CEESEN-BENDER

Building intErventions in vulNerable Districts against Energy poveRty

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Country reports:

Summary of Household Energy Advising Visits

Summary of expert services to building managers, homeowner associations and other stakeholders

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1. Summary of Household Energy Advising Visits in Alba Iulia (Romania)

Within Task 5.2 of the CEESEN-BENDER project, six household energy advising visits were carried out in Alba Iulia, Romania, by the Alba Local Energy Agency — ALEA. The visits took place between 16 and 18 February 2026 and were conducted by the ALEA technical expert Eng. Laurențiu Mihet. All six dwellings were apartments located in multi-apartment buildings in Alba Iulia. The purpose of the visits was to assess living comfort, identify energy-related problems, review electricity and natural gas consumption, and provide practical advice to residents on possible energy-saving measures and improvements to indoor comfort.

The visited households represented different living situations, including elderly residents, families with children, and rented apartments occupied by students. The apartments also differed in size, orientation, floor position and level of exposure to external walls or structural heat losses. This variety made it possible to identify both household-specific issues and recurring problems related to the wider condition of the multi-apartment buildings.

1.1 Overall housing and comfort conditions

The general comfort level in the visited apartments was assessed as ranging from acceptable to good, but several recurring problems were identified. The most common issue was the absence of an adequate thermal envelope in the multi-apartment buildings. This affected both winter and summer comfort. During winter, some apartments experienced heat losses through structural elements such as floors, balconies, external walls or window gaskets. In one ground-floor apartment, lower comfort was reported in the bathroom because of heat losses towards the basement. Thermal camera observations confirmed these losses.

Summer overheating was another important issue. Several apartments experienced reduced comfort during heat waves, especially where external walls heated up quickly and transferred heat into the indoor space. South-oriented apartments and dwellings located in dense urban settings were particularly affected. In these cases, residents relied on air-conditioning units to maintain acceptable comfort levels. However, this also contributed to increased electricity use during the summer period.

Indoor air quality was also a repeated concern. Some households reported insufficient ventilation, especially during winter, when residents were less likely to open windows regularly. In one apartment, high humidity on exterior walls led to mould formation. In another small apartment of 24 m² occupied by four persons, air quality deteriorated quickly, especially during heat waves and during periods with insufficient ventilation. These findings show that energy efficiency problems were closely linked with comfort, health and quality of life.

1.2 Findings on energy use

The analysed apartments used electricity and natural gas as the main energy sources. Natural gas was used primarily for space heating and domestic hot water, while electricity was used for appliances, lighting, air conditioning and other household needs.

Electricity consumption varied considerably between the six dwellings, ranging from **1.3 MWh/year** to **4.1 MWh/year**. The lowest electricity consumption was recorded in a dwelling with elderly residents and relatively new appliances, while higher consumption was linked to air-conditioning use, electric appliances and household behaviour. In one apartment rented to students, electricity consumption was affected by irregular occupancy patterns, with lower or almost no consumption during academic breaks.

Natural gas consumption ranged from **4.4 MWh/year** to **12.6 MWh/year**. Higher gas consumption was associated with heat losses through the building structure, such as losses through floors to basements, thermal bridges, balcony areas or poorly sealed windows. In several cases, households reported that natural gas costs during the winter months created financial pressure.

The age and efficiency of household appliances varied. Some apartments had newer appliances with relatively low energy consumption, while others had appliances of mixed age. Across all visits, residents were advised to pay attention to energy labels when purchasing new appliances and to monitor appliance consumption more actively.

1.3 Energy poverty-related findings

Several indicators of energy poverty were identified during the visits. Some households explicitly reported being affected by energy poverty due to high winter heating costs, particularly where natural gas consumption was high. In one case, the residents linked their energy poverty situation to increased gas use caused by heat losses through the floor towards the basement.

In another case, elderly residents with low pension income reported keeping temperatures lower in some rooms in order to limit heating costs. This shows that energy poverty was not only visible through high consumption or high bills, but also through behavioural adaptation, such as under-heating parts of the dwelling.

The Romanian visits therefore show a direct relationship between poor building performance, household income constraints and reduced living comfort. Vulnerable households are particularly exposed when buildings lack insulation, when heating demand is high, or when summer overheating requires additional electricity use for air conditioning.

1.4 Main issues identified

Across the six visits, the most common problems were:

- lack of adequate thermal insulation in the multi-apartment buildings;
- summer overheating during heat waves;
- heat losses through floors, walls, balconies, thermal bridges and window gaskets;
- insufficient ventilation and reduced indoor air quality;
- humidity and mould formation on exterior walls;
- high natural gas consumption for heating and hot water in some apartments;
- financial pressure linked to winter heating costs;
- need for better monitoring of appliance-level electricity use.

These issues suggest that many household-level problems cannot be solved only through behavioural changes. While small measures and better energy management can help, several of the identified problems point to the need for building-level interventions, especially improvement of the thermal envelope, better sealing, balcony treatment, basement ceiling insulation and ventilation solutions.

1.5 Advice and recommended measures

The advice provided during the visits combined behavioural, low-cost and building-related measures.

A common recommendation across the visits was to improve awareness of electricity consumption. Residents were advised to monitor appliance consumption using smart programmable sockets and to reduce unnecessary standby consumption. They were also encouraged to use appliances more efficiently, select appropriate operating programmes and consider energy labels when buying new appliances.

Indoor air quality and humidity were another important focus. Residents were advised to increase manual ventilation by opening windows more frequently, monitor indoor air quality and relative humidity, and consider using dehumidifiers or existing air-conditioning systems to control humidity where mould risk was present. In several cases, the use of the ALEA Home Monitor device was recommended to help residents understand indoor air quality conditions and adapt their behaviour accordingly.

Several technical or low-cost building-related measures were also proposed. These included improving the sealing of thermopane window gaskets, adjusting window closing pressure, closing or improving open balconies to reduce thermal losses and thermal bridges, and insulating basement ceilings to reduce heat losses from ground-floor apartments. These measures were directly linked to problems observed during the visits, including heat loss, thermal discomfort and overheating.

1.6 Relevance for broader renovation support

The Romanian household visits provide strong evidence that household energy advising should be connected with wider building-level renovation support. The most frequent problems identified — lack of thermal envelope, heat losses, overheating, mould risk and ventilation problems — are linked to the condition of the multi-apartment buildings rather than only to individual household behaviour.

This means that the advice given to households can raise awareness and support immediate energy-saving actions, but deeper and more durable improvements require coordinated action involving apartment owners, building managers, homeowner associations and local experts. For Romania, the findings point especially to the need for renovation support related to building envelope improvements, treatment of thermal bridges, better ventilation strategies and protection of vulnerable households from high heating and cooling costs.

1.7 Short conclusion

The six home energy advising visits in Alba Iulia 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.

2. Summary of expert services to building managers, homeowner associations and other stakeholders in Alba Iulia (Romania)

In the Alba Iulia Pilot Area, expert advisory support was provided to strengthen the capacity, knowledge and confidence of the main local actors involved in the renovation of communist-era multi-apartment buildings. The support focused primarily on apartment owners and residents, homeowners' association representatives, municipal representatives and, where relevant, building management actors. The experts provided practical advice on the benefits, technical options, financial aspects and feasibility of renovation measures, while also helping stakeholders better understand the expected impacts of renovation, including reduced energy costs, energy savings, lower emissions and improved living conditions.

A central element of the support was the use of locally grounded examples and success stories. Rather than presenting renovation as an abstract technical process, the experts explained the benefits through concrete local experience and evidence from previous renovation projects. This helped make the results of renovation more visible and credible for residents and homeowners' associations. Examples from other CEESEN-BENDER partner countries, such as the renovation experience in Tartu, were also used to show that similar challenges had been addressed successfully elsewhere in Central and Eastern Europe.

Expert support was delivered through a combination of formats. These included home visits, field visits to multi-apartment buildings, project workshops, in-person and online training sessions, pre-announced on-site meetings, informal consultations by phone, and written communication through a dedicated article on renovation-related situations in Alba Iulia. During home and field visits, experts responded directly to residents' questions, discussed specific building and household conditions, and, where relevant, used tools such as thermal imaging and household-level energy advice to make problems and possible solutions more tangible.

The most effective forms of support were those based on direct, tailored interaction with residents and homeowners' association representatives. Bilateral discussions, home visits, on-site meetings and phone consultations proved particularly useful because they allowed the experts to address concrete concerns linked to specific buildings, apartments and socio-economic circumstances. These formats were especially relevant in cases where energy poverty, affordability, quality of life and access to financing were important concerns. The experience shows that practical, personalised advice is more effective than general information when trying to build understanding and trust around complex renovation processes.

The expert support also played an important role in improving communication between residents, homeowners' associations and the municipality. In Alba Iulia, the municipality has a key role in coordinating and applying for regional and national renovation grants. The experts therefore helped explain not only the technical and financial aspects of renovation, but also the role of local institutions in managing the process. This contributed to increasing trust in both the renovation solutions and the actors responsible for implementing them.

One important added value was the involvement of experts with strong local knowledge. Their understanding of the local building stock, previous renovation projects and the socio-economic situation of residents made the advice more relevant and credible. This was particularly important when discussing renovation of social or vulnerable housing contexts, where technical recommendations need to be connected with affordability, resident engagement and realistic financing options.

Several lessons can be drawn from the experience. First, expert support is most valuable when it is adapted to real local conditions and responds to the actual concerns of residents and homeowners' associations. Second, trust-building is a necessary part of the renovation process, especially in multi-apartment buildings where decisions depend on collective understanding and acceptance. Third, residents' expectations regarding financing need to be addressed carefully and transparently. In Alba Iulia, previous renovation projects were often fully subsidised for apartment owners and homeowners' associations. As a result, some residents expected future renovations to also be fully financed by third parties, especially the municipality. This created a challenge for experts when explaining financial sustainability, limited grant availability and the need for active involvement by apartment owners.

The main organisational challenge was arranging meetings with residents and homeowners' association representatives. Many consultations had to be scheduled outside regular working hours, including late evenings, in order to match residents' availability. In some cases, advisory activities were perceived as an additional burden because residents and local representatives were expected to actively engage in understanding the current situation and possible renovation measures. This underlines the importance of flexible timing, clear communication and support formats that respect the daily realities of the target groups.

Overall, the experience in Alba Iulia shows that expert advisory support can significantly strengthen renovation processes when it combines technical knowledge, local credibility, practical examples and direct engagement with residents. The most valuable contribution was not only the transfer of technical information, but also the ability to translate renovation benefits into concrete, locally understandable terms and to support trust between residents, homeowners' associations and municipal actors.

3. Summary of Household Energy Advising Visits in Tartu (Estonia)

Within Task 5.2 of the CEESEN-BENDER project, six household energy advising visits were carried out in Tartu City, Tartu County, Estonia. The visits covered apartments in multi-apartment buildings with different ownership situations, building conditions and renovation statuses. The audited dwellings included both rented and owner-occupied apartments, ranging from small apartments to larger dwellings, and included both unrenovated and renovated buildings connected to district heating. The visits assessed living comfort, indoor climate, energy use, building-related deficiencies and possible low-cost or behavioural improvements.

The Estonian visits show a clear distinction between apartments in unrenovated buildings and those in buildings where technical systems or full renovation had already been implemented. In unrenovated buildings, the main problems were not always high household electricity consumption, but rather comfort-related issues caused by weak building envelopes, thermal bridges, air leakage and outdated heating systems. In renovated or partly upgraded buildings, the advice focused more on optimising system use, ventilation behaviour, indoor temperature settings and summer comfort.

3.1 Overall housing and comfort conditions

Most visited apartments were assessed as having acceptable to good living comfort, especially during the winter period. Residents generally did not report severe underheating, and in some cases apartments were even described as rather warm. However, several comfort problems were repeatedly identified in unrenovated buildings. These included air leakage around windows, balcony doors or entrance doors, local cold bridges at wall–ceiling junctions, cold corners and, in one case, a cold kitchen floor area linked to air leakage or insufficient airtightness. Thermal images in the reports confirmed typical envelope-related issues such as colder external wall corners, leakage around balcony doors and window reveal areas.

Summer overheating appeared as a common concern, particularly in apartments located on top floors, in south-facing positions or in buildings with uninsulated concrete structures. One rented 65 m² top-floor apartment had three external walls and was expected to be vulnerable to summer overheating because of its location below an uninsulated flat roof and exposure to sun. Another apartment experienced reduced comfort during prolonged heatwaves because heat accumulated in the concrete structure, although greenery in front of the building provided partial shading.

Indoor air quality was generally acceptable or good in most cases. In several apartments, CO_2 monitoring showed sufficient ventilation or broadly acceptable air quality. However, some reports noted ventilation-related optimisation needs. In one larger owner-occupied apartment, CO_2 levels exceeded 1200 ppm during around 13% of the monitored period, with short peaks above 2000 ppm, indicating some ventilation limitations. In a renovated apartment with demand-controlled ventilation, the main challenge was not the lack of technical systems, but uncertainty about how the smart home and ventilation controls should be used.

Moisture and mould were not identified as widespread problems in the visited Estonian dwellings. However, several reports noted that local cold surfaces, colder corners and poor air circulation near external walls could increase the risk of moisture accumulation or mould locally if not managed properly. Residents were therefore advised to keep furniture away from colder external wall corners and maintain air circulation.

3.2 Findings on energy use

The Estonian visits show that household electricity consumption was generally low to moderate in most apartments. In several dwellings, electricity use was around 40–160 kWh per month and was mainly linked to lighting, cooking, household appliances, electronics and washing machine use. In smaller or carefully managed households, electricity consumption was below or close to regional averages.

One exception was an owner-occupied 77 m² apartment where electricity consumption was around 600 kWh per month, which was above the regional average for similar apartments. This was linked to active cooling, dryer use, multiple appliances, a high equipment level and especially a high-performance gaming computer that could draw significant power under certain operating conditions. The resident already used advanced energy management practices, including home automation, indoor climate monitoring and electricity price optimisation, so the advice focused mainly on further optimisation rather than basic awareness.

Space heating in the visited apartments was provided through district heating. Heating demand varied depending on building condition, apartment size, floor location and renovation status. In unrenovated buildings, annual district heating consumption was typically estimated in the range of approximately 6,300–11,000 kWh per year, while in a renovated 41 m² apartment the annual space heating consumption was much lower, around 2,450–3,150 kWh per year. This difference shows the impact of building renovation and improved technical systems on heating demand.

In some unrenovated buildings, the main problem was not insufficient heating but overheating or inefficient heat distribution. One apartment had a one-pipe radiator system without apartment-level control, causing the tenant to open windows to reduce overheating during winter. This indicates avoidable heat loss at building level and points to the need for heating system balancing, improved controls or longer-term system replacement.

Water consumption was generally low to moderate across the visited apartments. Several reports recommended replacing faucet aerators with low-flow anti-calc models, usually around 5–6 l/min, and maintaining them regularly. This was suggested as a simple, low-cost way to reduce water consumption without reducing usability.

3.3 Energy poverty-related findings

The Estonian reports do not describe severe energy poverty situations in the same direct way as the Romanian reports. The residents generally maintained acceptable comfort levels, and several households already had relatively efficient energy-use habits. However, the visits still identified affordability and vulnerability-relevant issues.

In unrenovated buildings, heating costs remained comparatively high because of poor thermal envelopes, cold bridges, older windows or outdated heating systems, even where residents used electricity and water efficiently. One report specifically notes that despite careful household energy use, heating costs were still relatively high due to the uninsulated building envelope, thermal bridges and older windows.

Another important issue is that tenants have limited ability to implement larger building-level improvements. Several recommendations were therefore limited to low-cost maintenance and behavioural actions, while the reports clearly state that major improvements would depend on apartment associations or building-level renovation, such as façade insulation, roof insulation, heating system renewal or transition from one-pipe to two-pipe systems.

This suggests that the Estonian visits are highly relevant for energy vulnerability, even where households were not explicitly classified as energy poor. The main risk is that residents may experience comfort problems or unnecessary heating costs due to building-level deficiencies that cannot be solved by individual households alone.

3.4 Main issues identified

Across the six Estonian visits, the most common issues were:

- air leakage around balcony doors, entrance doors and windows;
- local cold bridges in unrenovated buildings, especially at external wall corners and wall–ceiling junctions;
- summer overheating risk, especially in top-floor, south-facing or concrete-structure apartments;
- outdated heating systems in some unrenovated buildings, especially one-pipe systems without apartment-level control;
- overheating during the heating season due to limited heat regulation;

- need for better window and door adjustment, sealing and gasket maintenance;
- need for improved water-saving fittings;
- in renovated buildings, need for better understanding and optimisation of smart heating and ventilation systems.

The thermal images included in the Estonian reports are useful evidence for these findings. They show, for example, colder external wall corners indicating thermal bridges, air leakage at balcony doors, leakage in window corner areas and examples of improved conditions in renovated buildings where windows and walls showed more even surface temperatures.

3.5 Advice and recommended measures

The advice provided during the Estonian visits was mostly practical, low-cost and tailored to whether the apartment was rented, owner-occupied, renovated or unrenovated.

For unrenovated buildings and rented apartments, advice focused on measures that residents or landlords could realistically implement without major investment. These included adjusting and tightening balcony doors and windows, sealing cracks around window frames, replacing or maintaining gaskets, improving airtightness in leakage points, and avoiding furniture placement directly against cold external wall corners. In one apartment with a cold kitchen floor, the resident was advised to investigate the corner by removing the skirting board and improving airtightness where possible.

Several recommendations addressed summer overheating. Residents were advised to use night-time or cooler-period ventilation, avoid opening windows when outdoor air was warmer than indoor air, use shading measures such as external blinds, temporary light-coloured balcony shading or solar control film, and consider fans or ceiling fans to improve perceived comfort during heatwaves.

For apartments with ventilation or indoor air quality concerns, the advice focused on short and intensive airing, CO_2 monitoring, avoiding unnecessary window opening during the heating season, and improving the use of existing mechanical ventilation systems. In the renovated apartment, the resident was advised to verify radiator thermostat settings, batteries and communication with the smart control system, and to avoid keeping windows open for long periods because the mechanical ventilation system already provides fresh, filtered and preheated air.

Energy-use advice was more targeted than general. In households with already low electricity use, the recommendations did not focus on basic consumption reduction, but on optimisation. In the apartment with high electricity use, advice included reducing indoor temperature below 23 °C during the heating season, improving ventilation when CO_2 levels are elevated, using night-time cross-ventilation and considering external shading or solar protection film to reduce cooling demand.

Water-saving recommendations were repeated in several visits. Residents were advised to replace faucet aerators with anti-calc low-flow models and maintain them regularly.

In one apartment, high water pressure was also identified as an issue to be addressed through flow restriction.

3.6 Relevance for broader renovation support

The Estonian household visits clearly show that many comfort and energy issues are connected to building-level conditions. In unrenovated buildings, residents can reduce discomfort through sealing, better ventilation practices, shading and small maintenance measures, but they cannot fully eliminate cold bridges, heat losses, poor heating control or summer overheating. Several reports explicitly state that significant improvement would require façade insulation, roof insulation, wider building renovation, heating system balancing or heating system replacement.

The visits also demonstrate the value of comparing renovated and unrenovated buildings. The renovated apartment had low heating consumption, room-level heating control and demand-controlled ventilation, showing the benefits of comprehensive renovation. However, it also showed that renovated buildings require user understanding: residents need clear guidance on smart controls, ventilation systems and optimal indoor climate management.

For T5.2, the Estonian findings therefore support two messages. First, household advising can help residents address immediate comfort and consumption issues through low-cost actions. Second, many recurring problems require coordinated action by apartment associations, building managers and other building-level stakeholders. This is particularly relevant for decisions on façade insulation, roof insulation, heating system modernisation, heating curve optimisation, ventilation improvement and summer heat protection.

3.7 Short conclusion

The six home energy advising visits in Tartu 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.

4. Summary of expert services to building managers, homeowner associations and other stakeholders in Tartu (Estonia)

In the Estonian pilot area, expert advisory support was provided through a combination of strong technical renovation expertise and complementary knowledge on apartment association governance, housing policy and energy poverty. The core expert support was led by TREA, with Martin Kikas as the internal expert and the wider TREA expert team contributing technical consultancy, civil engineering knowledge, building design expertise, energy modelling, energy simulations, energy audits and energy performance assessments. The external expert from the Estonian Union of Co-operative Housing Associations (EKYL) complemented this with knowledge related to homeowners' associations, apartment association governance, legal issues, housing policy and communication with the wider apartment association sector.

The main target groups were homeowners' associations, apartment association boards and apartment owners. These actors are central to renovation processes in Estonia, as they are responsible for initiating, discussing and approving renovation decisions in multi-apartment buildings. Building managers were involved where such structures existed, but their role in Estonia is usually more focused on day-to-day building management and maintenance than on leading renovation processes. Therefore, most support was provided directly to apartment associations and their boards, often in cooperation with technical consultants, designers, energy auditors, financing institutions and other specialists involved in renovation preparation.

Expert support was delivered throughout different stages of the renovation process. It included initial consultations with apartment association boards, site visits, assessment of building conditions, identification of renovation needs and priorities, discussion of suitable technical solutions and support in planning next steps. The experts also helped associations understand renovation grant requirements, application timelines, documentation needs, eligibility criteria and the sequencing of technical preparation activities in relation to funding deadlines. In more advanced cases, support also included cooperation with designers and contractors, technical reviews, indoor climate assessments, energy performance calculations and preparation for renovation grant applications.

A significant part of the expert support took place through direct participation in apartment association meetings, board meetings and general assemblies of apartment owners. These meetings were important because they allowed experts to explain renovation concepts directly to residents, present technical solutions, clarify financing options and answer questions about costs, loan obligations, expected energy savings, technical risks and construction processes. This direct communication helped improve residents' understanding of renovation and supported apartment associations in making more informed decisions.

The experts also cooperated with building managers and property management companies in cases where these actors were involved in specific buildings. This cooperation focused on renovation planning, technical options, financing possibilities and coordination between apartment associations, designers, technical specialists and other stakeholders. In one pilot building that progressed to the preparation and submission of a renovation grant application, cooperation took place with a highly experienced building manager who also had previous experience as a certified technical renovation consultant. In this case, the cooperation focused on identifying suitable technical solutions, analysing the condition and needs of the building, supporting indoor climate measurements and contributing to resident consultations.

The main concerns raised by apartment owners and residents were related to renovation costs, affordability, long-term loan obligations, uncertainty about actual energy savings, construction-related disturbances and the overall complexity of renovation projects. Many residents also lacked technical knowledge about renovation processes and needed repeated explanations before they were ready to support renovation-related decisions. The experts addressed these concerns through direct communication, practical explanations and building-specific advice. Technical consultants translated complex renovation topics into more understandable language, explaining technical solutions, expected energy efficiency improvements, indoor climate benefits, financing possibilities, grant conditions and organisational procedures.

Expert support was provided in several formats. Individual consultations, site visits and direct meetings with apartment association boards and apartment owners proved to be the most effective. Renovation projects are highly building-specific and usually involve complex technical, financial and organisational questions. As a result, apartment associations needed advice that was directly linked to their own building condition, financial situation, renovation goals and decision-making process. Repeated building-specific consultations were more effective than one-time general information sessions because they allowed trust, understanding and consensus to develop gradually.

Workshops, Q&A sessions, online meetings and stakeholder events were also organised and were useful for broader awareness-raising, knowledge exchange and discussion of common renovation barriers. These formats covered topics such as renovation opportunities and support schemes, technical and organisational aspects of apartment building renovation, communication and awareness-raising, energy poverty, indoor climate issues, cooperation with housing sector stakeholders and practical experience from renovation projects. However, practical progress towards renovation decisions was usually achieved through more targeted consultations and repeated discussions with apartment associations.

The added value of the expert group came from combining TREA's strong in-house technical competence with external expertise on apartment associations and housing governance. TREA already had extensive experience in renovation consultancy, energy efficiency, renovation planning and support for apartment associations, which enabled the team to respond to most direct technical support needs. The external expert added broader insight into the organisational, legal and communication aspects of renovation and helped strengthen links with the national apartment association network. In practice, most support needs in the pilot buildings were technical, but the wider expertise remained important for understanding the governance and communication context in which renovation decisions are made.

Several challenges were identified. The main difficulties were not linked to organising expert activities as such, but to the inherent complexity of renovation in multi-apartment buildings. Financial capacity and affordability were key barriers, especially in smaller buildings where comprehensive renovation costs can be high in relation to residents' financial possibilities. The complexity and timing of renovation support schemes also created challenges, as apartment associations often had to coordinate technical preparation, financing decisions, project documentation and residents' approvals within limited grant application periods.

Technical and organisational challenges included differing expectations among apartment owners, difficulties in reaching decisions within apartment associations, limited technical knowledge among residents, uncertainty about future construction costs, availability of qualified designers and contractors, delays in technical documentation or design updates, and specific constraints related to heritage or protected buildings. Communication was also a recurring challenge, as renovation processes require repeated explanations of technical solutions, financing conditions, long-term benefits and possible risks.

The Estonian experience shows that expert advisory support is most effective when it is long-term, technically grounded and adapted to the decision-making realities of apartment associations. General awareness-raising can support understanding, but concrete progress depends on direct building-level consultations, participation in apartment owner meetings and repeated communication. The most important lesson is that apartment associations need not only technical expertise, but also support in navigating financing schemes, documentation requirements, internal decision-making and communication with residents. Effective support therefore requires a combination of technical clarity, financial realism and patient, building-specific guidance.

5. Summary of Household Energy Advising Visits in Warsaw (Poland)

Within Task 5.2 of the CEESEN-BENDER project, six household energy advising visits were carried out in Warsaw, in the Mazovian region of Poland. The visits took place between August and December 2025 and focused on assessing apartment conditions, living comfort, electricity consumption and possible energy-saving measures. The visited apartments showed different levels of comfort and technical condition, ranging from very comfortable and well-maintained apartments to one apartment with severe structural and indoor environmental problems.

Overall, the Polish household visits indicate that electricity consumption was generally not excessive in most of the analysed apartments. The main recurring issue was not high electricity use, but rather thermal comfort, especially overheating during the summer. In several cases, apartments were reported to be comfortable or very comfortable during winter, while summer comfort was rated as unpleasant or extremely unpleasant due to excessive indoor heat. One case also showed severe winter discomfort linked to structural problems, dampness, mould and poor indoor conditions.

5.1 Overall housing and comfort conditions

The condition of the visited apartments varied significantly. Several apartments were assessed as being in good, very good or excellent condition, without reported structural problems such as dampness, rot, draughts, leaking roofs or mould. In these cases, winter comfort was generally rated as pleasant or extremely pleasant, and residents did not report major problems with cold indoor conditions.

However, summer overheating appeared as the most frequent comfort-related issue. In several apartments, residents reported that the dwelling becomes too hot during the summer months. In one apartment, the summer comfort was rated as extremely unpleasant, with windows kept open almost continuously during hot periods. In another apartment with new airtight plastic windows and doors, winter comfort was rated as extremely pleasant, but summer comfort was described as extremely uncomfortable because opening windows did not sufficiently reduce overheating.

A second recurring issue was overheating during winter in at least one apartment. In this case, the apartment was generally in very good condition, but the heating pipes became very hot during the winter. As a result, the resident almost never used the radiators and frequently opened windows to cool the space. This indicates a heating system regulation or distribution issue rather than a lack of heating capacity.

One visit identified much more severe problems. The apartment was assessed as very uncomfortable, with overheating, mould, a leaking roof, damp walls and floors, rot in the floors and window frames, very high humidity and poor air circulation. Winter comfort was rated as extremely unpleasant because the walls and floors remained cold despite active heating. This case differs strongly from the other Polish visits and indicates a serious need for structural intervention and comprehensive renovation.

5.2 Findings on energy use

The Polish reports generally indicate no signs of excessive electricity consumption in most households. Electricity consumption values varied between the visits, but were usually described as comparable to the national average or efficient. Recorded monthly electricity consumption included values such as 40.6 kWh, 112 kWh, 113.5 kWh, 156.62 kWh and 315 kWh per month. Reported monthly electricity costs ranged from approximately 30 EUR to 45 EUR.

In several households, the reports specifically note efficient and economical use of equipment. One apartment with excellent comfort conditions used high-performance and energy-saving equipment and had low energy consumption. Another household demonstrated energy-efficient use of equipment, with overall energy consumption comparable to the national average.

One report described high use of electric energy, with electricity consumption of 112 kWh/month and a monthly cost of 44.71 EUR. However, this case also involved severe structural and comfort problems, including mould, dampness and cold surfaces. This suggests that the main problem was not only electricity consumption, but the poor condition of the apartment and the inability to achieve healthy and comfortable indoor conditions.

Overall, the Polish findings suggest that household electricity use was generally not the dominant issue. Instead, energy-related problems were more closely linked to thermal comfort, overheating, poor ventilation, heating system regulation and, in one severe case, building defects and moisture-related degradation.

5.3 Energy poverty-related findings

The Polish reports do not consistently identify households as energy poor. Several apartments were in good or excellent condition and showed efficient energy use. However, some findings are relevant from an energy vulnerability perspective.

The strongest energy poverty-related case was the apartment with severe structural problems, mould, dampness, cold walls and floors, and extremely unpleasant winter comfort. Even though heating was active, the apartment did not provide adequate comfort. This indicates a situation where energy use does not translate into healthy or comfortable living conditions, which is a key concern for energy poverty.

Other cases suggest vulnerability related to overheating and lack of control over indoor conditions. In several apartments, summer temperatures became extremely unpleasant, and residents relied on continuous window opening to cope. In another apartment, winter overheating caused by very hot heating pipes forced the resident to open windows frequently, leading to avoidable heat losses. These examples show that energy vulnerability can also arise from poor system control and inability to maintain comfortable indoor temperatures across seasons.

5.4 Main issues identified

Across the Polish visits, the most common issue was summer overheating. This was reported in several apartments, including otherwise well-maintained dwellings with good winter comfort. The problem appears to be linked to excessive heat gains, insufficient passive cooling possibilities and, in some cases, limited effectiveness of window opening as a cooling strategy.

A second issue was heating system optimisation. One apartment became too hot in winter because heating pipes were overheated, while another report recommended checking the heating system for leaks. These findings suggest the need for technical review of heating system operation, insulation and regulation.

Ventilation and air quality monitoring were also recurring topics. Several reports recommended continued airing, air quality monitoring, ventilation system inspection or measures to prevent mould and bacteria. This was especially relevant in apartments affected by overheating, dampness or poor air circulation.

The most severe building-related issues were concentrated in one apartment, where the visit identified leaking roof, damp walls and floors, mould, rot in floors and window frames, high humidity and poor air circulation. This case requires larger structural measures and cannot be solved through behavioural changes alone.

5.5 Advice and recommended measures

The advice provided during the Polish visits was mostly focused on practical, low-cost actions and improved energy awareness. In apartments with good or very good living conditions, no major investments were recommended. Instead, residents were advised to continue energy-saving practices, monitor energy consumption and use appliances efficiently.

Several recommendations focused on the timing and efficient use of household appliances. Residents were advised to run washing machines and dishwashers only when fully loaded, maximise the use of natural light, monitor energy consumption over a 24-hour cycle, and use available applications to monitor the real-time energy mix. This would allow households to operate high-power devices during periods when renewable energy sources represent a higher share of the electricity grid.

Equipment-related advice was also provided. Some households were advised to replace outdated equipment with modern energy-efficient models and to consider monitoring systems. In one case, the replacement of old utility equipment was recommended as part of a wider package of measures to improve living conditions.

Advice related to indoor climate focused on airing, air quality monitoring and ventilation. Residents were advised to continue airing apartments, monitor air quality to prevent possible mould growth, and inspect ventilation systems where needed. In apartments affected by overheating, the advice included monitoring apartment conditions and contacting the building administration to obtain information about ventilation and possible energy-efficiency upgrades.

For technical systems, the recommendations included checking the heating system for leaks, inspecting the tightness and insulation of heating systems, and considering thermostats or improved regulation. These measures are particularly relevant where apartments were overheated during winter or where heating performance and comfort were not balanced.

In the most severe case, larger investments were strongly recommended. These included a complete thermal retrofit, replacement of damaged floors, removal of mould and mildew, replacement of old utility equipment, inspection of the heating system for leaks and inspection of the ventilation system. This case clearly requires building-level intervention rather than only household-level advice.

5.6 Relevance for broader renovation support

The Polish household visits show that household energy advising can be useful even where energy consumption is not excessive. In several apartments, the main problems were related to comfort, overheating, ventilation and system regulation rather than inefficient household behaviour. This means that advisory support should not focus only on reducing consumption, but also on improving the ability of residents to maintain healthy and comfortable indoor conditions.

The most frequent issue, summer overheating, is relevant for future renovation planning. Measures such as improved shading, ventilation strategies, passive cooling, better control of indoor temperatures and building-level energy-efficiency upgrades should be considered where apartments become excessively warm. This is especially important as overheating can affect vulnerable households even when winter heating comfort is adequate.

The Polish reports also show the importance of building administration and building-level decision-making. In one case, residents were specifically advised to contact the building administration about ventilation and possible energy-efficiency upgrades. In another case, the severity of dampness, mould and structural damage clearly points to the need for comprehensive renovation and coordinated action beyond the individual household.

For Task 5.2, the Polish findings therefore confirm that home visits can identify both minor behavioural savings and deeper building-level needs. While many households only required small recommendations, at least one case demonstrated the need for substantial renovation, and several cases highlighted the need for better building-level solutions for overheating, ventilation and heating system control.

5.7 Short conclusion

The household energy advising visits in Warsaw 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.

6. Summary of expert services to building managers, homeowner associations and other stakeholders in Poland

In Poland, expert advisory support combined technical, financial and practical implementation expertise to assist local stakeholders in planning and initiating energy renovation activities. The support was mainly directed towards building managers, homeowners' associations and landlords, who were the primary actors involved in the preparation and coordination of renovation measures in multi-apartment buildings.

The expert support addressed both the technical feasibility and the financial viability of renovation. On the technical side, the experts helped assess the condition and energy performance of selected buildings, identify suitable energy efficiency measures and develop possible renovation scenarios. This included the preparation of energy reports and technical assessments for selected buildings, with recommendations for modernisation. These outputs supported building managers and housing administrations in understanding the current situation of their buildings and in making more informed decisions about possible renovation pathways.

On the financial side, the experts provided guidance on available EU and national funding opportunities and helped stakeholders better understand application procedures and possible routes for securing financial support. This was particularly important because access to financing remained one of the main barriers to renovation. The combination of technical and financial advice enabled a more complete approach, linking suitable renovation measures with realistic funding possibilities.

One specific result of the expert support was the establishment of cooperation between the pilot housing estate administration and a contractor in the field of renewable energy, especially photovoltaics, linked to the BGK RES grant. The experts acted as initiators of this cooperation, helping to connect local renovation needs with available renewable energy solutions and financing opportunities. Advisory support also covered building renovation solutions such as heat pumps, renewable energy systems and BMS/SCADA systems.

Support was provided mainly on request, through advisory consultations with building managers and other stakeholders. The experts contributed through written outputs, technical assessments, energy reports, preparation of guidance materials and support for training-related activities. Their input also indirectly supported home visits and communication with residents by providing practical recommendations that project teams could use in their engagement activities. Although the experts were not directly involved in meetings with apartment owners, residents or homeowners' associations, their advice helped building managers and project teams explain technical measures, financing options and expected renovation processes more clearly.

Homeowners' associations, apartment owners and residents were also reached through information and advisory activities organised within the project. These included informational webinars on energy efficiency measures and renovation opportunities, as well as home visits carried out by project teams. During these visits, residents received practical advice on good practices and simple energy-saving measures that can be implemented at household level. In selected cases, air quality measurements were also carried out, followed by reports presenting the results. This helped raise awareness of indoor environmental conditions and linked renovation discussions with residents' everyday living environment.

The main concerns expressed by residents related to the costs of renovation, access to financing and uncertainty about the overall process. Residents were also concerned about the implementation phase itself, including possible noise, disruption to daily life, the presence of external contractors and the general stress associated with renovation works. To address these issues, the expert contribution focused on providing clear, accessible information that could be used by project teams and building managers in communication with residents. This included explaining available funding options, clarifying the renovation process and helping residents better understand what to expect during implementation.

The experience showed that direct, in-person formats such as meetings and home visits were more effective than online formats. Personal contact allowed for more open communication, helped build trust and made it easier to respond to individual questions and concerns. Webinars were useful for sharing general information, but they offered more limited interaction and were less effective in engaging participants. Some residents also faced barriers to participating in online meetings, which reduced the reach and impact of digital formats.

The added value of involving an external expert was particularly visible in the financial dimension of the work. While the MAE expert primarily contributed technical knowledge on building condition, energy efficiency measures and renovation scenarios, the external expert complemented this with expertise on EU and national funding mechanisms. This made it possible to provide stakeholders with broader support, covering not only what should be renovated and how, but also how renovation could potentially be financed.

Several lessons can be drawn from this experience. First, renovation support needs to combine technical recommendations with financial guidance, as technical solutions alone are unlikely to move forward without a realistic funding pathway. Second, written assessments and energy reports are useful tools for supporting decision-making, especially for building managers and housing administrations. Third, resident engagement requires accessible communication and preferably direct contact, as online formats alone are not sufficient to build trust or address concerns. Finally, the limited time and capacity of building managers and housing administrations must be taken into account, as their daily administrative, technical and management responsibilities can restrict their ability to actively participate in advisory processes or follow up on recommended actions.

Overall, the MAE experience shows that expert advisory support can add significant value when it connects building-level technical analysis with funding opportunities and practical implementation guidance. The most important contribution was the creation of a more holistic support structure, helping local stakeholders understand both the renovation measures themselves and the financial and organisational conditions needed to move them forward.

7. Summary of Household Energy Advising Visits in Čakovec (Croatia)

Within Task 5.2 of the CEESEN-BENDER project, household energy advising visits were carried out in Čakovec, Međimurje County, Croatia, during February 2026. The uploaded material includes seven apartment reports from multi-apartment buildings located at Istarska 14, Istarska 16, Janka Slogara 4, Travnik 11, Travnik 12 and Travnik 17. The visited apartments ranged from 42 m² to 74 m² and were located in buildings with different numbers of housing units, from smaller buildings with 8–12 apartments to larger multi-apartment buildings with 28–34 units.

The Croatian visits focused on assessing apartment condition, living comfort, energy use, heating systems, water consumption and possible measures to improve comfort and reduce energy costs. The reports show a broad range of living conditions: some apartments were in relatively good internal condition, while others showed serious signs of dampness, mould, poor insulation, draughts and structural deterioration. Across the cases, the condition of the wider building envelope was often worse than the condition of individual apartments, which is important for understanding the need for building-level renovation.

7.1 Overall housing and comfort conditions

The Croatian visits identified significant differences between apartments. Some dwellings were described as generally well maintained and pleasant to live in, while others were in poor condition and showed clear signs of inadequate maintenance, weak thermal protection and moisture problems.

The most severe problems were found in some apartments in Istarska 14 and Istarska 16. One apartment in Istarska 14 was described as being in poor condition, with damp walls and floors, wet foundations, rot in door frames and floors, bad odours, strong draught through doors and active mould on walls and ceilings. Although the tenant rated comfort as "neither pleasant nor unpleasant", the report notes that the apartment remained cold despite heating, rooms did not warm sufficiently, and the apartment was wet and mouldy. This suggests that the neutral comfort rating may reflect adaptation to poor conditions rather than genuinely acceptable living comfort.

Another apartment in Istarska 16 also showed serious indoor environmental problems, including damp and mouldy walls, mouldy ceilings, wet foundations, visible mould in window frames, draught through the entrance door and water leakage from poorly executed installations. The report describes these conditions as unhealthy and categorises the household as energy poor due to the low level of comfort, health risks and high energy loss.

In other cases, the internal apartment condition was better, but building-level problems were still present. At Janka Slogara 4, the apartment itself was in good condition, without visible dampness, mould or rot, but the outside of the building was in much worse condition, with no envelope insulation, rotten and mouldy balconies, partly wet walls and water entering the basement through foundation damage. Similarly, Travnik 11 and Travnik 17 apartments were described as generally well maintained, but the buildings showed issues such as damaged façades, leaking roofs, dirty or wet façade areas, mould or lichen on external surfaces and draught through entrance or balcony doors.

Summer overheating was also a recurring issue, especially in south-facing apartments. Several tenants reported unpleasant summer comfort due to direct sunlight and high indoor temperatures. In some cases, overheating could not be adequately mitigated because the apartment lacked air conditioning, while in others older air-conditioning units were present but inefficient.

7.2 Findings on energy use

The Croatian apartments used different combinations of electricity, natural gas, air conditioning units, radiators and electric water heaters. Several households relied heavily on electricity for lighting, appliances, cooking, heating, cooling and domestic hot water, while others used natural gas central heating with radiators and electricity for appliances, cooling or water heating.

Electricity costs and consumption varied considerably. One apartment in Istarska 14 spent approximately **100 EUR/month** on electricity, with estimated electricity consumption of **12,000 kWh/year**, because electricity was used for almost all household needs, including heating, cooling and domestic hot water. Given the poor condition of the apartment and the lack of insulation, this created high costs while still failing to provide adequate thermal comfort. The report explicitly describes this as a classic case of an energy poor household.

Other households reported lower electricity use, for example around **102.5 kWh/month**, **116 kWh/month**, **166 kWh/month**, **177 kWh/month** or **216 kWh/month**, depending on household size, appliance use and heating arrangements. In some cases, relatively low electricity use may indicate careful or restrained consumption, possibly linked to cost concerns.

Natural gas was used as the main heating source in several apartments, usually through central heating and radiators. However, the effectiveness of this heating was often reduced by draughts, poor insulation, damp walls or façade defects. At Travnik 12, for example, natural gas consumption was reported at **4,500 kWh/year**, but the tenant still experienced cold rooms despite heating, suggesting that a significant share of energy was being lost due to poor insulation, draught and building envelope problems.

Some reported gas consumption values should be interpreted cautiously. At Travnik 11, natural gas consumption was reported as **150 m³/year** with an annual cost of **80 EUR**, which the report itself notes may be incomplete or estimated. At Travnik 17, natural gas consumption was reported as **6,000 m³/year** for a 67 m² apartment, which appears very high and may require verification before being used quantitatively in the synthesis report.

Water consumption also varied. Some households reported moderate or average water use, such as **36 m³/year**, while others reported higher consumption, such as **72 m³/year**, **84 m³/year** or **96 m³/year**. In some single-person households, water consumption was assessed as higher than average. In several apartments, domestic hot water was prepared with electric water heaters, some of which were identified as potentially inefficient or in need of inspection or replacement.

7.3 Energy poverty-related findings

Energy poverty indicators were clearly present in several Croatian cases. The most severe cases were linked to a combination of poor building condition, high energy costs, weak thermal comfort and limited effectiveness of heating systems.

In the Istarska 14 case, the combination of electricity-based heating, domestic hot water preparation by electric boiler, lack of insulation, permeable windows and poor envelope condition resulted in high electricity bills and low thermal comfort. The report explicitly identifies this as a classic energy poor household.

In the second Istarska 14 apartment, the report notes that the apartment was somewhat colder than average because electricity was the only heating source and no stronger heating option was available. This was described as an indication that the household was dealing with some aspects of energy poverty.

The Istarska 16 report also explicitly links the apartment's bad condition, mould, wet walls, high energy loss and unpleasant living conditions with energy poverty. In this case, the problem was not only affordability, but also health risk and poor indoor environmental quality.

In other apartments, energy poverty was less directly stated, but there were still vulnerability-related concerns. For example, tenants experienced draughts, cold rooms despite heating, inefficient air-conditioning units, high or questionable gas use, and building-level problems that individual households could not solve alone. These situations show how energy vulnerability can exist even where the apartment appears internally well maintained.

7.4 Main issues identified

Across the Croatian visits, the most common issues were:

- lack of building envelope insulation;
- damaged or poorly maintained façades;
- dampness, wet foundations and moisture penetration;
- mould on walls, ceilings or building elements in the more severe cases;
- draught through entrance doors, balcony doors or poorly adjusted windows;
- overheating in south-facing apartments during summer;
- inefficient or old air-conditioning units;
- old or inefficient household appliances in some apartments;
- electric heating and electric water heating causing high costs in some households;
- damaged roofs, balconies, foundations or water installations requiring building-level intervention.

A key pattern is that internal apartment conditions were sometimes better than the condition of the overall building. This means that residents may maintain their own dwellings reasonably well, but still suffer from energy losses, dampness, overheating or comfort problems caused by the common building envelope, roof, façade, foundations, balconies or shared infrastructure.

7.5 Advice and recommended measures

The advice provided in Croatia combined immediate low-cost measures with recommendations for larger building-level interventions.

Low-cost and practical recommendations were repeated across several visits. These included installing seals on entrance doors or balcony doors, adjusting windows to the appropriate winter or summer mode, applying silicone around gaps, installing carpets or insulating underlays, using thermal foil behind radiators, cleaning air-conditioning units, ventilating rooms regularly for 5–10 minutes, and using dehumidifiers where dampness or mould risk was present.

Several recommendations addressed summer overheating. These included applying window tint film to reduce direct sunlight, using thermal window films to retain heat in winter, increasing cooling temperatures, and considering replacement of old air-conditioning units with more efficient models. In some cases, air-conditioning units were more than 11 or 16 years old and were considered inefficient, with reduced heating or cooling performance.

Appliance-related advice was also provided. Some households were advised to replace old, inefficient appliances, especially washing machines, cooking stoves, air-conditioning units or electric water heaters. Energy classes A or B and higher were recommended depending on the appliance and report. In one case, the installation of energy-saving light bulbs was recommended to reduce electricity costs.

For buildings and apartments with moisture or structural problems, the recommendations went beyond household behaviour. Larger interventions included overall energy renovation of buildings, façade insulation, insulation of walls, floors and ceilings, repair of roofs, repair and waterproofing of foundations, repair of water installations, replacement of carpentry, and improvement of heating systems, including possible switching to natural gas or heat pumps where appropriate.

A repeated organisational recommendation was for households to continue consultations with energy experts, attend energy-saving workshops and consult building managers about possible overall energy renovation. This link between household-level advice and building-level decision-making is important for the wider T5.2 logic.

7.6 Relevance for broader renovation support

The Croatian visits provide strong evidence that household energy advice must be connected with building-level renovation support. Many of the most serious problems identified during the visits cannot be solved by tenants alone. Dampness, wet foundations, façade damage, roof leakage, mould on structural elements, poor envelope insulation, rotten balconies, water penetration and inefficient heating performance require collective decisions and intervention by building managers, apartment owners, homeowner associations or other responsible stakeholders.

The reports repeatedly recommend consultations with building managers about overall energy renovation, showing that individual household visits can help identify needs, but the next step must be organised support for the building as a whole. This is especially important in buildings where the apartment interior is still acceptable, but external walls, roofs, foundations or façades are deteriorating.

The Croatian findings also show that energy poverty is not only a question of energy consumption levels. In several cases, households had low or moderate consumption but still experienced poor comfort, cold rooms, overheating or dampness. This suggests that some households may be limiting energy use because of costs, while others are paying significant energy bills without achieving adequate comfort. Both cases are relevant for renovation support under T5.2.

7.7 Short conclusion

The Croatian household visits in Čakovec 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.

8. Summary of expert services to building managers, homeowner associations and other stakeholders in Čakovec (Croatia)

In the Croatian pilot site in Međimurje County, with a focus on the town of Čakovec, expert advisory support was organised through a strong cooperation between the regional energy agency, building managers and experts specialised in energy poverty. The expert group included representatives of Međimurje Energy Agency Ltd. (MENEA), the regional building managers GP Stanorad Ltd. and Euroland Ltd., and additional support from the Society for Sustainable Development Design (DOOR). This combination brought together project management, technical knowledge, practical building management experience and direct expertise in working with vulnerable and energy-poor households.

The support was mainly directed towards landlords, homeowners and tenants living in renovated and unrenovated multi-apartment buildings, as well as vulnerable households in selected pilot buildings. The involvement of building managers was particularly important, as they already had established relationships with residents and access to relevant building-level information. This helped the expert group communicate more effectively with target groups, organise consultations and obtain data needed for project activities and building-level planning.

A key characteristic of the Croatian approach was that building managers were not only beneficiaries of expert support, but also active members of the expert group. Since they were already responsible for the management and renovation of multi-apartment buildings, they did not require direct advisory support in the traditional sense. Instead, their role was strengthened through capacity-building activities, especially the Train the

Trainer workshop in Tartu. This training helped improve their ability to communicate with vulnerable households, explain renovation benefits, address doubts and support residents in understanding renovation as a possible solution to poor housing conditions.

The capacity-building process covered social aspects of energy poverty, stakeholder engagement, communication with vulnerable households, conflict resolution, active listening, practical energy-saving measures and funding opportunities. The training helped building managers and energy experts move beyond purely technical explanations and address emotional, social and financial barriers to renovation. In particular, the "home versus house" perspective helped underline that renovation is not only about reducing energy consumption, but also about improving comfort, health, safety and quality of life.

Expert support to residents and homeowners was delivered through workshops, Q&A sessions, individual and group consultations, on-site and phone advice, expert visits to vulnerable households and visits to demonstration buildings. The main topics covered included upcoming energy renovation calls for multi-apartment buildings, preparation of documentation, identification of quality project designers and contractors, cost management during renovation, application support, air quality monitoring results and presentation of good renovation practices.

The expert visits to vulnerable households were an important part of the support. During these visits, experts assessed actual living conditions, including problems such as moisture, mould, draughts, inadequate heating or cooling and inefficient appliances. They provided tailored, face-to-face advice on low-cost behavioural and technical measures that could improve comfort and reduce energy bills. Energy-saving packages were also distributed, including energy-efficient light bulbs, draft seals for doors and windows, written guidelines and household-specific recommendations for energy saving. These simple measures were useful because they provided immediate, visible and practical support, especially for households where larger renovation investments were not yet realistic.

The experts also helped residents and homeowners better understand the wider benefits of energy renovation. Instead of focusing only on financial savings, they explained social, health and comfort benefits, such as improved indoor air quality, reduced mould, more stable room temperatures, fewer draughts and lower risk of dampness-related health problems. Environmental benefits, including reduced CO_2 emissions, were also presented where relevant. Local and regional examples of successfully renovated multi-apartment buildings, including demonstration buildings from the project, were used to reduce fear of the unknown and make renovation outcomes more credible.

One of the strongest elements of the Croatian experience was the use of trusted intermediaries. Because many residents already knew the building managers from everyday interactions, their involvement helped open doors and build trust. This made it easier for residents to accept home visits, share sensitive information about financial difficulties or health problems linked to poor housing conditions, and express doubts without feeling judged or pressured. The building managers were also able to translate technical messages into language that residents understood and trusted.

Individual consultations proved to be the most effective support format. They allowed experts to focus fully on specific cases and provide tailored advice to one or two persons at a time. On-site consultations were more effective than phone consultations because direct interaction created a more relaxed atmosphere and encouraged participants to speak more openly about their concerns, opinions and problems. Workshops and Q&A sessions were useful for addressing common questions, but individual and on-site formats were better suited for building trust and dealing with sensitive household-level issues.

The main added value of the expert group came from combining different types of expertise. MENEA contributed knowledge on energy efficiency measures, renewable energy, funding opportunities and project management. Building managers contributed practical, daily experience with the actual condition of multi-apartment buildings, ownership structures, technical systems, energy consumption patterns and previous renovation attempts. DOOR added specific expertise on energy poverty and socially sensitive engagement with vulnerable households. Together, this made the support more realistic, practical and socially grounded.

The experience also showed that renovation advice must respond to deep-rooted concerns and not only provide technical information. Many residents perceived energy renovation as a long, exhausting process with high administrative and financial burden. Some concerns could be addressed immediately, while others were more difficult because they were linked to previous negative experiences, mistrust or strong existing opinions. In some buildings, poorly managed renovation processes in the past, including unreliable contractors, unexpected costs, long delays or broken promises, had made residents highly sceptical of new initiatives.

Financial insecurity was another important barrier. Many vulnerable households expressed fear of debt and loss of control over their expenses. Even when funding opportunities were explained, some residents remained afraid that renovation, even on a small scale, could lead to costs they could not manage. In response, experts provided tailored information on EU and national funding instruments, bank and green loans, the possibility of phased renovation and, where relevant, options for connecting households with social welfare support.

The main challenges were organisational and communication-related. Many residents were at work during the day or located in different parts of the town, so the expert group had to adapt activities to their schedules. It was also difficult to motivate people to participate in support activities, respond to invitations or accept home visits. Some residents were open to cooperation, others needed time to process the idea, and some were resistant from the beginning. Communication channels also created difficulties, as not all target groups used email and some relied only on phone communication, while collecting private contact information was limited by GDPR requirements.

Several lessons can be drawn from the Croatian experience. First, trusted local intermediaries are essential when working with residents and vulnerable households, especially in multi-apartment buildings where trust and collective decision-making are crucial. Second, expert support is most effective when it combines technical, financial and social knowledge. Third, vulnerable households often need repeated, patient and non-judgemental communication before they are willing to engage. Fourth, small and immediate measures, such as energy-saving packages and practical household advice, can help reduce scepticism and create a first positive experience with energy support. Finally, renovation communication should address comfort, health, safety and dignity, not only energy savings and technical performance.

Overall, the Croatian experience demonstrates that expert advisory support can be most effective when it is embedded in existing local relationships and delivered through a multidisciplinary team. The combination of energy experts, building managers and energy poverty specialists helped create practical, trusted and socially sensitive support for residents, homeowners and vulnerable households. The most important contribution was the ability to connect renovation planning with real household conditions, residents' fears, building-specific knowledge and long-term trust-building.

9. Summary of Household Energy Advising Visits in Kidričevo (Slovenia)

Within Task 5.2 of the CEESEN-BENDER project, household energy advising visits were carried out in Kidričevo, in the Spodnje Podravje region of Slovenia. The uploaded material includes seven household visit reports from apartments located in multi-apartment buildings at Čučkova ulica 7, Ulica Borisa Kraigherja 10, Ulica Borisa Kraigherja 12 and Ulica Borisa Kraigherja 21. All visited apartments were located in buildings that had not been energy renovated, with no thermal insulation on the external walls and no adequate insulation of the attic or cellar ceiling.

The visited apartments ranged from 52 m² to 87 m² and were located either on the ground floor or on the upper/last floor of the buildings. Several apartments were placed at the end of the building, meaning that they had three external walls. This increased their exposure to heat losses in winter and overheating in summer. The household visits focused on living comfort, heating costs, electricity and water use, moisture and mould risks, and practical advice for both apartment-level behaviour and building-level renovation measures.

9.1 Overall housing and comfort conditions

The main finding from the Slovenian visits is that living comfort is strongly affected by the poor thermal performance of the buildings. All analysed buildings are unrenovated and lack insulation on the façade. In addition, the attics and cellar ceilings are generally not insulated, which creates additional heat losses for apartments on the top floor and, in some cases, through the floor towards the cold cellar.

Several apartments were located on the last floor, directly below a cold attic. These apartments were particularly exposed to heat losses through the ceiling. In addition, some apartments were located at the end of the building and therefore had three external walls, further increasing the exposed surface area. This building configuration contributed to high heating needs, occasional low indoor temperatures and increased risk of thermal bridges.

Measured indoor temperatures during the visits varied. In some apartments, temperatures were low, around **18.3–18.7 °C**, which was linked either to high heating costs and energy saving behaviour or to the poor thermal performance of the building. In other apartments, measured temperatures were more comfortable, around **20–22.7 °C**. However, even where temperatures were acceptable at the moment of the visit, residents often reported high heating costs, unpleasant summer conditions and occasional winter discomfort.

Moisture and mould were recurring concerns. In several apartments, mould was observed especially at the junctions between walls and ceilings, which the reports identify as classic geometric thermal bridges. This problem was particularly pronounced where the attic was not insulated. In one apartment, mould was present in the bathroom; in others, it appeared in the kitchen or at wall-ceiling corners. In one case, mould had not yet appeared, but significant temperature differences between walls and corners indicated conditions favourable for mould formation if ventilation is insufficient.

Summer overheating was also repeatedly reported. Several residents described summer conditions as unpleasant due to high temperatures in the apartments. This was especially relevant for upper-floor apartments and apartments with several external walls. Winter comfort varied: some residents reported pleasant conditions, while others reported neither pleasant nor unpleasant conditions or unpleasant conditions during winter, partly due to occasional low temperatures and high heating costs.

9.2 Findings on energy use

All visited Slovenian apartments were connected to the district heating system in Kidričevo, with heat transferred through radiators. The district heating system is affected by heat losses in the network and that the poor condition of the district heating network, combined with the lack of building envelope insulation, results in high heating costs for households.

Heating costs were one of the most important findings. Several households reported annual heating costs of approximately **1,500 EUR/year**, which was considered high, especially for smaller apartments of around 52 m². Other households reported heating costs between **1,000 and 1,200 EUR/year**, or between **1,200 and 1,500 EUR/year**. In one apartment, the January heating cost alone was around **170 EUR**, while another reported around **150 EUR** for January.

One ground-floor apartment reported lower district heating costs, around **800 EUR/year**, but this was because the apartment was also heated with a firewood furnace. This indicates that the lower district heating cost does not necessarily reflect better building performance, but rather the use of an additional heating source.

Electricity was used for lighting, home appliances, cooking, air conditioning and domestic hot water. Several reports note that household appliances were older, commonly between 5 and 15 years old, and in one case up to 20 years old. Electric boilers for domestic hot water were often new, around one year old. Monthly electricity costs varied between approximately **45 EUR** and **90 EUR**, depending on household size, appliance age and use.

Water costs were generally low to moderate. Some households reported water costs of around **7 EUR/month**, while others reported around **10–15 EUR/month** or water use of about **9 m³/month**. Water use was not identified as the main energy or affordability issue in the Slovenian reports.

9.3 Energy poverty-related findings

The Slovenian visits show a strong link between poor building performance, high heating costs and energy vulnerability. Several households faced high annual heating costs despite living in unrenovated buildings where heat losses were structurally embedded. This was especially problematic for smaller apartments and for older persons living alone.

In one case, the apartment owner was an older person living alone, and the measured indoor temperature was only around **18.3 °C**. The report links this low temperature to energy and cost saving behaviour, as the January heating cost was around **170 EUR**. This is a clear indicator of energy poverty risk: the household reduced indoor temperature in order to manage high heating costs.

Another person living alone had an indoor temperature of around **18.7 °C**, with reported heating costs between **1,000 and 1,200 EUR/year** and around **150 EUR** in January. Although this resident reported pleasant conditions during the year, the combination of relatively low indoor temperature, high heating costs and an uninsulated building indicates vulnerability to energy poverty.

The reports also show that energy poverty should not be understood only through low income or low indoor temperature. Some households maintained more comfortable temperatures, but only at the cost of high annual heating bills. Others experienced mould, thermal bridges, summer overheating or occasional low temperatures because of building-level deficiencies. These problems cannot be solved fully by individual behaviour and point to a need for broader building renovation and district heating system improvements.

9.4 Main issues identified

Across the Slovenian visits, the most common issues were:

- uninsulated façades in all analysed buildings;
- uninsulated attics and cellar ceilings;
- heat losses through ceilings in top-floor apartments;
- heat losses towards cold cellars in ground-floor apartments;
- high heating costs linked to district heating network losses and poor building envelopes;
- thermal bridges at wall-ceiling junctions;
- mould in bathrooms, kitchens or wall-ceiling corners;

- risk of mould formation where temperature differences between walls and corners are high;
- occasional low indoor temperatures due to energy saving behaviour;
- summer overheating in several apartments;
- older household appliances in some dwellings;
- limited effectiveness of apartment-level measures without building-level renovation.

A repeated pattern is that the apartments did not generally suffer from leaking roofs, rotten windows or doors, or severe window air leakage. Instead, the main problems came from the absence of building insulation, thermal bridges, attic and cellar heat losses, and the condition of the district heating system. This distinguishes the Slovenian cases from some of the Croatian cases, where dampness, wet foundations and façade damage were more prominent.

9.5 Advice and recommended measures

The main recommendation across all Slovenian visits was building-level renovation, especially insulation of the façade. Since all analysed buildings lacked external wall insulation, façade insulation was repeatedly identified as the most important measure to improve living comfort and reduce heating costs.

A second repeated recommendation was insulation of the attic. For apartments on the last floor, insulating the attic was considered particularly important because of heat losses to the cold attic. Where full building-level attic insulation would not be implemented, residents were advised to check whether the area above their apartment could be insulated individually.

For ground-floor apartments, insulation of the cellar ceiling or the area below the apartment was recommended as a way to reduce heat losses towards the cold cellar. In one case, this was suggested as an individual measure if the building-level intervention would not be implemented.

At apartment level, the most common recommendation was appropriate ventilation to reduce the risk of mould growth. Where mould was already present, residents were advised to treat it with special mould-removal preparations and repaint with paint that inhibits future mould formation. In one kitchen where ventilation was hindered by equipment placement, the report notes that even a local recuperator did not prevent mould from forming, highlighting that ventilation behaviour and thermal bridge treatment must be addressed together.

In some cases, additional apartment-level measures were proposed. One report recommended considering a local recuperation unit, while another proposed installing reflective foil behind radiators as a small low-cost measure to improve heat comfort by supporting better movement of warm air.

9.6 Relevance for broader renovation support

The Slovenian household visits clearly show that household-level advice is useful, but insufficient on its own. The main problems identified are structural and building-level: lack of façade insulation, uninsulated attics, uninsulated cellar ceilings, thermal bridges and high district heating costs. Individual households can improve ventilation, treat mould, add reflective foil behind radiators or consider limited local insulation, but the main improvements require coordinated decisions by apartment owners and building-level stakeholders.

The findings are particularly relevant for the expert advisory support component of Task 5.2. In Kidričevo, the household visits provide evidence that building managers, homeowner associations and apartment owners need support to understand the benefits of façade insulation, attic insulation, cellar ceiling insulation and possible improvements to the district heating system. The visits also show that vulnerable households, especially older persons living alone, may already be reducing indoor temperatures to control costs. This makes affordability and social protection important elements of any future renovation process.

The Slovenian cases also underline the importance of linking building renovation with district heating performance. Even if apartment-level behaviour improves, high heat losses in the district heating network and uninsulated building envelopes will continue to create high costs and comfort problems. Therefore, renovation support should consider both building-side measures and the wider heating system context.

9.7 Short conclusion

The Slovenian household energy advising visits in Kidričevo 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.

10. Summary of expert services to building managers, homeowner associations and other stakeholders in Kidričevo (Slovenia)

In the Slovenian pilot area, expert advisory support was provided through a combination of internal operational expertise and external advisory input. The internal expert carried out most of the technical and field-related work, including technical support, training activities, household visits, consultations with residents and participation in meetings with relevant stakeholders. The role was initially carried out by Dalibor Šoštarič and later continued by Roman Kekec, who provided direct energy advice to vulnerable residents, explained the renovation process, informed residents about possible renovation measures and clarified opportunities for subsidies or other financial support.

The external expert had a more advisory role and was involved when specific additional expertise was needed, particularly in relation to the work of building managers, the renovation process of multi-apartment buildings and engagement with residents. This external perspective helped the project team better understand the practical challenges faced by building managers and residents during renovation processes.

The support mainly targeted apartment owners and residents of multi-apartment buildings, with special attention to vulnerable residents. The experts also worked with building managers, the municipality and other local and national stakeholders. In addition to direct engagement with residents, consultations were held with the municipality and with the Institute for the Protection of Cultural Heritage of Slovenia. Meetings were also organised with national stakeholders, including the Ministry of the Environment, Climate and Energy, the ECO Fund and other national agencies. These consultations were important because the renovation process involved not only technical and financial questions, but also administrative requirements and cultural heritage-related conditions.

Support to building managers and other stakeholders focused on possible renovation measures, technical options and the practical steps needed to move the renovation process forward. The experts provided advice on materials, thermal insulation characteristics, energy efficiency measures and the technical and economic implications of different renovation options. With the municipality, discussions focused on the possible role of local authorities in supporting renovation, including financial and non-financial support. With national stakeholders, the focus was mainly on subsidies and financial support mechanisms. With the cultural heritage authority, discussions focused on detailed planning of renovation works, especially façades and insulation requirements.

A specific feature of the Slovenian experience was the need to align renovation planning with cultural heritage requirements. One of the objectives was to help unify the renovation process for the whole settlement. This required consultations with the Institute for the Protection of Cultural Heritage of Slovenia, especially regarding façade renovation and acceptable insulation thickness. A short study was prepared to analyse the area and compare different renovation options, showing the technical differences and economic viability of different solutions. This was important because, in some previous cases, strict requirements led to the use of more expensive materials and very high renovation costs, which were not affordable for vulnerable residents and became one of the reasons why buildings remained unrenovated.

Through the expert support and consultation process, an important step forward was achieved. A more suitable approach for future renovations in the area was agreed, taking into account technical requirements, cultural heritage aspects and affordability for residents. This was one of the most important results of the advisory support, as it helped connect technical feasibility with social and financial reality.

The experts did not take over the communication role of building managers. Instead, they acted more as mediators between residents, building managers, the municipality and the cultural heritage authority. These actors often had different priorities and perspectives, which could lead to misunderstandings or disagreements. The experts helped clarify technical and financial issues, explain the implications of different renovation options and support a more constructive dialogue between stakeholders. This mediation role contributed to better mutual understanding and helped support the renovation process.

In the pilot area, there were no homeowners' associations in the formal sense, so support was mainly provided directly to apartment owners and residents. The support included technical advice, energy advice, explanation of possible renovation measures, information about renovation benefits and guidance on available financial support. Residents were informed about possible energy savings, the renovation process and the practical steps needed for decision-making. Vulnerable residents received additional support through household visits and individual advice, where the expert explained renovation possibilities and clarified how subsidies or other forms of support could be accessed.

The experts participated in workshops, meetings with residents and household visits. These activities were used to explain the renovation process, present possible measures, provide technical and financial information and answer questions from residents. They also allowed the experts to better understand residents' concerns and barriers to renovation. Common concerns included renovation costs, uncertainty about available subsidies, doubts about renovation benefits and technical questions related to specific buildings. The experts responded by explaining expected energy savings, improved comfort and long-term building performance, while also presenting good practice examples and addressing specific technical cases.

The support was provided through several formats, including individual consultations, bilateral meetings, group meetings, workshops, household visits, phone calls, email communication, informal consultations, meetings with building managers, meetings with municipal representatives, consultations with the cultural heritage authority and meetings with national stakeholders. These different formats made it possible to address both technical and non-technical aspects of renovation, including resident communication, financial support, stakeholder coordination and cultural heritage-related requirements.

Direct in-person meetings proved to be the most effective format, especially when working with residents and vulnerable households. Mass information methods were less effective, as many residents needed individual explanations, the opportunity to ask questions directly and communication from people they already trusted. In-person meetings, household visits and direct consultations helped build trust, explain the renovation process in a more understandable way and address specific concerns linked to individual buildings or households.

The added value of the external expert was his practical insight into renovation of multi-apartment buildings and work with residents and building managers. His experience complemented the project team by offering an additional perspective on stakeholder roles and the challenges that arise in communication between residents, building managers, municipalities and other institutions. This was especially useful in questions related to building management, resident engagement and practical implementation of renovation activities.

The main challenge was how to effectively inform and engage residents. General communication methods were not sufficient in the pilot area. Residents needed more personal contact, direct explanations and support from trusted local actors. To address this, the project team started the engagement process through people who had already built trust in the area, such as elected municipal representatives, city councillors and other local actors. Their involvement helped increase the credibility of the project activities and supported communication with residents.

Another important challenge was the need to coordinate stakeholders with different priorities, including residents, building managers, the municipality, national institutions and the cultural heritage authority. The renovation process involved technical, financial, legal, communication-related and cultural heritage aspects. The expert support helped connect these perspectives and support a more coordinated approach.

The Slovenian experience shows that expert advisory support is particularly valuable where renovation is affected by multiple overlapping conditions, including affordability, cultural heritage protection, technical feasibility and resident trust. The most important lesson is that renovation support must be practical, locally grounded and based on direct communication. Where vulnerable residents are involved, solutions must not only meet technical and regulatory requirements, but also remain financially realistic and understandable for the people expected to participate in the renovation process.

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