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Overcoming Underperforming Renovations in Central and Eastern Europe

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Federal Ministry for Economic Affairs and Climate Action
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European Climate Initiative EUKI

Renovation roadmap

Maria Konopnicka Kindergarten No. 4 in Cieszyn

EPG
EnEffect
Regional Energy Agency North
POLSKA SIEĆ Energie Cités
Cieszyn

1. Basic information

Building name*[1]: Maria Konopnicka Kindergarten No. 4 in Cieszyn

Address: Karola Miarki Street 15, 43-400 Cieszyn | plot no. 72/2

Building type*: Public utility building - educational

Year of construction *: 1980

Usable area *: 813,87 m^2

Construction type: Traditional construction

Number of storeys: 3

Is the building a monument? No

Building Usage Schedule *: The building of the Kindergarten No. 4 in Cieszyn is used from Monday to Friday from 6:00 a.m. to 5:00 p.m. and is used to conduct educational activities for children of preschool age.

[1] The symbol * means that the indicated data is necessary for the preparation of the document

Additional information:

The plot of land 72/2 is located within unit 44 of the Cieszyn city land registry, on K. Miarki Street. The area is developed with a four-unit kindergarten building, a playground, green spaces, and a utility yard. The kindergarten building was constructed using traditional methods as a two-story structure with a full basement and an inaccessible ventilated flat roof, featuring a single-pitch roof covered with tar paper on bitumen. The building has access and entry from K. Miarki Street, with the utility yard situated near the main entrance. The property is fully fenced, well-maintained, and developed with existing technical infrastructure, including a combined sewer system, cold water supply, electricity, and a gas boiler room located in the basement.

Based on the technical assessment of the basement walls, it's recommended to install external vertical damp-proof insulation. Between 1998 and 2000, approximately 30% of the basement wall perimeter received a coating insulation of Isolplast, protected by foundation foil. Two window well enclosures were replaced with Aco Markant system solutions, including drainage connected to an existing well on the front side of the building. In recent years, some window joinery was replaced with PVC windows, as detailed in the graphic documentation for each floor plan. The existing discharge wells and basement light wells are significant contributors to wall dampness. The exterior basement surfaces are mostly in good condition for light wet-method wall insulation (maximum of 5% of the wall surface requiring repair before insulation work). The existing tar paper roof covering, wall flashings, and sheet metal roof trim should be replaced during the insulation work. Outside the playground equipment and garden greenery areas, the kindergarten building's surroundings require renovation, particularly the building accesses, sidewalks, and storage areas, as well as the rooms adjacent to the playground fence.

The planned comprehensive thermal retrofitting of Kindergarten No. 4, named after Maria Konopnicka, in Cieszyn, as outlined in the steps below, envisions a step implementation of actions aimed at significantly improving energy efficiency, reducing CO_2 emissions, and lowering the building's operating costs. This modernization includes insulating external partitions, replacing windows and doors, upgrading the heating system, and installing renewable energy sources. Each action has been planned based on project documentation and an energy audit.

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* [kWh/(m^2·rok)]	Launch year	Demand for final energy* [kWh/(m^2·year)]
1	District heating from the heating plant – hard coal (compact heat substation with casing)	42	79,78	-	79,78
2	Electricity from the systemic power grid	27	41,82	-	41,82
Renewable energy sources					
sing.	Type of energy source*	Power [kW]	Annual production* (with unit)	Launch year	Share of annual final energy demand* [%]
Currently, no renewable energy installations are operating in the building.					

Energy demand of the building:

Annual Primary Energy Demand Index **EP***	208,3	kWh/(m^2·year)
Building Energy Class (according to the draft regulation on this matter)	D	
Annual Final Energy Demand Index **EK**	121,6	kWh/(m^2·year)
Annual Useful Energy Demand Index **EU**	60,5	kWh/(m^2·year)
Specific CO_2 Emission Value*	0,04137	t CO_2/(m^2·year)

Energy bills[2]*:

Energy carrier	Consumption amount (with unit)	Total gross cost	Settlement period
District heating	261,6 GJ	20 660,76 (78,98 PLN /GJ)	Year 2021
	239,1 GJ	20 055,89 (83,88 PLN)	Year 2022
	229,1 GJ	33 593,25 (146,63 PLN/GJ)	Year 2023
Grid electricity	11 958 kWh	5 826,01	Year 2021

[2] The increase in heating and electricity costs between 2021 and 2023 was a result of the energy crisis. This crisis was caused by the sudden economic recovery after the COVID-19 pandemic, the outbreak of war in Ukraine, and significant instability in fossil fuel prices. Although some European Union countries implemented protective mechanisms (e.g., price caps or subsidies), these types of solutions were introduced with delays in Poland and did not cover all public facilities, including educational institutions.

		(49 gr/kWh)	
	11 369 kWh	6 388,29 (56 gr/kWh)	Year 2022
	10 808 kWh	8 108,82 (75 gr/kWh)	Year 2023

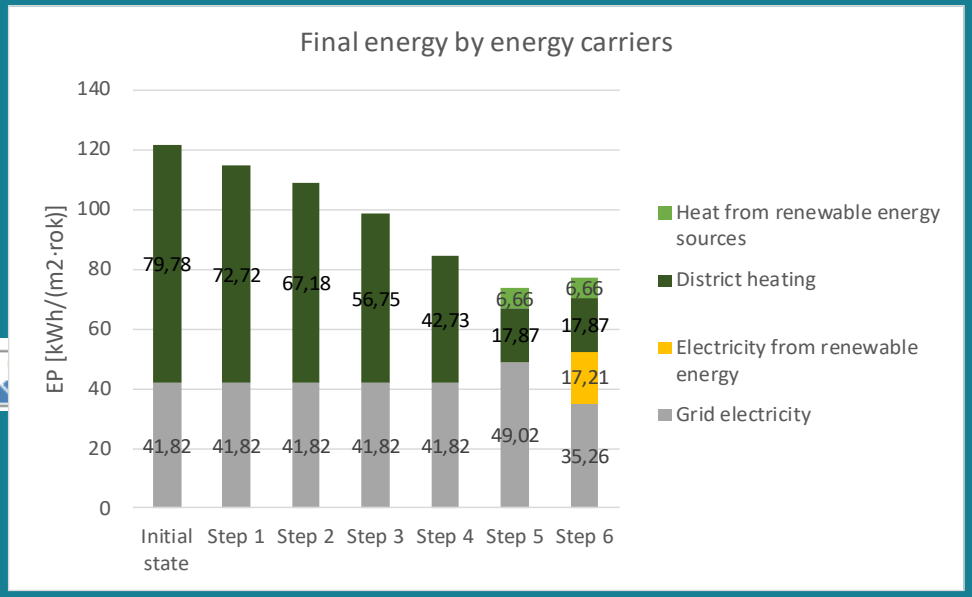
Description of renovations carried out in the building in the past*:

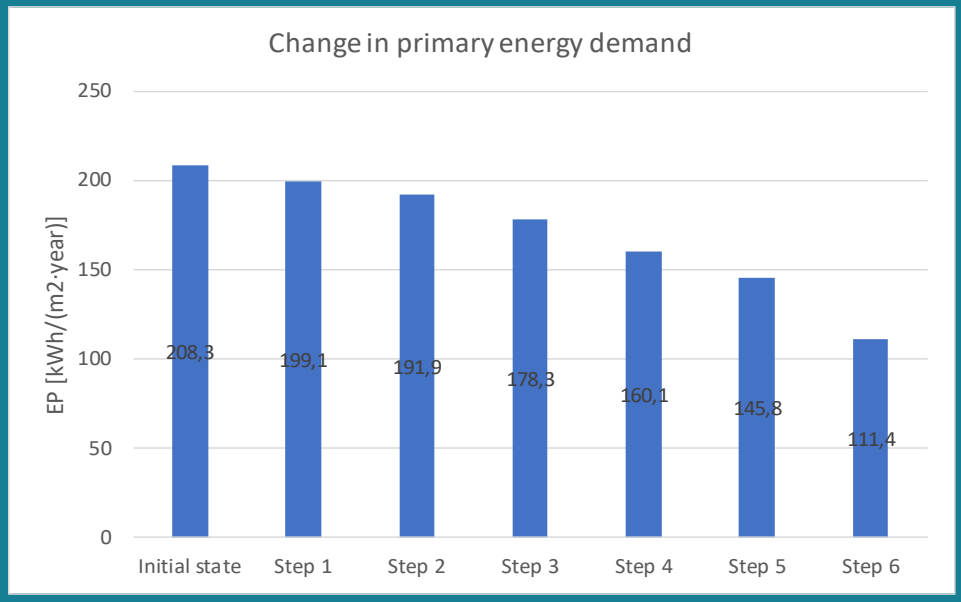
sing.	Description of the completed modernization	Funding sources	Year
1	Execution of vertical insulation for portions of the basement walls using the coating method (Izoplast), along with dewatering and drainage.	Own funds of the municipality	1998-2000
2	Partial replacement of window frames with PVC windows and installation of external sills.	Own funds of the municipality	2005
3	Modernization of the heat source – replacement of the old coal-fired boiler with a new heat source.	Own funds of the municipality, WFOŚiGW subsidy	2019

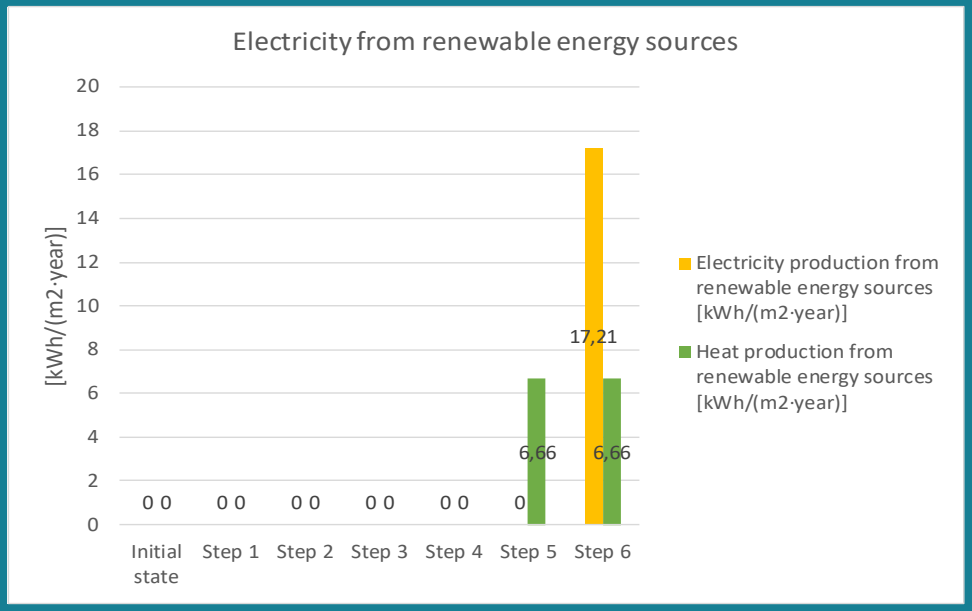
3. Renovation plan

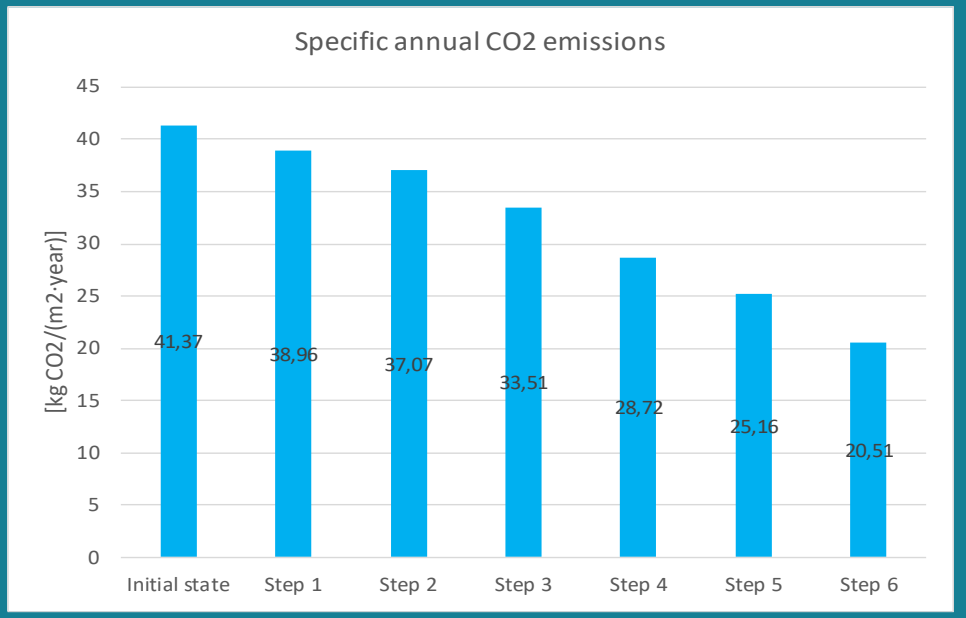
	Planned implementation date	Description of planned actions	Building parameters after the implementation of planned actions			Cost pf planned actions
			Energy Class[3]	Energy consumption	Reduction of CO_2 emissions	
Step 1*	4th quarter of 2025	Action 1: External wall insulation	D	199,1 kWh/(m2·year)	6%	55 890,95 PLN
Step 2*	4th quarter of 2025	Action 1: Foundation wall and basement ceiling insulation	D	191,9 kWh/(m2· year)	5%	218 341,73 PLN
Step 3	4th quarter of 2025	Action 1: Window replacement Action 2: Door replacement	D	178,3 kWh/(m2· year)	10%	192 918,46 PLN
Step 4	2027	Action 1: Roof insulation	C	160,1 kWh/(m2· year)	15%	77 657,28 PLN
Step 5	2027	Action 1: Heat source replacement Action 2: Solar collector installation	C	145,8 kWh/(m2· year)	12%	56 900,00 PLN
Step 6	2028	Action 1: Photovoltaic system installation	B	111,4 kWh/(m2· year)	18%	65 731,00 PLN

[3] 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
EP [kWh/(m2·rok)]
140
120
100
80
60
40
20
0
79,78
72,72
67,18
56,75
42,73
6,66
17,87
6,66
17,87
17,21
41,82
41,82
41,82
41,82
41,82
49,02
35,26
Initial state
Step 1
Step 2
Step 3
Step 4
Step 5
Step 6
Heat from renewable energy sources
District heating
Electricity from renewable energy
Grid electricity


Change in primary energy demand
EP [kWh/(m2·year)]
250
200
150
100
50
0
208,3
199,1
191,9
178,3
160,1
145,8
111,4
Initial state
Step 1
Step 2
Step 3
Step 4
Step 5
Step 6


Electricity from renewable energy sources
[kWh/(m2·year)]
20
18
16
14
12
10
8
6
4
2
0
0 0
0 0
0 0
0 0
0 0
0
6,66
17,21
6,66
Initial state
Step 1
Step 2
Step 3
Step 4
Step 5
Step 6
Electricity production from renewable energy sources [kWh/(m2·year)]
Heat production from renewable energy sources [kWh/(m2·year)]


Specific annual CO2 emissions
[kg CO2/(m2·year)]
45
40
35
30
25
20
15
10
5
0
41,37
38,96
37,07
33,51
28,72
25,16
20,51
Initial state
Step 1
Step 2
Step 3
Step 4
Step 5
Step 6

4. Description of renovation steps

4.1. Step 1 - External wall insulation

According to the project documentation and energy performance characteristics, the plan is to insulate the external walls of the kindergarten building, which currently have a heat transfer coefficient (U-value) of approximately 0.31 W/m²·K. After applying 15 cm thick polystyrene insulation, a U-value of ≤ 0.20 W/m²·K will be achieved. This meets the WT2021 requirements and will significantly improve the building's energy efficiency.

4.1.1. Action 1 - External wall insulation

Planned date of action implementation*:	4th quarter of 2025
Description of action implementation*:	External wall insulation using the light-wet technology with 15 cm thick polystyrene boards. Improvement of the thermal insulation of vertical partitions.
Required materials and their technical specifications*:	EPS 70 polystyrene boards, thermal conductivity coefficient for masonry external wall: λ ≤ 0.033 W/m·K, 6 cm thickness. ETICS system with silicone render.
Investments costs*:	55 890,95 PLN
Maintenance costs*:	Warranty inspections of the facade. – 500 PLN/year
Required procedures, permits, agreements*:	Notification of construction works to the county office, building design for thermomodernization.
Addditional information:	Notification of construction works to the county office, building design for thermomodernization.

4.1.2. Notes on the implementation of Step 1 activities

Total cost of planned activities*: 55 890,95 PLN

Possible sources of financing*: Own funds, WFOŚiGW, FEnIKS subsidy – Energy efficiency in public buildings.

Description of the procedure for monitoring the results of implemented actions*: Comparison of heat consumption based on invoice data (e.g., for the years 2021–2023) with the analogous period after the action's implementation. Monitoring of EK, EP, and EU indicators by updating the energy performance certificate and periodically reading data from heat consumption meters. It is recommended to prepare an annual simplified report monitoring energy and financial effects based on invoice data and monitoring EK and EP indicators from new certificates.

Additional benefits associated with the implementation of the planned modernizations*: Improved thermal and acoustic comfort for children and kindergarten staff. Reduction of damp areas and mold problems. Limitation of external noise and drafts, especially in corner rooms and near windows. Increased durability of building partitions and extended lifespan of the facade. This also includes improved aesthetics of the facade and elimination of thermal bridges.

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*	0,0241 t CO_2/(m²·year) – by 5.8% from the initial value			
Traditional energy sources after Step 1				
sing.	Type of energy source*	Power[kW]	Annual fuel consumption* [kWh/(m²·year)]	Demand for final energy [kWh/(m²·year)]*
1	District heating	-	72,72	72,72
2	Electricity (systemic power grid)	-	41,82	41,82
Traditional energy sources after Step 1				
sing.	Type of energy source*	Power [kW]	Annual production* (with unit)	Share of annual final energy demand* [%]
-	-	-	-	-
Energy demand of the building after Step 1				
Annual Primary Energy Demand Index **EP***			199,1	kWh/(m²·year)
Building Energy Class (according to the draft regulation on this matter)			D	
Annual Final Energy Demand Index **EK**			114,5	kWh/(m²·year)
Annual Useful Energy Demand Index **EU**			54,7	kWh/(m²·year)
Specific CO_2 Emission Value:			0,03896 (94,2% initial value)	t CO_2/(m²·year)

Estimated amount of energy bills*:

Energy carrier	Consumption amount (with unit)	Total cost [PLN]
Grid electricity	41,82 kWh/(m2·year)	8 108,82
District heating	72,72 kWh/(m2· year)	30 620,47

4.2. Step 2 - Foundation wall and basement ceiling insulation

The planned insulation will cover the basement walls and the ceiling above the basement, which currently have high heat losses (U = 2.16 W/m²·K for the ceiling). Insulating with 10–12 cm thick polystyrene or PIR boards will allow achieving U values below 0.25 W/m²·K. The scope also includes moisture protection for the vertical walls near the ground.

4.2.1. Action 1: Foundation wall and basement ceiling insulation

Planned date of action implementation*:	4th quarter of 2025
Description of action implementation*:	Application of thermal insulation to foundation walls and the ceiling above the basement using PIR or EPS 100 material, 10–12 cm thick.
Required materials and their technical specifications*:	PIR/EPS 100 boards, λ ≤ 0.035 W/m·K. Protective layer of dimpled membrane and mosaic plaster. Thermal conductivity coefficient for: • Walls on the ground: λ ≤ 0.035 W/m·K, 13 cm thickness • Floors on the ground: λ ≤ 0.038 W/m·K, 12 cm thickness.
Investments costs*:	• Walls on the ground: 77 811,03 PLN • Floors on the ground: 140 530,70 PLN
Maintenance costs*:	No significant operating costs.
Required procedures, permits, agreements*:	Coordination with underground utility network managers (if applicable), notification of works.

4.2.2. Notes on the implementation of Step 2 activities

Total cost of planned activities*: 218 341,73 PLN

Possible sources of financing*: European Funds for Infrastructure, Climate, Environment 2021-2027, WFOŚiGWown funds.

Description of the procedure for monitoring the results of implemented actions*: Monitoring the effects will involve analyzing data from heating invoices and comparing temperatures and comfort in ground-floor rooms before and after modernization. It's also recommended to record humidity levels in areas prone to water vapor condensation.

Additional benefits related to the implementation of planned modernization*: Improved hygienic and sanitary conditions in basement rooms, increased protection of the structure against dampness, and enhanced durability of building materials. This action will also impact the overall thermal stability of the entire building.

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*	D			
Reduction of CO_2 emissions*	0,00189 t CO_2/(m^2·year) – by 10,4% from the initial value			
Traditional energy sources after Step 2				
sing.	Type of energy source*	Power[kW]	Annual fuel consumption* [kWh/(m^2·year)]	Demand for final energy [kWh/(m^2·year)]*
1	District heating	-	67,18	67,18
2	Electricity (systemic power grid)	-	41,82	41,82
Renewable energy sources after Step 2				
sing.	Type of energy source*	Power [kW]	Annual production* (with unit)	Share of annual final energy demand* [%]
-	-	-	-	-
Energy demand of the building after Step 2				
Annual Primary Energy Demand Index **EP***			191,9	kWh/(m^2·year)
Building Energy Class (according to the draft regulation on this matter)			D	
Annual Final Energy Demand Index **EK**			109,0	kWh/(m^2·year)
Annual Useful Energy Demand Index **EU**			50,1	kWh/(m^2·year)
Specific CO_2 Emission Value:			0,03707 (89,6% initial value)	t CO_2/(m^2·year)

Estimated amount of energy bills*:

Energy carrier	Consumption amount (with unit)	Total cost [PLN]
Grid electricity	41,82 kWh/(m2·year)	8 108,82
District heating	67,16 kWh/(m2·year)	28 287,72

4.3. Step 3 - Replacement of window and door frames

As part of the work, all remaining unreplaced windows (PVC) will be replaced, which will allow for better insulation parameters (U ≤ 0.90 W/m²·K). The windows will be equipped with triple-glazed units with a multi-chamber frame and appropriate hygro-controlled vents in accordance with project requirements. The building's external doors, currently characterized by low airtightness and a high U-value, will be replaced with doors boasting a U ≤ 1.30 W/m²·K, made using aluminum or PVC technology with a thermal insulation core. The replacement will also include fittings and seals.

4.3.1. Action 1: Window joinery replacement

Planned date of action implementation*:	4th quarter of 2025
Description of action implementation*:	Replacement of existing leaky windows with joinery offering better thermal parameters (window U-value ≤ 0.90 W/m²·K).
Required materials and their technical specifications*:	PVC windows with triple-glazed units, multi-chamber frames.
Investments costs*:	168,779.71 PLN
Maintenance costs*:	Periodic inspections of fittings and seals. – approx. 300 PLN/year
Required procedures, permits, agreements*:	Works do not require a building permit if they do not change the dimensions of the openings.

4.3.2. Action 2: Door joinery replacement

Planned date of action implementation*:	4th quarter of 2025
Description of action implementation*:	Replacement of external doors with structures offering higher airtightness and a lower heat transfer coefficient (door U-value ≤ 1.30 W/m²·K).
Required materials and their technical specifications*:	Aluminum or PVC doors with insulation, weather-resistant.
Investments costs*:	24,138.75 PLN
Maintenance costs*:	Periodic inspections of fittings, locks, and seals. – approx. 300 PLN/year
Required procedures, permits, agreements*:	Notification of construction works if the arrangement of openings changes.

4.3.1. Notes on the implementation of Step 3 activities

Total cost of planned activities*: 192 918,46 PLN

Possible sources of financing*: Possible sources of financing*: European Funds for Infrastructure, Climate, Environment 2021-2027, WFOŚiGW, own funds

Description of the procedure for monitoring the results of implemented actions*: It is recommended to compare the functional conditions in the entrance areas before and after modernization, including temperature and humidity measurements and potential airflow measurements (anemometric). Energy effects can also be confirmed by analyzing invoice data and measuring the surface temperature of the new doors.

Additional benefits related to the implementation of planned modernization*: Reduced drafts, decreased external noise, improved aesthetics, and enhanced thermal and acoustic insulation of entrance areas.

4.3.2. Expected results

Description of the expected results after the implementation of renovation activities under Step 3.

Basic information on the results of the implemented actions				
Energy class*	D			
Reduction of CO_2 emissions*	0,00356 t CO_2/(m^2·year) – by 19% from the initial value			
Traditional energy sources after Step 3				
sing.	Type of energy source*	Power[kW]	Annual fuel consumption* [kWh/(m^2·year)]	Demand for final energy [kWh/(m^2·year)]*
1	District heating	-	56,75	56,75
2	Electricity (systemic power grid)	-	41,82	41,82
Traditional energy sources after Step 3				
sing.	Type of energy source*	Power[kW]	Annual fuel consumption* (with unit)	Demand for final energy [kWh/(m^2·year)]*
-	-	-	-	-
Energy demand of the building after Step 3				
Annual Primary Energy Demand Index **EP***			178,3	kWh/(m^2·year)
Building Energy Class (according to the draft regulation on this matter)			D	
Annual Final Energy Demand Index **EK**			98,6	kWh/(m^2·year)
Annual Useful Energy Demand Index **EU**			41,5	kWh/(m^2·year)
Specific CO_2 Emission Value:			0,03351 (81% initial value)	t CO_2/(m^2·year)

Estimated amount of energy bills*:

Energy carrier	Consumption amount (with unit)	Total cost [PLN]
Grid electricity	41,82 kWh/(m2·year)	8 108,82
District heating	56,75 kWh/(m2·year)	23 895,92

4.4. Step 4 - Roof insulation

As part of the work, a thermal insulation layer of mineral and glass wool, with a total thickness of approximately 35–40 cm, is planned to be laid on the ceiling beneath the unused ventilated attic. According to the technical documentation, this treatment will allow the U-value of the roof to be lowered to ≤ 0.08 W/m²·K.

4.4.1. Action 1: Roof insulation

Planned date of action implementation*:	1st quarter of 2026
Description of action implementation*:	Insulation of the flat roof using mineral and glass wool mats, 33 cm thickness.
Required materials and their technical specifications*:	Glass wool λ ≤ 0.033 W/m·K, vapor barrier, windproof film.
Investments costs*:	77,657.28 PLN
Maintenance costs*:	n/a
Required procedures, permits, agreements*:	Design documentation, notification of construction works.
Additional information:	The partition should be insulated with the calculated thickness of the thermal insulation layer, ensuring the currently required partition resistance and the most favorable SPBT. The total cost of the improvement is the product of the unit price of the improvement and the total area planned for modernization, along with necessary additional costs.

4.4.2. Notes on the implementation of Step 2 activities

Total cost of planned activities*: 77 657,28 PLN

Possible sources of financing*: Possible sources of financing*: European Funds for Infrastructure, Climate, Environment 2021-2027, WFOŚiGW, own funds

Description of the procedure for monitoring the results of implemented actions*: Monitoring of effects can include recording temperatures in rooms below the flat roof during the heating season, measuring relative humidity, and observing any potential condensation points. It's advisable to take thermal imaging photos after the completion of works and compare them with pre-modernization documentation.

Additional benefits related to the implementation of planned modernization*:Roof insulation will reduce heat loss through the upper horizontal partition, which will translate into improved thermal comfort, especially in winter. It will also decrease the risk of rooms overheating in summer and improve the durability of the roof structure by limiting temperature fluctuations.

4.4.3. Expected results

Description of the expected results after the implementation of renovation activities under Step 4.

Basic information on the results of the implemented actions				
Energy class*	C			
Reduction of CO_2 emissions*	0,00479 t CO_2/(m^2·year) – by 30,6% from the initial value			
Traditional energy sources after Step 4				
sing.	Type of energy source*	Power[kW]	Annual fuel consumption* [kWh/(m^2·year)]	Demand for final energy [kWh/(m^2·year)]*
1	District heating	-	42,73	42,73
2	Electricity (systemic power grid)	-	41,82	41,82
Renewable energy sources after Step 4				
sing.	Type of energy source*	Power [kW]	Annual production* (with unit)	Share of annual final energy demand* [%]
-	-	-	-	-
Energy demand of the building after Step 4				
Annual Primary Energy Demand Index **EP***			160,1	kWh/(m^2·year)
Building Energy Class (according to the draft regulation on this matter)			C	
Annual Final Energy Demand Index **EK**			84,6	kWh/(m^2·year)
Annual Useful Energy Demand Index **EU**			29,9	kWh/(m^2·year)
Specific CO_2 Emission Value:			0,02872 (39,2% initial value)	t CO_2/(m^2·year)

Estimated amount of energy bills*:

Energy carrier	Consumption amount (with unit)	Total cost [PLN]
Grid electricity	41,82 kWh/(m2·year)	8 108,82
District heating	42,73 kWh/(m2·year)	17 992,47

4.5. Step 5 - Replacement of Heat Source and Installation of Solar Collectors

Although the building currently uses the municipal district heating network, supplementation or modernization of the internal distribution system and domestic hot water (DHW) tanks is being considered. It's also possible to install a local, low-emission auxiliary source (e.g., an air-to-water heat pump) in a hybrid system. Flat or vacuum solar collectors (approx. 10 m² of active surface area) are planned for installation on the roof, intended for DHW heating. The installation will be integrated with a buffer and a solar automation system, which will allow for a significant reduction in useful heat demand.

4.5.1. Action 1: Heat source replacement

Planned date of action implementation*:	2027
Description of action implementation*:	Replacement of the heating system (e.g., with a new heat pump with a higher energy class), modernization of the heat distribution system and domestic hot water (DHW) tank.
Required materials and their technical specifications*:	Air-to-water heat pump, DHW tank with high insulation class, check valves, and modern control automation.
Investments costs*:	36,900.00 PLN
Maintenance costs*:	Maintenance every 2 years – approx. 800 PLN
Required procedures, permits, agreements*:	Project documentation

4.5.2. Action 2: Solar collector installation

Planned date of action implementation*:	2027
Description of action implementation*:	Installation of flat or vacuum collectors on the building's roof for domestic hot water heating.
Required materials and their technical specifications*:	Set of solar collectors (min. 10 m² active surface area), solar tank, circulation pump, control system, glycol.
Investments costs*:	20,000.00 PLN
Maintenance costs*:	Maintenance and glycol replenishment every 2–3 years. – approx. 300 PLN
Required procedures, permits, agreements*:	Notification of the RES installation to the competent authority and OSD (Distribution System Operator) records.

4.5.3. Notes on the implementation of Step 5 activities

Total cost of planned activities*: 77 657,28 PLN

Possible sources of financing*: “Ciepłownictwo powiatowe” programme, European Funds for Infrastructure, Climate, Environment 2021-2027, WFOŚiGW, own funds

Description of the procedure for monitoring the results of implemented actions*: The effects of this action will be assessed by analyzing domestic hot water (DHW) heat consumption and observing user comfort after modernization. It's recommended to compare energy consumption before and after collector installation, and to verify the solar system's operation by recording supply and return temperatures. The use of heat meters for DHW is also an option.

Additional benefits related to the implementation of planned modernization*: Increased self-sufficiency of the building in terms of domestic hot water preparation, reduced operational costs, and decreased energy consumption from the district heating network. The installation aligns with the city's climate policy and can be used for educating children about renewable energy sources.

4.5.4. Expected results

Description of the expected results after the implementation of renovation activities under Step 5.

Basic information on the results of the implemented actions				
Energy class*	C			
Reduction of CO_2 emissions*	0,00356 t CO_2/(m^2·year) – by 50,4% from the initial value			
Traditional energy sources after Step 5				
sing.	Type of energy source*	Power[kW]	Annual fuel consumption* (with unit)	Demand for final energy [kWh/(m^2·year)]*
1	District heating	-	17,87 [kWh/(m^2·year)]	17,87
2	Electricity (systemic power grid)	-	49,02 [kWh/(m^2·year)]	49,02
Renewable energy sources after Step 5				
sing.	Type of energy source*	Power [kW]	Annual production* (with unit)	Share of annual final energy demand* [%]
1	On-site energy generation in the building - Solar energy (collectors)	18W	6,66 [kWh/(m^2·year)]	15,08%
2	Heat pump	-	12,27 [kWh/(m^2·year)]	
Energy demand of the building after Step 5				
Annual Primary Energy Demand Index **EP***			145,8	kWh/(m^2·year)
Building Energy Class (according to the draft regulation on this matter)			C	
Annual Final Energy Demand Index **EK**			73,6	kWh/(m^2·year)
Annual Useful Energy Demand Index **EU**			29,9	kWh/(m^2·year)
Specific CO_2 Emission Value:			0,02516 (49,6% initial value)	t CO_2/(m^2·year)

Estimated amount of energy bills*:

Energy carrier	Consumption amount (with unit)	Total cost [PLN]
Grid electricity	49,02 kWh/(m2·year)	9 504,89
District heating	17,87 kWh/(m2·year)	7 524,58

4.6. Step 6 - Photovoltaic system installation

4.6.1. Action 1: ***Photovoltaic system installation***

Planned date of action implementation*:	2028
Description of action implementation*:	Installation of PV panels with a peak power of up to 20 kWp on the building's roof. Self-consumption of electricity for lighting and appliances.
Required materials and their technical specifications*:	Monocrystalline PV panels, three-phase inverter, cabling, safety features.
Investments costs*:	65,731.00 PLN
Maintenance costs*:	Service every 2–3 years, panel cleaning. – approx. 800 PLN/year
Required procedures, permits, agreements*:	Notification of micro-installation to the OSD (Distribution System Operator).

4.6.2. Notes on the implementation of Step 6 activities

Total cost of planned activities*: 65 731,00 PLN

Possible sources of financing*: „Mój Prąd” programme for JST, LIFE, FEnIKS

Description of the procedure for monitoring the results of implemented actions*: It is recommended to monitor electricity production using a remote reading system (web platform or application). Monthly and annual data should be analyzed, taking into account self-consumption and surpluses fed into the grid. Comparing data with electricity bills will allow for the assessment of actual savings.

Additional benefits related to the implementation of planned modernization*: The PV installation will reduce the cost of purchasing electricity from the grid and limit greenhouse gas emissions. It can also serve as an educational element for children and the local community regarding renewable energy. In the long term, it will increase the facility's energy independence and contribute to the stability of operating costs. This also includes promoting green energy and raising ecological awareness among the facility's users, with the potential for future expansion of the installation.

4.6.3. Expected results

Description of the expected results after the implementation of renovation activities under Step 6.

Basic information on the results of the implemented actions				
Energy class*		B		
Reduction of CO_2 emissions*		0,00465 t CO_2/(m^2·year)		
Traditional energy sources after Step 6				
sing.	Type of energy source*	Power[kW]	Annual fuel consumption* (with unit)	Demand for final energy [kWh/(m^2·year)]*
1	District heating	-	17,87 [kWh/(m^2·year)]	17,87
2	Electricity (systemic power grid)	-	35,26 [kWh/(m^2·year)]	35,26
Renewable energy sources after Step 6				
sing.	Type of energy source*	Power [kW]	Annual production* (with unit)	Share of annual final energy demand* [%]
1	On-site energy generation in the building - Solar energy (collectors)	18 kW	23,86 [kWh/(m^2·year)]	36,75%
2	Heat pump	-	12,27 [kWh/(m^2·year)]	
Energy demand of the building after Step 6				
Annual Primary Energy Demand Index **EP***			111,4	kWh/(m^2·year)
	Building Energy Class (according to the draft regulation on this matter)		B	
Annual Final Energy Demand Index **EK**			77,0	kWh/(m^2·year)
Annual Useful Energy Demand Index **EU**			29,9	kWh/(m^2·year)
Specific CO_2 Emission Value:			0,02051	t CO_2/(m^2·year)

Estimated amount of energy bills*:

Energy carrier	Consumption amount (with unit)	Total cost [PLN]
Grid electricity	35,26 kWh/(m2·year)	6 836,85
District heating	17,87 kWh/(m2·year)	7 524,58

Renovation Roadmap of Maria Konopnicka Kindergarten No. 4 in Cieszyn

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