CEESEN-BENDER

Building intErventions in vulNerable Districts against Energy poveRty

Deliverable 5.2

Synthesis report on energy consulting in 5 regions

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WP5 Creating roadmaps and support services for building energy renovations for vulnerable districts.

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Executive summary

This report summarises expert group activities carried out in the CEESEN-BENDER pilot regions, with a focus on household energy advising, expert support to building-level renovation stakeholders and specialised feasibility work on PV-based energy communities. Across Estonia, Poland, Slovenia, Croatia and Romania, expert groups supported vulnerable households, apartment owners, tenants, building managers, homeowner associations, landlords, municipalities and other stakeholders involved in multi-apartment building renovation.

The household energy advising visits showed that many problems experienced by vulnerable residents are closely linked to building-level conditions. Recurring issues included weak thermal envelopes, high heating costs, summer overheating, mould and dampness, poor ventilation, inefficient or poorly controlled heating systems and limited household capacity to finance larger improvements. While no-cost and low-cost measures can provide immediate benefits, durable improvements often require coordinated renovation at building level.

Expert services beyond household visits helped building managers, homeowner associations and other stakeholders better understand renovation options, financing possibilities, administrative procedures and communication challenges. The activities showed that renovation support in multi-apartment buildings must go beyond technical advice. It also needs to address affordability, trust, resident engagement, decision-making procedures and coordination between local actors.

The specialised expert work under Task 5.3 added a structured assessment of PV and energy community potential in the pilot regions. The assessment showed that PV installation is often technically feasible, but technical feasibility does not automatically translate into investment readiness. Practical implementation depends on electricity sharing rules, financial return, structural readiness, apartment association decisions and the role of PV within broader renovation priorities.

The main conclusion is that expert support adds value when it connects technical knowledge with trusted communication, financial guidance, local stakeholder coordination and practical follow-up. Future support services should therefore combine household-level advice with building-level renovation pathways, targeted assistance for vulnerable residents and early assessment of wider renovation options, including renewable energy and energy community models where relevant.

1. Background of CEESEN BENDER and purpose of the report

1.1 Background of the CEESEN-BENDER project

The main goal of the project "Building intErventions in vulNerable Districts against Energy poveRty" (i.e. CEESEN-BENDER), launched on September 1 2023, is to empower and support vulnerable homeowners and tenants living in buildings built after the Second World War and before 1990's in 5 CEE countries: Croatia, Slovenia, Estonia, Poland and Romania. The project will help them through the renovation process by identifying the main obstacles and creating trustworthy support services that include homeowners, their associations, and building managers.

Coordinated by Society for Sustainable Development Design (DOOR), the project CEESEN-BENDER brings together leading European researchers and experts in the field from six countries: Croatia (Society for Sustainable Development Design / DOOR, Medjimurje Energy Agency Ltd. / MENEA, EUROLAND Ltd. / Euroland, GP STANORAD Ltd. / GP STANORAD), Estonia (University of Tartu / UTARTU, Tartu Regional Energy Agency / TREA, The Estonian Union of Co-operative Housing Associations / EKYL), Slovenia (Local Energy Agency Spodnje Podravje / LEASP), Romania (Alba Local Energy Agency / ALEA, Municipality of Alba Iulia / ALBA IULIA), Poland (Mazovia Energy Agency / MAE, Housing Cooperative Warszawska Spółdzielnia Mieszkaniowa - The Warsaw Housing Cooperative / WSM), Germany (Climate Alliance) in addition to Central Eastern European Sustainable Energy Network (CEESEN).

The project CEESEN-BENDER is carried out from September 2023 until August 2026 and has a total budget of €1,85 million, of which €1,75 million is funded from the European Union's Programme for the Environment and Climate Action (LIFE 2021-2027) under grant agreement n° LIFE 101120994.

As stated, the main objective of CEESEN-BENDER is to empower and support vulnerable homeowners and renters living in multi-apartment buildings (MABs) through the renovation process by identifying the main obstacles, and creating trustworthy support services that include homeowners, their associations, and building managers.

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

- The project will analyse the ownership structure and physical characteristics of buildings in the pilot sites in targeted regions to comprehensively understand the obstacles that impede or halt homeowner associations, landlords, and property managers from pursuing energy renovations.
- Project partners will identify both legislation and financial, and technical administrative obstacles for the renovation in pilot countries. The identification of obstacles from the homeowners' perspective will help the creation of tailor-made solutions not only for homeowners but also for building managers, landlords, municipalities and other relevant stakeholders involved in the renovation process.

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

1.2 Purpose of the report

This report summarises the expert group activities carried out in the CEESEN-BENDER pilot regions. It focuses on three connected areas of work: household energy advising, expert support to building-level renovation stakeholders, and specialised feasibility work on PV-based energy communities under Task 5.3.

The aim of the report is to present the main activities, findings, lessons learnt and recommendations from the expert support provided in Estonia, Poland, Slovenia, Croatia and Romania. It shows how household-level advice helped identify practical needs and comfort-related problems, how expert services supported building managers, homeowner associations and other local actors, and how PV and energy community feasibility was assessed as part of broader renovation planning.

The synthesis is based on household energy advising reports, partner inputs on expert advisory support activities and Task 5.3 feasibility assessment materials prepared by the project partners. The household reports provided information on apartment conditions, comfort, energy use, indoor climate issues and advice given during visits. The expert support inputs summarised activities with building managers, homeowner associations, municipalities, landlords and other stakeholders. The findings should be understood as practice-based evidence from the pilot regions rather than statistically representative survey results.

2. Expert groups in the five regions, their role and tasks

In each participating region, an expert group was established consisting of at least one expert from the project partner organisation and at least one external/local expert. The purpose was to combine knowledge of the project, local stakeholder relations and specialised technical, financial or advisory expertise. The expert groups were expected to support both vulnerable households and building-level actors, and to become part of the wider CEESEN expert network.

Table 1: Country expert profiles.

Country	Main expert profile	External/local expertise
Estonia	Technical renovation and energy performance expertise	Apartment association governance and housing policy
Poland	Building renovation and energy efficiency expertise	EU funding and financing expertise
Slovenia	Energy advice and renovation support	Building management and local housing knowledge
Croatia	Energy agency and building manager expertise	Energy poverty and resident engagement expertise
Romania	Energy efficiency and municipal renovation expertise	Municipal building renovation and technical expertise

2.1. Role and tasks of the expert groups

The expert groups established under Task 5.2 had the overall role of providing practical, technical and advisory support to vulnerable households, apartment owners, tenants, building managers, homeowner associations, landlords, municipalities and other stakeholders involved in the renovation of multi-apartment buildings. Their task was not only to provide information, but also to help translate complex renovation processes into concrete and understandable steps for the different target groups.

Across the five pilot regions, the expert groups combined internal project knowledge with external or local expertise. Internal experts were usually responsible for the operational implementation of support activities, including household visits, technical advice, coordination with partners, preparation of reports and communication with local stakeholders. External experts complemented this with additional expertise related to building management, financing, apartment association governance, municipal procedures, cultural heritage requirements, renewable energy, energy poverty or practical renovation experience.

The expert groups worked at two connected levels. At household level, they supported vulnerable residents and apartment owners by providing advice on energy and water saving, indoor comfort, heating and cooling practices, ventilation, appliance use and possible small measures that could reduce energy costs or improve living conditions. During or after household visits, experts helped residents understand their energy

consumption, identify problems in the apartment and consider practical improvements that could be implemented immediately or at low cost.

At building level, the expert groups supported actors responsible for renovation decisions and implementation. This included building managers, property management companies, homeowner associations, apartment association boards, landlords, municipalities and other relevant stakeholders. The support covered renovation planning, identification of possible renovation measures, explanation of technical options, preparation or interpretation of technical assessments, financing opportunities, administrative procedures and stakeholder coordination. In some cases, experts also supported the preparation of energy reports, technical assessments, short studies or other materials needed for informed decision-making.

A major part of the experts' role was to explain the benefits and implications of energy renovation in a way that was understandable for non-specialists. Residents and building-level actors often needed support to understand expected energy savings, indoor comfort improvements, health benefits, costs, financing options, possible disruption during works and the long-term value of renovation. The experts therefore acted as translators between technical knowledge and everyday concerns.

The expert groups also played an important role in communication and consensus-building. Renovation of multi-apartment buildings requires collective decisions, and different stakeholders often have different expectations, priorities and levels of knowledge. Experts helped clarify misunderstandings, answer questions, address doubts and support dialogue between residents, building managers, municipalities, homeowner associations and other institutions. In several regions, this mediation role was particularly important where renovation involved sensitive issues such as affordability, cultural heritage requirements, municipal grant procedures or previous negative experiences with renovation.

The types of support provided can be grouped into three main categories:

Type of support	**Description**
Household-level advice	Advice on energy and water saving, indoor comfort, bills, ventilation, heating and cooling behaviour, appliance use, small measures and possible household-level improvements.
Building-level renovation support	Advice on renovation planning, technical options, financing, administrative steps, grant requirements, documentation, decision-making and preparation of building-level renovation processes.
Stakeholder coordination and communication	Support for communication between residents, building managers, homeowner associations, municipalities, technical experts, financing institutions and other actors involved in renovation.

Expert support was delivered through different formats depending on the needs of each region and target group. These included individual consultations, household visits, site visits, meetings with apartment owners or association boards, workshops, Q&A

sessions, online meetings, phone calls, email communication, written reports, technical reviews, training activities and informal consultations. In practice, the most effective role of the experts was often to combine these formats: providing general information where needed, but also following up with direct, tailored advice when specific household or building-level problems were identified.

Overall, the expert groups acted as a bridge between vulnerable households and the wider renovation process. They helped identify practical household needs, explain technical and financial options, support building-level stakeholders and create conditions for more informed and trusted renovation discussions.

3. Home visits and support to homeowners and residents

3.1 Purpose and approach of home visits

The home visits were an important part of the household-level support provided under Task 5.2. As Task 5.2 did not include a quantified KPI or contractual target for the number of household energy advising visits, the project partners jointly agreed to test the expert household visit methodology on a minimum total sample of 30 buildings, corresponding to at least six buildings per pilot region. Their purpose was to better understand the real living conditions of vulnerable homeowners and tenants in multi-apartment buildings and to provide practical, understandable and household-specific energy advice. The visits helped experts move beyond general assumptions about energy poverty and renovation needs by observing actual apartment conditions, discussing residents' concerns directly and identifying both immediate energy-saving opportunities and deeper building-level problems.

During the visits, experts assessed the technical condition of the apartments, the level of thermal comfort, heating and cooling practices, electricity and water use, ventilation habits, indoor air quality and visible signs of building-related problems such as draught, mould, dampness, cold surfaces or overheating. Where possible, advisers reviewed electricity, heating and water bills, analysed available consumption data and discussed the household's energy costs with residents. In some regions, additional tools such as thermal imaging, indoor climate monitoring, air quality measurements or household energy reports were used to make problems more visible and to support concrete recommendations.

The approach was deliberately practical and advisory rather than inspection based. Experts discussed residents' everyday habits, comfort problems and financial constraints, and then proposed realistic measures adapted to each household. The advice included no-cost behavioural changes, low-cost improvements and, where relevant, larger renovation measures that would require action at building level. Residents were informed about possible energy savings, ventilation practices, appliance use, heating and cooling behaviour, water-saving options, available subsidies and the wider renovation process.

A key aspect of the visits was trust-building. Many vulnerable households face financial insecurity, limited technical knowledge or scepticism towards renovation processes.

Direct visits allowed experts to explain issues in simple language, answer questions and listen to concerns that might not emerge in larger meetings or online formats. In several regions, home visits also helped connect household-level problems with wider renovation discussions involving building managers, homeowner associations, municipalities or other stakeholders.

The household visits therefore served two functions. First, they provided immediate support to residents through tailored advice on energy saving, comfort and small improvements. Second, they generated practical evidence on building-level renovation needs. Many problems identified during the visits, such as uninsulated façades, heat losses through attics or cellars, poor heating control, mould, dampness, overheating or weak building envelopes, could not be solved by individual households alone. The visits thus confirmed the need to link household energy advising with broader expert support for building-level renovation processes.

3.1.1 Summary of household visits by country

The energy advising visits in **Alba Iulia (Romania)** showed that vulnerable households face a combination of technical, financial and comfort-related challenges. While the general living comfort in several apartments was acceptable or good, recurring problems were identified, particularly summer overheating, insufficient ventilation, heat losses and high natural gas costs. The advice provided focused on practical energy-saving behaviour, appliance monitoring, better ventilation, humidity control and targeted low-cost improvements such as window sealing and basement ceiling insulation. At the same time, the findings show that many problems require broader building-level renovation measures, confirming the importance of linking household energy advising with expert support to building managers, homeowner associations and other renovation stakeholders under Task 5.2.

The six home energy advising visits in **Tartu (Estonia)** showed that the main energy-related challenges in Estonia were linked less to excessive household electricity use and more to building-level performance, comfort and system optimisation. In unrenovated buildings, recurring issues included air leakage, cold bridges, limited heating control and summer overheating risks. In renovated or partly upgraded buildings, the main advisory needs concerned correct use of heating, ventilation and smart control systems. Most recommendations were low-cost or behavioural, such as window and door adjustment, sealing, short intensive ventilation, shading, water-saving aerators and improved appliance or temperature management. However, the reports also show that lasting improvements require building-level renovation measures, especially façade and roof insulation, heating system balancing or renewal, improved ventilation and better summer heat protection.

In **Poland**, the household visits showed generally efficient electricity use and, in several cases, good or very good apartment conditions. The main recurring issue was thermal discomfort during summer, with several apartments becoming excessively hot despite acceptable or pleasant winter comfort. Some cases also pointed to heating system regulation problems, including winter overheating caused by very hot heating pipes. One apartment showed severe structural and indoor environmental problems, including leaking roof, dampness, mould, rot and extremely unpleasant winter comfort, requiring comprehensive renovation. The advice provided focused mainly on low-cost

behavioural measures, efficient appliance use, energy monitoring, air quality monitoring, ventilation, heating system checks and replacement of outdated equipment. The Polish findings show that household-level energy advising should be linked to broader building-level support where problems relate to overheating, ventilation, heating system regulation or structural degradation.

The household visits in **Čakovec (Croatia)** show that vulnerable households and residents in multi-apartment buildings face a combination of building envelope problems, moisture, draught, inefficient heating or cooling systems, and summer overheating. The most serious cases included damp walls, mould, wet foundations, high energy costs and poor thermal comfort, clearly indicating energy poverty. Other apartments were internally well maintained but still affected by building-level problems such as damaged façades, leaking roofs, foundation water penetration or draught through old doors and balcony openings. The advice provided focused on immediate low-cost measures such as sealing doors, improving ventilation, using window films, maintaining air-conditioning units and replacing inefficient appliances. However, the reports consistently show that durable improvement depends on broader building-level renovation, especially insulation, roof and façade repair, foundation waterproofing, carpentry replacement and more efficient heating or cooling solutions.

The household energy advising visits in **Kidričevo (Slovenia)** show that the main challenges are high heating costs, poor thermal performance of unrenovated multi-apartment buildings, thermal bridges, mould risk and summer overheating. All analysed buildings lack façade insulation, while attics and cellar ceilings are also not adequately insulated. Several households reported annual heating costs of around 1.500 EUR, and in at least one case an older person living alone kept the apartment at a low temperature to save energy costs. The advice provided focused mainly on façade insulation, attic or cellar ceiling insulation, appropriate ventilation, mould treatment and small apartment-level measures such as reflective foil behind radiators. The findings clearly confirm that long-term improvement depends on building-level renovation and coordinated action among apartment owners, building managers and other local stakeholders.

3.2 Main issues identified

The home visits across the five regions showed that vulnerable households often face a combination of technical, financial and comfort-related problems. Although the situation differed between countries and buildings, several common patterns were identified.

One of the most frequent issues was poor thermal performance of multi-apartment buildings. In several pilot areas, buildings lacked adequate façade insulation, attic insulation or cellar ceiling insulation. This caused heat losses in winter, higher heating costs and reduced comfort, especially in apartments located on the top floor, ground floor, at the end of the building or with several external walls. Thermal bridges, cold corners, heat losses through floors, balconies, external walls and window areas were repeatedly identified. In some cases, residents had to heat more to maintain acceptable comfort, while in others they reduced indoor temperatures to limit costs.

High heating costs and affordability problems were another recurring issue. In some households, heating costs created direct financial pressure, especially among older persons, single-person households or residents with low income. In some cases, residents kept rooms cooler or reduced heating to manage bills. In other cases, households paid high energy costs but still did not achieve adequate comfort because the building envelope was poor or the heating system was inefficient. This shows that energy poverty is not only linked to energy consumption levels, but also to the ability to achieve healthy and comfortable indoor conditions at an affordable cost.

Summer overheating was also a common finding. It was reported in different regions, including apartments on upper floors, south-facing dwellings, buildings with uninsulated structures and apartments exposed to direct sunlight. In several cases, residents relied on air conditioning or continuous window opening to cope with high indoor temperatures. Overheating is therefore becoming an increasingly relevant comfort and health issue, especially for vulnerable households, and should be considered in future renovation planning alongside winter heating demand.

Moisture, mould and dampness were identified in several pilot areas, although with different severity. In some apartments, mould appeared around wall-ceiling junctions, bathrooms, kitchens, external walls or window areas, often linked to thermal bridges, poor ventilation, cold surfaces or damp building elements. In more severe cases, apartments had damp walls and floors, wet foundations, rot, mould on walls and ceilings, leaking roofs or poor air circulation. These problems are important not only from an energy perspective, but also because they affect health, dignity and quality of life.

Ventilation and indoor air quality were also recurring topics. Some households ventilated insufficiently, especially during winter, because of heat loss concerns. Others opened windows frequently because of overheating or lack of heating control, which caused avoidable energy losses. In renovated or technically upgraded buildings, residents sometimes needed guidance on how to use mechanical ventilation, smart controls or heating systems correctly. This shows that both unrenovated and renovated buildings require user-oriented advice, although the content of the advice differs.

Old or inefficient appliances were identified in some households, but they were not always the main source of energy problems. In many cases, electricity use was moderate or even low, while the main problems were related to heating, cooling, building envelope quality or system regulation. Nevertheless, residents were often advised to monitor appliance use, replace inefficient equipment when possible, use energy labels when buying new appliances and reduce standby consumption.

A major cross-cutting finding is that many household-level problems cannot be solved only through behavioural changes. Small measures such as ventilation advice, window sealing, LED lighting, low-flow water fittings, radiator reflectors, draught seals or improved appliance use can provide immediate benefits. However, durable improvement often requires coordinated building-level measures such as façade insulation, attic and cellar ceiling insulation, roof repair, foundation waterproofing, heating system balancing or replacement, ventilation improvement, shading, façade repair and comprehensive renovation.

The home visits therefore confirmed that household energy advising is most useful when it is connected to building-level renovation support. The visits helped identify practical household needs, but they also revealed structural problems that require action by apartment owners, building managers, homeowner associations, municipalities, technical experts and financing institutions.

3.3 Advice and measures proposed

The advice provided during the household visits was adapted to the specific conditions of each apartment and household. Across the five regions, experts proposed a combination of no-cost behavioural measures, low-cost improvements, larger investment measures and organisational support linked to building-level renovation processes. The recommendations reflected the fact that some problems could be addressed directly by residents, while others required collective action at the level of the building, building manager, homeowner association, municipality or another responsible stakeholder.

No-cost measures focused mainly on everyday behaviour and better use of existing systems. Residents were advised to improve ventilation practices, especially in apartments with humidity, mould risk or poor indoor air quality. In many cases, experts recommended short and intensive airing instead of keeping windows open for long periods, particularly during the heating season. Residents were also advised to monitor indoor temperature and humidity, avoid placing furniture directly against cold external walls, reduce unnecessary standby consumption, use appliances efficiently and pay attention to heating and cooling behaviour.

Energy consumption awareness was another important part of the advice. Several households were encouraged to monitor electricity use more actively, including appliance-level consumption where possible. In some cases, experts recommended the use of smart sockets, indoor climate monitoring devices or other simple tools to help residents better understand how their behaviour and equipment affected energy use, comfort and costs. Residents were also advised to consider energy labels when buying new appliances and to operate washing machines, dishwashers and other high-consumption appliances efficiently.

Low-cost measures were proposed where immediate and affordable improvements were possible. These included replacing traditional lighting with LED bulbs, sealing windows and doors, maintaining or replacing window gaskets, adjusting window and balcony door closing pressure, installing draught seals, using radiator reflectors, replacing faucet aerators with low-flow models and applying simple shading measures to reduce summer overheating. In several cases, residents were advised to clean or maintain air-conditioning units, use window films or other shading solutions, install carpets or insulating underlays, and use dehumidifiers where humidity or mould risk was present.

In some regions, energy-saving packages were distributed to vulnerable households. These included items such as energy-efficient light bulbs, draught seals for windows and doors, written energy-saving guidelines and household-specific recommendations. Such measures were especially useful because they provided residents with immediate,

visible and practical support, even where larger renovation investments were not yet possible.

Larger investment measures were recommended where household-level behaviour and low-cost measures were not sufficient. These recommendations typically concerned the building envelope and shared building systems. Across the pilot regions, experts frequently identified the need for façade insulation, attic insulation, cellar ceiling insulation, roof repair, basement or foundation waterproofing, replacement or repair of windows and doors, treatment of thermal bridges, heating system balancing, heating system modernisation, ventilation improvements and comprehensive energy renovation. In some cases, replacement of old appliances, electric water heaters or inefficient air-conditioning units was also recommended.

A recurring finding was that many comfort and energy problems were caused by building-level deficiencies rather than individual household behaviour. Heat losses through uninsulated façades, attics, cellars, balconies, floors or external walls could not be fully solved by residents alone. Similarly, problems such as mould caused by thermal bridges, damp walls, damaged façades, leaking roofs, poor heating control or summer overheating often required coordinated building-level intervention. The advice therefore often linked household-level observations with the need for wider renovation planning.

Organisational support was also an important part of the advice. Residents were informed about renovation procedures, available subsidies, possible financing mechanisms and the practical steps needed for decision-making. In several cases, experts encouraged residents to contact building managers, homeowner associations or municipal representatives to discuss broader renovation options. Where appropriate, household-level findings were used to support further dialogue with building-level stakeholders.

The proposed measures can be summarised as follows:

Type of advice	**Examples of measures**
No-cost measures	Improved ventilation habits, monitoring indoor temperature and humidity, reducing standby consumption, efficient appliance use, avoiding furniture placement against cold walls, better heating and cooling behaviour.
Low-cost measures	LED lighting, draught seals, window and door gasket maintenance, radiator reflectors, low-flow faucet aerators, window films, simple shading, dehumidifiers, cleaning air-conditioning units, small insulation or sealing works.
Larger investments	Façade insulation, attic insulation, cellar ceiling insulation, roof repair, foundation waterproofing, window replacement, heating system balancing or modernisation, ventilation improvements, comprehensive renovation, replacement of inefficient appliances or technical systems.

Organisational support	Explaining renovation procedures, informing residents about subsidies and financing options, linking household problems with building-level renovation, encouraging communication with building managers, municipalities or homeowner associations.

Overall, the advice provided during home visits confirmed that small measures can bring immediate benefits, especially for vulnerable households, but they are not sufficient to solve structural energy poverty risks. The most durable improvements require building-level renovation, supported by clear communication, financing guidance and cooperation between residents, building managers, homeowner associations, municipalities and technical experts.

4. Expert services to building managers, homeowner associations and other stakeholders

Across the pilot countries, the project activities focused on strengthening the capacity of local actors involved in the renovation of multi-apartment buildings. The main target groups included building managers, homeowners' and apartment associations, apartment owners, tenants, municipalities, technical experts, financing institutions, cultural heritage authorities and other national or regional stakeholders. Although the country contexts differed, the activities shared a common objective: to make renovation processes more understandable, technically feasible, financially realistic and socially acceptable for the people and organisations expected to take decisions or support implementation.

A key feature of the activities was the use of direct and practical engagement formats. Instead of relying only on general awareness-raising, partners organised targeted consultations, workshops, stakeholder meetings, apartment association meetings, Q&A sessions, site visits, phone consultations and bilateral discussions. These formats helped address concrete concerns related to costs, financing, technical solutions, administrative procedures, resident approval, construction disruption and expected benefits. In most countries, direct in-person engagement proved more effective than online or general information formats, especially when dealing with complex renovation decisions in multi-apartment buildings.

Table 2: Comparative overview of expert services to building-level stakeholders.

Country	Main target groups	Main activity formats reported	Focus of support	Main outputs or added value
Romania	Homeowners' associations, residents, municipal representatives, building management actors	Consultations, stakeholder communication, explanation of renovation examples and success stories	Renovation benefits, technical options, financing aspects, feasibility of renovation measures,	Improved understanding of renovation benefits; stronger communication between residents, homeowners'

			municipal grant coordination	associations and the municipality
Estonia	Apartment association boards, apartment owners, building managers and property management companies	Board meetings, general assemblies, building-specific consultations	Renovation solutions, financing options, grant requirements, documentation and sequencing of renovation preparation	Support to apartment associations in decision-making, technical planning and preparation for funding procedures
Poland	Building managers, homeowners' associations, landlords and housing administrations	Technical assessments, energy reports, consultations on funding and renewable energy options	Building condition, renovation pathways, EU and national funding opportunities, PV and renewable energy solutions	Energy reports and technical assessments for selected buildings; cooperation initiated with a renewable energy contractor
Croatia	Building managers, residents, vulnerable households, energy poverty experts and regional energy agency actors	Workshops, Q&A sessions, individual and group consultations, demonstration building visits, Train the Trainer activity	Resident communication, renovation benefits, documentation, contractors, funding opportunities, air quality monitoring and vulnerable household engagement	Strengthened capacity of building managers as trusted intermediaries; improved communication on comfort, health, safety and quality-of-life benefits
Slovenia	Residents, building managers, municipality, national institutions and cultural heritage authority	Consultations, mediation meetings, technical-economic comparison study, discussions with cultural heritage authority	Renovation options under cultural heritage constraints, façade renovation, insulation thickness, technical feasibility and affordability	Identification of a more suitable renovation approach balancing technical feasibility, heritage requirements and affordability

4.1 Summary of expert services to building-level stakeholders

In **Romania**, activities in the Alba Iulia pilot area focused on homeowners' associations, residents, municipal representatives and building management actors. Experts supported stakeholders by explaining the benefits, technical options, financial aspects and feasibility of renovation measures. A strong emphasis was placed on locally grounded examples and success stories from previous renovation projects, which helped make renovation benefits more visible and credible. The activities also supported communication between residents, homeowners' associations and the municipality, which plays an important role in coordinating and applying for renovation grants. The Romanian experience highlighted the importance of local credibility and practical examples in building trust around renovation processes.

In **Estonia**, the activities were strongly linked to the decision-making role of apartment associations. Support was provided to apartment association boards, apartment owners and, where relevant, building managers and property management companies. Experts participated in board meetings, general assemblies and building-specific consultations, helping residents understand renovation solutions, financing options, grant requirements, documentation needs and the sequencing of preparation activities. A particularly important element was the combination of technical expertise with knowledge on apartment association governance and housing policy. The Estonian case showed that practical progress depends heavily on repeated building-level consultations and support to apartment associations as they navigate internal decision-making, technical planning and funding procedures.

In **Poland**, activities in the MAE pilot area focused mainly on building managers, homeowners' associations and landlords. Expert support combined technical assessment with financial guidance. Energy reports and technical assessments were prepared for selected buildings, helping building managers and housing administrations better understand building conditions and possible renovation pathways. Experts also provided information on EU and national funding opportunities, including support related to renewable energy solutions and the BGK RES grant. One concrete result was the establishment of cooperation between the pilot housing estate administration and a renewable energy contractor, especially in relation to photovoltaics. The Polish experience underlined the importance of linking technical recommendations with realistic financing routes.

In **Croatia**, the activities were built around close cooperation between the regional energy agency, building managers and energy poverty experts. Building managers played a particularly important role, not only as stakeholders but also as active members of the expert group. Their existing relationships with residents helped create trust, facilitate communication and access relevant building-level information. Capacity-building activities, including a Train the Trainer workshop, helped building managers improve their communication with vulnerable households, explain renovation benefits and address social, emotional and financial barriers. Croatian activities also included workshops, Q&A sessions, individual and group consultations, visits to demonstration buildings and advisory support on documentation, contractors, funding opportunities and air quality monitoring results. A notable finding was that residents responded better when renovation was explained not only through energy savings, but also through comfort, health, safety and quality of life.

In **Slovenia**, activities focused on residents, building managers, the municipality, national institutions and the cultural heritage authority. The pilot area had no formal

homeowners' associations, so engagement was directed mainly towards apartment owners and residents, while experts also acted as mediators between different institutional actors. A specific feature of the Slovenian case was the need to align renovation planning with cultural heritage requirements. Consultations with the Institute for the Protection of Cultural Heritage of Slovenia addressed façade renovation, insulation thickness and acceptable renovation options. A short study compared different renovation solutions and their technical and economic implications. This process helped identify a more suitable approach for future renovations, balancing technical feasibility, cultural heritage requirements and affordability for residents. The Slovenian experience highlighted the importance of mediation when renovation depends on several overlapping conditions and institutions.

Across the countries, several interesting findings emerged:

1. Building managers and apartment associations often require support not only on technical matters, but also on communication, financing and resident engagement.
2. Renovation decisions in multi-apartment buildings are highly dependent on trust, repeated explanation and the ability to translate technical information into clear, practical language.
3. Financial concerns were present in all pilot areas, but they appeared in different forms: expectations of full public subsidies in Romania, affordability and loan concerns in Estonia, access to funding in Poland, fear of debt among vulnerable households in Croatia, and cost implications of cultural heritage requirements in Slovenia.
4. Local intermediaries, such as building managers, municipal representatives or trusted local actors, played an important role in making engagement credible and accessible.

Overall, the country activities show that support to building managers, homeowner associations and other stakeholders must go beyond one-way information provision. Effective renovation support requires a combination of technical advice, financial guidance, practical examples, stakeholder coordination and trust-building. The most successful activities were those adapted to the specific governance, financial and social realities of each pilot area. While expert visits to households provided useful insights into living conditions and resident concerns, the broader added value of the activities was the creation of more informed, better connected and more confident local stakeholder groups capable of supporting renovation processes in multi-apartment buildings.

5. Specialised expert task: Feasibility assessment of PV-based energy communities

In addition to supporting households, building managers, and homeowner associations, the experts also carried out specific technical tasks, such as assessing the feasibility of implementing PV-based energy communities in the pilot areas and targeted MABs.

5.1 Introduction to Task 5.3

The aim of Task 5.3 was to assess whether photovoltaic installations and PV-based energy communities could realistically be implemented in the CEESEN-BENDER pilot regions and, where relevant, integrated into building-level renovation roadmaps. The task did not treat PV installation or energy community formation as mandatory renovation measures. Instead, it provided a structured way to check whether these options are technically possible, legally allowed, structurally realistic and economically worth further consideration.

The assessment was especially relevant because decisions on PV installations in multi-apartment buildings are ultimately investment decisions made by apartment associations, building owners or other responsible local actors. For such investments to move forward, they need to provide clear and measurable benefits, such as lower electricity costs, higher self-consumption, improved long-term financial performance or added value within the wider renovation process. The task therefore aimed to ensure that the PV and energy community option was systematically assessed that feasibility conditions were documented, and that any decision not to proceed could be clearly justified.

5.2 Methodology

The methodology combined three levels of assessment:

1. A preliminary technical and regulatory screening was carried out using the CEESEN-BENDER Feasibility Checklist. This reviewed grid connection possibilities, permitting and planning conditions, roof condition, structural suitability, availability of subsidies, electricity sharing possibilities and options for selling electricity.
2. Where the initial screening justified further work, a preliminary economic assessment was prepared using the StartSun Energy Community Feasibility Calculator or an equivalent local approach. This required building-specific data, including electricity consumption, electricity costs, roof area and consumption patterns.
3. Where implementation would be pursued, the checklist identified the next project development steps, including PV simulations, design preparation, cost quotations, permitting, construction and commissioning.

5.3 Summary

Across the pilot countries, the assessment showed that the technical potential for PV installation is generally positive. Grid access and planning conditions were not major

barriers in most pilot areas, and structural constraints were usually manageable, especially where roof renovation was already planned. However, the feasibility of full energy community models was more limited. In several countries, internal electricity sharing within multi-apartment buildings was not yet possible or not sufficiently developed in practice. This reduced the potential for collective self-consumption and weakened the economic attractiveness of building-level energy community models.

In Croatia, the pilot buildings showed favourable technical and regulatory conditions for PV installation. Grid connection is allowed, no building permit is required under current conditions, roof renovation is planned and structural reinforcement can be included where needed. From this perspective, PV installation is feasible. However, electricity sharing within the building is currently not possible, and electricity can be sold to the grid but not to neighbouring buildings. This limits the possibility of developing a full building-level energy community model. The Croatian case therefore remains at screening level, with technical feasibility confirmed but investment attractiveness still limited by the current economic and regulatory framework.

In Estonia, two different building typologies were assessed: large, prefabricated apartment buildings in Annelinn and smaller wooden apartment buildings in Karlova. In both cases, grid and planning conditions allow PV installation. In Annelinn, the situation is more favourable because roof renovation is planned, making it possible to align PV installation with broader renovation works. In Karlova, feasibility is weaker because roof renovation is not planned soon and additional structural verification would be required. A specific Estonian finding is that comprehensive renovation can reduce heating demand while increasing electricity consumption due to mechanical ventilation and other modern building systems. Rooftop PV could therefore help offset part of this additional electricity demand. However, the lack of internal electricity sharing and the need to justify PV investment within the wider renovation budget mean that implementation has not progressed beyond preliminary screening.

In Poland, technical feasibility was generally strong across the pilot buildings. Some buildings already have PV installations connected to common areas and operating under the net-billing system. For these buildings, the main question is not initial deployment, but optimisation, for example through increased self-consumption, battery storage or possible adjustment of billing arrangements. For buildings without PV, installation is possible, although roof load-bearing assessments are still needed in some cases. One important finding was that in one building, the available roof area would not be sufficient to cover the full electricity demand, showing that full self-sufficiency is not realistic in all cases. The Polish case also shows a clear implementation gap: while technical potential exists, the current regulatory framework for energy clusters and citizen energy communities provides limited financial incentives in urban contexts. No building has progressed to full energy community formation within the project scope.

In Romania, the representative pilot building showed strong technical feasibility. Grid and planning conditions allow PV installation, roof renovation is planned, structural assessment is foreseen and electricity can be sold to the grid. As in several other countries, however, internal electricity sharing is not currently allowed. This limits the development of a building-level energy community model, even though PV installation itself appears technically realistic. The Romanian assessment indicates that future

building-level roadmaps and investment strategies may consider PV systems together with other renovation measures, such as mechanical ventilation. Final decisions will depend on detailed design, cost assessment and financial feasibility.

Slovenian tested pilot building showed very favourable structural and regulatory conditions. The roof has already been renovated, load-bearing capacity is sufficient, grid connection is available, internal electricity sharing is legally possible and sale to neighbours is also feasible. On paper, this creates one of the most promising conditions for both PV installation and energy sharing. However, cultural heritage protection requirements create a significant economic barrier. PV modules would need to match the roof colour, which substantially increases investment costs. Under optimistic assumptions, the estimated payback period increases to around 21 years, compared to approximately seven years under standard market conditions. The Slovenian case therefore demonstrates that technical and regulatory feasibility alone are not enough; specific local requirements can substantially weaken economic feasibility and reduce investment attractiveness.

5.4 Key findings

The cross-country assessment shows a clear distinction between feasibility in principle and investment readiness. Most pilot areas achieved high preliminary feasibility scores, meaning that PV installation is technically and legally possible under certain conditions. However, no pilot area had progressed to construction stage at the time of reporting. The reasons are not primarily technical. The main barriers are financial, institutional and organisational. These include moderate economic returns, unclear or limited electricity sharing mechanisms, uncertain support schemes, apartment association decision-making, competing renovation priorities and the need for detailed project design before any final investment decision can be made.

A key finding is that energy community development depends strongly on the maturity of national regulatory frameworks. Where electricity sharing within buildings is not possible or not practical, the potential for building-level energy communities remains limited, even if rooftop PV installation is technically feasible. Similarly, where support schemes or financial incentives are weak, apartment associations may prioritise other renovation measures with clearer or more immediate benefits.

Overall, Task 5.3 provided a structured and transparent basis for deciding whether PV installations and energy communities should be included in building-level renovation roadmaps. The assessment confirmed that technical potential exists in most pilot regions but also showed that practical implementation remains conditional on financial return, legal electricity sharing options, apartment association decisions and the strategic role of PV within the wider renovation plan. The results therefore support two possible outcomes: either the integration of PV and energy community options into future renovation planning, or a justified decision not to proceed under current technical, regulatory or economic conditions.

Table 3: Country assessment status.

Country	PV technical feasibility	Main limitation	Status
Croatia	Positive	No internal electricity sharing; moderate economics	Screening level
Estonia	Positive, stronger in Annelinn	No internal sharing; structural issues in Karlova	Screening level
Poland	Positive; some existing PV	Limited urban EC incentives; roof area limits in some cases	Optimisation / screening
Romania	Positive	No internal electricity sharing	Future roadmap consideration
Slovenia	Technically and legally strong	Cultural heritage requirements weaken economics	Not investment-ready

6. Main findings across the five regions

The implementation of expert services across Estonia, Poland, Slovenia, Croatia and Romania shows that expert advisory support is most effective when it connects household-level advice with building-level renovation processes. The five regions differed in their housing structures, renovation experience, role of building managers, financial support systems and institutional arrangements, but several common findings emerged.

At household level, vulnerable residents often faced a combination of poor comfort, high or difficult-to-control energy costs, limited investment capacity and insufficient knowledge about possible solutions. In many cases, residents were not simply using energy inefficiently. Rather, they were living in buildings with poor thermal performance, weak heating control, insufficient insulation, overheating risks, mould or dampness. This means that advice focused only on individual behaviour would be insufficient. Behavioural and low-cost measures can reduce discomfort and support better energy management, but they cannot replace building-level renovation where structural problems are present.

The household visits were valuable because they made these problems visible. They helped experts understand how building performance affects everyday life, especially for vulnerable households. The visits also helped residents better understand the link between their energy bills, comfort problems, ventilation habits, appliance use and the condition of the wider building. In several regions, direct contact with residents proved more effective than general communication, especially where trust was low or where residents had concerns about costs, disruption or previous negative renovation experiences.

Across the five regions, building-level renovation support was needed not only for technical questions, but also for communication, financing and decision-making. Building managers, homeowner associations, landlords and apartment owners often needed support to understand renovation options, prepare documentation, assess financing opportunities, communicate with residents and build consensus. In multi-apartment buildings, renovation is rarely only a technical decision. It requires collective agreement, trust in the process, clarity on costs and benefits, and confidence that the proposed measures are realistic and affordable.

Financing uncertainty was one of the strongest common barriers. Residents and building-level actors were often concerned about renovation costs, loan obligations, availability of subsidies, application procedures and the risk of unexpected costs. In some areas, previous fully subsidised renovations created expectations that future renovations should also be covered by third parties. In other areas, vulnerable households feared debt or loss of control over their expenses. Expert support therefore had to explain not only technical measures, but also funding opportunities, financial sustainability, phased renovation options and the limits of available grants.

Communication challenges were also common. Residents often needed repeated explanations before they were ready to support renovation decisions. Technical language had to be translated into practical and understandable terms. The most effective communication focused not only on energy savings, but also on comfort, health, safety, reduced mould, better indoor air quality, more stable indoor temperatures and improved quality of life. This was especially important for vulnerable households, where renovation decisions are closely linked with financial insecurity, fear of disruption and trust in local actors.

The role of building managers differed significantly between countries. In Estonia, apartment associations and their boards are central decision-makers, while building managers usually play a more supportive role. In Croatia, building managers were active members of the expert group and acted as trusted intermediaries between residents and energy experts. In Slovenia, the experts often acted as mediators between residents, building managers, the municipality and the cultural heritage authority. In Romania, the municipality played an important role in coordinating renovation and applying for grants. In Poland, support was strongly linked to technical and financial advisory services for building managers, housing administrations and landlords. These differences show that expert support must be adapted to national and local governance structures.

The added value of expert groups was visible in all regions. Experts provided technical knowledge, financial guidance, neutral advice, local credibility and practical support for communication between stakeholders. In several cases, external experts complemented project partners by adding specialised knowledge on financing, building management, apartment association governance, cultural heritage, energy poverty or local renovation practice. The multidisciplinary nature of the expert groups made it possible to address renovation as a combined technical, social, financial and organisational process.

The Task 5.3 feasibility work added another layer to the expert group activities by showing that technically feasible renewable energy solutions do not automatically

become investment-ready projects. Across the pilot regions, PV installation was often technically possible, but implementation depended on electricity sharing rules, financial return, apartment association decisions, structural readiness and the position of PV within broader renovation priorities. This confirms that expert support is needed not only to identify technical options, but also to assess whether they are legally, financially and organisationally realistic.

Overall, the five-region experience confirms that expert advisory support can help bridge the gap between household needs and building-level renovation. Home visits identify concrete problems and build trust with residents, while expert services to building managers, homeowner associations, municipalities and other actors help translate these findings into possible renovation pathways. The strongest results were achieved where advice was practical, locally grounded, repeated over time and delivered through trusted actors.

7. Lessons learnt and recommendations

7.1 Lessons learnt

Lesson 1

The first lesson from the expert group activities is that **expert support should be designed as a continuous process** rather than a one-off activity. Renovation in multi-apartment buildings requires time, repeated communication and gradual trust-building. One meeting, one home visit or one information session is rarely enough to move vulnerable households or apartment owners towards renovation decisions. Future support services should therefore include follow-up consultations, repeated explanations and opportunities for residents and building-level actors to ask questions as the process develops.

Lesson 2

Household-level advice must relate to building-level renovation support. Many recommendations from home visits can be implemented directly by residents, such as improved ventilation, better appliance use, sealing windows and doors, installing LED lighting, using water-saving devices or monitoring energy consumption. However, the most serious problems often require collective action, including façade insulation, attic or cellar ceiling insulation, heating system improvement, ventilation upgrades, roof or façade repair and treatment of thermal bridges. Future advisory services should therefore include a clear pathway from household visits to building-level discussions with apartment owners, building managers, homeowner associations and municipalities.

Lesson 3

The third lesson is that **technical advice alone is not sufficient**. Renovation support must also address financing, affordability, administrative procedures, resident concerns and decision-making. Vulnerable households and apartment owners need clear information about costs, subsidies, loan obligations, grant conditions, expected savings and possible disruption during works. Support services should therefore combine technical,

financial and social expertise, rather than treating renovation only as an engineering task.

Lesson 4

The fourth lesson is that **trust is a central condition for successful engagement**. Residents are more likely to engage when advice is provided by people they know, or by experts introduced through trusted local actors. Building managers, municipal representatives, local councillors, homeowner association leaders and community-based organisations can play an important intermediary role. Future activities should involve trusted local actors early in the process and use them to support communication with residents, especially in vulnerable communities.

Lesson 5

Communication should focus on lived benefits, not only energy performance. Residents often respond more strongly to messages about comfort, health, safety, mould reduction, stable temperatures, lower stress and improved quality of life than to abstract technical indicators. Expert support should explain renovation in terms that reflect residents' everyday experience. This is especially important where households are sceptical, afraid of debt or have had negative experiences with previous renovation attempts.

Lesson 6

The sixth lesson is that **direct and personalised formats are generally more effective than mass communication**. Workshops, webinars and written information are useful for awareness-raising, but practical progress is usually achieved through individual consultations, site visits, home visits, apartment association meetings and direct discussions with residents. Online formats can support information sharing, but they should not replace in-person engagement where trust, vulnerability or complex decision-making are involved.

Lesson 7

The seventh lesson is that **renovation advice must be tailored to local institutional and legal conditions**. The role of building managers, homeowner associations, municipalities, cultural heritage authorities and financing institutions differs between countries and even between pilot areas. Support models should therefore not be standardised too rigidly. Instead, each region should identify who has decision-making power, who is trusted by residents, who controls technical information and who can move the renovation process forward.

Lesson 8

The last lesson is that **expert groups should remain multidisciplinary**. The most useful support was provided where technical experts, financial experts, building managers, energy poverty specialists and local institutions worked together. This allowed the advisory process to address building condition, household vulnerability, financing opportunities, stakeholder coordination and communication barriers at the same time.

Future expert groups should therefore include or have access to expertise in energy efficiency, renovation planning, financing, social engagement and local governance.

Lesson 9

PV and energy community options should be assessed early but treated as investment decisions rather than automatic renovation measures. The Task 5.3 feasibility work showed that rooftop PV may be technically possible in many pilot buildings, but implementation depends on electricity sharing rules, financial return, structural readiness, apartment association decisions and the position of PV within the wider renovation package. Early screening is therefore useful because it helps clarify whether PV should be integrated into the building-level roadmap, postponed until conditions improve, or excluded with a clear technical, regulatory or economic justification.

7.2 Recommendations

Based on these lessons, several recommendations can be made:

1. Future renovation support services should combine home visits with structured follow-up at building level.
2. Vulnerable households should receive advice that is practical, affordable and linked to available support schemes.
3. Expert advice should be presented in simple and locally understandable language, supported by visual evidence where possible, such as thermal images, indoor climate measurements, energy reports or examples from renovated buildings.
4. Support to building managers and homeowner associations should include communication tools and guidance for consensus-building, not only technical recommendations.
5. Financing information should be included from the beginning, because affordability concerns strongly influence residents' willingness to engage.
6. PV and energy community feasibility should be screened at an early stage of building-level renovation planning, but final decisions should be based on detailed design, electricity sharing rules, financial return, structural readiness and apartment association priorities.

Finally, policy and programme design should recognise that vulnerable households cannot be expected to initiate or finance renovation alone. They need trusted advice, accessible funding, administrative support and coordinated action by building-level and public actors. Task 5.2 shows that expert advisory support can play an important bridging role between residents' everyday problems and the formal renovation process. To be effective, this support must remain practical, locally embedded, socially sensitive and connected to concrete renovation opportunities.

The findings from D5.2 will directly inform the next step of the project, particularly the preparation of building-level roadmaps under D5.3. The household visits and expert group activities have identified recurring comfort problems, technical deficiencies, affordability concerns, stakeholder barriers and possible renovation measures in the

pilot buildings. These findings provide a practical evidence base for translating resident needs and expert observations into more structured building-level renovation pathways. In D5.3, this evidence should be used to prioritise feasible renovation measures, assess technical and financial options, and define realistic next steps for pilot buildings, including the possible integration of PV or energy community solutions where they are technically, legally and economically justified.

8. Annexes

- Annex 1: List of expert groups
- Annex 2: Country reports: Summary of Household Energy Advising Visits, Summary of expert services to building managers, homeowner associations and other stakeholders
    - Estonia
    - Romania
    - Poland
    - Croatia
    - Slovenia
- Annex 3: Task 5.3 – Feasibility Assessment of PV-Based Energy Communities in Pilot Regions Summary

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