

Baseline report

Administrative building - Gabrovo Municipality



Developed by:



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Developed for:



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1. General information

Municipality:	Gabrovo
Building type:	Administrative building
Address:	5300 Gabrovo, 3 Vazrazhdane square
Total floor area:	7,870 m ²

The expected results based on the preliminary assessments of possible energy efficiency measures are presented in Table 1. Values may vary after development of the Energy Audit. For the calculation of the payback period the needed investments are divided by all monetary savings coming from the reduction of energy consumption (no other savings are expected). The negligible increase of the electricity consumption is due to additional cooling energy after measures implementation.

TABLE 1. EXPECTED RESULTS (ALL MEASURES)

Parameter	Value	Unit
Electricity savings	-0.6	MWh/yr
Heat energy savings	441,9	MWh/yr
Cost savings	18,483	EUR/yr
CO ₂ emission reduction	89	tCO ₂ /yr
CAPEX	178,559	EUR
Payback period	9,66	year

2. Building status

Commissioned:	1970
Building structure:	Monolithic reinforced concrete structure. The building is in good condition and no major structural repairs are required before the implementation of the proposed energy efficiency measures.
Walls:	25 cm of brick masonry. The main part is covered with limestone. Other parts are covered with lime-cement plaster or sandstone.
Roofs:	Two slabs of reinforced concrete with air gap between. Only small parts consist of single reinforced concrete slab. Some areas of the roof are already insulated, while others are not.
Floors:	Mainly it is non-heated basement, however part of the basement has a heating system.
Windows:	Three types of windows: old wooden framework with double glazing; old aluminum framework with double glazing; new PVC framework with double glazing (30% of the total area). The old windows (wooden and aluminum

framework) are in very poor condition and with relatively high U-values.

- Heating:** There is a boiler that operated in LFO until the middle of 2013. After that the burner was replaced and currently natural gas is used for heating. The boiler supplies also a hall situated next to the administrative building. There is no individual measurement for the heat energy delivered to the hall.
- DHW:** Local electrical boilers.
- Ventilation and air-conditioning:** There is no centralized ventilation and air-conditioning system. There are few individual air-conditioners in certain premises.
- Lighting:** The existing lighting is based on new energy efficiency T5 tubular fluorescent lamps. The lighting system is in good condition.
- Appliances:** Mainly office equipment (PC, printers, etc.). The consumption is comparatively high and will be analyzed in details during the development of the Energy Audit.
- Exploitation:** Typical for administrative buildings - 5 days per week, 9 hours per day.

3. Current energy consumption

Table 2 presents the actual energy consumption in the facility for the period 2013 - 2015. During the first months of 2013 LFO was used for heating. In the summer of 2013 a new burner was installed and since then the main energy carrier for heating is natural gas. At this stage there is no explanation for the much higher consumption of electricity in 2015. The variations of the heat energy consumption are based on the different weather conditions through the years.

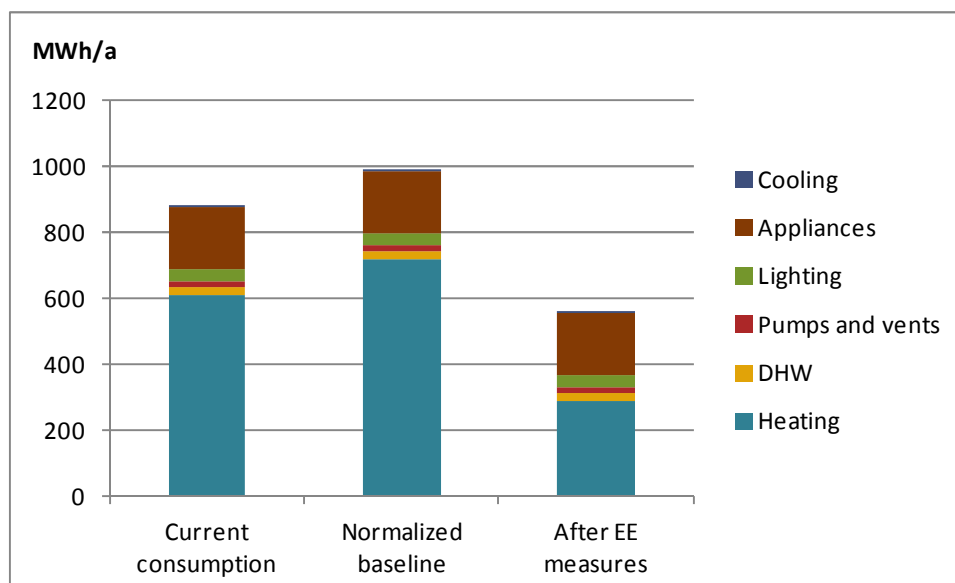
TABLE 2. ENERGY CONSUMPTION AND EXPENSES FOR 2013 - 2015

Year	Electricity		Heat energy		Total	
	MWh/yr	EUR/yr	MWh/yr	EUR/yr	MWh/yr	EUR/yr
2013	270	26727	622	30667	892	57394
2014	270	26438	538	24904	808	51342
2015	336	36001	670	27933	1006	63935
<i>Average</i>	<i>292</i>	<i>29722</i>	<i>610</i>	<i>27835</i>	<i>902</i>	<i>57557</i>

4. Baseline of the energy consumption

The results from the preliminary analyses of the actual and normalized energy consumption as well as the expected energy consumption after measures implementation is presented in Figure 1.

FIGURE 1. COMPARISON BETWEEN THE ACTUAL CONSUMPTION, THE NORMALIZED CONSUMPTION AND EXPECTED CONSUMPTION AFTER IMPLEMENTATION OF EE MEASURES



The normalized baseline is estimated in accordance with the Bulgarian legislation. EnEffect calculated the energy needs for maintaining the required indoor air quality in such type of buildings with the existing on site installations.

There is a difference in the values for heating (current consumption) in Table 2 and Figure 1 as the boiler is supplying also a hall situated next to the administrative building. The heat consumption of the hall is roughly calculated and subtracted from the total consumption reported in Figure 1.

5. Possible energy efficiency measures

The expected savings after measures implementation are presented in Table 3. As there is no centralized ventilation and/or cooling systems and the heating is based on a relatively effective and reliable hot water boiler, only measures on the building envelope were investigated. The specific facade view of the building is not to be changed so mainly internal insulation is recommended. Insulation of the roof is not recommendable at this stage as the last floor of the main building is used as a storage for paper documents and heating is not required.

Pessimistic approach was used for the calculation of the investments. The contracted prices in a potential ESCO contract may be lower.

TABLE 3. PRELIMINARY ESTIMATIONS OF THE POSSIBLE ENERGY SAVINGS

Measure	Expected savings			CAPEX	Payback
	MWh _{el} /yr	MWh _{th} /yr	EUR/yr	EUR*	year
ESM 1. Insulation of walls	-623	297,736	12,475	109,518	8.8
ESM 2. Replacement of windows		112,127	4,673	58,604	12.5
ESM 3. Insulation of floor		32,038	1,335	10,436	7.8
Total for the investigated measures:	-623	441,901	18,483	178,559	9.7

ESM 1. Insulation of walls

The measure envisages installation of two types of thermal insulation. The walls with limestone slabs will be insulated from inside, while the walls with lime-cement plaster will be insulated from outside.

The internal insulation will be 8 cm of XPS covered with plaster. For better performance and avoidance of thermal bridges the insulation will also be placed on the inside walls and the ceiling at least 50 cm inwards. During the construction works the radiators must be moved in order to install the insulation behind them.

The external insulation will be 15 cm of EPS-F covered with plaster.

ESM 2. Replacement of windows

The old windows with wooden and aluminum framework are in poor condition. The calculated U-values are 2.75 W/m²K (wooden framework) and 3.28 W/m²K (aluminum framework). The measure envisages replacement of the existing old windows with new, double glazed, with solar and thermal protection with PVC framework with thermal break and U-value not more than 1,75 W/m²K.

ESM 3. Insulation of floor

The measure is concerning the unheated basement that is about 40 % of the total floor area. The recommendation is to insulate the ceiling of the unheated basement with 10 cm EPS.

6. Other remarks

During the implementation of any energy efficiency measures, a monitoring system should be envisaged. The main reason is to divide the heat energy for the administrative building and the neighboring hall. Other benefits of the system are verification of the achieved savings and improved control of the installations.