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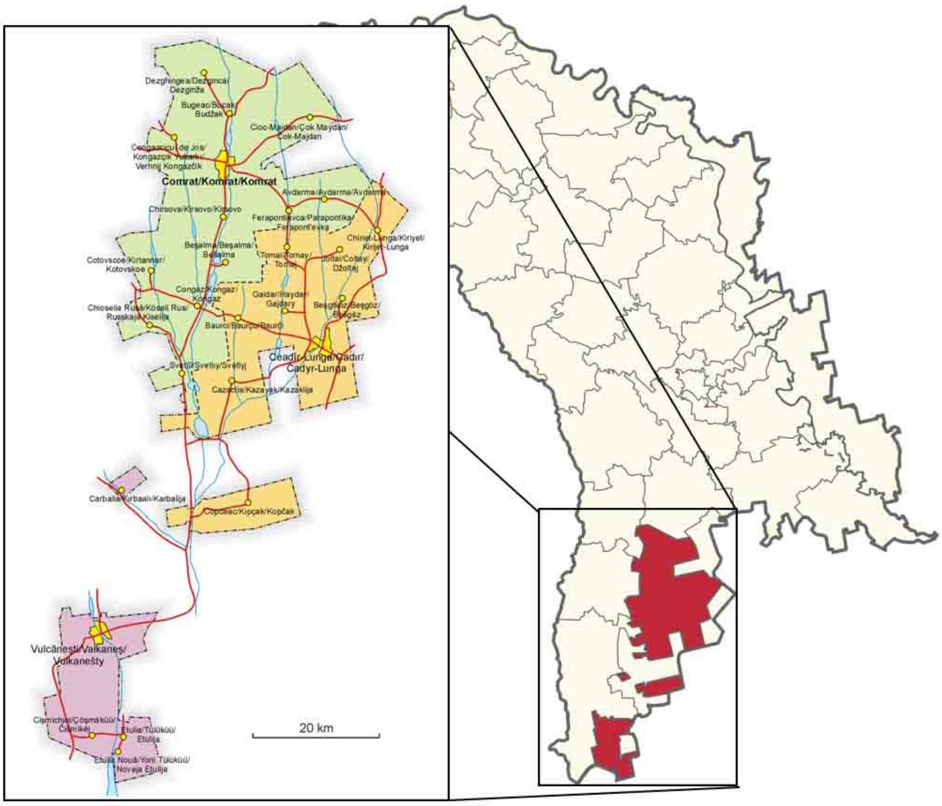
Modernization of the Local Public Services in the Republic of Moldova



Project Concept
(report on walk-through energy audit)

Professional school, Ceadir – Lunga municipality

May 2018

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Comrat, May 2018

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Institution: Professional school, Ceadir – Lunga municipality

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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 ATU Gagauzia and in entire country.*

1. Introduction

Professional School is the place where young people have the opportunity to learn the professions of cooks, seamstresses, carpenters, agricultural machinery mechanic, cutter, plumber, restorer of decorative plaster and stucco products, etc.

Now in professional school are making their studies 321 pupil.

Photo 1 Professional school in Ceadir-Lunga municipality, western facade

Working staff consists of 72 persons.
Main building was built in 1965.

The components (indicated in photo 2):

А – main building of the professional school
Б – Dormitories
В – Laboratories;
Г – Dormitories (unused)

Photo 2 Professional school, Orto photo, S 1:1000. Source – www.geoportal.md

Note: in this concept only the main educational building of the complex is considered.

2. Energy Consumption

Electricity consumption was 44.67 MWh in 2014 with an increase to 49.70 MWh in 2016. Between 2014 and 2016, average electricity demand was 47.55 MWh per year. There is an electricity consumption of 30.7 kWh / m2, which is normal value for a school.
Gas consumption increased from 20100 m3 in 2014 to 20140 m3 in 2016, or it is an average gas consumption of 20180 m3 per year, or approximately 130 kWh / m2 per year, which is normal for a school.

Table 2 Energy consumption

Energy	unit	consumption		
		2014	2015	2016
Electricity	kWh	44670	48300	49700
Gas	$м^3$	20100	20300	20140

3. General data on the studied buildings

3.1 Heating system

The building is heated using a gas boiler house, which is located in the southern part of the building. The thermal agent enters directly into the educational building. This boiler room also provides heating in the laboratory and to the dormitories.

3.1.1 Boiler house

The boiler house is serviced by a separate economic agent. Used fuel is natural gas.

3.1.2 Heating system and network

Internal heating networks were installed in 1965 (no replacement was made).

3.2 Hot water supply system

Hot water is only available in the kitchen, the source - gas boiler.

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

In 2002 the roof was replaced – flat roof was replaced with pitched roof covered with asbestos cement sheets.

3.7 Planned projects for the coming years

In the near future partial internal repair works are planned.

4. Data on the proposed project

4.1 Description of the current situation

Analysed building was built in 1965. The building is U – shaped, main entrance is situated on the west side. The central part consists of two floors in which classrooms are located. South and North parts of the building have one level, in south part of the building kitchen and auxiliary rooms are situated. In Northern part of the building is situated the gym class, changing rooms and showers. The basements are located only under the southern wing of the building, the entrance to a part of them from inside of the building, while the entrance to auxiliary rooms are from outside. In northern part of the building, the boiler room is situated. There were no visible signs of degradation of main resistance structures.

4.2 Building proprieties (constructive part)

The foundation of the building consists of large limestone blocks; basement walls are 600 mm wide.

The walls (interior and exterior) of the building are laid out of a cauldron, the width is 500 mm. The gym and the canteen are covered with reinforced concrete ribbed panels which relies on reinforced concrete trusses. The other parts of the building are covered with hollow-core reinforced concrete panels.

4.3 Windows and doors

During the last several years 30% of the windows were replaced with double glazed PVC windows. The profile is thick; in some places the seals are not properly finished. Other 70% of the windows and doors are old, and in a very poor condition.

Table 3 Windows and doors in the main block

	PVC	Wooden
Windows	34	60
Surface of the windows	120 m^2	210 m^2
External doors	2	2
Surface of the doors	6 m^2	3 m^2

Photo 3 Windows and external door, north facade.

4.4 Roof

The roof is pitched; wooden framework is in good condition. The roof is not protected by any insulation membranes or any other auxiliary materials. There is no rainwater management system.

The total area of the attic floor is 1549 m^2.

4.5 Heating system

The building is heated by its own gas boiler house. Access to the boiler room is limited, as it is carried out by a separate economic agent. Heating system is two-pipe, radiators are old type made mainly from cast-iron. In large rooms, the radiators are tubular, covered with protective screens.

Quantity of radiators – 94 units.

Photo 4 Radiator in the corridor of the first floor and measuring of its temperature.

4.6 Ventilation system

The centralized ventilation system in the building is present only in the kitchen. The ventilation holes in gym are covered. Ventilation holes for natural ventilation in the walls are present, having a direct connection to the roof.

Photo 5 Ventilation system in the kitchen

4.7 Hot water supply

For preparation of the hot water a gas water heater is used, its capacity is 10 litters, the hot water is supplied just at the kitchen. There is no possibility to prepare and provide the hot water from the boiler house.

Photo 6 Gas water heater, in the kitchen.

4.8 Lightning system

For lighting, fluorescent and incandescent lamps are used.

Table 4 Characteristics of the lighting devices

	Incandescent lamps	Fluorescent lamps
Quantity	68	120
Power	100 W	100 W

Photo 7 Lighting in the basement.

5. Project Concept

5.1 Description of the proposed energy efficiency measures

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

- Roof

Experts suggest a complete replacement of the existing sloped roof. It is proposed to install a new sloped roof with modern roofing materials. It is recommended to check the reliability of the wooden framework system and its replacement in case if it is needed. Attic floor should be covered with vapour layer, after that to make the insulation with XPS or rock wool, the next layer should be hydro insulation and after then a cement floor.
It is also necessary to ensure the evacuation of rainwater through drains. It is important to take the end of the vertical drainage pipes to a minimum of 50 cm from the walls of the building to prevent the destruction of the blind area along the entire perimeter of the building.

Annual energy savings = **160 MWh/y**
Estimated investment = 55 106 €

- Facades

First of all, it is necessary to remove the old layer of external coating and to seal the joints. Insulate the facades of the building with rock wool. Also it is necessary to ensure the waterproofing of the walls along the entire perimeter of the building and to reconstruct the blind on all the perimeter of the building.

Annual energy savings = **208 MWh/y**
Estimated investment = 209 301 €

- Windows and doors

Replace obsolete windows and doors on PVC structures, taking care of the dimensions of the door and windows openings. Ensure embedding of slopes using insulating membranes. Install external (tin) and internal window sills (plastic).

Annual energy savings = **39 MWh/y**
Estimated investment = **65 221 €**

- Lightning system

Throughout the building, replace the lighting devices with LED elements. In the corridors it is recommended to use motion sensors which will automatically turn off lights when there is no movement.

Annual energy savings = **30 MWh/y**
Estimated investment = 3 308 €

- Additional recommendations

Ventilation system

Ventilation should maintain an optimum temperature and supply of fresh oxygen into the rooms. The intensity of air exchange should be calculated on the basis of current standards. To ensure comfort in the gym and canteen room, it is recommended to restore the vent in the ceilings (natural ventilation system), equip them with a heater and pallets to drain the accumulated condensate. For classrooms, it is proposed to use supply and exhaust ventilation devices in case if it is not impossible to clean and restore channels for natural ventilation.

Heating system

The replacement of old radiators is recommended. New radiators should be equipped with thermostatic regulators. In the gym, to provide such protective screens for radiators, which will not create any minimization in the heat distribution.

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 5 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
Thermal insulation of the attic floor and roof replacement	1549	160	5 699	55 106	32	12,4
Thermal insulation of the facades	1765	208	7 420	209 301	42	36,1
Windows and doors replacement	330	39	1 383	65 221	8	60,4
Replacement of the lighting devices		30	1 240	3 308	6,6	2
Total		**437**	**15 742**	**332 936**	**88,6**	**29,1**

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 **6,825 mln MDL** (**332 936 EURO**)[1].
The share of the energy relevant investments of the total investment is around 50 %.
Refurbished floor area in m²: 1540.
When considering only the energy relevant investment the payback period is 29,1 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
- 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
- Thermal insulation of the attic floor and roof replacement
- Thermal insulation of the facades
- Windows and doors replacement
- 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 437 MWh/y**. Due to this saving, it is estimated that **emissions will decrease** by **88,6 t/CO_2 per year**.

[1] Exchange rate: 1 EURO = 20,50 MDL (average value for 2017).

Annex 1

Draft Implementation schedule

Task No	Phase	Activities	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	· Preparation of the working field																												
Task 13		· Thermal insulation of the attic floor and roof replacement									estimated winter periode*												estimated winter periode*							
Task 14		· Thermal insulation of the facades																												
Task 15		· Windows and doors replacement																												
Task 16		· Replacement of the lighting devices																												
Task 17		· Staff training, documentation																												
Task 18	Acceptance	Final acceptance																												

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

Annex 2

Анкета

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

I. Общие данные:

Название населённого пункта / района: _город Чадыр-Лунга_

Название публичного учреждения: __Профессиональное училище_

Собственности (АТЕ 1-го / 2-го уровня) ___Учебный корпус __

Год строительства здания публичного учреждения: ___1965 год___

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	5
2.	Количество рабочего персонала:	человек	67
3.	Количество пользователей / бенефициаров (дети / студенты / пациенты / клиенты)	человек	336
4.	Общая площадь здания	$м^2$	1549
5.	Количество этажей здания	единицы	2
6.	Средняя высота каждого этажа	м	3,2
7.	Общая площадь внешних стен здания	$м^2$	1765
8.	Количество окон	единицы	94
9.	Общая площадь окон	$м^2$	330
10.	Общая площадь крыши	$м^2$	1549
11.	Тип крыши:	плоская крыша или скатная крыша	скатная

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

Тип источника энергии	Ед. изм.	Потребление		
		2014	2015	2016
Электричество	кВтч	44670	48300	49700
Дизель (исключить транспортные средства)	Литры	------	--------	--------
Природный газ	$м^3$	20100	20300	20140

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. Центральное отопление **(автономное)**

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**
- ☐ двухтрубная система

1.2. Укажите тип используемого топлива:

- ☐ Электричество
- ☐ **Натуральный газ**
- ☐ Уголь
- ☐ Биомасса (древесная щепа, гранулы и т. д.)

1.3. Укажите мощность (Гкал) ___120_____

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

- ☐ Электрические индивидуальные обогреватели
- ☐ **Электрические радиаторы**
- ☐ Кондиционер
- ☐ Другие (укажите)__________

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

- ☐ Центральная система горячего водоснабжения
- ☐ Электрический бойлер
- ☐ Нет горячей воды
- ☐ **Другой (укажите)_Газовая колонка ___**

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)
- ☐ Индивидуальная система в каждом помещении (рабочая)
- ☐ Индивидуальная система в каждом помещении (нерабочая)
- ☐ Отсутствует вообще

C.5. Есть ли центральная система вентиляции: ☐ Да; или ☐ Нет.

Какова она?

- ☐ принудительный
- ☐ **естественный поток**

C.6. Система внутреннего освещения:

Показатели	Ед. изм.	Значение
Количество ламп	единицы	188

Тип ламп (светодиодные-LED, люминесцентные лампы, лампы накаливания)	Тип лампы накаливания люминесцентные лампы	68 120
Средняя мощность ламп	W	100
система автоматизации освещения	Да / нет	да

Part D. Описание бойлеров

Количество бойлеров: ______

Тип топлива, используемого для бойлеров:

- ☐ Электричество, Установленная мощность (кВтч): ________ эффективность (%)____
- ☐ Уголь, Установленная мощность (кВтч): _________ эффективность (%)____
- ☐ Газ, Установленная мощность (кВтч): _________ эффективность (%)____
- ☐ Мазут, 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 ____4___ 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: _____________

III. Просьба указать, есть ли проекты энергоэффективности, внедренные в течение последних 5 лет? (если таковые имеются)

Проект	Год внедрения	Донор	Стоимость, тыс. лей
---------	-----	-------	-------
-------	----	----	