CEESEN-BENDER

Building intErventions in vulNerable Districts against Energy poveRty

Deliverable 2.3

Workshops report on advocacy for energy renovation of buildings

Dissemination Level: Public

WP2 Reinforcing and adapting the governance and decision-making of building management actors to support the energy renovation of private multi-apartment buildings

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V1	23.04.2025	First version of the content created by MENEA (PP6) and sent to DOOR (LP).
V2	23.09.2025	Document created and sent to the project consortium for review.
V3	29.09.2025	Accepted comments and suggestions provided by the project consortium and finalization of the document.
V3	29.09.2025	Final document sent to the project consortium and Project Officer (PO).

Background of the CEESEN-BENDER project

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

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

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

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

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

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

- Through the project, methods and tools that can be used to address different aspects of energy poverty will be developed. This includes:
    - Data gathering on energy poverty in the pilot sites;
    - A digital tool identifying buildings with high levels of energy poor households in the greatest need of renovation;
    - A model of potential savings in buildings undergoing renovation, and a tool for calculating the return on investment for energy renovations.

- 5 Pilot area roadmaps will be developed that prioritize building renovation based on their potential for maximizing emissions reduction via energy savings as well as an increase of quality of life and wellbeing for vulnerable homeowners.

- Within the 5 pilot areas, at least 30 building-level roadmaps will be created that specify the technical details for renovations. These pilot buildings will be supported in the entire pre-construction phase, drawing of plans, applying for permits, audits or other requirements and for financing. Plans will call for the decarbonization of the heating and cooling supply and integration of renewable energy sources (RES), to produce energy to cover its own consumption.

- Also, a support system for homeowners, municipalities, and other large owners of multiapartment buildings (MABs) in targeted regions will be created to speed up the renovation process, by:
    - Advising at least 3.500 homeowners, landlords and building managers on legal, financial, technical and other aspects of energy renovations.
    - Advocating for changes of regulatory requirements and policies to lower the costs and time needed for the preparatory phase of projects.
    - Train at least 30 energy professionals on energy poverty and related topics.

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Executive Summary

The following Deliverable presents a compilation of the various topics addressed on the organized awareness raising events within the project CEESEN-BENDER. Input for this document was gathered from 5 (out of 6) partner countries (Croatia, Estonia, Poland, Romania and Slovenia) which organized a series of workshops, Q&A sessions and site visits in their selected pilot sites with the aim of sharing information and experience about the energy renovation of MABs. Furthermore, the required data was gathered via Excel and Word documents for reporting about the topics, discussions and main questions addressed during the workshops and Q&A sessions for different stakeholders.

Related to the mentioned, this Deliverable covers the main conclusions of the awareness raising events distinguishing, thereby, the theoretical workshops from the more practical Q&A sessions. In addition, to support the theoretical awareness raising with practical experience, this documents briefly presents the results of the air quality monitoring carried out in 32 MABs in the selected pilot sites, as well as shows the addressed questions, challenges and benefits of the 6 demonstration buildings serving as good practice examples in each of the 5 (out of 6) partner countries (Croatia, Estonia, Poland, Romania and Slovenia). Finally, for a better understanding of the gathered information and results, the same are presented in Tables and supported by detailed textual descriptions.

Apart from being a separate document, this Deliverable is an addition to the other documents created within the project CEESEN-BENDER and intended to facilitate a more focused communication of energy renovation of MABs between different stakeholders.

1. Introduction and relevance of the Deliverable

The energy renovation of buildings is considered to be a complex process whose successful implementation depends on a variety of soft and infrastructural activities, experienced professional and technical staff, optimal investment costs and realistic deadlines. In order to address the potential challenges, it is important to meet the knowledge, expertise, motivation and needs of all relevant stakeholders involved in the process, starting from the "supply side" which includes building managers (or homeowner associations), technical staff, supporting organizations, financial institutions and national, regional and local authorities, up to the members of the "demand side" in the roles of landlords, homeowners, tenants and their representatives.

Related to the mentioned, one of the key factors in the energy renovation is the motivation and knowledge of the "end-users", meaning the people living in the multiapartment buildings (MABs). It is well known that their experiences and level of awareness of the complexity of the required activities influence their motivation for the energy renovation process. To foster the interest of such vulnerable stakeholders it is important to adequately inform them about all aspects of the energy renovation, as well as the risks and benefits the process brings. Thereby, a timely and quality information exchange can be ensured through various activities and events, with the aim of raising awareness about the long-term benefits of the energy renovation, reducing the possible negative perspectives and doubts of the stakeholders, as well as enhancing their commitment to energy efficiency through improved, green and sustainable MABs.

The issues related to energy renovation of MABs are especially visible in the countries of Central and Eastern Europe, where the period after the Second World War and before 1990's had a significant influence on the building stock in terms of construction and aesthetics, used materials and durability of the technical systems. Furthermore, in the modern era such buildings implicate poor living and health conditions, negative impact on the environment and the occurrence of energy poverty. Tackling these and many other negative aspects of unrenovated MABs became the main aim of the project **CEESEN-BENDER - Building intErventions in vulNerable Districts against Energy poveRty**, which was planned and is implemented by a project consortium consisting of 10 partner organizations from 6 Central and Eastern European countries (Croatia, Estonia, Germany, Poland, Romania and Slovenia). Thereby the project's main focus are the following 2 groups of tasks:

- Analysis of the current situations in the 5 (out of 6) partner countries, mainly through activities such as air quality monitoring in unrenovated and renovated buildings, energy poverty surveys, review of the regulatory, market and technical barriers on national levels, development of tailormade tools for building prioritization and return on investment (ROI) calculation, as well as creation of roadmaps for fostering energy renovation

- Awareness raising – through workshops, Q&A sessions, trainings, consultations, interviews, site visits and other events for management authorities (building managers, homeowner associations), homeowners, landlords and tenants.

Regarding the latter, awareness raising activities contribute to a deeper knowledge exchange and sharing of practical and "on field" experiences between the involved parties, as well as provide more detailed information and solutions for the problems and doubts related to various aspects of energy renovation. Also, such activities foster, so called, peer – to – peer learning, where the on-site discussions and interactions between different types of stakeholders enable a better understanding of their current knowledge, thoughts and plans regarding energy renovation, as well as strengthen the connection and trust between the members of the "supply" and "demand" side.

Related to the mentioned, one of the first activities of the project **CEESEN-BENDER** included the organization of several awareness raising events in the forms of, mainly, workshops and Q&A sessions supported by trainings, consultations, interviews and site visits for different stakeholders (building managers, homeowner associations, homeowners, landlords and tenants) across the 5 (out of 6) partner countries (Croatia, Estonia, Poland, Romania and Slovenia). The main aim of the mentioned events was to get a clear overview of the current knowledge and information the stakeholders possess regarding the energy renovation, as well as offer advice, guidance and practical solutions for the problems and doubts they are facing before, during and after the process itself. Also, the organized workshops and Q&A sessions are considered to be the most significant input for the **Workshops report on advocacy for energy renovation of buildings**, which presents the main topics, discussions and possible solutions related to the energy renovation and addressed within the project **CEESEN-BENDER**. As the end result arising from the organized workshops and Q&A sessions, the purpose of this document is to:

- Summarize the main topics addressed during the awareness raising events organized in the selected pilot sites
- Present the most discussed problems and doubts regarding energy renovation of MABs and give advice for potential solving of the same
- Highlight the main features of the air quality monitoring in the selected pilot sites with short recommendations for improvement of the critical values (anomalies)
- Give a brief overview of the demonstration buildings in the selected pilot sites, highlighting, thereby, the most common challenges and benefits.

Development methodology

As mentioned, this document is based on various awareness raising events organized by the project partner organizations from the 5 (out of 6) Central and Eastern European countries (Croatia, Estonia, Poland, Romania and Slovenia) involved in the project **CEESEN-BENDER**. The creation of this document is foreseen and supported by the following practical tasks which are, also, the main sources of information:

- T2.2 Awareness raising for homeowners and landlords, as well as building managers

- T2.3 Q&A sessions for homeowners and landlords
- T2.4 Air quality monitoring in pilot buildings
- T2.5 Identifying renovated demonstration building(s).

The overall implementation of the project **CEESEN-BENDER** started with the selection of the relevant pilot sites in 5 (out of 6) partner countries (Croatia, Estonia, Poland, Romania and Slovenia), as well as focusing on MABs which are in the biggest need for energy renovation. The second step was the organization of the, before mentioned, awareness raising events, mainly, in the form of workshops and Q&A sessions for the various stakeholders involved in the energy renovation process. To generate the best possible results and ensure a widely spread information sharing, the total number of the organized events was set to 40 (8 per pilot site) and distributed as follows:

- 2 workshops for building managers (or homeowner associations)
- 3 workshops for homeowners and landlords of MABs
- 3 Q&A sessions for landlords of MABs.

The mentioned figures are the minimum values that were foreseen within the project **CEESEN-BENDER**, with the possibility for each partner country to organize more than the planed number of events. Furthermore, to continuously monitor the progress of the events and gather the relevant information needed for the creation of the **Workshops report**, Excel and Word documents were prepared and filled with data such as date, time, place, location, organizers and target groups, main topics, conclusions and feedback/questions from the participants. Apart from the information collected on the workshops and Q&A sessions, additional input was gathered from the previously prepared reports and documents within the tasks T2.4 Air quality monitoring in pilot buildings and T2.5 Identifying renovated demonstration building(s).

Furthermore, the planned tasks contributed to the creation of this **Workshops report on advocacy for energy renovation of buildings**, with the aim of summarizing the main topics addressed on the organized awareness raising events for the building managers, homeowner associations, homeowners, landlords and tenants, as well as providing guidance and advice in tackling the challenges that occur before, during and after the energy renovation. Also, since the document covers information from 5 (out of 6) partner countries (Croatia, Estonia, Poland, Romania and Slovenia), it is a comparison of the main concerns troubling the homeowners, landlords and tenants related to various aspects of the energy renovation of MABs.

In addition, this **Workshops report** has an impact and presents an input for other planed project tasks, out of which the most significant are:

- T5.1 Development of pilot area roadmaps
- T5.2 Support services to building managers, homeowner associations, landlords and vulnerable households
- T5.4 Development and implementation of building-level roadmaps and investment strategies.

Finally, the discussions and conclusions presented in this document will serve the management authorities (building managers, homeowner associations) of the MABs as

overall guidance when communicating the energy renovation process with the homeowners, landlords and tenants. The various topics covered during the organized awareness raising events will contribute to overall networking, knowledge and experience sharing, as well as help break down the existing prejudices about the energy renovation process in general. At last, the **Workshops report on advocacy for energy renovation of buildings** is a supporting document of the previously prepared **Guidelines for facilitation of communication between building managers and homeowners on building renovation process**, covering in more detail the information and experience gathered "on field" and through direct interaction with the stakeholders which are the main "end-users" of the results the energy renovation of MABs brings.

2. Awareness raising activities within the project CEESEN-BENDER

As mentioned, the first activity of the project CEESEN-BENDER was the organization of workshops and Q&A sessions for managing authorities (building managers, homeowner associations), homeowners, landlords and tenants with the aim of discussing burning questions regarding energy renovation of MABs. Thereby the main planned topics were related to technical solutions, benefits of energy renovation, tackling energy poverty and raising the level of experience sharing and communication between the stakeholders. As mentioned before, the total amount of the awareness raising events was set to 40, but to answer the growing interest of the stakeholders, the final amount of the organized events increased to 49. Thus, the following subchapters present the main information about the organized awareness raising events in the selected pilot sites with focus on the main topics covered.

2.1. Workshops for stakeholders

From the 25 planned workshops for different stakeholders (managing authorities (building managers, homeowner associations), homeowners, landlords and tenants) the 5 pilot sites count a total of 30, distributed as follows below.

CROATIA

Croatia organized 3 workshops for homeowners, landlords and tenants, as well as 2 workshops for building managers. The workshops provided a comprehensive platform for discussing **air quality monitoring**, **tenant engagement** and **collaboration with building managers** regarding energy renovation projects. The building managers contributed with valuable information by identifying unrenovated and renovated buildings, while the homeowners, landlords and tenants were informed about survey procedures, timeframes, data usage and the functionality of air quality measurement devices. The homeowners, landlords and tenants, but, also, the building managers, were all introduced to the **benefits of energy renovation**, **with practical examples from the Croatian pilot site** and briefed about relevant legislative updates, including key changes under the new **Building Management and Maintenance Act**, valid from the 1st January 2025.

The focus of the workshops was on presenting and analyzing **air quality monitoring results** from selected MABs in the pilot site Medjimurje County, including both unrenovated and renovated buildings. Discussions emphasized significant findings, including average values, daily and yearly variations and critical values (anomalies) in the measurement data, along with the recommendations for improving air quality. Participants were actively engaged into the clarification of the parameters, understanding contributing factors to critical values (anomalies) and exploring options for continued monitoring beyond the project. The workshops strengthened the participants' knowledge, fostering informed decision-making, improved indoor air quality and long-term effectiveness of energy renovation initiatives.

One of the main problems identified through the workshops is that the energy renovation process often includes **poorly executed renovation works**, **flawed project**

designs and incomplete cost estimates. To address these challenges, it is essential to engage **reliable contractors**, implement regular quality control inspections and provide training for the technical staff on energy-efficient techniques, technologies and methods. Flawed project designs can be mitigated by engaging **qualified project designers** with experience in designing energy efficient buildings. It is also important to involve all stakeholders early in the process to ensure effective solutions and timely problem solving. **Regular coordination meetings** help monitor the progress of the renovation works, while **site visits** and the exchange of experience among stakeholders support informed decision-making throughout the renovation process.

In conclusion, addressing the challenges of energy renovation requires careful planning, qualified professionals, accurate cost estimation and ongoing coordination. By ensuring quality implementation and informed decision-making the renovation process can achieve both efficiency and long-term sustainability.

The main information about the workshops in the Croatian pilot site are presented in the table below.

Table 1: Summary of the workshops in the pilot site Medjimurje County (Croatia)

Country (pilot site)	Type of workshop	Date and place	Organizers	Number of participants	Topics
Croatia (Medjimurje County)	W1 – Homeowners, landlords and tenants	15th February 2024, Technology Innovation Centre Medjimurje I (Čakovec)	MENEA, DOOR	23 (3 from MENEA)	Project CEESEN-BENDER, surveys for the homeowners, landlords and tenants, air quality monitoring, energy renovation process
	W2 – Homeowners, landlords and tenants	13th December 2024, Metal Centre (Čakovec)	GP Stanorad Ltd., MENEA	43 (2 from MENEA)	Project CEESEU-DIGIT, project CEESEN-BENDER, changes in the Building Management and Maintenance Act
	W3 – Homeowners, landlords and tenants	3rd July 2025, Scheier Building (Čakovec)	MENEA	10 (3 from MENEA)	Project CEESEN-BENDER, air quality monitoring results, critical values (anomalies) in the measured data
	W1 – Building managers	23rd November 2023, MENEA's headquarters (Čakovec)	MENEA	8 (4 from MENEA)	Project CEESEN-BENDER, main activities relevant for the building managers
	W2 – Building managers	4th September 2024, MENEA's headquarters (Čakovec)	MENEA	6 (3 from MENEA)	PP Meeting and Train the Trainer education in Tartu (Estonia), organization of the demonstration building site visit

Source: Project CEESEN-BENDER, WP2: T2.2 Awareness raising for homeowners and landlords, as well as building managers, 2025

ESTONIA

Estonia organized 3 workshops for homeowners, landlords and tenants, as well as 2 workshops for building managers. The main topics covered in the workshops were related to **energy renovation**, **possible funding sources** and **cultural heritage renovation guidelines**. The goal was to raise awareness on the necessity of energy-efficient renovation, which has benefits such as increased indoor air quality and living comfort, but, also, lower energy costs. The workshops underlined the necessity of renovation both for individuals and society as a whole, while highlighting the role of **energy agencies** in supporting homeowner associations. Participants asked about the most effective approaches to renovation, whether through full-scale projects or staged processes and were provided with insights into technical and organizational practices from completed renovation projects.

The workshops also revealed that up to 1/3 of homeowners and tenants are primarily **motivated to undertake energy renovation** by increased **living comfort** and enhanced **building aesthetics.** This suggests that, in addition to energy savings, factors such as improved living conditions and the visual quality of the building play a significant role in encouraging stakeholders to invest in renovation measures.

Furthermore, the Estonian pilot site, also, has an **abundance of wooden buildings**, out of which many are architecturally and historically significant and preserved. Therefore, it is of significant importance to perform energy renovation in a way that ensures quality, while preserving their distinctive character, as well as cultural and historic value. According to the mentioned, the biggest challenge is **balancing energy efficiency with buildings' physics** and **heritage preservation**. The potential solution is a well-rounded **renovation strategy** that combines the right materials, quality design and professional installation, ensuring both energy efficiency and long-term durability of the wooden structure. The competences of the homeowner associations, technical staff, project designers and construction workers are crucial for a successful energy renovation. Therefore, regular trainings and ongoing discussions are essential to ensure effective implementation of the measures.

During the workshops, a recurring issue emerged regarding the difficulty of **securing renovation funds** (initial co-financing is often required to cover project preparation and technical consultancy costs), higher maintenance costs and the challenges associated with energy retrofitting of buildings classified as cultural heritage. The proposed solution emphasized careful planning, transparent communication and the involvement of qualified professionals to ensure that such renovations are sustainable in the long-term.

Additional information about the organized workshops is provided in Table 2.

Table 2: Summary of the workshops in the pilot site City of Tartu (Estonia)

Country (pilot site)	Type of workshop	Date and place	Organizers	Number of participants	Topics
Estonia (City of Tartu)	W1 – Homeowners, landlords and tenants	30th January 2024, Online	TREA, Tartu Development Association	27	The necessity of energy efficient renovation, criteria for renovation support measures
	W2 – Homeowners, landlords and tenants	28th August 2025, TREA's headquarters (Tartu)	Tartu Renovations	19	Renovation grant, challenging renovation of wooden MABs, heritage building guidelines
	W3 – Homeowners, landlords and tenants	02nd September 2025, Nature House (Tartu)	TREA	25	Air quality monitoring results, energy saving tips, renovation solutions
	W1 – Building managers	08th – 10th June 2025, Croatia (Zagreb, Gospić)	TREA, City of Tartu, EIS, Estonian Union of Co-operative Housing Association, DOOR, City of Zagreb, Komunalac Gospić Ltd.	13 (3 from TREA)	Municipal environmental strategy, deep renovation, international study visit to renovated MABs in Croatia
	W2 – Building managers	28th August 2025, TREA (Tartu)	TREA	4 (2 from TREA)	Results from indoor climate study, renovation barriers

Source: Project CEESEN-BENDER, WP2: T2.2 Awareness raising for homeowners and landlords, as well as building managers, 2025

POLAND

Poland organized 6 workshops for homeowners, landlords and tenants, as well as 4 workshops for building managers. The main topics covered were related to **energy poverty**, **energy renovation** and it's **benefits** and **the air quality monitoring process.** The workshops, also, covered the topic of **thermomodernization** of the buildings' envelopes, as well as highlighted the critical issues of **energy poverty** and the importance of building renovation as a pathway to sustainable, comfortable and cost-efficient living environments. Participants gained **practical knowledge** about the technical solutions, regulatory requirements and funding opportunities for energy efficient renovation. **Demonstration buildings** showcased effective thermomodernization measures including insulation, ventilation improvements, renewable energy installations and other energy efficient technologies, illustrating benefits such as lower energy costs, improved living comfort and enhanced building aesthetics. Also, the integration of a SCADA system for monitoring and diagnostics was presented as an effective method for

detection of inefficiencies in energy consumption, temperature and performance of the systems.

The workshops, also, highlighted the issue of how **individual consumption habits** contribute to the increase and decrease of **energy poverty**. Homeowners, landlords and tenants are aware that everyday decisions regarding electricity, heating and water use can collectively have a significant impact on increased and decreased energy consumption, costs and living conditions of energy poor households. By adopting small, practical measures, such as turning off unused appliances, using water more efficiently, optimizing heating and cooling settings, as well as being mindful about their daily habits, they can significantly reduce the level of wasted energy. In addition to lowering utility costs, these actions foster a sense of personal responsibility and engagement in sustainable living. The first and crucial step towards energy renovation is promoting awareness of **individual energy-saving practices** among residents. In parallel, conducting thorough **energy audits** was recognized as an essential measure to identify improvement opportunities and guide renovation planning effectively.

Furthermore, an additional workshop was organized with the topic of **tools for climate change adaptation** in terms of water retention, urban cooling, enhancement of biodiversity and overall energy efficiency improvements. Finally, **financing instruments** such as energy service companies (ESCo) and energy performance contracts (EPC) were explained and presented through best practice examples and case studies. Related to the mentioned, other **funding opportunities** in the forms of green bonds, recovery plans and climate funds were mentioned as the main drivers of energy renovation projects and sustainable development.

The workshops highlighted the **challenge of reaching consensus** among homeowners, landlords and tenants regarding the **implementation of energy renovation**. The way forward lies in ensuring that stakeholders are well-informed and actively involved in the process. Transparent communication, more educational workshops and participatory approaches help to build understanding of the benefits and foster collaboration, ensuring that renovation projects are carried out effectively and more sustainably.

Overall, the workshops in Poland demonstrated that energy renovation, when supported by informed stakeholders, practical solutions and social consensus, can effectively address energy poverty, while improving the living comfort and sustainability of the buildings' characteristics. Finally, building awareness and strengthening cooperation are key drivers for a successful energy renovation of MABs in the Polish pilot site.

Table 3 gives an overview of the workshops from the Polish pilot site.

Table 3: Summary of the workshops in the pilot site Mazovia Voivodeship (Poland)

Country (pilot site)	Type of workshop	Date and place	Organizers	Number of participants	Topics
Poland (Mazovia Voivodeship)	W1 – Homeowners, landlords and tenants	22nd May 2024, Administracja Osiedla WSM Wawrzyszew Nowy (Warsaw)	MAE, WSM Wawrzyszew	9 (1 from MAE)	Energy poverty surveys, air quality monitoring, benefits of the energy renovation
	W2 – Homeowners, landlords and tenants	21st June 2024, Warszawska Spółdzielnia Mieszkaniowa (Warsaw)	MAE	99	Energy poverty surveys, air quality monitoring
	W3 – Homeowners, landlords and tenants	4th June 2025, Online	MAE, WFOŚiGW	165 (3 from MAE)	Energy poverty, process of modernization of the building's envelope, funding opportunities, technical/legal aspect of energy renovation
	W4 – Homeowners, landlords and tenants	16th July 2025, Online	MAE	9 (2 from MAE)	Advice for reducing energy and water consumption, empowering communities
	W5 – Homeowners, landlords and tenants	23rd July 2025, Online	MAE	8 (2 from MAE)	Preliminary results from air quality monitoring, energy-saving advice, tenants' inquiries regarding air quality
	W6 – Homeowners, landlords and tenants	13th August 2025, Online	MAE	54 (3 from MAE)	Energy management systems (EMS), modernization of residential buildings (case studies)
	W1 – Building managers	29th May 2024, Administracja Osiedla WSM Wawrzyszew Nowy (Warsaw)	MAE	8 (3 from MAE)	Project CEESEN-BENDER and the most relevant WPs, air quality monitoring, planning the implementation of the energy poverty survey
	W2 – Building managers	05th August 2025, Szczytno	MAE, WM Śląska 12	18 (4 from MAE)	Investment process, modernization of the building's envelope,

					status on air quality monitoring
	W3 – Building managers	06th August 2025, Mazovia Energy Agency (Warsaw)	MAE	13 (2 from MAE)	Tool for climate adaptation measures, pilot testing in a neighborhood, translation of game-based decisions into real-world actions
	W4 – Building managers	16th September 2025, Online	MAE	199 (7 from MAE)	Project MESTRI-CE, characteristics of ESCo projects and EPCs, financial instruments and support schemes for renovation, project CEESEN-BENDER, SCADA system for energy management with presentation of a renovated MAB

Source: Project CEESEN-BENDER, WP2: T2.2 Awareness raising for homeowners and landlords, as well as building managers, 2025

ROMANIA

Romania organized 3 workshops for homeowners, landlords and tenants, as well as 2 workshops for homeowner associations. The main topics covered on the workshops were the **energy renovation process**, air quality monitoring and the collected data. They also covered the topic of energy communities (at the level of homeowners' associations) and helpful **tools for finding more competitive offers** from energy providers (online comparison tool for allowing consumers to view all licensed electricity providers, compare tariffs and receive guidance on how to switch providers).

The workshops revealed that Alba Iulia has made notable progress in addressing **energy poverty** and enhancing the quality of life in MABs by strengthening the municipality's capacity to plan and implement energy renovation projects. Key interventions include facade insulation, window replacement, heating system upgrades and improved ventilation, addressing issues such as poor thermal performance, dampness or inadequate indoor air quality. Furthermore, **air quality monitoring** supports the identification of structural problems and guides investments to ensure healthier and more comfortable indoor environment, particularly for vulnerable residents. Moreover, by encouraging the **creation of energy communities**, Alba Iulia enables residents to jointly invest in **renewable energy systems** such as rooftop solar panels and heat pumps. These initiatives reduce energy costs, strengthen social cohesion and raise awareness of sustainable practices, while directly contributing to the municipality's energy transition. Together, these efforts create more resilient, efficient and inclusive housing, while, at the same time, addressing the challenges of energy poverty.

A recurring challenge in MAB renovations is maintaining **clear** and **effective communication between homeowner associations**, **homeowners**, **landlords** and **tenants**. Energy renovation of the chosen Romanian MABs requires majority consent, co-financing and includes temporary disruptions, hesitation or resistance. To address that, the Municipality of Alba Iulia and homeowner associations applied structured **communication strategies**, sharing transparent information throughout all phases of the process. By clearly presenting the **benefits, costs** and **expected impacts** of the renovation and tailoring messages to the diverse demographic of residents, they built trust and secured active engagement. Accessible information on financial support options, technical interventions and expected savings, combined with regular updates on project progress proved to be crucial in maintaining collaboration. This approach strengthened acceptance and collaboration, enabling a smoother transition towards ensuring an energy-efficient building stock.

Overall, the workshops provided homeowner associations with practical guidance on how to effectively communicate renovation plans and **energy efficiency measures** to homeowners, landlords and tenants. They also **raised awareness** about the importance of energy renovation of MABs, which includes enhanced living comfort, indoor air quality and health, through improved insulation, upgraded heating or modern ventilation. However, **challenges** remain and some of the most significant are **high costs of interventions** and the **risk of poor-quality work** due to **inadequate contractors.** These barriers are addressed through careful contractor selection, transparent communication of long-term financial benefits and sharing best practices.

Other relevant topics addressed on the workshops are summarized in Table 4.

Table 4: Summary of the workshops in the pilot site Alba County (Romania)

Country (pilot site)	Type of workshop	Date and place	Organizers	Number of participants	Topics
Romania (Alba County)	W1 – Homeowners, landlords and tenants	13th June 2024, Homeowners Association 15 (Alba Iulia)	ALEA, Municipality of Alba Iulia	11	Problems affecting the level of comfort in MABs, controlling temperature and relative humidity in MABs
	W2 – Homeowners, landlords and tenants	16th July 2025, DELEX headquarters (Alba Iulia)	ALEA, Municipality of Alba Iulia, DELEX	20	Energy prices, MAB renovation programs, solutions for energy savings
	W3 – Homeowners, landlords and tenants	20th August 2025, Association B172 headquarters (Alba Iulia)	ALEA	10	Air quality monitoring results, funding programs, challenges of energy renovation
	W1 – Building managers	25th April 2024, University "1 Decebrie 1918" (Alba Iulia)	ALEA, Municipality of Alba Iulia	17 (3 from ALEA)	Results of the project CEESEN-BENDER, measurement devices, energy renovation

	W2 – Building managers	27th November 2024, City Hall (Alba Iulia)	ALEA, Municipality of Alba Iulia	19 (3 from ALEA)	Funding mechanisms, energy communities, effective communication strategy

Source: Project CEESEN-BENDER, WP2: T2.2 Awareness raising for homeowners and landlords, as well as building managers, 2025

SLOVENIA

Slovenia organized 3 workshops for homeowners, landlords and tenants, as well as 2 workshops for building managers. The main topics covered in those workshops included **energy poverty**, **air quality monitoring** but, also, challenges of renovating MABs under **cultural heritage protection.**

During the workshops, participants were introduced to **soft measures**, simple, low-cost actions and everyday **behavioral changes** that households can implement to save energy. It was emphasized that adopting such measures can reduce energy consumption by up to a quarter, providing immediate benefits even before larger renovation projects are undertaken. The workshops also focused on supporting **vulnerable** and **energy-poor individuals** by informing participants about available subsidies and practical ways to lower energy costs**. Home energy advising sessions** were presented as a key tool, offering tailored guidance to tenants on applying for financial support and implementing effective energy-saving solutions. These steps are essential for accelerating the renovation process of the selected MABs in the pilot site, ensuring that energy efficiency improvements are both practical and widely adopted.

Insights from the workshops indicated that renovations of MABs in the Slovenian pilot site Kidričevo are particularly challenging due to the fact that all MABs are under **cultural heritage protection**, which requires careful planning and coordination. To address this, it was recognized as necessary to involve the Institute for the Protection of Cultural Heritage of Slovenia in future discussions, ensuring that renovation measures comply with heritage requirements, while still improving energy efficiency.

Furthermore, **lack of interest** from homeowners, landlords and tenants, also emerges as a challenge, making workshops crucial for **raising awareness** about the importance and benefits of energy renovation, particularly in terms of health benefits and overall quality of living.

A summary of the topics from the Slovenian workshops is presented in Table 5.

Table 5: Summary of the workshops in the pilot site Spodnje Podravje (Slovenia)

Country (pilot site)	Type of workshop	Date and place	Organizers	Number of participants	Topics
Slovenia (Spodnje Podravje)	W1 – Homeowners, tenants and landlords	19th November 2024, Kidričevo	LEASP, EKO SKLAD	11	Financial incentives to reduce energy poverty, eligible renovation measures, efficient energy use
	W2 – Homeowners, tenants and landlords	26th November 2024, Ptuj	LEASP, EKO SKLAD	8	Subsidies for energy renovation, soft measures to lower energy costs
	W3 – Homeowners, tenants and landlords	28th August 2025, Online	LEASP	10	Air quality monitoring results, eligible renovation measures
	W1 – Building managers	4th November 2024, LEASP headquarters (Ptuj)	LEASP	7 (3 from LEASP)	Energy poverty survey, indoor climate, addressing energy poverty
	W2 – Building managers	29th July 2025, Ptuj	LEASP	5 (2 from LEASP)	Status of CEESEN-BENDER activities, future project tasks

Source: Project CEESEN-BENDER, WP2: T2.2 Awareness raising for homeowners and landlords, as well as building managers, 2025

For additional discussions about the various topics raised on the workshops, each pilot site organized a series of Q&A sessions for relevant stakeholders. Each of the Q&A sessions was aimed at answering potential questions, presenting best practices and experience sharing in the fields of energy renovation, funding opportunities, renovation benefits, energy poverty and many others.

2.2. Q&A sessions for stakeholders

Out of 15 planned Q&A sessions for homeowners, landlords and tenants the total amount of the organized ones in the 5 pilot sites is 19. Their distribution per partner country is presented in the following paragraphs.

CROATIA

Croatia organized 4 Q&A sessions with homeowners, landlords and tenants, whereby the focus was on **air quality measurement devices** and **the elements of a successful renovation.** Furthermore, a **site visit** to the selected demonstration building was also organized**.**

The Q&A sessions and site visit provided the participants with a comprehensive understanding of both the technical and organizational aspects of energy renovation and air quality monitoring. The **demonstration building** served as a practical example, enabling participants to learn about the initiation of the renovation process, required documentation, residents' engagement, technical staff involvement and the role of

building managers. Discussions addressed both the **positive outcomes of energy renovation**, such as improved living conditions and lower energy use and the **difficulties encountered**, including cost increases, technical delays and rising costs of materials. The experiences shared by building representatives reinforced that the **selection of qualified professionals** is an essential factor for implementing successful and sustainable renovation projects.

Air quality monitoring was a central focus of the sessions, with explanations provided on device placement, measurement intervals, data storage and accessibility. Participants sought clarifications on technical details such as power supply, connectivity and data availability during and after the monitoring process. The findings pointed to the need to optimize indoor conditions by improving ventilation, managing CO_2 concentration and maintaining appropriate relative humidity and indoor temperature.

To summarize, the Q&A sessions promoted dialogue, clarified technical and organizational issues and emphasized the importance of active resident participation in ensuring long-term success of energy renovation initiatives.

The table below gives an overview of the discussions from the Q&A sessions in Croatia.

Table 6: Summary of the Q&A sessions in the pilot site Medjimurje County (Croatia)

Country (pilot site)	Date and place	Organizers	Number of participants	Topics	Questions and discussions
Croatia (Medjimurje County)	15th February 2024, Technology Innovation Centre Medjimurje I (TICM I) (Čakovec)	MENEA, DOOR	22 (3 from MENEA)	Air quality measurement devices	Where are the air quality measurement devices going to be located?
	9th April 2024, Technology Innovation Centre Medjimurje I (TICM I) (Čakovec)	MENEA, Emasys Ltd., DOOR	8 (1 from MENEA)	Air quality monitoring	Will the data be accessible during and after the measurements? Who needs to pay for the devices? Will they be connected via Wi-Fi or own Internet access?
	13th December 2024, Metal Centre (Čakovec)	GP Stanorad Ltd., MENEA	44 (2 from MENEA)	Heating system of the demonstration building, characteristics of the Building Management and Maintenance Act	Was the heating system renovated? Are there potential fees and penalties for tenants or only the building representatives?
		MENEA	10	Air quality monitoring	How to achieve optimal balance between the

	3rd July 2025, Scheier Building, (Čakovec)		(3 from MENEA)		air quality parameters? What causes anomalies in the measured data?
				Energy renovation process	What are the key elements of a successful renovation? What issues arise from poorly renovated buildings or bad designs? How do rising material and labor prices impact renovations?

Source: Project CEESEN-BENDER, WP2: T2.3 Q&A sessions for homeowners and landlords, 2025

ESTONIA

Estonia organized 3 Q&A sessions with homeowners, landlords and tenants. The main topics covered were **energy renovation activities**, **planning and guidance**, as well as **technical solutions** and **challenges** during the renovation process**.** The Q&A sessions highlighted that renovating older MABs is a complex process requiring careful planning, technical guidance and financial support. Homeowners often face **budget constraints**, differing levels of resident participation and the need for trustworthy contractors. Conducting an **energy audit** was emphasized as a critical first step to evaluate the building's condition and set renovation priorities.

Even when **deep renovation** is not immediately feasible, **staged or partial improvements** can deliver meaningful results. Prioritizing **essential measures** such as upgrading windows, improving heating systems and insulation can significantly improve energy efficiency, indoor comfort and long-term sustainability of the building. The potential integration of solar panels was recognized as a practical option to reduce energy costs and enhance environmental performance, either alongside broader renovation works or independently with careful planning.

Support and available **financial mechanisms** play a pivotal role in enabling homeowners to undertake gradual improvements, ensuring that interventions are both technically sound and financially manageable. Beyond energy savings these renovations contribute to improved indoor climate, reduced operational costs, as well as enhanced aesthetics and market value of the building. Overall, a tailored, step-by-step approach, guided by experts' advice and supported by accessible funding, allow residents to achieve substantial **long-term benefits**, while addressing practical and financial constraints in a sustainable and effective manner.

Additional information on the Q&A session in the Estonian pilot site is presented in the Table below.

Table 7: Summary of the Q&A sessions in the pilot site City of Tartu (Estonia)

Country (pilot site)	Date and place	Organizers	Number of participants	Topics	Questions and discussions
Estonia (City of Tartu)	17th June 2025, Online	TREA	5	Energy renovation	How can renovation be done with reasonable costs? What preparations are needed? How to find reliable construction workers?
	18th June 2025, Online	TREA	8	Planning and guidance through renovation	How can TREA support and guide homeowners during renovation? Who is responsible for preparing the renovation task description?
				Technical solutions and challenges	Is an energy audit needed for older buildings? Are solar panels practical for smaller buildings? Can they be installed without full renovation?
	26th August 2025, Online	TREA	4	TREA's renovation supporting option	When is it appropriate to replace old windows, especially in heritage buildings? Which documents are needed if a contractor changes window opening dimensions?
				Renovation grant	What to do if the project changes are needed but the designer is unresponsive? Must the project be finished before the grant deadline?

Source: Project CEESEN-BENDER, WP2: T2.3 Q&A sessions for homeowners and landlords, 2025

POLAND

Poland organized 4 Q&A sessions with homeowners, landlords and tenants. The Q&A sessions covered topics related to **indoor air quality** and **parameters**, whereby the majority of questions focused on **air quality measurement devices** and the interpretation of the collected data, while other inquiries were related to **energy management**, **energy efficiency** and **potential funding opportunities.**

The events provided participants deeper understanding of **technical**, **financial** and **practical aspects** of energy renovation and air quality monitoring. Clarifications were given regarding the functioning and interpretation of measurement devices, as well as the influence of building conditions, insulation and human behavior on the **air quality**

results. Potential causes of persistent relative humidity and elevated CO_2 concentration were explained, together with practical solutions, while participants were assured that ongoing monitoring will contribute to **individualized recommendations** and foster broader renovation planning.

The sessions also clarified the role of **renewable energy systems**, including PV panels and heat pumps, as well as the cost-saving benefits of reactive power compensator. Homeowners, landlords, tenants and building managers learned how **coordinated actions** at the community level can contribute to national energy efficiency objectives. Furthermore, financial and technical aspects of the **demonstration building** highlighted the feasibility of funding renovations through a combination of loans, grants and own resources, with eligible project documentation included in investment costs. Special emphasis was set on involving **skilled professionals** for grant applications and ensuring the quality of technical implementation.

In general, the Q&A sessions enhanced participants' knowledge of the benefits and best practices in energy renovation, air quality management and sustainable building maintenance.

Additional addressed questions from the Q&A sessions are shown in Table 8.

Table 8: Summary of the Q&A sessions in the pilot site Mazovia Voivodeship (Poland)

Country (pilot site)	Date and place	Organizers	Number of participants	Topics	Questions and discussions
Poland (Mazovia Voivodeship)	22nd May 2024, Warszawska Spółdzielnia Mieszkaniowa (Warsaw)	MAE, WSM Wawrzyszew	8	Air quality parameters	How to read the data? Why is there humidity in MABs even though it's regularly ventilated?
	23rd July 2025, Online	MAE	6	Indoor air quality	How to read the data from the air quality measurement devices? What is the solution for poor air quality in MABs?
	05th August 2025, Szczytno	MAE, WM Śląska 12	18 (4 from MAE)	Demonstration building	Do balcony solar panels power only shared building systems? Did installing reactive power compensators reduce electricity costs?
	13th August 2025, Online	MAE	54 (3 from MAE)	Energy management and efficiency measures	Which low-cost upgrades give the best results? How can their impact be tracked?
				Energy renovation	What is the current status of EPBD in the

					Polish law? How will the new rules affect the energy renovation?
				Project preparation and funding	What funding sources are available? What documents are needed? How to achieve consensus for renovation projects?

Source: Project CEESEN-BENDER, WP2: T2.3 Q&A sessions for homeowners and landlords, 2025

ROMANIA

Romania organized 4 Q&A sessions with homeowners, landlords and tenants. The covered topics were **energy renovation**, **relationship** and **communication with energy providers**, **energy efficiency** and **energy communities**. They, also included **air quality measurements** and raised questions about effective ways to control the key parameters (CO_2 concentration, relative humidity and indoor temperature).

The Q&A sessions highlighted several **critical issues** affecting MAB residents, particularly the urgent need for comprehensive renovations to address **poor insulation**, **outdated systems** and **deteriorating living conditions.** The homeowners, landlords, tenants and homeowner associations expressed concerns over the **inadequate incentives** and **financial support** from national authorities, noting that substantial investments are required to achieve improvements in energy efficiency. While **local municipalities** were recognized for their efforts, the consensus was that broader government intervention, comprehensive policies and accessible financing options are essential to empower homeowners and ensure inclusive access to renovation opportunities.

The discussions also revealed **strained relationships** between homeowners and energy providers, with dissatisfaction over **billing transparency**, **hidden costs** and **limited customer support**. The **absence of trust** further complicates efforts to manage energy consumption effectively and underlines the importance of quality communication and accountability from providers. In addition, **poor indoor air quality** was identified as a significant concern, stemming from inadequate ventilation, mold growth and high humidity, all of which pose risks to residents' health. Solutions such as integrating ventilation systems with insulation measures, employing shading systems and adopting efficient cooling technologies were emphasized as key to healthier, more sustainable living conditions. Finally, the selected **demonstration building** was presented with its main interventions such as thermal insulation of the facade and roof, as well as replacement of windows. During the site visit the main challenges and benefits were highlighted and the session ended with a presentation of the technical solutions and materials.

In conclusion, improving energy efficiency and living comfort in MABs in the Romanian pilot site requires coordinated actions among homeowners, homeowner associations, municipalities and national authorities. Stronger government support, transparent

energy practices and residents' engagement through **energy communities** are vital to ensure healthier, more efficient and sustainable housing.

Table 9 presents a summary of the main discussions from the Q&A sessions organized in Alba Iulia.

Table 9: Summary of the Q&A sessions in the pilot site Alba County (Romania)

Country (pilot site)	Date and place	Organizers	Number of participants	Topics	Questions and discussions
Romania (Alba County)	25th April 2024, University "1 decembrie 1918" (Alba Iulia)	ALEA, Municipality of Alba Iulia	13 (3 from ALEA)	Energy renovation and support from authorities	Will the government increase grants and policies for energy efficiency? What financial tools can help the homeowners in energy renovations?
	13th June 2024, Homeowners Association 15 Office (Alba Iulia)	ALEA, Municipality of Alba Iulia	12	Energy providers	What causes distrust between homeowners and energy providers? What steps could rebuild trust? How do hidden fees affect the homeowners?
				Energy efficiency investment	How can financing options be more accessible? What subsidies are needed to support renovations? How does investment level affect energy efficiency in MABs?
	15th March 2025, Homeowners Association Livezii premises (Alba Iulia)	ALEA	18 (1 from ALEA)	Air quality parameters and living conditions	What are effective ways to control relative humidity and indoor temperature in old MABs? Why is proper ventilation important?
				Energy communities and energy renovation	How can resident feedback improve renovation plans? What benefits do energy communities offer?
	11th September 2025, BI8 premises (Alba Iulia)	ALEA	10	Site visit to the demonstration building	Practical insights into the energy renovation works on the demonstration building, showcase of the construction process, technical solutions, challenges and benefits, presentation of the technical solutions

Source: Project CEESEN-BENDER, WP2: T2.3 Q&A sessions for homeowners and landlords, 2025

SLOVENIA

Slovenia organized 4 Q&A sessions for homeowners, landlords and tenants. The main topics covered were **energy renovations** of pilot buildings, **energy efficiency measures** and **cultural heritage protection** requirements.

The Q&A sessions focused on the energy renovation of the selected MABs within the Slovenian pilot site and the **development of building area roadmaps**. The topics included building prioritization, financial investment needs, expected returns in energy savings and CO_2 concentration reduction. Therefore, the key issues raised were **regulatory constraints**, **cultural heritage protection requirements**, **limited funding opportunities** and the need to engage diverse stakeholder groups (homeowners, landlords and vulnerable tenants). The discussions, also, included a review of **air quality monitoring data**, comparing unrenovated and renovated MABs, as well as identifying measures that residents can implement to enhance indoor air quality.

To address these challenges, the sessions explored several strategies. A **phased renovation** was recommended to enhance energy efficiency gradually without compromising heritage protection. **Effective communication** and **cooperation** among stakeholders were emphasized as essential for project success. Additionally, **innovative financing mechanisms** were discussed as means to secure the necessary investment and leverage available subsidies. Clarifications were provided regarding eligible renovation measures and the scope of permissible works under **cultural heritage regulations**, helping homeowners and landlords to understand both technical and financial opportunities for buildings marked as cultural heritage.

Furthermore, valuable information was shared on the presentation of the **demonstration building**, where the participants gained insights into the implemented renovation measures. These included thermal insulation of the walls and replacement of external carpentry, which contributed to the reduction of energy consumption and costs, as well as improved living comfort of the residents.

The Q&A sessions highlighted the municipality's commitment to balance renovation needs with cultural, financial and social considerations. They reinforced the dual objective of energy renovation: **enhancing living comfort** and **indoor air quality**, while **improving energy efficiency** and **reducing energy poverty** at both building and neighborhood levels. The sessions fostered a shared understanding of the challenges, solutions, best practices and supporting **informed decision-making** for ongoing and future renovation initiatives.

Finally, Table 10 shows the main information on the Q&A session organized in the Slovenian pilot site.

Table 10: Summary of the Q&A sessions in the pilot site Spodnje Podravje (Slovenia)

Country (pilot site)	Date and place	Organizers	Number of participants	Topics	Questions and discussions
Slovenia (Spodnje Podravje)	14th July 2025, Kidričevo	LEASP	5 (2 from LEASP)	Energy renovation	What energy efficiency measures are planned? How will the measures affect long-term costs?
				Cultural heritage protection	Which heritage restrictions affect renovations the most? How much can RES be integrated under heritage rules?
	23rd July 2025, Ptuj	LEASP	3 (1 from LEASP)	Energy renovation activities	Which energy-saving measures are planned? What is the timeline for renovations? Will tenants be involved in the planning of the process?
	27th August 2025, Primary school (Kidričevo)	LEASP, ENSVET	23 (2 from LEASP)	Energy renovation, financial incentives	What steps are needed to begin the energy renovation? What financial support is available? How can residents improve the air quality results?
	12th September 2025, Ptuj	LEASP	10 (2 from LEASP)	Site visit to the demonstration building	Presentation of the benefits and measures implemented on the demonstration building

Source: Project CEESEN-BENDER, WP2: T2.3 Q&A sessions for homeowners and landlords, 2025

As evident, the awareness raising activities covered various topics related to energy renovation and poverty by informing the participants about the possibilities, challenges and benefits, as well as offering support and advice during the process. Nevertheless, the theoretical knowledge and information sharing were supported by 2 practical activities, in which experience and results were collected "on field" and presented to the participants of the awareness raising activities, as examples of good and bad practices when it comes to energy renovation.

3. Air quality monitoring in the pilot buildings

It is well known that persuading homeowners, landlords and tenants to accept and start the process of energy renovation is challenging due to their different emotional states and beliefs, whereby doubts regarding the potential benefits is one of the most significant ones. An activity that may help in the communication is showing the parameters of air quality in different MABs, as well as showcase the better levels of CO_2 concentration, relative humidity and indoor temperature in renovated in comparison to unrenovated buildings. Therefore, the following subchapters cover the topic of air quality monitoring implemented in the selected pilot sites, with the results and recommendations for improvement as main focus points.

3.1. Air quality monitoring within the project CEESEN-BENDER

Apart from energy poverty, current state analysis, creation of various tools and documents, as well as awareness raising, the project CEESEN-BENDER focuses, also, on differences between unrenovated and renovated MABs in terms of building characteristics, living conditions and energy efficiency. For these purposes, one of the tasks within the project was the monitoring of air quality in several MABs in the selected pilot sites following, thereby, an equal distribution in the number of the unrenovated and renovated buildings. The main aim of the task was to analyze the current air quality in the MABs through the 3 main parameters, as well as to give an overview and compare the living conditions in unrenovated and renovated buildings.

The results of the air quality monitoring were needed to support the thesis that energy renovation can bring multiple benefits, not only for the building construction and environment, but, also, for the homeowners, landlords and tenants, who "use" the building on a daily basis and whose living conditions highly effect their health, way of life and, indirectly, level of energy costs. Furthermore, the results of the monitoring were used in other activities to better identify buildings in the greatest need for energy renovation, as well as to foster behavioral changes of the groups targeted within the awareness raising activities.

Related to the mentioned, the task of air quality monitoring was planned to be implemented as follows:

- In 5 pilot sites with selected 6 MABs per pilot site, giving 30 MABs in total
- Even distribution of MABs in the process, meaning equal number of included unrenovated and renovated MABs
- Installed 2 to 3 measurement devices per selected MAB, located in different parts of the building (with apartments being the main focus)
- Measuring air quality through 3 main parameters: CO_2 concentration, relative humidity and indoor temperature
- Measurement interval set to 15 minutes, with the option to save the data
- Measurement process carried out during 12 months to cover all seasons and conditions.

Since the "on field" conditions did not fully correspond to the ones planned within the project, the task was performed with several modifications, but still in line and following the main aim of the monitoring itself. Therefore, Table 11 presents the real conditions encountered during the implementation of air quality monitoring in the selected pilot sites.

Table 11: Air quality monitoring in the selected pilot sites

Country (pilot site)	Number of MABs	Number of measurement devices	Parameters	Measurement intervals	Duration
Croatia (Medjimurje County)	7 (4 UR, 3 R)	12 (in apartments)	CO_2 concentration, relative humidity, indoor temperature	15 minutes	12 mos. (May 2024 – April 2025)
Estonia (City of Tartu)	6 (3 UR, 3 R)	9 (in apartments)	CO_2 concentration, relative humidity, indoor temperature	30 minutes	12 mos. (June 2024 – June 2025)
Poland (Mazovia Voivodeship)	6 (3 UR, 3 R)	13 (9 in apartments and 4 in hallways)	CO_2 concentration, relative humidity, indoor temperature	10 minutes	12 mos. (May 2024 – May 2025)
Romania (Alba County)	7 (6 UR, 1 R)	15 (in apartments)	CO_2 concentration, relative humidity, indoor temperature	5 minutes	12 mos. (July 2024 – June 2025)
Slovenia (Spodnje Podravje)	6 (3 UR, 3 R)	12 (in apartments)	CO_2 concentration, relative humidity, indoor temperature	30 minutes	12 mos. (July 2024 – July 2025)

* UR = unrenovated ; R = renovated

Source: Project CEESEN-BENDER, WP2: T2.4 Air quality monitoring in pilot buildings, 2025

As evident, air quality monitoring was carried out in all 5 selected pilot sites, whereby some of them performed the task in more than the planed 6 MABs and the distribution of unrenovated and renovated buildings was not equal (due to inability to find enough homeowners, landlords and tenants interested in the activity). Furthermore, in some cases the devices were installed in more than 12 premises and the measurement was performed not only in apartments, but, also the common spaces, meaning hallways. Inside the apartments the devices were installed in rooms where the residents spend most of their time and the level of relative humidity is not high, such as living rooms, bedrooms and hallways. Also, the measurement intervals range from 5 to 30 minutes, while all pilot sites have different starting and ending dates, which is the result of certain difficulties during the procurement of adequate measurement devices.

3.2. Results of air quality monitoring in the pilot sites

The workshops and Q&A sessions were, mainly, focused on raising awareness about the possibilities of energy renovation of MABs with special emphasis on technical solutions, benefits, financing opportunities, as well as tackling energy poverty. One of the topics, also, covered, were the results of the air quality monitoring, whereby special focus was set on the critical values (anomalies) in the measured parameters and discussions about their improvement. As evident from chapter 2 and corresponding subchapters 2.1 and 2.2, 5 (out of 6) partner countries (Croatia, Estonia, Poland, Romania and Slovenia) presented the results of air quality monitoring during their awareness raising activities, fostering fruitful discussions and communication between the participants.

Furthermore, the air quality monitoring showed detailed results for each pilot site, with some expected similarities in the CO_2 concentration, relative humidity and indoor temperature during the summer and winter seasons. To gain better insights into the measured data, the following tables present the average results for all 3 parameters in the 5 pilot sites with additions of the main discussions held on the organized workshops and Q&A sessions.

Table 12: Air quality monitoring results in the pilot site Medjimurje County (Croatia)

Croatia (Medjimurje County)			
MAB	**CO_2 concentration**	**Relative Humidity**	**Indoor temperature**
Building 1 (R)	S: < 1.500 ppm W: > 2.000 ppm	S: 55 – 65 % W: 50 %	S: 25 – 27 °C W: 21 – 23 °C
Building 2 (R)	S: 500 – 700 ppm W: 1.000 – 1.200 ppm	S: 70 – 75 % W: 50 – 60 %	S: 25 – 27 °C W: 19 – 21 °C
Building 3 (UR)	S: 500 – 900 ppm W: 1.700 – 2.100 ppm	S: 50 – 65 % W: 45 – 50 %	S: 25 – 28 °C W: 20 – 26 °C
Building 4 (UR)	S: < 1.000 ppm W: > 1.700 ppm	S: 35 – 65 % W: 45 – 52 %	S: 26 – 28 °C W: 22 – 23 °C
Building 5 (UR)	S: 500 – 800 ppm W: 500 – 800 ppm	S: 55 – 66 % W: 35 – 47 %	S: 24 – 26 °C W: 18 – 22 °C
Building 6 (R)	S: 400 – 800 ppm W: 700 – 1.200 ppm	S: 48 – 71 % W: 31 – 48 %	S: 23 – 28 °C W: 19 – 23 °C
Building 7 (UR)	S: 500 - 730 ppm W: 1.100 – 1.600 ppm	S: 54 – 68 % W: 34 – 46 %	S: 26 – 28 °C W: 17 – 19 °C

* UR = unrenovated ; R = renovated ; S = summer ; W = winter

Source: Project CEESEN-BENDER, WP2: T2.4 Air quality monitoring in pilot buildings, 2025

DISCUSSION:

During the workshop and Q&A session organized on the 3rd July 2025 in Čakovec the organizers presented the results of air quality monitoring to the homeowners, landlords and tenants from the MABs included in the activity. Although the attendance was not very high, the participants started valuable discussions and shared their insights on the living conditions in the presented MABs. Thereby, the main topics addressed were the following:

- Critical values (anomalies) in the CO_2 concentration, relative humidity and indoor temperature
- Advice on how to achieve optimal and healthier levels of the measured parameters
- Unforeseen increases of the prices of materials and works before and during the energy renovation
- Experiences with the poorly implemented works during the energy renovation of MABs, whereby bad project designs with incomplete cost estimates are the main causes of inadequate measurement results in renovated buildings
- Possibilities for installing Heat Recovery Ventilation (HRV) systems in the buildings, with focus on construction conditions and funding sources
- Future plans for air quality monitoring in the MABs of the Croatian pilot site.

Table 13: Air quality monitoring results in the pilot site City of Tartu (Estonia)

Estonia (City of Tartu)			
MAB	**CO_2 concentration**	**Relative Humidity**	**Indoor temperature**
Building 1 (UR)	< 1.200 ppm	30 – 60 %, below 30 % relatively frequent	18 – 23 °C, 25 °C in some periods
Building 2 (UR)	1.500, > 2.000 ppm	30 – 60 %, below 30% occasionally	23 – 25 °C
Building 3 (UR)	< 1.200 – 1.500 ppm	30 – 60 %, below 30 % occasionally	18 – 23 °C, 27 °C in some periods
Building 4 (R)	< 1.200 ppm	30 – 60 %, occasional dryness	18 – 23 °C, 25 °C in some periods
Building 5 (R)	< 1.200 ppm	30 – 60 %, below 30 % occasionally	18 – 23 °C, limited overheating
Building 6 (R)	< 1.200 – 1.500 ppm	30 – 60 %, occasional dryness	18 – 23 °C, limited overheating

* UR = unrenovated ; R = renovated

Source: Project CEESEN-BENDER, WP2: T2.4 Air quality monitoring in pilot buildings, 2025

DISCUSSION:

The air quality monitoring was a significant part of the workshop held on the 2nd September 2025 in Tartu. Here the importance of healthy indoor air quality and climate was shared together with information about other activities relevant for the energy renovation of MABs. These included:

- Comparison between air quality in unrenovated and renovated MABs
- Benefits of a comprehensive step – by – step approach during energy renovation
- Importance of regular audits and energy certificates as preparatory activities
- Building roadmaps with the current conditions, budgets and funding options
- Possible study visit to a renovated MAB in case the participants show interest.

Table 14: Air quality monitoring results in the pilot site Mazovia Voivodeship (Poland)

Poland (Mazovia Voivodeship)			
MAB	**CO_2 concentration**	**Relative Humidity**	**Indoor temperature**
Building 1 (UR)	420 – 1.600 ppm	17 – 65 %	S: 24 – 31 °C, W: 17 – 21 °C
Building 2 (UR)	400 – 1.600 ppm	20 – 70 %	S: 22 – 27 °C W: 14 – 21 °C
Building 3 (UR)	400 – 2.500 ppm	15 – 66 %	S: 22 – 28 °C W: 14 – 22 °C
Building 4 (R)	400 – 1.600 ppm	25 – 62 %	S: 23 – 29 °C W: 16 – 22 °C
Building 5 (R)	450 – 1.600 ppm	22 – 66 %	S: 19 – 26 °C W: 17 – 22 °C
Building 6 (R)	450 – 2.000 ppm	16 – 63 %	S: 22 – 30 °C W: 18 – 22 °C

* UR = unrenovated ; R = renovated ; S = summer ; W = winter

Source: Project CEESEN-BENDER, WP2: T2.4 Air quality monitoring in pilot buildings, 2025

DISCUSSION:

On the 2 workshops, whereby the first one was organized on the 16th July 2025 and the second one together with a Q&A session on the 23rd July 2025, the results of the air quality monitoring were presented. The participants were informed about the number of installed devices, parameters and measurement intervals. After highlighting the main findings in terms of oscillations in the CO_2 concentration, relative humidity and indoor temperature, organizers linked the results to human behavior, indoor comfort and health issues. Further discussions were related to the following:

- Possibility to access and read the measured data in the MABs
- Concerns about high CO_2 concentration and relative humidity, despite regular ventilation of rooms
- Clarifications on how building conditions, insulation and human behavior influence the end results of the monitoring
- Advice on tackling the issues with poor air quality, offering guidance for challenges related to ventilation, heating and energy costs
- Reassurance that continuous air quality monitoring will ensure broader energy renovation planning.

Table 15: Air quality monitoring results in the pilot site Alba County (Romania)

Romania (Alba County)			
MAB	**CO_2 concentration**	**Relative Humidity**	**Indoor temperature**
Building 1 (UR)	2.000 – 2.500 ppm	Average values	S: 28,3 °C W: 24,6 °C
Building 2 (UR)	2.000 ppm	Average values	S: 26,7 °C W: 20,1 °C
Building 3 (UR)	>/= 2.000 ppm	Higher than average	S: 27,6 °C W: 20,7 °C
Building 4 (UR)	Average values	Higher than average	S: 28,3 °C W: 21 °C
Building 5 (UR)	Average values	50 %	S: 28,1 °C W: 22,3 °C
Building 6 (UR)	Average to higher values (3.000 – 4.000 ppm in W)	60 – 70 %	S: 29 °C W: 22,3 °C
Building 7 (R)	Average to higher values (5.000 ppm)	Average values	S: 28,3 °C W: 23,5 °C

* UR = unrenovated ; R = renovated ; S = summer ; W = winter

Source: Project CEESEN-BENDER, WP2: T2.4 Air quality monitoring in pilot buildings, 2025

DISCUSSION:

The results of air quality monitoring in the Romanian pilot site were presented on the awareness raising event organized on the 20th August 2025 in the headquarters of a local homeowner association. During the event key findings from the monitoring activity were shared and comparative data from unrenovated and renovated MABs presented to the participants. Thereby, accompanying discussions covered the following topics:

- The measured data in renovated MABs showed improvements of living comfort with more stable indoor temperature and cleaner air than in unrenovated MABs
- Elevated CO_2 concentration was recorded, mainly, in unrenovated MABs
- Presented a clear link between poor air quality and more frequent health issues, as well as inadequate living conditions
- Announced site visit to a renovated MAB with the opportunity to directly observe the energy renovation works and understand the applied solutions.

Table 16: Air quality monitoring results in the pilot site Spodnje Podravje (Slovenia)

Slovenia (Spodnje Podravje)			
MAB	**CO_2 concentration**	**Relative Humidity**	**Indoor temperature**
Building 1 (UR)	S: < 1.000 ppm W: 1.500 ppm	40 – 70 %	20 – 30 °C
Building 2 (UR)	1.500 – 3.000 ppm	30 – 60 %	20 – 30 °C
Building 3 (UR)	700 – > 2.000 ppm	30 – 70 %	20 – 30 °C
Building 4 (R)	500 – 1.200 ppm	20 – 70 %	24 – 25 °C
Building 5 (R)	500 – 2.000 ppm	30 – 70 %	15 – 26 °C
Building 6 (R)	500 – 1.500 ppm	40 – 60 %	20 – 27 °C

* UR = unrenovated ; R = renovated ; S = summer ; W = winter

Source: Project CEESEN-BENDER, WP2: T2.4 Air quality monitoring in pilot buildings, 2025

DISCUSSION:

The Slovenian project partner presented the results of air quality monitoring on the 27th August 2025 in Kidričevo and on the 28th August 2025 online. Both presentations included information about the results of monitoring carried out in the pilot site Ptuj. Thereby, the main focus of the discussions was set on the following:

- Differences in the measured data of unrenovated and renovated MABs
- Participants' engagement in the improvement of the measured parameters
- Energy renovation as a possible solution for poor air quality in MABs
- Eligible renovation measures and funding solutions in cases of starting the energy renovation
- Offered possibilities for experts' home visits, with focus on energy poor households for advice and consultations.

The presented data and discussions indicate that the air quality in the selected pilot sites ranges from good to unhealthy depending on the season outside and human behavior inside the buildings. Therefore, in addition to the presentation of the measured results, during the workshops and Q&A sessions guidelines for the long-term improvement of air quality and the rational use of energy were provided to participating homeowners, landlords and tenants.

3.3. Recommendations for improvement

Air quality is one of the most significant factors in maintaining a comfortable and healthy lifestyle. It has great influence on the physical, psychological and mental states of people, causing changes in their thoughts, actions and behavior. Depending on the season, weather and temperature conditions outside, people spend more or less time in their buildings performing various activities which have great impact on the indoor air

quality. To ensure healthy living conditions and, indirectly, lower energy costs, homeowners, landlords and tenants can follow certain steps, advice and suggestions, out of which the most effective ones are provided below.

CO_2 CONCENTRATION

1. **Air exchange and ventilation**
   - In rooms with large fluctuation of people and located heating devices
   - Manual ventilation by widely opening windows on opposite sides of the rooms, several times a day for 5 – 10 minutes
   - Frequently during winter seasons when the rooms are heated
   - Automated ventilation with possible Heat Recovery Ventilation (HRV) systems

2. **Heating and cooling (HC) systems and devices**
   - Installation of energy efficient HC systems and devices (possibly RES based)
   - Service HC systems and devices to ensure optimal performance

3. **Electricity**
   - Replacement of old bulbs with LED lightning
   - Use of energy efficient appliances rated with energy efficiency class "A" and above
   - Turning of appliances when out of use.

RELATIVE HUMIDITY

1. **Relative humidity levels**
   - Regular checks, especially in heating seasons

2. **Humidifiers and dehumidifiers**
   - Use of humidifying devices during heating seasons and dry climates
   - Use of dehumidifying devices in rooms with high relative humidity such as basements, bathrooms, kitchens

3. **Ventilation**
   - Regular ventilation of rooms, especially bathrooms and kitchens, as well as during drying clothes indoors

4. **Heating and cooling (HC) control**
   - Maintain balanced heating and cooling temperature as excessive heat dries the air, while too much cooling increases humidity

5. **Houseplants**
   - Rational amount of house plants to maintain the natural moisture of the rooms.

INDOOR TEMPERATURE

1. **Temperature control**
    - Set the indoor temperature to 20 – 22 °C during winter and 24 – 26 °C during summer
    - Thermostats for automatic temperature adjustments
    - Reducing heating and cooling when leaving the premises and during the night

2. **Maintaining natural temperature**
    - Use curtains or blinds to keep the natural heat inside during winter and outside during summer seasons
    - Use outdoor blinds or sunshades to effectively manage solar heat entering indoor spaces
    - Use curtains or blinds for preventing the rooms from overheating in summer seasons and during cooling

3. **Insulation of the building envelope**
    - Thermal insulation of the walls and roofs, as well as replacement of windows and doors for a better temperature control.

As mentioned, maintaining healthy levels of air quality can be achieved through different methods depending on the renovation level of the buildings, whereby increasing energy efficiency is important for unrenovated and changes in human behavior for renovated MABs. Nevertheless, starting the energy renovation process and continuous maintenance of the energy efficiency technical systems is crucial for ensuring long-term positive health and living conditions.

4. Overview of the selected demonstration building(s)

In addition to the air quality monitoring implemented in the selected pilot sites, one more "on field" activity was the selection of renovated MABs, which served as demonstration and model buildings for a better understanding of the energy renovation process in certain partner countries. These buildings were selected taking into account various criteria out of which the renovation level and type were the most significant ones. Related to the mentioned, the next subchapters briefly present different demonstration buildings from the selected pilot sites, as well as their benefits and main challenges tackled during the energy renovation process.

4.1. Good practices from the pilot sites

Apart from analyzing the features of unrenovated MABs, each pilot site selected and provided information on 5 demonstration buildings, which best represent the measures, benefits and results of the energy renovation. As the demonstration buildings needed to have similar or same characteristics as the unrenovated MABs included in the project, the overall aim was to present the renovation process, outcomes and benefits, as well as obstacles faced before and during the renovation which can be overall replicated. Furthermore, the idea was to demonstrate the homeowners, landlords and tenants various technical solutions and approaches implemented, not only to improve the performance of the buildings, but also to increase the living comfort and tackle energy poverty.

To gain a better insight into the characteristics of the selected demonstration buildings, their general information and implemented renovation measures are summarized in the table below.

Table 17: Demonstration buildings in the selected pilot sites

Croatia (Medjimurje County)				
Year of construction	**Gross building area (GBA)**	**Number of floors and apartments with average area**	**Energy data**	**Energy efficiency class**
1970	4.134,49 m^2	F = 3 A = 49 (57 with business premises) AAA = 57 m^2	Individual heating system based on natural gas, electricity	B
Renovation measures: Insulation of the envelope (outside walls, roof, floor and ceiling), replacement of external carpentry (windows and doors), modernization of indoor lighting, green roof				
Estonia (City of Tartu)				
Year of construction	**Gross building area (GBA)**	**Number of floors and apartments with average area**	**Energy data**	**Energy efficiency class**
1964	1.776,40 m^2	F = 4 A = 32	District heating based on biomass,	A

		AAA = 42,30 m²	natural gas, electricity	
Renovation measures: Insulation of the envelope (outside walls, roof, floor), replacement of external carpentry (windows and doors), modernization of indoor lighting, installed PV plant, district heating for water and space heating				
Poland (Mazovia Voivodeship)				
Year of construction	**Gross building area (GBA)**	**Number of floors and apartments with average area**	**Energy data**	**Energy efficiency class**
1974	1.907,52 m²	F = 4 A = 40 AAA = 46,66 m²	Radiator system povered by heat pump, electricity	/
Renovation measures: Insulation of the envelope (outside walls, roof, ceiling), replacement of external carpentry (windows and doors), replacement of stairwells, installation of heat pumps, solar and PV plants, modernization of indoor lighting				
Romania (Alba County)				
Year of construction	**Gross building area (GBA)**	**Number of floors and apartments with average area**	**Energy data**	**Energy efficiency class**
1978	5.215 m²	F = 4 A = 64 AAA = 70 m²	Individual heating system, electricity	A
Renovation measures: Insulation of the envelope (outside walls, roof, attic, foundation), replacement of external carpentry (windows and doors)				
Slovenia (Spodnje Podravje)				
Year of construction	**Gross building area (GBA)**	**Number of floors and apartments with average area**	**Energy data**	**Energy efficiency class**
1989	5.798,20 m²	F = 8 A = 64 AAA = 56,80 m²	District heating, wooden biomass and natural gass	/
Renovation measures: Insulation of the envelope (outside walls,), replacement of external carpentry (windows and doors)				

* F = floor(s) ; A = apartment(s) ; AAA = average apartment area(s)

Source: Project CEESEN-BENDER, WP2: T2.5 Identifying renovated demonstration building(s), 2025

The presented demonstration buildings were used as supporting methods on the organized workshops and Q&A sessions aimed, mainly, to foster a deeper and practice-based communication among the participants. The overall idea was to present "on field" measures implemented within the energy renovation, as well as to discuss their functionalities and benefits for the buildings and their residents.

To showcase the implemented measures and their performances in practice, several site visits for homeowners, landlords and tenants were organized within the awareness

raising events. Thereby, the most used forms of presentation were classical workshops and Q&A sessions, supplemented with interviews with the building representatives, "before" and "after" poster displays, as well as demonstrations of the energy efficient technical systems and solutions.

Apart from the mentioned, an international study visit was organized between Estonia and Croatia, with the Estonian delegation consisting of building managers, consultants and decision makers visiting the city of Zagreb and the town of Gospić in Croatia and gaining new knowledge about energy poverty and renovation measures in this country. Furthermore, the participants had the opportunity to exchange knowledge about environmental strategies, installation of PV plants on public buildings and practical approaches in tackling energy poverty, fostering, thereby, cooperation and capacity building.

In addition to presenting the results of energy renovation to the participants, the organized site visits were an opportunity to exchange experiences and gather into discussions about various topics related to the renovation itself. Here, the mostly addressed questions from participants were related to funding opportunities for project designs and works in the forms of grants, subsidies, bank loans, private capital and building reserves, the importance of selecting reliable technical staff and supporting organizations which continuously monitor the renovation process, as well as possible technical solutions which could be installed into the buildings. Furthermore, communication issues with the other building residents were recognized as one of the main hindering points when speaking about energy renovation. Finally, quality and timely collaboration between the building managers (or homeowner associations) and homeowners, landlords and tenants was highlighted as the main step in the energy renovation process, which helps to tackle challenges such as unprofessional staff, price increases, uninterested residents and, indirectly, energy poverty.

4.2. Challenges tackled

Although energy renovation of MABs is a complex process which implies a variety of challenges and obstacles, it cannot be denied that it brings significant benefits for the buildings, their residents and the environment. These were presented in detail during the site visits to the selected demonstration buildings in order for the participants to gain better insights and motivation while considering the energy renovation of their buildings.

As elaborated many times, energy renovation presents a higher level of efficiency by improving the characteristics, performances and systems of the buildings ensuring, thereby long-lasting benefits for the society. Related to the mentioned, after undergoing the renovation process the demonstration buildings ended up being more energy efficient, having stronger and more resistant constructions, better insulation and improved aesthetics. Also, the improvement of their internal technical systems resulted with high and environmentally friendly performances, decreased CO_2 concentration and better waste management. The rational use of appliances and energy in general was achieved through various RES based systems such as PV plants and heat pumps, which directly resulted in lower energy consumption and costs for the residents. The

demonstration buildings recorded, also, improvements of the living conditions with better air quality (in terms of lower CO_2 concentration, moderate relative humidity and consistent indoor temperature), less or no mold, fresh odors and visually larger spaces. In such conditions the residents experience more motivation, concentrate easily, have more energy and are less prone to diseases. The overall living comfort was increased, also, due to better aesthetics of the buildings, which present models for fostering the energy renovation of the neighborhoods there are located in.

Apart from the overall satisfaction of the residents, demonstration buildings recorded very few or no data about energy poverty and vulnerable households. Also, the involvement and importance of the building managers (or homeowners associations) during the renovation process resulted in better communication with the residents and more mutual trust.

Finally, the organized site visits to demonstration buildings were a unique opportunity for homeowners, landlords and tenants to combine the theoretical knowledge and practical experience, showing that the energy renovation can be a long-lasting, exhausting and expensive process, which ultimately has many positive effects. Through different discussions and questions, they gained more information about the living conditions in renovated buildings and, hopefully, are now more motivated to tackle the negative energy, environmental, health and cost impacts of their unrenovated MABs.

From all of the mentioned above it can be concluded that awareness-raising is a crucial part of the energy renovation. It can be considered as one of the first steps to a deeper understanding of the process itself and lead to more effective and successful results for all involved stakeholders. As summarized in this document, some of the main ways and methods to foster better communication are workshops for sharing information and Q&A sessions for discussing the main issues and doubts of the participants. Nevertheless, these 2 main activities can be combined with more practical forms of collaboration such as trainings, site visits to demonstration buildings, experts' home visits (with emphasis on energy poor and vulnerable households), as well as interviews with people who have undergone the energy renovation process and can share their experience.

The effectiveness of these methods has been proven by the 5 (out of 6) partner countries of the project CEESEN-BENDER (Croatia, Estonia, Poland, Romania and Slovenia), whereby they served their organizers as a way to share information about the various steps and characteristics of the energy renovation, as well as help the participants to open up about their doubts, issues and experience with both positive and negative outcomes of the process. Therefore, the awareness-raising methods described in this document, as well as the topics, discussions and results are recommended to be used in future initiatives with the aim of motivating the various stakeholders for considering the energy renovation as a crucial step for a better quality of life.

5. Conclusion

Human perspectives are often one of the main obstacles when it comes to major investments and projects, especially when speaking about the energy renovation of MABs. Lack of quality information and experience, emotional states and doubts on the side of the homeowners, landlords and tenants, as well as inadequate communication and support from the managing authorities (building managers, homeowner associations), lead to the inability to start the modernization and hinder improvements in energy efficiency and sustainability of the building stock. In order to foster joint collaboration, it is important to provide timely information about all aspects of the energy renovation to both the "supply" and "demand" sides of the process.

One of the methods used for increasing interest and motivation is awareness raising in forms of workshops, Q&A sessions, interviews, peer – to – peer learning, site visits and many others. Such activities have proven to be an effective tool in the pilot sites of the project CEESEN-BENDER, where 5 (out of 6) partner countries (Croatia, Estonia, Poland, Romania and Slovenia) used them to gather the most relevant stakeholders and present different topics, information and results in order to raise interest and break the existing prejudices about the energy renovation. Various discussions about the steps, technical solutions, funding opportunities, challenges and benefits helped the involved stakeholders to understand the long-term effects of the energy renovation on their buildings, living comfort and environment. Special emphasis was given to the topic of tackling energy poverty and supporting vulnerable households, which is an emerging issue in the countries of the Central and Eastern Europe.

Apart from the mentioned, to deepen the theoretical information sharing and discussions, the awareness raising events included 2 crucial topics – air quality monitoring and demonstration buildings. Being based on the "on field" results and experience gathered during the project CEESEN-BENDER, both topics helped to expand the knowledge of the stakeholders (mainly, homeowners, landlords and tenants) about the various benefits the energy renovation brings them. Here, better air quality with lower CO_2 concentration, manageable relative humidity and optimal indoor temperature were highlighted as a way to improve health, ensure comfortable living conditions and increase physical and psychological well-being of the residents. Furthermore, experience sharing with the representatives from the demonstration buildings helped in mitigating information gaps of the involved stakeholders, as well as raised motivation for improving not only the buildings' characteristics, but also their lifestyles, management of energy costs and the environment.

Finally, awareness raising is very often used as a method to foster collaboration and help in the communication between different stakeholders. Here, the participating homeowners, landlords and tenants, but also the building authorities (building managers, homeowner associations) used the opportunity to gain trust and deepen their relationships through mutual understanding, problem solving and support. Therefore, as this document covers the practical insights and "on field" experience, it can serve as a guideline document for fostering better communication between the different stakeholders involved into the energy renovation of MABs.

References

1. Project CEESEN-BENDER, WP2: T2.2 Awareness raising for homeowners and landlords, as well as building managers, T2.3 Q&A sessions for homeowners and landlords, T2.4 Air quality monitoring in pilot buildings, T2.5 Identifying renovated demonstration building(s)

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