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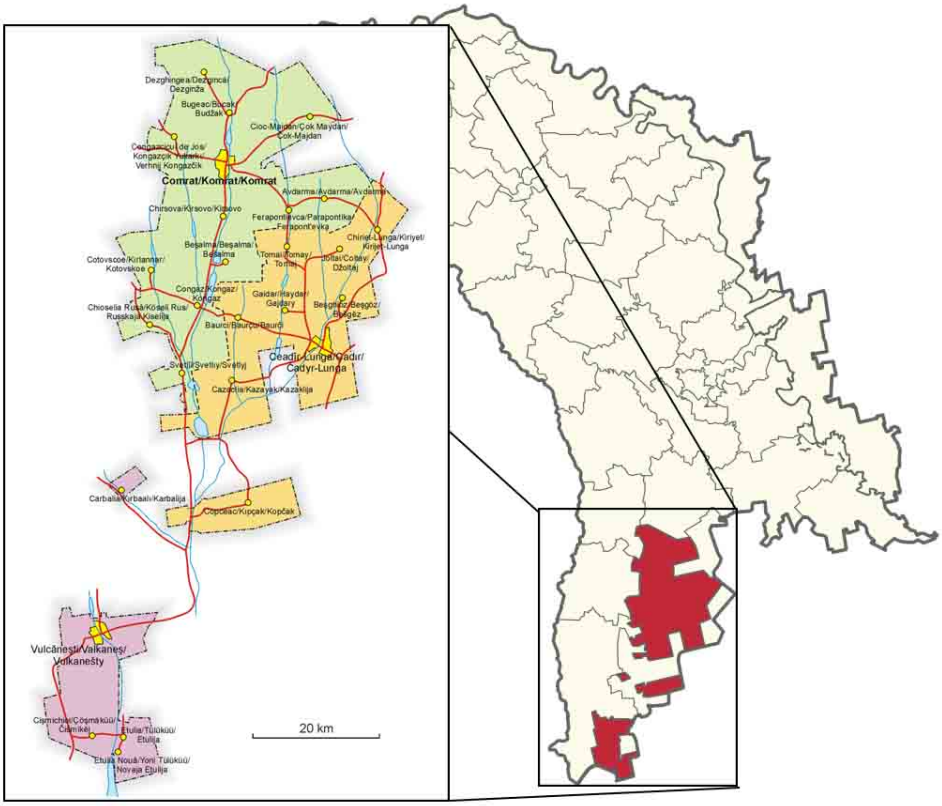
Modernization of the Local Public Services in the Republic of Moldova



Project Concept
(report on walk-through energy audit)

Regional Sports Boarding School,
Comrat municipality

May 2018

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Project Partners:

Ministry of Agriculture, Regional Development and Environment of the Republic of Moldova
North, Center, South and ATU Gagauzia Regional Development Agencies

Comrat, May 2018

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Foreword

The main goal of the project concept is to increase the efficiency of the energy resources use at the regional level in ATU Gagauzia through the implementation of energy-saving measures and technologies in public buildings.

The objectives of the concept project are:

- *identification of energy saving potential for the specific institution;*
- *facilitation of the decision-making process of the responsible authorities and financial organizations when considering the possibility of investment.*

Specific objectives are:

- *Development and implementation of pilot projects for demonstration of the application of innovative energy efficiency in public buildings;*
- *Informing and training of local stakeholders on energy efficiency issues;*
- *Increase the involvement of the local public authorities and population in the initiatives related to energy efficiency sector;*
- *Developing of a monitoring and replication mechanisms to ensure the reproduction of project results in ATO Gagauzia and in entire country.*

1. Introduction

Regional Sports Boarding School in Comrat is a sports and educational institution established with the aim of developing sportingly gifted children in the southern part of the Republic of Moldova. There are 10 classes in the lyceum, a modern equipped gym, one library, a dining room, dormitories and rest room. The building was built in 1966.

Photo 1 Regional Sports Boarding School in Comrat, East facade

Photo 2 Regional Sports Boarding School in Comrat (Orto photo, Scale 1:1000), source www.geoportal.md

Buildings marked in the Photo 2:

А – Study block and dormitories
Б – Sports block
В – Boiler house

The working stuff consists of 26 employers.
221 pupils are studying in the lyceum, at least half of them are living in dormitories.

2. Energy Consumption

The electricity consumption was 81.2 MWh in 2014 with a big increase to 394,9 MWh in 2016. Between 2015 and 2016, the average electricity demand was 370,5 MWh per year. It is observed a consumption of electricity of 189 kWh/m2, and this is a high value for a school.
Gas consumption increased from 23 000 m3 in 2014 to 29400 m3 in 2016, by 20%, or average consumption of 40150 m3 of gas per year, or approximatively 270 kWh/m2 per year, and this is a high value for a school.

Table 1 Energy consumption

Energy	unit	consumption		
		2014	2015	2016
Electricity	kWh	81200	346 200	394900
Gas	$м^3$	23 000	23 000	29400

3. General data on the studied buildings

3.1 Heating system

The school is heated by a boiler house which is located close to the block Б. The thermal agent goes by the shortest path into both buildings.

3.1.1 Boiler house

The boiler house was built in 2013, it works on natural gas. The installed boilers are “Thermona” type.

3.1.2 Heating system and network

In the block А, the internal heating network is old type (cast-iron radiators and pipes). In the block Б the system is fully renewed.

3.2 Hot water supply system

Hot water is available in the shower rooms; the source of hot water production is a gas boiler installed in the boiler house.

3.3 Fresh water supply and sanitation system

The building is supplied with fresh water from the urban water supply system, sewerage system is connected to urban sanitation system.

3.4 Electricity consumption system

The electricity supply is provided by the local distributor Gas Natural Union Fenosa.

3.5 Natural gas supply system

The source of natural gas supply in boiler house and kitchen is the city's natural gas distribution system.

3.6 Previously implemented energy efficiency projects

Over the past 2 years, Block Б has been completely renovated (including also internal reparations).

In 2013, a new boiler house was constructed, which provides also the possibility of preparing hot water.

3.7 Planned projects for the coming years

In the near future, implementation of measures related to energy efficiency are not planned.

4. Data on the proposed project

Note: further description and proposed measures apply only to the building A.

4.1 Description of the current situation

The block A was built in 1966. In a spatial arrangement, the shape of the building resembles the shape of the letter U. The building has two floors, on the ground floor there are dormitory rooms, a dining room and a kitchen, on the second floor there are several classrooms.

4.2 Building proprieties (constructive part)

The foundation of the building consists of large limestone blocks; the basement is missing around the perimeter of the building.

External walls are 500mm thick (including interior and exterior finish) and consist of small limestone blocks. The main internal walls are also built from small limestone blocks. The separation between floors is made of of hollow-core reinforced concrete panels. The internal partitions are built from the same material.

4.3 Windows and doors

During last several years, all the windows and external doors in the building were replaced with double glazed PVC constructions.

Photo 3 Window on the first floor.

4.4 Roof

The pitched roof is covered with asbestos sheets. The attic is not affected by the leaks.

Photo 4 Pitched roof, north part of the building

4.5 Heating system

The building is heated by the boiler house powered by natural gas. In the separate building (block B) 3 gas boilers are installed and one separate boiler for hot water preparation. The heating agent is transported on the shortest way through insulated pipes directly into the heating network inside the building, no separate thermal point is installed. Two-pipe system is providing heat through cast-iron heaters.

Photo 5 Gas boilers in the boiler house

4.6 Ventilation system

There is no central ventilation system installed in the building. The natural ventilation is ensured by regular opening of the windows. There is a high level of humidity in the building.

Photo 6 Consequences of the low ventilation level, first floor, classroom

4.7 Hot water supply

One gas boiler is used for the preparation of hot water, which is supplied to the shower rooms and kitchen.

4.8 Lighting system

In block A, fluorescent lamps are used for lighting. The lighting level is low.

Photo 7 Lighting in classrooms

5. Project concept

5.1 Description of the proposed energy efficiency measures

The consultants propose the following list of measures for the thermal rehabilitation of the building:

- Roof

Due to the considerable service life of the old roof, the experts propose a complete removal of the existing roof coverage. Also, the replacement of rafter system should be considered. For the subsequent operation it is proposed to install a new pitched roof, with appropriate hydro and thermal insulation, as well as the insulation of the attic floor with thermal insulation materials (such as rock wool or similar).

Annual energy savings = **54 MWh/y**
Estimated investment = **18 748 €**

- Facades

It is suggested to insulate the external walls of the entire building. On the prepared surface, install a heat-insulating layer (10cm of mineral wool with a proper insulation proprieties), auxiliary layers (glue composition, fiberglass mesh, primer) and finish with the final decorative coating.
The socle must also be insulated with a thinner layer of heat-insulating material (for example, XPS) to prevent the penetration of cold directly into the room and its base, as well as to create a barrier for ground moisture and waters formed as a result of precipitation. Installation of thermal insulation material will require exposing the foundation walls to 50 cm from the ground, that is, the total height will be 1 m. After the installation of the insulation material, all the crevices should be removed with foam or sealant. After installation, restore the blind on the entire perimeter, keeping a slope of at least 7 degrees from the walls of the building. A blind with a width of 70cm should be framed with curb and the rainwater diversion must be organized.

Annual energy savings = **141 MWh/y**
Estimated investment = **142 301 €**

- Lighting system

Lighting should be replaced in the entire building. LED lights are recommended. In the corridors, motion sensors should be installed in order to automatically turn off the lighting in the absence of movements.

Annual energy savings = **6,7 MWh/y**
Estimated investment = **3 496 €**

- Additional recommendations

Ventilation system

It should be kept in mind that ventilation should maintain the optimum temperature and the flow of fresh oxygen to different rooms, and there should not be strong airflows in the rooms. The intensity of air exchange should be calculated on the basis of current

standards. For classrooms, it is proposed to clean and restore channels for natural ventilation, also to install combined ventilation units.

5.2 Preliminary assessment of energy saving potential

The calculation of the preliminary final energy consumption for heating is based on a simplified calculation methodology according to the "Energetische Bewertung von Bestandsgebäuden"; provided by the German Energy Agency. The thermal conductivity of the building elements was estimated based on Moldavian standards and norms and on Consultants experiences.

The preliminary final energy consumption for heating and the estimated saving potential were calculated based on a reference climate, a standard indoor temperature and a basic air ventilation rate.
Note: the results do not necessarily reflect the actual energy consumption of the buildings due to the current poor heating/ventilation comfort in the buildings (e.g. shortened heating period, reduced indoor temperature, poor/no ventilation, etc.).

Table 2 The proposed energy efficiency measures and their characteristics

Proposed measures	Surface, m^2	Annual energy savings, MWh/y	Annual energy savings in €	Investments, €	Reduction of emissions t/CO_2 per year	Payback period, years
Isolation of the ceiling of the last floor and installation of a new roof	527	54	1 939	18 748	11	12,4
Insulation of external walls	1200	141	5 045	142 301	28	36,1
Replacement of lighting devices		6,7	744	3 496	1,5	4,7
Total	**1 727**	**201,7**	**7 728**	**164 545**	**40,5**	**29,5**

6. Financial analysis

The estimation of the required investment costs was based on the Consultant's experiences (specific investment costs per refurbished element). The Consultant did not request/receive offers from potential supplier's/construction companies. All costs incl. VAT.

The total investment costs were estimated to around **3,37 mln MDL** (**164 545 EURO**)[1].
The share of the energy relevant investments of the total investment is around 50 %.
Refurbished floor area in m^2: 1727.
When considering only the energy relevant investment the payback period is 29,5 years.

7. Preliminary project implementation plan

The description of the steps necessary to implement the described recommendations can be divided into 3 main stages: the development of energy audit of the building, preparation for the implementation of the project and the implementation process itself.

Each stage includes the following actions:

A. Development of energy audit of the building:

- Decision-making on financing of energy audit

[1] Exchange rate: 1 EURO = 20,5 MDL (average value for 2017).

- Development of the task of energy audit
- Tender & Energy Audit Contract
- Energy audit
- Designing a design task

B. Preparing for project implementation:

- Decision-making on investment
- Tender for the development of technical documentation
- Development of technical documentation, approval, tender documents
- Tender for project implementation
- Evaluation of offers, contract
- Coordination of the work plan

C. Implementation of the project:

- Preparation of the working field
- Insulation of the ceiling of the last floor in buildings
- Insulation of the external walls
- Replacement of the lighting devices
- Staff training, documentation

Upon completion of the implementation of these measures, the building can be put into operation.

The approximate timeframe for the project implementation plan is given in the annex 1.

8. Conclusion

As a result of the proposed measures, the expected **energy savings will be 201,7 MWh/y**. Due to this saving, it is estimated that **emissions will decrease** by **40,5 t/CO_2 per year**.

Annex 1

Draft Implementation schedule

Task No	Phase	Activities	Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Task 1	Energy Audit	Funding decission for Energy Audit																													
Task 2		Preparation of the Task for Energy Audit																													
Task 3		Tender & Contracting Energy Audit																													
Task 4		Performing Energy Audit																													
Task 5		Preparation of the Task for Design																													
Task 6	Preparation	Funding decission for Investment																													
Task 7		Tender for full technical design																													
Task 8		Elaboration of the final design, authority approvals, tender book																													
Task 9		Tender procedure for implementation company																													
Task 10		Assessment of proposals, contract																													
Task 11		Work packages to be conducted by the institution																													
Task 12	Implementation	Construction site preparation																													
Task 13		Insulation of the ceiling of the last floor																													
Task 14		Insulation of the external walls																													
Task 15		Replacement of the lighting devices																													
Task 16		Training, documentation																													
Task 17	Acceptance	Final acceptance																													

estimated winter

estimated winter

*Estimated non-working period caused by winter winter conditions; the correct time of this period can indicated earliest at the time of the funding decision

Annex 2.

Анкета

по сбору данных для диагностического анализа сектора энергоэффективности в регионе АТО Гагаузии

I. Общие данные:

Название населённого пункта / района: __м. Комрат_____

Название публичного учреждения: Региональный спортивный лицей интернат

Собственности (АТЕ 1-го / 2-го уровня) _____

Год строительства здания публичного учреждения: 1966 г.

Тип строительного материала общественного здания:

- ☐ Бетонные панели
- ☐ **Котелец**
- ☐ Кирпич
- ☐ Другой (укажите)

II. Энергетическая ситуация в общественных зданиях

Part A. Общие данные об здании:

Укажите пожалуйста значение для следующих показателей:

	Показатели	Единица измерения	Значение
1.	Количество административного персонала:	человек	6
2.	Количество рабочего персонала:	человек	20
3.	Количество пользователей / бенефициаров (дети / студенты / пациенты / клиенты)	человек	221
4.	Общая площадь здания	$м^2$	1960
5.	Количество этажей здания	единицы	**2**
6.	Средняя высота каждого этажа	м	2.60
7.	Общая площадь внешних стен здания	$м^2$	1200
8.	Количество окон	единицы	78
9.	Общая площадь окон	$м^2$	240
10.	Общая площадь крыши	$м^2$	527
11.	Тип крыши:	плоская крыша или скатная крыша	Скатная крыша

Part B. Потребление энергии за последние 2 года (по источнику):

Тип источника энергии	Ед. изм.	Потребление		
		2014	2015	2016
Электричество	кВтч	81200	346 200	394900
Дизель (исключить транспортные средства)	Литры	------	-----	------
Натуральный газ	$м^3$	23 000	23 000	29400
Уголь	тонны	-------	------	--------

Биомасса (древесная щепа, гранулы и т. д.)	$м^3$	---------	-------	-------
Централизованное отопления	Гкал	--------	-------	-------
Другой (укажите) _____		-------	-------	-------

Part C. Энергетические системы

C.1. Тип отопления в здании центральное отопление?

a. <u>Центральное отопление</u>

b. Электрические индивидуальные обогреватели для каждой комнаты

(Если «a» укажите ответы на вопросы 1.1, 1.2, 1.3, если «b» перейдите к вопросу № 2.

1.1. Если есть, укажите тип системы отопления:

□ однотрубная система

□ **<u>двухтрубная система</u>**

1.2. Укажите тип используемого топлива:

□ Электричество

□ **<u>Натуральный газ</u>**

□ Уголь

□ Биомасса (древесная щепа, гранулы и т. д.)

1.3. Укажите мощность (Гкал) _____

C.2. Если используются отдельные обогреватели, какого типа они?

□ Электрические индивидуальные обогреватели

□ Электрические радиаторы

□ **<u>Кондиционер</u>**

□ Другие (укажите)_____

C.3. Существует ли в здании центральная система горячего водоснабжения или используется ли отдельные бойлера?

□ Центральная система горячего водоснабжения

□ **<u>Электрический бойлер</u>**

□ Нет горячей воды

□ Другой (укажите)_____

C.4. ***Есть ли в здании центральная система кондиционирования воздуха или используется отдельная система для каждого помещения?***

□ Центральная система кондиционирования (рабочая)

□ Центральная система кондиционирования (нерабочая)

□ **<u>Индивидуальная система в каждом помещении (рабочая)</u>**

□ Индивидуальная система в каждом помещении (нерабочая)

□ Отсутствует вообще

C.5. Есть ли центральная система вентиляции: □ **<u>Да</u>**; или □ Нет.

Какова она?

□ **<u>принудительный</u>**

□ естественный поток

C.6. Система внутреннего освещения:

Показатели	Ед. изм.	Значение
Количество ламп	единицы	94
Тип ламп (светодиодные-LED, люминесцентные лампы, лампы накаливания)	тип	Светодиодные люминесцентные
Средняя мощность ламп	W	8 - 12
система автоматизации освещения	Да / нет	да

Part D. Описание бойлеров

Количество бойлеров: _2_____

Тип топлива, используемого для бойлеров:

- □ Электричество, Установленная мощность (кВтч): 3 эффективность (%)_96___
- □ Уголь, Установленная мощность (кВтч): __------_____ эффективность (%)__----__
- □ Газ, Установленная мощность (кВтч): __------_____ эффективность (%)__----__
- □ М азут, Установленная мощность (кВтч): _____ эффективность (%)____
- □ Дизель, Установленная мощность (кВтч): _____ эффективность (%)____
- □ Биомасса, Установленная мощность (кВтч): _____ эффективность (%)____

Part E. Другие единицы потребления энергии

E.1. Духовки (кухни)

Количество духовок, используемых в здании __2_____ единиц

Тип потребляемой энергии:

- □ Электричество
- □ **Газ**
- □ Другое (просьба указать)

E.2. Существует ли стационарные группы двигателей внутреннего сгорания, электрогенераторы?

Количество электрогенераторов: _____------_____

Установленная мощность электрогенераторов (кВт): _____-----_____

Средние рабочие дни для электрогенератора в год: _____-------_____