Energy Renovation Roadmap - REER - for Stakeholders in the Bükk-Region

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.

COPYRIGHT INFORMATION

Released in 2024 under the RENOVERTY project.

Abbreviations used in this document:

REER	Rural Energy Efficiency Roadmap
DREEM	Dynamic High-Resolution Demand Management Model (DSM) Dynamic high-Resolution dE-mand-sidE Management
EU	European Union
LAG	Local Action Group
EEOS	Energy Efficiency Obligation Scheme
NECP	National Energy and Climate Plan
MEKH	Hungarian Energy and Public Utility Regulatory Authority
ÉMOR	Building Renovation Monitoring System
ÉKM	calculation of building energy performance
RRF	Recovery and Resilience Facility

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.

Table of Contents

ABOUT THE RENOVERTY PROJECT

The RENOVERTY project promotes the energy efficiency renovation of residential buildings in Central and Eastern Europe, Southeast Europe and Southern Europe. It provides a methodological and practical framework for developing financially viable and socially fair roadmaps for the renovation of vulnerable rural areas.

The project aims to provide tools and resources to local and regional actors and support them in developing and implementing practical roadmaps to help with energy renovation of residential buildings in rural areas. A scalable model facilitates the widespread use of roadmaps in other regions and their implementation at EU level by other actors. Strategically, the project contributes to reducing the logistical, financial, administrative and legal burden caused by the complex and multi-stakeholder home renovation process. RENOVERTY will also ensure that the renovation of buildings takes social aspects into account by incorporating safety, comfort and accessibility into roadmaps to further improve the quality of life of vulnerable populations.

The roadmaps prepared within the framework of the three-year project provide direct assistance in seven pilot areas: Sveta Nedelja (Croatia), Tartu (Estonia), Bükki and Somló-Marcalmente-Bakonyalja (Hungary), Zasavje (Slovenia), Parma (Italy), Coimbra (Portugal) and Osona (Spain) and can be integrated into rural and peri-urban development policy processes in the long term.

SYNOPSIS

This document serves as a roadmap for stakeholders addressing energy poverty, aimed at facilitating the energy renovation of residential buildings and single-family homes.

The Rural Energy Efficiency Roadmap (REER) is designed to assist a wide range of actors involved in the energy renovation process, including homeowners planning to renovate their properties, organisations supporting household renovation efforts—such as municipalities, NGOs, experts, energy consultants, and local action groups (LAGs).

While the first section of REER focuses on technical aspects, the second section addresses structural and community-related challenges associated with renovating rural households impacted by energy poverty. This part delves into overcoming non-technical barriers, such as legislative, financial, and administrative obstacles.

The development of REER has been a collaborative effort, involving contributions from a variety of local, regional, and national stakeholders—including municipalities, service providers, NGOs, and local action groups—through joint workshops and consultations. Importantly, individuals directly affected by energy poverty were actively engaged in the roadmap's creation, ensuring it reflects the fundamental needs of local communities.

1. THE CURRENT STATE AND CHALLENGES OF ENERGY POVERTY IN HUNGARY AND BÜKK-REGION

The European Union identifies households affected by energy poverty as those unable to maintain adequate indoor temperatures during winter or effectively cool their homes in summer. According to the EU-SILC survey, energy poverty in Hungary affected 7.2% of the population in 2023, placing the country among the most favourable third in the EU. Remarkably, Hungary performs better than economically stronger nations such as Germany.[1] This favourable figure is likely due to government-regulated electricity and gas prices, which are kept low. However, this regulation creates challenges for and slows down the energy renovation of residential buildings.

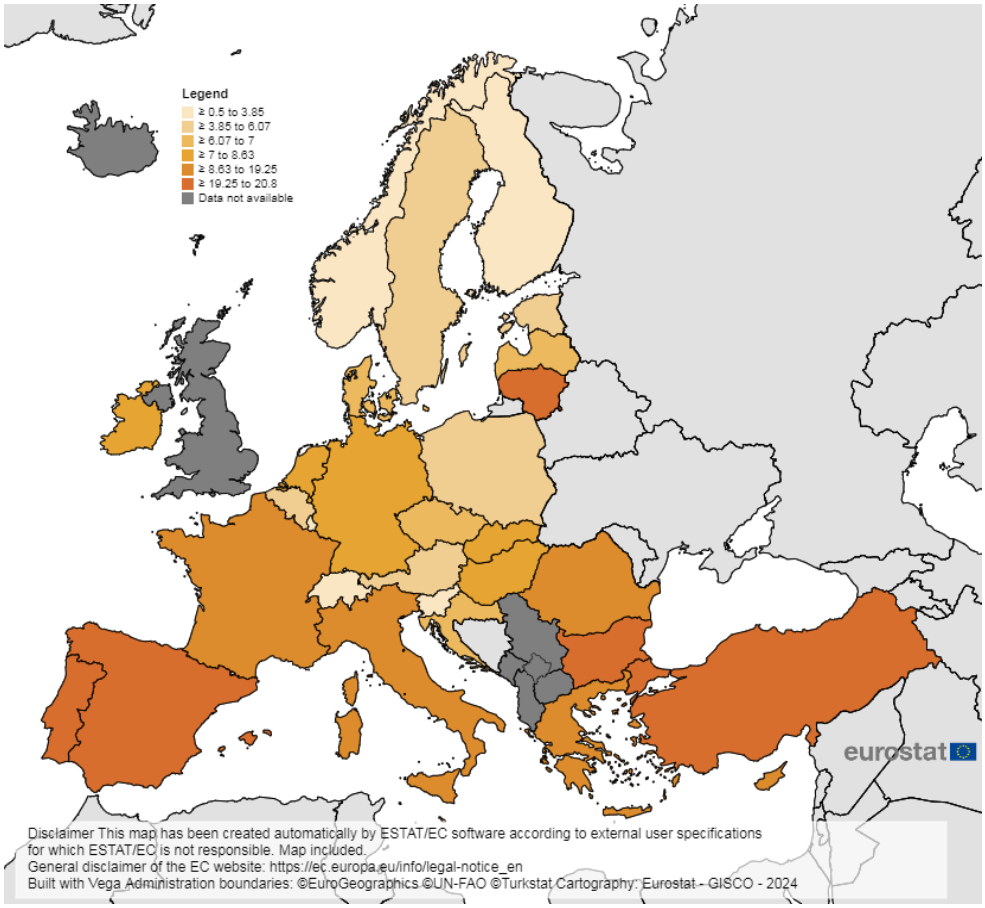

Figure 1 - Energy poverty in EU Member States

[1] *Inability to keep home adequately warm - Findings from the EU-SILC survey (2023)*

Comprehensive data on the energy performance of Hungary's residential building stock is limited. Currently, there is no national database offering sufficient information on the actual condition of residential buildings to support the development of targeted and effective strategic measures. In 2018, energy consumption in the residential sector amounted to 244 PJ, representing 33% of the country's total final energy consumption. Approximately half of this energy consumption stems from natural gas, with one-quarter derived from renewable energy sources. However, in the case of renewable energy, the primary sources are biomass and firewood. Consequently, residential energy consumption accounts for around 13% of Hungary's national greenhouse gas emissions, largely due to fossil fuel combustion. Notably, over 70% of residential energy consumption is attributed to heating.

In Hungary, 54% of the population resides in single-family houses. Alarmingly, more than three-quarters (78%) of these homes fall into the four poorest energy-efficiency categories. For Hungary to meet both national and European climate policy targets, the residential building stock must undergo a near-complete energy renovation in the coming years.

NATIONWIDE DISTRIBUTION OF ESTIMATED ENERGY RATINGS FOR FAMILY HOUSES[2]

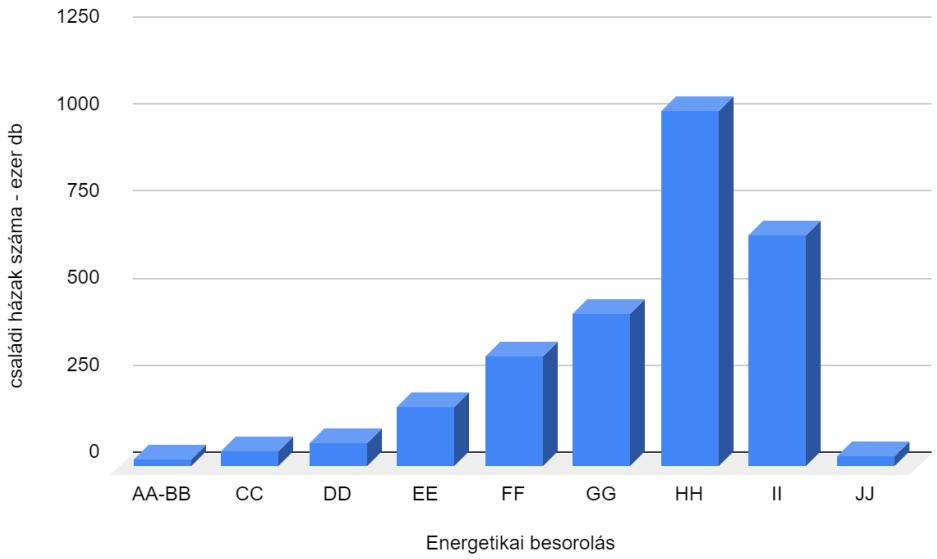

Figure 2 - Nationwide distribution of estimated energy ratings for family houses in Hungary

The most effective approach to reducing energy poverty is the energy renovation of residential buildings. This roadmap, informed by conducted surveys, outlines the associated capabilities, opportunities, and challenges.

[2] *Source: Estimation of the energy demand of the residential real estate stock in Hungary - Mónika Bene – Antal Ertl – Áron Horváth – Gergely Mónus – Judit Székely – Credit Institution Review, Vol. 22, No. 3, September 2023, pp. 123–151.*

1.1 THE BÜKK REGION

The region is located in the beech area of the North Central Mountains. The natural and economic geography of the area surrounding the Bükk Mountains is varied. The rich flora and fauna of the western part is preserved in the Bükk National Park. The natural richness of the eastern part of the region is reflected in rivers, lakes, thermal waters and high quality casting soils. In the eastern part of the region there are industrial, construction and agricultural enterprises, while in the western part there are mainly tourism and wine-growing enterprises. The southern Bükk hills are home to high-quality grapes and fruit, and hundreds of wine cellars are tourist attractions.

The strengths of the Local Action Group (LAG) are that it is the meeting point of important European transport routes, it is rich in natural resources, underground assets, thermal water resources, building material deposits, its varied landscapes attract tourists, it is a leader in the use of renewable energy sources in Hungary, its hill farming is suitable for ecological farming, its lowland farms are viable. All these assets are combined with the community's commitment and willingness to act. In recent years, there has been a positive trend in the settlement of young families, both from the capital and from the big cities

The Local Action Group (LAG) covers an area of 925.67 km^2, with a total number of 42 municipalities and a population of 76 960. 20.5% of the population has not completed the 8 grades of the primary schools. Its strengths are its natural resources: solar, wind, water, geothermal energy, the heat of air and biomass. The region's strategy focuses on environmental and sustainability issues.

The Reflex Environmental Association has carried out energy audits for 4 detached houses with the region's stakeholders (Holocen Nature Conservation Association). The houses were selected to represent the building materials and construction methods typical of the area.

1.2 THE ENERGY AUDIT[3]

An energy audit is a comprehensive examination that assesses the energy efficiency of a building, identifies energy losses, and evaluates processes related to its usage. It provides a detailed analysis of the building and its operational characteristics. During the audit, the energy expert (auditor) evaluates the property and its operating methods, delivering a tailored set of recommendations to cost-effectively reduce energy consumption. The resulting expert report specifies where and how energy is used, in what quantities, and the associated costs.

[3] Figure 3 - The Authentic Energy Certificate - *Source: National Certification Centre* https://otk.hu/tanusitvany-tartalom-minta

HITELES ENERGETIKAI TANÚSÍTVÁNY

A tanúsítvány az e-tanúsítás elektronikus alkalmazásban azonosítóval vagy QR kóddal ellenőrizhető és megtekinthető. www.e-epites.hu/e-tanusitas

Energetikai besorolás:	CO_2 kibocsátás:	Azonosító:	Érvényesség dátuma:
A+++	A+++	HET-1002-1000	2029.02.05.

ÖSSZEFOGLALÓ LAP

AZ ÉPÜLET ADATAI

Megrendelő neve
Cím
Helyrajzi szám
Tanúsítvány kiállításának oka
Épület rendeltetése
Építési év
Jelentős felújítás éve
Műemléki vagy helyi védettség
Hasznos alapterület
Kondicionált térfogat
Épület szintjeinek száma
Épület felület-térfogat aránya

HATÉKONYSÁGI KATEGÓRIÁK

	%	Összesített energetikai jellemző	CO_2 kibocsátás
A+++	≤ 0	-309% (-235.04 kWh/m²év) A+++	-177% (-35.45 kg/m²év) A+++
A++	0 <...≤ 50		
A+	50 <...≤ 90		
A	90 <...≤ 100		
B	100 <...≤ 130		
C	130 <...≤ 160		
D	160 <...≤ 200		
E	200 <...≤ 250		
F	250 <...≤ 310		
G	310 <...≤ 390		
H	390 <...≤ 500		
I	500 <		

	Összesített energetikai jellemző	CO_2 kibocsátás	Fajlagos hőveszteség-tényező
Jelenlegi érték	-235.04 kWh/m²év	-35.45 kg/m²év	0.26 W/m³K
Jelentős felújítás követelményszintje	150.00 kWh/m²év		0.52 W/m³K
Közel nulla energiaigényű épületek követelményszintje	76.00 kWh/m²év	20.00 kg/m²év	0.37 W/m³K

Teljesül a jelentős felújítás követelményszintje?	igen
Teljesül a közel nulla energiaigényű épületek követelményszintje?	igen
Nyári hővédelmi követelményeknek megfelel?	igen
Hasznosított megújuló energia mennyisége	151.23 kWh/m²év

TANÚSÍTÓ ADATAI

Név
Cím
Telefon
E-mail
Jogosultsági szám
Szoftver és verzió

ÉRVÉNYESSÉG

Helyszíni szemle dátuma: 2024.02.05.
Kiállítás dátuma: 2024.02.05.
Érvényesség dátuma: 2029.02.05.

Aláírás P.H.

Figure 3 - The layout of the Authentic Energy Certificate

Energy audits in Hungary can only be performed by authorised professionals. Accreditation is managed by the Hungarian Chamber of Engineers, and only qualified expert engineers who have completed the required training are eligible to become energy auditors. The Hungarian Energy and Public Utility Regulatory Authority (MEKH)[4] maintains a list of accredited experts. Energy audits are regulated by a government decree[5], based on which energy performance certificates are issued for residential buildings. These certificates facilitate the energy renovation of

[4] List of energy auditors

[5] Government Decree No. 176/2008 of 30 June 2008 on the certification of the energy performance of buildings

buildings and provide valuable information for those buying or renting real estate. They guide property owners and tenants toward cost-effective solutions for energy-efficient renovations. The energy performance certificate consists of four main sections:

1. Summary Sheet: The first page is standardised across all certifiers, generated by the National Building Register. It contains key information about the property, the client, the engineer, the energy calculations' results, and the classification achieved.
2. Energy Calculations: This section includes the parameters of the building's structures and detailed calculations of the mechanical systems.
3. Renovation Proposal: This section outlines recommended upgrades and measures that can be implemented to improve the property's energy performance.
4. Supporting Documents: The final section contains relevant attachments and photographs of the property.

1.3 EXAMINATION OF SAMPLE FAMILY HOUSES IN THE BÜKK REGION

To select the households, we asked for the help of local actors - local action groups, NGOs - who possess strong local knowledge. We published a call for proposals, which was promoted by the Bükk - Regional Leader Association. On the basis of the call, interested parties were asked to fill in a short questionnaire to indicate their willingness to cooperate, which, in addition to the information needed to contact them, also asked about the main characteristics of the residential buildings: date of construction, building materials used, date of last renovation. The households were also consulted in person by representatives of Reflex and the Holocen Association, who informed them about the possibilities for energy modernisation. The energy audits were carried out by registered experts who personally visited the residential buildings to assess the building's characteristics and draw up energy performance certificates, suggesting the steps to be taken and the expected impact of the modernisation.

In the Bükk area, we audited four family houses. Most of these households consist of 1-4 residents, who occupy the homes primarily after working hours, from the afternoon until morning, and throughout the weekends. The construction dates of the surveyed buildings range from 1868 to 1996. Selection criteria focused on examining buildings that are representative of the region, including traditional farmhouses, the prevalent "Kádár cubes" from the post-1960s era, and newer constructions.

TYPES OF BUILDINGS

In rural Hungary, family houses are the predominant form of residential construction, typically positioned freely on the plot or along the property boundary. Many of these buildings have

cellars and are predominantly single-storey, with two-storey structures being less common. It is rare to find panel-built residential buildings using industrial methods in rural areas. Family houses have evolved in design and function over time, adapting to the prevailing trends and available resources.

The most common type is the "**Kádár cube**," built between the 1950s and 1970s. These one-storey, square brick structures (80-100 m²) feature a pitched roof and were often adapted (in the '60s and '70s) from traditional farmhouses along the street front. During the 1980s and 1990s, many of these buildings were expanded with attic conversions or additional floors. The houses audited in this study were constructed between 1868 and 1996, typically single-storey with some featuring basements. The average total floor area is 145.76 m², with an average habitable area of 114.06 m².

BUILDING MATERIALS

The construction materials of family houses have historically been sourced locally. Common masonry materials include adobe, stone, wood, and later, brick. Traditional roofing materials in Hungary were reeds, straw, and tiles. From the 1950s onward, brick and ceramic masonry elements became standard, with aerated concrete also used in certain regions. Doors and windows are primarily wooden (typically with two glazed wings), featuring a beam frame design. Modern replacements—double-glazed plastic doors and windows—began appearing in the 1990s. Concrete and reinforced concrete became prevalent for foundations and floors since the 1950s. Asbestos slate, commonly used for roofing - in combination with tiles - from the 1950s to 1970s, was later found to pose significant health risks.

The selected audited buildings include a variety of construction types beyond the typical Kádár cubes, with brick being the dominant material. Stone and adobe walls are also present in each building. Partial renovations have replaced original wooden doors and windows with plastic alternatives in several houses. Shell materials include tiles for seven houses and asbestos slate for one.

HEATING SYSTEMS

In rural Hungary, residential heating is typically managed at the property level. Traditionally, individual rooms were heated using stoves fueled by firewood or coal. From the 1970s, central heating systems became more common alongside the expansion of the natural gas network in rural areas. This led to the adoption of gas convectors and later central gas boilers in family homes. The audited houses feature various heating systems, including central heating with multi-fuel boilers (wood and coal), gas boilers, tiled stoves, and gas convectors. The total heating capacity for each house ranges between 24-30 kW.

IMPLEMENTED ENERGY RENOVATIONS

Of the four audited family houses, three had undergone partial but insufficient energy renovations. External wall insulation was either lacking or inadequately thick. In two buildings, the original double-glazed wooden doors and windows were replaced with double-glazed plastic versions, offering improved thermal insulation.

1.4 BARRIERS AND CHALLENGES

The barriers and challenges related to energy renovations in Hungary and the Bükk-region are similar to those faced in other European countries. These challenges are often interconnected and can be addressed progressively in stages.

Lack of Information - Households experiencing energy poverty are often poorly informed and ill-prepared to address the issue. While they are aware of the financial strain caused by high energy costs, they often lack knowledge about available solutions, services, and support programmes. Initiatives such as RENOVERTY, which present practical, locally relevant examples, play a crucial role in raising awareness. Expanding access to information and offering free advisory services beyond short-term campaigns—through collaboration with state, municipal, and civil society organisations—would be essential for long-term impact.

Impact of Utility Cost Reductions - In Hungary, the government subsidises residential energy costs, making electricity and natural gas available at prices significantly lower than market rates. Households benefit from electricity priced at a reduced rate up to an average consumption of 2,523 kWh per year and natural gas up to 63,645 MJ per year (or approximately 1,729 m^3 per year). While this policy alleviates short-term financial pressure, it also extends the payback period for energy efficiency investments, reducing the incentive for households to undertake renovation efforts. Redirecting state funds from utility subsidies to energy renovation programmes would require a central government decision, which is unlikely under the current administration.

Social and Financial Constraints - Households affected by energy poverty often lack the financial resources to invest in energy-efficient renovations. Many do not have sufficient savings, nor are they adequately informed about the complexity of energy renovations. Without targeted financial support, these vulnerable groups are unable to initiate renovation projects. To enable these projects, accessible funding mechanisms and resources must be provided.

Challenges in Support Programmes - Available support options in Hungary are discussed in detail in Section 3.4. However, a major challenge in planning energy renovation projects is the absence of long-term, continuous programmes, which makes it difficult for households to engage in structured, multi-phase renovation projects.

Fragmented Planning Processes - Due to the limited and sporadic availability of financial resources, energy renovation efforts are often dictated by funding opportunities rather than a strategic, step-by-step renovation plan. Households tend to implement upgrades based on the eligibility criteria of specific grants rather than following an optimised, sequential renovation process. This fragmented approach can lead to inefficient investments and missed opportunities for comprehensive energy efficiency improvements.

Construction and Workforce Shortages - The implementation of planned renovations is further complicated by a shortage of qualified professionals. Skilled workers are often booked several months in advance or engaged as subcontractors for larger projects, making them less available for smaller-scale residential renovations. Additionally, hiring a general contractor significantly increases renovation costs. To mitigate these challenges, solutions such as maintaining a database of qualified professionals, establishing expert networks, and ensuring timely planning and contractual agreements with contractors would help streamline renovation processes.

2 ACTION TO TACKLE ENERGY POVERTY: ENERGY RENOVATION OF SINGLE-FAMILY HOUSES

The second section of the Rural Energy Efficiency Roadmap (REER) focuses on practical solutions for addressing energy poverty through the renovation of single-family houses. This section provides step-by-step guidance for rural citizens on implementing energy-efficient renovations, from initial planning to the execution of practical, financially viable upgrades.

The roadmap also introduces practical renovation options, supported by calculations from the DREEM model[6], to help stakeholders evaluate the most effective and cost-efficient solutions. By following these structured recommendations, homeowners, policymakers, and professionals can better navigate the challenges of energy efficiency improvements, ensuring sustainable and impactful renovations in rural communities.

2.1 SETTING EXPECTATIONS AND INDICATORS FOR THE RENOVATION OF RURAL HOUSING

The energy renovation of residential buildings, including slab and wall insulation, window replacement, and heating system upgrades, generally does not require building authority permits in Hungary. However, exceptions apply to buildings located in protected areas or historically significant environments, where additional regulatory approvals may be necessary.

Hungarian building energy performance legislation sets[7] specific expectations and standards only for newly constructed residential buildings or renovations involving significant expansion.

Certain renovation grant programmes, however, do impose specific energy efficiency targets. For instance, the Home Renovation Programme, detailed in Section 2.5, requires that energy

[6] The DREEM model (Dynamic high-Resolution dE-mandsidE Management) is a tool used to assess various energy efficiency measures based on their energy-saving potential and techno-economic feasibility. The measures considered include external wall insulation, replacing windows with double glazing, roof insulation, upgrading heating systems (gas, biomass, or heat pumps), and efficient lighting (LED lamps). Modeling results show that the effectiveness of the measures strongly depends on the initial condition of the building and the existing heating systems. This highlights the importance of targeted interventions to achieve significant improvements in energy efficiency and environmental sustainability.

[7] 9/2023. (V. 25.) ÉKM (calculation of building energy performance) decree

renovation measures result in a minimum 30% reduction in specific primary energy consumption compared to the pre-renovation state.

Hungary does not currently define official national indicators related to energy poverty. However, under the European directive on energy poverty, households affected by energy poverty are those unable to heat their homes to an adequate temperature in winter or cool them during the summer. While the directive does not specify exact temperature thresholds, in practice, a heating range of 20-22°C is widely accepted as an appropriate indoor temperature during winter.

In rural Hungary, artificial summer cooling of buildings using air conditioning remains uncommon. However, due to increasingly frequent heatwaves, many households install air conditioners as an early measure, often preceding comprehensive energy renovation efforts.

GOALS OF THE RENOVATION OF SINGLE-FAMILY HOUSES

The renovation of households affected by energy poverty is aimed at improving living conditions, reducing energy costs, and enhancing overall well-being. The primary objective is to increase energy efficiency through a combination of retrofitting boundary structures, insulating or replacing windows, upgrading heating systems and major household appliances. These measures lead to lower energy consumption, which in turn reduces utility costs, providing both economic and environmental benefits.

Beyond energy savings, renovations play a crucial role in ensuring homes meet modern health and safety standards. Poorly insulated and energy-inefficient buildings often suffer from moisture-related problems, such as condensation and mould growth, which can cause respiratory and other health issues. Energy renovations should therefore prioritise not only efficiency improvements but also the creation of a healthier indoor environment for residents.

At a broader level, energy-efficient renovations contribute to national and international climate policy goals by reducing greenhouse gas emissions. Enhancing the energy performance of buildings helps countries meet their commitments to carbon reduction, playing a key role in the transition to a more sustainable energy system.

Finally, energy renovation projects combat energy poverty and promote social justice. Energy-efficient homes improve the quality of life for low-income families, reducing socioeconomic disparities and enhancing social inclusion. By investing in the renovation of energy-poor households, governments and organisations provide not only immediate financial relief but also long-term sustainability, improved health, and greater social equity.

INDICATORS TO MEASURE RENOVATION GOALS AND PROGRESS

Target	Indicator	Expected result
- Improving the energy efficiency of the residential building	- Energy saved (kWh) - Saved energy per unit area (kWh/m2) - Improved energy efficiency rating.	- Energy demand per unit of living space (1 m2) is reduced to 50-90 kWh/year - The energy rating of the building will be improved by at least two classes (e.g. from G to E)
- Reducing household overhead costs	- Reduction in utility bills (HUF)	A 20% to 50% reduction in energy bills.
- Improving quality of life - thermal comfort, indoor air quality	- Increase / decrease in indoor temperature in winter (°C) - Ideal indoor humidity - mould eliminated - Reduction of indoor particulate matter	- The indoor humidity does not reach 50% - Mould growth is eliminated
- Reducing the carbon footprint of the household	- Reduction of carbon dioxide emissions (kg) - Reduction of carbon dioxide emissions per unit area (kg/m2)	- Carbon dioxide emissions reduced by 20-50%

Table 1 - Targets, indicators and expected results of energy renovation

2.2 PLANNING THE RENOVATION

Planning the energy renovation of households affected by energy poverty requires a structured approach to ensure maximum energy efficiency, reduced utility costs, and improved living comfort. The process involves several key steps, beginning with an energy audit, as outlined in the previous section. The audit helps to identify the most effective renovation measures tailored to the specific needs of the building and its occupants.

One of the primary focuses of renovation is improving the thermal insulation of building envelopes, including walls, roofs, and floors, to minimise heat loss. Ensuring proper insulation or replacing outdated doors and windows further enhances energy efficiency. Another crucial step is upgrading heating systems to improve energy performance and reduce costs.

To further reduce reliance on fossil fuels, integrating renewable energy sources into the renovation plan should be considered. The installation of solar panels or the use of heat pumps can provide a cleaner, more sustainable energy supply while lowering household energy expenses in the long run.

A well-planned renovation strategy ensures that households benefit from renovation efforts in a cost-effective and sustainable manner, leading to improved living conditions, enhanced energy efficiency, and long-term financial savings.

SCHEDULING ACCORDING TO COSTS AND AVAILABLE GRANTS

A critical aspect of planning an energy renovation is assessing costs and identifying available financial support. Households affected by energy poverty often lack the resources to carry out necessary renovation measures without subsidies. However, in Hungary, financial resources for residential energy renovations are limited, difficult to access, and do not comprehensively support all necessary renovation processes. Given these constraints, the renovation process should follow a structured schedule to optimiSe both efficiency and affordability.

1. The first step in the renovation process is a **general condition assessment** of the building, which identifies critical issues that must be addressed before energy renovation works can begin. These may include replacing outdated electrical wiring, repairing or replacing a deteriorated roof, and ensuring adequate waterproofing of walls or floors. Without resolving these fundamental structural problems, further energy efficiency upgrades may be ineffective or even counterproductive.

2. Following the general assessment, a **building energy audit** should be conducted. This evaluation helps to identify the weak points of the building and determine the most effective energy renovation steps. The audit provides crucial data on heat loss, insulation efficiency, heating system performance, and potential energy savings, guiding homeowners in making informed renovation decisions.

3. Once the energy audit is complete, a **rational sequence of renovation steps** should be established, considering the interdependencies of each process and any external factors that may impact implementation. The first priority should be **ensuring or maintaining ideal indoor humidity levels**, as replacing windows and doors in homes with high humidity often leads to increased condensation and mold growth. Proper ventilation must be considered when selecting materials and structural solutions.

One of the most immediate and cost-effective measures is the **insulation or replacement of doors and windows**, as the greatest heat loss in single-family homes typically occurs through these openings. If full replacement is not financially feasible, simple insulation measures can be undertaken to improve efficiency. However, switching from poorly sealed wooden windows to airtight plastic alternatives must be carefully considered, as modern materials, while offering better insulation, also prevent natural moisture transfer, which can exacerbate humidity-related issues.

Another highly effective and relatively affordable upgrade is **slab insulation** in houses with unbuilt attic spaces. This process, which has seen advancements in environmentally friendly techniques, helps insulate hard-to-reach areas, particularly between wooden structures. The next step, **external wall insulation**, is a crucial component of energy efficiency but requires professional calculation and expert guidance. The effectiveness of insulation materials has significantly improved in recent years, making it advisable to choose the thickest feasible insulation while considering building characteristics such as ledge width. In the case of adobe masonry, special attention must be given to using breathable insulation materials, such as glass wool, instead of polystyrene.

If part or all of the attic is built-in or planned for future use, **roof insulation** should be considered. This step is often complex, requiring the dismantling of existing structures, and therefore necessitates professional planning. Similarly, **floor insulation** should not be overlooked, as heat loss through flooring can be substantial, particularly in single-story houses with large floor areas.

Upgrading the heating system is another critical step in the renovation process and requires the expertise of mechanical engineers. The building's overall energy performance depends on multiple interconnected factors, making it essential to conduct detailed calculations before selecting a heating system. While heating system upgrades are generally positioned later in the renovation sequence, in cases where gas convectors are being replaced with a central heating system or heat pumps, structural modifications may necessitate completing this step earlier in the process.

Throughout the modernisation process, renewable energy integration should be considered, particularly the potential for solar energy utilisation through solar panels or solar collectors. However, system design must account for both current and future household energy needs, as oversizing can lead to excessive costs that are difficult to recover.

4. Given the financial constraints of energy-poor households, **accessing available grants and subsidies** is essential. Although funding opportunities for residential energy renovations in Hungary are currently limited, this situation is expected to improve. It is advisable to review existing grant programs in light of the planned renovation steps and consider applying for financial assistance. Details of currently available funding options are outlined in Section 2.5.

5. Finally, the **implementation phase of the renovation process** must align with the terms of any grant agreements, which may dictate specific timelines, including the earliest and latest start dates, deadlines for completion, and maximum project duration. Additional external factors, such as weather conditions and building occupancy considerations, should also be taken into account. Careful pre-planning is essential, including ensuring the availability of necessary materials and skilled professionals, checking supplier and contractor options, and securing appropriate agreements. Certain funding programmes, such as the Home Renovation Programme, restrict the selection of materials and service providers to pre-approved lists, making it important to confirm eligibility before proceeding with purchases or hiring professionals.

By following a well-structured renovation schedule, households can maximise energy efficiency improvements while ensuring that financial resources are utilised effectively and strategically, leading to long-term sustainability and reduced energy costs.

POSSIBLE STEPS OF RENOVATION BASED ON THE DREEM MODEL IN BÜKK PILOT HOUSEHOLDS

The RENOVERTY project utilised the DREEM model to analyse the potential energy savings achievable through various energy renovation measures. The model was applied to experimental households in the Bükk region to determine the impact of different renovation steps on overall energy efficiency.

The findings provide quantitative insights into the energy savings associated with each renovation measure. These results offer a data-driven approach for homeowners, policymakers, and energy experts to prioritise renovations based on cost-effectiveness and impact.

The table below presents the energy savings that can be achieved through different renovation steps (energy efficiency measures - EEM):

Modernisation activites	Energy saved (kWh)	Energysavings (%)
EEM1 - Thermal insulation of external walls	16,196	39.5
EEM2 - Replacement of doors and windows	2,503	6.1
EEM3 - Floor insulation	13,275	32.4
EEM4 - Heating modernisation - natural gas	10,477	25.6
EEM5 - Heating modernisation - biomass	8,149	19.9

EEM6 - Heat pump	29,415	71.8
EEM7 - Energy efficient luminaires	390	1.0

Table 2 - Energy saving potential of energy efficiency measures (EEM) by using the DREEM model

For energy audits carried out in the Somló-Marcalmente-Bakonyalja areas and the DREEM model recommends modernisation steps as follows:

	Replacement of doors and windows	***Thermal insulation of slabs***	***Thermal insulation of external walls***	***Thermal insulation of floors***	***Heating modernisation***
ET_01638040					■
ET_01638423	■	■	■	■	■
ET_01638936		■	■		■
ET_01639698	■	■	■		■

Table 3 - Recommended steps of the DREEM model

The cost-effectiveness and return on investment of the renovation activities examined are shown in the Figure 4 below.

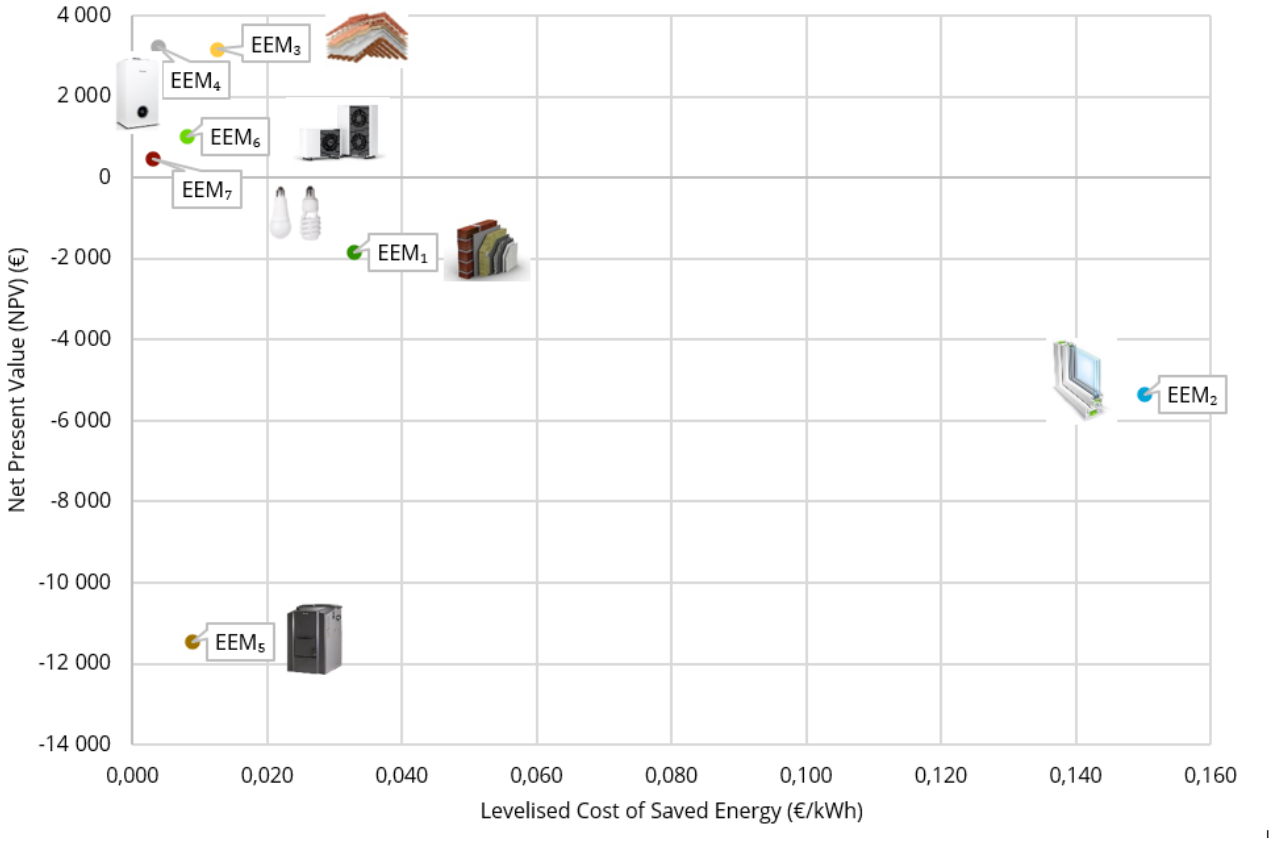

Figure 4 - Cost-effectiveness and return on investment of DREEM model renovation activities

With 50-75% support, the activities are financially profitable even with the current, reduced utility prices.

SUPPORT OPPORTUNITIES FOR ENERGY MODERNISATION PROCESSES

The financial resources and grants outlined in Section 2.5 of the roadmap provide various funding opportunities for the energy renovation of single-family houses. These support mechanisms can be utilised to implement different renovation measures, making energy efficiency improvements more accessible for homeowners, particularly those affected by energy poverty.

The table below outlines how the available financial resources can be applied to different energy renovation processes.

	External insulation of building	Replacement of external doors and windows	Modernisation of heating systems	Hot water system modernisation	Slab insulation	Photovoltaic system
Home Renovation Programme 2024	■	■	■	■		
Energy Efficiency Obligation Scheme (EEOS)					■	
Solar Energy Plus Programme						■
"Village CSOK" - Family Housing Allowance	■	■	■	■	■	■
Rural Home Improvement Programme	■	■	■	■	■	■

Table 4 - Subsidies available for the renovations

2.3 NECESSARY SPECIALISTS AND ENTERPRISES

The energy renovation of single-family houses involves multiple technical tasks, many of which require the expertise of qualified professionals and enterprises. For complex, deep renovations, hiring a general contractor can be beneficial, as they coordinate and manage the various specialists required for the project. While this approach reduces the workload for the homeowner, it also increases costs. Additionally, some financial support programmes impose restrictions on eligible professionals and contractors, which can further impact the overall budget.

Before hiring or contracting a specialist or enterprise, it is essential to verify the quality of their previous work. Checking references, certifications, and past projects helps ensure reliable execution and long-term efficiency of the renovation.

KEY PROFESSIONALS AND BUSINESSES INVOLVED IN THE RENOVATION PROCESS

Planners play a crucial role in the initial stages of energy renovations. Registered energy auditors conduct building energy assessments and help determine the most effective renovation measures. Structural alterations, heating system upgrades (such as switching from individual heating to central heating), or the installation of photovoltaic systems require the expertise of certified designers. In solar energy projects, contractors often provide their own design specialists to ensure compliance with technical and regulatory requirements.

Masons typically handle thermal insulation, door and window replacements, as well as traditional tasks like plastering, concreting, and masonry work. However, due to increasing specialisation, dedicated insulation and window installation professionals are more commonly involved in these specific areas.

Window installers specialise in the installation and replacement of doors and windows. Many of these specialists are independent contractors or companies that also manufacture custom-built energy-efficient windows.

Heat Insulation Specialists focus on thermal insulation for walls, roofs, and floors. They often work with specific insulation systems, such as attic floor insulation or external wall insulation, ensuring optimal energy efficiency.

Painters are not only responsible for surface finishing but may also undertake façade insulation work, making them relevant in external renovations.

HVAC Specialists (Heating, Ventilation, and Air Conditioning) include gas and plumbing professionals, who are required for upgrading heating and domestic hot water systems. Their role is critical when installing energy-efficient boilers, upgrading water heating systems, or implementing central heating solutions.

Carpenters and Roofers are necessary for roof insulation projects, as roof renovation often involves structural modifications. These professionals ensure that the roof structure remains stable while optimising thermal insulation.

Photovoltaic System, Heat Pump, and Air Conditioning Installers specialise in the installation of renewable energy systems and energy-efficient heating and cooling solutions. It is advisable to hire certified contractors for such installations, as they ensure compliance with technical requirements and maximise energy efficiency.

Electricians play an essential role when renovations involve upgrades to the household electrical system. If a renovation includes solar panels, heat pumps, or other high-energy consumption systems, electricians must upgrade the electrical network to handle the increased load safely and efficiently.

Each of these specialists and enterprises contributes to different aspects of energy modernisation, ensuring that renovations meet efficiency goals, comply with regulations, and improve long-term sustainability. Proper planning and hiring of skilled professionals is key to a successful and cost-effective renovation process.

2.4 SETTING TARGETS FOR ENERGY RENOVATIONS

Renovating rural households affected by energy poverty aims to improve living conditions, reduce energy costs, and enhance indoor air quality. This section outlines the expectations associated with the renovation measures and proposes indicators to effectively measure progress.

The goal related to energy moderniastion	Indicators for measuring goals
Households in need should have access to funds for energy renovations.	Number of vulnerable households included in the scheme
Improvement of the quality of life in residential buildings.	Number of households included in the scheme. Decrease of exposure to damp and mould. Increased comfort in the home.
Reduction of energy costs for households in need.	Decreasing expenditure.
Improvement of energy efficiency by X% (in line with DREEM).	Improved energy efficiency rating of the building. An ideal improvement corresponds to a jump of at least two energy classes (e.g., from G to E).
Improvement of thermal comfort in the residential building.	Warmer living spaces in winter, cooler in summer.
Improvement of indoor air quality.	Lower amount of particulate matter. Lower humidity. Repelled mold.
Development of alternative heating options.	Number of alternative heating systems installed.
To empower and help vulnerable households to join energy communities.	Number of households joining an energy community.

To prepare households for disasters - flash floods, storm damage.	Number of households prepared.

Table 5 - Renovation objectives and their measurement

2.5 FINANCIAL RESOURCES AND GRANTS

Currently, there is no continuous support programme in Hungary dedicated to financing the energy renovation of rural residential buildings and family houses. Existing funding sources are fragmented and lack a centralised platform where individuals can access comprehensive and up-to-date information about available and upcoming grants. The Home Renovation Programme is expected to be revised soon, with additional funding programmes anticipated in the Just Transition regions of Borsod-Abaúj-Zemplén, Heves, and Baranya counties.

At the time of preparing this roadmap, the below-mentioned financial resources are available to be used.

HOME RENOVATION PROGRAMME 2024

Period: 01.07.2024 – 31.12.2025 (or until funds are exhausted)

Budget: HUF 108.24 billion

Expected number of eligible projects: up to 20,000 households

This programme is part of the Recovery and Resilience Facility (RRF), funded by the European Union, and supports energy renovations for habitually inhabited, single- and multi-family homes built before December 31, 1990. Eligible properties include detached houses, terraced houses, semi-detached houses, and homes registered as indoor, outdoor, or closed-garden dwellings. To qualify for support, the renovation must achieve at least a 30% reduction in primary energy consumption compared to the initial state.

The application process requires the submission of a cost plan at an MFB Point before applying for funding. Once the budget is approved, the grant application can be submitted, and if successful, the lending bank disburses the full loan amount. The state-supported loan is interest-free, with a maximum repayment period of ten years. An authentic energy performance certificate must be presented both before and after the renovation to verify the improvement. Renovation works must be completed within two years, with a possible six-month extension. The total support available ranges from HUF 2.5 to 6 million, consisting of an interest-free loan and a non-refundable state grant. A prerequisite for the use is a deductible, which amounts to HUF 1 million in the case of the total 6 million grant, and a proportional amount in the case of a smaller budget.

The level of grant funding is primarily determined by the average income of the applicant's district. In areas where the average income is below 75% of the national average, applicants may receive HUF 3.5 million in non-refundable support. In districts where income falls between 75% and 110% of the national average, the grant is HUF 3 million, while households in districts with an average income above 110% of the national average can receive HUF 2.5 million - List of districts.

The grant covers costs related to external insulation, the replacement of doors and windows, heating system and hot water system upgrades.

The Home Renovation Programme requires the use of specific products and registered professionals, although this is not mandatory. The lists of recommended construction materials, heat and hot water generation equipments and registered contractors are publicly available. However, experience with the programme in its initial months has been mixed. Administrative requirements are complex, with applications typically requiring more than twenty different documents, totaling 70 to 80 pages. Separate contracts must be signed with different contractors for each category of work, even if multiple energy efficiency upgrades are being carried out simultaneously. Moreover, unsubsidised works are often requested and the strict bureaucratic requirements pose challenges for both homeowners and contractors.

The consultants registered in the Home Renovation Programme help the loan applicant - they provide general information, help in the technical-professional energy preparation of investments and provide technical-professional support until the implementation of the investment.

The Hungarian government is currently working on modifications to improve accessibility and ease of implementation.

ATTIC FLOOR INSULATION - ENERGY EFFICIENCY OBLIGATION SCHEME (EEOS)

The Energy Efficiency Obligation Scheme (EEOS) is a market-based mechanism that obliges designated actors in the energy market to achieve a certain level of energy savings for end-users in proportion to their energy sales. Under this scheme, energy savings achieved by users are verified and certified by accredited audit organisations. Once validated, these Certified Energy Savings (HEMs) can be sold to energy traders as a form of tradable property right. Through this system, participating households can access significant financial resources to fund energy efficiency upgrades.

Since the summer of 2024, an increasing number of market participants have begun offering free attic floor insulation, a practice that may seem unusual at first. Small construction teams complete the insulation of unoccupied attic spaces in single-family houses within just a few hours. This business model is likely to play an important role in response to the bureaucratic challenges and administrative burden of the EU-funded Home Renovation Programme, which has seen relatively low participation. The growing demand for slab insulation has been

particularly noticeable since spring, especially in smaller rural settlements. While the government is considering modifications to the programme that supports these market activities, it is unlikely to introduce policies that would restrict or discourage the renovation of rural homes.

As of October 2024, the total net cost of attic insulation—including the energy audit, materials, and labor—ranges between HUF 300,000 and 350,000 for an average-sized family house with an 80-100 m² attic slab. The most commonly used material is blown glass wool insulation, typically applied in 25 cm layers. For a standard home, this insulation upgrade can achieve approximately 45-50 GJ of certified energy savings (HEM). These savings can then be sold on the EEOS stock exchange, allowing traders to generate substantial profits.

Certified Energy Savings (HEMs) - *The concept of Certified Energy Savings (HEM) is integral to Hungary's 2030 climate goals, which aim to maintain the country's final energy consumption on a predetermined downward trajectory. To meet these targets, Hungary introduced the Energy Efficiency Obligation System (EEOS) in 2021, requiring electricity and natural gas traders, energy service providers, fuel sellers, and other obligated parties to implement and finance programmes that lead to measurable energy savings at the consumer level. These initiatives, such as audited thermal insulation of residential properties, are called certified energy savings or HEMs.*

Certified energy savings are tradable assets with limited transferability, meaning they can only be sold to obligated parties through bilateral agreements or structured market transactions, such as stock exchange auctions. In February 2024, a series of EEOS auctions was launched on the CEEGEX gas exchange, enabling the monetisation of verified energy savings.

SOLAR ENERGY PLUS PROGRAMME

Budget: HUF 105.8 billion
Expected number of eligible projects: 25,805

The Solar Energy Plus ProgramMmE is a government initiative that provides non-refundable financial support for households to install solar panels and energy storage systems. The program aims to enhance household energy self-sufficiency, reduce electricity bills, and alleviate pressure on the national power grid by promoting the local storage and use of renewable energy.

The programme has a total budget of HUF 105.8 billion, following a HUF 30 billion increase by the Ministry of Energy in the summer of 2024. At the time of writing, financial support remains available.

Households can receive up to HUF 5 million in grants, covering 66% of the total investment costs. By enabling local energy production and consumption, the programmE contributes to Hungary's energy sovereignty and enhances the security of domestic energy supply.

"VILLAGE CSOK" - FAMILY HOUSING ALLOWANCE

The Village CSOK is a non-refundable state grant introduced as part of the Hungarian government's family support package, which was launched on July 1, 2019. As of 2024, the programme is available exclusively in settlements with fewer than 5,000 inhabitants.

The grant provides financial assistance for second-hand housing purchases, expansions, and renovations, including energy efficiency improvements.
The maximum available funding is HUF 15 million, and the exact amount granted depends on several factors, including the purpose of the support, the useful floor area of the property, and the number of existing or assumed children.

A key feature of the Village CSOK is that it is a non-repayable grant, meaning that recipients are not required to return the funds as long as they fulfill the contractual obligations, including the condition that the assumed children (1-3) are born within the agreed timeframe.

In addition to direct financial support, the grant can be combined with preferential loans, allowing families to access further financing for property purchases and renovations.

RURAL HOME IMPROVEMENT PROGRAMME

The Rural Home Improvement Programme, launched in January 2025, is designed to enhance housing conditions for families living in small settlements with fewer than 5,000 inhabitants. The program aims to support the renovation and modernisation of rural homes, promote the renewal of the housing stock, and contribute to reducing undeclared construction work.

This initiative provides non-refundable state support covering up to 50% of renovation costs, with a maximum grant amount of HUF 3 million. The specific terms and conditions of the programme are governed by regulations that have been in effect since January 1, 2025.

Unlike the Home Renovation Programme 2024, the Rural Home Improvement Programme features a simpler and more favourable application process, making it more accessible to homeowners. While the programme supports general home improvements, it also allows for energy renovation projects, providing a valuable funding source for increasing energy efficiency in rural housing.

3 MEASURES TO TACKLE ENERGY POVERTY: OPPORTUNITIES IN RURAL AREAS

The third section of the roadmap will help stakeholders in the field of energy poverty to take action to tackle this social problem. It shows how to overcome the obstacles, alongside the intervention options identified in the policy framework. Stakeholders will also identify partners who can contribute to the process and how to replicate the improvements achieved in other regions.

3.1 DEFINITION OF RENOVATION OBJECTIVES, INDICATORS AND POSSIBLE INTERVENTIONS BY STAKEHOLDERS

The primary objective of energy renovations in rural areas is to improve the living conditions of households experiencing energy poverty, reduce their energy costs and improve environmental sustainability. These objectives result in measurable social, economic and environmental benefits, the benefits and opportunities of which are described below.

TACKLING ENERGY POVERTY

Renovations in energy efficiency contribute to reducing energy costs by improving the overall efficiency of buildings and reducing energy consumption. This allows households to increase their financial security by saving resources on heating in winter and cooling in summer.

IMPROVEMENT OF LIVING CONDITIONS

Measures such as thermal insulation, the replacement of appliances or instalment of a more efficient heating system can improve indoor thermal comfort, resulting in a healthier and more comfortable living environment for households living in single-family houses.

REDUCTION OF CO_2 EMISSIONS

By improving energy efficiency and reducing energy consumption, households can significantly contribute to reducing their environmental impact. This also contributes to the efforts to mitigate climate change and to a more sustainable use of natural resources. The installation of renewable energy sources such as solar panels or heat pumps further enhance the reduction of fossil fuel use.

BOOSTING THE LOCAL ECONOMY

Energy renovation measures generate job opportunities for local companies and professionals in the construction and environmental sectors. These schemes strengthen the economies of rural areas, which are often underprivileged compared to urban areas.

RESILIENT HOUSEHOLDS

More energy-efficient dwellings provide shelter in extreme weather conditions, during the more frequent summer heatwaves. This leads to increased housing security, reduced health risks and increased residential security.

DEVELOPMENT OF A LONG-TERM, SUSTAINABLE SUBSIDY SCHEME

The long-term objective is to provide a long-term sustainable renovation subsidy scheme that does not require significant resources to maintain, while providing ongoing benefits to communities and the environment. Through such an approach, energy efficiency renovation measures not only improve the quality of life for households experiencing energy poverty and economic difficulties, but also contribute to building more resilient and inclusive rural communities.

POTENTIAL INDICATORS

In order to measure the effectiveness of energy renovation, indicators are required that can be used to evaluate energy, economic, social and environmental aspects:

Energy indicators

- Energy consumption reduction (kWh saved) - measures how much energy has been saved following interventions.

- Improvement in energy rating of the building - assesses the improvement in the efficiency of the dwellings compared to the initial condition.

- Percentage of renewable energy utilisation: Reflects the level of sustainable energy integration achieved.

Economic indicators

- Reduction in household energy costs - tracks the reduction in energy bills, highlighting the financial impact on household budgets.

- Return on investment - measures the period required to recover the costs of renovation through energy savings.

- Local job creation: Measures the number of jobs generated in the local community, contributing to economic growth by involving businesses and professionals in the construction sector.

Social indicators

- Percentage of households transitioning out of energy poverty - quantifies the number of households no longer classified as energy-poor as a result of energy-efficiency renovations.

- Improvement in the quality of living - surveys are used to evaluate perceived improvements in thermal comfort and overall quality of life.

- Number of families benefiting from interventions: Provides insight into the wider social impact of the intervention.

Environmental indicators

- Reduction in CO_2 emissions - quantifies the overall impact of the project on climate change mitigation through reduced energy consumption and integration of renewable energy sources.

- Reduction of the ecological footprint of households - an assessment of the overall environmental benefits achieved by renovated households.

3.2 IDENTIFYING AND OVERCOMING BARRIERS AND CHALLENGES

The energy renovation of residential buildings in rural areas is often hindered by several barriers and challenges. These barriers can be technical, financial, administrative, or social, making it difficult for households to implement necessary improvements.

The table below outlines the key obstacles faced in the energy renovation of rural homes, along with potential responses and solutions to overcome them.

Barriers and challenges	*Options for overcoming barriers and challenges*
TECHNICAL	
Occupancy of living spaces during renovation - a living spaces are not intended to be used for living purposes for a longer or shorter period of time.	The problem may arise in the case of extensive renovation when replacing windows, insulating floors and/or upgrading the heating system, in which case it is advisable to carry out the renovation in phases or, if possible, to move out during the renovation. *(households and construction professionals)*
Lack of skilled professionals - there are few skilled and competent professionals and they are highly engaged	Contact well-respected professionals in advance - even months before - to schedule and contract for the planned work. *(households)*

Under-qualified professionals - there are a number of contractors in the area whose work may lack professionalism and there may be quality related concerns with them.	Before contracting, request references of previous work carried out. Ensure that there are no proceedings against the company. *(households)*
The range of materials and service providers available for renovation is limited - the range of suppliers and service providers available under the Home Renovation Programme is limited and subject to registration, with few applicants so far.	Considering the possibility of an application, follow up the call and its modifications, and prepare an application in case of favourable changes. Encourage relevant actors in the area to register for the programme.
FINANCIAL	
Utility cost reduction - With residential energy prices kept low, the payback period is extended.	Advocacy - the central funding used for utility cost reductions should be made available to vulnerable households on favourable terms for residential renovation projects. *(advocacy organisations, NGOs)*
The vulnerable households lack the financial resources to invest in energy-efficiency renovations.	Provide vulnerable households with a subsidy or loan at a reduced rate where no upfront funding is required and the household can repay the loan from future savings. *(state, bank)*
Unpredictable subsidies - available subsidies cannot be predicted even in the medium term. Subsidies currently available may not be available in the future due to exhaustion or regulatory changes.	Advocacy - the government should develop a long-term, predictable and sustainable subsidy policy. *(advocacy organisations, NGOs)*
Difficult to get funding - the Home Renovation Programme is complicated to apply for.	Advocacy - simplification of the Home Renovation Programme. *(advocacy organisations, NGOs)*
Excluded beneficiaries - the application process for the Home Renovation Programme is complicated for vulnerable households.	Advocacy - to broaden the scope of beneficiaries in the Home Renovation Programme. *(advocacy organisations, NGOs)*
LEGAL AND ÉS ADMINISTRATIVE	
General contractor or own coordination - It is up to the vulnerable households to decide whether to coordinate the renovation process themselves and consult with the various professionals or to	An advisor with expertise can assist the decision making process of the concerned vulnerable households. *(households, consultants)*

involve a general contractor to coordinate the process.	
The application for the Home Renovation Program is complicated - without professional help, a small percentage of households experiencing energy poverty can fill out the application themselves.	Development of a list of experts, free or discounted professional advocacy. *(RenoPont)* Simplification of the process of submitting a request to the Home Renovation Programme. *(state)*
The challenge of contracting - both subsidy related contracts and service related contracts.	Making a complex contract more transparent. *(organisations providing subsidies, bank)* Templates for contracts with entrepreneurs. *(RenoPont, advocacy organisations, NGOs)*
Renovation of non-residential property - In rural areas, it is common to find people living in properties that are in residential areas, and classified as non-residential, but as agricultural property (e.g. a press house or a storage building). There is no subsidy scheme for these properties, as they could not be used for permanent housing.	Local authorities could assist with the cadastral rezoning of inhabited properties and their reclassification as residential. *(local government)*
Renovation of a heritage listed property - heritage protection rules make the process of energy upgrading more difficult.	The renovation process must be carried out without altering the protected parts - e.g. the street façade or the roof shape, roof materials. *(construction professionals)*
COMMUNITY	
Community energy - In the coming years, it is expected to be an opportunity for households experiencing energy poverty.	Supporting vulnerable households and households experiencing energy poverty at local and/or national level to join the energy communities that are being set up on favourable terms.
AWARENESS AND CONFIDENCE	
Lack of knowledge - Households experiencing energy poverty are not aware of the benefits of energy-efficiency renovations, the availability of resources and eligibility of opportunities.	Programmes and awareness raising campaigns to raise the awareness of the vulnerable households and the households experiencing energy poverty.

	Introduction to the funding schemes. (*advocacy organisations, NGOs, organisations providing subsidies)*
Vulnerable households are sceptical about subsidy schemes.	Dissemination of best practices that have been implemented with the support of subsidies. (*advocacy organisations, NGOs, organisations providing subsidies)*
Households have no confidence in entrepreneurs and professionals.	Development of local, regional databases with the contact details of trusted professionals and their references. *(RenoPont)*

Table 6 - Barriers, challenges and options for barriers and challenges

3.3 STAKEHOLDERS AND KEY ACTORS

The renovation of family houses in poor energy condition is a complex process that extends beyond technical and financial challenges. It also involves overcoming behavioral habits, fears, and social resistance to renovations. Establishing a strong network of relevant stakeholders is essential to effectively supporting renovation efforts. These actors should be locally accessible and work collaboratively to facilitate the process.

This section outlines the national, regional, and local stakeholders who play a crucial role in assisting energy-poor households through the energy renovation process. Their involvement ensures that renovation initiatives are not only technically and financially feasible but also socially accepted and effectively implemented.

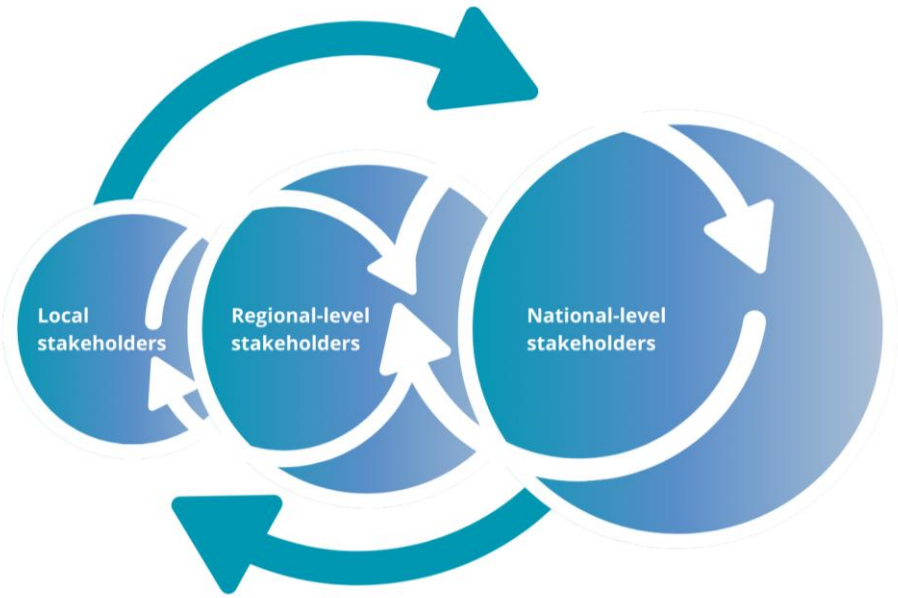

Figure 5 - Scope of the territorial stakeholders involved in the processes

Stakeholders	***Their role in the energy-efficiency renovation process***
NATIONAL-LEVEL STAKEHOLDERS	
Ministry of Energy	Development of policies and measures to tackle energy poverty.
Ministry of Public Administration and Regional Development	Tasks related to grants implemented from EU funds, development of the Home Renovation Programme grant scheme, and the announcement of the programme.
Managing Authority of the Environmental and Energy Efficiency Operational Programme - KEHOP IH	Responsible for subsidy policy, which covers the second objective - Greener Europe - of the policy objectives set by the European Union through five priorities, including energy
Hungarian Energy and Public Utility Regulatory Authority - MEKH	The Authority (MEKH) is the regulatory authority of the domestic energy and public services market, supervising strategically important sectors of the national economy. The Authority was established by Act XXII of 2013 as an autonomous regulatory body with regulation-making powers, as the successor to the Hungarian Energy Office (MEH) established by Act XLI of 1994 on gas supply.

Hungarian National Rural Network	Network of information and cooperation for actors involved in rural development and coordination of their activities. .
ÉMI - Construction Quality Control Innovation Non-profit Ltd.	Contribution to the Home Renovation Programme for the implementation of energy efficiency investments in households
NFFKÜ – International Fund Development and Coordination Agency Co.	Tasks of managing state-funded residential energy and consumer protection calls - Solar Energy Plus Program
Network of MFB Points Plus for citizens (MFB - Hungarian Development Bank)	The Network of MFB Points helps the implementation of housing development by mediating interest-free subsidy and loan programmes funded by the European Union - the intermediary of the Home Renovation Programme.
Energy Traders - Actors Involved in the Energy Efficiency Obligation Scheme (EEOS)	Through the Energy Efficiency Obligation System, energy traders support energy users who contribute to reducing Hungary's energy consumption by implementing energy efficiency investments.
Green Policy Center	A Hungarian climate policy think tank that was established to address climate change and other urgent green policy issues in a balanced, honest and non-partisan manner, based on scientifically sound information..
RenoPont	The advisors of the RenoPont Energy Home Renovation Center provide assistance in developing the concept, schedule and financing of the renovation, recommend professionals and the best value for money products.
NGOs with National Scope - Reflex Environmental Protection Association - Climate Alliance Hungary - MEHI Hungarian Energy Efficiency Institute - EMLA - Environmental Management and Law Association - Habitat for Humanity Hungary	National NGOs working in the field of energy poverty - implementing model programmes, advocacy, resource mobilisation, awareness raising, dissemination of information, consultancy, participation in international networks.

- Climate Policy Institute - WWF Hungary - Hungarian Charity Service of the Order of Malta - National Society of Conservationists – Friends of the Earth Hungary - GreenDependent Association	
Universities and Research Centres - ELTE Department of Environmental and Landscape Geography - Széchenyi István University Department of Applied Sustainability - University of Miskolc, Institute of Geography-Geoinformatics - Centre for Economic and Regional Studies - Institute for Regional Studies (RKI)	Academic institutions and research centres working on energy poverty issues - research, surveys, pilot projects.
Energy Communities - Community Energy Knowledge Space - KESZ Community Energy Service Provider	In Hungary, the first pilot energy communities are being set up this period, and their real operation will begin in the coming years, which should lead to a momentum in several areas and on a local level.
Media	National media actors who are engaged in the fight against energy poverty - providing information, raising awareness.
REGIONAL-LEVEL STAKEHOLDERS	
Network of MFB Points Plus for citizens (MFB - Hungarian Development Bank)	Applications for the Home Renovation Programme can be submitted through MFB Points.
County Government of Borsod-Abaúj-Zemplén	The county councils are responsible for local energy issues in the region. In addition to the planning process, they have a role in information and awareness raising.

Bükk Leader Local Action Group (LAG)	The local action groups deal with development and support policies and play a role in providing information and raising awareness. In Hungary, local action groups do not play a role in the delivery of subsidies to the residents.
NGOs in the Region of SMB LAG: - Holocen Nature Conservation Association	NGOs in the regions who are involved in tackling energy poverty - implementation of pilot programmes, transfer of funds, awareness raising, dissemination of information and advocacy.
Energy Agencies - LENERG Energy Agency - North Great Plain Regional Energy Agency	Energy agencies address the challenges of energy poverty mainly in the context of a project implementation. They provide professional support to national, regional and local actors, NGOs and local authorities.
Energy Auditors	The auditors are responsible for energy audits of buildings, which are a requirement for several funding opportunities. Most of the experts are not available locally but only at regional level.
Home Renovation Programme - Construction products - List of heat and hot water generation equipment - List of contractors (suppliers)	The national subsidy scheme defines the range of products and services that the beneficiary can use in the course of the energy modernisation supported by the subsidy. The products and services are available at regional level.
Consultants for Grant Programmes	Access to funding can be facilitated by experts who can assist vulnerable households in preparing and submitting application documents.
Designers - Architectural Designers - HVAC Designers	Preparation of design documentation for some of the processes of energy efficiency upgrading, such as structural works or heating system retrofitting.
Energy Supplier - Customer Service Offices - Representatives of the Sector	In the renovation process, service providers may be involved in cases that may entail a modification of the service contract, e.g. when connecting a solar system to the grid.
Media - BOON B-A-Z County News Portal	Regional media actors who also deal with energy poverty issues - providing information, raising awareness.

LOCAL STAKEHOLDERS	
Local Authorities - Mayor - Notary - Members of the Municipal Council - Local Government Staff	They assist national and regional actors in local activities: providing information, raising awareness, active outreach to the affected households.
Local Governments for National and Ethnic Minorities	They assist national and regional actors in local activities: providing information, raising awareness, active outreach to the affected households. (Among minorities, there is often a higher percentage of vulnerable households.)
NGOs	Not only energy sector related organisations. They help to involve the local community actively, informing and raising awareness.
Educational Institutions	Through the youth attending the institution, they help to raise awareness and reach out to vulnerable households
Distributors of Building Materials	Geographically the closest source for the purchase of materials for energy renovation. Unfortunately, local traders are mostly not included among the beneficiaries of the support programmes.
Construction Professionals, Enterprises (Contractors)	Geographically the closest professional workforce to carry out the processes. Unfortunately, local professionals are mostly not included among the beneficiaries of the support programmes.
Social Care Network Staff - Family Support Services	They can help to reach the vulnerable households more effectively.
Churches	They help to involve the local community actively, informing and raising awareness.
Media - Printed and Online Local Newsletters - Social Media Sites	They help to involve the local community actively, informing and raising awareness.

Table 7 - Stakeholders involved in addressing energy poverty

3.4 NATIONAL PROGRAMMES LINKED TO THE ROADMAP AND ENERGY SECTOR

The Rural Energy Efficiency Roadmap (REER) is aligned with several national programmes aimed at energy renovation, sustainability, and poverty reduction. When revising these strategies, it is

essential to ensure that national policies are adjusted to better support REER objectives, facilitating more effective energy efficiency measures in rural areas.

National Energy Strategy 2030[8] - Hungary's National Energy Strategy 2030 seeks to balance energy and climate policy with economic development and environmental sustainability. The strategy outlines acceptable energy demand levels, sets long-term energy development directions, and defines a vision for the country's energy transition with contributions from key energy sector stakeholders. The strategy provides detailed recommendations for policymakers and industry leaders up to 2030, while also incorporating a long-term roadmap extending to 2050 to place short-term actions within a global long-term framework.

National Energy-and Climate Plan (NECP)[9] - The National Energy and Climate Plan (NECP) aligns with the objectives of the National Energy Strategy 2030 and focuses on energy security, sovereignty, cost reduction, and decarbonisation. Given Hungary's geopolitical and economic context, ensuring a stable energy supply and reducing dependence on energy imports have become critical national security priorities. A key strategic goal of the NECP is to decrease the share of natural gas in Hungary's energy mix, reducing reliance on fossil fuels while expanding the use of renewable energy sources.

Hungary Recovery and Adaptation Plan[10] **-** The Hungary Recovery and Adaptation Plan was introduced to address the economic and social impacts of the COVID-19 pandemic, while also strengthening economic resilience, sustainability, and preparedness for challenges associated with green and digital transitions.

Several key energy-related initiatives under this plan contribute directly to the reduction of energy poverty and the promotion of affordable, sustainable energy access:

CATCHING UP SETTLEMENTS: This initiative focuses on constructing and renovating social housing, with a target of 1,600 renovated and 400 new social housing units, improving living conditions for vulnerable communities.

Renewable Energy Initiatives: The programme aims to develop community-based renewable energy generation in disadvantaged municipalities, with a goal of supplying annual electricity needs for at least 5,000 vulnerable families.

Social Measures: Investments are directed toward improving access to quality education, primary healthcare, and social services, particularly for disadvantaged populations.

[8] National Energy Strategy 2030

[9] National Energy and Climate Plan

[10] Hungary Recovery and Adaptation Plan

Long-Term Renovation Strategy[11] - Hungary's long-term renovation strategy sets ambitious energy efficiency and decarbonisation goals for the country's building sector, with a focus on deep renovation and sustainability. The strategy outlines several key objectives:

A 3% annual renovation rate for residential buildings by 2030, which is expected to lead to a 20% reduction in total energy consumption and CO_2 emissions.

A 5% annual renovation rate for public buildings, contributing to an expected 18% reduction in energy consumption and CO_2 emissions in the public sector.

Achieving nearly zero-energy building (BB) standards for 90% of the building stock by 2050 through deep renovations. Given the high costs associated with such renovations, the strategy emphasises the importance of phased renovation approaches to ensure affordability for property owners.

The strategy sets out 35 actions. To ensure effective monitoring and evaluation, the Building Renovation Monitoring System (ÉMOR) has been established. This system facilitates continuous data collection and feedback processing, allowing for real-time policy adjustments and the identification of new intervention points when needed.

3.5 SCALABILITY AND REPLICABILITY

Ensuring the scalability and replicability of the REER roadmap is essential for maximizing its impact and making it accessible to all stakeholders involved in the renovation of households affected by energy poverty. By designing a framework that can be adapted and expanded, the roadmap can be implemented in different contexts, allowing for broader adoption and a more significant contribution to national energy efficiency goals.

The REER roadmap was developed with scalability in mind, ensuring that the methods, steps, and stakeholders involved in the renovation process are clearly outlined and adaptable to various local and regional conditions. The document provides a step-by-step guide that can be customised and applied to different communities, funding structures, and policy frameworks.

To ensure that the REER roadmap is widely adopted and effectively utilised, the following key dissemination steps have been outlined:

IDENTIFICATION OF STAKEHOLDERS AND TERRITORIAL CONTEXT

For scalability and replicability, the process should start with a comprehensive mapping of target areas to identify key actors and stakeholders at local, regional, national and international level.

[11] Long-Term Renovation Strategy

In order to ensure consistent and flexible application, it is essential to establish tools and guidelines that can be easily adapted to the needs of each area. In addition, promoting cooperation will facilitate the sharing of best practices and support the wider implementation of solutions. This approach will ensure that the REER remains a relevant and effective tool in tackling energy poverty while ensuring adaptation to the constantly changing social and economic environment.

NETWORKING

After identifying the key stakeholders, the REER should be presented to the national organisations and networks in the area. These organisations can play a key role in supporting the implementation and strengthening the impact of the model through their contacts and expertise.

GATHERING FEEDBACK AND NATIONAL ADAPTATION

Feedback from networks and social institutions should be integrated to improve and adapt the REER for wider national dissemination. At this stage, roadmaps should address the specific needs of each region or community. This step is essential to enhance the comprehensiveness and relevance of the document. It is vital to ensure the scalability of the model to ensure that it can be applied on a broader scale at the regional and national level.

INTEGRATE REER INTO NATIONAL LEVEL POLICIES/STRATEGIES

A crucial step for the success of REER is its integration into national policies and strategies through direct cooperation with the competent authorities. This integration will provide institutional support and recognition of the Roadmaps as an integral part of the official efforts to tackle energy poverty.

QUANTIFIED BENEFITS AND RESULTS

A detailed analysis of the expected economic, social and environmental benefits at national level is essential to secure the support of policy makers and institutions. In addition, a clear and concrete demonstration of the projected results is essential to strengthen stakeholder commitment. Practical examples, such as energy savings achieved or reduced household costs, can illustrate the value of REER and thus become an effective and compelling tool for broad adoption.

By implementing these steps, the REER roadmap can serve as a widely applicable, structured approach to tackling energy poverty, ensuring that more households benefit from affordable, energy-efficient, and sustainable housing solutions.

@RENOVERTYLife

RENOVERTY Project

https://ieecp.org/projects/renoverty/

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.