31/10/2025

Rural Energy Efficiency Renovation Roadmap for Vulnerable Groups (REER)

Renovation roadmap for Kääpa 8 building, Estonia.

Co-funded by the European Union under project ID 101077272. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or CINEA. Neither the European Union nor the granting authority can be held responsible for them.

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Published in 2025 by RENOVERTY.

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1. INTRODUCTION

Every house ages and eventually requires repair or even major renovation, as the exterior, structure, and building systems deteriorate. The safety and usability of the building may fall below the owners' expectations or no longer meet basic requirements. At the same time, the skills of builders and designers are improving, and new, more advanced technologies are entering the market to help improve the home living environment.

Apartment owners and apartment associations often do not know how to start and what to do to ensure that, in time, their building meets expectations and is comfortable and safe. This roadmap has been prepared for the renovation process of an apartment building located in a rural areas.

This guide has been composed for the reconstruction of the apartment building with the address **Kääpa 8, Kääpa village, Mustvee rural municipality**.

The guide has been prepared for the complete renovation of an apartment building using national renovation grant from Enterprise and Innovation Foundation (EIS). The roadmap also includes an alternative phased option.

This technical roadmap is intended for households in Estonia, who would like to improve their homes' energy efficiency, reduce their bills, or enhance comfort through renovation. This guide is created by the **RENOVERTY** project [1] which seeks to promote the renovation of vulnerable rural districts and lay the foundations for increasing energy efficiency in an accessible and socially just way.

2. ENERGY RENOVATION OF APARTMENT BUILDINGS

Before beginning, it's better to understand what an energy renovation implies. Energy renovation means improving your home to make it more energy-efficient, comfortable, and eco-friendly. This can include better insulation, upgrading windows, switching to energy-saving heating systems, or even using renewable energy like solar panels. By making these changes, you can lower your energy bills, reduce your carbon footprint, and enjoy a cozier home all year round.

While energy renovation has great benefits, it can also come with some challenges. The upfront costs can be high, and it may take time to see savings on energy bills, requiring a long-term commitment before the investments pay for themselves. Finding reliable professionals and understanding available grants or subsidies can also be complex. But don't worry—financial aid programs and expert guidance are available to help make the process smoother and more affordable!

Different renovation methods and options

Renovation can be carried out basically in two ways: comprehensive renovation or step-by-step renovation.

Comprehensive (sometimes also deep, full) **renovation** involves the complete renovation of a building, during which the condition of the building and its energy efficiency are significantly improved, often with the aim of achieving optimal energy consumption. This type of renovation usually covers all the different elements of the building, including insulation, windows and heating, cooling and ventilation systems, as well as water and sewerage systems, etc. The aim is to significantly improve the condition of the building, ensure the necessary indoor climate and safety, and reduce energy consumption and greenhouse gas emissions. Comprehensive renovation often requires more extensive preparation and implementation than step-by-step renovation.

Step-by-step renovation is a gradual, multi-stage approach to renovate a building. Instead of carrying out the entire renovation in one step, this method divides the renovation process into individual, more manageable and gradually achievable measures. In this approach, improvements are identified and implemented in several stages, allowing individual elements of the building to be addressed. This makes it easier to manage the limited resources available, both in terms of money and time. Mainly due to the financial burden and the difficulty of financing a comprehensive renovation, the step-by-step renovation approach is most suitable for energy-poor households, where (based on an energy audit) we identify and prioritize the key energy efficiency measures that need to be addressed immediately.

For the renovating of apartment buildings in Estonia, owners and apartment associations must choose between **comprehensive renovation (all activities at once)** or a **step-by-step approach (gradual renovation over 15-20 years)**. Both methods have their advantages, depending on financial resources, project complexity, and long-term goals. In Table 1, the comparison of a full versus a step-by-step renovation is provided.

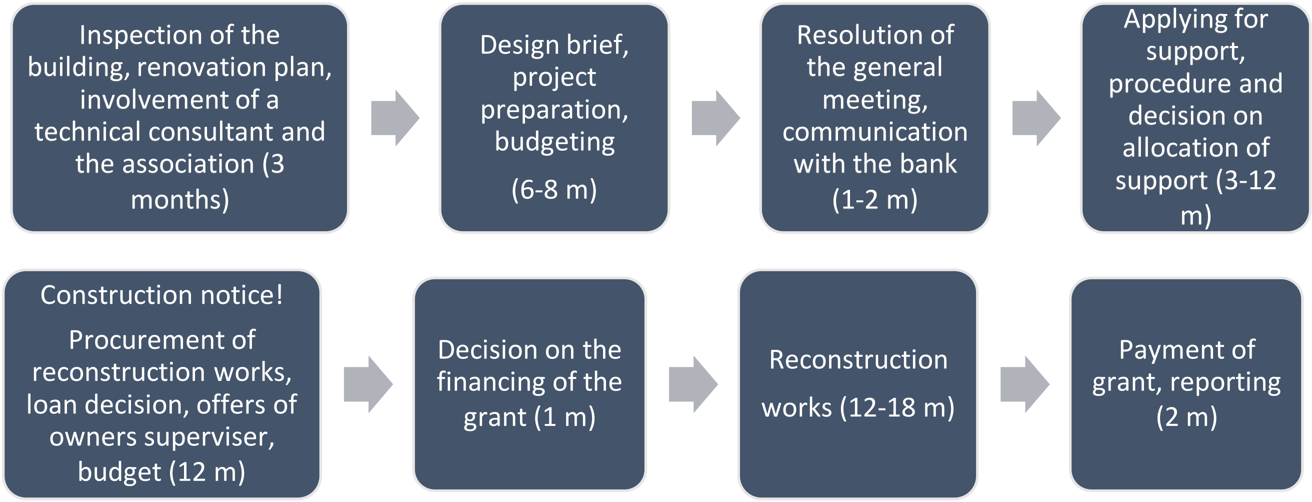
Table 1. Comparison of renovation options

Factor	Full Renovation (All at Once)	Step-by-Step Renovation
Energy Savings	Immediate and maximum (50-70%)	Gradual, spread over years
Financing & Subsidies	More government/EU support	Some subsidies available, but lower amounts
Property Value	Increases significantly in short term	Gradual increase over time
Disruption to Residents	High but only once	Lower per step, but repeated over years
Cost Control	Fixed cost at today's prices	More flexible but affected by inflation
Efficiency of Renovation	All systems are optimized together	Risk of mismatches in older vs. newer upgrades
Long-Term Cost Savings	No need for repeated work	Possible extra costs for redoing some parts

Comprehensive renovation is suitable if sufficient funding or needed financial resources, like grant, are available. Of course, it also depends on the grant's form and requirements, as well as the share and amount of support. In Estonia, a renovation grant for apartment buildings is available, therefore this roadmap describe renovation journey using the renovation grant form EIS. The grant provides 30-50 % share of renovation costs depending on location, with a higher share for areas with lower economic levels.

In Illustration 1, you can find the general process to follow when renovating your home with EIS grant with preliminary timeline. What is unpredictable is grant application timeline, as there are no fixed dates for grant calls.. However, not all steps can be simple and most of them require an expert's insight. So, if you find yourself lost in the process, don't worry! The steps that you should follow as a citizen, as well as the complexities you may encounter, are detailed in this guide to help you address problems before they even arise. Let's take a look at the first step: Contacting experts and seeking advice.

Illustration 1: Infographic summary of the energy renovation process



Source: Kredex

3. STEPS TO FOLLOW TO RENOVATE YOUR HOME

3.1. Step 1 – Seek advice and look for professionals

The owners (households and apartment association) play a key role in designing a home. The quality of the final result generally depends on the ability to manage the design and construction processes and the ability **to involve competent specialists in the team**. There is a simple rule: the more informed and smarter the client, the better the result.

Start by getting information and advice.

In beginning you can contact the Estonian Business and Innovation Agency (EIS), County Development Agencies, local municipality for guidance. They will explain to you how to start, what grants and loans are available and how to apply. County development centers across Estonia offer free consultations on EIS services aimed at apartment associations.

Building state of art

It starts by assessing the technical condition of the building. If you lack the necessary knowledge, it is essential to involve experts in technical systems and construction. It is advisable for the apartment association to hire a technical consultant when planning the work. In the case of applying for subsidies to EIS for comprehensive renvation, involving a technical consultant is mandatory.

Professionals working in renovation market and support owners on renovation journey shown in Tabel 2.

Table 2: Entities and organisations of professionals operating in Estonia

Entity	Link
Estonian Business and Innovation Agency	https://kredex.ee/et
List of renovation technical consultants	https://kredex.ee/et/kodudkorda
Union of technical consultants for renovation	https://tkliit.ee/
County develpment centers	https://eis.ee/noustamine-maakondlikes-arenduskeskustes/
Tartu Regional Energy Agency	http://www.trea.ee
Estonian Qualifications Authority (energy auditors)	https://kutsekoda.ee/en/
Estonian Association of Architectural and Consulting Engineering companies (EAACEC)	https://ekel.ee/en/contact

Source: Tabel prepared by TREA

3.2. Step 2 – Inspection of the building.

Evaluate the technical condition of the building and involve a technical consultant. Start by assessing the technical condition of the building. If you lack the necessary knowledge, it is essential to involve experts in technical systems and construction. It is advisable for the apartment association to hire a technical consultant when planning the work. In the case of applying for subsidies, involving a technical consultant is mandatory.

Energy audit of Kääpa 8

An energy audit is by its very nature a comprehensive energy analysis of a building. The most general goal of an energy audit is to identify, in detail, the specifics of a building's energy use and, based on this, to define savings opportunities.

During the energy audit, the building's energy balance is prepared, defining how the energy supplied to the building (mainly electricity and thermal energy) has actually been used over a given period. In other words, how much was lost through the building envelope (walls, roof, floor, doors, windows), how much left the building with waste water, how much was exhausted through ventilation, and so on.

During the energy audit, an assessment is also given about the equipment that produces, distributes, and uses energy in the building (boiler house/heating unit, heating system, electrical system, water pipeline, ventilation system), evaluating its efficiency and the possibility of saving measures.

The building was built in 1991. It has 18 apartments, of which 4 are four-room apartments, 8 are three-room apartments, 2 two-room apartments and 4 one-room apartments. Windows have double glazing with plastic frames. Heated area is 1020,1 m². According to the building's Energy Performance Certificate (EPC), the weighted energy use of this building is 302 kWh/m², which corresponds to **energy class "G".**

The load-bearing walls in this building are made of aerated concrete. In general, the wall thickness of the Kääpa building is approximately 30 cm and the thermal transmittance $U \approx 0.9$ W/m²K.

The Kääpa village in the Mustvee parish, in Eastern Estonia, is an active community. The village is home to a museum dedicated to Kalevipoeg, an Estonian mystical hero and a small associated theme park. The community is also participating in other projects such as the ongoing StartSun project under the Interreg Baltic Sea Region programme, aimed at developing an energy community in the village.

Owners of houses (buildings, having a energy performance certificates "C" or better or having environmental certificates, including energy-efficient buildings) often have specific expectations and advantages when considering energy renovation. These factors typically revolve around cost savings, environmental impact, and comfort improvements. In tabel 3 described general renovation objectives and actions can be suggested to owners.

Tabel 3. Renovation objectives (in general)

Objectives of Energy Renovation	
Reduced Energy Consumption:	• Minimize the energy required for heating, cooling and lighting buildings. • Replace or optimize heating, ventilation, and air conditioning (HVAC) systems.
Reduction of CO_2 Emissions:	• Lower the environmental impact of buildings through improved energy efficiency and integration of renewable energy sources.
Improved Living Comfort:	• Achieve optimal indoor temperatures, enhanced air quality, and better sound insulation. • Reduce heat loss to ensure greater indoor climate stability. • Improve health and well-being by reducing presence of damp and mould.
Increased Share of Renewable Energy:	• Incorporate solar panels, photovoltaic systems, or geothermal systems to decrease reliance on traditional, non-renewable energy sources.
Economic Enhancement of Buildings:	• Elevate the energy class of buildings (e.g., A, B, C), and the increasing of the value of the property for the owners. • Reduce long-term energy management costs. • Allow households to become prosumers.
Cost Savings for Users:	• Lower energy expenses through targeted efficiency improvements. • Opportunity for households to not be exposed to the effects of poverty or energy poverty.
Compliance with Energy Regulations:	• Adhere to European, national, and local energy efficiency directives, such as the Energy Performance of Buildings Directive (EPBD).

3.3. Step 3 - Make a plan, initial task, design and costs

A renovation plan means a well-thought-out construction project with financing and construction. It is based on the most accurate terms of reference/initial task. A comprehensive, well-thought-out and balanced initial brief is a prerequisite for a high-quality result. You, as the client, must thoroughly clarify for yourself and the entire team participating in the co-creation process – the following:

- the need for renovation, its purpose and value to you as the end users;

- the conditions arising from the local and national legal framework;
- the support/grant providers, in this case EIS, set of the technical requirements for the renovation result;
- the resources used to build the object;

and the impact of the planned building on the region at large. The preparation of initial task for Kääpa 8 was led by TREA (who tested the OSS model and had a role of technical consultant from side of Kredex) with the residents, the local government, the village association and local development organization, the district heating operator, and the structural and energy engineers were involved in the co-creation process. Later, the designer joined in to prepare a construction project for the renovation based on the initial task.

The renovation measures that were proposed were:

- insulating the entire building envelope: foundation, walls, roof
- install new energy-efficient windows (especially triple-glazed) and doors;
- renovating the heating system as a whole and switching to an air-to-water heat pump system; The system must ensure the possibility of regulating the room temperature in each apartment.
- installing heat recovery ventilation with a specified energy efficiency index,
- reconstructing water and sewerage systems installing a PV station on the roof.
- renovating the staircases and basement.

DREEM model

The most relevant measures for Kääpa 8 in the framework of the RENOVERTY project were selected and analysed through the DREEM (Dynamic high-Resolution dE-mand-sidE Management) model. This software enables the simulation of consumption scenarios and proposes optimized energy efficiency interventions based on potential savings and technical-economic feasibility. These are as follows:

- EEM_1 - Insulation of exterior walls: Insulation of the exterior walls of a building.
- EEM_2 - Double-glazed windows: Replacing single-glazed windows with more energy-efficient windows (double-glazed IZO windows) to reduce heat loss.
- EEM_3 – Thermal insulation of the roof: Insulation between and under the rafters of the roof reduces the overall heat transfer coefficient by adding materials with low thermal conductivity.
- EEM_4 - Energy Efficient Heating System (Boiler Upgrade - Gas): In this case, the existing heating system is replaced by a more efficient gas boiler with a higher efficiency rate. The gas heating system was analysed solely for financial indicators, but given its negative

impact on the environment and contribution to climate change, it is recommended to switch to sustainable heating systems that use renewable energy sources, such as heat pumps and biomass.

- EEM$_5$ - Energy Efficient Heating System (Boiler Upgrade - Biomass): In this case, the existing heating system is replaced by a more efficient biomass boiler with a higher efficiency rate.
- EEM$_6$ - Energy Efficient Heating System (Heat Pump): In this case, the outdated heating system is replaced by a heat pump with a higher degree of operation.
- EEM$_7$ – LED lighting: In this case, fluorescent and incandescent bulbs are replaced by high-efficiency LED lamps.

Tabel 4. EEM and annual total energy savings (in kWh) energy saving in Tartu, Estonia

Annual energy savings (kWh) (MFH, Tartu, Estonia)		
	Energy savings (kWh)	**Reduction (%)**
EEM$_1$: Exterior wall insulation	5,522.1	28.1
EEM$_2$: Double-glazed windows	1,959.7	10.0
EEM$_4$: Boiler upgrade - gas	3,602.1	18.4
EEM$_5$: Boiler upgrade - biomass	728.4	3.7
EEM$_6$: Heat pump	10,837.2	55.2
EEM$_7$: Energy efficient light bulbs	85.4	0.4

Measures EEM1, EEM6 and EEM7 are considered the most financially relevant while measures EE1 lead to the most energy savings, meaning that measures EEM1, EEM6 and EE7 are the more beneficial ones to be implemented. In the case of the Kääpa 8 building, **EEM1, EEM6, EEM7** measures will be implemented to achieve deep renovations.

Cost allocation

The cost of renovation may vary depending on the size of a building and type of works to be undertaken and is usually between 450€ and 1000€ per square metre of the building's net enclosed area. In this particular case, the cost on construction works is expected to be around 650€ to 700€ per square meter. F The final cost will be confirmed following the procurement of suitable construction company and its best offer.

At the same time, renovation grants cover a substantial part of most costs of renovating. In rural areas, the grant covers 50% of all costs, including the fee for technical consultants, the cost of design of renovation, mandatory building inspection, construction works, and also the potential surveys needed to establish the state of building before or during design phase.

The calculator for calculation of renovation estimated cost developed by EIS: can be found: https://eis.ee/rekonstrueerimise-kulude-kalkulaator-korteruhistutele/

The calculator for calculating expected energy performance class and number can be found: https://eis.ee/arvutusliku-energiamargise-kalkulaator-projekteerijale/

3.4. Step 4 - How to finance energy renovations

In Estonia three possible finance sources are available for apartment associations: own funds, bank loan and EIS support/grant. In most of renovation cases, a mixed financing model is used, typically involving the national renovation grant.

For apartment associations for Comprehensive renovation of apartment buildings national support is available. For the 2022-2027 period, the state has allocated 330 million euros from the European Union Structural Funds for apartment building reconstruction grants.

The last reconstruction grant call took place in September–October 2025. The next call will follow.

The main conditions are:

- The grant can be applied for the renovation of an apartment building built before 2000that has an apartment association
- The grant can only be applied to reconstruction works that are included in the relevant main project. The construction project required for the reconstruction of an apartment building must comply with § 13(3) of the Building Code,, the standard EVS 932 or equivalent requirements and the requirements of the regulation, and the architect of which must be at least on the professional level 7 of authorised architect. The project must be approved by the Board of the Apartment Association.
- The applicant must conclude a contract with the technical consultant or the company through which the technical consultant provides the service, except if the applicant did

not receive any bids for reasons beyond their control. The contract between the technical consultant and the Apartment Association is concluded no later than the moment the application is submitted.

- The cost of preparing the construction project (including conducting the construction survey and building audit on which the construction project is based) and the service of a technical consultant are eligible for the grant before the date of application submission to the implementation unit. If the technical consultant also performs owner supervision, the cost of owner's supervision is not eligible for the grant before the project start date specified in the decision approving the application.

Grant rate and maximum grant amount (some main points, whole document available here):

- In Tallinn and Tartu: 30%, or 50% when using prefabricated elements for reconstruction.
- In settlements adjacent to Tallinn and Tartu where the market value of real estate in the year preceding the application exceeds 500 €/m² according to the Land Board transaction database, and in Ilmatsalu, Märja, Haapsalu, Keila, Kohila, Kuressaare, Maardu, Otepää, Paikuse, Pärnu, Rakvere, Rapla, Sauga, Uuemõisa, and Viljandi: 40%, or 50% when using prefabricated elements for reconstruction.
- In the rest of Estonia: 50%, or 55% when using prefabricated elements for reconstruction.
- In other regions, excluding Tallinn and Tartu, it is possible to apply for a grant that is 10% lower if all the specified conditions are not met (e.g., no heat recovery ventilation is installed, or window thermal bridging requirements are not fulfilled)

For more information about the technical requirements for renovation and eligible measures, as well as for the grant, please visit the webpage of renovation grant.

3.5. Step 5 - Possible complexities you may encounter

Subtitle step 5. Addressing complexities in the retrofitting process

Starting an energy renovation project involves various complexities ranging from financial and technical difficulties to adaptation to regulations, administrative complexity and resistance to change. The **One Stop Shop and hired technical consultants** are the main point of reference that will inform, guide, advise and accompany you in your energy retrofitting processes, offering solutions to the difficulties that may be encountered and unblocking the possible obstacles across the different stages of the project.

Table 5 offers an analysis of possible risks that may emerge during an energy renovation project:

Table 5: Analysis of possible risks associated with energy renovation (from co-creation process)

	RISK	SOLUTION	WHO	HOW
ADMINISTRATIVE COMPLEXITY	Gathering and submitting the necessary permits and documentation can discourage homeowners from undertaking renovations	Consulting with OSS (tested within RENOVERTY by TREA) or technical consultant (TC) and they will help or prepare correct documentation. Or check the guidelines available in online "Renovation guide". Or participate on online or in person trainings.	Professional staff of OSS, and TC. Renovation (construction) guide (in Estonian)	OSS and TC will help by guidance or providing a service. Also, TREA provides trainings for apartment associations using platform model tested in RENOVERTY. Trainings are available online and in person. Link to renovation guide provided in Chapter 4
ADMINISTRATIVE COMPLEXITY	Application processes for existing programs are often unclear and inaccessible to people experiencing energy poverty	Consulting with EIS (application requirements), OSS or technical consultant (TC) and they will help or prepare correct documentation.	Professional staff of EIS, OSS, and TC	OSS and TC will help by guidance or providing a service. Links to EIS (grant

SOCIAL CHALLENGES	Homeowners with energy poverty often lack information about renovation options, subsidies or incentives, even when available	First check online "Renovation guide", Consulting with Local authority (LA), OSS, technical consultant (TC) and they will help or prepare correct documentation. Participate on trainings.	LA, OSS, TC, Renovation guide (link on chapter 4)	OSS, TREA will guide how to start of renovation journey. Also, TREA provides trainings for apartment associations using platform model tested in RENOVERTY. Trainings are available online and in person.
ECONOMIC	The high initial costs, as homeowners often lack the financial resources to finance the renovation.	Revising of renovation plan and initial task, consultations with OSS and TC. Online renovation guide helps also prioritize measures	Professionals form OSS or TC	Renovation guide (link on chapter 4
TECHNICAL	Older homes may require significant structural improvements before they can proceed with energy-efficient renovations, increasing the complexity and cost of the project	Participating in trainings and info sharing events for getting information from experts like OSS or TC. Secondly, take consultations from them and they will help with development of renovation plan.	OSS, TC	Professionals OSS, TC etc can advise how to proceed. TREA provides trainings for apartment associations using platform model tested in RENOVERTY. Trainings are available online and in person
	Developing of initial task for	Consulting with OSS or technical	Professional staff of the	In team with professional staff

	reconstruction works is complicated for owners, because there are different requirements and expectations	consultant (TC) and they will help with development of initial task. They involve needed expertise. Take a training on co-creation process of renovation	OSS, TC and necessary expert	managed by OSS or TC initial task can be developed. Link to online training of co-creation available in Chapter 4

Source: TREA

Some effects during of renovation

The management of the effects during the energy renovation phase of buildings is a critical part of ensuring the success of the project. Different possibilities are highlighted below, but in all cases, detailed and careful planning and communication are always the fundamental starting points for any renovation.

It is key that you have a clear work plan, the estimated duration of the works, the working hours and the defined work areas, as well as organize regular meetings with experts to understand each step of the project's progress and resolve any doubts you may have along the way

Effects can be the negatives and positives. Residents' resentment when renovations spread to apartments: replacing pipes, replacing/installing radiators, replacing windows, and installing ventilation.

Form positive side what we experienced: The renovation process brings residents closer together because they have all lived through this time and interacted with each other.

3.6. Summary

Congratulations, you have arrived to the end of this guide. Please bear in mind that once you decide to undergo an energy renovation in your home, it is necessary to understand your household's financial capacities to complete the project, taking into account the applicable grants and subsidies. At an economic level, although the subsidies in this guide are received in full at the end of the process, the financing methods mentioned in previous sections allow the funds to be advanced and can make your renovations more feasible. In parallel, you can contact professionals which can generate a complete renovation offer (audit, advice on feasibility and all the different solutions, cost optimization, project completion, construction management) and construction companies that perform the work. The works require licenses that must be processed at the town hall of the municipality, and the payment of the related fees. Finally, checking the general complexities and drawbacks that the process may cause is crucial to applying mitigation measures and guaranteeing a smooth and satisfying renovation experience.

Don't forget! As written throughout this guide, **the One Stop Shop and TC can advise** households like yours during this process and help you address the possible complexities that may arise during the different stages of energy renovation**.**

Now, it is your turn to plan your renovation!

1. Seek advice	When should I plan to visit or contact the TREA office?	**Add contacts**
2. Look for professionals and budgets	How many professionals and budgets will you contact and when? Can the professionals apply for grants?	Check section 3.1
3. Select the most appropriate measures	Do you know which measures might work better for you? What measures suit you better in terms of energy savings and economic viability?	Check sections 3.2 and section 3.3
4. Check the main complexities the process may have	What inconveniences can you find in the process?	Check section 3.5 and keep yourself prepared!

4. REFERENCES AND LINKS

Online Renovation guide (in estonian): https://livekluster.ehr.ee/ui/ehr/v1/abi/ehitusgiid

Concept of single family building renovation roadmap: https://www.bpie.eu/wp-content/uploads/2018/03/iBRoad-The-Concept-of-the-Individual-Building-Renovation-Roadmap.pdf

Public Procurement Register. https://riigihanked.riik.ee/rhr-web/#/

Calculator for Apartment associations for renovation costs: https://eis.ee/rekonstrueerimise-kulude-kalkulaator-korteruhistutele/

National renovation strategy: https://kliimaministeerium.ee/sites/default/files/documents/2023-06/Hoonete%20rekonstrueerimise%20pikaajaline%20strateegia.pdf

Kredex (EIS renovation webpage): https://kredex.ee/en

Last renovation call regulations (into Estonian): https://www.riigiteataja.ee/akt/124092024008?leiaKehtiv=

Co-creation online training : https://renoverty.aisforacademy.eu/?lang=en

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Co-funded by the European Union under project ID 101077033. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or CINEA. Neither the European Union nor the granting authority can be held responsible for them.