OUR-CEE
Overcoming Underperforming Renovations in Central and Eastern Europe

Supported by:
Federal Ministry for Economic Affairs and Climate Action
on the basis of a decision by the German Bundestag
European Climate Initiative EUKI

Renovation Roadmap

For the Raciechowice Commune Office Building

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Regional Energy Agency North
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1. Basic information

Building name*[1]: Raciechowice Commune Office Building

Address: Raciechowice 277, 32-415

Building type*: Public utility building – other

Year of construction*: 1995

Usable area*: 453 m^2

Construction type: Traditional brick construction

Number of storeys: 2

Is the building a monument? No

Building Usage Schedule*: The building is used on Mondays, Tuesdays, and Thursdays from 7:30 AM to 3:30 PM; on Wednesdays from 7:30 AM to 5:00 PM; and on Fridays from 7:30 AM to 2:00 PM.

Additionally, meetings or conferences are occasionally held in this building.

In the evenings, the building is cleaned until 7:00 PM.

[1] The symbol * indicates, that the specific data is required for the preparation of the document.

Additional informations:

The building features a traditional construction with brick external partitions equipped with thermal insulation, which, however, does not meet the current requirements specified in the Regulation of the Minister of Infrastructure regarding thermal transmittance. Consequently, these partitions will not be analyzed for further insulation. The ceiling above the basement has insufficient thermal insulation, but its modernization is limited due to the floor height. The roof is not intended for modernization.

Both the windows and external doors have a heat transfer coefficient of U=1.6 and do not meet the current technical standards. Additionally, they are in poor technical condition, exhibiting leaks through, which results in heat losses. This provides a basis for their replacement as part of the thermomodernization measures.

The building's heating system is based on a central heating installation with a bottom distribution, powered by a local boiler room with a De Dietrich MCR3 gas boiler with a capacity of 30/35 kW. The heating system uses glycol as the heat transfer medium, and heat is supplied via steel radiators. Pipes in unheated areas are insulated. Although the overall condition of the system is rated as good, the installation is partially uninsulated and may require improvements to enhance energy efficiency

Domestic hot water is also produced by the De Dietrich MCR3 gas boiler, but its modernization is currently planned, with a transition to a heat pump supply. The annual DHW consumption is 236 m^3, and there is one draw-off point in the building.

Ventilation is carried out mechanically, without the use of a heat recovery system, which means there is no heat recovery from the exhaust air. Thermal comfort in summer is provided by an air conditioning system – air conditioners are installed in each office and in the meeting room. The air conditioning serves a comfort function and is mainly used in the summer to lower the temperature in the rooms.

The building also has an energy management system that allows for temperature control in individual rooms, which supports more efficient energy use and improves user comfort.

2. Current state of building (energy data)

Energy sources used in the building:

Traditional energy sources					
sing.	Type of energy source*	Power [kW]	Annual fuel consumption* (with unit)	Launch year	Demand for final energy* [kWh/(m²·year)]
1	Oil-fired boiler	127	2 532,27 kg	1996	66,83
2	Air-to-water heat pump	34	8 819,91 kWh	2020	19,47
Renewable energy sources					
sing.	Type of energy source*	Power [kW]	Annual production* (with unit)	Launch year	Share of annual final energy demand* [%]
1	PV system	18,29	21 000 kWh	2020	25,31
2	Air-to-water heat pump	34	14 111,85 kWh	2020	6,25

Energy demand of the building:

Annual Primary Energy Demand Index **EP***	248,43	kWh/(m²·year)
Building Energy Class (according to the draft regulation on this matter)	E	
Annual Final Energy Demand Index **EK**	136,8	kWh/(m²·year)
Annual Useful Energy Demand Index **EU**	77,49	kWh/(m²·year)
Specific CO_2 Emission Value*	0,06444	t CO_2/(m²·year)

Energy bills*:

Energy carrier	Consumption amount (with unit)	Total cost [PLN]	Settlement period
Heating oil	2 532,27 kg	14 935 zł	2024
Electricity (heat pump)	8 819,91 kWh	8 335 zł	2024

Assessment of the building's renovation potential

The Raciechowice Commune Office Building is characterized by high primary energy consumption – the EP before modernization is 248.43 kWh/m²·year, which significantly exceeds the reference level. Structural elements (windows, doors) do not meet current technical requirements, and the efficiency of the heating and DHW systems needs improvement. Thanks to the planned measures, it is possible to reduce the final energy demand by over 20% and limit CO_2 emissions by over 15%, which indicates a significant modernization potential.

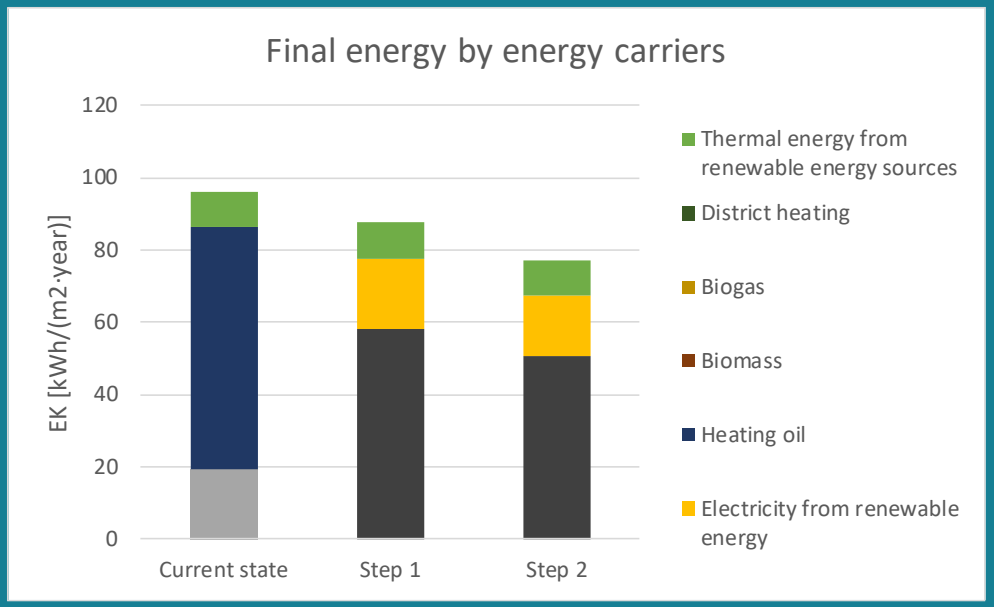
Description of renovations carried out in the building in the past*:

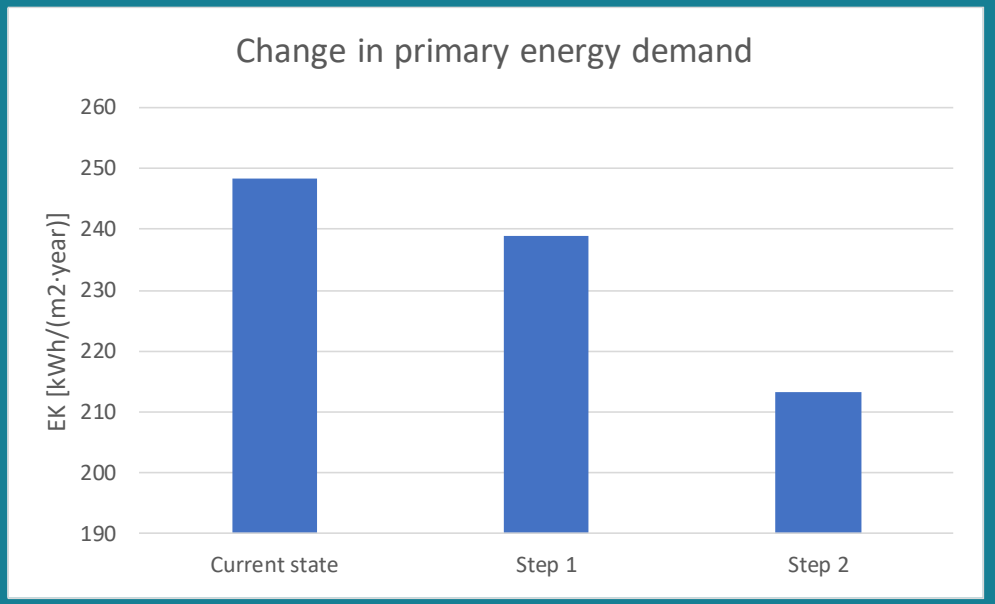
sing.	Description of the completed modernization	Funding sources	Year
1	Installation of PV system	Funds from the Raciechowice Commune budget	2020
2	Installation of a air-source heat pump	Funds from the Raciechowice Commune budget	2020

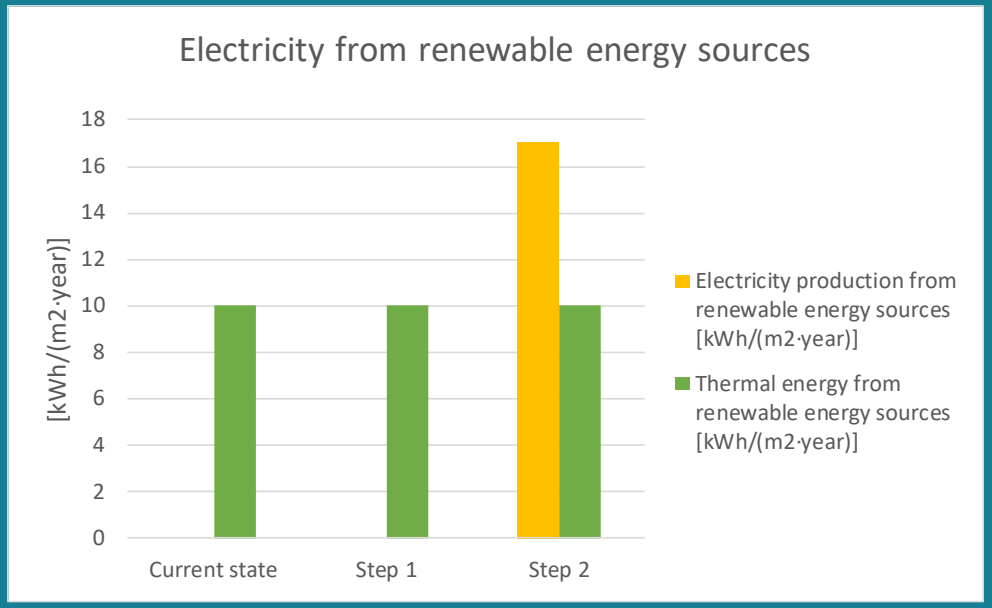
3. Renovation plan

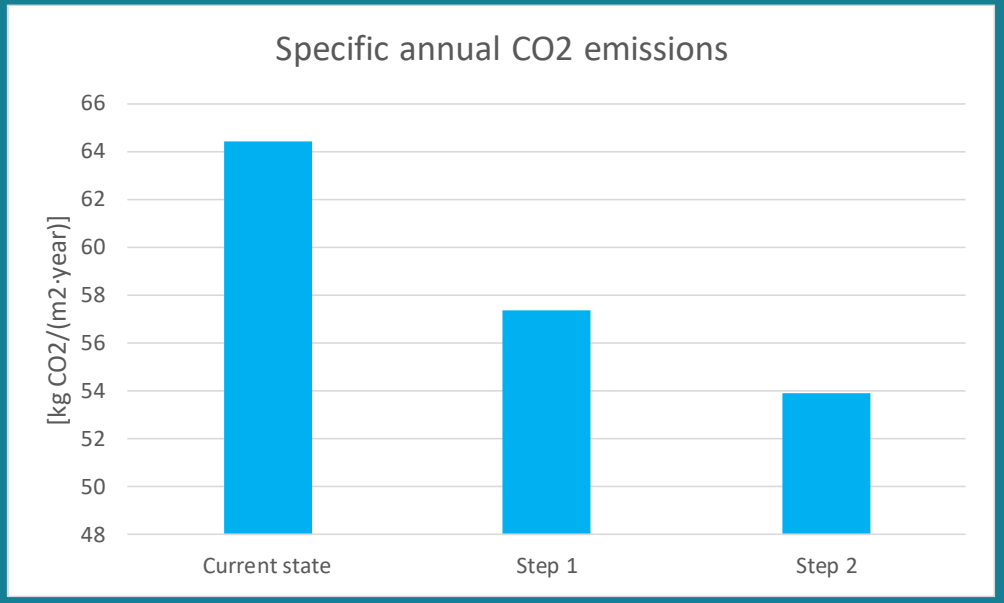
	Planned implementation date	Description of planned actions	Building parameters after the implementation of planned actions			Cost pf planned actions
			Energy Class[2]	Energy consumption	Reduction of CO_2 emissions	
Step 1	2025	Modernization of the heat source (replacement of the oil boiler with a condensing gas boiler along with adaptation of the CH and DHW installations)	G	238,90 kWh/(m2·year)	3,20 t CO_2	43 665 PLN
Step 2	2026	Replacement of window and door joinery	G	213,38 kWh/(m2·year)	1,56 t CO_2	175 275 PLN
Step 3	2026	Implementation of a certified energy management system according to ISO 50001	G	n/a	n/a	30 000 PLN

[2] Energy classes based on Załącznik 1 to the draft regulation of the Minister of Development and Technology on the methodology for determining the energy performance of a building or part of a building, as well as energy performance certificates, as set out in the draft regulation (LINK, pages 70-72)


Final energy by energy carriers
120
100
80
60
40
20
0
EK [kWh/(m2·year)]
Current state
Step 1
Step 2
Thermal energy from renewable energy sources
District heating
Biogas
Biomass
Heating oil
Electricity from renewable energy


Change in primary energy demand
260
250
240
230
220
210
200
190
EK [kWh/(m2·year)]
Current state
Step 1
Step 2


Electricity from renewable energy sources
18
16
14
12
10
8
6
4
2
0
[kWh/(m2·year)]
Current state
Step 1
Step 2
Electricity production from renewable energy sources [kWh/(m2·year)]
Thermal energy from renewable energy sources [kWh/(m2·year)]


Specific annual CO2 emissions
66
64
62
60
58
56
54
52
50
48
[kg CO2/(m2·year)]
Current state
Step 1
Step 2

4. Description of renovation steps

4.1. Step 1

Replacing the outdated oil boiler with a modern condensing gas boiler, along with the modernization of the central heating (CH) and domestic hot water (DHW) systems, will improve the efficiency of the heating system and reduce CO_2 emissions and heating costs.

4.1.1. Step 1: Modernization of the peak heat source

Planned date of action implementation*:	**2025**
Description of action implementation*:	Modernization of the heat source (replacement of the oil boiler with a condensing gas boiler along with adaptation of the CH and DHW installations)
Required materials and their technical specifications*:	To implement the planned thermomodernization improvements, the following materials and equipment, meeting specific technical requirements, will be necessary: A **condensing gas boiler** with an energy class of A++ and the dismantling of the existing source. Additionally: Necessary fittings and accessories required for the proper integration of the device with the central heating (CH) and domestic hot water (DHW) systems.
Investments costs*:	43 665 PLN
Maintenance costs*:	Annual boiler inspections required by law
Required procedures, permits, agreements*:	**Adapting the central heating (CH) and domestic hot water (DHW) systems to the requirements of the new heat source.** **Performing hydraulic balancing** to ensure efficient and even heat distribution throughout the building
Addditional information:	

4.1.2. Notes on the implementation of Step 1 activities

Total cost of planned activities*: 43 665 PLN

Possible sources of financing*:

As part of **Step 1**, planned for 2025, the modernization of the peak heat source will be carried out – the replacement of the oil boiler with a gas condensing boiler, along with the adaptation of the central heating (CH) and domestic hot water (DHW) systems. The investment cost amounts to 43 665 PLN. The planned sources of funding are: the Raciechowice Commune's own funds in the amount of 15 000 PLN and an investment loan of 28 665 PLN. Additionally, it is possible to apply for external funds, such as grants from the FEnIKS Programme (e.g., FENX.02.03 Energy efficiency in public buildings), national programs supporting the replacement of heat sources (e.g., "Ciepłownictwo Powiatowe") and preferential loans from the WFOŚiGW (Voivodeship Fund for Environmental Protection and Water Management).

Description of the procedure for monitoring the results of implemented actions*:

The system for monitoring energy effects in the building will be adapted to the subsequent stages of modernization, taking into account available tools and data.

After **Step 1** (heat source modernization), monitoring will include:

1. Registration of natural gas consumption and electricity consumption by the heat pump.
2. Comparison of annual final energy (EK) consumption and heating costs with data from previous years.
3. Service documentation and operating parameters of the new boiler.

Additional benefits associated with the implementation of the planned modernizations*:

- Reduction of heating and DHW preparation costs by over 9 000 PLN per year.
- Increased energy efficiency of systems and reduced failure rates.

The environmental impact associated with the implementation of the planned modernizations*:

As a result of replacing the oil boiler with a condensing gas boiler and adapting the central heating (CH) and domestic hot water (DHW) systems, the building's final energy demand will decrease from 136.80 to 128.13 kWh/(m²·year), which represents a reduction of 8.67 kWh/(m²·year), or a total of approximately 3,928 kWh per year for the entire building. Primary energy will decrease from 248.43 to 238.90 kWh/(m²·year), resulting in a saving of 9.53 kWh/(m²·year) – approx. 4,318 kWh per year (15.5 GJ). CO_2 emissions will fall from 0.06444 to 0.05738 tCO_2/(m²·year), which translates to an emission reduction of about 3.20 tonnes of CO_2 per year. The share of renewable energy sources will increase slightly – from 6.25% to 6.56%.

4.1.3. Expected results

Description of the expected results after the implementation of renovation activities under Step 1.

Basic information on the results of the implemented actions				
Energy class*	E			
Reduction of CO_2 emissions*	3,19818 t CO^2/year			
Traditional energy sources after Step 1				
sing.	Type of energy source*	Power[kW]	Annual fuel consumption* (with unit)	Demand for final energy [kWh/(m^2·year)]*
1	Oil-fired boiler	40,5	2 595,69 m^3	58,16
2	Air-to-water heat pump	34	8 819,91 kWh	19,47
Renewable energy sources after Step 1				
sing.	Type of energy source*	Power [kW]	Annual production* (with unit)	Share of annual final energy demand* [%]
1	PV system	18,29	21 000 kWh	36,17
2	Air-to-water heat pump	34	14 111,85 kWh	6,56
Energy demand of the building after Step 1				
Annual Primary Energy Demand Index **EP***			238,90	kWh/(m^2·year)
Building Energy Class (according to the draft regulation on this matter)			E	
Annual Final Energy Demand Index **EK**			128,13	kWh/(m^2·year)
Annual Useful Energy Demand Index **EU**			77,49	kWh/(m^2·year)
Specific CO_2 Emission Value*			0,05738	t CO_2/(m^2·year)

Estimated amount of energy bills*:

Energy carrier	Consumption amount (with unit)	Total cost [PLN]	Settlement period
Natural gas	2 595,69 m^3	11 421 PLN	2025
Electricity (heat pump)	8 819,91 kWh	8 335 PLN	2025

4.2. Step 2

Replacing the old, leaky window and door joinery with new windows and doors with high insulation parameters will reduce heat loss, improve the thermal comfort of users, and significantly decrease energy demand.

4.2.1. Action 1: Window joinery replacement

Planned date of action implementation*:	**Second quarter of 2026**
Description of action implementation*:	Replacement of window joinery with elements that meet the currently applicable technical conditions. Recommended tight and thermal installation.
Required materials and their technical specifications*:	To implement the planned energy efficiency improvements, the following materials and equipment, meeting specific technical requirements, will be necessary: **Window joinery** (**modernization of external windows U = 1.6**): Required heat transfer coefficient for new joinery: **U = 0.900W/(m^2· K)** Type of joinery: **Tight joinery**, with an air permeability class 'a' in the range **0,5 < a <1**
Investments costs*:	151 290,00 PLN
Maintenance costs*:	Legally required inspections
Required procedures, permits, agreements*:	The materials must meet current technical standards and ensure high thermal insulation in accordance with applicable regulations.

4.2.2. Action 2: Door joinery replacement

Planned date of action implementation*:	**Second and third quarter of 2026**
Description of action implementation*:	Replacement of door joinery with elements that meet the currently applicable technical conditions. Recommended tight and thermal installation.
Required materials and their technical specifications*:	To implement the planned energy efficiency improvements, the following materials and equipment, meeting specific technical requirements, will be necessary: **Window joinery** (**modernization of external doors U = 1.6**): Required heat transfer coefficient for new joinery: **U = 1,300 W/(m²·K)** Type of joinery: **Tight joinery**, with an air permeability class 'a' in the range **0,5 < a < 1**
Investments costs*:	23 985,00 PLN
Maintenance costs*:	Legally required inspections
Required procedures, permits, agreements*:	The doors must meet current technical standards and ensure high thermal insulation in accordance with applicable regulations.

4.2.3. Notes on the implementation of Step 2 activities

Total cost of planned activities*: 175 275,00 PLN

Possible sources of financing*:

In this case, possible funding sources include an investment loan of up to 50 000 PLN (according to the audit analysis), as well as grants from programs such as: regional operational programs (RPO) and funds from the WFOŚiGW (Voivodeship Fund for Environmental Protection and Water Management) earmarked for improving energy efficiency.

Description of the procedure for monitoring the results of implemented actions*:

After Step 2 (joinery modernization) monitoring will be expanded to include:

1. Periodic inspections of external joinery in the context of tightness, heat loss, and impact on user comfort.
2. Analysis of changes in electricity consumption – including a potential decrease in demand for air conditioning during the summer season.
3. Annual reports on energy indicators (EU, EK, EP) and CO_2 emissions, with reference to data from the audit and energy performance certificates.

The monitoring system will also be used for planning further optimization measures, and the results of its operation will be available to stakeholders and residents as part of the commune's transparent energy policy.

Additional benefits related to the implementation of planned modernization*:

The implementation of the second stage of the Raciechowice Commune Office Building's modernization will bring a number of additional benefits beyond direct energy savings. The replacement of external joinery will improve the building's thermal insulation, which will significantly affect the comfort of users – reducing drafts, external noise, and improving temperature stability in the rooms. Thanks to the use of modern materials with high tightness and a low heat transfer coefficient, energy losses during the heating season will also be reduced.

The environmental impact associated with the implementation of the planned modernizations*:

The second phase of the renovation will allow for further improvement in the building's energy efficiency. The final energy demand will decrease from 128.13 to 108.55 kWh/(m²·year), which means a reduction of 19.58 kWh/(m²·year), or over 8,870 kWh per year. The EP indicator will decrease from 238.90 to 213.38 kWh/(m²·year), resulting in a saving of 25.52 kWh/(m²·year), or approximately 11,569 kWh per year (41.6 GJ). CO_2 emissions will fall from 0.05738 to 0.05394 tCO_2/(m²·year), which means an annual reduction of 1.56 t of CO_2. The share of renewable energy

sources will increase from 6.56% to 15.31%, which reflects better utilization of the existing PV installation and heat pump due to the reduction of heat loss through external partitions.

4.2.4. *Expected results*

Description of the expected results after the implementation of renovation activities under Step 2.

Basic information on the results of the implemented actions				
Energy class*	E			
Reduction of CO_2 emissions*	1,55832 t CO^2/year			
Traditional energy sources after Step 2				
sing.	Type of energy source*	Power[kW]	Annual fuel consumption* (with unit)	Demand for final energy [kWh/(m^2·year)]*
1	Oil-fired boiler	40,5	2 260,47 m^3	50,69
2	Air-to-water heat pump	34	7 542,45 kWh	16,62
Renewable energy sources after Step 2				
sing.	Type of energy source*	Power [kW]	Annual production* (with unit)	Share of annual final energy demand* [%]
1	PV system	18,29	21 000 kWh	28,23
2	Air-to-water heat pump	34	14 111,85 kWh	15,31

Zapotrzebowanie energetyczne budynku po zakończeniu kroku 2		
Annual Primary Energy Demand Index **EP***	213,38	kWh/(m^2·year)
Building Energy Class (according to the draft regulation on this matter)	E	
Annual Final Energy Demand Index **EK**	108,55	kWh/(m^2·year)
Annual Useful Energy Demand Index **EU**	66,36	kWh/(m^2·year)
Specific CO_2 Emission Value*	0,05394	t CO_2/(m^2·year)

Estimated amount of energy bills*:

Energy carrier	Consumption amount (with unit)	Total cost [PLN]	Settlement period
Natural gas	2 260,47 m^3	9 946 PLN	2026
Electricity	7542,45 kWh	7 131 PLN	2026

4.3 Step 3

The implementation of an intelligent energy management system will enable ongoing monitoring and optimization of energy consumption in the building, supporting the lasting effects of the thermomodernization and conscious operational management.

4.3.1 Action 1: Certified energy management system

Planned date of action implementation*:	**Third quarter of 2026**
Description of action implementation*:	Implementation of a certified energy management system including digital temperature control in rooms, energy consumption scheduling, and energy data analysis. The system's goal is to optimize the consumption of heat and electrical energy depending on the time of day, the presence of employees, and demand.
Required materials and their technical specifications*:	The energy management system will consist of a central control unit, temperature sensors, regulators, software, and communication modules. It should comply with ISO 50001 standards and allow for remote access and registration of measurement data. All components must be certified and adapted for integration with the existing heating installation.
Investments costs*:	40 000 PLN
Maintenance costs*:	Maintenance costs include the annual certification of the energy management system according to the ISO 50001 standard. For three years after implementation, the certification will be financed from the Commune's budget.
Required procedures, permits, agreements*:	Employee training and annual certification

4.3.2 Notes on the implementation of Step 3 activities

Total cost of planned activities*: 40 000,00 PLN

Possible sources of financing*:

Due to the Raciechowice Commune's participation in the European OwnYourSECAP project, it is possible to implement a certified energy management system. The implementation costs will be covered by project funds under the LIFE program, while the costs of annual certification for a period of three years will be financed from the Raciechowice Commune's budget.

Description of the procedure for monitoring the results of implemented actions*:

After **Step 3**, monitoring will be expanded to include:

1. Detailed recording of temperature data, consumption schedules, operating hours of heating and cooling devices, and trend analysis.
2. Generation of monthly and annual reports and their export for further analysis.
3. Optimization of system operating parameters and planning of further energy efficiency improvements, based on the collected data.

The monitoring system will also be used for planning further optimization measures, and the results of its operation will be available to stakeholders and residents as part of the commune's transparent energy policy.

Additional benefits related to the implementation of planned modernization*:

The energy management system will enable the reduction of excessive energy consumption, which will translate into a further reduction in operating costs. It will also facilitate the control of comfort conditions at work, reducing the risk of overheating or underheating rooms. From a management perspective, the system will facilitate decision-making regarding the technical maintenance and modernization of the building.

4.3.3 Expected results

The implementation of a certified energy management system (compliant with ISO 50001) does not directly result in a reduction of EP, EK, EU indicators or CO_2 emissions. However, it is a tool that enables the ongoing optimization of energy consumption in real-time, which can lead to additional operational savings, estimated at 3 to 10% annually depending on the extent to which the system's functions are utilized.

The results include:

- reduction of energy losses resulting from improper use of heating and cooling installations,
- more precise control of temperature and equipment operating schedules,
- identification of energy consumption anomalies (e.g., leaks, incorrectly set devices),
- creation of reports and analyses supporting investment and operational decision-making.

After the system is implemented, data on temperature, energy consumption, and installation operation will be archived and used for long-term planning of modernization activities. It is estimated that thanks to better management of heating and lighting systems, annual operating costs may be further reduced.

OUR-CEE
Overcoming Underperforming Renovations in Central and Eastern Europe

Renovation Roadmap for the Raciechowice Commune Office Building

Created as part of the OUR-CEE project
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Realizowanego przez:

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