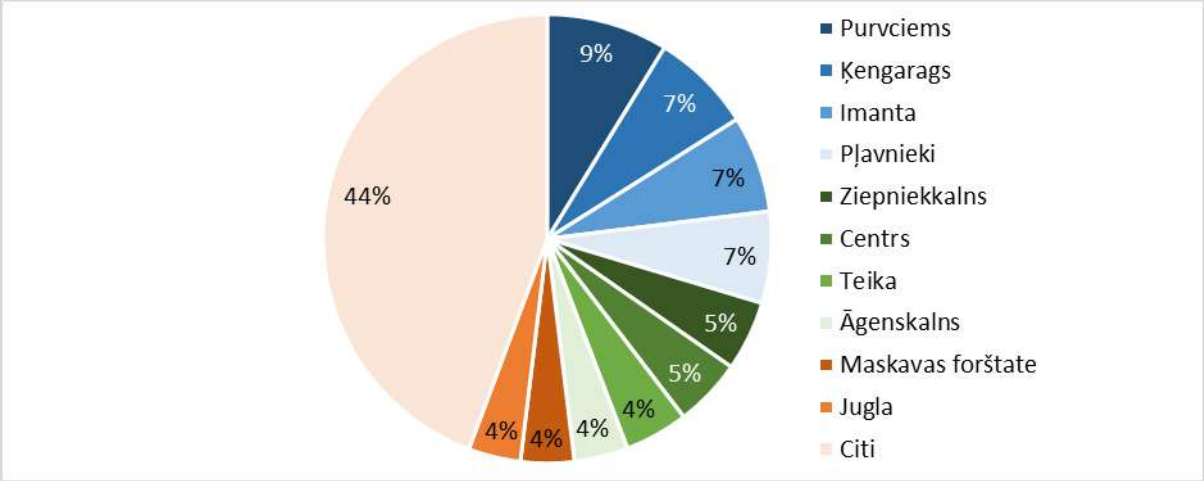

Figure 24. Share of population of Riga neighbourhoods in 2020.

Riga's economy forms an important part of the country's economy, it is justified by the volume of GDP, the number of employees, the number of enterprises, investment volumes, as well as other indicators:

- 341,600 or 34.8% of the total economically active population of Latvia live in Riga;
- A total of 480,100 people are employed in Riga, which is 46% of all employed in Latvia;
- 35.1% of all employed in Riga are residents of Riga.

3.3 Housing characteristics

Three or more apartment buildings are considered to be apartment buildings. In the city of Riga in total, there are 11.7 thousand such buildings, which is 29.7% of the total number of apartment buildings in Latvia. Referring to the data provided by the REA, the total useful area of apartment buildings in Riga is 18,615 thousand m^2, where the average useful area is 1,585 m^2 per building.

Apartment buildings and their quarters are located in different areas of the city of Riga. Based on the years of construction of apartment buildings, which also affect their energy performance requirements, they can be divided into the following groups:

1. Pre-war buildings built until 1945. They are basically located in the Riga City Centre District and the Old Town.
2. Buildings built during soviet occupation (USSR) built between 1946 and 1991, which are mainly located in the peripheral districts of the city of Riga (e.g., Bolderāja, Imanta, Mežciems, Pļavnieki, Purvciems, Ziepniekkalns, Zolitūde, etc.). They account for the largest share of apartment buildings in Riga both in number and area.
3. New buildings built after 1992, which are located in different districts of the city of Riga and are in relatively small numbers.

The largest share of buildings (59%) are buildings that were put into operation in the period up to 1945. Buildings put into operation in the period from 1946 to 1993 have the largest

useful area (56% of the total), that is, buildings built during the USSR. Examples of the buildings are shown in Figure 25.

Figure 25. Examples of multifamily buildings built in time period from 1946 to 1993.

Studies show that the energy efficiency requirements of multi-apartment buildings built during the USSR occupation and up to 2015 do not comply with the requirements of the currently valid Cabinet Regulation No. 280 “Regulations Regarding the Latvian Construction Standard LBN 002-19 "Thermal Engineering of Building Envelopes”. Changes in the regulatory requirements for multi-apartment buildings in relation to specific energy consumption for heating, according to the year of construction of the building, are shown in Table 1. Exceptions in terms of energy performance requirements are specified for buildings that correspond to the status of cultural monuments.

Table 3. Changes in energy efficiency regulatory requirements for multi-apartment buildings.

	1980	1992	2003	2015	2016	2017-2018	2019-2020
	Specific heat consumption for heating, kWh/m2 per year						
New buildings	150-200	100-130	70-90	60-85	≤70	≤60	≤50
Refurbishment and redevelopment	-	-	-	≤90			

Riga has a high share of buildings in need of deep renovation (about 6,000 apartment buildings) and at the same time low activity of renovation of existing buildings. By 2019, only 159 or 1.4% of the total number of apartment buildings in the city of Riga have been renovated in Riga.

Building managers play an important role in promoting the renovation of multi-apartment buildings. Riga has a lot of competition in the house management market, as well as many new companies that are entering. One of the largest management companies is SIA "Rīgas namu managers" (RNP), which manages 4284 residential buildings. In total, more than 170 building management companies and more than 500 apartment owners’ cooperative societies (DzĪKS) are registered in the city of Riga.

4 PESTEL analysis

A PESTEL analysis was conducted so as to identify the most important parameters and the main market barriers and market failures (administrative, financial, technical, awareness and other) in the pilot area.

The PESTEL analysis consisted of the following steps:

- Step 1: Speculate the PESTEL factors
- Step 2: Identify and map all the relevant PESTEL factors
- Step 3: Assess the level of impact of PESTEL factors
- Step 4: Identify opportunities and threats
- Step 5: Select the most effective policies and measures

The PESTEL analysis concluded that the current policy developments at the national and European levels constitute a meaningful driver to foster the energy renovation of the residential buildings in Latvia. More specifically, the ambitious building renovation target within the NECP at the national level for 2030 and the adopted long-term strategy for the renovation of the building stock will enable the implementation of targeted policy measures in the residential sector. The current programme for the renovation of the residential buildings should be considered as the fundamental basis for the implementation of energy efficiency interventions, while the centrally designed and implemented building renovation policies and measures will facilitate the coordinated and more effective implementation of the foreseen policy measures. Finally, the improvement and simplification of the existing renovation programmes are imperative so as to become more effective.

The sufficient availability of lending funds from the banking sector and the imposition of more realistic requirements to provide the necessary lending funds to households are considered the main economic factors for the energy renovation of residential buildings. The high interest rates, the limited access to loans and the difficulty for households to provide their own funds for implementing the required renovation interventions constitute the main barriers hampering the further renovation of the residential buildings. The notable increase in the cost of living and energy expenses due to the energy crisis and the increased levels of energy taxation hinder the implementation of energy efficiency interventions. The uncertainty about the economic development in the future and the lack of stability due to various economic factors pose additional concerns leading to the postponement of the investment decisions. However, the poor technical condition of existing buildings and poor energy efficiency of existing buildings forces homeowners to take more serious action regarding their building renovation. Finally, the materialization of energy efficiency interventions will trigger positive impacts to the Latvian economy due to the considerable growth of the construction sector.

The deterioration of the energy poverty due to the high energy prices and the increased inflation has created significant social problems highlighting the urgent need to address them. Moreover, the low level of awareness and knowledge about energy efficiency issues has been identified as one of the main obstacles. Another major obstacle is the inability of the apartment owners of a MFB to agree on the necessity to implement energy efficiency measures and building renovation.

The building sector is characterised by a considerably high RES and energy efficiency potential contributing to the achievement of environmental targets. The limited environmental restrictions during the renovation and the lack of knowledge for adapting buildings to climate change have been identified as barriers to minimizing the environmental performance of the building sector. Finally, the low resistance and preparedness towards future pandemics and energy crises should be addressed appropriately ensuring the continuous renovation of the residential buildings.

The adoption of the required legislative and regulatory framework for all energy-related issues will facilitate the achievement of the imposed renovation targets along with the implementation of the policy measures as foreseen within the framework of the National Energy and Climate Plan and the long-term strategy for the renovation of the building stock. Finally, the renovation of the buildings should be reinforced with the update, simplification and optimization of the related to the building sector legislative and regulatory framework.

Table 2 presents the factors that affect the preparation of the building renovation roadmap.

Table 4. Identification and assessment of the factors, which affect the building renovation roadmap.

	External factors to consider	Factors affect building renovation roadmaps	Importance to the renovation roadmap (High-medium-low)
Political	*Policy goals/specified national targets (e.g., in energy, environment, regional development)*	Specification of building renovation target within the NATIONAL ENERGY AND CLIMATE PLAN of Latvia till 2030 – renovation of at least 2000 MFBs and 5000 SFBs	High
		Adoption of the long-term strategy for the renovation of the building stock, in which renovation of 4860 MFBs is mentioned.	High
		Development of typological renovation packages for certain building series.	Medium
	Incentives/financial Measures	Implementation of a continuous programme for the renovation of the residential buildings with a guarantee from the national investment bank ALTUM	High
		Centrally designed and implemented building renovation policies and measures	High
		Some municipalities adopt a tax reduction on buildings and land, which have been renovated	Low
	EU directives focused on 2050 Governance structures (e.g., formal or non-formal structures that supports governance	NECP committee and the working group for monitoring the progress of the implemented policies and measures have established, however, no monitoring documents have yet been produced	Medium
		Difficulties in monitoring the progress of the implemented policies and measures aiming at the building renovation	High
	Pending legislation changes	Harmonization of the national legislation with Fit-for-55 packages leading to the adoption of more ambitious energy and climate change targets	High

	External factors to consider	Factors affect building renovation roadmaps	Importance to the renovation roadmap (High-medium-low)
		Changes in legislation aimed at simplifying and streamlining documentation evaluation for renovation projects.	High
	Political stability and renumeration framework	Lack of coordination among the authorities at the different administrative levels	Medium
		Building renovation and building life span have been set as priorities by the majority of political parties.	Medium
Economic	*Availability of lending funds*	Banking sector has sufficient free funds to support building renovation.	High
		Strict requirements for providing lending funds to MFBs, more than 60% of apartment owners have to agree on building renovation.	High
		Lending from the private banking sector is not always available for buildings outside of regional economic centres.	Low
		National investment bank is providing funds for MFB renovation in regions, where private banks are not willing to finance renovation.	High
		Banking sector is adapting different strategies for promoting energy efficiency in the building sector	Medium
		High interest rates due to overall inflation	High
	Capacity of construction and energy sector	Low ability of the construction sector to satisfy the demand for the renovation of the buildings	Medium
		Workforce capacity is not sufficient to substantially increase the renovation rate of buildings with existing technologies.	High
	Competitiveness	Rise in competitiveness has consequently risen at higher rates than the EU average, however, it is still far lower than the EU average.	Low
	Cost of living	Considerable increase in the cost of living due to the energy crisis	High
		High inflation increasing the cost of living	
	Demand for building renovation and energy services	Increased interest in renovating the buildings so as to address the impacts triggered by the energy crisis	High
		Increased demand for building renovation is driving up renovation costs.	High
		Building renovation linked not only to building energy need reduction but also to refurbishment of technical systems and building envelope, which in the majority of the existing buildings is in poor technical condition	High
	Economic development patterns (future trend)	Uncertain economic development patterns	High
		According to Latvian Bank, GDP in 2023 is expected to grow by 1,2% compared to 2022.	Medium
		Inflation is set to reduce to 8,5% in 2023.	Medium
	Economic growth/decline (current status)	Lack of stability. Temporary economic growth after the economic recession and economic decline afterwards due to COVID-19 and the war in Ukraine	High
	Energy expenses	High energy expenses for all end-users due to the energy crisis	High

	External factors to consider	Factors affect building renovation roadmaps	Importance to the renovation roadmap (High-medium-low)
	Energy prices	High energy prices	High
	Energy services companies	Limited activation of energy services companies	Medium
		Energy service companies are seen as middle man, who take part in the achieved energy savings	High
	Interest rates	High interest rates increasing the lending cost	High
	Prevailing economic sectors in terms of GVA with competitive advantages	The construction sector is an important part of Latvia's economy, contributing to 6,8% of the country's GDP.	High
	Skilled energy efficiency professionals	Need to enhance the existing skills of the professionals evaluating and carrying out energy efficiency projects.	Medium
	Split incentives	Multi-owner split incentives have been addressed to foster MFB renovation	Medium
	Unemployment	Unemployment levels are at 6,5%	Low
	Financing renovation interventions	Difficulty for households to provide their own funds for implementing the required renovation interventions	High
		Limited access to loans in regions outside big cities	High
		Household scepticism of additional financial obligations	High
Social	*Energy consumption & production patterns*	Continuous reduction of energy consumption mainly due to external factors, such as economic recession, energy crisis	High
		Energy production from RES is steadily rising year on year basis.	Medium
	Level of awareness on delivered impacts by RES and energy efficiency	Low level of awareness for all end-users, however, the situation is improving.	High
	Social capacity	Different informational spaces for different social and natively speaking groups	High
	Lifestyle factors	Tendency to save energy and reduce energy bills	High
	Demographics	Continuous reduction of the population	Medium
		Continuous ageing of the population	High
	Rates and characteristics of energy poverty in the population	Increase in energy poverty due to the high energy prices	High
		Income level is not keeping up with inflation rates resulting in lower purchasing power.	High
	Rates and characteristics of general poverty in the population	Increase in general poverty due to the increase of inflation and the high energy prices	High
	Tenancy	High number of tenants in MFBs delays communication with apartment owners to decide on building renovation.	Medium
	Resistance to change	Improvement of the willingness to accept changes	Low
	Willingness to accept the implementation energy efficiency interventions	Motivation to renovate building if neighbouring buildings have been renovated	Medium
		If financial incentives are provided, the willingness to implement energy efficiency measures rise.	High
	Role of prosumers	There is no understanding of prosumerism and community-based energy production	Low
Technology	*Automation*	No targeted framework for promoting automation	Low

	External factors to consider	Factors affect building renovation roadmaps	Importance to the renovation roadmap (High-medium-low)
	Innovation	No targeted framework for promoting innovation	High
	Disruptive technologies	No targeted framework for promoting disruptive technologies	High
	Smart city concept	Lack of smart city platforms	Low
		Promotion of smart cities within the carbon-neutral cities concept	Low
	New energy-saving technologies	Limited penetration of new innovative energy-saving technologies	Medium
	Renewables technologies	Majority of MFBs in Riga are connected to the district heating system	Low
	Degree of digitalization of the energy sector	Low digitalization of the energy sector	Medium
	Smart meters deployment	Low deployment of smart meters	Medium
Environment	*Environmental restrictions imposed by in-country*	Limited environmental restrictions during the implementation of renovation activities	Medium
	Adaptation policies	Limited knowledge of adapting buildings to climate change	Medium
	Sustainable energy resources/potential	High energy saving and RES potential	High
		Low efficiency of the existing building stock	High
	Circular economy	There are no initiatives for circular economy at the national level during the renovation of the buildings	Low
	CSR (Corporate social responsibility)	Increasing interest in CSR activities from enterprises	Low
	Future crisis	Low resistance and preparedness towards future pandemics and energy crisis	High
Legal	*Common law*	Revision of national laws to be harmonized with the sustainable goals and the energy and climate targets	High
	Legislative and regulatory framework (e.g., for energy, spatial planning, environment, regional development)	Adoption of the required legislative and regulatory framework for all energy-related issues	High
		Adoption and implementation of the National Energy and Climate Plan and the Long-term Strategy for the Renovation of the Building Stock as the roadmap for 2030	High
		Address the problems that are created by the general assembly hindering the implementation of energy efficiency interventions in multi-apartment buildings	Medium
	Level of compliance with the laws	Need for updating, simplifying and optimizing the legislative and regulatory framework according to NECP	High
	Laws & regulations on permissions and licenses	Adoption of the required laws and regulations on permissions and licenses	High

5 Roadmap

5.1 Methodological approach

The building renovation roadmap resulted from the implementation of a methodological approach, which consisted of four different steps (Figure 26).

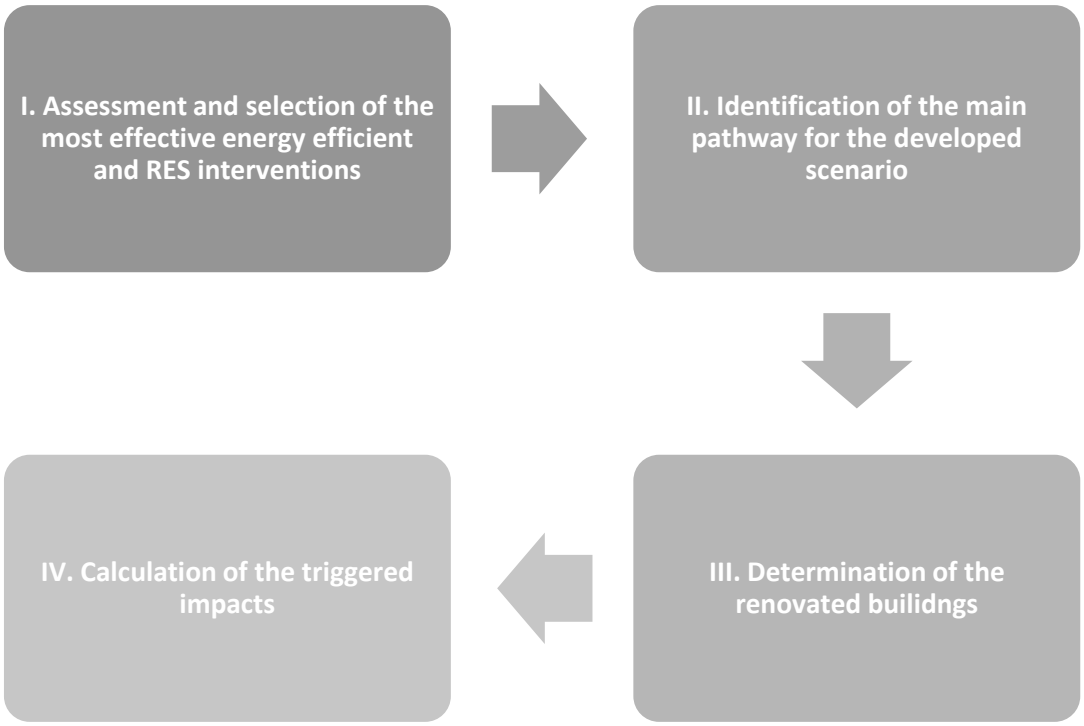

Figure 26. Applied methodological approach.

Firstly, the assessment and selection of the available energy-efficient and RES interventions occurred in Step I. Three different combinations of energy efficient and RES interventions were modelled in order to evaluate their performance and to select the most cost-effective one taking into consideration the cost-effectiveness ratio based on the delivered energy savings and CO_2 emission reduction. The main pathway for combating energy poverty through the renovation of the building stock was identified in Step II taking into account the selected energy efficient and RES interventions within the framework of Step I. Moreover, the number of renovated buildings was calculated for the formulated pathway in Step III, while the utilization of unitary metrics for the most effective energy-efficient and RES interventions led to the quantification of the triggered impacts in Step IV.

5.2 Step I: Assessment and selection of the most effective energy-efficient and RES interventions

Three different combinations of energy efficiency measures were analysed for multi-family buildings as depicted in Figure 27.

More specifically, the following renovation options were modelled and analysed:

- Option 1: Building envelope insulation with mineral wool
- Option 2: Building envelope insulation with EPS
- Option 3: Building envelope insulation with EPS and additional 50mm insulation

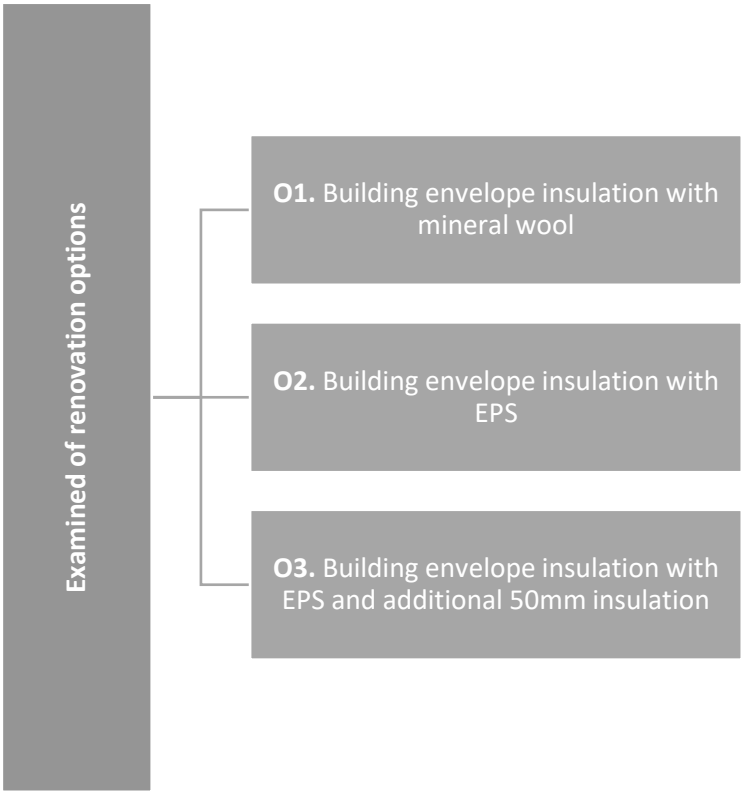

Figure 27. Examined combinations of energy efficient and RES interventions.

The analysis led to the following results as presented in Table 3 in regard to the calculation of two different indicators for their comparative analysis.

Table 5. Results of the examined energy efficiency and RES interventions.

Cost-effectiveness based on the final energy savings (€/kWh)	Multi-family buildings
O1. Building envelope insulation with mineral wool	2.515
O2. Building envelope insulation with EPS	2.329
O3. Building envelope insulation with EPS and an additional 50mm insulation	2.543
Cost-effectiveness based on the CO_2 emission reduction (€/kg CO_2)	**Multi-family buildings**
O1. Building envelope insulation with mineral wool	8.752
O2. Building envelope insulation with EPS	8.097
O3. Building envelope insulation with EPS and an additional 50mm insulation	8.821

The building envelope insulation with EPS has the best performance on the examined indicators, followed by building insulation with mineral wool.

5.3 Step II: Identification of the main pathway for the developed scenario

The main aim of the building renovation roadmap is to accelerate the deep renovation of residential buildings to combat energy poverty. Options one and two seem to be both suitable to achieve a standard that meets or exceeds the targets for deep renovation. The holistic approach of building envelope upgrades also extends the life span of the building because the main building envelope components are fixed and encapsulated to protect them from damages associated with sharp temperature swings and other factors influenced by severe weather conditions.

Holistic and standardized building envelope renovation is possible for buildings built during the soviet occupation, where the building envelope elements were built with standardised technology and materials. Moreover, the majority of these buildings can be categorised into distinct building project types, for which somewhat standardised projects can be developed.

The unitary results of the selected combination of energy efficiency measures of option two are presented in Table 4.

Table 6. Estimated unitary results for the selected energy efficiency measures.

Selected energy efficiency and RES interventions	Multi-family buildings
Final energy savings (kWh/m^2)	77.565
Primary energy savings (kWh/m^2)	69.809
CO_2 emission reduction (kg CO_2/m^2)	22.308
Investment cost (€/m^2)	193.406
Cost savings (€/m^2 a year)	5.324

5.4 Step III: Determination of the renovated buildings totally

The number of renovated buildings was estimated taking into consideration that 20% of the households are affected by the phenomenon of energy poverty as resulted in the presented analysis in Section 2.

Information about the number of new and cumulative renovated buildings is provided in Tables 5 (for the different examined periods) and 6 (cumulative) correspondingly, including the respective trajectory and timeline.

Table 7. Number of new renovated buildings for the examined periods.

Type of households – Roadmap I	2025-2030	2031-2035	2036-2040	2041-2045	2046-2050
Multifamily building renovation rate – buildings	200	897	897	897	897
Multifamily building renovation rate – thousand m^2	548.166	2,458.523	2,458.523	2,458.523	2,458.523
Energy poor households (MFB) – thousand m^2	109.633	491.705	491.705	491.705	491.705

Table 8. Number of cumulatively renovated buildings for the examined periods.

Type of households – Roadmap I	2025-2030	2031-2035	2036-2040	2041-2045	2046-2050
Multifamily building renovation rate – buildings	200	1097	1994	2891	3788
Multifamily building renovation rate – thousand m^2	548.166	3,006.689	5,465.212	7,923.735	10,382.26
Energy-poor households (MFB) – thousand m^2	109.633	601.338	1,093.043	1,584.748	2,076.453

The estimation of the triggered impacts was implemented with the utilization of unitary metrics as resulted from the modelling activity, which was carried out for each examined measure within the framework of Step I (Table 4).

5.5 Step V: Calculation of the triggered impacts for all renovated buildings

The expected cumulative final energy savings, primary energy savings and CO_2 emission reduction (calculated over the examined periods) are presented in Tables 7-9 respectively. The calculation of the delivered impacts was performed using the unitary metrics in Table 4 and the cumulative number of renovated buildings.

Table 9. Resulted cumulative final energy savings (GWh) for the examined periods.

Type of households – Roadmap I	2025-2030	2031-2035	2036-2040	2041-2045	2046-2050
Energy poor households in multifamily buildings	8,504	46,643	84,782	122,921	161,060

Table 10. Resulted cumulative primary energy savings (GWh) for the examined periods.

Type of households – Roadmap I	2025-2030	2031-2035	2036-2040	2041-2045	2046-2050
Energy poor households in multifamily buildings	7,653	41,979	76,304	110,629	144,954

Table 11. Resulted cumulative CO_2 reduction (ktn CO_2) for the examined periods.

Type of households – Roadmap I	2025-2030	2031-2035	2036-2040	2041-2045	2046-2050
Energy poor households in multifamily buildings	2,446	13,415	24,384	35,353	46,322

The expected employment impacts were calculated (Table 10) using the respective results of the COMBI project, i.e. about 15.5 person-years/million EUR invested in building renovations. It should be noted that the calculation was performed based on the number of new renovated buildings.

Table 12. Resulted employment impacts (person-years) for the examined periods.

Type of households – Roadmap I	2025-2030	2031-2035	2036-2040	2041-2045	2046-2050
Energy poor households in multifamily buildings	328.7	1,474.0	1,474.0	1,474.0	1,474.0

Finally, the expected cumulative multiple benefits were calculated (Table 11) assuming that are equal to 0.011 €/kWh of final energy savings (calculated on first-year savings) for the cumulative number of renovated buildings in each examined period.

The multiple benefits were estimated by making use of the monetisation results of COMBI online tool (COMBI project, 2018). More specifically, the following benefits have been considered: Avoided asthma morbidity due to indoor dampness; Avoided electricity generation from combustibles-based power plants; Avoided direct GHG emissions; Avoided premature mortality due to inadequate heating and cooling; Avoided Morbidity due to indoor air pollution; Avoided yearly deaths due to reduced ozone exposure; Avoided yearly deaths due to PM2.5 exposure; Avoided life expectancy loss due to PM2.5. For more details refer to Section 6.2.4 of D2.1 “State-of-the-art review and assessment report”.

Table 13. Resulted cumulative multiple benefits (million €) for the examined periods.

Type of households – Roadmap I	2025-2030	2031-2035	2036-2040	2041-2045	2046-2050
Energy poor households in multifamily buildings	0.092	0.502	0.913	1.324	1.735

6 Policies and measures

The specified renovation targets will be achieved with the design and implementation of 11 policies and measures. It should be mentioned that the described policies and measures are in full alignment with the provisions of the NECP.

Information about the required policies and measures is provided in the following tables.

Name of policy or measure	M1: Supporting the energy upgrade of the building envelope and technical systems
Short description	**M1** will provide a combination of incentives so as to support the energy upgrade of the building envelope in the multifamily residential buildings. The supported interventions will include both the insulation of the building envelope and the upgrade of the technical systems to foster deep renovation and take a holistic approach to building component upgrades. The provision of subsidies is considered the most effective means of economic support covering partly the investment cost. The subsidy rate should be decided so as to increase the private leverage taking into consideration the capability of the involved end-users to provide their own funds. Moreover, the subsidy rates can be considerably higher for the case of energy-poor households covering the investment gap. Additional financial and fiscal measures will be initiated, such as the adoption of targeted tax deductions, credit lines and soft-interest loans in case the contribution of the planned subsidies is not sufficient. Targeted incentives will be designed for the households that dwell in multi-family buildings in the case that all of them participate in the measure.
Quantified objective	Renovation of the residential buildings
Type of policy or measure	Economic measure
Planned budget and funding sources	Public and private funds
Entities responsible for implementing the policy	Ministry of Economics Ministry of Climate and Energy
Affected roadmaps	Roadmap I
Number of affected households	10.963 owner-occupied apartments (MFB)
Expected impact in relation to the specified targets	Final energy savings: 8,504 GWh Primary energy savings: 7,653 GWh CO_2 emission reduction: 2,446 ktn
Status of implementation	Existing

Name of policy or measure	M1: Supporting the energy upgrade of the building envelope and technical systems
Date of entry into force	2022
Implementation period	2022-2026

Name of policy or measure	M2: Enhancing the role of the energy performance certificates
Short description	**M2** foresees the reinforcement of the role of energy performance certificates of buildings, while they will be accompanied by the renovation passports providing recommendations for the most cost-effective energy rehabilitation measures. The renovation passports will describe a sequence of renovation steps so as to transform the building into a zero-emission building, estimate the expected benefits in terms of energy savings, savings on energy bills and operational greenhouse emission reductions as well as wider benefits related to health and comfort and the improved adaptive capacity of the building to climate change and contain information about potential financial and technical support. Moreover, the framework of the renovation passports will be expanded so as to cover also relevant aspects of the phenomenon of energy poverty. Finally, the existing system for the permanent monitoring and control of the energy performance of building certificates will be improved covering also the issued renovation passports.
Quantified objective	Awareness-raising for homeowners related to the building renovation
Type of policy or measure	Regulatory measure
Planned budget and funding sources	Public funds
Entities responsible for implementing the policy	Ministry of Economics Ministry of Climate and Energy
Affected roadmaps	Roadmap I
Number of affected households	10.963 owner-occupied apartments (MFB)
Expected impact in relation to the specified targets	Contribution to the expected impacts triggered by M1
Status of implementation	Planned
Date of entry into force	2025
Implementation period	2025-2026

Name of policy or measure	M3: Overcoming split incentive barrier
Short description	**M3** will remove the potential regulatory and non-regulatory barriers to energy efficiency, without prejudice to the basic principles of the property and tenancy law regarding the split of incentives between the landlord and the tenant of a building or among landlords. Targeted measures will be initiated so as to ensure that the involved parties will not be deterred from making efficiency-improving investments that they would otherwise have made due to the fact that they will not individually obtain the full benefits or by the absence of rules for dividing the costs and benefits between them. The launched measures may include indicatively the simplification of the decision-making processes in multi-owner properties, the provision of incentives both to landlords and tenants, the repeal or amendment of legal or regulatory provisions, the adoption of guidelines and interpretative communications and the simplification of the required administrative procedures.
Quantified objective	Renovation of the partially private-rented residential buildings
Type of policy or measure	Regulatory and economic measure
Planned budget and funding sources	Public and private funds
Entities responsible for implementing the policy	Ministry of Economics Ministry of Climate and Energy Riga Municipality
Affected roadmaps	Roadmap I
Number of affected households	10.963 owner-occupied apartments (MFB)
Expected impact in relation to the specified targets	Contribution to the expected impacts triggered by M1
Status of implementation	Planned
Date of entry into force	2025
Implementation period	2025-2050

Name of policy or measure	M4: Promoting energy services and energy performance contracts
Short description	**M4** will promote energy services in the residential buildings through a holistic framework both for removing the potential barriers and launching targeted financing programs for the case of energy-poor households. Firstly, the existing standard contracts will be promoted, while targeted guidelines will be developed in order to facilitate the design and

Name of policy or measure	M4: Promoting energy services and energy performance contracts
	implementation of energy efficiency projects through Energy Performance Contracts. Moreover, the conduction of technical training programmes and the provision of technical assistance will familiarize the involved parties leading to successful case studies. Specialized financing mechanisms will be applied, such as the provision of low-interest loans or guarantees to energy service providers in order to facilitate the smoot access to financing. Finally, targeted pilot projects will be designed so as to promote energy performance contracts in the dwellings of energy-poor households.
Quantified objective	Renovation of the residential buildings
Type of policy or measure	Economic measure
Planned budget and funding sources	Private funds
Entities responsible for implementing the policy	Ministry of Economics Ministry of Climate and Energy
Affected roadmaps	Roadmap I
Number of affected households	10.963 owner-occupied apartments (MFB)
Expected impact in relation to the specified targets	Contribution to the expected impacts triggered by M1
Status of implementation	Planned
Date of entry into force	2030
Implementation period	2030-2050

Name of policy or measure	M5: Supporting the renewable and the citizen energy communities
Short description	**M5** will strengthen the role and operation of both the renewable energy communities and the citizen energy communities through the design and implementation of specialized financial instruments. Specifically, dedicated fiscal and economic incentives will be provided so as to foster both the further deployment of renewable energy sources and the materialization of energy efficiency projects in residential buildings through the application of new business models.
Quantified objective	Renovation of the residential buildings
Type of policy or measure	Economic measure
Planned budget and funding sources	Public and private funds
Entities responsible for implementing the policy	Ministry of Economics Ministry of Climate and Energy

Name of policy or measure	M5: Supporting the renewable and the citizen energy communities
	Riga Municipality
Affected roadmaps	Roadmap I
Number of affected households	10.963 owner-occupied apartments (MFB)
Expected impact in relation to the specified targets	Contribution to the expected impacts triggered by M1
Status of implementation	Planned
Date of entry into force	2025
Implementation period	2025-2050

Name of policy or measure	M6: Organizing information and training activities
Short description	**M6** will promote the conduction of awareness-raising and dissemination activities in all final energy consumption sectors with a focus on households. Specialised awareness-raising and dissemination activities will be organised both for the consumers and the involved engineers. Moreover, the development of databases with information about the building stock and the implemented energy efficiency interventions and voluntary certification schemes of ecological, green and sustainable buildings can improve the current level of knowledge and awareness. Finally, the concept of carbon footprint and the impact of energy efficiency measures throughout the entire life cycle of the promoted technologies and equipment should be promoted to familiarize the involved stakeholders with the full impact of energy efficiency.
Quantified objective	Awareness-raising of homeowners related to the building renovation
Type of policy or measure	Awareness-raising measure
Planned budget and funding sources	Public funds
Entities responsible for implementing the policy	Ministry of Economics Ministry of Climate and Energy Riga Municipality
Affected roadmaps	Roadmap I
Number of affected households	10.963 owner-occupied apartments (MFB)
Expected impact in relation to the specified targets	Contribution to the expected impacts triggered by M1
Status of implementation	Planned
Date of entry into force	2025
Implementation period	2025-2027

Name of policy or measure	M7: Establishing one-stop shops
Short description	**M7** will aim at the establishment of one-stop shops in order to support energy-poor households with information, advice and financing during the renovation of their buildings. Different business models will be utilised to provide different services such as indicatively: • Facilitation model: (e.g. reinforce awareness about energy renovation benefits, inform about the optimal renovation works, advice for the different steps etc). • Coordination model: (e.g. undertake the coordination of the involved market actors without having responsibility for the outcomes of the renovation nor supporting them to all renovation steps). • All-inclusive model: (e.g. provide full renovation packages undertaking the responsibility for the expected outcomes and supporting them to all renovation steps). The one-stop shops will facilitate also the provision of financing through different options such as the provision of products negotiated with partner technology suppliers and service providers, the development of local incentive schemes and the provision of their own financial products.
Quantified objective	Awareness-raising for homeowners related to the building renovation and provision of technical assistance
Type of policy or measure	Awareness-raising measure
Planned budget and funding sources	Public funds
Entities responsible for implementing the policy	Ministry of Economics Ministry of Climate and Energy Riga Municipality
Affected roadmaps	Roadmap I
Number of affected households	10.963 owner-occupied apartments (MFB)
Expected impact in relation to the specified targets	Contribution to the expected impacts triggered by M1
Status of implementation	Existing
Date of entry into force	2023
Implementation period	2023-2050

Name of policy or measure	M8: Developing a scheme for the qualification, accreditation and certification of energy efficiency professionals
Short description	**M8** will aim at the improvement of the existing and, if necessary, establishment of new qualification, accreditation, or certification schemes for all energy efficiency professionals (e.g. providers of energy services, energy advisors, energy managers, responsible engineers of the energy efficiency of buildings and installers of energy related budling elements that are related to the improvement of the energy performance of a building, developers of design and technical documentation). Specialized training programs will be organized, tools will be developed and technical support will be provided within the framework of the current measure. It should be noted that the measure will focus also on the RES professionals. Finally, it will be examined the expansion of the measure so as to cover the accreditation and certification of the energy efficiency equipment and technologies.
Quantified objective	Awareness-raising for issues related to the building renovation
Type of policy or measure	Regulatory and awareness-raising measure
Planned budget and funding sources	Public funds
Entities responsible for implementing the policy	Ministry of Economics
Affected roadmaps	Roadmap I
Number of affected households	10.963 owner-occupied apartments (MFB)
Expected impact in relation to the specified targets	Contribution to the expected impacts triggered by M1
Status of implementation	Planned
Date of entry into force	2025
Implementation period	2025-2050

Name of policy or measure	M9: Promoting energy audits in households
Short description	**M9** will support financially the conduction of energy audits. More specifically, a pilot program will be launched for the residential buildings covering the implementation cost in order to increase their awareness and to promote their further conduction according to the provisions of the EED. Furthermore, the derived recommendations can be supported through the provision of financial aid.
Quantified objective	Awareness-raising for homeowners related to the building renovation

Name of policy or measure	M9: Promoting energy audits in households
Type of policy or measure	Awareness-raising measure
Planned budget and funding sources	Public funds
Entities responsible for implementing the policy	Riga Municipality
Affected roadmaps	Roadmap I
Number of affected households	10.963 owner-occupied apartments (MFB)
Expected impact in relation to the specified targets	Contribution to the expected impacts triggered by M1
Status of implementation	Existing
Date of entry into force	2023
Implementation period	2023-2027

Name of policy or measure	M10: Strengthening the technical and administrative capacity of the involved policy makers
Short description	**M10** will reinforce on continuous basis the technical and administrative capacity of the involved policy makers in order to facilitate the effective design, implementation, monitoring and evaluation of the energy efficiency measures. Specialized trainings will be organized and sophisticated tools and materials will be prepared ensuring that the existing level of knowledge and the required skills are sufficient. Training can include requirements for the preparation of project/technical documentation in order to increase the quality and the utilization of the projects for the deep renovation of the buildings, but also preparation of technical documentation and design brief for their implementation. Finally, tools will be further improved and, when needed, developed for monitoring the achievement of the established targets and the performance of the implemented policies and measures.
Quantified objective	Awareness-raising for issues related to the building renovation
Type of policy or measure	Awareness-raising measure
Planned budget and funding sources	Public funds
Entities responsible for implementing the policy	Ministry of Economics Ministry of Climate and Energy
Affected roadmaps	Roadmap I
Number of affected households	10.963 owner-occupied apartments (MFB)
Expected impact in relation to the specified targets	Contribution to the expected impacts triggered by M1

Name of policy or measure	M10: Strengthening the technical and administrative capacity of the involved policy makers
Status of implementation	Planned
Date of entry into force	2025
Implementation period	2025-2035

Name of policy or measure	M11: Fostering the implementation of innovative financing mechanisms
Short description	**M11** will foster the implementation of innovative financing mechanisms, which will facilitate the implementation of the renovation roadmap. Firstly, the main challenges, which are derived by the design and implementation of the envisaged financial measures such as the maximization of the expected leverage, the most cost-effective exploitation of the available fund, the adoption of innovative financing tools and the active mobilization of the domestic financial sector, will be addressed. All the available funds will be mobilized at national and EU levels. The effective coordination of the available financial stream is essential for the effective implementation of the planned financial measures. Moreover, the provision of technical assistance will be foreseen for facilitating the financing of the energy efficiency projects. Moreover, the bankability of the energy efficiency projects will be improved with the utilization of specialized tools and methodologies so as to minimize the existing levels of risk. The implementation of a quality assurance scheme and the establishment of a methodological approach for the standardization of the different steps during the evaluation of energy efficiency projects will facilitate the de-risking of the energy efficiency investments. The involvement of the banking sector is essential, while the design of new financial products specifically dedicated to the financing of the energy efficient projects will facilitate the financing of the energy efficiency projects. Towards this direction, specialized training will be organized in order to achieve the above-mentioned objectives. Finally, the foreseen market-based instruments will be utilized in order to accelerate the renovation investments in the residential buildings. More specifically, the obligated parties within the framework of the Energy Efficiency Obligation Scheme will be incentivized so as to focus on households, while the adoption of the legislative

Name of policy or measure	M11: Fostering the implementation of innovative financing mechanisms
	framework for on-bill financing will provide an alternative option for repaying the foreseen investments.
Quantified objective	Awareness-raising for homeowners related to the building renovation
Type of policy or measure	Regulatory and awareness-raising measure
Planned budget and funding sources	Public funds
Entities responsible for implementing the policy	Ministry of Economics Ministry of Climate and Energy
Affected roadmaps	Roadmap I
Number of affected households	10.963 owner-occupied apartments (MFB)
Expected impact in relation to the specified targets	Contribution to the expected impacts triggered by M1
Status of implementation	Planned
Date of entry into force	2025
Implementation period	2025-2050

7 Investment needs

The investment needs, which are required for the implementation of the building renovation roadmap, are presented in Tables 12 (for the examined periods) and 13 (cumulatively) both for the case of the new and cumulative ones.

Table 14. Required new investments (million €) for the examined periods.

Type of households – Roadmap I	2025-2030	2031-2035	2036-2040	2041-2045	2046-2050
Energy-poor households in multifamily buildings	21	95	95	95	95

Table 15. Required cumulative investments (million €) for the examined periods.

Type of households – Roadmap I	2025-2030	2031-2035	2036-2040	2041-2045	2046-2050
Energy-poor households in multifamily buildings	21	116	211	306	402

The allocation of the total investments to public and private investments is presented in Table 14.

The allocation was performed assuming that the energy-poor households can be divided into three different categories with different capabilities to contribute with their own funds to the planned investments. More specifically, the following assumptions were made:

- Category I: 80% of the targeted energy-poor households will receive public aid equal to 50% of the foreseen investment cost, excl. VAT.
- Category II: 20% of the targeted households will receive public aid equal to 90% of the foreseen investment cost, excl. VAT.

Table 16. Allocation of the total investments to public and private investments (million €).

Roadmap	Energy poor households	Share	Public funds	Private funds	Total
Energy-poor households in multifamily buildings	**Category I**	80%	160.5	160.5	321
	Category II	20%	72	8	80
	Total	**100%**	**232.5**	**168.5**	**401**

8 Renovations triggered by REVERTER

REVERTER is expected to contribute to the renovation of multifamily buildings in the period during the project implementation phase (3 MFBs) and five years after the completion of the project (10 MFBs) through the establishment and operation of the physical and digital one-stop shops, visits to homes of energy-poor households by REVERTER Ambassadors who will inform them about energy renovation issues and the awareness-raising and training activities in order to reinforce the existing level of knowledge of the energy poor households and their neighbours who are living in the same MFB and who are also in risk of energy poverty due to poor technical condition of the building they inhabit. According to the initial estimates described in Section 3 "Impact calculation table" of D1.4 "Extract of the project data from the LIFE KPI webtool", approximately 5,700 households in Riga will be reached through information campaigns, home visits and social engagement events. Of these households, it is estimated that around 670 will visit the physical and digital one-stop shops and around 50%, i.e. 334 households, will express interest in upgrading their home in the next 5 years. The contribution of the REVERTER project is summarised in Table 15, while the allocation of the total investments to public and private investments triggered by the REVERTER project is presented in Table 16.

Table 15. Contribution of the REVERTER project to the implementation of the specific roadmap for the renovation of MFBs during the implementation of the project and five years after the end of the project.

Impacts	Energy poor households– Multi-family houses-Apartments (MFB)
Number of new renovated buildings	13
Resulted cumulative final energy savings (GWh)	0.55
Resulted cumulative primary energy savings (GWh)	0.49
Resulted cumulative CO_2 reduction (ktn CO_2)	0.16
Resulted employment impacts (person-years)	21.39
Resulted cumulative multiple benefits (million €)	0.006
Required new investments (million €)	1.38

Table 16. Allocation of the total investments to public and private investments triggered by REVERTER project (million €) in the period 2025-2030.

Period	Roadmap	Energy poor households	Share	Public funds	Private (own) funds	Total
2025-2030	**Energy poor households Multi-family houses-Apartments (MFB)**	**Category I**	80%	0.55	0.55	1.10
		Category II	20%	0.25	0.03	0.28
		Total	**100%**	0.80	0.58	1.38

9 Monitoring and evaluation framework

A holistic monitoring and evaluation framework will be established to monitor and assess the implementation of the building renovation roadmap and the realization of the planned investments.

The proposed monitoring and evaluation mechanism consists of seven different sub-mechanisms, which are related either directly or indirectly (coordination, monitoring, measurement, data collection, control and verification, reporting and evaluation mechanisms) as depicted in Figure 28.

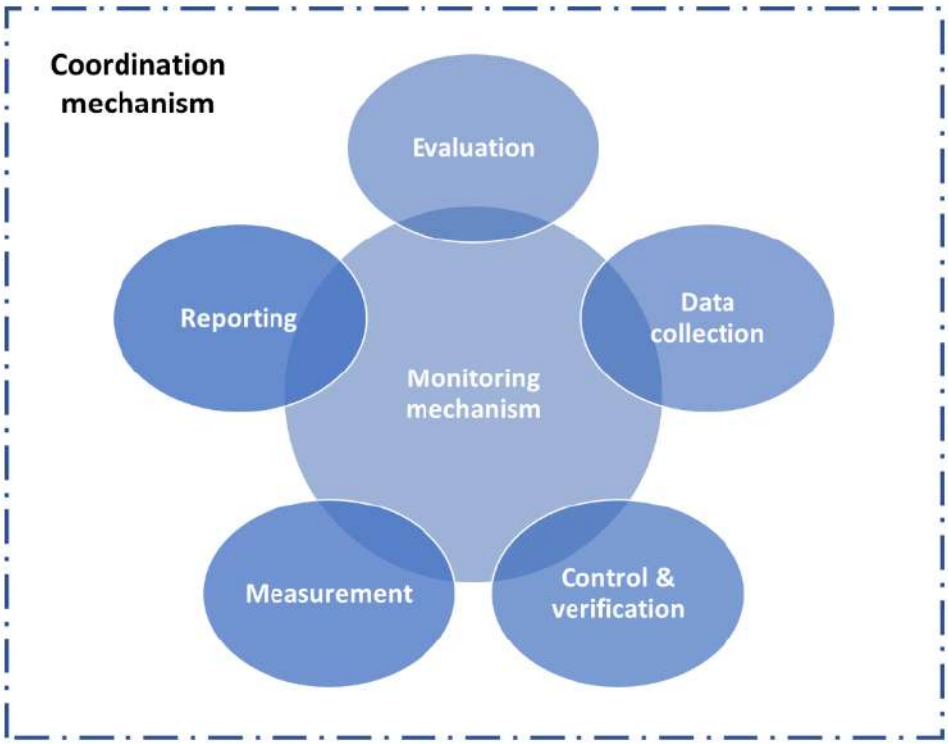

Figure 28. Overview of the sub-mechanisms within the established monitoring and evaluation framework.

The role of the coordination sub-mechanism is considered the most important one, as it will facilitate the efficient cooperation and implementation of the remaining six sub-mechanisms, ensure the coherence of the monitoring and evaluation mechanism with the energy efficiency and RES investments and create the appropriate conditions of commitment and trust among the involved authorities and bodies.

The coordination sub-mechanism should be developed to facilitate the vertical and horizontal coordination of the planned investments. Vertical coordination ensures effective communication and administration among the different governmental levels, namely national, regional and local levels for designing and implementing energy efficiency policies and/or concrete measures. Horizontal coordination enables the effective communication and administration of the different energy efficiency measures, schemes or programmes at the same level.

The monitoring sub-mechanism aims at the continuous monitoring of the implemented energy efficiency and RES investments and the delivered impacts so as to initiate the appropriate measures in the case that the progress is not assessed as satisfactory and according to the roadmap. The monitoring sub-mechanism should be based on the combination of top-down and bottom-up

monitoring, which is recommended to be implemented through the development and operation of an IT-platform. The top-down monitoring will be carried out with the monitoring of specific statistical data at national and sectoral levels about the evolution of both final energy consumption and energy poverty. Simultaneously, the framework for bottom-up monitoring should be established for collecting information on the number of renovated buildings. It should be pinpointed that the introduction of bottom-up monitoring affects the implementation of the measurement, control, verification and data collection procedures.

The development of the measurement sub-mechanism should be implemented taking into consideration the provisions of Annex V of the Directive 2023/1791/EE. Specifically, the calculation of the achieved energy savings should be conducted through the utilization of five different calculation methods (deemed savings, metered savings, scaled savings, surveyed savings and savings of people affected by energy poverty, vulnerable customers, people in low-income households and, where applicable, people living in social housing based on engineering estimates using standardized occupancy and thermal comfort conditions or parameters.

The data collection sub-mechanism should consist of six different steps. Initially, the energy efficiency and RES investment should be selected for monitoring and assessment in Step 1. Then, the various types of data, which should be collected, must be identified within the context of Step 2. The selection of the required data must be done along with the measurement method either top-down or bottom-up, which has been developed for each energy efficiency and RES investment separately.

After the identification of the data, the available data sources should be mapped in Step 3, while the responsible body and the respective procedure for the collection of the identified data must be specified. It is crucial to define with clarity what type of data should be collected by each involved body, how these data will be analysed and by whom. Step 4 foresees the collection of the required data from the identified data sources.

Moreover, a specialized procedure should be implemented so as to control and validate the collected data in accordance with specific criteria, such as their accuracy, robustness and coherence within the control and verification sub-mechanism in Step 5. Indicative methods in order to validate the compliance with these criteria include the evaluation of the closeness between the estimated results and the true values, the comparison of the obtained results with the respective ones over time and from other spatial domains and the comparison of the estimated results with the corresponding ones from different sources or methods.

Finally, a combination of verification and control techniques (plausibility check, desktop checks, on-site checks on a specific sample and extrapolation to the total investments) to the collected data should be conducted in Step 6 to ensure the quality of the collected data as displayed in Figure 29.

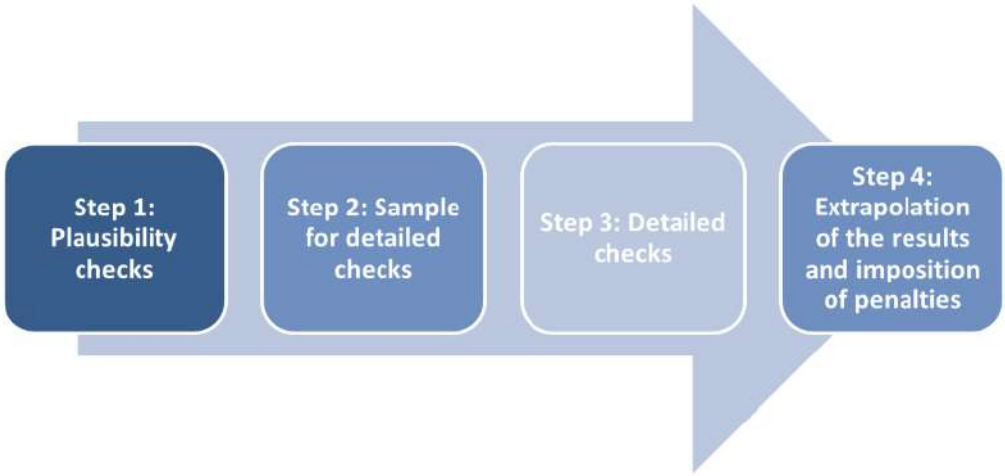

Figure 29. Steps for the conduction of the required control and verification activities.

The reporting of the implemented energy efficiency and RES investments should be performed on annual basis within the framework of the reporting sub-mechanism. The actual budget and the quantified impacts should be reported for each energy efficiency and RES investments separately. The calculation of the delivered energy savings will be performed in accordance with the selected measurement protocol. Moreover, additional quantitative information about the implementation of the energy efficiency and RES investments should also be provided. It should be noted that the quantitative information must be linked with the developed bottom-up equations within the bottom-up monitoring. It is obvious that he required data will be collected by the implementation of both foreseen top-down and bottom-up monitoring procedures.

Finally, all the implemented energy efficiency and RES investments should be evaluated within the framework of the assessment sub-mechanism through the conduction of cost-effectiveness and cost-benefit analyses. The aim of the analysis is to assess the effectiveness of the implemented investments to decide either their continuation, or their improvement or their replacement with new more effective so as to achieve the specified renovation targets.