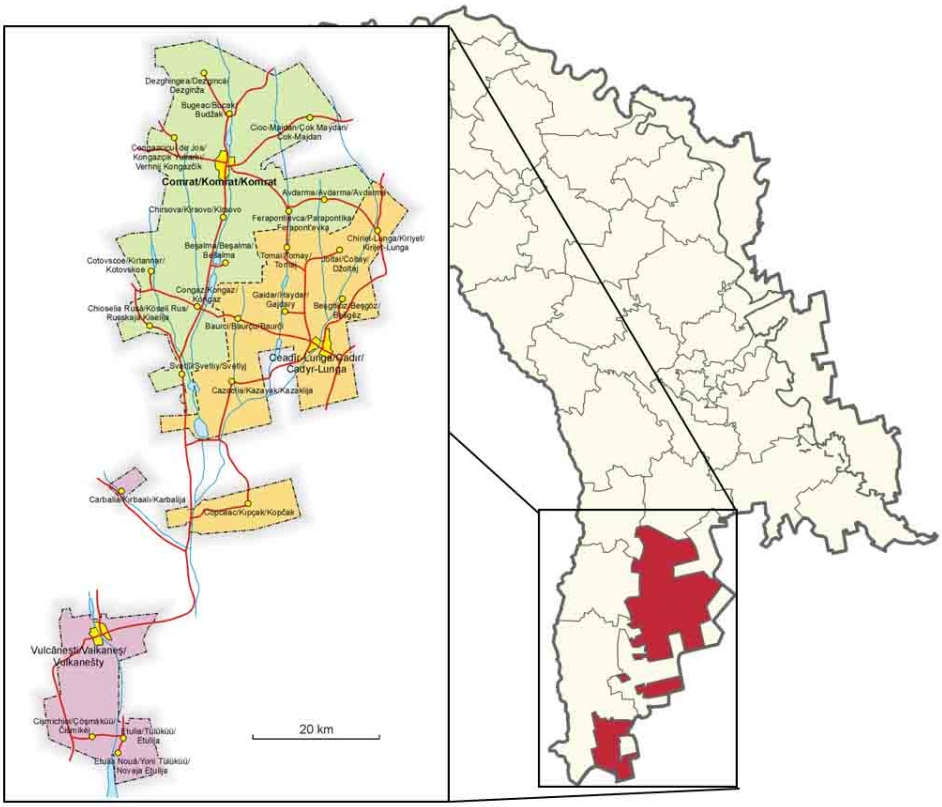
cooperare germană
DEUTSCHE ZUSAMMENARBEIT

MINISTERUL AGRICULTURII, DEZVOLTĂRII REGIONALE ȘI MEDIULUI

Sweden
Sverige

Modernization of the Local Public Services in the Republic of Moldova



Project Concept
(report on walk-through energy audit)

Professional school, Vulcanesti

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

Registered office:

Bonn and Eschborn, Germany

Friedrich-Ebert-Allee 40
53113 Bonn, Germany
T +49 228 44 60-0
F +49 228 44 60-17 66

Dag-Hammarskjöld-Weg 1-5
65760 Eschborn, Germany
T +49 61 96 79-0
F +49 61 96 79-11 15

E info@giz.de
I www.giz.de

Authors:

Sergiu Robu, Kyriakos Argyroudis, Ion Melestean, Tatiana Mosent

Developed by:

Consortium **GFA – Consulting Group** – BCI Business Consulting Institute.-MM Mott Macdonald

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

Comrat, May 2018

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

Institution: Professional School, Vulcanesti

Visited on: 16.02.2018

Address: 62 Cahul street, Vulcanesti
Contacts:

- Name, surname: Corina Povalache
- Tel: 029331092, 069516979

Content

List of tables

List of photos

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

Professional School in Vulcanesti is an educational institution where the students has the opportunity to get secondary education on several specialties.

Photo 1 South façade of the main study block (panoramic view)

200 pupils from different localities study at the institution. Working stuff has 38 employees.

On the territory of the school following buildings are located (photo 2):

1. Main study block
2. Laboratory
3. Dormitories
4. Auxiliary buildings (boiler house and storage)

Photo 2 Spatial arrangement of the various blocks of the school (Ortho photo, Scale 1:1000)

2. Energy Consumption

The electricity consumption was 40 MWh in 2014 with an increase to 64,2 MWh in 2016. Between 2014 and 2016, the average electricity demand was 53,4 MWh. It is observed a consumption of electricity of 36 kWh/m2, and this is normal value for a school.
Gas consumption increased from 34000 m3 in 2014 to 47450 m3 in 2016, or an average consumption of 40150 m3 of gas per year, or approximatively 270 kWh/m2 per year, this is a high value for a school.

Table 1 Energy consumption

Energy	unit	consumption		
		2014	2015	2016
Electricity	kWh	40000	56000	64215
Gas	$м^3$	34000	39000	47450

3. General data on the studied buildings

3.1 Heating system

The building is heated by a boiler house operating on natural gas, which is located in the eastern part of the territory. The thermal agent flows through the external heat networks to all buildings.

3.2 Hot water supply

In the study block, the hot water is provided only in the kitchen by an electric boiler. In the dormitories hot water is also prepared using electric boilers.

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 the main study block new LED lamps are installed, in some classrooms the old windows were replaced with PVC double glazed windows.

3.7 Planned projects for the coming years

At the moment of the experts' visit, on the second floor of the main study block, internal capital refurbishment was in the process and the replacement of windows in that area is included into the list of works.

4. Data on the proposed project

Note: further description and proposed measures applies only to the main study building (1).

4.1 Description of the current situation

The main study block was built in 1974. In a spatial arrangement, the building is U-shaped. There are 3 basement spaces that are used for technical and storage purposes, they occupy about 1/3 of the area under the first floor (633 m2). On the ground floor of the building there are classrooms and a small hall for cultural activities, a canteen and kitchen in the west wing of the building, a gym, showers and locker rooms in the east wing of the building, as well as bathrooms. On the second floor there are also several classes, toilet facilities, the second floor is built over the central part of the building. Total floor area is 1478,14 m^2.

Photo 3 Part of the south façade (central 2 levels part and left wing of the building)

Photo 4 West façade of the building

4.2 Building proprieties (constructive part)

The building is built of large limestone blocks, the width of the bearing walls is 500 mm, the thickness of the basement walls is 700 mm. The floors are separated by reinforced concrete slabs. In bearing structures, no damage was observed. The masonry of the walls is exposed on the biggest part of the facades, the plinth is also damaged, there is no blind area along the entire perimeter of the building. It was noticed that the floors of the first level are skewed (especially noticeable in the corridor on the way to the gym). Probably, the walls of the basement room under it sag because of the constant humidity, but the final verdict about the safeness of exploitation of this part of the building should be announced by technical expertise.

4.3 Windows and doors

A part of the old wooden windows and the doors of the main entrance were replaced with PVC double glazed windows and doors. The slopes of the replaced windows are not finished. The windows of the back side of the building (north part) are wooden double framed with one layer of glass each frame.

Total area of the windows - 227,25m^2, of which wooden structures – 90m^2.

Photo 5 New and old windows on the second floor

4.4 Roof

The roof is sloped and the coating layer is asbestos-cement sheets. The roof is damaged and leaking in some places. There is no rainwater management system supposed. Total area of the roof – 1478 m^2.

Photo 6 Roof over the gym

Photo 7 Signs of roof leaking in the corridor

4.5 Heating system

The main block of the school is heated by the boiler house with 3 boilers installed inside (2 of them are working and one is reserve). The thermal agent is pumped into the external insulated pipes that are positioned underground. Internal heating system consist of cast-iron pipes and radiators.

Photo 8 Radiators in the gym

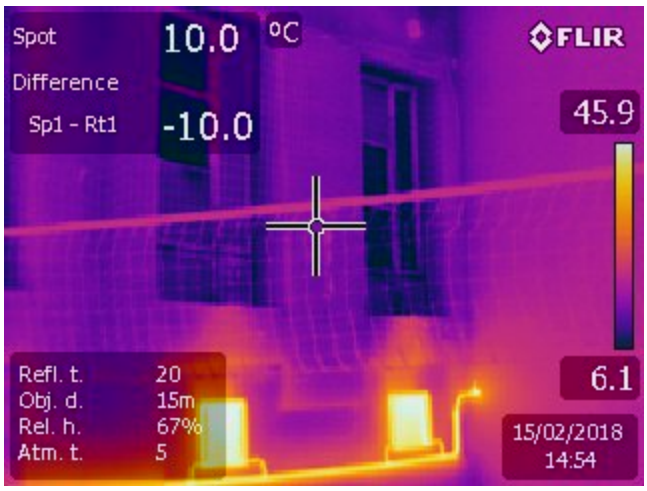


Photo 9 Radiators in the gym (view from infrared camera)

4.6 Ventilation system

Vent holes in the walls designed for natural ventilation have direct access to the roof of the building. In the classes where the windows have been replaced, traces of mold could be observed.

Photo 10 Vent holes in canteen

4.7 Hot water supply

For the preparation of hot water, an electric boiler with a capacity of 1.5 kW installed in the kitchen is used. In the showers near the gym hot water is not available.

4.8 Lighting system

For illumination, LED lamps with the 20W power are used (152 pieces in the entire building).

Photo 11 Lighting devices in classroom, first floor

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:

- Experts propose the **thermal insulation of the ceiling of the last floor and installation of a new sloped roof**. It is recommended to install a thermal insulation layer of mineral wool, with the laying of vapor barrier and waterproofing membranes.

It is also necessary to ensure the evacuation of rainwater through drains. The walls and the blind area should be protected from destruction through properly installed drain pipes.

Annual energy savings= 152 MWh/y
Estimated investment = 52 580 €

- Thermal insulation of building facades with a layer of rock wool is recommended (total area of the external walls is 1800,26m2). Before installing the thermal insulation material, remove the existing coating.

It is recommended to insulate the ceiling of the basement with XPS or rock wool (633 m2).

The plinth must also be insulated with a thinner layer of XPS to prevent the penetration of cold directly into the room and its base, as well as to create a barrier to ground moisture and water generated by melting snow. Its installation will require exposing the foundation walls to 50 cm from the ground level, that is, the total height will be 1 m. The walls of the basements should be completely insulated with the same layer of XPS. After installation, the blind on the entire perimeter should be created, keeping a slope of at least 7 degrees from the walls of the building. A blind with a width of 70cm must be framed with a curb, which allows drainage of rainwater.

Annual energy savings= 273 MWh/y
Estimated investment = 230 966 €

- Replace obsolete windows and doors with PVC double glazed windows, in the northern part of the building energy-efficient glass Low-E could be used. Ensure embedding of slopes using insulating membranes. External (tin) and internal sills (plastic) should be replaced, also.

Annual energy savings= 11 MWh/y
Estimated investment = 17 788 €

- Additional recomendations

During the visit, it was found that in the gym and canteen, despite the working heating system, the temperature in the rooms is low. Experts propose to recalculate the size of the radiators for these spaces in order to increase them, for more comfortable conditions. It should also be possible to regulate the supply of thermal agent to the gym and canteen in order to save energy.

Natural ventilation in the rooms is not efficient, therefore additional ventilation equipment should be installed - it is proposed to install air-handling units with a heat exchanger for classrooms.

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
Replacement and thermal insulation of the roof	1478	152	5 438	52 580	30	12,4
Thermal insulation of the external walls and basement ceiling	2433	273	9 762	230 966	55	30,3
Windows and doors replacement	90	11	377	17 788	2	60,4
Total	**4001**	**436**	**15 577**	**301 334**	**87**	**24,8**

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 **6,174 mln MDL** (**301 334 EURO**)[1].

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

The share of the energy relevant investments of the total investment is around 50 %.
Refurbished floor area in m²: 2070.
When considering only the energy relevant investment the payback period is **24,8 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
- Replacement and thermal insulation of the roof
- Thermal insulation of the external walls and basement ceiling
- Windows and doors replacement
- Staff training, documentation

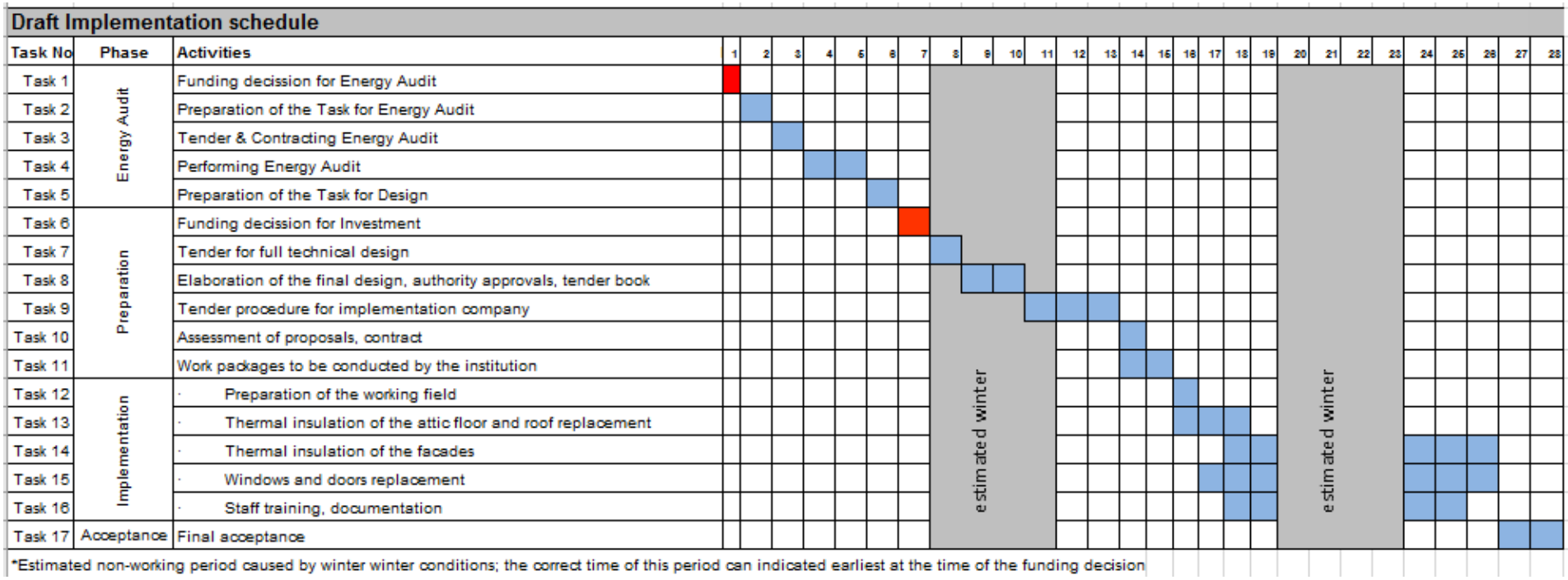
Upon completion of the implementation of these measures, the building can be put into operation.

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 436 MWh/y**. Due to this saving, it is estimated that **emissions will decrease** by **87 t/CO_2 per year**.

Annex 1


Draft Implementation schedule
Task No
Phase
Activities
1 2 3 4 6 8 7 8 9 10 11 12 13 14 16 18 17 18 19 20 21 22 23 24 25 26 27 28
Task 1
Task 2
Task 3
Task 4
Task 5
Task 6
Task 7
Task 8
Task 9
Task 10
Task 11
Task 12
Task 13
Task 14
Task 15
Task 16
Task 17
Energy Audit
Preparation
Implementation
Acceptance
Funding decission for Energy Audit
Preparation of the Task for Energy Audit
Tender & Contracting Energy Audit
Performing Energy Audit
Preparation of the Task for Design
Funding decission for Investment
Tender for full technical design
Elaboration of the final design, authority approvals, tender book
Tender procedure for implementation company
Assessment of proposals, contract
Work packages to be conducted by the institution
· Preparation of the working field
· Thermal insulation of the attic floor and roof replacement
· Thermal insulation of the facades
· Windows and doors replacement
· Staff training, documentation
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 данныхдля диагностического анализа
сектора энергоэффективности в регионе АТО Гагаузии

I. Общие данные:

Название населённого пункта / района: **г. Вулканешты**

Название публичного учреждения: **Профессиональная школа I-ый Учебный корпус**

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

Год строительства здания публичного учреждения: **1974**

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:	9 человек	Для планирования и принятия решений
2.	Количество рабочего персонала:	29 человек	Для выполнения необходимых хоз. работ для подержания здания
3.	Количество пользователей / бенефициаров (дети / студенты / пациенты / клиенты)	197 человек	Для эффективного образования
4.	Общая площадь здания	1478,14 м^2	Для эффективного проведения учебно – воспитательной работы
5.	Количество этажей здания	2 единицы	Для эффективного проведения учебно – воспитательной работы
6.	Средняя высота каждого этажа	3 м	Для большого проникновения света
7.	Общая площадь внешних стен здания	1800,26 м^2	Каркас здания
8.	Количество окон	89 единицы	Для улучшения освещения
9.	Общая площадь окон	227,25 м^2	Для улучшения освещения
10.	Общая площадь крыши	1478,14 м^2	Для предотвращения проникновения воды в здании
11.	Тип крыши:	плоская крыша	Для предотвращения

		или **скатная** крыша	проникновения воды в здании

Part B. Потреблениеэнергиизапоследние 2 года (по источнику):

Тип источника энергии	Ед. изм.	Потребление		
		2014	2015	2016
Электричество	кВтч	40000 квт	56000 квт	64215 квт
Дизель (исключить транспортные средства)	Литры			
Натуральный газ	$м^3$	34000 $м^3$	39000 $м^3$	47450 $м^3$
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?

- ✓ **Центральное отопление**

a. 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) _____

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)_____

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 каждомпомещении (рабочая)
- □ Индивидуальная система в каждомпомещении (нерабочая)

✓ **Отсутствует вообще**

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

Каковаона?

□ принудительный

✓ **естественный поток**

C.6. Система внутреннего освещения:

Показатели	Ед. изм.	Значение
Количество ламп	152 единицы	Для хорошего внутреннего освещения
Тип ламп(светодиодные-LED, люминесцентные лампы, лампы накаливания)	**LED** тип	Для хорошего внутреннего освещения
Средняя мощностьламп	20 W	Для хорошего внутреннего освещения и в целях экономии
система автоматизации освещения	Да / **нет**	

Part D. Описание бойлеров

Количество бойлеров: ___**1**_____

Тип топлива, используемого для бойлеров:

✓ Электричество, Установленная мощность (кВтч): __1,5__ эффективность (%)__**95**__

□ 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 ___**1**____ 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
