Baseline report

Sport hall Orlovetz - Gabrovo Municipality

Developed by:

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Developed for:

European Bank for Reconstruction and Development

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1. General information

Municipality: Gabrovo

Building type: Sports hall

Address: 111, Orlovska Str., Gabrovo

Total floor area: 8,879 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. Based on more detailed estimations during the Energy Audit development new measures may be analyzed and recommended.

TABLE 1. EXPECTED RESULTS (ALL MEASURES)

Parameter	Value	Unit
Electricity savings	208	MWh/yr
Heat energy savings	412	MWh/yr
Cost savings	63,654	EUR/yr
CO_2 emission reduction	290	tCO_2/yr
CAPEX	**609,943**	EUR
Payback period	**9,96**	year

2. Building status

Commissioned: The technical project is developed in 1981 but the actual commissioning is in 1991.

Building structure: Monolithic reinforced concrete structure.

Walls: Three main type of walls. Type 1(main type) is reinforced concrete with outside cover of limestone. Type 2 is situated only under the windows and consists of reinforced concrete with specific outside cover. Type 3 is only at the lower part of the building and consists of bricks covered with limestone.

Roofs: The construction is made of steel rods and steel ropes. Currently the insulation consist of 6 cm mineral wool. The finishing outside layer is made of cooper sheets. Possible additional insulation may be installed but detailed analyses are required in order to guarantee that the construction can endure the additional load and the investment is economically feasible.

Floors: There are three types of floors. Mainly it is non-heated basement, however small part of the basement has a heating system. The third floor is over outside air.

Windows:	Aluminum framework without broken thermal bridge with double glazing (4-12-4). Very poor condition, with numerous gaps. During rainfalls water is leaking inside the building and reflect on the condition of the walls.
Power supply:	The power substation of the building is oversized and not in good condition.
Heating distribution system:	The existing heating distribution system is installed since the commissioning of the building. It is based on "shell and tube" heat exchangers and no automatic control is available.
DHW:	Local electrical boilers.
Ventilation and air-conditioning:	There are 4 ventilation and air conditioning systems: two for the main hall, one for the scene and one for the lobby (formerly a smoking area). Ventilation systems are equipped with sections for heating, cooling and air recirculation. The designed automatic control was not installed during the construction and the systems are controlled manually by the operational staff. According to the technical design the cooling is based on a chiller using cold water from the urban water supply system. The system was never put into operation. The system (designed flows) is over estimated to cover the highest norms in Bulgaria, which is not necessary for these type of premises and according to the current legislation can be reduced significantly. In addition there is one more only exhaust ventilation designed to lead off the hot air from the lighting system in the main hall. The existing ventilation and air-conditioning systems cannot provide the needed parameters of the microclimate neither through the winter nor through the summer. As the cooling section is not in operation, during the hot summer months the hall is not operating.
Lighting:	The existing lighting is based on out-of-date technologies. The lamps are worn and with low energy efficiency. Only in small areas in the building new energy efficiency lamps are implemented. The total installed capacity of 270 kW is insufficient and the current regulations requirements cannot be reached. During certain events additional temporary lighting is mounted.
Appliances:	Not investigated in details for the baseline report. There are offices for the operational staff, offices for rent, and a coffee-house where electricity consumption is measured by individual energy meter. The total consumption is negligible compared to the expenses for heating, air-conditioning and lighting.
Exploitation:	The hall is used mainly for training and is in operation 10 hours per day, 7 days per week. The offices are occupied 8 hours per day only in workdays. As the cooling installation is not in operation the hall is usually not used in the hottest summer months.

3. Current energy consumption

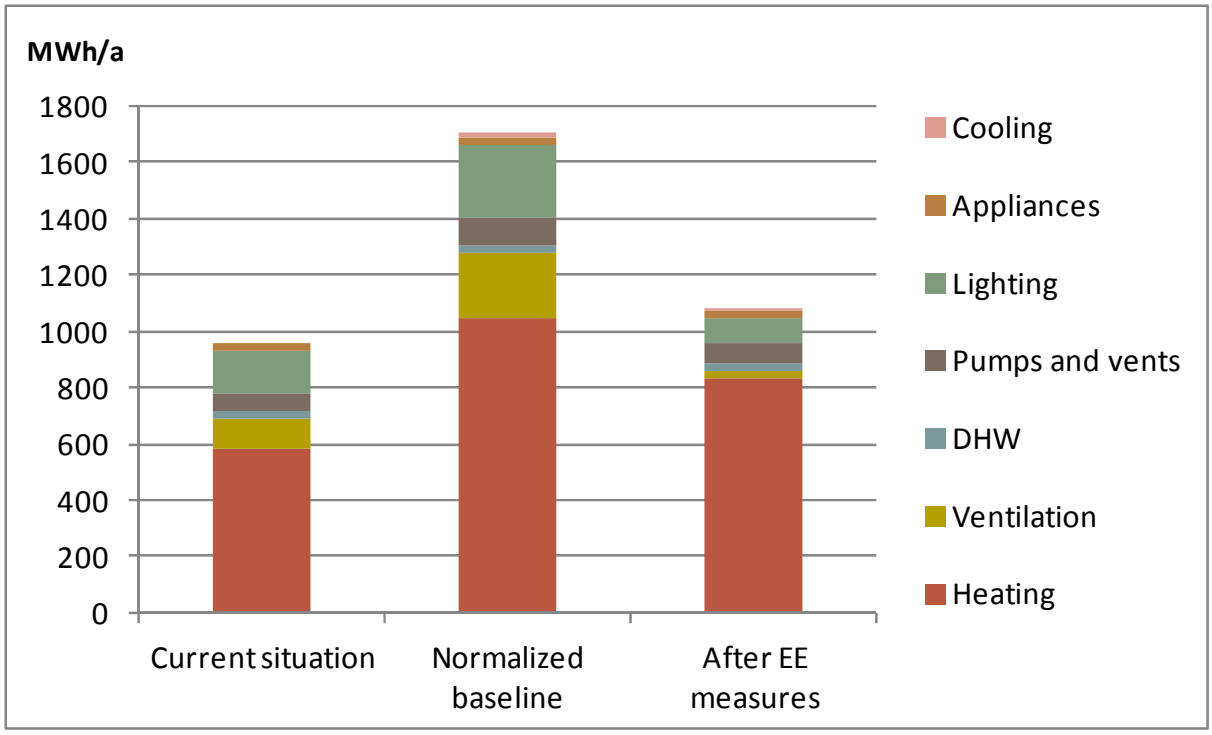
TABLE 2. ENERGY CONSUMPTION AND EXPENSES FOR 2013 - 2015

Year	Electricity		Heat energy		Total	
	MWh/yr	EUR/yr	MWh/yr	EUR/yr	MWh/yr	EUR/yr
2013	212	17,092	532	27,147	744	44,239
2014	188	15,843	595	25,229	784	41,073
2015	266	28,130	711	30,544	977	58,674
Average	*222*	*20,355*	*613*	*27,640*	*835*	*47,995*

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



5. Possible energy efficiency measures

The expected savings after measures implementation are presented in Table 3. During these preliminary analyses, technically possible measures concerning the external walls of the building were not found. The main obstacles are: insulation cannot be installed outside due to the specific

view of the facades, that is not supposed to be changed; external insulation is also not possible in most of the cases, as the corridors bordering with the outer walls are too narrow. Possible solutions for insulation of the external walls will be researched during the development of the detailed Energy efficiency audit, however it will be probably neither economically feasible nor technically possible. Possible energy efficiency measures of the roof will be investigated in details, as currently detailed analyzes of the construction properties were not performed. If the investment is possible, the installation of 12 cm mineral wool will lead to energy savings in the amount of 70 MWh/a for 12 cm.

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. Replacement of windows	1,086	194,084	8,339	127,283	15.2
ESM 2. Replacement of heating distribution system		64,078	6,768	17,895	2.6
ESM 3. Reconstruction of ventilation and air-conditioning systems	35,787	182,280	29,704	247,181	8.3
ESM 4: Replacement of lighting fixtures	170,882	- 28,375	18,795	217,584	11.6
Total for the investigated measures:	**207,755**	**412 067**	**63 654**	**609,943**	**9.96**

ESM 1. Replacement of windows

The existing windows are in very poor condition. The estimated U value is 3,38 W/m^{2}K. The measure includes replacement of the existing windows with new double glazed with solar and thermal protection, with aluminum framework (PVC is also possible but the slope of the building should be taken into consideration, as the PVC framework may twist over time) with thermal break and U value not more than 1,75 W/m^{2}K. Although the measure is not financially attractive (bankable) its implementation is mandatory as the leakages (during rainfalls) through the gaps in the framework endangers the buildings construction characteristics.

ESM 2. Replacement of heating distribution system

The existing heating distribution system is characterized with out-of-date technology and lack of automatic control. The estimated efficiency of heat exchanger is around 97%, and efficiency of manual control is assumed to be 95 %. The measure includes replacement of the existing distribution system with new up-to-date one with plate heat exchangers and automatic control. The efficiency of the new system according to the heat exchanger is almost 100%, and automatic control is assumed to be 99%.

ESM 3. Reconstruction of ventilation and air-conditioning systems

The measure consists of replacement of the existing equipment for ventilation and air-conditioning. The new ventilation units will be with reduced flow of fresh air that meets the applicable regulation standards and will be equipped with recirculation section with high efficient heat recovery and heat recovery heat pump using exhaust air and connected to the head distribution station. The heat

pump module using exhaust air will be powerful enough to provide cooling to the room in summer mode.

ESM 4. Replacement of lighting fixtures

The measure includes replacement of the whole lighting system in the hall with new up-to-date one. The places of the lighting points will be changed, new cables and control panels will be installed. The total installed capacity will be increased in order to provide the needed lighting quality. The lamps in the other premises will be replaced with much more efficient LED ones.

6. Other remarks

The electrical installation of the building is not corresponding to the existing regulations (Ordinance No 3 of 09.06.2004 for the structure of electrical installations and power lines). The replacement of the whole electrical network in the building is obligatory. These investments will not lead or will lead to negligible energy savings and can be considered as a **reconstruction measure**. Considering the above it is recommendable to be implemented not under ESCO contract but with own funds by the building owner. Indicative investments are calculated in the amount of 90,000 EUR, but the sum must be specified with the development of a techincal design project that will cost approximately 5,000 EUR.

Currently the building is supplied by a power sub-station, situated in the yard of the neighboring supermarket but owned by the sports hall, that consists of two oil transformers with capacity of 630 kVA and one with capacity of 250 kVA. The substation is oversized and not in good condition. Currently only the small transformer is in operation. After measures implementation the nominal electrical loads will be around 380 kW. Development of a new project for reconstruction of the sub-station is recommendable (details will be investigated in the Energy audit). The measure may not be defined as energy efficiency measure, as the reduced losses will be negligible, but the installation of a new power transformer is recommendable and may be economically feasible.