Energy Efficiency Audit. Executive Summary

Wanda Chotomska School and Kindergarten Complex

7 Św. Kingi Street, 62-540 Kleczew

Client: Polish Green Network Association Association (Warsaw)

Contractor: Z Kwadrat Piotr Zaborowski – author: Piotr Zaborowski

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Background information on the energy efficiency project

A project to improve energy efficiency:	Thermal modernization of the Primary School Complex in Kleczew
Project description (max. 250 characters):	• Replacement of window joinery • Changing existing ventilation to heat recovery ventilation • Lighting replacement
Data of the entity in which the project may be carried out	Kleczew Commune

Parameters of a project to improve energy efficiency

Average annual amount of final energy planned to be saved:	1285895,34	kWh/year	110,57	toe/year
Average annual amount of primary energy planned to be saved:	1421052,97	kWh/year	122,19	toe/year

Data of the energy efficiency auditor

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1. Introduction

The purpose of the audit is to assess the current energy performance of the ZSP building in Kleczew and to identify measures to improve its energy efficiency, in line with the Audit Agreement and the prepared Document Plan.

The report includes an assessment of the building's current condition, as well as calculations and modelling results for the proposed modernisation measures. It also presents a comparison of different variants, an evaluation of their energy, environmental, and economic impacts, and a recommendation for a modernisation package based exclusively on renewable energy sources (RES) as new heat sources.

Improving energy efficiency not only reduces operating costs for the Facility Manager but also contributes to environmental protection by lowering emissions.

This audit report provides the basis for applying for co-financing for the thermal modernisation of the school complex, to improve the building's overall energy performance.

1.1. Description of the client

The direct client of the audit is the Polish Green Network Association – a non-governmental organization, which is a party to the Agreement and the recipient of this study, which has obtained funding under "LIFE RePower the Regions PL". As part of this project, in cooperation with the municipality of Kleczew, decarbonization activities are carried out in Eastern Wielkopolska. Therefore, the beneficiary of the audit is the Kleczew commune, in particular, the School Complex indicated by the commune authorities.

1.2. Description of the aim of the contract

The main goal is to conduct an energy audit of the building of the School and Kindergarten Complex in Kleczew and to prepare a report in accordance with the requirements of the Agreement and the Document Plan.

2. Description and diagnosis of the existing condition and the results of basic measurements

In the second half of September 2025, an on-site inspection of the facility was carried out. A visual assessment of the condition of the structure was made, and materials from the manager were collected, which served as the basis for the study.

There is a RES power plant (wind and solar power plant) in the commune, which, after expansion, is expected to reach a capacity exceeding 300 MW. The completion of the expansion was planned for 2025.

2.1. Building partitions – thermal parameters, current state

As a result of the query of the documentation received from the Facility Manager, building partitions were defined in the Arcadia TermoCad 12 software. The characteristics of the materials and their thickness were entered. Their physical properties, density and thermal insulation result from the applicable technical standards included in the program.

Thermal bridges were identified at the wall-to-floor joints on the ground, on lintels and jambs, at the roof-wall junction, and in the corners of external walls.

Due to the age of the windows, a leak was assumed (and > 4). Recommended comprehensive replacement of windows with a U-≤0.9 and U-≤ doors of 1.3 W/(m^2· K) and improving the tightness of the joints.

Only the roof over the school meets the currently applicable technical conditions in terms of thermal insulation.

2.2. Installations – current state

2.2.1. Heat sources – central heating and hot water

The building is supplied with heat by means of two Viessmann gas condensing boilers with a capacity of 170 kW each. In addition, the Vitocell 100 water exchanger, also from Viessmann, is used to heat domestic hot water. The entire system is set up using the Viessmann HK1 wall-mounted controller. The recommendations provide for only clean energy sources (RES), in accordance with the Agreement with the Polish Green Network for the audit and the terms and conditions of the "LIFE RePower the Regions PL" program.

2.2.2. Ventilation

The gravity system generates significant energy losses during the heating season. It is recommended to switch to a mechanical supply and exhaust system with heat recovery (recuperation) and balance the air flows.

2.2.3. Built-in lighting

It is recommended to implement automation (presence and daylight sensors), which will reduce electricity consumption and operating costs. If you need to replace your lighting fixtures due to wear and tear, it is recommended to consider installing LED fixtures that can be integrated with motion sensors.

2.2.4. Existing RES installations

A PV installation with a capacity of 39.78 kW was installed on the building. The electricity obtained is included in the energy balance provided on the invoice. The existing installation does not cover the entire electricity demand. When analyzing electricity bills, the balance of energy given and consumed differs depending on the month (season and sunlight).

While the power of the PV system is sufficient to power the auxiliary drives of the heating system, in the case of lighting, it would be necessary to increase the power along with the installation of energy storage.

3. Rules for determining baseline energy consumption and environmental indicators

Energy consumption was determined on the basis of the methodology provided for audits and energy performance certificates (among others EN ISO 13790) using Arcadia Termocad 12.

To verify the calculations of the program, three approaches were performed:

1. Full modernization, including replacement of heat and power sources with ventilation and partitions
2. Modernization of the construction joinery itself with ventilation

3. Modernization of partitions, ventilation, heat sources, without replacing the power source

As a result of the analysis, it was found that the greatest annual savings are brought by a full modernization. On the other hand, the greatest efficiency, taking into account the ratio of financial outlays to computational annual savings, is achieved thanks to the replacement of window joinery and mechanical ventilation installations with heat recovery.

4. Enhancements

4.1. Improvements – window and door joinery

Improving window and door joinery consists in replacing it with joinery with better parameters of heat transfer coefficient and better tightness.

The cost of replacing the entire window joinery throughout the building is estimated at ***PLN 1,256,093.21 gross.***

4.2. Improvements – ventilation with heat recovery

Supply and exhaust units with heat recovery are recommended, with the selection of air streams for the function of zones and real loads. The heat exchanger is recommended to use the spiral type due to its high efficiency. This improvement significantly reduces ventilation losses during the heating season by ensuring good ventilation of the rooms.

The cost of a new ventilation installation with heat recovery is estimated at ***PLN 2,208,206.96 gross.***

5. Rules for the selection of modernization projects

The selection was based on weighting criteria: legal conditions (meeting current technical conditions), technical conditions (feasibility), cost-effectiveness (SPBT), environmental efficiency (emission reduction).

6. Recommended variant and final conclusions

Due to the high costs of full improvements, the recommended package includes:

1. replacement of joinery and sealing
2. mechanical ventilation with heat recovery

The package provides a significant reduction in energy demand and a reduction in exhaust emissions.

It is recommended to consider increasing the number of existing PV panels to reduce current consumption from the grid and installing energy storage to power the lighting.

It is also recommended to install automatic lighting control for LED luminaires.

Depending on the available financing of modernization projects, thanks to this analysis, the Building Management will be able to choose the cost-optimal variant that qualifies it for obtaining the fund.

The least profitable is the insulation of the partitions themselves. The greatest efficiency is achieved by replacing the joinery along with the installation of mechanical ventilation with heat recovery, because this is where the greatest heat losses currently occur.

In the case of a full modernization, including insulation of permanent building partitions, replacement of the heat source with a ground pump, and a photovoltaic installation. In the case of PV installations, it is recommended to make an energy storage system.

For environmental reasons, the expanded solar-wind hybrid power plant is a great opportunity for the region.

Option	Average annual final energy savings [GJ/year]	Tons of oil equivalent [toe/year]	Average annual primary energy savings [GJ/year]	Tons of oil equivalent [toe/year]	Estimated amount of CO 2 emission reductions [tonnes/year]	Planned total costs [PLN]	Annual energy cost savings [PLN/year]	SPBT [years]
1	5894,60	140,79	8003,54	191,16	291,23	12653051,97	523875,59	24,15
2	4612,30	110,16	5073,53	121,18	204,79	4196458,78	294243,43	14,26
3	4806,77	114,81	6308,85	150,68	215,89	6997904,12	310780,97	22,52