CEESEN-BENDER

Building intErventions in vulNerable Districts against Energy poveRty

Deliverable 5.1

Building renovation roadmaps in 5 pilot areas

Pilot area roadmap for the City of Tartu

WP 5 - Creating roadmaps and support services for building energy renovations for vulnerable districts

Dissemination Level: Public

Co-funded by the European Union

Contents

1. Introduction

Tartu’s building stock mirrors the national picture: buildings account for roughly half of Estonia’s final energy consumption, and the majority were constructed before 2000 with low energy performance. This makes deep renovation the key lever for reducing energy use, improving comfort, and lowering emissions.

According to Tartu Housing Forecast (*Tartu elamuprognoos 2035,* 2014), 82.1% of dwellings were built before 1990 and 86.6% before 2000. Newer dwellings make up only 8.9%, with 4.6% of unknown construction year. Based on building permits, renovation works had been carried out in about 35% of dwellings, but only 13% according to usage permits — suggesting that some projects were not implemented, while others were completed without formal documentation.

- **Karlova**: one of Tartu’s historic wooden districts, where 78% of dwellings were built before 1990, with an additional 8.4% of unknown age. Nearly half of all homes were constructed before 1945.
- **Annelinn**: 97% of dwellings were built before 1990 (and 99.5% before 2000), dominated by 5- and 9-storey Soviet-era panel blocks.

National rules require all new buildings to reach nZEB (class A) and all major renovations to achieve at least energy class C, pushing the market toward deeper, quality-assured retrofits.

Renovation potential in Tartu’s pilot districts is significant:

- In **Annelinn**, large-scale multi-apartment retrofits can deliver major energy savings and cost reductions.
- In **Karlova**, upgrades must balance energy efficiency with heritage and streetscape conservation, often favouring fabric-first, moisture-safe measures and staged retrofits.

Municipalities, including Tartu, have limited financial tools to directly support renovation. Their role is primarily to share knowledge, educate residents, and introduce national grant schemes. Small-scale municipal support has been provided in specific cases, for example restoring original features of heritage buildings (windows, doors, decorative façades). Renovation subsidies, however, are designed and managed nationally, with conditions and distribution decided at the state level.

2. Vision of the roadmap

By 2030, Annelinn and Karlova will be healthier, more resilient, and more affordable districts where staged deep renovation is standard practice and fully aligned with Tartu's Sustainable Energy and Climate Action Plan (SECAP). Renovation upgrades will reduce space-heating demand, cut CO_2 emissions from heat supply, and improve indoor environmental quality — while respecting the urban heritage of Karlova's wooden district and ensuring scale and equity in Annelinn's large multi-apartment stock.

This vision supports the objectives of Tartu Energia 2030 and the city's commitments under the Covenant of Mayors.

3. Objectives of the roadmap

This roadmap is dedicated to accelerating the renovation of multi-apartment buildings (MABs) in Tartu, which dominate the city's housing stock and represent the greatest potential for energy savings, improved comfort, and CO_2 reduction. At the same time, the roadmap is consistent with Tartu's wider SECAP 2030 objectives, which also include targets for private houses, municipal buildings, and energy systems. Its main aims are to:

- **Renovate 50% of apartment buildings (MABs)** — approx. 980,000 m² of floor area — to at least energy class C, achieving an expected CO_2 reduction of **~29,400 tonnes per year**.
- **Achieve a total annual CO_2 reduction of ~59,920 tonnes*** through the renovation of residential buildings, with MABs as the primary focus.

Alignment with SECAP (Tartu Energy 2030):

- **Increase renewable energy use in the housing sector**, solar PV and connecting with district heating.
- **Improve indoor comfort, health, and resilience** of the building stock, ensuring better air quality, reduced energy poverty, and adaptation to climate impacts such as heatwaves and heavy rain.
- **Strengthen citizen engagement** through awareness-raising, one-stop-shops, and renovation support centres, enabling housing associations and residents to make informed decisions.

*While the roadmap focuses on MABs, SECAP also sets targets to renovate 40% of private houses (approx. 412,000 m² to class C, ~25,500 tonnes CO_2 reduction). These actions are complementary, but they are not the central objective of this roadmap.

4. The current status of legislative and regulatory frameworks for building renovation

4.1 EU directives and other policy instruments

Building renovation in Tartu is guided by the transposition of EU legislation into national law. Key directives include:

- **Energy Performance of Buildings Directive (EPBD, recast)** – requires all new buildings to be nearly zero-energy (nZEB), sets minimum requirements for major renovations, and introduces long-term renovation strategies and building renovation passports.

- **Energy Efficiency Directive (EED, revised 2023/1791)** – strengthens obligations on the public sector, including annual renovation of 3% of total floor area and final energy reduction targets, which cascade to municipal building stock.

- **Renewable Energy Directive (RED III, 2023/2413)** – sets higher renewable energy targets, promotes renewables in heating and cooling, and supports renewable integration in district heating systems.

- **EU Taxonomy and Green Deal initiatives** – indirectly influence renovation by shaping financing criteria, including green bonds, grants, and loans.

These EU instruments define the overall framework and targets which Estonia must follow and implement at national and local levels.

4.2 National laws and regulations

Estonia has transposed EU requirements into its legal framework. The main instruments are:

- **Building Code (Ehitusseadustik)** – the overarching legal act regulating the design, construction, renovation, and demolition of buildings.
- **Minimum energy performance requirements** – new buildings must meet energy class A (nZEB), and major renovations must achieve at least energy class C. Performance values are periodically reviewed.
- **Energy Performance Certificates (EPC / energiamärgis)** – mandatory for new buildings, major renovations, and property transactions; widely used to demonstrate compliance and evaluate renovation results.
- **Long-term Renovation Strategy (2020)** – sets targets for the national building stock, defines investment needs, and guides funding schemes.
- **Grant schemes** (e.g. Estonian Business and Innovation Agency (EIS), formerly KredEx) – provide state subsidies for deep renovation of apartment buildings and single-family houses, strongly influencing renovation activity.

These regulations form the baseline for Tartu's building renovation activities, including those in the pilot districts.

4.3 Accreditation / certification of construction professionals

Professional qualifications in the construction and energy efficiency sector are overseen by Kutsekoda (the Estonian Qualifications Authority), which manages occupational standards and certification for architects, engineers, energy auditors, energy efficiency specialists, construction managers, and site supervisors [1].

In practice, renovation-related competences are organised through three main systems:

- Estonian Qualifications Authority (Kutsekoda) – issues professional certificates (e.g. energy auditor, energy efficiency specialist, architect, engineer, construction manager), ensuring individual competence[1].
- Economic activity register (Majandustegevuse register (MTR)) – lists companies and individuals licensed to provide design, construction, and owner's supervision services.[2]
- EIS technical consultants list – required for apartment building renovation grants; apartment associations must involve a certified technical consultant from this list[3].

In grant-funded renovation projects, the involvement of certified professionals — particularly technical consultants, energy auditors, designers, and supervision specialists — is often mandatory. This system ensures technical quality, compliance with regulations, and comprehensive support for housing associations throughout the renovation process

4.4 Labelling of construction materials

Construction products in Estonia must comply with the EU Construction Products Regulation (CPR, 305/2011 / new CPR), requiring CE marking, conformity assessment, and a Declaration of Performance (DoP). This applies to insulation, windows, ventilation units, and other materials commonly used in renovation[4]. In addition, EU and national energy-efficiency labelling schemes (e.g. for windows, boilers, heat pumps) support transparency and consumer choice.

Looking ahead, Estonia is preparing to introduce life-cycle carbon footprint requirements for buildings: from 2028 for those over 1,000 m², and from 2030 for all new buildings, along with carbon limit values [5]. National methodologies have already been developed, and in future, a materials database / CO_2 register will help standardise embodied carbon data for construction products[5]. These changes will gradually extend to renovation projects, making embodied carbon accounting and product footprint labels an integral part of renovation policy.

[1] Estonian Qualifications Authority (Kutsekoda). Qualification awarding bodies and professional register. Available at: https://www.kutsekoda.ee/kutseregister (accessed 15 September 2025).
[2] Register of Economic Activities (MTR). Available at: https://mtr.mkm.ee/ (accessed 16 September 2025).
[3] EIS. Technical consultants. Available at: https://www.eis.ee/tehniline-konsultant (accessed 15 September 2025).
[4] European Commission. New EU rules for safety and sustainability of construction products. Available at: https://single-market-economy.ec.europa.eu/news/new-eu-rules-safety-and-sustainability-construction-products-mark-new-step-sectors-competitiveness-2025-01-07_en (accessed 15 September 2025).
[5] Ministry of Climate (Estonia). Building carbon footprint. Available at: https://kliimaministeerium.ee/elukeskkond-ringmajandus/energiatohusus-ja-keskkonnasaast/hoone-susinikujalajalg (accessed 16 September 2025).

5.Energy poverty

5.1 National context regarding energy poverty and specifically MABs

In Estonia, energy poverty has a legal definition introduced in the Energy Sector Organisation Act. According to § 2[6]:

- A *"vulnerable energy consumer"* is a person living alone, or a family whose monthly income per family member during the last six months does not exceed the minimum wage.
- A *"person suffering from energy poverty"* is a person living alone, or a family that has received subsistence benefits at least once during the last six months, and whose income per family member in the last month does not exceed the minimum wage.

This definition links energy poverty directly to income levels and social support measures, making it narrower than the broader EU understanding, which also considers the energy efficiency of dwellings and the affordability of energy services.

The national context highlights the following aspects:

- **High share of MABs:** Around 70% of Estonian households live in multi-apartment buildings, many of which were built in the Soviet era with poor insulation and outdated heating systems. These buildings are central to energy poverty risks, particularly for low-income or elderly residents[7].
- **Energy price shocks:** The steep rise in energy prices in 2021–2022 significantly increased the number of households at risk of energy poverty.
- **State measures:** Temporary compensation schemes (electricity and heating subsidies) were introduced, but they do not structurally solve the problem of low energy efficiency in buildings.
- **Renovation as a long-term solution:** Grant schemes (e.g. through EIS) support deep renovation of apartment buildings and single-family houses, which reduce energy demand and bills, but co-financing remains a barrier for vulnerable groups[7].

5.2 Energy poverty situation at Tartu level

At the city level, energy poverty and related risks are visible in both pilot districts in Tartu, but they manifest differently depending on building characteristics and energy supply systems.

Annelinn is dominated by large multi-apartment buildings constructed mainly in the 1960s–1980s. These buildings generally have low energy performance and are predominantly connected to the district heating network. While district heating prices in Tartu are relatively moderate compared to alternative heating options, price fluctuations and overall energy costs disproportionately affect residents of non-renovated buildings due to their high heat demand. Although deep renovation projects can significantly reduce energy consumption and

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[6] Riigikogu. Energy Sector Organisation Act. Available at: https://www.riigiteataja.ee/en/eli/ee/518052017002/consolide (accessed 23 September 2025).

[7] Estonian Business and Innovation Agency. Renovation support programmes for apartment buildings and private houses. Available at: https://www.eis.ee/ (accessed 23 September 2025).

housing costs, limited financial capacity and co-financing requirements often constrain renovation decisions within housing associations.

Karlova is a historic district characterised by wooden buildings, many of which rely on individual heating systems, including wood, electricity, or small boilers. Energy poverty here is reflected not only in high energy costs but also in poor indoor comfort, such as cold indoor temperatures, draughts, and moisture-related issues. Renovation efforts are further complicated by heritage and milieu protection requirements, as well as the small size of buildings, which limits economies of scale and results in higher renovation costs per square metre compared to larger apartment buildings.

The findings for Tartu are based on data from the CEESEN-BENDER survey conducted in 2024, which examined energy poverty and the impacts of energy renovation in multi-apartment buildings constructed between 1945 and 1991. The survey was implemented across five pilot cities in Central and Eastern Europe and included a total of 2,034 respondents. [8]

n each pilot city, including Tartu, approximately 400 households were surveyed, with a balanced sample of households living in renovated and unrenovated buildings. Data were collected through face-to-face interviews with one adult respondent per household who had sufficient knowledge of the building and household energy use; participation was voluntary and anonymous. This methodological approach enables a robust comparison between renovated and unrenovated housing stock and supports the assessment of how energy renovation affects energy affordability, thermal comfort, and overall living conditions at both local and cross-country levels.

The study provides specific evidence for Tartu that further complements the energy poverty analysis in this chapter[8]:

- **Energy bills and payment arrears**: In Tartu, 9.4% of households in unrenovated buildings reported payment arrears compared to 5.6% in renovated buildings, confirming that renovation is associated with a lower risk of financial difficulties related to energy costs.
- **Winter thermal comfort**: 19.8% of households were unable to keep their homes adequately warm before renovation, compared to only 7% after renovation, indicating a substantial improvement in thermal comfort.
- **Summer comfort challenges**: 55% of households reported insufficient cooling before renovation versus 48.4% after renovation, highlighting a persistent issue of summer overheating that remains characteristic of the Tartu context.
- **Overall housing conditions**: The share of households reporting “no significant problems” increased from 22% to 77% in Tartu, demonstrating a clear overall improvement in living conditions, although ventilation-related issues remained a recurring concern.

[8] CEESEN-BENDER project (2024). Energy poverty and building energy use in vulnerable districts. LIFE Programme (Grant Agreement No. 101120994 — LIFE22-CET-CEESEN-BENDER).

Overall, the 2024 CEESEN-BENDER survey indicates that households living in renovated buildings in Tartu experience fewer housing defects and a lower risk of payment arrears, while challenges related to summer overheating and ventilation continue to affect quality of life.

Municipal support: The City of Tartu, through its Sustainable Energy and Climate Action Plan (*SECAP – Tartu Energy 2030*) and with support from the Tartu Regional Energy Agency (TREA), provides technical advice, information campaigns, and access to national renovation grants[9]. These efforts aim to link renovation policy with reducing energy poverty risks.

Overall, while Estonia defines energy poverty in legal terms tied to income and social benefits, in practice the quality of the building stock in Tartu's districts is equally important. Poorly insulated MABs in Annelinn and old wooden houses in Karlova make households vulnerable to rising energy costs, even when incomes are above the legal threshold.

6.MAB renovation in the pilot area

6.1 National programmes

Estonia runs large-scale grant schemes for deep renovation of multi-apartment buildings (MABs), managed by the Estonian Business and Innovation Agency (EIS) and the Environmental Investment Centre (KIK). These programmes typically subsidise 30–50% of eligible renovation costs, requiring improvements to at least energy class C, including envelope insulation, window replacement, heating system upgrades, and installation of mechanical ventilation with heat recovery[10].

In Tartu, housing associations have made extensive use of these grants, particularly in the last funding round. The general support level was 30%, but higher rates were available in specific cases, such as buildings under heritage protection or projects using innovative prefabricated renovation methods. In practice, most Annelinn panel buildings that applied received support at the 30% level, while in Karlova some wooden buildings accessed additional subsidies due to cultural heritage restrictions.

The most recent grant round was heavily oversubscribed, with applications exceeding available funding within hours of opening. This has created uncertainty and a "stop-and-go" market dynamic for housing associations and contractors in Tartu. The terms of the next round are not yet announced, leaving associations with ongoing projects in a waiting position.

At the regional and municipal level, there have never been large-scale renovation grant schemes. Local governments, including the City of Tartu, focus instead on providing advice,

[9] Tartu City Government. Sustainable Energy and Climate Action Plan – Tartu Energy 2030. Available at: https://www.tartu.ee/et/tartu-energia-ja-kliimakava (accessed 23 September 2025).
[10] EIS. Renovation grants for apartment buildings and private houses. Available at: https://www.eis.ee/ (accessed 23 September 2025).

awareness-raising, and technical support (often via TREA), and on participating in EU-funded projects to complement national measures.

6.2 MAB context

In Estonia, most multi-apartment buildings (MABs) are divided into individually owned apartments and organised under a housing association. Renovation decisions are made collectively by the general meeting of the association, where each apartment owner has a vote. In practice, this means that a majority decision is required to approve a renovation project. While the system is democratic, it can be challenging in larger buildings with residents from very different socio-economic backgrounds. Pensioners and low-income households often fear higher monthly costs and oppose borrowing, even if renovation would reduce bills in the long run. This slows down decision-making and is one of the main bottlenecks in initiating deep renovation projects.

Housing associations usually appoint a building manager or a management company to oversee daily operations. However, their technical and financial capacity varies greatly. In many cases, associations lack in-house expertise and rely on external consultants, energy auditors, and engineering firms to plan renovations and prepare grant applications.

The socio-economic vulnerability of residents also shapes renovation prospects. In Karlova, many households live in small wooden houses where per-unit renovation costs are high, while in Annelinn, panel apartment blocks concentrate a large number of pensioners and low-income families. These groups face greater difficulties in securing co-financing, even when grants are available.

From a technical perspective, Annelinn is dominated by prefabricated panel buildings from the 1960s–1980s. These buildings typically have poor insulation, outdated heating substations, and inefficient ventilation. Karlova, as a historic wooden district, presents a different set of challenges: old timber structures with moisture problems, inefficient stoves or electric heaters, and restrictions due to cultural heritage protection.

Renovated MABs are required to achieve at least energy class C, delivering 50–60% reductions in energy demand compared to baseline. Typical renovation packages therefore include building envelope insulation, modernisation of heating and ventilation systems, and, where feasible, the integration of renewable energy solutions such as solar panels or heat pumps[11].

[11] Environmental Investment Centre (KIK). Building renovation support programmes. Available at: https://kik.ee/ (accessed 23 September 2025).

6.3 Stakeholder involvement in the renovation of MAB sector in the pilot regions

The renovation of multi-apartment buildings (MABs) in Tartu involves a wide range of stakeholders with different roles and levels of engagement. The renovation of multi-apartment buildings (MABs) in Tartu brings together several stakeholder groups:

- **Apartment owners and housing associations** – the main decision-makers.
- **Property management companies** – responsible for daily management and sometimes coordination of renovation.
- **National funding agencies** (EIS, KIK) – providers of renovation grants and the financial backbone of projects.
- **Local and regional support organisations** – the City of Tartu and the Tartu Regional Energy Agency (TREA), offering advice, awareness-raising, and training.
- **Market actors** – construction companies, energy auditors, and certified technical consultants, responsible for preparation and implementation.

At the core are the apartment owners and their apartment associations, which represent the collective ownership of buildings. General meetings make the final renovation decisions, but reaching consensus among diverse owners can be difficult. Property management companies support associations in daily operations; some take an active role in coordinating renovation processes, while others remain passive.

The national agencies Estonian Business and Innovation Agency (EIS) and KIK are crucial as grant providers, without which large-scale renovation would not happen. Their programmes shape the scale, timing, and conditions of renovation in Tartu.

Local actors, including the City of Tartu and TREA, complement this by offering technical advice, awareness-raising, and capacity building. Their role is facilitation and support, as municipalities in Estonia do not have their own large-scale renovation subsidies.

Market actors—particularly certified technical consultants—play an important bridging role between residents, contractors, and financial institutions, supporting communication and trust throughout the renovation process.

Stakeholder engagement takes place through a variety of channels, including public information campaigns and expert consultations organised by the city and TREA, as well as apartment association general meetings where binding decisions are made. Successful renovation cases in Tartu demonstrate that trust-building between residents, consultants, and contractors is essential, especially in more vulnerable communities. The CEESEN-BENDER survey (2024) highlights a remaining participation gap in Tartu. While the share of residents reporting being “not informed” about building decisions decreased significantly after renovation (from 13.9% to 4.7%), the proportion reporting being “not involved” declined only modestly (from 35% to 29.6%). This indicates that although access to information has improved, meaningful involvement of residents in decision-making remains limited.[12]

[12] CEESEN-BENDER project (2024). Energy poverty and building energy use in vulnerable districts. LIFE Programme (Grant Agreement No. 101120994 — LIFE22-CET-CEESEN-BENDER).

6.4 Main drivers of the MAB renovation process

In Estonia, and particularly in Tartu, the renovation of multi-apartment buildings is driven by a combination of financial, technical, and social factors. Based on the CEESEN-BENDER household survey results referred to in the previous section, complemented by the Estonian report on technical and economic barriers to building renovation (project deliverable 3.2), the main drivers of renovation are:

- availability of national grants (EIS, KIK),
- reduction of monthly energy costs,
- repair of failing technical systems,
- improved comfort and indoor climate,

The availability of national grants remains the strongest motivator. In particular, the comprehensive renovation support scheme managed by the Estonian Business and Innovation Agency (EIS) typically covers 30–50% of eligible renovation costs, making deep renovation financially feasible for many housing associations. In practice, the availability of grant support is often a prerequisite for initiating renovation projects.

Another important driver is the reduction of monthly housing costs. Renovated buildings consume significantly less energy, resulting in lower heating bills and improved financial stability for households. Even when loan repayments partially offset short-term savings, residents value greater cost predictability, increased reliability of building technical systems, and overall improvements in living comfort. Findings from the CEESEN-BENDER project confirm this pattern: in Tartu, the most frequently cited motivation for renovation was the reduction of energy and heating costs, followed by improvements in quality of life and overall energy performance of buildings

Addressing failures in technical systems and safety risks is also a key trigger for renovation. Many buildings face urgent problems related to heating, electrical and sewage systems, as well as the structural condition of balconies, roofs, and load-bearing elements. In such cases, renovation becomes unavoidable rather than a voluntary choice.

Improved living conditions represent a strong social driver. Residents frequently highlight the need for modern comfort standards, better indoor climate, and healthier living environments. These aspects were also reflected in the CEESEN-BENDER survey, where improvements in quality of life ranked among the main motivations for renovation.

While climate and environmental objectives, such as greenhouse gas emission reduction, are central at national and European Union levels, they are not typically primary decision-making drivers for residents. CEESEN-BENDER findings show that both in Estonia and across other participating countries, climate considerations were mentioned by only a small share of respondents, indicating that CO_2 reduction plays a marginal role in household-level decisions. Instead, residents primarily associate renovation with tangible and immediate benefits, such as lower energy costs, improved living comfort, and better overall housing conditions.

This highlights a clear gap between policy-level climate ambitions and everyday motivations at building level. While renovation delivers important climate benefits at system level, these are rarely the arguments that trigger decisions within housing associations. In practice, renovation in Tartu is driven by financial incentives, cost predictability, and the urgent need to address technical deficiencies, combined with a broader aspiration to modernise housing and improve quality of life. Climate and environmental benefits therefore function mainly as co-benefits, rather than as decisive motivators.

This reveals a clear gap between policy-level climate ambitions and everyday motivations at the building level. Although renovation delivers significant climate benefits, these benefits tend to function primarily as co-benefits rather than decisive drivers in housing association decision-making.

6.5 Main difficulties of the MAB renovation process

Although awareness of the need for renovation is increasing, the renovation process in Tartu and Estonia faces several persistent barriers that slow down large-scale implementation. The main difficulties include:

- Limited financial capacity of apartment owners and apartment associations.
- Dependence on national support schemes and irregular funding round.
- Shortages of qualified designers, consultants, and construction companies.
- Difficulty in reaching consensus in housing association general meeting.
- Regional differences in property values and market condition.

Financial constraints remain the most critical barrier. Even with national grants covering 30–50% of eligible renovation costs, many housing associations struggle to secure the required co-financing. Pensioners and low-income households are often reluctant to take on loan obligations, while in areas with lower property values access to loan financing is more limited.

Irregular national funding rounds create a so-called “stop-and-go” dynamic. Calls for applications are frequently oversubscribed within the first hours after opening, meaning that available funding is rapidly allocated. As a result, a large number of renovation projects become concentrated within short timeframes, sharply increasing demand for design and construction services. Market actors respond to this time pressure with price increases, making long-term and cost-effective planning more difficult for apartment associations.

Shortages of specialists become a significant bottleneck particularly when funding rounds open with short notice. The challenge is not a complete lack of expertise, but the simultaneous demand for design and advisory services across many projects. This places pressure on designers of building services, such as heating and ventilation systems, as well as certified technical consultants, slowing project preparation and increasing service costs.

Social and institutional factors represent an additional barrier. Reaching majority agreement in housing association general meetings is often difficult due to the diverse socio-economic backgrounds of owners within the same building. While some owners are willing to invest, others fear increases in monthly costs, which can lead to delays or blockages in decision-making.

Finally, regional differences in property markets also affect renovation dynamics. Although the renovation market in Tartu is relatively active compared to smaller municipalities, the availability of offers and price levels are not without challenges, particularly during peak funding periods. In areas with lower property values, financial risks for both banks and apartment owners are higher: access to loan financing is more constrained, and willingness to invest is reduced when renovation costs are not proportional to potential increases in property value. This makes renovation decisions more difficult even where technical needs and support schemes are in place.

6.6 MAB renovation role in achieving national targets

Multi-apartment buildings (MABs) are central toEstonia's long-term renovation and climate policy. Around 70% of Estonian households live in MABs, and the majority of these buildings were constructed before 1990 with poor energy performance. Renovation of this building stock is therefore a key lever for achieving national and EU-level energy and climate targets.

According to Estonia's Long-Term Renovation Strategy[13], the national objective is to renovate the majority of the existing building stock by 2050 in order to achieve significant energy savings and emissions reductions. For multi-apartment buildings alone, cumulative investment needs of around €17 billion are estimated, making large-scale renovation of the MAB sector essential for meeting these long-term targets.

In addition, Estonia's 2030 climate and energy targets – aligned with the EU Green Deal – aim for a reduction of approximately 70% in greenhouse gas emissions compared to 1990 levels. Given the significant share of energy consumption and CO_2 emissions attributable to the building sector, renovation represents a key pathway to meeting these objectives.

For cities like Tartu, the role of MAB renovation is threefold:

- **Energy consumption and emissions:** While district heating in Tartu is largely biomass-based and relatively low in CO_2 intensity, deep renovation reduces overall energy demand and enables renewable energy sources to cover a larger share of the city's needs. In districts relying on individual heating systems, such as stoves or gas heating, renovation directly reduces fossil fuel use and improves air quality.
- **Energy poverty reduction:** Renovation lowers heating bills and improves indoor comfort, directly supporting national objectives to reduce energy poverty.
- **Adaptation and resilience:** Renovated buildings are more resilient to climate risks, including heatwaves, cold spells, and extreme weather events, contributing to broader national goals of a climate-resilient building stock.

While responsibility for achieving national climate and energy targets rests primarily at the state level, the contribution of local renovation activity is essential. Tartu's large stock of MABs and its gradual deep renovation directly support Estonia's national long-term

[13] Ministry of Economic Affairs and Communications (MKM). Estonia's Long-Term Renovation Strategy (LTRS). Available at: https://ec.europa.eu/energy/sites/default/files/documents/ee_2020_ltrs_en.pdf (accessed 10 October 2025).

renovation strategy and demonstrate how local action contributes to national and EU-level objectives.

Tartu's Sustainable Energy and Climate Action Plan (Tartu Energy 2030) sets a target to reduce approximately 59,920 tonnes of CO_2 annually through residential building renovation by 2030. This local commitment clearly illustrates how large-scale renovation of Tartu's MAB stock supports Estonia's national climate ambitions and the EU's broader climate goals.

6.7 Financial solutions

The renovation of multi-apartment buildings (MABs) in Tartu relies on combining national grants with commercial bank loans, supported in some cases by EU-level funding and technical assistance.

- **National renovation grants:** The Estonian Business and Innovation Agency (EIS) provides the main national subsidy scheme for apartment building renovation. In Tartu this typically covers around 30% of eligible costs, with higher support available for special cases (e.g. heritage-protected buildings). Grants are linked to deep renovation achieving at least energy class C. The Environmental Investment Centre (KIK) has additionally supported specific renovation-related measures, such as connecting buildings to district heating networks or upgrading and installing central heating systems.
- **EU project-based funding:** Large renovation demonstration projects such as SmartEnCity and OpenLab have been supported by Horizon 2020 and other innovation programmes, testing new solutions and business models. These complement but do not replace national support schemes.
- **EU technical assistance and loans:** Through the ELENA programme (European Local Energy Assistance), Tartu has already secured funding to establish the *"Tartu Renovates"* programme, which provided technical assistance and capacity building for local renovation projects. ELENA-type support can reduce upfront risks and help municipalities or energy agencies prepare renovation pipelines. The European Investment Bank (EIB) and national banks can also provide long-term financing, especially when grants are combined with loans.
- **Commercial bank loans:** In practice, housing associations almost always need a bank loan to cover their co-payment, since grants rarely exceed 30–40% of total costs. Loans from Swedbank, SEB, LHV and others are the standard solution, and favourable conditions are usually tied to projects that achieve higher energy performance. However, in smaller municipalities with low property values, collateral remains a barrier even when grants are available.

Overall, renovation in Tartu is financed through a stacked model, where the EIS renovation grant is the key driver that makes projects possible. Once grants are secured, bank loans – almost always necessary – provide the remaining financing, while EU instruments (such as ELENA) and innovation projects (e.g. SmartEnCity, OpenLab) play a supporting role.

For the future, further diversification of financing – including cooperative PV models, energy communities, and green loan products – could help reduce dependence on unpredictable grant cycles and strengthen the continuity of renovation activity.

6.8 MABs in need for renovation works

A significant share of Tartu's multi-apartment buildings (MABs) still require renovation, reflecting both the age structure and the technical condition of the housing stock. Earlier assessments, including the Tartu Housing Forecast 2035, have highlighted the extensive renovation needs arising from the ageing residential stock.

In this section, this general assessment is refined through an analysis of the age distribution of buildings based on data from the Estonian Building Register, covering the entire housing stock, and complemented by an assessment of renovation levels using energy performance certificate data. As shown in Table 1, the majority of residential buildings – including MABs – were constructed before 1990, meaning that a large share of the housing stock is concentrated in older building cohorts. This confirms that renovation needs in Tartu are primarily linked to the ageing housing stock rather than to recent construction.

Table 1. *Distribution of residential buildings and multi-apartment buildings in Tartu by construction period*

	unit	-1990	1990–1999	2000+	Unknown	Total
Total buildings	pcs	8199	2177	2580	4995	17951
-Residential buildings	pcs	6991	1389	1461	335	10176
--Single-family houses	pcs	5163	1185	933	205	7486
--Multi-apartment buildings (MABs) (3+ dwellings)	pcs	1601	153	446	108	2308
Distribution by construction period of MABs (% of buildings)	%	69%	7%	19%	5%	100%
Area of MABs (3+ dwellings)	1000 m^2	1859,2	375,9	568,5	120,5	2924,1
Distribution by construction period of MABs (% of floor area)	%	64%	13%	19%	4%	100%

While deep renovation can typically reduce energy demand by around 50–60%, its impact on CO_2 emissions in Tartu is more nuanced. Most MABs in Annelinn are connected to the district heating system, which is largely biomass-based and already relatively low in carbon intensity. In these cases, renovation mainly reduces heating demand and household costs, while the absolute CO_2 reduction may be more modest compared to buildings relying on fossil fuels. In Karlova, many buildings still use local heating systems such as stoves and small boilers (predominantly wood-fired, though district heating connections and heat pumps are gradually increasing). Here, renovation does not always lead to large CO_2 reductions, but it significantly improves indoor comfort and local air quality

The assessment of renovation needs is further supported by the analysis of energy performance certificate (EPC) data. Figure 1 shows the coverage of EPCs by building age group in Tartu, illustrating that EPC availability is uneven across the building stock and particularly limited in older buildings.

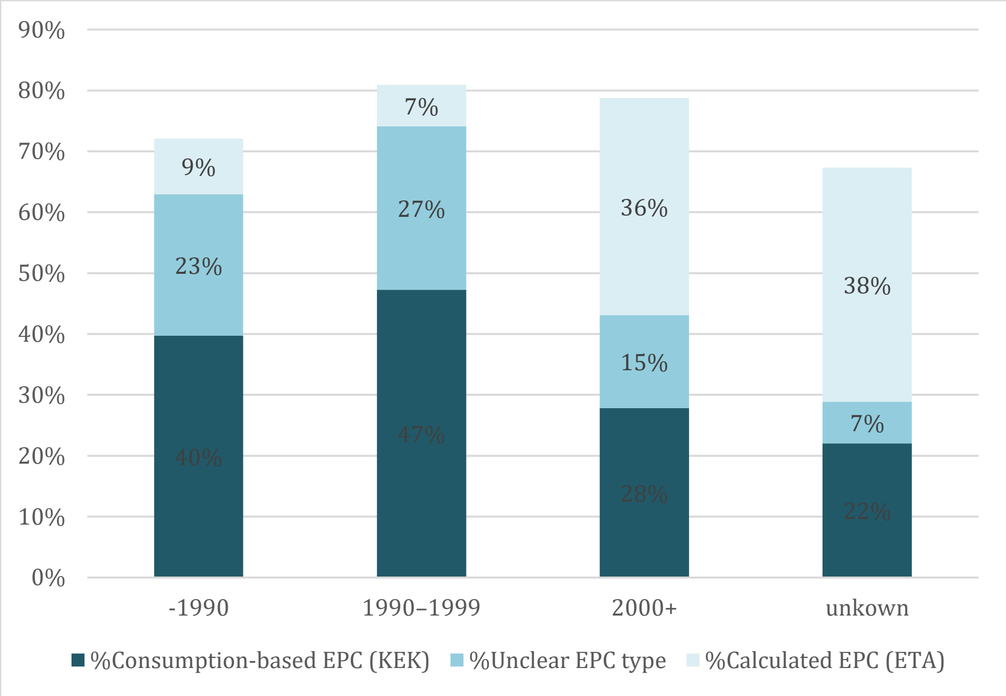

Figure 1. *Energy performance certificate coverage by building age group in Tartu*

Figure 2 focuses on buildings that have achieved higher energy performance (classes A–C), which can be interpreted as an indicator of renovated or recently constructed buildings.

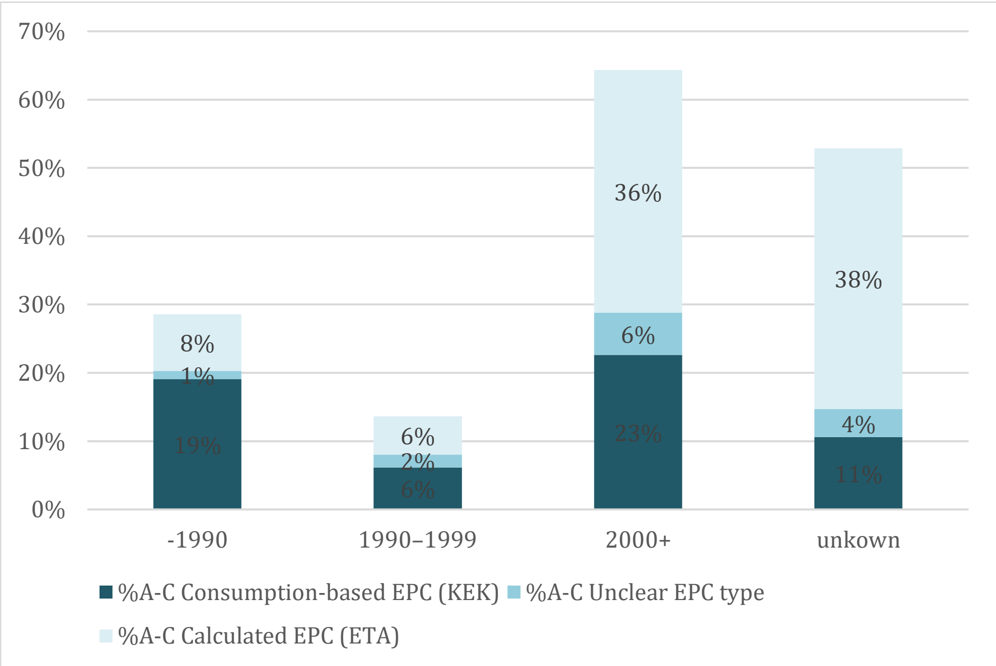

Figure 2. *Share of A–C energy performance certificates by building age group (indicator of renovated or newer buildings)*

The figure clearly shows that A–C class buildings are concentrated in newer age groups, while pre-1990 buildings remain largely outside higher energy performance classes. This underlines the substantial renovation potential of older MABs

Together, the age distribution of buildings and the EPC analysis confirm that a large share of Tartu's MAB stock remains energy-inefficient and in need of renovation. At the same time, the analysis also highlights important data limitations: EPC data and building stock general data (inc construction year) are currently available in separate datasets and cannot be fully combined at building level. As a result, the analysis supports identification of overall trends and priorities, but does not yet allow precise ranking of individual buildings.

6.9 Tools supporting estimation and planning of renovation

To support apartment associations in assessing renovation costs, financing needs and payback, several tools are available:

- **CEESEN ROI tool[14]:** a simple calculator that allows estimation of investment needs, potential energy cost savings and indicative payback periods.
- **EIS renovation cost calculator[15]:** a tool provided by a national institution, supporting apartment associations in estimating renovation costs and energy savings and in preparing applications for national renovation support schemes.
- **Commercial bank loan calculators[16,17]:** for example those offered by Swedbank and SEB, which allow modelling of loan amounts, repayment terms and, in some cases, the impact of energy cost changes on monthly payments.

In Estonia, including in Tartu, building-related CO_2 emissions are strongly linked to both heat and electricity consumption. While comprehensive renovation of apartment buildings generally reduces heat demand, it may simultaneously increase electricity consumption due to the introduction of new technical systems, such as mechanical ventilation. In the context of Tartu's low-carbon district heating system, increased electricity use can therefore significantly reduce the net greenhouse gas emission reductions achieved through lower heat consumption. For this reason, on-site renewable electricity generation represents an important mitigation measure.

The **StartSun calculator[18]** enables apartment associations to assess the potential for installing solar PV systems, particularly in the context of self-consumption or energy community

[14] CEESEN-BENDER project. Renovation tools and planning platform (ROI tool). LIFE Programme (Grant Agreement No. 101120994 — LIFE22-CET-CEESEN-BENDER). Available at: https://ceesen.org/tools/ (accessed 9 October 2025).
[15] Estonian Business and Innovation Agency (EIS). Renovation cost calculator for apartment associations. Available at: https://eis.ee/rekonstrueerimise-kulude-kalkulaator-korteruhistutele/ (accessed 11 October 2025).
[16] Swedbank. Loan calculator. Available at: https://www.swedbank.ee/private/home/more/calculator/calc/kykredex (accessed 8 October 2025).
[17] SEB. Apartment building renovation loan. Available at: https://www.seb.ee/ariklient/finantseerimine/korterelamu-renoveerimislaen (accessed 12 October 2025).
[18] Tartu Regional Energy Agency (TREA). StartSun calculator. Available at: https://www.trea.ee/blog/startsun-kalkulaator-on-nuud-avalikult-kasutatav/ (accessed 10 October 2025).

models. In addition, within the CEESEN-BENDER project, a simplified feasibility pre-assessment checklist has been developed. This checklist can be used as an initial screening step before more detailed data collection and modelling, helping to determine whether solar PV and energy community solutions are suitable and worth further analysis.

At present, there is no systematic prioritisation framework at either national or municipal level, for example to account for energy poverty considerations when targeting renovation support. Renovation support schemes in Estonia are largely designed and administered at national level, meaning that local governments lack a dedicated mechanism to determine which buildings or neighbourhoods should be prioritised for renovation. Furthermore, municipalities have limited access to detailed and reliable local-level data. National statistics are mainly available at country level and are insufficiently detailed, while municipal-level data on energy poverty and building conditions remain fragmented or incomplete.

As a result, at local level there is limited capacity to develop an integrated overview of:

- where energy poverty is most concentrated,
- which districts or building types are in relatively better or worse condition, and
- how renovation efforts could be sequenced to maximise both energy savings and social benefits.

To help address this gap, an energy poverty risk-based renovation prioritisation tool was developed within the CEESEN-BENDER project. The tool combines socio-economic indicators with building-level energy consumption data to support the simultaneous assessment of renovation needs and energy poverty risk in pilot areas.

The tool applies a data-driven model that enables buildings to be ranked according to renovation priority. The methodology integrates building energy use and household socio-economic indicators, reflecting both technical condition and social vulnerability. As a result, a composite score is calculated for each building, where a higher score indicates a higher combined renovation need and energy poverty risk, and therefore a higher priority. A more detailed description of the prioritisation methodology is provided in Annex 1.

The tool is intended primarily to support decision-making and prioritisation. The results of its application in the Tartu pilot areas, together with associated renovation cost estimates, are presented in the following section.

6.10 Results of energy poverty risk-based prioritisation and renovation cost estimates

In Tartu, the CEESEN-BENDER energy poverty risk-based renovation prioritisation tool was applied to a total of 194 apartment buildings located in the Annelinn and Karlova pilot areas. The analysis was based on anonymised building-level energy consumption data from the first quarter of 2024, combined with socio-economic indicators describing the households living in the buildings. This approach enabled the simultaneous assessment of renovation needs and energy poverty risk.

As a result of the analysis, a prioritisation ranking of apartment buildings in the pilot areas was established. Buildings with higher composite scores are those where the technical condition of the building and the socio-economic vulnerability of residents together indicate a greater need for intervention.

Annex 2 presents a list of the 30 highest-ranked buildings, while this section focuses on the three buildings with the highest composite scores in order to illustrate the results of the tool and to provide more detailed insight into their renovation needs and associated investment volume.

Table 2. *The key characteristics of the highest-ranked buildings*

Key building parameters	A92	J171	A85
Year of initial commissioning	1986	1986	1977
Valid energy certificate	N/A	N/A	E
Latest energy certificate	E	D	E
Number of floors	9	9	5
Number of apartments, m^2	144	72	75
Building footprint area, m^2	1246	603	1126
Total area of residential and non-residential units, m^2	7958,7	3963,6	4222,5
Enclosed net area, m^2	10043,5	4941,5	5510,2
Common areas, m^2	1290,4	977,9	397,9
Construction material	Precast reinforced concrete	Precast reinforced concrete	Brick, precast reinforced concrete
Main heating system	District heating	District heating	Local heating
Other heating	Oil-fired boiler	Boiler	Gas-fired boiler

All three buildings are located in the Annelinn district, which is characterised by a large stock of pre-1990 apartment buildings and widespread use of district heating. While district heating is the main heating system in two of the buildings, all three buildings also feature additional heating solutions; according to building register data, one building relies primarily on a local gas-based heating system. Two of the buildings are located in immediate proximity to each other, while the third is situated approximately 300 metres away. Considering the overall scale of Annelinn, the selected buildings are located relatively close to one another, creating potential for coordinated renovation planning.

Like most apartment buildings constructed before 1990, all three buildings require comprehensive renovation to achieve substantial improvements in energy performance and indoor comfort. Although indicative renovation cost levels are relatively well established on the market, actual investment costs may still vary significantly depending on several factors, including market conditions, procurement timing and the number of buildings undergoing renovation simultaneously. Experience from repeated procurement processes shows that even for similar projects, bid prices may differ considerably, and the same contractor may submit markedly different offers depending on workload and market activity.

For this reason, the renovation cost levels used in this assessment are derived from unit cost estimates per square metre of enclosed net floor area, as illustrated in Figure 3, which describes the relationship between renovation costs and building size.

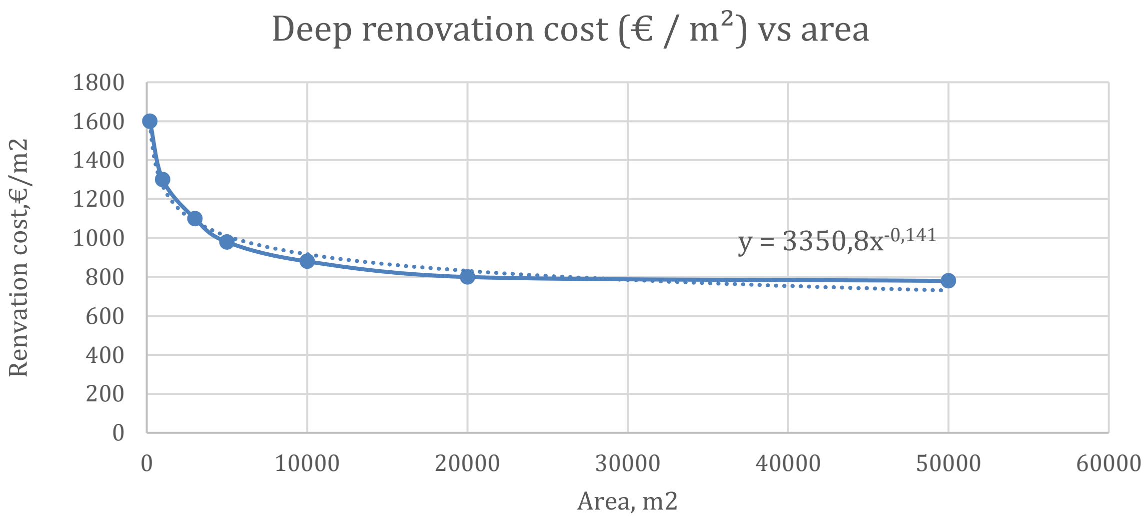

Figure 3. *Estimated renovation cost per square metre by building size (The figure illustrates indicative unit cost levels used for estimating renovation investments, acknowledging that actual procurement prices may vary depending on market conditions)*

Table 3 presents construction consultants' expert estimates of renovation costs for each building, together with unit cost values derived from the cost–area relationship. The table also shows the assumed share of public support, based on the current national renovation support framework, as well as the resulting own financing requirement, expressed both as total investment and as an average cost per apartment. This provides a realistic indication of the financial scale of comprehensive renovation projects from the perspective of apartment associations and individual apartment owners.

Table 3. *Estimated renovation investment and average cost per apartment*

	A92	J171	A85
Need	Deep renovation	Deep renovation	Deep renovation
Cost, € / m² (expert opinion)	800…900	900…1100	900…1100
Cost, € / m² (by cost vs area graph*)	910	1010	990
Renovation cost, M€	9,1	5,0	5,5
Potential grant, %	30%	30%	30%
Own contribution, M€	6,4	3,5	3,8
Own contribution, € / apartment	44400	48500	50900

[AREA]= 3350,8[COST]-0,141

It should be noted that the buildings also have potential for on-site solar PV installations, estimated in the range of 40–80 kWp per building, which could help reduce operating costs after renovation. The actual achievable capacity will depend primarily on the design of technical systems (e.g. the extent of ventilation and other rooftop equipment), roof load-bearing capacity and available space.

Renovation projects supported by national grants and achieving higher energy performance classes are typically eligible for long-term bank financing, usually with loan maturities of 20–30 years. This allows investment costs to be spread over time and reduces the monthly financial burden on apartment owners.

Based on the estimated own financing requirement, the monthly principal repayment per apartment would be approximately €185–212 for a 20-year loan and €123–141 for a 30-year loan, depending on building size and total investment cost. Including interest, assuming an indicative total interest rate of approximately 5% (Euribor plus bank margin), the total monthly loan payment would be in the order of €305–350 per apartment for a 20-year loan and €200–230 per apartment for a 30-year loan. These figures are indicative and depend on actual loan conditions and market developments.

When comparing Tartu Energia 2030's target of renovating 50% of apartment buildings with the existing Building Register and energy certificate data, the estimated remaining renovation need depends on how buildings classified as "already renovated" are interpreted. Given that achieving at least energy class C is the minimum requirement for renovation support, Building Register data indicate that approximately 18% of buildings have a consumption-based A–C class energy certificate (KEK). In addition, around 35% of buildings have an A–C class calculated energy certificate (ETA) or an energy certificate with unclear type.

In practice, it is common for calculated energy certificates issued at construction stage (ETA) to be approximately one class higher than consumption-based certificates (KEK) observed during actual operation. For this reason, it may also be reasonable to consider buildings with a D-class consumption-based certificate as effectively renovated.

Under a conservative interpretation, where only buildings with at least a C-class consumption-based energy certificate are counted as renovated, the remaining renovation need in Tartu's apartment buildings would amount to approximately 0.94 million m². Under a broader interpretation, also including A–C class certificates of unclear or calculated type, the remaining volume would be approximately 0.45 million m².

Assuming an indicative average renovation cost of €1,000 per m², this corresponds to a total investment need in the range of approximately €450–940 million. These figures are indicative and depend on data completeness and the definition applied for "renovated" buildings.

7. Renovation-supporting initiatives in Tartu

At the municipal level, Tartu does not provide dedicated local renovation subsidies – all major financial instruments for building renovation are designed and administered at the national level. As a result, the City of Tartu and the Tartu Regional Energy Agency (TREA) have focused on advising housing associations, strengthening local capacity, and participating in EU-funded pilot projects. These initiatives have supported renovation activities in line with the objectives of Tartu Energy 2030. The most relevant examples are outlined below.

SmartEnCity (EU Horizon 2020) - The SmartEnCity project was implemented in Tartu's city centre, covering a pilot area of approximately 0.39 km². The area included 42 residential buildings, of which 18 were renovated. The project demonstrated the comprehensive renovation of Soviet-era apartment buildings, combined with smart building solutions and active resident engagement. As an additional element, photovoltaic panels were installed on the renovated buildings, enabling partial on-site renewable electricity generation.

Tartu Renoveerib (ELENA, EIB) - Tartu Renovates was a technical assistance programme implemented with support from the European Investment Bank's (EIB) ELENA facility. The programme aimed to support housing associations in preparing renovation projects. A project team procured by the City of Tartu provided structured technical assistance, including building condition assessments, cost-effectiveness analyses, and support in preparing applications for EIS deep renovation grants.

OpenLab (EU Horizon 2020) - OpenLab is an EU Horizon 2020 project with its Tartu pilot area located in the southern part of Annelinn. The pilot area covers 22 nine-storey apartment buildings, home to approximately 3,500 residents. Within the project, three apartment buildings are being renovated and integrated solutions are being piloted, including photovoltaic systems, energy storage, and home automation. Notably, several of these solutions are being tested in Estonia for the first time in buildings higher than five storeys.

BuildEST (LIFE IP) - BuildEST is a national LIFE Integrated Project led by the Ministry of Climate, aimed at supporting the implementation of Estonia's Long-Term Renovation Strategy. The project focuses on developing and piloting technical renovation solutions, methodologies for addressing climate resilience, circular economy approaches, and digital tools that support holistic and sustainable building renovation.

City of Tartu guidance materials - The City of Tartu's website provides guidance materials and standard design solutions for renovation in heritage and milieu-protected areas (e.g. window, door, and façade detail solutions). Although these are not financial support measures, they help housing associations and designers align energy efficiency improvements with architectural quality and heritage protection requirements, particularly in areas such as Karlova's wooden building district.

In summary, these initiatives demonstrate that renovation support in Tartu is primarily delivered through knowledge transfer, pilot projects, and technical assistance. Together, they complement national support schemes and help create the conditions for more systematic and higher-quality renovation practices at the local level.

8. Priority areas and recommendations in the pilot region

8.1 Priority area 1 - Energy poverty.

Objective: Reduce energy poverty risks in Tartu by improving targeting, awareness, and low-threshold support for vulnerable households and districts.

Actions:

1.1 Energy poverty mapping and prioritisation
Carry out a local energy poverty mapping exercise to identify districts and building types with the highest vulnerability. Ideally, this mapping should be integrated into an updated SECAP and linked to renovation and funding prioritisation.

1.2 Targeted technical support in vulnerable districts
Use the mapping results to direct EU-funded projects and advisory services towards housing associations in vulnerable areas, providing enhanced technical assistance in the early stages of renovation planning.

1.3 Low-cost measures for indoor climate and health
Promote low-budget interventions that improve indoor climate and reduce energy consumption, such as energy counselling, on-site consultant visits, and practical energy-saving guidance. Raise awareness of the links between indoor climate, health, and quality of life.

8.2 Priority area 2 - Energy efficiency and comprehensive renovation

Objective: Accelerate deep renovation of the MAB stock while maximising energy savings, cost-effectiveness, and long-term performance.

Actions:

2.1 Maximising uptake of national renovation grants
Strengthen awareness-raising and advisory support to ensure that national renovation grants are fully utilised in Tartu, with particular focus on helping housing associations identify building needs and suitable renovation pathways.

2.2 Piloting and scaling prefabricated renovation solutions
Pilot and gradually scale up prefabricated (industrial) renovation approaches, which have the potential to reduce costs, shorten construction time, and improve quality in the long term. Awareness-raising among housing associations and property managers is essential.

2.3 Capacity building for property managers
Improve the capacity of property management companies to advise on renovation options, energy efficiency measures, and post-renovation system optimisation (including correct system settings and user guidance).

2.4 Integration of renewable energy solutions

Promote the integration of renewable energy solutions, particularly solar PV aimed at self-consumption. Increase awareness of how to achieve optimal self-consumption rates to help offset increased electricity demand after renovation**.**

2.5 Promotion of efficient heating practices

Encourage correct heating practices and appropriate fuel choices, contributing to improved energy efficiency, cost savings for households, and better urban air quality.

8.3 General recommendations related to the renovation works in the pilot region

3.1 Continued information and advisory activities

The City of Tartu and the Tartu Regional Energy Agency (TREA) should continue providing information, training, and awareness-raising activities for housing associations, residents, and property managers.

3.2 Strategic use of EU projects

Use EU-funded projects to test innovative technical and social solutions, address energy poverty challenges, and align outcomes with SECAP objectives, while ensuring that non-vulnerable groups are not excluded.

3.3 Simple local monitoring framework

Develop a light and practical local monitoring solution to track progress in renovation and energy poverty reduction, supporting evidence-based decision-making.

3.4 Development of cooperative models

Promote cooperative approaches such as joint procurement, neighbourhood-level renovation initiatives, and energy communities to reduce costs and increase participation.

3.5 Tailored guidance for wooden buildings

Pay special attention to wooden buildings, which face higher renovation costs and technical constraints. Develop tailored guidance and examples to support renovation of this building type.

Annexes

Annex 1. Methodology for ranking buildings by renovation priority

To determine the renovation priority of multi-apartment buildings, a data-driven multi-step methodology was applied, combining statistical analysis methods with a weighted composite score.

- **Correlation analysis -** Correlation analysis between independent variables was conducted to avoid multicollinearity. Where strong correlations were identified, only one variable was retained for further analysis.
- **Multiple Linear Regression (MLR) -** Multiple linear regression models were tested to identify variables that remained statistically significant across different model specifications.
- **LASSO model -** To validate the MLR results and identify the most relevant predictors, a LASSO (Least Absolute Shrinkage and Selection Operator) model was applied. LASSO enables variable selection when a large number of potential indicators are included and reduces the influence of less important variables.

Following correlation analysis and LASSO-based variable selection, four variables were retained for the final composite score.

Results of the LASSO model*:

Significant factor	Coefficient	Weight
part (Urban area (district))	-0.2222928523	0.4
hhold3 (Number of 3-person households)	0.0432284071	0.3
over65 (Share of residents over 65)	0.0007886124	0.2
msalary (Median salary)	-0.0004512478	0.1

* Weights were assigned based on the relative magnitude of the LASSO coefficients.

Prior to calculating the final composite score, selected variables were standardised to ensure comparability and to avoid bias arising from different measurement scales.

Calculation of the weighted composite score

The renovation priority score for each building was calculated using the following weighted formula:

– part × 0.40 + hhold3_std × 0.30 + Over65_std × 0.20 – msalary_std × 0.10
Where:

- part indicates the urban area (district);
- hhold3_std is the standardised number of 3-person households;
- over65_std is the standardised share of residents over 65;
- msalary_std is the standardised median salary.

Annex 2. Highest-priority multi-apartment buildings for renovation in Tartu pilot area

This annex presents 30 multi-apartment buildings that received the highest composite scores under the energy poverty risk-based renovation prioritisation model and were therefore identified as the most urgent candidates for renovation in the comparative assessment.

Buildings are listed in descending order of priority (highest priority first).

Number in the data	Address	Existing Energy Label
153	Anne tn 92	-
154	Jaama tn 171	-
148	Anne tn 85	E
194	Mõisavahe tn 42	E
163	Jaama tn 195	-
145	Anne 73	E
142	Anne tn 53	-
151	Anne tn 86	-
152	Anne tn 88	-
162	Kaunase pst 20	-
159	Kaunase pst 12a	-
187	Kaunase pst 60	-
192	Kaunase pst 81	F
182	Mõisavahe tn 24	-
183	Mõisavahe tn 25	-
184	Mõisavahe tn 31	-
179	Kaunase pst 62	E
180	Kaunase pst 63	F
167	Jaama tn 197	-
185	Mõisavahe 23	E/C?
188	Kaunase pst 56	-
189	Kaunase pst 57	-
190	Kaunase pst 58	-
124	Uus 65	F/C?
126	Uus 60	F/C?
129	Anne tn 28	-
160	Kaunase pst 14	-
164	Kaunase pst 7	-
158	Kaunase pst 8	-
172	Kaunase pst 27	-

Note. The prioritisation provides a comparative decision-support tool and does not replace building-specific technical audits or individual investment decisions.

Background of the CEESEN-BENDER project

The main goal of the project “Building intErventions in vulNerable Districts against Energy poveRty” (i.e. CEESEN-BENDER), launched on September 1 2023, is to empower and support vulnerable homeowners and tenants living in buildings built after the Second World War and before 1990’s in 5 CEE countries: Croatia, Slovenia, Estonia, Poland, and Romania. The project will help them through the renovation process by identifying the main obstacles and creating trustworthy support services that include homeowners, their associations, and building managers. Coordinated by Society for Sustainable Development Design (DOOR), the project CEESEN-BENDER brings together leading European researchers and experts in field from six countries: Croatia (Society for Sustainable Development Design / DOOR, Medjimurje Energy Agency Ltd. / MENEA, EUROLAND Ltd. / Euroland, GP STANORAD Ltd. / GP STANORAD), Estonia (University of Tartu / UTARTU, Tartu Regional Energy Agency / TREA, The Estonian Union of Co-operative Housing Associations / EKYL), Slovenia (Local Energy Agency Spodnje Podravje / LEASP), Romania (Alba Local Energy Agency / ALEA, Municipality of Alba Iulia / ALBA IULIA), Poland (Mazovia Energy Agency / MAE, Housing Cooperative Warszawska Spółdzielnia Mieszkaniowa - The Warsaw Housing Cooperative / WSM), Germany (Climate Alliance) in addition to Central Eastern European Sustainable Energy Network (CEESEN). The project CEESEN-BENDER is carried out from September 2023 until August 2026 and has a total budget of €1,85 million, of which €1,75 million is funded from the European Union’s Programme for the Environment and Climate Action (LIFE 2021-2027) under grant agreement n° LIFE 101120994. As stated, the main objective of CEESEN-BENDER is to empower and support vulnerable homeowners and renters living in multiapartment buildings (MABs) through the renovation process by identifying the main obstacles, and creating trustworthy support services that include homeowners, their associations, and building managers.

Therefore, the detailed objectives for CEESEN-BENDER are stated below:

- The project will analyse the ownership structure and physical characteristics of buildings in the pilot sites in targeted regions to comprehensively understand the obstacles that impede or halt homeowner associations, landlords, and property managers from pursuing energy renovations.
- Project partners will identify both legislation and financial, and technical administrative obstacles for the renovation in pilot countries. The identification of obstacles from the homeowners' perspective will help the creation of tailor-made solutions not only for homeowners but also for building managers, landlords, municipalities and other relevant stakeholders involved in the renovation process.
- Through the project, methods and tools that can be used to address different aspects of energy poverty will be developed. This includes:
    - Data gathering on energy poverty in the pilot sites;

  - A digital tool identifying buildings with high levels of energy poor households in the greatest need of renovation;
  - A model of potential savings in buildings undergoing renovation, and a tool for calculating the return on investment for energy renovations.
- 5 Pilot area roadmaps will be developed that prioritize building renovation based on their potential for maximizing emissions reduction via energy savings as well as an increase of quality of life and wellbeing for vulnerable homeowners.
- Within the 5 pilot areas, at least 30 building-level roadmaps will be created that specify the technical details for renovations. These pilot buildings will be supported in the entire pre-construction phase, drawing of plans, applying for permits, audits or other requirements and for financing. Plans will call for the decarbonization of the heating and cooling supply and integration of renewable energy sources (RES), to produce energy to cover its own consumption.
- Furthermore, a support system for homeowners, municipalities, and other large owners of multi apartment buildings (MABs) in targeted regions will be created to speed up the renovation process, by:
  - Advising at least 3.500 homeowners, landlords and building managers on legal, financial, technical and other aspects of energy renovations.
  - Advocating for changes of regulatory requirements and policies to lower the costs and time needed for the preparatory phase of projects.
  - Train at least 30 energy professionals on energy poverty and related topics.

Co-funded by the European Union

The CEESEN-BENDER project has received funding from the European Union's Programme for the Environment and Climate Action (LIFE 2021-2027) under grant agreement no LIFE 101120994. The information and views set out in this material are those of the author(s) and do not necessarily reflect the official opinion of the European Union or CINEA. Neither the European Union nor the granting authority can be held responsible for them.