CEESEN-BENDER

Building intErventions in vulNerable Districts against Energy poveRty

Deliverable 5.3

Report on building – level renovation roadmaps in 5 pilot regions

Renovation roadmaps and investment strategies for buildings in the pilot region Wawrzyszew Pilot Area, Warsaw (Poland)

- Summary -

Dissemination Level: Public

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

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CENTRAL & EASTERN EUROPEAN SUSTAINABLE ENERGY NETWORK
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Building – level renovation roadmaps and investment strategies for pilot multiapartment buildings in Wawrzyszew Pilot Area, Warsaw (Poland)

The six pilot buildings assessed within the CEESEN-BENDER project represent typical multi-family residential buildings located in both Warsaw and the rest of the country. Although they differ in size, construction period and previous renovation history, they share similar technical and operational challenges typical of post-war residential buildings.

The building assessments combined:

- Technical analyses,
- Indoor environmental quality (IEQ) monitoring,
- Resident consultations,
- Advisory visits,
- And, where available, Energy performance assessments.

The monitoring campaign (May 2024 – May 2025) evaluated indoor temperature, relative humidity and CO_2 concentration in apartments and common areas, providing valuable information on both building performance and occupants' comfort.

Main findings

1. Summer overheating

All monitored buildings experienced overheating during summer.

Apartment temperatures frequently reached 25–29°C, while temperatures in common areas often exceeded even 30°C. Although winter thermal conditions were generally acceptable, summer overheating significantly reduced occupants' comfort and is expected to become an increasing problem due to climate change.

2. Indoor air quality requires improvement

The most consistent issue identified across all pilot buildings was insufficient ventilation inside apartments.

Measured CO_2 concentrations regularly exceeded recommended indoor air quality limits:

- Sokratesa 2B – up to 1,900 ppm
- Wolumen 6 – over 3,000 ppm
- Wolumen 4 – nearly 3,000 ppm
- Szekspira 4 – approximately 1,600–1,700 ppm
- Reymonta 23 – approximately 1,500–1,800 ppm
- Petöfiego 1 – approximately 2,000 ppm

In contrast, CO_2 levels in common areas generally remained within acceptable ranges, indicating that ventilation deficiencies mainly occur inside occupied apartments rather than in shared spaces.

3. Indoor humidity remains generally acceptable but decreases during winter

Relative humidity inside apartments was usually within a comfortable range.

However, common areas frequently experienced very low humidity during the heating season, occasionally dropping below 20%, which may reduce occupants' comfort and negatively affect indoor environmental quality.

4. Previous thermal retrofits improved Energy performance but further optimisation is needed

Several buildings had already undergone comprehensive thermal renovation, including:

- Roof insulation,
- Facade insulation,
- Building envelope imrpovements.

These measures significantly reduced heat losses.

Nevertheless, the analyses showed that additional improvements are still possible, particularly through:

- Ventilation improvements,
- Renewable energy integration,
- Better energy management,
- Optimisation of technical systems.

Buildings that had already been renovated now require optimisation rather than another full-scale thermal retrofit.

Building observations

1. Sokratesa 2B

The building demonstrates good overall technical condition but suffers from:

- Elevated CO_2 concentrations,
- Roof leakage and local moisture problems reported by residents,
- Overheating during summer.

A photovoltaic installation (16.84 kWp) has been technically designed and represents one of the most economically attractive investments identified within the project.

2. Wolumen 6

The largest challenges include:

- The highest recorded CO_2 concentrations,

- Poor air circulation,
- Mould and excessive indoor humidity reported during advisory visits,
- Overheating during summer.

A 24.57 kWp photovoltaic system has been designed for the building and is expected to substantially reduce electricity costs for common areas.

3. Wolumen 4

The monitoring confirmed:

- Recurring overheating,
- Insufficient ventilation,
- Extremely high CO_2 concentrations,
- Very low humidity in common areas during winter.

A 12.74 kWp rooftop photovoltaic installation has been proposed as the first stage of further energy improvements.

4. Szekspira 4

This building has already undergone major thermal modernisation.

The remaining priorities concern:

- Maintaining the achieved energy performance,
- Improving ventilation,
- Reducing overheating,
- Expanding the existing photovoltaic installation,
- Improving operation and maintenance of technical systems.

5. Reymonta 23

Previous renovation significantly improved energy performance.

Further improvements should focus on:

- Optimasation of technical installations,
- Ventilation efficiency,
- Mitigation of overheating,
- Expansion of renewable energy systems,
- Implementation of smart energy management solutions.

6. Petofiego 1

The building is also thermally renovated and performs relatively well.

Remaining issues include:

- Elevated CO_2 concentrations,
- Overheating in common areas,
- Low winter humidity,
- Opportunities for further optimisation of ventilation and technical systems.

The building no longer requires major structural renovation but rather operational improvements and continuous optimisation.

Common recommendations and overall conclusions

Based on the analyses performed across all six pilot buildings, the following actions are recommended.

- Improve ventilation;
- Reduce overheating;
- Continue improving energy efficiency;
- Expand renewable energy use;
- Apply a staged renovation approach.

The six pilot buildings demonstrate that improving indoor environmental quality should receive the same attention as energy efficiency during renovation planning. While previous thermal retrofits have successfully reduced heat losses in several buildings, monitoring revealed persistent issues related to ventilation, overheating and indoor comfort. Future renovation programmes should therefore combine energy efficiency measures with climate adaptation, indoor air quality improvements and renewable energy deployment. An integrated, staged renovation strategy will maximise environmental, economic and social benefits while improving residents' quality of life across the Wawrzyszew pilot area.

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