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Overcoming Underperforming Renovations in Central and Eastern Europe

Supported by:
Federal Ministry for Economic Affairs and Climate Action
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European Climate Initiative EUKI

Renovation Roadmap

For OSP Kwapinka Building

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1. Basic information

Building name*[1]: OSP Kwapinka Building

Address: Kwapinka 65, 32-415, Raciechowice

Building type*: Public utility building

Year of construction*: 1965

Usable area*: 356 m^2

Construction type: Traditional brick construction

Number of storeys: 2

Is the building a monument? No

Building Usage Schedule*: The building is heated 7 days a week, without interruptions. Heat is supplied via a water-based heating system with sectional or panel radiators, depending on whether central or local regulation is used, with a thermostatic valve with proportional control. The local heat source (an oil-fired boiler) is located within the heated building, with insulated pipes, fittings, and equipment installed in an unheated space.

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

Additional informations:

The OSP Kwapinka Building is a public utility facility located at Kwapinka 65, 32-415 Raciechowice. It was commissioned for use in 1965 and has a usable floor area of 356 m². The building has two storeys and is constructed using traditional brickwork techniques, with a sheet metal roof covering.

The current technical condition of the building indicates partial thermomodernization; however, individual building partitions (external walls, floor on ground, roof, window frames, and doors) do not meet the current thermal insulation standards specified in the Regulation of the Minister of Infrastructure. In particular, the heat transfer coefficients for external walls, roof, windows, and doors exceed the permissible values under current regulations.

The current heating and domestic hot water system is based on an outdated, low-efficiency oil-fired boiler, installed in 2000, with a capacity of 127 kW. The central heating system is equipped with traditional panel and sectional radiators, with local thermostatic control. Domestic hot water is produced centrally.

The building uses gravity ventilation without heat recovery, which significantly increases energy losses, especially during the winter season. Lighting is based on traditional sources without automatic adjustment depending on daylight levels or occupancy. Currently, the building has a relatively high primary energy demand (EP = 197.20 kWh/m²·year), which results in significant operating costs and CO_2 emissions at the level of 0.03717 t CO_2/m²·year.

The planned thermomodernization measures, including the replacement of the oil boiler with a gas condensing boiler and the installation of a photovoltaic system, will significantly reduce the demand for final energy, improve energy efficiency, and substantially lower building maintenance costs. Additionally, the implementation of these measures will contribute to a significant reduction in greenhouse gas emissions, improvement of local air quality, and enhanced comfort for building users.

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/(m^2·year)]
1.	Oil-fired boiler	127	2 182,28 kg	2000	123,9
Renewable energy sources					
sing.	Type of energy source*	Power [kW]	Annual production* (with unit)	Launch year	Share of annual final energy demand* [%]
n/a					

Energy demand of the building:

Annual Primary Energy Demand Index **EP***	197,20	kWh/(m^2·year)
Building Energy Class (according to the draft regulation on this matter)	D	
Annual Final Energy Demand Index **EK**	123,90	kWh/(m^2·year)
Annual Useful Energy Demand Index **EU**	51,5	kWh/(m^2·year)
Specific CO_2 Emission Value*	0,03717	t CO_2/(m^2·year)

Energy bills:

Energy carrier	Consumption amount (with unit)	Total cost [PLN]	Settlement period
Hard coal			
Natural gas			
Heating oil	2182,28 kg	15 800 PLN	2024
Biomass			
Grid electricity	12 000 kWh	11 340 PLN	2024
District heating			

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

No documented modernization activities prior to year 2025.

Assessment of the building's renovation potential

The OSP Kwapinka building is characterized by relatively high energy demand, particularly for space heating and domestic hot water preparation. The annual primary energy demand index (EP) amounts to 197.20 kWh/(m²·year), and the final energy demand index (EK) is 123.90 kWh/(m²·year), which indicates low energy efficiency of the building in its current state. The heat source is an outdated oil-

fired boiler with a high capacity (127 kW), resulting in high operating costs and CO_2 emissions of 0.03717 t CO_2/(m²·year).

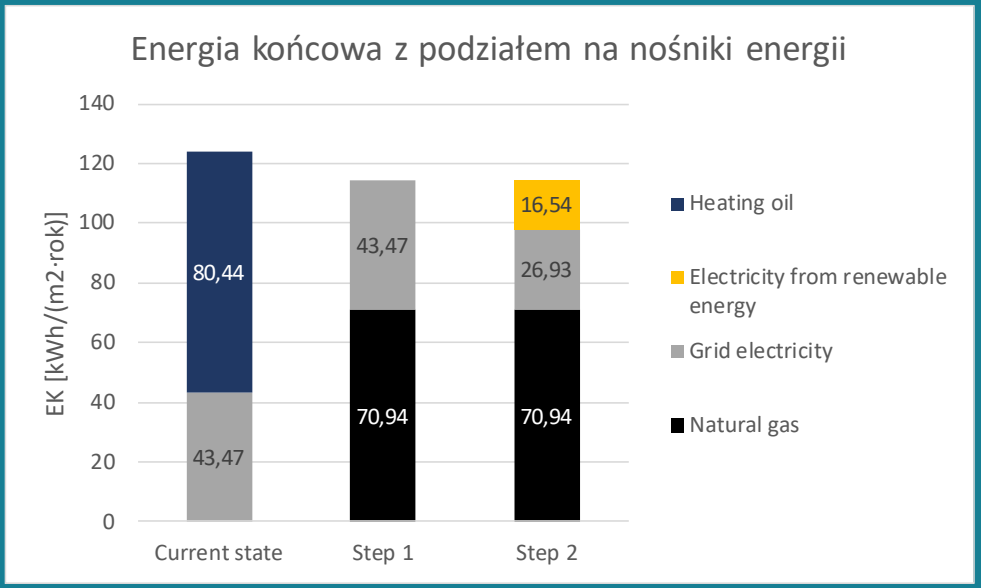
The building has not undergone any comprehensive thermomodernization to date. Building partitions, such as walls, roof, windows and door frames, do not meet current thermal insulation standards. Moreover, the building does not utilize renewable energy sources, which further reduces its energy rating. There is also a lack of modern energy management systems or heat recovery from ventilation.

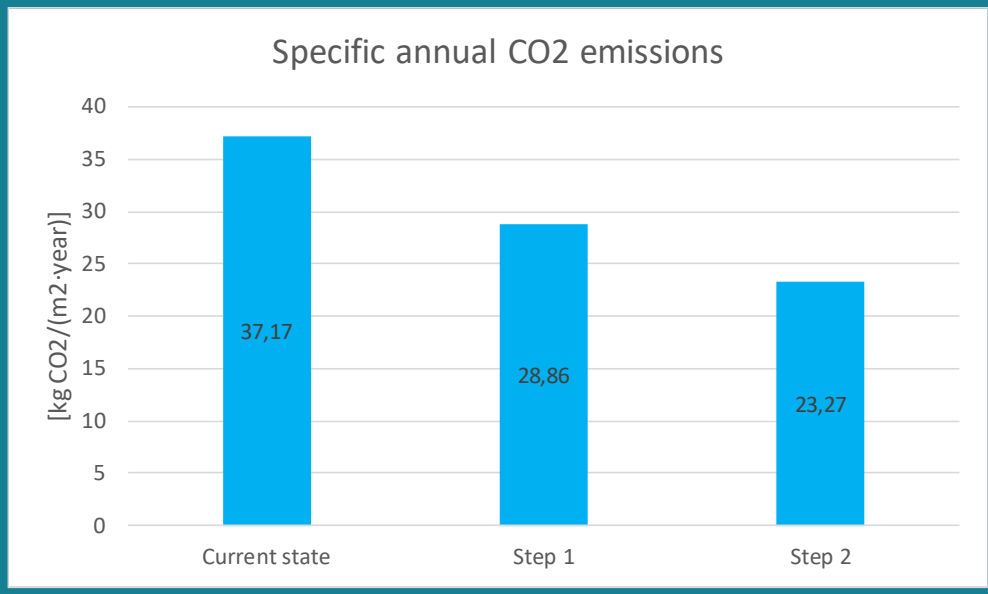
Thanks to the planned measures – replacement of the oil boiler with a gas condensing boiler and installation of a photovoltaic system – a significant improvement in energy efficiency can be achieved. It is estimated that, after implementing these steps, CO_2 emissions will be reduced by approximately 4.95 tons annually, and operating costs will decrease by over PLN 11,900 per year. This demonstrates that the OSP Kwapinka building has substantial modernization potential, both economically and environmentally.

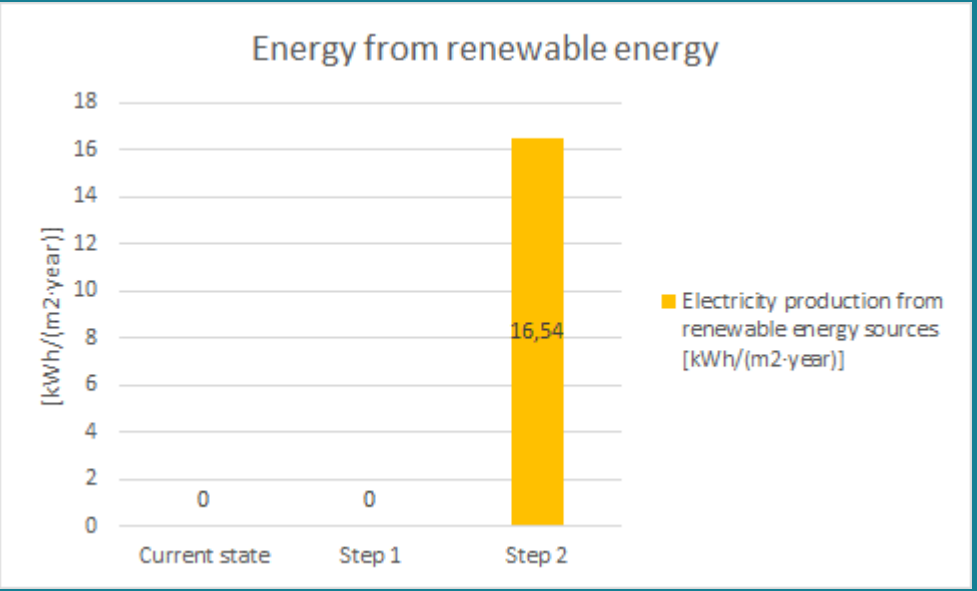
3. Renovation plan

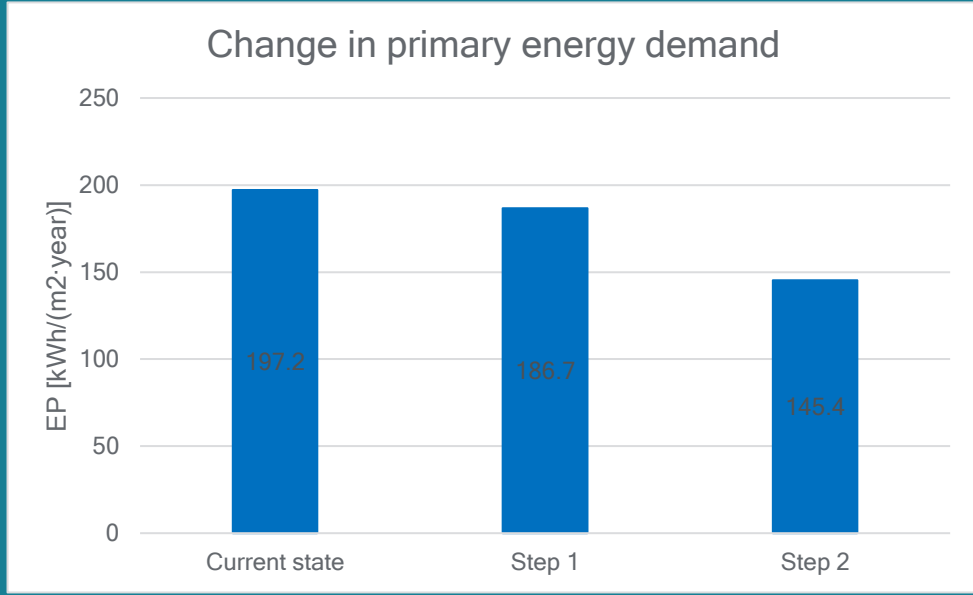
	Planned implemen-tation date	Description of planned actions	Building parameters after the implementation of planned actions			Cost pf planned actions
			Energy Class[2]	Energy consumption	Reduction of CO_2 emissions	
Step 1	2025	Action 1 – Modernization of the heat source (replacement of the oil boiler with a condensing gas boiler along with adaptation of the CH and DHW installations)	D	186,72 kWh/m^2/year	2,89 t CO_2	43 665 PLN
Step 2	2026	Action 2 – Installation of a PV system	C	145,4 kWh/m^2/year	2,33 t CO_2	30 135 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)


Energia końcowa z podziałem na nośniki energii
EK [kWh/(m2·rok)]
140
120
100
80
60
40
20
0
80,44
43,47
43,47
70,94
16,54
26,93
70,94
Current state
Step 1
Step 2
Heating oil
Electricity from renewable energy
Grid electricity
Natural gas


Specific annual CO2 emissions
[kg CO2/(m2·year)]
40
35
30
25
20
15
10
5
0
37,17
28,86
23,27
Current state
Step 1
Step 2


Energy from renewable energy
[kWh/(m2·year)]
18
16
14
12
10
8
6
4
2
0
0
0
16,54
Current state
Step 1
Step 2
Electricity production from renewable energy sources [kWh/(m2·year)]


Change in primary energy demand
EP [kWh/(m2·year)]
250
200
150
100
50
0
197.2
186.7
145.4
Current state
Step 1
Step 2

4. Description of renovation steps

4.1. Step 1

As a first step, the existing oil boiler will be replaced with a modern 26 kW condensing gas boiler. This will also require the adaptation of the central heating and domestic hot water (CH and DHW) installations to the new operating conditions.

4.1.1. Step 1: Modernization of the peak heat source

Planned date of action implementation*:	**2026**
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*:	**Required materials and their technical specifications:** • Condensing gas boiler class A++ • Mounting accessories (valves, pumps, pipe insulation, weather controllers) • Adaptive elements for the existing heating (CH) and hot water (DHW)
Investments costs*:	41 205 PLN
Maintenance costs*:	Annual boiler inspections required by law
Required procedures, permits, agreements*:	Notification of heat source replacement As-built documentation of the installation
Addditional information:	

4.1.2. Notes on the implementation of Step 1 activities

Total cost of planned activities*: 41 205 PLN

Possible sources of financing*:

- Own funds of the Municipality of Raciechowice
- Investment loan (e.g., preferential loans from the National Fund for Environmental Protection and Water Management - WFOŚiGW)
- Grants from national programs: "Ciepłownictwo Powiatowe"
- Grants from EU funds: European Funds for Infrastructure, Climate and Environment Program (FEnIKS 2021–2027), e.g., actions related to energy efficiency of public buildings

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

1. Registration of natural gas and electricity consumption (e.g., monthly or quarterly meter readings).
2. Comparative analysis of annual bills and fuel/energy consumption (comparison of data with the period before modernization)
3. Technical documentation of services, regular inspections of the boiler's technical condition.
4. Verification of CO_2 emission reduction through annual calculations and reporting of the achieved energy performance indicators EK and EP.

Additional benefits related to the implementation of planned modernization*:

The implementation of the first step, which is the replacement of the oil boiler with a modern condensing gas boiler, will significantly improve the energy efficiency of the heating system and the preparation of domestic hot water. In addition to direct savings resulting from reduced fuel consumption, the OSP Kwapinka building will offer higher user comfort due to a more reliable and precisely regulated heat source. Furthermore, the reduction of CO_2 emissions will improve the quality of local air and positively impact the natural environment, while also strengthening the municipality's pro-environmental image.

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*	D			
Reduction of CO_2 emissions*	2,95836 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	Condensing gas boiler	26	2 488,44 m^3	70,94
Renewable energy sources after Step 1				
sing.	Type of energy source*	Power [kW]	Annual production* (with unit)	Share of annual final energy demand* [%]
n/a				
Energy demand of the building after Step 1				
Annual Primary Energy Demand Index **EP***			186,72	kWh/(m^2·year)
Building Energy Class (according to the draft regulation on this matter)			D	
Annual Final Energy Demand Index **EK**			114,42	kWh/(m^2·year)
Annual Useful Energy Demand Index **EU**			51,49	kWh/(m^2·year)
Specific CO_2 Emission Value*			0,02886	t CO_2/(m^2·year)

Estimated amount of energy bills*:

Energy carrier	Consumption amount (with unit)	Total cost [PLN]	Settlement period
Natural gas	2 488,44 m^3	8 709 PLN	2025
Electricity	12 000 kWh	11 340 PLN	2025

4.2. Step 2

Description of planned actions

4.2.1. Step 2: Installation of a PV system

Planned date of action implementation*:	**2026**
Description of action implementation*:	Installation of a PV system
Required materials and their technical specifications*:	High-efficiency monocrystalline panels Hybrid inverter with the option to connect to an energy storage system Support structure adapted to the roof Protection system and bidirectional counter
Investments costs*:	30 135,00 PLN gross
Maintenance costs*:	Legally required inspections
Required procedures, permits, agreements*:	Notification of the micro-installation to the grid operator Obtaining grid connection conditions Comprehensive agreement for energy sales
Addditional information:	Reduction of annual final energy demand thanks to PV: approx. **13.35%**

4.2.2. Notes on the implementation of Step 2 activities

Total cost of planned activities*: 30 135,00 PLN

Possible sources of financing*:

- “Mój prąd” program (if the micro-installation qualifies for funding),,
- Regional Operational Programme of the Małopolska Voivodeship (RPO WM 2021–2027, support for energy efficiency and renewable energy sources),
- Preferential loan from the Voivodeship Fund for Environmental Protection and Water Management (WFOŚiGW Kraków),
- Own funds of the Municipality of Raciechowice

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

1. Monitoring of electricity production from the PV installation using a bidirectional counter and inverter (annual and quarterly recording).
2. Comparison of annual electricity consumption data before and after the PV installation.
3. Annual verification of the share of renewable energy sources in the building's total energy balance (EK and EP).
4. Technical documentation of periodic inspections and maintenance of the PV system.

Additional benefits related to the implementation of planned modernization*:

The second step, namely the installation of photovoltaic panels, will bring additional benefits in the form of significant savings on electricity bills through the production of on-site energy for the building's needs. The building will become more energy independent, reducing its reliance on external energy sources, which will enhance the overall energy security of the facility. Additionally, with an increased share of renewable energy sources, the municipality will achieve a further reduction in CO_2 emissions, aligning with the European Union's climate policy and supporting local sustainable development goals.

4.2.3. *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*	C			
Reduction of CO_2 emissions*	1,99004 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	Condensing gas boiler	26	2 488,44 m^3	70,94
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 installation	6,5	7 5000 kWh	14,46
Energy demand of the building after Step 1				
Annual Primary Energy Demand Index **EP***			145,37	kWh/(m^2·year)
Building Energy Class (according to the draft regulation on this matter)			C	
Annual Final Energy Demand Index **EK**			114,42	kWh/(m^2·year)
Annual Useful Energy Demand Index **EU**			51,49	kWh/(m^2·year)
Specific CO_2 Emission Value*			0,02886	t CO_2/(m^2·year)

Estimated amount of energy bills*:

Energy carrier	Consumption amount (with unit)	Total cost [PLN]	Settlement period
Natural gas	2 488,44 m^3	10 947 PLN	2026
Electricity	4 500 kWh	4 253 PLN	2026

As a result of the planned modernization activities for the building, a significant reduction in annual energy costs is expected. After the first step, which involves replacing the existing oil boiler with a condensing gas boiler, the expected savings will be approximately 4,853 PLN per year. This difference is between the estimated cost of purchasing heating oil (15,800 PLN) and the cost of purchasing natural gas (10,947 PLN). In the second stage, thanks to the installation of a 6.5 kW photovoltaic system with an annual energy production of 7,500 kWh, the demand for electricity from the grid will decrease. This will result in additional savings of about 7,087 PLN annually—reducing energy costs from 11,340 PLN before the PV installation to 4,253 PLN after its implementation. In total, the completion of both steps will result in annual savings of nearly 11,940 PLN, significantly improving the building's operational economics.

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