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
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Roadmap for Building Renovation. “Zvance” Kindergarden

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Overcoming Underperforming Renovations in Central and Eastern Europe

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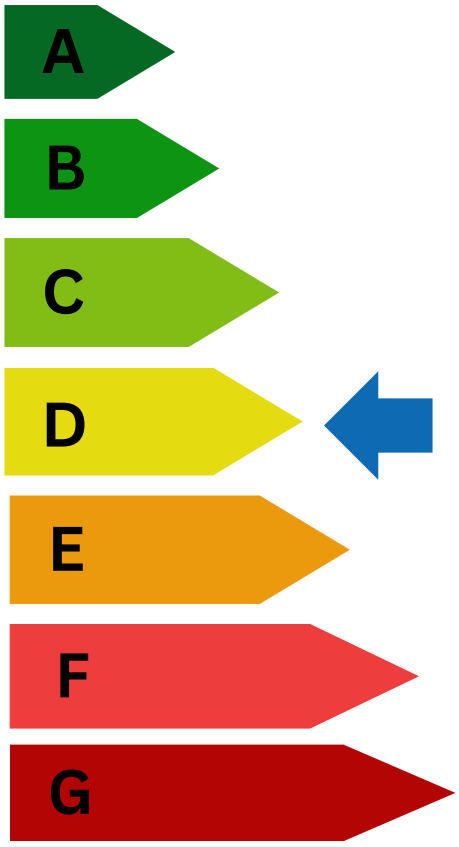
ROADMAP
BUILDING RENOVATION

Building name:	“Zvance” Kindergarden
Address:	69 Slavyanska Street, Lom

GENERAL BUILDING DATA

Building type	Municipal public
Year of construction	1979
Total build-up area	1585,9 м2
Occupancy schedule	From 06:00 to 18:00., 250 days a year
Renewable energy sources	Industrial gas oil, electricity
Renewable energy sources	Absorbed energy from outdoor air
Previous renovation measures	Replacement of windows (2012) Insulation in the attic space (2012)
Total primary energy consumption	259 kWh/m2year
Total primary non-renewable energy consumption	240 kWh/m2year
Annual energy costs	57 073 BGN/year
CO2 emissions:	49,08 kg/m2year
Final energy consumption by sources	Source 1: Electricity: 40.19 kWh/m2year Source 2: Gas oil: 134.32 kWh/m2year Source 3: Absorbed energy from outdoor air: 11.19 kWh/m2year

ENERGY CLASS:



ROADMAP
BUILDING RENOVATION

Building renovation steps

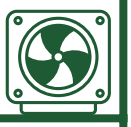
Current status

Energy consumption class:	D
List of previously implemented measures:	- Replacement of windows (partial) -Thermal insulation of mineral wool in the roof space
Total final energy consumption:	**185,70 kWh/m2year**
CO2 emissions:	49,80 kg/m2year
Energy costrs	**57 073 BGN**

Step 1

Energy class:	B
Implementation period:	until 2030 г.
List with recommended energy saving measures: 	- ECM B1 Thermal insulation of external walls - ECM B3 Roof thermal insulation - ECM B4 Thermal insulation of underground walls ** - ECM B5 Windows and doors - ECM C6 VRF system
Investment costs:	921 437 BGN
Maintenance costs:	1500 BGN/year (inspection, replacement of filters on indoor units, refilling with refrigerant)
Total final energy consumption:	**46,60 kWh/m2year**
CO2 emissions:	*15,24 kg/m2year*
Energy costs:	***16240 лв. BGN***

Step 2

Energy class:	A
Implementation period:	until 2040.
List of names of recommended energy saving measures: 	- ECM C10 Ventilation with heat recovery - ECM S11 DHW - ECM C12 Lighting - RES Photovoltaic power plant
Investment costs:	134,800 BGN.
Maintenance costs:	500 BGN/year (inspection and cleaning and replacement of filters on ventilation systems)
Total final energy consumption:	**30.43 kWh/m^{2}year**
CO2 emissions:	6.1 kg/m^{2}year
Energy costs:	***4350 BGN***

DESCRIPTION OF THE BUILDING RENOVATION STEPS

Measure 1: ECM B1 Thermal insulation of external walls

Laying a thermal insulation system with an open structure (breathable), finished with plaster on the walls of the building;
Materials and technical characteristics The measure involves the installation of 150 mm EPS insulation (λ= 0.034 W/mK) on the cleaned and leveled surfaces of the main exterior walls of the building (1st and 2nd floors). The insulation will be applied using cement adhesive and finished with reinforcing mesh and plaster, all components being compatible and part of an External Thermal Insulation Composite System (ETICS).
Investment costs: 202,529 BGN.

Measure 2: ECM B3 Roof thermal insulation

Due to observed leaks and mold on the ceilings, it is recommended to replace the existing roof waterproofing, along with the existing thermal insulation. In parallel, external insulation should be applied to the walls of the attic space.
Materials and technical characteristics: The attic walls should be insulated with 100 mm EPS, while the ceiling insulation should be replaced with 120 mm glass wool.
Investment costs: 170,100 BGN.

Measure 3: ECM B4 Thermal insulation of basement walls

Installation of insulation on the exterior walls of the basement, finished with a surface layer resembling the original bush-hammered texture; application of waterproofing and underground insulation. Materials and technical characteristics: for the basement walls 120mm XPS (λ= 0.034 W/mK), installed in the same way.
Investment costs: 13,752 BGN.

Measure 4: ECM B5 Windows and doors

Complete replacement of transparent envelope components. All windows and glazed storefronts will be replaced with new windows with PVC frames. On the 1st and 2nd floors, triple-glazed units with a total U-value not exceeding 1.1 W/m²K will be installed. This also includes the replacement of the external entrance door, which is part of the storefront.
Investment costs: 277,669 BGN.

Measure 5: ECM C6 VRF system

To reduce energy costs and improve the heating system, it is planned to replace the existing oil-fired boiler with a heat pump system using direct expansion of the refrigerant with variable refrigerant flow (VRF or VRV system), with an approximate capacity of 100 kW. This includes the procurement, delivery, and installation of one or more outdoor units, indoor units, a copper refrigerant piping network, branch joints, fittings, control systems, power supply, and obtaining the necessary permit for increased power capacity from the electricity distribution company.
Prior to implementation, a detailed design phase will be carried out, during which some of the proposed parameters may be adjusted.
Investment costs: 257,386 BGN.

Necessary administrative and legal procedures and documents:

- Preparation of application documentation for funding in accordance with the Guidelines for Applicants under the "Regional Development Programme," Priority 2: "Integrated Territorial Development of the Regions," Procedure: "Support for Integrated Urban Development in 40 Urban Municipalities," in line with the building's energy audit / submission of a funding request to the EERSF, NTEF or commercial bank along with the energy audit documentation / development of an energy performance contract with ESCO.
- Signing of a contract with the funding institution / ESCO.

DESCRIPTION OF THE BUILDING RENOVATION STEPS

Necessary administrative and legal procedures and documents:

- Preparation of tender documentation in accordance with the energy audit of the building and conducting public procurement procedures for selecting: a designer for the energy renovation; a contractor for the construction and installation works and a company for construction supervision (not applicable if ESCO is contracted).
- Appointment of an investor supervision representative.
- Appointment of an acceptance committee for the construction works.
- Signing of acts of acceptance of construction and civil engineering works.

Total investment costs:	921 437 BGN
Total maintenance costs:	1500 BGN/year. Inspection, replacement of filters on indoor units of the VRF/VRV system, refilling of the heat pump with refrigerant
Sources of funding:	Programme "Development of Regions", Priority 2 "Integrated Territorial Development of Regions", Procedure "Support for Integrated Urban Development in 40 Urban Municipalities" / Energy Efficiency and Renewable Sources Fund (EERF) / National Trust Ecofund (NTEF) / ESCO / Commercial bank loan / Own funds.
Non-renewable energy sources:	Electricity
Renewable energy sources:	Absorbed energy from the environment – outdoor air
Total primary energy consumption:	116,49 kWh/m2a
Total primary consumption of non-renewable energy:	107,17 kWh/m2year
Final energy consumption by sources:	Electricity = **46.60 kWh/m²year** Environment – outdoor air = **72.39 kWh/m²a** (considered saved energy according to national regulations when is with heat pump)
Annual energy costs:	**16 240 BGN/year**
CO2 emissions:	22,6 kgCO2/m2year
Power consumption class:	**B**
Additional benefits:	Improved thermal comfort Improved noise insulation from the outside environment
Monitoring and verification:	• The following values are measured and archived: • Indoor temperature in the building (daily, three times) • Outdoor temperature (daily, three times and determination of daily average value) • Total monthly and annual electricity consumption, kWh (once a week, at regular intervals, from the commercial electricity meter (Smart meter in the future)) • During the heating seasons, an “Energy-Temperature” curve shall be drawn (similar to the one found in the Energy Performance Certificate). If the weekly data point significantly deviates from the average curve, consultation with heat pump specialists should be sought. • Once a year, on the same date, the annual consumption of natural gas and electricity should be compared to the baseline values from Step 1. In case of significant deviations, an energy auditor should be consulted. One year after the implementation of the energy efficiency measures, an energy audit shall be conducted and a new, updated Energy Performance Certificate for the building shall be issued.

DESCRIPTION OF THE BUILDING RENOVATION STEPS

Measure 1: ECM C11 Domestic hot water supply (DHW)

To ensure the supply of DHW, it is planned to replace the existing storage water heaters with thermodynamic water heaters for optimal efficiency.
Materials and technical specifications:
Thermodynamic water heater with a capacity of 100 litters, equipped with an integrated heat pump.
Investment costs: 23,400 BGN.

Measure 2: ECM C12 Lighting

Replacement of all existing lighting fixtures is planned.
Materials and technical specifications:
The old luminaires will be removed and replaced with new LED fixtures reducing the energy consumption.
Investment costs: 11,400 BGN.

Measure 3: Ventilation installation

Installation of local ventilation systems with an approximate maximum airflow capacity of 400–600 m^3/h in the activity and sleeping rooms of the kindergarten. The ventilation units should have a heat recovery efficiency of 80% or higher and must be equipped with frost protection as well as an additional heater or air-to-water heat exchanger to supply warm air. Additionally, it is recommended to integrate CO_2-based control alongside the main system management to ensure optimal indoor air quality and energy efficiency.
Investment costs: 70,000 BGN.

Measure 4: RES Photovoltaic installation

Installation of a 20 kWp photovoltaic system on the roof, designed to use the generated energy for on-site consumption via an inverter.
Materials and technical specifications:
During the development of the renewable energy project, the expected output will be calculated to properly size the installation.
Investment costs: 30,000 BGN

Required administrative and legal procedures and documents:

- Preparation of application documentation for funding in accordance with the Guidelines for Applicants under the "Regional Development Programme," Priority 2: "Integrated Territorial Development of the Regions," Procedure: "Support for Integrated Urban Development in 40 Urban Municipalities," in line with the building's energy audit / submission of a funding request to the EERSF, NTEF or commercial bank along with the energy audit documentation / development of an energy performance contract with ESCO.
- Signing of a contract with the funding institution / ESCO.
- Preparation of tender documentation in accordance with the energy audit of the building and conducting public procurement procedures for selecting: a designer for the energy renovation; a contractor for the construction and installation works and a company for construction supervision (not applicable if ESCO is contracted).
- Assignment of a designer opinion regarding the admissibility of loading the roof slab in connection with the implementation of Measure 4.
- Appointment of an investor supervision representative.
- Appointment of an acceptance committee for the construction works.
- Signing of acts of acceptance of construction and civil engineering works

DESCRIPTION OF THE BUILDING RENOVATION STEPS

Total investment costs:	134 800 BGN.
Total maintenance costs:	500 BGN/year. Inspection, cleaning and replacement of filters on ventilation systems.
Sources of funding:	Program "Development of Regions", Priority 2 "Integrated Territorial Development of Regions", Procedure "Support for Integrated Urban Development in 40 Urban Municipalities" / Energy Efficiency and Renewable Sources Fund (EERF) / National Trust Ecofund (NTEF) / ESCO / Commercial Bank Loan / Own Funds.
Non-renewable energy sources:	Electricity
Renewable energy sources:	Absorbed energy from the environment – outdoor air
Total primary energy consumption:	49,15 kWh/m2year
Total primary consumption of non-renewable energy:	28,70 kWh/m2year
Final energy consumption by sources:	Electricity - **12.48 kWh/m^{2}year** Electrical energy from the sun - **17.96 kWh/m^{2}year** Environment – outdoor air - **39.26 kWh/m^{2}year** (considered saved energy according to national regulations when is with heat pump)
Annual energy costs:	**4350 лв./year**
CO2 emissions:	6.1 kgCO_2/m^{2}year
Power consumption class:	**A**
Additional benefits:	Improved visual comfort Improved indoor air quality
Monitoring and verification:	Monitoring will be carried out in accordance with the recommendations outlined in Step 1. Additionally, the following will be implemented: • Monthly reporting from the photovoltaic system • Monthly reporting on indoor air quality in activity and sleeping rooms by group, including CO_2 levels, temperature, and humidity