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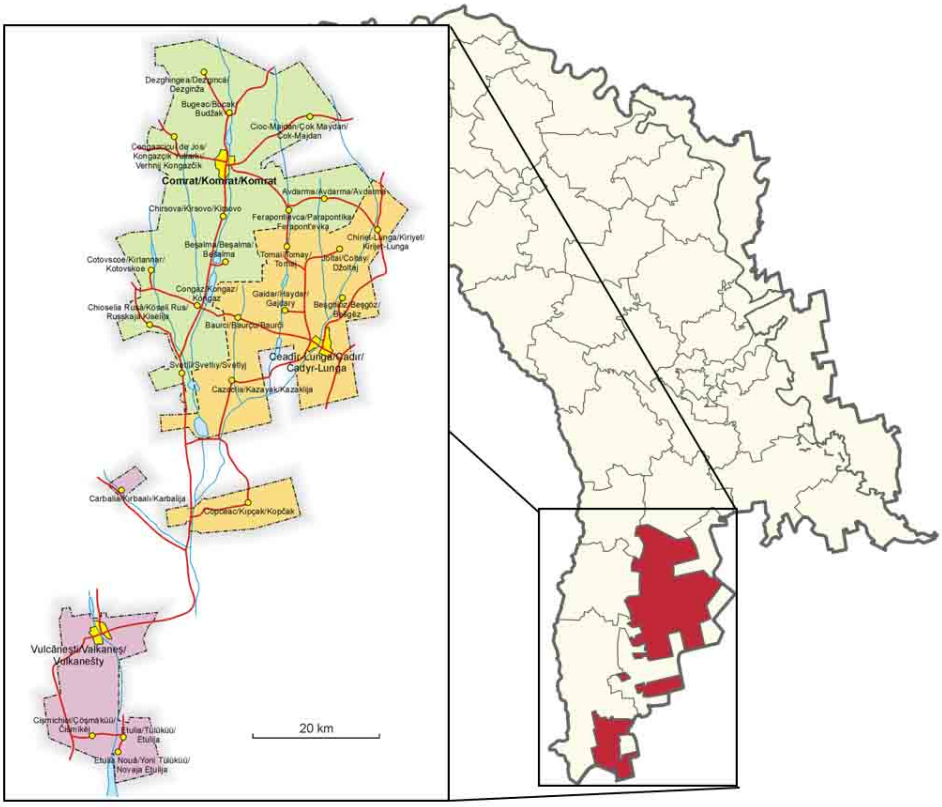
Modernization of the Local Public Services in the Republic of Moldova



Project Concept
(report on walk-through energy audit)

House of culture, Congaz village, Comrat rayon

May 2018

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Agency for Development and Cooperation SDC
Agenția Elvețiană pentru Dezvoltare și Cooperare

giz

Published by:

Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ) GmbH

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Bonn and Eschborn, Germany

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Prepared for:

The project 'Modernization of local public services in the Republic of Moldova' (MLPS) is implemented by the German Development Cooperation through GIZ in partnership with the Ministry of Agriculture, Regional Development and Environment of the Republic of Moldova and is financially supported by the German Ministry of Economic Cooperation and Development (BMZ), the European Union, the Swedish Government, the Romanian Government, and the Swiss Agency for Development and Cooperation (SDC).

Project Partners:

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

The expressed opinions belong to the author(s) and do not necessary reflect the views of the implementing agency, project's funders and partners.

Comrat, May 2018

Project Concept (report on the walk-through energy audit)

Institution: House of culture in Congaz village

Visited on: 16.02.2018

Address: 2nd 28 June street, Congaz village, Comrat rayon

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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

House of Culture in Congaz village is a centre of cultural and educational work not only for the local population, but for the whole of ATU Gagauzia, as this institution can accommodate 600 guests in the main concert hall for one event.

Photo 1 House of culture in Congaz village, main facade

The building was built in 1972. On the ground floor, the main concert hall is located. Also, there is a small hall closed by that used to be a restaurant, but at the moment it is used for small events. Here could be found several auxiliary rooms and training halls. On the second floor there is a hall for marriages, as well as several rooms that are used by the local registry office for state registration of acts of civil status. The working staff of the cultural center consists of 24 employees.

Photo 2 House of culture, Orto photo, Scale 1:1000. Source – www.geoportal.md

2. Energy Consumption

Electricity consumption was 365.26 MWh in 2014 with a decrease to 326.08 MWh in 2016. Between 2014 and 2016, average electricity demand was 333.05 MWh per year. There is an electricity consumption of 30 kWh / m2, which is normal for a house of culture.

Gas consumption increased from 6,910 m3 in 2014 to 10,892 m3 in 2016, or it is an average gas consumption of 9085 m3 per year, or approximately 83 kWh / m2 per year, which is normal for the house of culture. The growth in demand by 40% in the period 2014 - 2016 points to a rapid increase in the demand for public services of the house of culture.

Table 1 Energy consumption

Energy	unit	consumption		
		2014	2015	2016
Electricity	kWh	36526	30783	32608
Gas	$м^3$	6910	9457	10892

3. General data on the studied building

3.1 Heating system

The building is heated using 2 boiler houses. One of the boiler houses is located directly in the building in the north-western part, the second boiler-house is attached to the building in the south-western part of the building.

3.2 Hot water supply system

Hot water is not available in the entire building.

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 is the city's natural gas distribution system.

3.6 Previously implemented energy efficiency projects

The renovation of the heating system and lighting of the lobby and the celebration hall on the second floor was held in 2013-2014.

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

4.1 Description of the current situation

The building is located on the central square of the Congaz village. In a spatial arrangement, the building resembles the T-shape, where the central part consists of 2 floors, except for the main concert hall which corresponds to the height of two ordinary floors. The main facade is lined with decorative elements from a small mosaic, which in some places are already separated from the facade or destroyed.

4.2 Building proprieties (constructive part)

The foundation of the building is made of large limestone blocks. The walls consist from small limestone blocks, bearing structures - reinforced concrete columns. The slabs between levels are partly made of reinforced hollow core slabs, partly of ribbed slabs. The technical floor is missing, there is access direct in the attic. There is basement under the entire building, which is good technical conditions.

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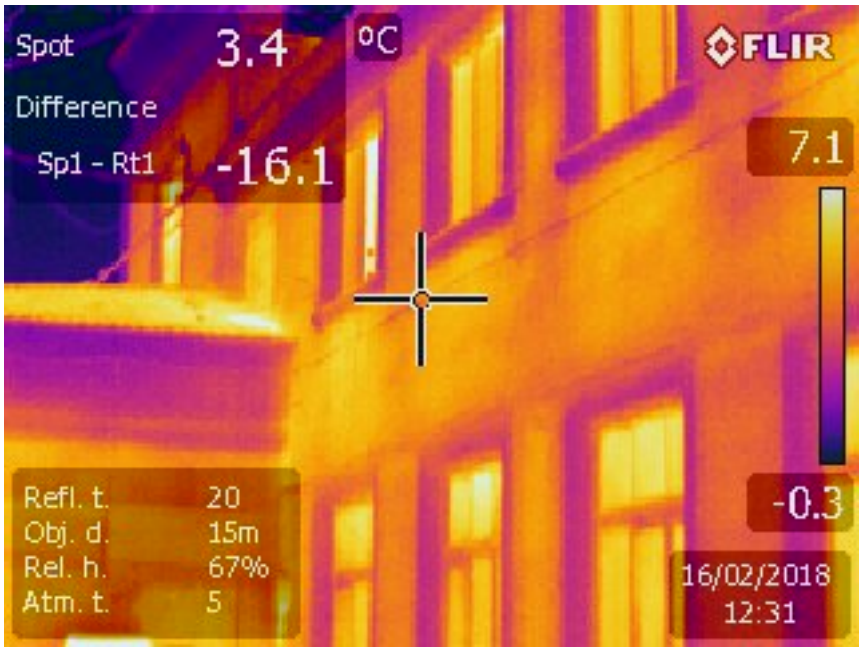


Photo 3 West façade (picture from the infrared camera)

4.3 Windows and doors

Almost all the windows and doors are old-type: double wooden frame separated with a small distance and with one layer of glass on each frame. Few windows were replaced with PVC constructions due to poor technical condition (on the side part of the building). Main entrance and vestibule doors were replaced also.

Photo 4 Double wooden framed window with one layer of glass

4.4 Roof

The wooden roof framework is roofed with corrugated asbestos-cement sheets. The roof wasn't refurbished during the last 20 years, general condition – poor (according to the words of administration, since the experts didn't have the possibility to climb on the roof). The rainwater collection system is not provided. Total area of the roof 1543 m^2.

4.5 Heating system

The building is heated by 2 boiler houses. One of the boiler houses is located inside the building in the north-western part, the second boiler-house is an annex to the building in the south-western part. The internal boiler room is equipped with two boilers and provides heating to the second floor of the building. The external boiler room provides the thermal agent to the rest of the building. Both boiler houses operate on natural gas. Internal heating networks in the lobby are replaced, the radiators are replaced by aluminum ones. Other networks and radiators are old model (cast iron).

Photo 5 Gas boiler in the interior boiler house

Photo 6 Radiator in the vestibule

4.6 Ventilation system

The centralized ventilation system in the building does not work. Natural ventilation works, but some channels are blocked.

4.7 Hot water supply

There is no hot water in the building.

4.8 Lighting system

Fluorescent and incandescent lamps are used in corridors and various rooms for lighting. Energy saving lamps (35 pieces) are used in the concert hall and on stage. There are 605 units of lighting in the entire building with the average power of 75 watts.

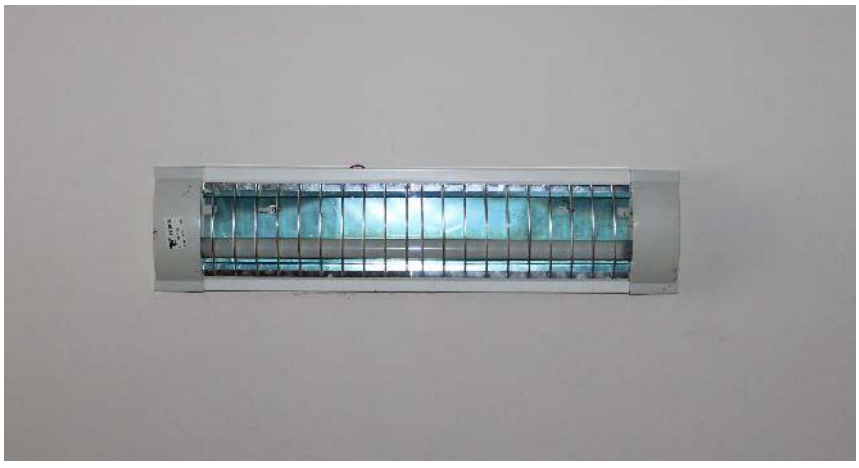


Photo 7 Lighting in the vestibule

Photo 8 Lighting on scene

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**

Experts suggest the **replacement of the old pitched roof with a flat roof, with thermal insulation layer**.
The approximate roof replacement plan assumes: concrete slabs are poured with a concrete layer to create a slope, then two layers of waterproofing material and after that a 15 cm layer of extruded polystyrene or a layer of rock wool. The next layer is laid with a film with high vapor permeability. The final layer is a clamping layer - you can lay a layer of gravel in 8 cm thick.
It is also necessary to ensure the evacuation of rainwater through drains. It is important to extend the end of vertical drainage pipes (at least 50 cm) from the building walls and to evacuate it in a proper way in order to prevent the destruction of the blind area along the entire perimeter of the building.

Annual energy savings = **159 MWh/y**
Estimated investment = 54 893 €

- **Facades**

It is suggested to **insulate the external walls of the entire building**. Beforehand, it is necessary to remove decorative elements from the facades. The facade method of warming the walls is suggested. On the prepared surface, install a heat-insulating layer (5 cm of mineral wool), auxiliary layers (glue, fiberglass mesh, primer) and finish with the final decorative coating.
Walls of basements should also be insulated with a layer of approx. 0.5 m below ground level with extruded polystyrene boards (XPS) and an additional protective and a drainage layer to prevent cold penetration directly into the room and its base, as well as to create a barrier to ground moisture and water formed as a result of melting snow. A layer of 5 cm of heat-insulating material is recommended. Its installation will require to bare the walls.
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 is framed with a curb, which allows drainage of rainwater.

Annual energy savings = **134 MWh/y**
Estimated investment = 135 186 €

- Basement

Experts propose the **thermal insulation of the basement ceiling**. It is necessary to provide for the preliminary replacement of communications that pass under the ceiling of the basement, in order to avoid additional more difficult to repair work.

Annual energy savings = **146 MWh/y**
Estimated investment = **41 504 €**

- Windows and doors

Replace windows and doors with PVC constructions with double-glazed windows, keeping the dimensions of the openings. In the northern part of the building energy-efficient glass Low-E could be installed. Ensure embedding of slopes using insulating membranes. External (tin) and internal sills (plastic) should be installed.

Annual energy savings = **27 MWh/y**
Estimated investment = **45 260 €**

- Boiler house and internal heating network

It is necessary **to replace the equipment in the boiler houses and internal heating systems**, with the installation of individual heat regulators. The current organization of the heating system does not allow the regulation of the heat supply for only one part of the building, therefore, the experts' recommendation is to install additional equipment to regulate the supply for different parts of the building, allowing to heat or disconnect unclaimed rooms or areas of the building.

Annual energy savings = **128 MWh/y**
Estimated investment = **119 845 €**

- Lighting system and building energy management system

Replace the existing lighting with LED lamps. In the concert hall where special lighting is necessary, general lighting and special illumination for the stage should be provided. In the corridors, **motion sensors for automatically turn off the lighting** in the absence of moving should be installed.

Annual energy savings = **63 MWh/y**
Estimated investment = **20 870 €**

Note: Cost estimation of replacing the lighting system does not take into account the specifics of such spaces as the concert hall. For the correct selection of the necessary sources of lighting, a specialist in lighting technology should be consulted.

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
Thermal insulation and replacement of the roof	1543	159	5 677	54 893	32	12,4
Insulation of the external walls	1140	134	4 792	135 186	27	36,1
Insulation of the basement ceiling	1500	146	5 203	41 504	146	10,2
Replacement of the windows and doors	229	27	960	45 260	5	60,4
Installation of the new equipment in the boiler house and replacement of the heating system	1389	128	2 109	119 845	19	72,8
Replacement of lighting devices		63	6 988	20 870	13,9	3
Total	**5801**	**657**	**25 729**	**417 558**	**242,9**	**25,3**

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 **23,6 mln MDL** (**417 558 EURO**)[1].
The share of the energy relevant investments of the total investment is around 50 %.
Refurbished floor area in m^2: 1543 (ground floor area).
When considering only the energy relevant investment the payback period is 25,3 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

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

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 and replacement of the roof
- Insulation of the external walls
- Insulation of the basement ceiling
- Replacement of the windows and doors
- Installation of the new equipment in the boiler house and replacement of the heating system
- Replacement of lighting devices
- Staff training, documentation

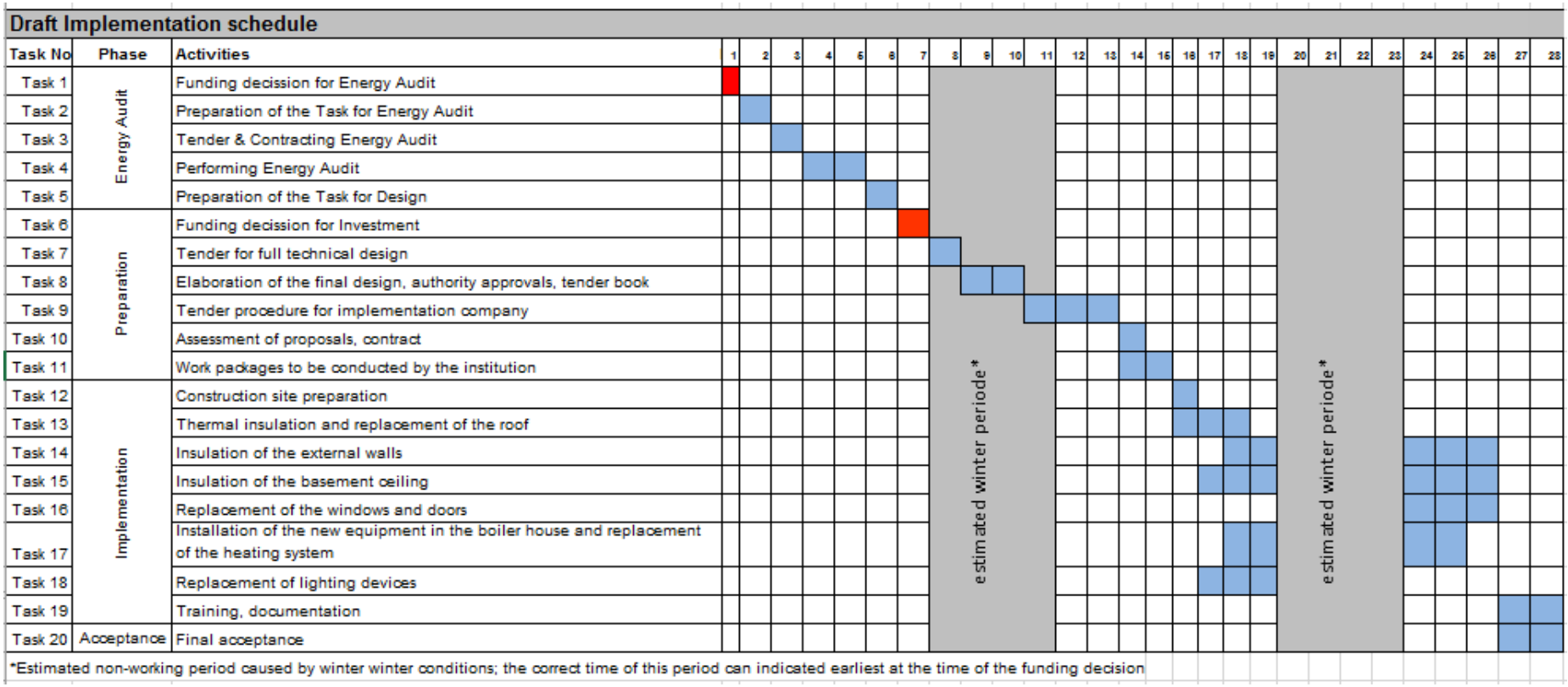
Upon completion of the implementation of these measures, the building can be put into operation.

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 657 MWh/y**. Due to this saving, it is estimated that **emissions will decrease** by **242,9 t/CO_2 per year**.

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
Construction site preparation
Task 13
Thermal insulation and replacement of the roof
Task 14
Insulation of the external walls
Task 15
Insulation of the basement ceiling
Task 16
Replacement of the windows and doors
Task 17
Installation of the new equipment in the boiler house and replacement of the heating system
Task 18
Replacement of lighting devices
Task 19
Training, documentation
Task 20
Acceptance
Final acceptance
estimated winter periode*
estimated winter periode*
*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: ____с. Конгаз_____

Название публичного учреждения: _____Дом Культуры_____

Собственности (АТЕ 1-го / 2-го уровня) _____1 уровня_____

Год строительства здания публичного учреждения: _____1972_____

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	
2.	Количество рабочего персонала:	человек	24
3.	Количество пользователей / бенефициаров (дети / студенты / пациенты / клиенты)	человек	17500
4.	Общая площадь здания	$м^2$	1093
5.	Количество этажей здания	единицы	2
6.	Средняя высота каждого этажа	м	3,5
7.	Общая площадь внешних стен здания	$м^2$	7651
8.	Количество окон	единицы	61
9.	Общая площадь окон	$м^2$	228,8
10.	Общая площадь крыши	$м^2$	
11.	Тип крыши:	плоская крыша или скатная крыша	Двухскатная

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

Тип источника энергии	Ед. изм.	Потребление		
		2014	2015	2016
Электричество	кВтч	36526	30783	32608
Дизель (исключить транспортные средства)	Литры			
Натуральный газ	$м^3$	6910	9457	10892

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:

- □ **<u>однотрубная система</u>**
- □ двухтрубная система

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
- □ Кондиционер
- □ Другие (укажите)_____

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

- □ Центральная система горячего водоснабжения
- □ Электрический бойлер
- □ **<u>Нет горячей воды</u>**
- □ Другой (укажите)_____

С.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)
- □ **<u>Отсутствует вообще</u>**

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

Какова она?

- □ принудительный
- □ **<u>естественный поток</u>**

C.6. Система внутреннего освещения:

Показатели	Ед. изм.	Значение
Количество ламп	единицы	605
Тип ламп (светодиодные-LED, люминесцентные лампы, лампы накаливания)	тип	Лампы накаливания-463 Люминесцентные - 142
Средняя мощность ламп	W	75
система автоматизации освещения	Да / нет	Нет

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 ____-___ 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
-	-	-	-