Sustainable Energy and Climate Action Plan (SECAP)

Onitcani village

2024-2034

Covenant of Mayors
for Climate & Energy

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1. EXECUTIVE SUMMARY

This PAEDC Sustainable Energy and Climate Action Plan (SECAP) is a key document of the vision and commitment of the village of Oniţcani in decarbonizing its territory by improving energy efficiency measures and deploying renewable energy, as well as by strengthening the village's capacity to adapt to the inevitable impact of climate change. Mitigation and adaptation actions to achieve the objectives are defined here along with time frames and assigned responsibilities.

The Covenant of Mayors is a unique movement that has brought together a large number of local and regional authorities to develop action plans and direct investments towards climate change mitigation measures. The new Integrated Covenant of Mayors for Climate and Energy was launched by the European Commission on 15 October 2015 at a ceremony in the European Parliament in Brussels. Now the signatories promise a reduction in CO2, an increase in energy efficiency and renewable energy sources and support the integration of climate change mitigation and adaptation under a common umbrella.

The initiative resulting from this partnership, the Covenant of Mayors for Climate and Energy, is both more ambitious and broader. The signatory municipalities commit to action to support the implementation of the EU's greenhouse gas reduction target by 2030 and the adoption of a common approach to climate change mitigation and adaptation.

In order to translate their political commitment into practical measures and projects, the signatories of the Pact undertake to submit, within two years from the date of the local council's decision, a PAEDC Sustainable Energy and Climate Action Plan (SECAP) that describes the key actions on who intend to undertake them. The plan will include a baseline emissions inventory to track mitigation actions and a climate risk and vulnerability assessment. The adaptation strategy can be part of the PAEDC (SECAP) or developed and integrated in a separate planning document. This bold political commitment marks the start of a long-term process, with cities committing to report every two years on the progress of implementing their plans.

The 27 member states of the European Union approved on 28.06.2021 the legislative text by which the targets for reducing greenhouse gas emissions become legally binding. The member states' agreement comes after the plenary of the European Parliament gave the green light to the EU's commitment to achieve climate neutrality by 2050, i.e. not to emit more greenhouse gases than it can absorb.

The European Commission adopted on 14 July 2021 a package of proposals for EU climate, energy, land use, transport and taxation policies to reduce net greenhouse gas emissions by at least 55%

by 2030 , compared to 1990 levels.

Achieving these emissions reductions over the next decade is crucial for Europe to become the world's first climate-neutral continent by 2050 and to make the European Green Deal a reality. The Commission is putting forward the legislative tools needed to meet the goals agreed under the European Climate Law and to fundamentally transform our economy and society for a fair, green and prosperous future.

A comprehensive and interconnected set of actions is envisaged that will enable the necessary acceleration of greenhouse gas emission reductions over the next decade. They combine: applying the ETS to new sectors and strengthening the current EU ETS; increased use of renewable energy; greater energy efficiency; faster development of low-emission transport modes and the infrastructure and fuels to support them; an alignment of fiscal policies with the European objectives of the Green Pact; measures to prevent the relocation of carbon dioxide emissions and tools for the conservation and development of natural carbon sinks.

The EU's Emissions Trading System (ETS) sets a price on carbon emissions and lowers the emission ceiling from certain economic sectors each year. Over the past 16 years, it has contributed to a 42.6% reduction in emissions from electricity production and energy-intensive industries. Today the Commission is proposing that the global emissions cap be lowered further and the annual rate of emissions reduction be increased. The Commission also proposes phasing out free allocations of emission allowances for the aviation sector and aligning it with the Global Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) and including for the first time emissions from transport maritime in the EU ETS. In order to address the lack of emission reductions in the road transport and buildings sector, a new separate emission allowance trading system is being established for the distribution of road transport and building fuels. The Commission also proposes to increase the financial envelope of the Innovation Fund and the Modernization Fund.

In addition to the substantial spending provided for in the EU budget for climate actions, member states should fully channel the revenues from the trading of emissions certificates to climate and energy projects. Part of the revenues generated by the new system applicable in road transport and in the buildings sector should be allocated to actions to mitigate the possible social impact of this measure on vulnerable households, micro-enterprises and users of means of transport.

The Land Use, Forestry and Agriculture Regulation sets a general EU target for the elimination of carbon dioxide through natural absorbers, corresponding to a volume of 310 million tonnes of CO2 emissions by 2030. National emission reduction targets require Member States to protect carbon sinks and strengthen their role so that the target can be met. By 2035, the EU should aim to achieve

climate neutrality in the land, forestry and agriculture sectors, including non-CO2 agricultural emissions such as those from fertilizer use and livestock farming. The EU Forest Strategy aims to improve the quality, quantity and resilience of EU forests. The strategy supports foresters and the forest bioeconomy, while emphasizing sustainable forestry and biomass use, as well as biodiversity conservation. The strategy also includes a plan to plant three billion trees across Europe by 2030.

As energy production and use account for 75% of EU emissions, it is essential to accelerate the transition to a greener energy system. The Renewable Energy Directive will set a more ambitious target for 40% of our energy to be produced from renewable sources by 2030. All Member States will contribute to this target and specific targets are proposed for the use of renewable energy in the transport sector, for heating and cooling systems, in buildings and in industry. In order to achieve our climate and environmental goals, sustainability criteria for the use of bioenergy are strengthened and Member States must develop support schemes for bioenergy that respect the principle of cascading the use of woody biomass.

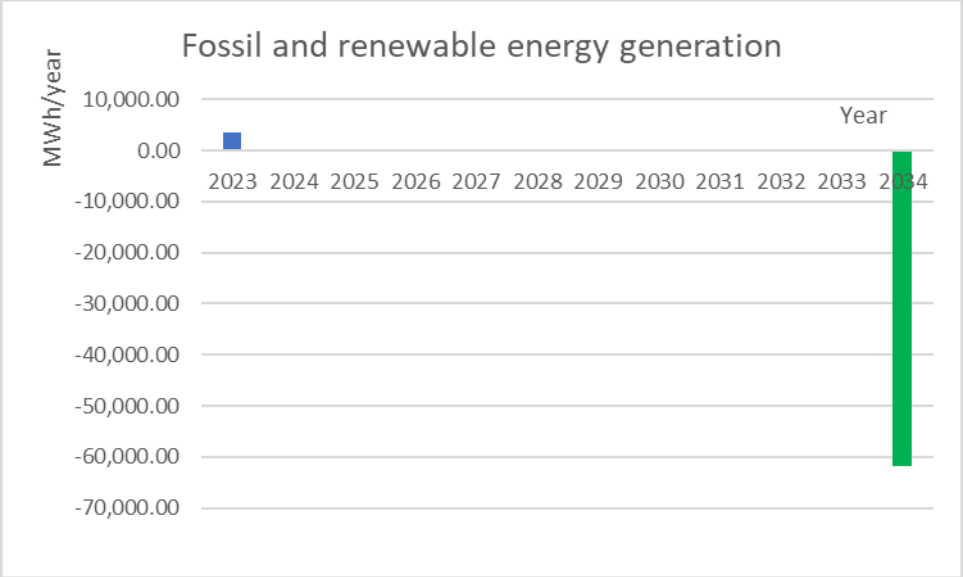
To lower total energy consumption, reduce emissions and tackle energy poverty, the Energy Efficiency Directive will set a more ambitious mandatory annual target for reducing energy consumption at EU level. It will guide how national contributions are set and impose a mandatory annual energy saving target on member states almost double the current one. The public sector will need to renovate 3% of its buildings each year to drive the wave of renovations, create jobs and reduce energy use and costs to taxpayers.

A combination of measures needs to be used to address rising emissions in road transport, in addition to the trading of emission allowances. Setting stricter standards for CO2 emissions from cars and vans will accelerate the transition to zero-emission mobility by requiring average new car emissions to fall by 55% in 2030 and 100% in 2035 compared to levels in 2021. Therefore, all new cars to be registered from 2035 onwards will have zero emissions. To ensure that, anywhere in Europe, drivers will be able to charge or refuel their vehicles from a reliable network, the revised Alternative Fuels Infrastructure Regulation will oblige Member States to expand charging capacity, aligning it with the volume of sales of zero-emission cars, and install charging stations and refueling at regular intervals on main highways: every 60 km for electric charging and every 150 km for hydrogen refueling.

The energy taxation system must protect and enhance the single market and support the green transition by setting the right incentives. A revision of the Energy Taxation Directive proposes to align the taxation of energy products with EU energy and climate policies, promoting clean technologies and eliminating outdated practices such as the application of tax breaks and reduced

tax rates, practices that currently encourage the use of fossil fuels. The new rules aim to reduce the harmful effects of tax competition in the energy sector, helping to ensure stable revenues for Member States from green taxes, which are less harmful to growth than taxes on labor income.

The Covenant of Mayors municipalities in the Eastern Partnership region have committed to actively support the implementation of the EU's CO2 reduction target and to adopt an integrated approach to climate change mitigation and adaptation. A sustainable energy and climate action plan (SECAP) presents the key mitigation and adaptation actions that Onitcani village intends to undertake. The following objectives will be achieved by implementing the proposed measures.



1. Estimated of fossil energy consumption and renewable generation

Fossil fuel consumption in 2023 will constitute 6% of renewable energy in 2034 and only 0.6% of energy savings that will come from the implementation of energy efficiency measures.

CO2 emissions in the village of Onitcani in 2023 constituted 804.4 tons or 0.36t per inhabitant.

The implementation of the given PAEDC will require investments of 9,688,050€ for the period 2024-2034. It will bring fossil energy saving 607,174.20MWh and allow the use of renewable energy in the amount of 61,943.50MWh. All activities will reduce annual CO2 emissions by 3,163.6 tons (fig.2), which means that the village will change from a CO2 generator to a CO2 consumer. Consumption will be 3,968 tons or 1.76t per inhabitant annually. This is due to the massive afforestation of the village, the use of renewable energy sources.

Most of the CO2 emissions of the village of Oniţcani come from the consumption of natural gas (73%). Natural gas emits 58.5 percent less carbon dioxide than coal, according to the US Energy Information Association. The European Union voted on 07/06/22 to maintain specific uses of natural gas and nuclear energy in its taxonomy of sustainable energy sources. In general, the use

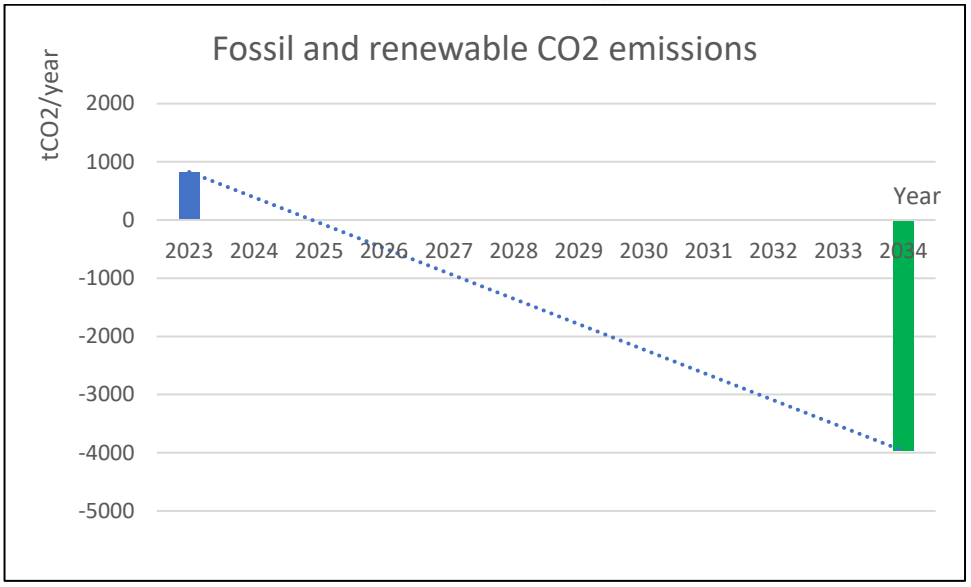


Fig. 2. Estimated CO2 emissions

of natural gas to generate electricity or to heat or cool many homes simultaneously will be considered sustainable, while other uses may be excluded. They will have to be below certain emission thresholds and only be approved until 2030 or 2035, depending on the specific situation. This SECAP describes the measures to be implemented in Onițcani village. Based on the data collected and analyzed, the village has an excellent perspective in terms of reducing GHG emissions and climate resilience.

A crucial element of the SECAP will be the strengthening of community engagement, ongoing engagement with stakeholders and key partners, as well as outstanding social impact.

Onitcani village

GENERAL PRESENTATION

Onitcani is a village in the Criuleni district of the Republic of Moldova. It is located on the bank of the Dniester (coordinates: latitude 47.146°, longitude 29.068°, and altitude of 21 meters above sea level). The first mention in the annals found in 1604. The village is famous for the large number of springs. Some of them are very specific in their chemical composition. The village has an area of about 1.42 square kilometers, with a perimeter of 5.24 km.

Direct distance to Criuleni is 12 km. Direct distance to Chisinau is 27 km. Steppes, hills, valleys form the relief of the area.

Climate

The village of Onitcani has a moderate continental climate, with generally hot summers and mild winters.

The climate is temperate continental with average annual temperature +10°C, average July temperature is +22°C, average January temperature is -4°C. Annual precipitation is 500–600 mm. Average wind speed 3-5 m/s.

Fig. 3. The settlement of Onitcani village

Hydrography

In total, there are four springs in the village: two are located directly in the village of Onitcani and two others in the Rădi river valley. It occupies a total area of 1.5 ha or 1.02 ha according to recent assessments. The springs are located in and around the village of Onitcani. All of them have cold water, they are trace minerals according to the degree of mineralization and descending from the terrace from a geological point of view, they have a high flow rate. The water is potable, odorless (except for the "Putna" spring), colorless, weakly alkaline and generally unpolluted with nitrates. According to the chemical composition, all the springs are with hydrocarbonate-sulfate-chlorinated-sodium-magnesium-calcium water, except for the "Putna" spring, which has sulfate-hydrocarbonate-chlorinated-calcium-sodium-magnesic water.

The spring "Putna" is located in the central part of the village. It is laid out as a network of concrete gutters that flow into a stream, through which the water reaches a landscaped sector in the village. The sector is a concrete lot with drain and high stone walls. The water, with the smell of hydrogen sulphide, has possible healing properties and provides the needs of the village population. The spring is bordered by constructions and individual sectors of local residents, where household

waste is sometimes stored, which can cause moderate environmental pollution. A few willow trees grow upstream of the spring.

The "Larga" spring is located in the southern part of the village. It is a plastered stone wall construction with a roof and access stairs to the metal pipe from which the water flows into a concrete channel. The water quality corresponds to the drinking water standard. It is used in this sense by the inhabitants of the village.

There are poplar and willow trees and residential houses in the immediate vicinity of the spring. In the vicinity of the villagers' yards, storage of household waste can be registered.

The third spring is located next to the old (non-functional) cattle farm, in the meadow on the right bank of the Rădi river, about 2 km northwest of Onițcani. It includes a landscaped sector with a limestone wall built approximative 1 m, provided with a hole for cups. Water flows through a metal pipe into a boiler. The water is drinkable, although the level of nitrate pollution is close to the limit. All villagers benefit from it, especially those who work agricultural land or graze animals in the given area. This, however, causes moderate environmental pollution, including through frequent grazing and watering of herds of sheep, goats and cows.

The fourth spring is located on the Rădi river terrace, approximately 700m upstream from the third spring. Its infrastructure is more developed, an edifice, a pumping station and a network of water collection wells, with its discharge through a metal pipe, have been built here — all this in a sector fenced with metal mesh.

The water has increased hardness, exceeding the maximum allowed concentration by 20%. The level of nitrate pollution is slightly below the limit. The spring maintains the flow of the Rădi River and, along with the other three, provides the village population with drinking water.

The protection area is dotted with clumps of trees, the adjacent land being covered by forest plantations. Some villas rise about 50 m upstream.

In addition to these four protected springs, the village of Onițcani has approximately 50 other springs, being nicknamed in the past "the valley with a hundred springs".

The springs system is under state protection according to Law no. 1538 of 1998 regarding the substance natural areas protected by the state. The protected area is on the balance sheet of the Town Hall.

The springs in the village are hydrological objects of national value. With the exception of the "Larga" spring, information panels are installed at all water collection points.

Apart from this, there are 2 ponds on the territory of the village: one private (3.0ha) and

another - public (1.9ha).

Geology

The seismic state of the territory is determined by the focal point from Vrancea (Romania, at the base of the Carpathians)[1], located approximately 202km away from the village. Seismic activity in the area reaches a magnitude of 7 (Richter scale). The specific geological structure determines favorable conditions for the wide development of landslides and erosion, represented by various furrows, ravines, canyons and valleys.

Vegetation and agriculture

The vegetation is rich and varied. It is caused by several factors: geographical position, relief, climate, water, character of the rocks. The peculiarities of the climate and the soil favor the general development of agriculture. The growing season usually starts from March 15 and lasts until the end of October.

The region is a traditional agricultural area due to the good characteristics of the soil. The main soils are typical chernozems containing significant amounts of rich humus. A wide range of vegetables, many types of fruit trees are grown in the area.

The population

In 2021, the number of inhabitants was 2,089 people, according to the Town Hall, and is presented in the following table 1.

According to table 1, the demographic situation at the moment is favorable, the majority of the population is between the ages of 18 and 65, that is, it is in the workforce and has a potential for employment. The dominant age groups are of working age and represent more

of 64% of the total population.

Table 1. Population distribution in Cotova commune by age and sex

Age, years	Men	Women	Total	Percentage of total, %
0-18	240	261	501	22.3
19- 65	650	791	1,441	64.1
Over 65	133	173	306	13.6
TOTAL	1,054	1,194	2248	**100**

[1]Ilieș, Ion. The integrated system of seismic monotirization Romania-Republic of Moldova. Akademos, no. 1 (20), March 2011, p. 62 - 69.

In the village of Oniţcani, 689 households were registered in the 2004 census and the average size of a household was 3.0 people. There are social facilities on the village territory: 1 gymnasium, 1 kindergarten, family doctor's office, cultural center, post office.

The length of local roads is 54.0km, of which only 2.0km are paved. About 70% of them are in a satisfactory condition.

The housing stock of the village is over 55,120m2. In the village there are 700 houses, of which 99.3% are equipped with centralized water supply.

Table 2. Population distribution in Onitcani village by ethnicity

Nr.	Ethnicity	Number of inhabitants	Percentage, %
1	Moldovans/Romanians	2,212	98.3
2	Russian	12	0.5
3	Ukrainian	12	0.5
4	Other	12	0.5
	TOTAL	**2,248**	**100.0**

Fuel, power and water supply

The village has a centralized gasification system. Public, residential and business buildings are heated with natural gas and wood.

The village is supplied with electricity by the distributor S.A. Premier Energy. A 35kV line of "Moldelectrica" passes near the village.

There are artesian wells that supply the village with drinking water. Constituent water consumption is distributed as follows: 99.3% - the population, 0.1% - public buildings and economic agents - 0.6%. The aqueduct has a length of 51.7 km.

Entrepreneurship and economic activity

16 economic agents operate on the territory of the Town Hall, most of them are local. All companies are private with the organizational form limited liability companies and peasant households. They specialize in growing grains, fruits, vegetables in greenhouses, manufacturing wood products, automotive services and trade.

The economic activity of the village represents a significant source of income for the local administration, taking into account the fact that a considerable part of deductions from state taxes is formed from the income tax of legal entities.

2. GENERAL STRATEGY

By signing up to the Pact of Mayors for Climate and Energy, the village of Onițcani voluntarily commits to achieving a goal of reducing CO2 emissions by at least 55% by 2030 compared to 1990 levels, thus sharing a common vision for a sustainable future and committed to developing a low carbon, resilient, energy efficient community.

The village's commitment is to take measures in the following areas:

ENERGY EFFICIENCY improving energy use and using renewable energy.

ADAPTATION AND MITIGATION OF CLIMATE CHANGE. The Town Hall is aware that adapting to climate change brings a number of benefits to the village and citizens. Disaster preparedness can reduce the cost of damage and future disaster response costs. The European Commission estimates that €1 invested in risk prevention saves up to €6 in disaster response efforts. Building rehabilitation can reduce tenants' energy costs and increase property values. Adaptation projects can create jobs and boost local businesses.

The co-benefits of local climate change mitigation and adaptation actions for well-insulated buildings will bring energy savings (mitigation) and adaptation to temperature rise, cooling through the use of solar systems. Planting trees and green spaces will reduce flooding and retain soil and subsoil moisture, shade land, cool the urban environment (adaptation) and sequester carbon (mitigation).

This Sustainable Energy and Climate Action Plan (SECAP) is presented and will be implemented by putting the village's commitment into practice. The following key actions are planned to be taken.

2.1 PURPOSE AND OBJECTIVES

The goal formulated by the village of Onițcani is to reduce the influence of the human being on climate change by reducing greenhouse gas emissions and rehabilitating the environment.

Based on the purpose, the following objectives were formulated in the table below.

Table 3. Goals and targets for energy reduction and climate change mitigation and adaptation

Target area		Purpose	Index	Description
Municipal, residential, tertiary buildings, equipment/facilities	**BE**	Building envelope	**BE1**	Thermal insulation of walls, replacement of old windows and doors, rehabilitation of roofs of public buildings and insulation.
			BE2	Thermal insulation of walls with biodegradable thermal insulation produced locally from agricultural waste

		Renewable energy for heating buildings and domestic hot water,	**BE3**	Installation of PVT (photovoltaic-thermal panels) and solar water heating collectors.
			BE4	Replacing the old heating system in public buildings
			BE5	Use biofuel production from energy willow.
			BE6	Installation of Independent Energy Systems (SEI) to provide electricity, heating and air conditioning in buildings
			BE7	Use of "air-to-air" or "air-to-water" heat pumps for heating public buildings and obtaining domestic hot water
			BE8	Installation of the individual heating plant operating on biofuel, their interconnection to the solar heating systems.
		Energy efficiency of electrical appliances	**BE9**	Biofuel production from energy willow.
			BE10	Replacing gas-powered kitchen and laundry appliances in kindergartens and gymnasiums with electric appliances
Public lighting	**LE**	Energy efficiency of lighting	**LE1**	Replacing old technology lighting with LEDs in buildings
			LE2	Replacing old technology lighting with LED technology in street lighting
Local production of electricity	**PG**	Generarea de energie fotovoltaică	**PG1**	Construction of a commercial photovoltaic farm of 1.2MW based on public-private partnership
Other Climate change mitigation and adaptation	**WW**	Waste water management	**WW1**	Design and construction of a sewage system together with the wastewater treatment plant
		Solid waste management	**WW2**	Arrangement of the solid waste storage site
			WW3	Organization of the solid waste collection, transport and storage service
		Planting the energy willow	**CA1**	Planting of 5.6 ha of energy willow based on public-private partnership
		Production of biodegradable thermal insulation	**CA2**	Establishing the production and use of biodegradable thermal insulation based on public-private partnership
		Creation of a wetland in the center of the village	**CA3**	Creation of a wetland in the center of the village with an area of 2.7ha

	CA	Creating a health care zone	**CA4**	Creation of an exploration area of water sources for health promotion
		Creating a fish breeding area	**CA5**	Creation of a water source exploration area for fish breeding
		Creating a recreation area	**CA6**	Creation of a recreation area on the bank of the Dniester 50.0ha
		Creating a tourist route	**CA7**	Creation of a tourist route involving the "Gamma Field"
		Reconstruction of the football stadium	**CA8**	The transformation of the existing football stadium into a multifunctional sports center
		Afforestation	**CA9**	Planting of 5.0 ha of trees on the bank of the public pond
		Afforestation	**CA10**	Afforestation of the banks of the Dniester River with an area of 49.3 ha
		Creating a recreation area	**CA11**	Creation of an area for amateur fishing with an area of 2.3 ha

Also, the following policy instruments have been defined to implement the formulated measures.

Table 4. Funding sources and subsidies

Target area	Index	Purpose	Index	Description
Buildings, energy efficiency	GS	Grants and subsidies	GS1	Incentives for energy efficiency and renewable energy generation
	SPF	Secondary funding. Public-private partnership	SPF	Design and construction of the sewage system and wastewater treatment plant

2.2 CURRENT SITUATION

The general development strategy of the village of Oniţcani formulated the objectives regarding the improvement of energy efficiency and the use of renewable energies. In the Environmental Strategy for the years 2024-2030, it is specified the rational use of natural resources, the creation of an intelligent waste management system and ensuring its operation, reducing the negative impact of economic activity on the environment, etc.

The Energy Strategy of the Republic of Moldova 2050 ensures the sustainability of the energy sector and mitigation and adaptation measures to climate change, the development of competitive markets and their regional and European integration.

2.2.1 ENERGY CONSUMPTION IN THE VILLAGE

The current situation

Energy consumption in public buildings and transport

On the territory of the village there are public buildings: the town hall, gymnasium, kindergarten, family doctors' office, cultural center, post office. The total area of public buildings is 9,116.5m2.

Foto 1. The Town Hall building

Foto 2. The House of Culture building

Photo 3. The gymnasium building

The village consumes energy mostly in the form of electricity and natural gas. In 2023, the Onitcani City Hall buildings consumed 120,185kWh of electricity and 86,120m3 of natural gas. The town hall has a "Škoda-Rapid" limousine, which consumed 1300 liters of fuel (gasoline).

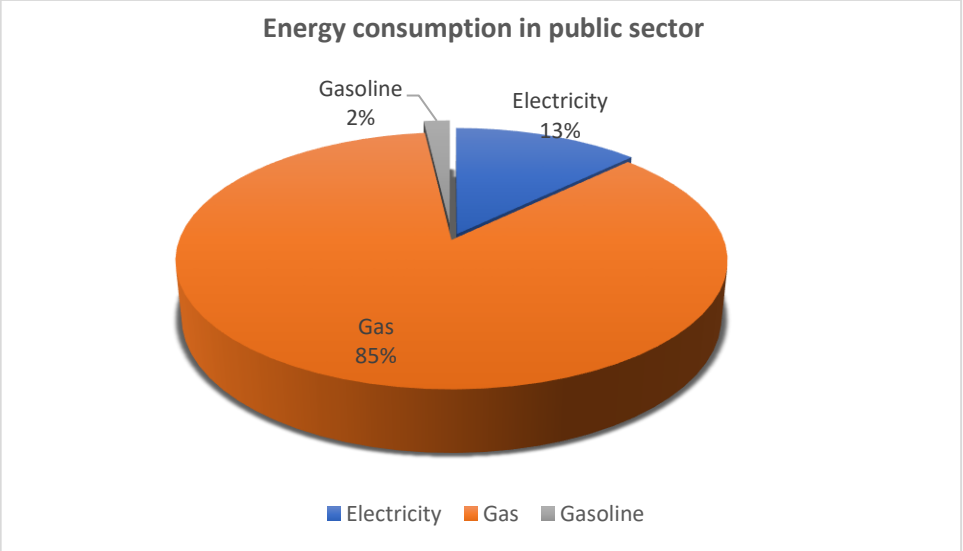


Fig.4. Energy consumption by Onitcani City Hall consumers in 2023

The diagram above (fig. 4) indicates that energy consumption is dominated by natural gas consumption to the extent of 85%. Electricity consumption is only 13%, and gasoline used for transport - 2%.

Electricity is mainly used for lighting (including street lighting), and natural gas for heating and cooking.

The residential sector and energy consumption

The overwhelming majority of houses are one-story stone houses and, less often, two-story

houses, and represents buildings in the residential sector.

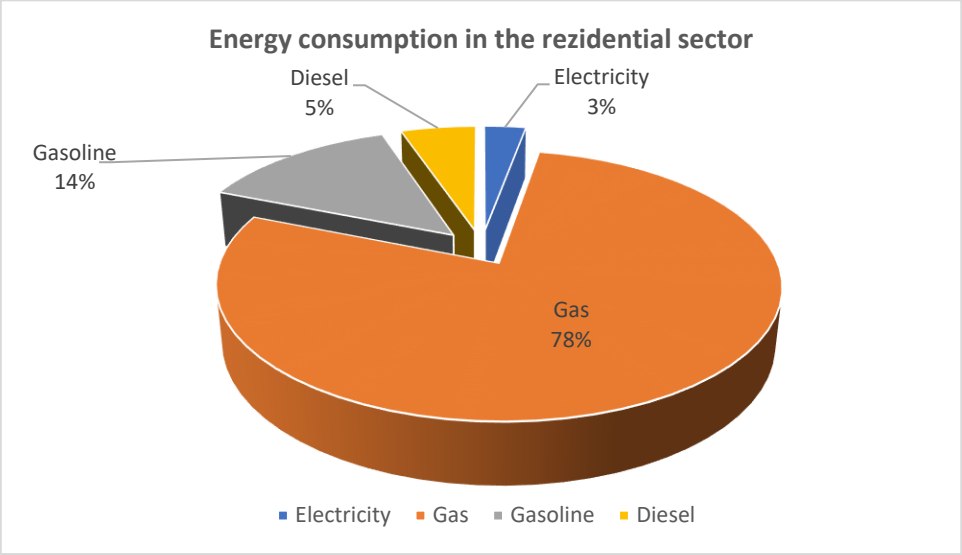


Fig. 5. Distribution of energy consumption in the residential sector in 2023

he village has 700 residential houses. In 2023 they consumed approximately 76,900kWh of electricity and 224,900m3 of natural gas.

In addition, it is estimated that local transport annually consumes 28.0 tons of gasoline and 12.0 tons of diesel fuel.

From fig. 5 shows that the residential sector of the village of Onitcani consumes 78% natural gas, 14% gasoline, 5% diesel and 3% electricity.

General energy consumption in the village of Onitcani

The village of Onițcani (fig. 6) consumes 76,900 kWh of electricity, 224,900 m3 of natural gas, 28,000 liters of gasoline and 12,000 liters of diesel. Energy from natural gas constitutes 80% of all energy consumed, 11% - from gasoline, diesel - 4% and electricity - 5%. The total annual energy consumption in the village of Onitcani is 3,612,601 kWh or 3,612.6MWh.

CO2 emissions in Onitcani village

Calculations show that the village of Onitcani emits 804.4 tons of CO2 or 0.36 tons per inhabitant annually. The amount of emissions also includes the consumption of diesel and gasoline for local and transit transport. All once the diagram in fig. 7 shows that they constitute 11% of total emissions (diesel-4%, gasoline-12%). The main emissions come from natural gas consumption (73%), especially from residential sector.

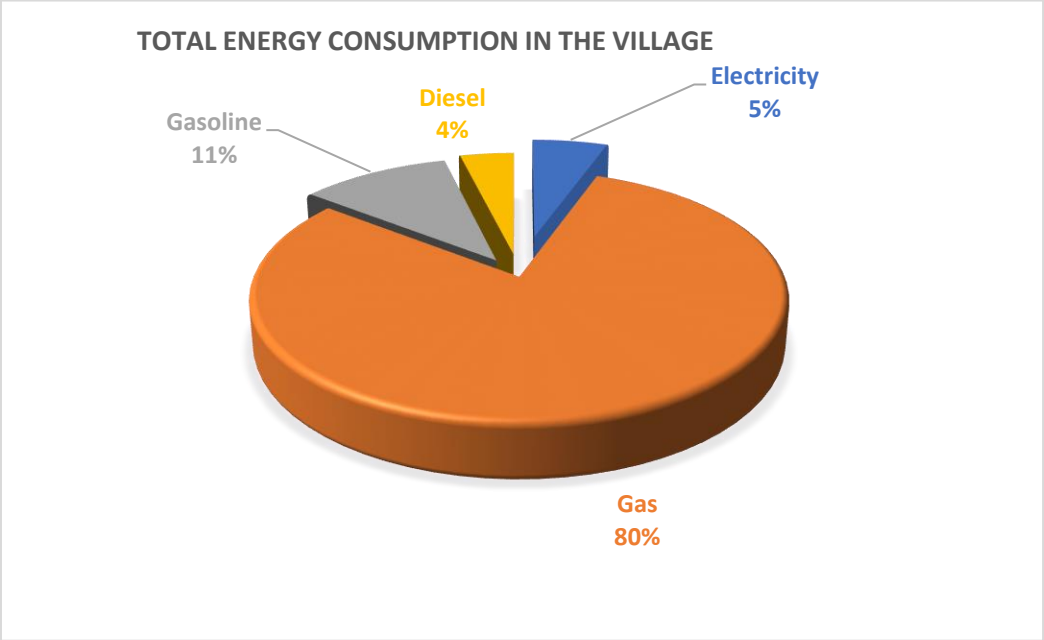


Fig. 6. Energy consumption in the village of Onițcani according to the type of fuel in 2023

Pollution in the public sector (fig.8) has emissions of 219.3 tons of CO2, which come from the consumption of natural gas (74%), electricity (24%) and gasoline (2%).

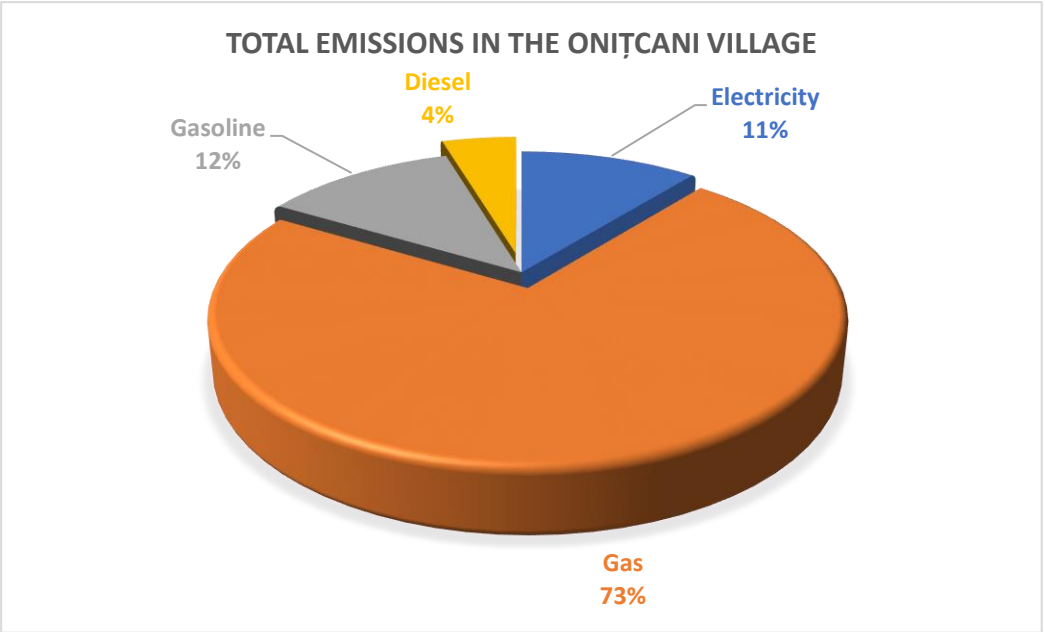


Fig. 7. CO2 emissions in the village of Onitcani according to the type of fuel in 2023

Most of the pollution comes from the residential sector (fig. 8) and comes from the large consumption of natural gas, which denotes a high standard of living.

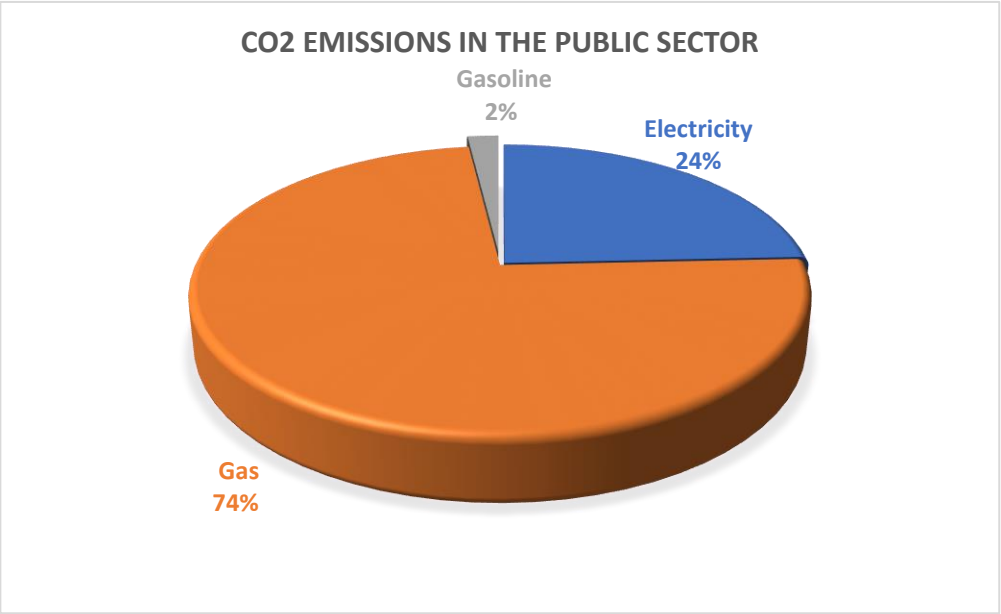


Fig. 8. CO2 emissions in the public sector in 2023

Poluarea în sectorul rezidențial provine din consumul de gaze naturale (74%), benzină (15%), electricitate (6%) (fig.9). Emisiile de la consumul motorinei constituie 5%.

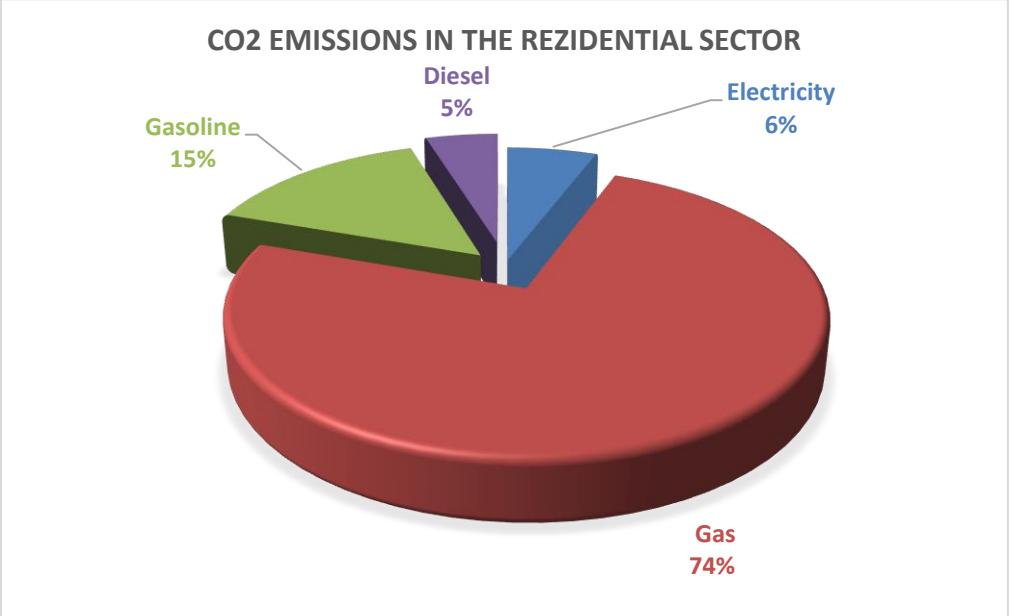


Fig. 9. Emisiile de CO_2 în sectorul rezidențial în 2023

3. Vision of actions

3.1 Buildings

Buildings are critical to the transition to a low-carbon economy. The average U value for existing walls and roofs are 1.4 ÷ 1.7 [W/m2K], for windows U = 2.8 ÷ 3.2 [W/m2K]. Mainly

greenhouse gas emissions in this sector come from building heating and domestic hot water heating.

The solutions, which were defined after analyzing the real situation, are presented in table 4 below.

BE1, BE2, BE3, BE4, BE5, BE6, BE7, BE8, BE9, BE10, BE11 refers to public buildings, which belong to the village hall. **BE3, BE6, BE7, BE8, BE5** also refers to residential buildings.

LE refers to public buildings, mainly kindergartens, schools and street lighting.

Tabelul 5. Energy efficiency measures in buildings

BE	Municipal, residential, tertiary buildings, equipment / facilities	Action
BE1	Building envelope	Thermal insulation of walls, replacement of old windows and doors, rehabilitation of roofs of public buildings and insulation.
BE2		Thermal insulation of walls with biodegradable thermal insulation produced locally from agricultural waste
BE3		Installation of PVT (photovoltaic-thermal panels) and solar water heating collectors.
BE4	Energy efficiency of building heating and domestic hot water preparation	Replacement of old heating system in public buildings
BE5	The use of renewable energy in the generation of electricity, heating of buildings, preparation of domestic hot water, air conditioning	Biofuel production from energy willow.
BE6		Installation of Independent Energy Systems (SEI) to provide electricity, heating and air conditioning in buildings
BE7		Use of "air-to-air" or "air-to-water" heat pumps for heating public buildings and obtaining domestic hot water
BE8		Installation of the individual heating plant operating on biofuel, their interconnection to the solar heating systems.
BE9		Biofuel production from energy willow.
BE10		Production of biodegradable thermal insulation from agricultural waste
BE11	Eficiența energetică a aparatelor electrice	Înlocuirea aparatelor de bucătărie și rufe care funcționează în grădinițe și școli cu gaz cu aparate electrice
LE	Energy efficiency of lighting systems	Replacing old technology lighting with LEDs.

The detailed description of the defined solutions is given below.

- **BE1. Thermal insulation of walls, replacement of old windows and doors, rehabilitation of roofs of public buildings and insulation**

The first step to be applied in any type of existing engineering system is to reduce energy consumption. This requires insulating the building envelope and replacing old windows and doors as a first step.

The thermal insulation of the walls must be carried out according to the usual technology with mineral wool of at least 100 mm thickness and λ = 0.041 [W/ m2K] with a density of at least 135 [kg/m3] according to SM SR EN 1602 or better.

The roof insulation must be made with mineral wool or extruded polystyrene (XPS) at least 100 mm thick and λ = 0.035 [W/m2K] with a density of at least 300 [kg/m3] according to SM SR EN 1602, covered with metal bond of concrete and waterproof layer of bituminous material.

In order for rehabilitated buildings to comply with local thermal requirements for their elements, the U-value of walls must be less than 0.22 [W/m2K] and roofs 0.24 [W/m2K].

Replacement of existing old windows and doors shall be with non-recyclable PVC frame windows and doors, 7-chamber, 1.2 mm thick reinforced metal U-frame coated with

plastic, without thermal bridges. Double-glazed windows with reduced emissivity (Low-e) 4-20-4 [mm].

Photo 4. The exterior of the kindergarten building

The U-value of windows must be less than 1.4 [W/m2K] and doors - less than U = 1.8 [W/m2K].
The selected materials and their technical characteristics are based on good engineering practices and are in accordance with the regulations in the country.
Based on past experience, heat consumption can be considerably reduced compared to existing consumption. In conditions where the sanitary and hygienic rules are not respected, this reduction will be much smaller.

- **BE2. Thermal insulation of walls with biodegradable thermal insulation produced locally from agricultural waste**

A good solution would be the use of thermal insulation based on biomaterial that will not affect the environment after the end of the life of the buildings. There is already a heat-insulating biomaterial obtained from industrial waste (paper, cardboard, jute and others) and agricultural waste (straw), with the same properties as the existing ones or even better, but the difference is that when it enters the soil, it rots, preventing pollution.
The material is grown with the help of Pleurotus ostreatus mushroom spores. As the tests of INCERCOM Î.S. Research Institute showed, it is biodegradable, does not burn, thermal conductivity λ = 0.038 [W/ m2K]. It can replace mineral fibers and polystyrene, which do not degrade over time by settling in the soil. Polystyrene is flammable. A lot of energy is spent on their production, and years from now, when the buildings isolated today, will be demolished, they will create serious ecological problems. The insulation is biodegradable and does not generate environmental pollution.
It is not hazardous to human health at the facility, as it does not contain hazardous substances.
It is not flammable. It doesn't burn, it just smolders.
Thermal conductivity close to polystyrene and mineral wool.
Good sound insulation (70-75% absorption).
It is durable. Storage of five samples of paper, cardboard, jute, willow leaves and straw for 4 years showed no deterioration.
High strength-to-weight ratio and much lower embodied energy compared to traditional construction

- **BE3. Installation of PVT (photovoltaic thermal panels) and solar water heating collectors**

The village has a gas pipeline. Natural gas is the main source of thermal energy. The use of solar

energy to obtain domestic hot water is at an early stage (photo 5).

Year-round solar radiation is very favorable for the use of solar collectors for water heating and photovoltaic (PV) panels for electricity generation. Moldovan legislation is also favorable.

At the point indicated in fig.10, 1kWp of monocrystalline PV panel can annually generate 1.207kWh of electricity (fig.11) in the photovoltaic park installed on the ground and 1.161kWh in the PV systems framed in the roof (fig.13). Hybrid photovoltaic-thermal (PVT) panels include both, solar collector and photovoltaic panel, which generate electricity and hot water. Photovoltaic panels are known to have a shortcoming that as the temperature increases, the electrical efficiency decreases up to 70%, depending of temperature. PVT increases its efficiency by cooling the

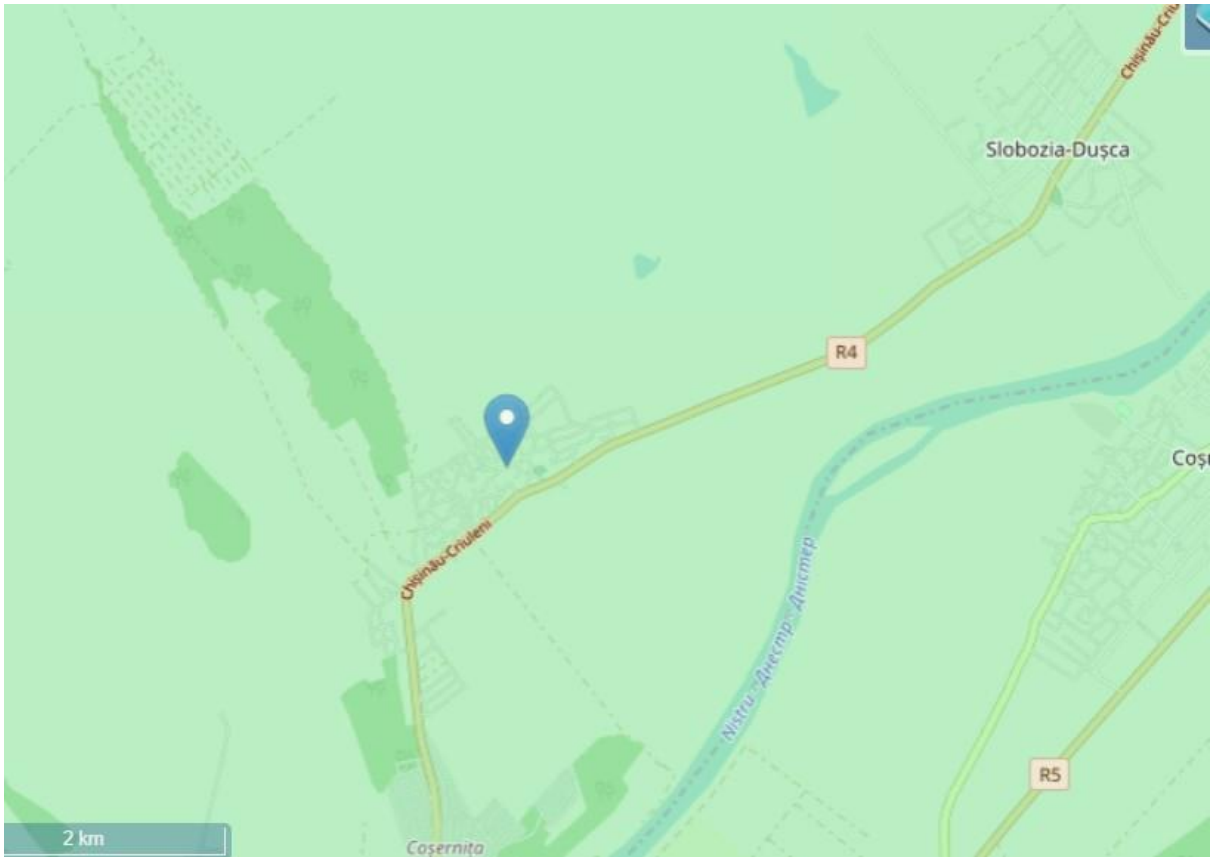
Photo 5. Photoelectric-thermal panels (PVT) at a kindergarten

photovoltaic cells and obtaining hot water for household needs. The average annual loss of electricity from temperature and low radiation in the locality is from 6.9% to 10.39%, according to fig. 11, 13. Experience shows that a PVT panel (1.5m2) can provide 25 liters/day of hot water with a temperature of 55°C during the hot season, from March to October (fig.12,14,15) . Additional annual yield to energy generation can bring more than 281kWh to each panel.

Solar collectors can accumulate more thermal energy when heating domestic water and provide households 7-8 months a year with hot water at a temperature of 60-90°C, the solar radiation being 1427kWh/m2 which means that each square meter can annually heat approximately 2.5m3 of water at a temperature of 60°C.

Each public building is expected to have its own solar collector or a photovoltaic-thermal (PVT)

panel system, installed on the building's roof or stand-alone unit. The advantage of the PVT system is that it generates electricity and hot water simultaneously. The solar collector and PV panels (PVT) should be installed at an angle of 36° (optimal) to the south. They will be connected to a boiler that has the volume according to the needs or the number of members in the consumer's family. An individual heating station will additionally heat the water from late February to mid-November. Exemplele existente în țară arată că consumul de energie pentru încălzirea apei poate fi redus cu până la 80% prin aplicarea acestui tip de măsură.



10. Calculation point of solar energy use

Provided inputs:	
Location [Lat/Lon]:	47.146,29.070
Horizon:	Calculated
Database used:	PVGIS-SARAH2
PV technology:	Crystalline silicon
PV installed [kWp]:	1
System loss [%]:	14

Simulation outputs:	
Slope angle [°]:	35
Azimuth angle [°]:	0
Yearly PV energy production [kWh]:	1206.88
Yearly in-plane irradiation [kWh/m^2]:	1535.83
Year-to-year variability [kWh]:	51.25
Changes in output due to:	
Angle of incidence [%]:	-2.82
Spectral effects [%]:	1.26
Temperature and low irradiance [%]:	-7.15
Total loss [%]:	-21.42

Fig. 11. Inputs and outputs of the 1kWp monocrystalline photovoltaic (PV) panel on the ground

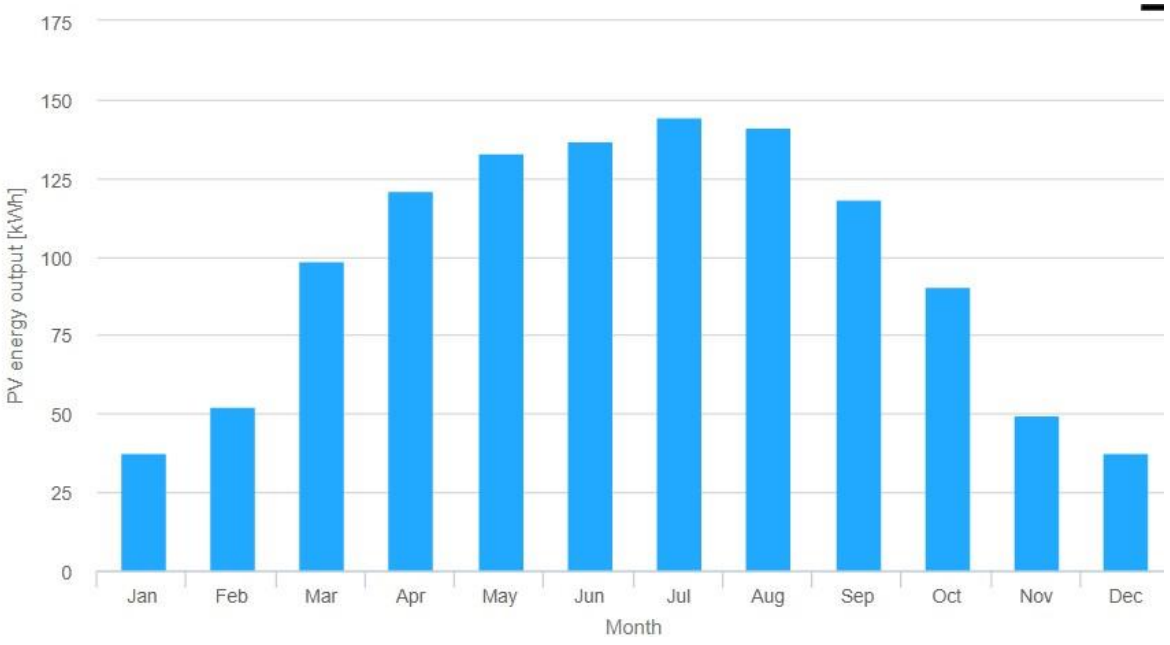


Fig. 12. Monthly electricity generation of the monocrystalline photovoltaic (PV) panel of 1kWp on the ground

About 30% of primary heating energy in the residential sector is consumed for domestic hot water.

Provided inputs:	
Location [Lat/Lon]:	47.146,29.070
Horizon:	Calculated
Database used:	PVGIS-SARAH2
PV technology:	Crystalline silicon
PV installed [kWp]:	1
System loss [%]:	14

Simulation outputs:	
Slope angle [°]:	35
Azimuth angle [°]:	0
Yearly PV energy production [kWh]:	1160.73
Yearly in-plane irradiation [kWh/m^2]:	1535.83
Year-to-year variability [kWh]:	48.73
Changes in output due to:	
Angle of incidence [%]:	-2.82
Spectral effects [%]:	1.26
Temperature and low irradiance [%]:	-10.7
Total loss [%]:	-24.42

Fig. 13. Inputs and outputs of the 1kWp monocrystalline photovoltaic (PV) panel integrated into the roof

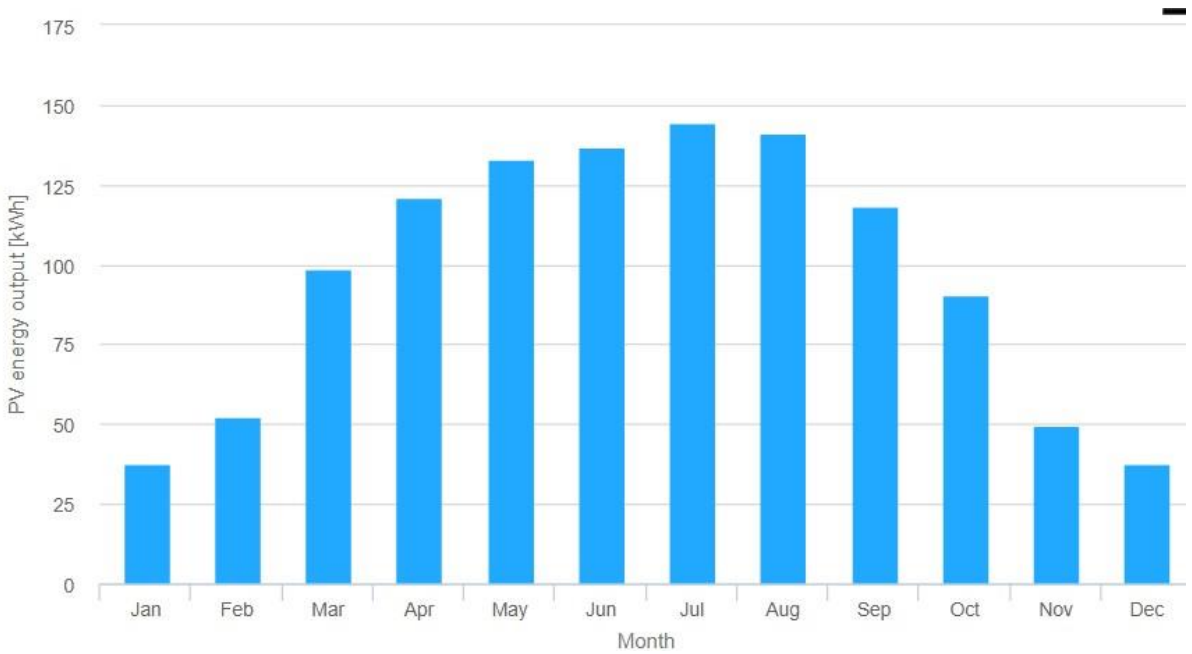


Fig. 14. Generarea lunară de energie electrică a panoului fotovoltaic monocristalin (PV) de 1kWp integrat în acoperiș

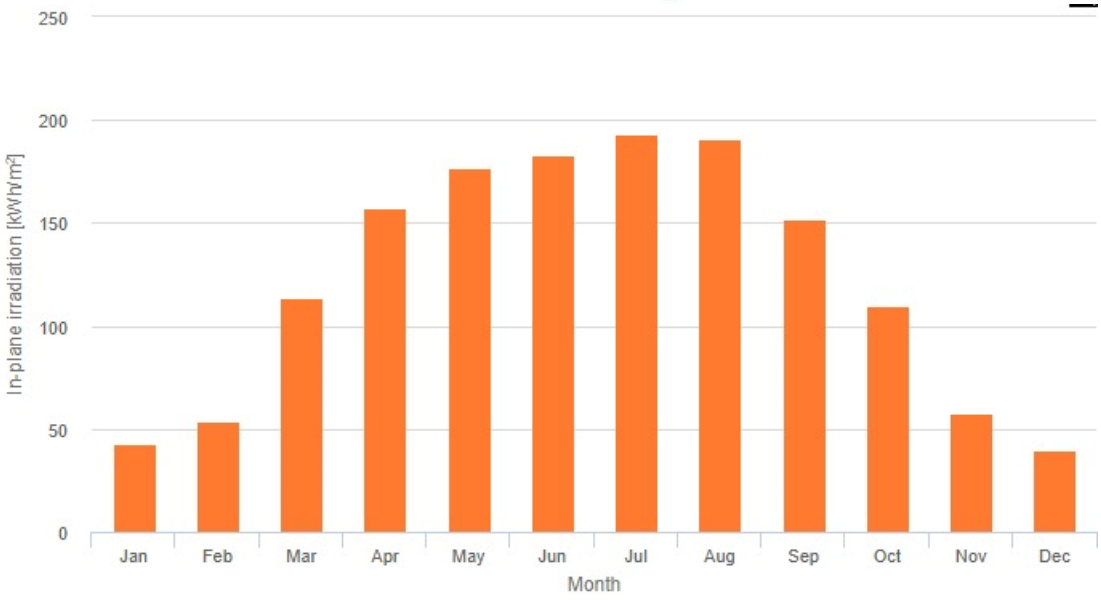


Fig. 15. Monthly solar irradiation per 1m2 of photovoltaic-thermal panel (PVT)

❖

❖ **BE4. Replacement of the old heating system in public buildings**

The replacement of the old heating distribution system complies with Directive EE 2012/27 / EU. The heating systems of public buildings were built over 25 years ago with little maintenance. The radiators are made of cast iron. Radiators and water pipes have not been cleaned, so they are sedimented with salts, rust and deposits of impurities. If the layer of salt sediments is 8mm, then the efficiency of the system depreciates by 40%, so their renovation with new pipes and radiators is necessary.

The most efficient and reliable are bimetallic radiators with higher heat radiation than steel and cast iron and have 150-190W/section.

It is necessary to install individual heat energy consumption control systems and heat point consumption control depending on the outside temperature with the renovation of the heating system.

The basic principle of automatic systems consists in regulating the flow of the thermal agent to the temperature measured inside (individual control) or outside the building. When adjusting the power of the thermal plant, the measurement of the outside air temperature is used, when adjusting the radiators - the internal temperature. With the increase of the external temperature and the internal temperature, the flow of the heat agent decreases proportionally, and vice versa - it increases when the temperature inside the building and the outside air decrease. By reducing the heat flow, the amount of heat consumption decreases.

The internal heating distribution system will be redesigned. A heating control system based on internal and external temperatures will be installed at each station. The indoor temperature valve will be installed in each room.

❖ BE5. Use biofuel from energy willow

Biofuel will replace coal and firewood for heating public, residential and commercial buildings, improving indoor comfort.

There are three methods for converting willow into energy:

• combustion is used for heating water or to raise steam for a turbine;

• gasification produces a combustible gas that can be burned in a boiler, or used as fuel for an engine or gas turbine;

• pyrolysis can be used to convert the crop into gas, oil or charcoal fuels.

One hectare of a well-managed willow plantation can yield 10 - 12 tonnes of dry matter per year, with energy equivalent to about 5,000 litres of oil.

As a rough guide, 1 kg of willow will yield about 1 kWh of electrical output. A district heating scheme for a development of 100 houses would require about 25 hectares of willow coppice. A combined heat and power system with 100kW electrical output will use 50ha of willow coppice harvested on a three year cycle. A power station generating 5 MW of electricity would need around 2,500ha of willow.

Most users need chipped fuel. The chipping operation, sometimes referred to as "comminution", often takes place during harvesting. Alternatively the crop can be harvested as long sticks, and chipped later.

Willow is harvested in winter. This coincides with the main demand for space heating, but electricity and industrial process heat are generally required all year round. Storage requirement can be minimised by using willow as it is harvested during winter, and other fuels (usually forestry residue) over the remainder of the year.

Storage and transport need careful management. Freshly harvested chips can deteriorate in store unless they are dried; full length willow sticks are easier to store, but more difficult to transport.

❖ **BE6. Installation of Independent Energy Systems (IES) to provide electricity, heating and air conditioning in buildings**

Recent developments and national research in this field have demonstrated the possibility of switching to autonomous energy systems through the wider use of photovoltaic-thermal panels (photo 6). Systems with PVT of different options can provide the consumer with electricity year round using the net billing mode and hot water 7 months a year or year round using the

a) *b)*

Foto 6. Examples of use of thermal photovoltaic panels

a). System with thermal photovoltaic panels for the generation of electricity and hot water during the warm period of the year;

b). Autonomous energy system with the generation of electricity, hot water and cold all year round.

Independent Energy System (SEI). In both cases the electricity generation efficiency is higher.

he advantage of SEI is that it provides the consumer with electricity, hot water for heating and domestic water and cold all year round. The average annual power generation efficiency is 10-15% higher than ordinary photovoltaic panels.

In this way, SEI can insure public consumers (kindergartens, hospitals, schools, etc.), consumers residential and economic consumers with year-round energy without fuel consumption (natural gas, coal, fuel oil, firewood).

This is an ultramodern technology (fig.16), which generates electricity, hot water for heating the building, domestic hot water and cold all year round. It has the following properties:

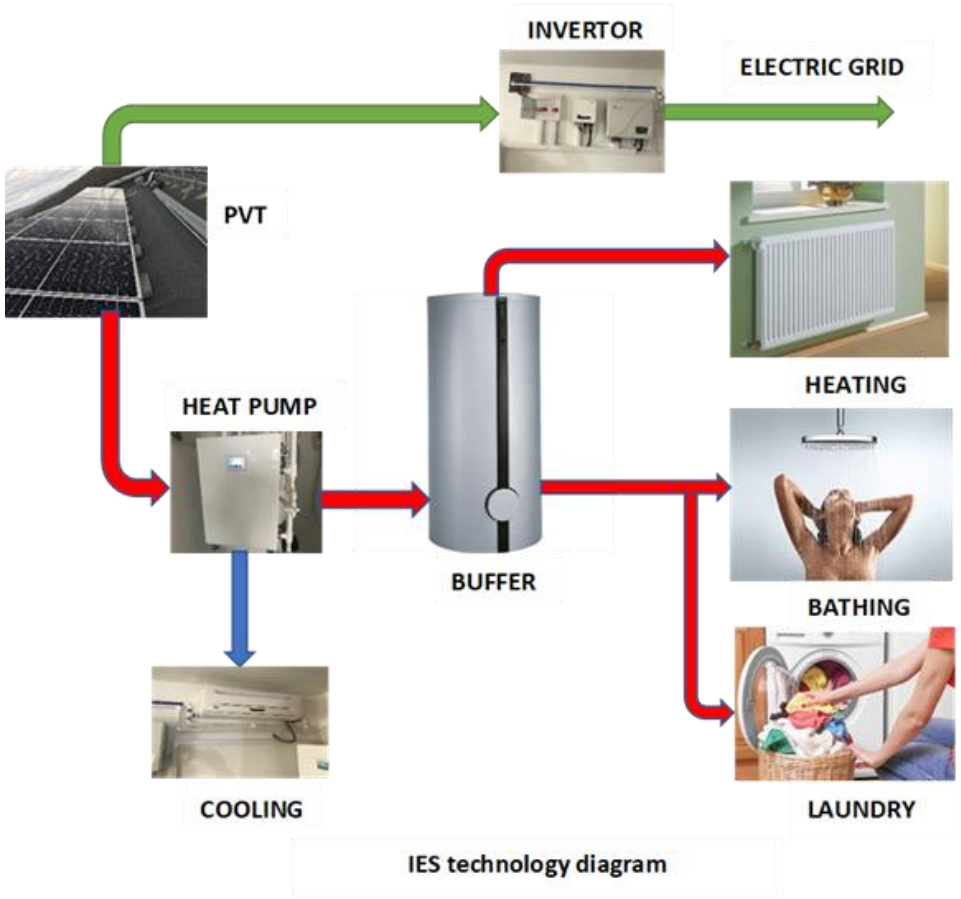


Fig. 16. Technological diagram of the Independent Energy System

- Higher efficiency than usual photovoltaic systems in generating electricity;
- Generates hot water with a temperature of 65°C and more for use in everyday life (bathing, washing clothes, kitchen dishes, etc.);
- Generates hot water with a temperature of 65°C and more for heating the building;
- Generates cold air for air conditioning in rooms;
- De-icing system allows snow and ice to melt on the photovoltaic-thermal panels during the winter;
- Works in automatic mode;
- Has the frost protection function of the room heating system;
- Electricity generation and consumption is carried out according to the net billing method: "consume when you generate"; The balance of generation and consumption is made at the end of the year: ai

consumed more than the contract stipulates - you pay the defense according to the supplier's tariff, you generated more - the supplier pays you at the tariff set by the contract.

It can be applied in family houses, apartment blocks, public buildings (kindergartens, hospitals, schools, administrative and social buildings), office buildings, of industrial enterprises, curative and recreational buildings (sanatoria, rest centers, cottages, etc.), seasonal and permanent greenhouses, vegetable dryers and fruit, agricultural production processing enterprises, poultry and animal breeding buildings

The technology is very efficient and allows obtaining energy all year round without the use of gas, coal, fuel, firewood, etc.

The implementation of building heating-cooling through the Independent Energy System and capillary tube technology can radically change the approach to heating and air conditioning. It will considerably increase energy efficiency in buildings.

The village has wells with hot water (22°C all year round. The hot geothermal water can be used to heat buildings and vegetable production greenhouses.

- **BE7. Use of "air-to-air" or "air-to-water" heat pumps for heating public buildings and obtaining domestic hot water**

A heat pump can ensure a healthy environment inside the building all year round, providing heat in the winter and coolness in the warm season. It can provide the building with domestic hot water throughout the year. An air source heat pump has three cycles: heating cycle, cooling cycle and defrost cycle. During the heating cycle heat is taken from the outside air and "pumped" into it. During the cooling cycle, the process described above is reversed to cool the building during the summer. The heat pump extracts heat from the building's air and pushes it outside.

Modern heat pumps can operate at temperatures below -25°C and thus the building is provided with heat and cold throughout the year. The lowest temperature in the Republic of Moldova is -17°C over a period of 3 days.

It is necessary to compensate the consumption of electricity from the municipality's own sources with the use of the "air-water" or "air-air" heat pump. The most suitable source is solar energy, which is the most valuable and cleanest renewable energy. Photovoltaic energy must cover the electricity requirement of the heat pump for space heating, partly for domestic water heating, LED lighting and other equipment.

From experience, the use of the "air-to-water" heat pump for space heating and domestic hot water (DHW) together with the use of photovoltaic-thermal panels (SEA system) is the most feasible option for heating buildings and obtaining DHW. It can exclude the use of fuel-based heating (fossil or bio), significantly reducing greenhouse gas (GHG) emissions. The water

temperature in the heating system will be 65-85°C, the domestic hot water temperature will not exceed 65°C. The simple payback period is 2.0-3.0 years.

The use of photovoltaic-thermal panels together with the "air-water" heat pump, LED lighting together with the thermal insulation of the walls and ceiling and the use of modern PVC windows and doors offer the possibility to pass the building to the class of passive buildings and to transform it from a consumer of heat and electricity into a generator of them. The PVT system will operate in net-metering network mode, being permanently connected to the electricity distribution network. The hot water generated by the PVT system will be delivered to the building's domestic hot water pipe.

The PVT system combined with the air-to-water heat pump can provide space heating (100%), LED lighting (100%), food preparation (100%), domestic water heating (100%).

- **BE8. Installation of new individual biofuel heating power plants, their interconnection with solar heating systems**

This measure will rehabilitate heating systems in public buildings. Now the thermal power plants are old, with low efficiency, running on coal and wood. They require manual operators.

The new stations should run on wood pellets produced locally from the energy willow. These will improve heating efficiency and reduce CO2 emissions.

The interconnection of the thermal plant with the solar water heating system will improve the reliability of obtaining hot water throughout the year, having a balance between two energy sources: biofuel and solar. Solar preheating of the water entering the boiler can reduce fuel consumption by up to 80%.

- **BE9. Biofuel production from energy willow. The use of wood pellets in public and residential buildings**

There is a 5.6 ha plot of land (fig.22) on the bank of a public pond located in the north-eastern part of the village. This land can be used for energy willow plantations, which every two to three years will have a yield of 20t/ha of dry material for pellets or chips. The total biofuel yield can reach 480 tons or 240 tons annually.

It will reduce CO2 emissions and provide the opportunity for a comfortable life.

Willow biomass crops can be planted on marginal agricultural land. A grower can harvest willow up to seven times from a single planting. Willow has the following advantages:

• Easily propagated from stem cuttings which grow new roots, shoots and leaves.

- Fast growth rate, produces hardwood biomass 10-15 times faster than native forests.
- After each harvest, new stems quickly re-grow from the remaining plant.
- Limited maintenance between harvests.
- The properties of willow chips are similar to forest residue chips and are suitable for mixing.
- High ornamental and landscape aesthetic value.

In addition to being a source of renewable energy and environmentally friendly products, willow's unique characteristics make it ideal for a wide range of environmental applications:

- Snow hedges - prevent snow from blowing onto the roads.
- Plant buffers - prevents the penetration of fertilizers and chemicals into ponds and rivers.
- Protects soil resources - prevents erosion and stabilizes riverbanks.
- Environmental remediation - cleans up and restores former industrial sites.
- Vegetal cover - a green alternative for the efficient covering of landfills.
- Biodiversity restored - the plantation is an ideal location for birds, animals and insects.

It is possible to produce biofuel by implementing public-private partnership together with energy willow plantation.

❖ BE10. Production of biodegradable thermal insulation from agricultural waste

The agricultural households of Onitcani village produce large quantities of grain and as a result there is a lot of straw, stubble and other agricultural waste. They can be transformed into biodegradable thermal insulation with a high added value. It has many advantages compared to polystyrene, namely, it is not flammable, it is not toxic and harmful, it is not sensitive to UV rays, it is not sensitive to chemicals (gasoline, kerosene, diesel, acetone, paints, etc.) , mechanical destruction is not easy, there is practically no expansion and contraction during exploitation, etc. At the same time, it is cheap and easy to produce material with a high profit margin. It can be produced locally by any householder. Production does not require high energy consumption. The production of biodegradable thermal insulation is based on fungal spores.

❖ BE11. Replacing gas-powered kitchen and laundry appliances in kindergartens and schools with electric appliances

Incentives for replacing kitchen and laundry appliances for new ones in kindergartens and schools is Directive 2012/27/EU. The kitchen equipment in the kindergartens and schools of the commune use liquefied gas, which creates the danger of accidental explosion. They must be

replaced by electric appliances, which will eliminate the use of fossil fuel.

❖ LE1. Replacing old technology lighting with LEDs in buildings

Public buildings are mainly lit with fluorescent tube lamps which lead to high energy consumption. Fluorescent tube lamps are more efficient than incandescent bulbs, but they contain mercury vapor, which is dangerous to people and the environment. In addition, they have

other shortcomings, and Ra is less than 80%. Ra is the color transmission index (Sunlight - 100%, incandescent lamp - 95%). It is planned to rehabilitate the internal lighting systems in all public buildings by replacing the old technological lamps with LEDs saving approximately 70% of energy.

Apart from saving energy, LED lighting has many advantages in indoor lighting:

- Ra is greater than 90%, which means high color transmission. It is important for the health of children and adults;

- LED lamps do not contain dangerous elements and are ecological;

- They have the longest lifespan, which means saving on maintenance.

Table 6. Administrative measures for existing buildings

BE1.	Buildings	Action
BE1.1	Energy certification of public buildings	Elaboration and display of energy certificates for municipal buildings that will be rehabilitated
BE1.2	Regulation of energy efficiency for private buildings	Development and implementation of energy efficiency regulations for existing and new private buildings
BE1.3	Grants and subsidies	Partial subsidies / subsidies for replacing old boilers with new ones for private house owners
BE1.4	Grants and subsidies	Incentives for replacing household appliances with new ones.
BE1.5	Partial grants	Subsidies for replacing old boilers with new biomass boilers for private house owners

To sensitize the population, the following solutions have been identified in the private, public and residential sectors.

❖ BE1.1. Energy certification. Elaboration and display of energy certificates for municipal buildings that need to be modernized

Placing certificates at the entrances of public buildings will sensitize the population and produce more positive effects.

The energy certificates displayed on the buildings related to the residential sector will show the owners the actual energy consumption of the building and what the consumption will be after rehabilitation, as well as the cost of the measures. They can estimate the monthly expenses of the bills.

The energy certificate for public buildings will make administrators look for ways to better manage energy consumption.

❖ **BE1.2. Regulation of energy efficiency for private buildings**

The Town Hall will adopt regulations for the construction of new private buildings and the renovation of old ones. It will contain requirements on energy efficiency, waste collection and environmental protection.

❖ **BE1.3. Grants and subsidies. Incentives for replacing household appliances with new ones**

The Town Hall will look for opportunities to participate in competitions from international donors, country funds and government organizations.

❖ **BE1.4 Grants and subsidies**

It is necessary to replace old, inefficient appliances of classes D or E in the residential sector, which must be replaced with equipment of type A +++. A co-financing of the measure of up to 30% is foreseen. It is expected to finance this measure from local taxes, ESCO or low-interest loans and donor organizations.

❖ **B1.5. Partial subsidies/Subsidies for replacing old boilers with new biomass boilers for private house owners**

Taking into account the fact that most of the buildings in the commune belong to the private sector, it will be decided to facilitate the house owners to replace the old boilers with new, more efficient ones.

They are expected to form a fund that will attract investment from various donor organizations, which could cover about 50% of the cost of purchasing the new boilers.

All existing boilers use mainly wood and coal with a low efficiency rate of around 60-70%. The new boilers are expected to use biomass with heat generation efficiency of at least 90%. This measure considerably reduces CO2 emissions. According to the SECAP template, the IPCC emission factor

for municipal biomass waste is considered 0 (zero), which means that by applying this measure, emissions will be completely excluded.

The impact of the measures in public buildings is presented in the table below.

Table 7. The impact of the implementation of the measures

№	Actions	Estimated investment, [euro]	Calculated reduction in energy consumption, [MWh/year]	Calculated reduction in CO2 emissions, [tones/year]
BE1	Thermal insulation of walls, replacement of old windows and doors, rehabilitation of roofs of public buildings and insulation.	800,000	379.0	76.5
BE2	Thermal insulation of walls with biodegradable thermal insulation produced locally from agricultural waste	200,000	95.0	19.1
BE3	Production of biodegradable thermal insulation from agricultural waste	150,000	95.0	19.1
BE4	Replacing the old heating system in public buildings	57,600	213.0	43.0
BE5	Installation of PVT (photovoltaic-thermal panels) and solar water heating collectors.	120,000	240.0	69.6
BE6	Installation of Independent Energy Systems (SEI) to provide electricity, heating and air conditioning in buildings	375,000	1,501	332.4
BE7	Use of air-to-air or air-to-water heat pumps for heating public buildings and domestic hot water	229,500	1,162.5	515.4
BE8	Installation of the individual heating plant operating on biofuel, their interconnection to the solar heating systems.	24,800	960	194.0
BE9	Establishment of pellet production based on public-private partnership	142,850	858	173
BE10	Replacing gas-powered kitchen and laundry appliances in kindergartens and schools with electric appliances	31,000	Children's safety will improve	
LE1	Replacing old technology lights with LEDs in buildings	27,800	17.0	7.5
LE2	Replacing old technology lights with LEDs in street lighting	220,300	57.2	25.4

PG1	Construction of a photovoltaic park with a power of 1.2MW	960,000	1,440	638.5
WW1	Design and construction of a sewage system together with the wastewater treatment plant	800,000	The level of environmental protection will increase	
WW2	Arrangement of the solid waste storage site	150,000	The level of environmental protection will increase	
WW3	Organization of the solid waste collection, transport and storage service	100,000	The level of environmental protection will increase	
CA1	Planting of 5.6 ha of energy willow	180,000		1,673
CA2	Production of biodegradable thermal insulation	100,000	858	173
CA3	Creation of a wetland in the center of the village with an area of 2.7ha	500,000	The level of environmental protection will increase	
CA4	Creation of an exploration area of water sources for health promotion	700,000	The level of environmental protection and well-being will increase	
CA5	Creation of a water source exploration area for fish breeding	800,000	The level of environmental protection and well-being will increase	
CA6	Creation of a recreation area on the banks of the Dniester with an area of 50.0ha	700,000	The level of environmental protection will increase	
CA7	Creation of a tourist route involving the "Gamma Field"	1,500,000	The level of environmental protection and well-being will increase	
CA8	The transformation of the existing football stadium into a multifunctional sports center	300,000	The level of environmental protection and well-being will increase	
CA9	Planting of 5.0 ha of trees on the bank of the public pond	150,000	The level of environmental protection and well-being will increase	
CA10	Afforestation of the banks of the Dniester River with an area of 49.3ha	300,000	The level of environmental protection and well-being will increase	
CA11	Creation of an area for amateur fishing with an area of 2.3 ha	100,000	The level of environmental protection and well-being will increase	

Note:

The IPCC national emission factor for electricity is 0.4434 [t · CO2 / MWh].

According to Part II "Baseline Emissions Inventory", the IPCC standard emission factor for natural gas is 0.202 [t · CO2 / MWh].

According to the SECAP template, the IPCC emission factor for municipal biomass waste is considered 0 (zero)

3.2 Public lighting

The current situation

The village of Onitcani is partially illuminated. Of the total length of the streets of 17.0km, 14.0km

or 82% are lit. The main street (photo 7) with a length of 2.0 km, which is paved, is fully illuminated. The secondary streets (photo 8) are partially lit. 250W high pressure sodium vapor and mercury vapor lamps are installed.

On average, street lighting operates 3877 hours per year.

Until now, street lighting has been partially financed by the Local Public Administration to improve the standard of living and the safety of citizens.

Photo 7. The lighting of the main street

Vision for the future

Table 8. Energy efficiency measures in public lighting

LE	Public lighting	Actions
LE1	Energy efficiency of lighting in public buildings	Energy efficiency of lighting in public buildings
LE2	Energy efficiency of street lighting	Energy efficiency of street lighting

To ensure road and people safety through energy efficient street lighting, the following measures are proposed, the detailed description of which is given below.

❖ LE1.2 Replacing old technology lights with LEDs in street lighting

Modern street lighting is based on LED lamps and the use of lighting fixtures with them. This technology offers great savings in energy and maintenance money. In addition, it is widely used with dimmable LED lamps that allow intensity control lighting depending on the night, pedestrians or cars present and the transition to intelligent lighting.

Photo 8. The lighting of a secondary street

Therefore, the street lighting in the commune should be with LED and intelligent control, which, in addition to controlling the light intensity according to the time of night, pedestrians or cars present can inform about the maintenance of the lighting system, the situation on the streets and others .

Currently, 14.0 km of streets are lit. Another 3.0 km are to be illuminated.

Given that the streets proposed for lighting are of class S6, the installation of LED lights with a power of 25W is calculated.

The calculations were carried out according to modern street lighting calculation methods. The distance between the newly placed poles is considered to be 30m and they will be installed on one side of the street. In total, 567 lighting fixtures based on LED technologies will be installed, of which 467 will be replaced.

The impact of the application of this measure is presented in the table below.

Table 9. The impact of the implementation of the measure in public lighting

№	Actions	Estimated investment, [euro]	Calculated reduction in energy consumption, [MWh/year]	Calculated reduction in CO2 emissions, [tones/year]
LE1	Replacing old technology lights with LEDs in public buildings	27,846	17.0	7.5
LE2	Replacing old technology lights with LEDs in street lighting	156,700	20.9	9.3
	New street lighting with LED	60,600	36.3	16.1

Note: The national emission factor for electricity is 0.4434 [t · CO2 / MWh].

3.2 Transport

The current situation

The transport sector plays an important role in the daily life of the village, supporting economic development.

The village of Onițcani is connected by an asphalted road with Chişinău (photo 9, fig. 17), Criuleni and Dubăsari through the M1 and R4 roads.

Major transport pollution comes from local transport of residents and economic agents. The village of Onitcani owns 220 cars, 84 trucks, 21 tractors, 3 combines and 65 motorcycles.

Approximately 6,300 cars, 2,200 trucks, 1,800 tractors and more than 8 combines pass through the village annually.

It does not take into account the major pollution from the transport that runs on the mentioned highways, which are national and regulated by the government. Other transport sectors in the locality are private, residential and economic in the commune. They are also regulated by the government.

About 50% of the roads are in a satisfactory condition. Most of the roads are country roads with no hard surface and no sidewalks, making it difficult for the elderly, disabled, mothers with strollers and children to walk. Rural roads become impassable in rainy weather, which makes it difficult for people to move to public institutions, makes it impossible to use personal transport and is an important barrier to the provision of quality services throughout the commune. Poor road

infrastructure can make access difficult for emergency services, fire and police.

Photo 9. Onitcani - Chisinau road

Fig. 17. Roads, streets and the transport plan of Onitcani village

It is estimated that local transport consumes 77.0 tons of gasoline and 26.0 tons of diesel fuel annually. Approximately the same amount of fuel is burned when transiting the commune.

3.4 Energy

POWER SUPPLY

The current situation

The National Electric System provides electricity in the Onitcani village through the electricity distribution company S.A. "Prime Energy Distribution"S.A.. "Prime Energy" is the sole owner of the distribution networks in the village.

In order to ensure the energy autonomy of the municipality and to reduce expenses for electricity consumption, it is appropriate to produce electricity locally using renewable energy sources.

The energy produced can cover the consumption of electricity in public buildings, street lighting, the operation of heat pumps, as well as partial heating of domestic water.

Table 10. Measure of local electricity production

PG	Local electricity production	Measure
PG1	Photovoltaics	Construction of a 1.2MW photovoltaic farm

The detailed description of the defined solutions is given below:

- **PG1. Construction of a photovoltaic park with a power of 1.2MWp based on a public-private partnership**

The current legislation[2] of the Republic of Moldova encourages the construction of a photovoltaic park with the aim of producing clean energy. The town hall of the commune owns a large area of land unusable, which is not available for agricultural use. The land with the surface of 2.0ha (fig.18) near the village of Onițcani can be used for the construction of a photovoltaic park. The town hall will attract investments for its construction. The amount of electricity generated annually is 1,156kWh for every 1 kWp of photovoltaic panel installed (fig. 11).

Table 11. Size of local electricity production

PG	Local electricity production	Measure	Amount of electricity generated, MWh / year	Reduced CO2 emissions, tones
PG1	Fotovoltaice	Construirea unui parc fotovoltaic de 1.2 MW	1,440	638

[2] LAW No. 10 of 26-02-2016 regarding the promotion of the use of energy from renewable sources

The advantage of the area is that a 35kV power line passes near the planned park. A 35/10kV power station is close to that place, where power can be generated into the grid. As can be seen from table 10, this action will annually replace 1,440MWh of fossil electricity and reduce CO2 emissions by 638 tonnes.

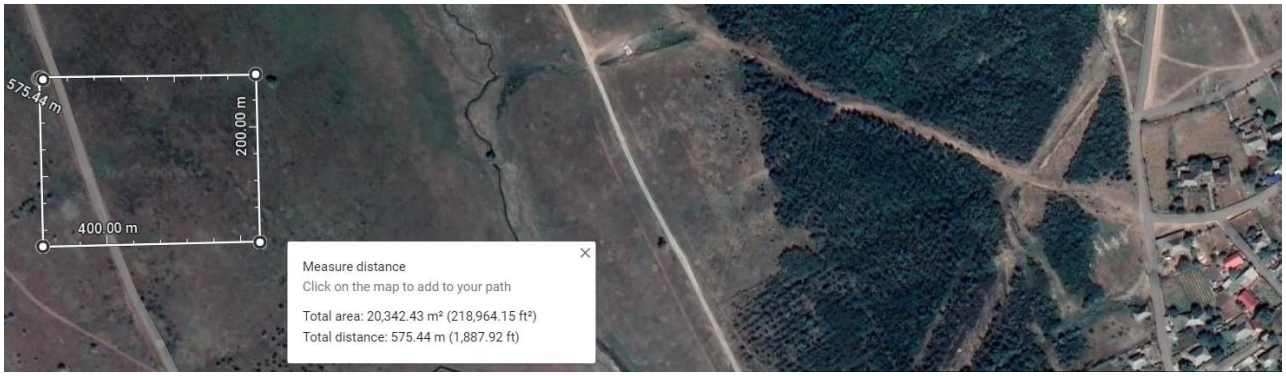


Fig. 18. The plot land for the location of the 1200kWp photovoltaic farm

THERMAL ENERGY

The commune has no urban heating system or domestic hot water system.

The municipality plans to plant 5.6ha of energy willow on the shore of the public pond to reduce the consumption of natural gas and firewood obtained by cutting down forests. The planned amount of pellets produced should cover the needs of public buildings, some companies and households. This action will establish a market for biofuels, create new businesses and generate jobs.

In addition, it is planned to replace individual old heating stations with new ones that run on biomass.

The heating stations will interconnect with the solar water heating installations.

3.5 Water and wastewater

Current situation

The village of Onitcani has a modern aqueduct with a length of 51.7 km. Public buildings are provided with 100% drinking water, economic agents – 60% and the population – 99%.

At the same time, the village does not have a centralized sewage system and a wastewater treatment system.

The inhabitants of the village have 700 toilets in the yard. The liquid from them penetrates directly into the underground waters, polluting them intensely. Public buildings and economic agents have 175 internal toilets, the contents of which are transported outside the town and poured onto a lot

nearby the commune. This method is as hazardous as external toilets.

The large number of households in the residential area do not have a centralized sewage system, and waste water is stored in hand-dug and unprotected outdoor pits, called toilets. Because of this, soils and groundwater sources are contaminated.

In addition, the waste water from the neighboring households of the Cainar river ends up directly in or in the ground water. Industrial and agricultural waste water also heavily pollutes the environment.

The construction of a sewerage and sewage treatment system is imperative.

Onițcani City Hall will initiate the design of the sewerage and wastewater treatment system, the orientation scheme of which is presented in fig. 19.

The solution that was defined after analyzing the situation is shown in table 12 below.

Table 12. Water, wastewater and solid waste management measures

WW	Name	Measure
WW1	Waste water management	Design and construction of a sewage system together with the wastewater treatment plant
WW2	Solid waste management	Arrangement of the solid waste storage place, creation of their collection service
WW3	Solid waste management	Design and construction of a sewage system together with the wastewater treatment plant

The detailed description of the defined solutions is given below:

- **WW1. Design and construction of a sewage system**

It is necessary to improve the standard of living of 700 households by building a centralized sewage system. The town hall of the commune must build a modern aqueduct that would satisfy the needs of public consumers and the inhabitants of the village. It is necessary to initiate the technical execution project of the sewage system and the treatment plant. The city hall must undertake actions to attract investments from development partners by participating in the contests announced by them.

The construction of the sewage system and the treatment plant will solve the problem of environmental pollution with waste water from inside the village territory.

In the residential sector of the village there are more than 700 toilets outside the polluting buildings intense environment. In addition to this, there are animal and bird breeders in the

village, which also contribute to pollution.

The central pipe of the sewage system could be as illustrated in fig. 19, but will be made concrete at the design stage. The centralized sewage system and the wastewater treatment plant will considerably reduce the negative impact on the environment, especially on the Dniester River and the several ponds nearby. It will also have a positive impact on groundwater resources and improve people's well-being and health.

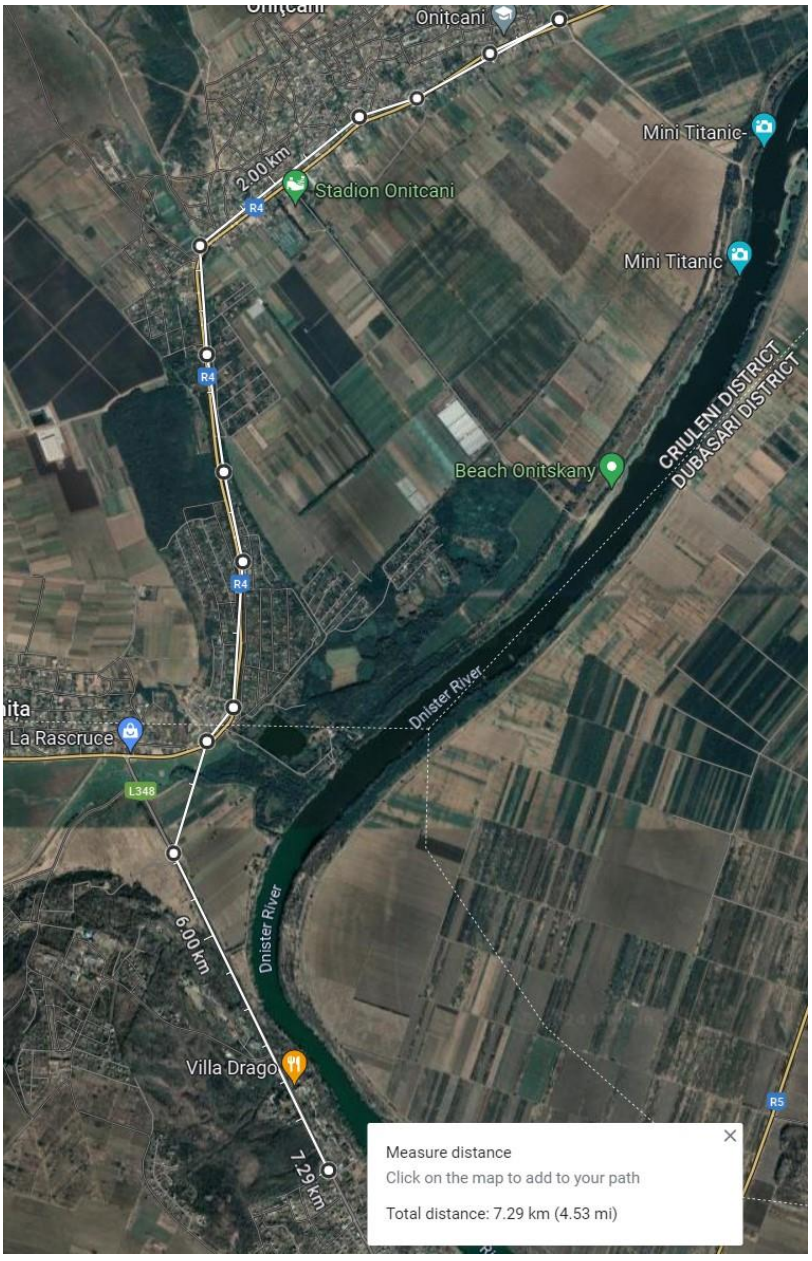


Fig.19. Linia centrală a sistemului planificat de canalizare

3.5 Solid waste

Current situation

A pressing problem of Onitcani village is the storage of manure from about 200 cattle, 84 pigs, 1,470

sheep and goats, 12 horses and over 17,000 poultry. Now the owners of animals evacuate the garbage outside the village, in unauthorized places (photo 10) and on agricultural fields to obtain organic fertilizers.

Fig. 20 shows the view from space of the environmental pollution situation with solid waste.

The environment is polluted with plastic, manure, construction waste and various packaging residues. Rains and melting snow transport a good part of them into the river Rădi, which flows through the meadow further down. As a result, not only the Radius is polluted, but also the Dniester, whose tributary it is. In other words, unauthorized dumping pollutes a vast area of the country.

Foto 10. Stocarea neautorizată a deșeurilor solide

- **WW2. Arrangement of the solid waste storage site**

The centralized collection of solid waste, transportation and storage in a specially designed place will change the appearance of the locality, reduce the impact on the terrestrial environment and ground water. The site of the waste deposit is valued (fig. 21), a land with a surface of 0.9ha. Its construction does not require large investments. Onițcani City Hall to solve the problem of their collection, transpotation and storage.

❖ **WW3. Organization of the solid waste collection, transport and storage service**

The organized collection of solid waste, their transportation to the specially arranged storage place and their qualified storage is necessary. For this, a specialized service is needed, waste and stable knowledge outside the towns, at the place of storage. equipped with transport and specialized cars. The minimum number of staff will organize the removal of the waste to the landfill.

Fig. 20. Stocarea neautorizată a deșeurilor solide văzută din spațiu

❖ **WW4. Solid waste management**

The solid waste and manure collection, transport and storage service will take care to store and process the waste with the subsequent use of the obtained products.

3.7 Climate change mitigation and adaptation

❖ **CA1. Planting of 5.6 ha of energy willow**

Planting energy willow is an important action to improve climate change mitigation and adaptation. This will make the village greener, mitigate the influence of precipitation, the consequences of snowmelt in winter and spring, and hot air currents in summer. Willow fixes riverbanks, steep slopes and helps prevent landslides.

The plantation will retain rainwater and snowmelt water which will slow water evaporation

during the dry summer period, positively influence climate change mitigation and adaptation. Wildlife, birds and insects will host the plantation restoring biodiversity.

The village municipality has no power to invest in this activity, therefore, it is wise to solve it by implementing public-private partnership. The municipality can provide land (fig. 22) for the plantation and the private partner will bear all the expenses for the planting and the production

Fig.21. Planul amplasării locului de stocare a deșeurilor solide

of biofuel. It also covers the costs of purchasing, tending, harvesting, transporting and storing the production and marketing of willow pellets. Another option could be considered. Energy willow is planted only once and harvested, starting from the second or third year, for 25-30 years. The energy willow can be cut about 12 times, once every two to three years.

It also cleans the air. A hectare of willow absorbs more than 65 tons of CO2 from the air annually. Willow cultivation is also suitable for the climate less favorable to the conditions of classical agriculture. At the same time, it helps preserve ecosystems.agriculture. At the same time, it helps preserve ecosystems.

❖ **CA2. Production of biodegradable thermal insulation**

Thermal insulation allows heating buildings with less fuel, reducing greenhouse gases, fighting

Foto 11. Vederea zonei care urmează a fi plantată salcia energetică

Fig. 22. Plantație planificată de salcie energetică de 5.6ha

global warming and climate change. Polystyrene, polyurethane foam, mineral wool and fiberglass are the most commonly used insulation materials. They are not biodegradable, which means that the waste pollutes the surface of the soil and water underground for a very long time (hundreds of years). Pollution will intensify when today's insulated buildings are demolished in 50-100 years, when much of the insulation will become waste. Also, their manufacture consumes a considerable amount of energy (kWh/m3): mineral wool-165, glass fiber-215, expanded polystyrene-450, extruded polystyrene-850, polyurethane-1100. At the same time, the country has a lot of vegetable waste (including the village of Onitcani) and industrial waste that can be used for this purpose.

The production requires natural raw material from agricultural vegetation, forestry and urban parks, paper and cardboard waste, waste from carpet factories.

Reduced water consumption during production. Water is used only for the initial hydration of the substrate and energy is required only for drying the finished material.

Production technology is simple that does not require expensive machines. It can be produced by any householder in the village from grain straw. The material is grown with the help of Pleurotus ostreatus mushroom spores, it is biodegradable, does not burn, thermal conductivity λ = 0.038 [W/ m2K]. It can replace mineral fibers and polystyrene, which do not degrade over time by settling in the soil and in the production of which a lot of energy is spent, and in years to come, when the buildings insulated today, will be demolished, they will create serious ecological problems.

- **CA3. Creation of a wetland in the center of the village with an area of 2.7ha**

In the middle of the village is an area (photo 12) with an area of 2.7ha. She can be transformed into a wet population recreation fairy. For this, it is necessary to clean the springs, to deepen the place of water accumulation. It is necessary to arrange the territory with the planting of trees and shrubs. The wetland would be flooded from stormwater and springs. It will retain water both temporarily and permanently, as long as environmental conditions allow, it will brake the departure of groundwater into deep. It will maintain a large amount of biodiversity and provide unparalleled natural wealth to adults and children. It will become a rest area with coolness on the heat.

Its realization will conserve biodiversity that is in danger of extinction, but it will also be able to become a tourist destination to provide an environmental service and help convey the values of nature conservation.

Hydrophilic vegetation will return, i.e. that which has a good predisposition to water. It will restore the habitat of a large number of species, notably migratory birds that come from wetlands around

the world to feed and rest. Some of the mammals, birds, reptiles, amphibians, fish and insects. This action has a significant ecological importance for the proper functioning of nature. Together with the ponds and the forested meadow of the Dniester, the clouds will stop above the estate of the village to discharge the rains during the hot season.

Foto 12. General view of the wetland

- **CA4. Creating a water source exploration area for health care**

The water from the Putna spring has healing properties with a fairly high flow rate and can be used to improve people's health.

At the present time, the place of the spring is arranged in the simplest version (photo 13). The modern development with the necessary infrastructure requires investments, therefore Onițcani City Hall will initiate activities to transform the spring into a healing center.

This measure will be able to catalyze the economic activity of the village, which will lead to the creation of jobs, attracting private and public investments.

- **CA5. Creation of a water source exploration area for fish breeding**

The Larga spring (photo 14) has a higher water flow than the Putna spring and is distinguished by the fact that it is not curved. Its water is used only for watering animals and in small quantities by local people as drinking water. Therefore water can be collected and used for growth fish of

valuable varieties such as trout, sturgeon and other varieties, which have significant economic value.

Photo 13. General view of the Putna spring

- **CA6. Creation of a recreation area on the banks of the Dniester with an area of 13.4ha**

The area with the surface of 13.4ha (fig.23) is located in the southeast of Oniţcani village, on the banks of the Dniester with a natural beach, old and shady trees. Its arrangement provides for the arrangement of the place for bathing and rest, the arrangement of places for rest and recreation, the creation of infrastructure, the construction of rest houses with parking for cars and places for amateur fishing, additional planting of trees on the river bank.

The municipality has no budget for such an action. An alternative source of financing can be the public-private partnership, where the City Hall will provide the land, and the private partners will invest money to build the recreation area.

This measure will help mitigate climate change, save and spread biodiversity and help people use a modern form of leisure.

Photo 14. General view of the Larga spring

❖ **CA7. Creation of a tourist route involving the "Gamma Field"**

During the Soviet period, there was an experimental station in Onitcani, where the effects of irradiating agricultural crops with radioactive rays were researched. There were 2-3 such stations in the world. The station was called "Gamma Field". The vegetables and fruits grown here were much more masked and tempting, so even if people were aware that they could harm them, they still sometimes tasted the forbidden fruits. The goal was to produce mutations in agricultural crops and experiment with their fruiting potential, respectively. Cultures were irradiated with the isotope Cesium 137.

The training ground was forgotten after the collapse of the Soviet Union. Now there is practically nothing left of the complex in Oniţcani, only the mound of earth with a diameter of 100 meters and a height of 5 meters still reminds of the experimental complex (photo 16,17,18).

The village is also famous for the large number of springs. Some of them are very specific in their chemical composition. They are also national heritage as they are centuries old.

Fig.23. The plan of the land reserved for the recreation area on the bank of the Dniester

Photo 15. The natural beach to be developed for recreational purposes

Photo 16. Entrance to the "Gamma Field"

The village has a church, unique in its architecture, the only similar analogue of which can only be seen in Romania, in Iași.

Onitcani white wine is known as a quality wine.

But if we also add here the valuable fish farm, the planned rest and recreation places, then all this could make up a very interesting tourist route. But in order to build it, it is necessary to develop a well-thought-out plan, in which the rehabilitation of the polygon, the construction of access roads, the visit of religious, historical and natural monuments with the tasting of local dishes, cheeses and other delicacies of the village, as well as wines are foreseen specific to Onitcani village. The organization of this tourist route will contribute to the accelerated economic development of the village, the development of the tourist and leisure infrastructure.

Photo 17. Inside the "Gamma Field"

Photo 18. The place where the Cesium 137 device was installed

❖ **CA8. The transformation of the existing football stadium into a multifunctional sports center**

The village has a soccer field (photo 19) at a very suitable place in the Dniester meadow. It is necessary to rehabilitate the shell and bring its infrastructure to a modern level to encourage residents to engage in outdoor sports.

Photo.19 The current state of the football stadium

The city hall makes an effort to implement sports. It is rational to continue the arrangement of this sports object by turning it into a multifunctional center for the wider attraction of children and adults in the practice of several outdoor sports. At the same time, it can become a green area of the village by improving the grass cover, planting trees and shrubs, building sidewalks, etc.

The football field, together with the related land, which can be used for this purpose, constitutes 2.4ha (fig.24).

The city hall will attract designers specialized in sports constructions to carry out the execution project of the multifunctional sports center.

❖ **CA9. Planting of 5.0 ha of trees on the bank of the public pond**

There is a 5.0ha plot of land near the public pond (fig.25) in the north-west part of Onițcani village, which can be used for planting trees of different species. This measure will catalyze the

Fig. 24. Plan of the multi-purpose stadium

restoration of biodiversity on the village estate. Animals and birds will return, including swimming ones. In addition, afforestation will retain rainwater, cool the area, which will contribute to the development of agriculture in the village.

- **CA10. Afforestation of the banks of the Dniester river with an area of 49.3 ha**

On the right bank of the Dniester, near the village of Onițcasni, there is an undeveloped territory (photo 20, fig. 26). It can be used both economically and for the improvement of the environment. The development of this land through afforestation will benefit the people of the village by attracting rains, keeping the area cool during hot summers and stopping snow and moisture in winter and spring. In addition, it will improve the well-being of residents as a place to walk and rest

to maintain the water level in the Dniester river. Fauna and flora will return to the riverbank. Afforestation will help mitigate the impact of climate change by absorbing carbon dioxide.

It is important to plant trees of several species, which will give the forest ecological stability. Hydrophilic tree and shrub species can be planted near the banks attracting waterfowl.

Fig. 25. The afforestation plan of the area around the public pond

❖ **CA11. Creation of an area for amateur fishing with an area of 2.3 ha**

Near the beach there is a well with geothermal water springing up permanently with a temperature of 22°C and poured into a channel (photo 21), which does not freeze even in severe frosts.

The water can be used for heating both holiday homes and winter greenhouses for growing vegetables.

An economically sustainable recreation area can be created here, because the village of Onitcani is located a short distance from Chisinau with a population of 1 million. of inhabitants, which needs rest areas, including amateur fishing.

The canal needs deepening and widening, and the land around it developed for amateur fishing. The reserved area with the surface of 2.3 ha for this purpose is indicated in fig 27.

Photo 20. The land to be afforested

It is necessary to create the infrastructure for amateur fishing. It involves filling the channel with fish of different varieties, raising and maintaining them. Providing fish processing and cooking services and more.

The action will increase the budget of the City Hall through new jobs, will attract local and foreign tourists, which will activate the services in the village.

The arrival of tourists will catalyze the demand for various goods and services, which is difficult to foresee in the current plan.

4. Organizational and financial aspect

The village hall will request funding from various sources to achieve the SECAP objectives with preliminary approval from the Town Council. The town hall will hire professionals, who will be responsible for the management and development of energy efficiency and environmental projects in the commune area. The global necessary budget for the implementation of the actions of the current SECAP is estimated at 9,688,050€ until 2034.

Several funding sources have been defined:

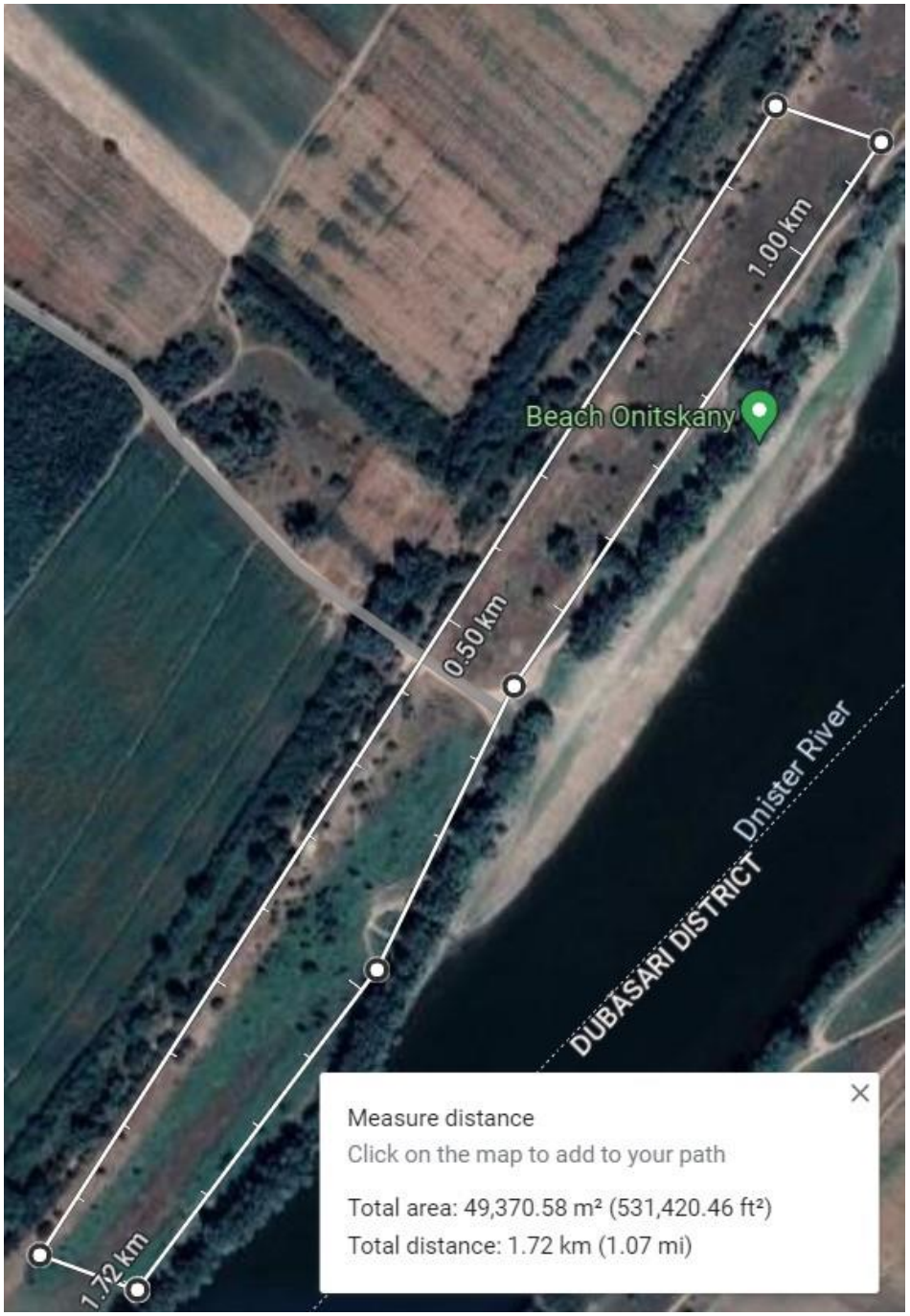


Fig. 26. The lot to be afforested

Local donors: the national state budget, the local budget of the village of Oniţcani, the Center for Sustainable Energy and Climate, the Energy Efficiency Fund, the National Ecological Fund, the "European Village" Program and others.

External donors: UNDP, Sweden (SIDA), Germany (GIZ), SUDEP, Horizon 2020, USAID, International Climate Initiative (IKI), GES, etc.

The technical supervision of the execution of the works will be provided by the local consulting companies contracted by the Town Hall. The submission of reports on implementation and monitoring will be done by the person designated by the Town Hall.

Photo 21. The warm water channel around the Dniester

Fig. 27. Land plan for amateur fishing

Covenant of Mayors
for Climate & Energy

5. Baseline Emission Inventory (BEI)

Baseline Emission Inventory		
1) Inventory year	2023	
2) Number of inhabitants in the inventory year	2,248	
3) Emission factors	☑	IPCC
	☐	LCA (Life Cycle Assessment)
4) Emission reporting unit	☑	tones CO_2
	☐	tones CO_2 equivalent

Covenant of Mayors
for Climate & Energy

Table 12. Final energy consumption

A. Final energy consumption

ⓘ Please note that for separating decimals dot [.] is used. No thousand separators are allowed.

Sector		FINAL ENERGY CONSUMPTION [MWh]															
				Fossil fuels								Renewable energies					Total
		Electricity	Heat/cold	Natural gas	Liquid gas	Heating oil	Diesel	Gasoline	Lignite	Coal	Other fossil fuels	Plant oil	Biofuel	Other biomass	Solar thermal	Geothermal	
BUILDINGS, EQUIPMENT/FACILITIES AND INDUSTRIES																	
Municipal buildings, equipment/facilities		120.2		800.9													920.9
Tertiary (non municipal) buildings, equipment/facilities				0													0
Residential buildings		76.9		2,091.6													2,168.5
Public lighting		27.9		0													27.9
Industry	Non-ETS															0	0
	ETS (not recommended)															0	0
Subtotal		**225**	**0**	**2,892.5**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3,117.5**
TRANSPORT																	
Municipal fleet								17.03									**17.03**
Public transport																	**0**
Private and commercial transport							139.2	383.83									**523.03**
Subtotal		**0**	**0**	**0**	**0**	**0**	**139.2**	**400.86**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**540.06**

OTHER	1															
Agriculture, Forestry, Fisheries																**0**
TOTAL	**225**	**0**	**2,892.5**	**0**	**0**	**139.2**	**400.86**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3,657.56**

Table 13. Adopted CO2 emission factor[t/MWh]

Electricity		Heat/cold	Fossil fuels			
National	Local		Gas	Diesel	Gasoline	Coal
0,4434			0,202	0,267	0,249	0,354

Tabelul 14. Inventarul de emisii

Sector	CO_2 emissions [t] / CO_2 eq. emissions [t]						
	Electricity	Heat/cold	Fossil fuels				Total
			Gas	Diesel	Gasoline	Coal	
BUILDINGS, EQUIPMENT/FACILITIES AND INDUSTRIES							
Municipal buildings, equipment/facilities	53.3		161.78				**215.1**
Tertiary (non municipal) buildings, equipment/facilities	0		0				**0**
Residential buildings	34.1		422.5				**456.6**
Public lighting	12.37		0				**12.37**
Industry						**0**	**0.00**
Subtotal	**99.77**	**0**	**584.28**	**0**	**0**	**0**	**684.1**
TRANSPORT							
Municipal fleet					4.24		4.24
Public transport							
Private and commercial transport	0	0	0	37.2	95.6	0	132.74
Subtotal	**0**	**0**	**0**	37.2	99.84	**0**	**136.98**

OTHER							
Agriculture, Forestry, Fisheries	0	0	0	0	0		0
OTHER NON-ENERGY RELATED							
Waste management							0
Waste water management							0
Other non-energy related							0
TOTAL	**99.77**	**0**	**584.28**	**37.2**	**99.84**	**0**	**821.03**

6. Assessment of climate risks and vulnerabilities (RVA)

As there were no climate disasters that resulted in harmful consequences, no risk and vulnerability assessment studies or LPA decisions were developed for the urban area. In the event of any risks, appropriate measures will be taken.

Possible hazard risks and their indicators in relation to the region are presented in the table below.

Table 15. Hazard Risks and Indicators.

	<< Current Risks >>	<< Anticipated Risks >>		
Climate Hazard Type	**Current hazard risk level**	**Expected change in intensity**	**Expected change in frequency**	**Timeframe**
Extreme Heat	Moderate	Not known	Not known	Short-term
Extreme Cold	Low	Not known	Not known	Short-term
Extreme Precipitation	Low	Not known	Not known	Short-term
Floods	Low	Not known	Not known	Short-term
Droughts	Moderate	Not known	Not known	4 years
Storms	Low	Not known	Not known	Short-term
Landslides	Low	No change	No change	Short-term
Other [please specify]	[Drop-Down]	[Drop-Down]	[Drop-Down]	[Drop-Down]

Table 16. Other Risks and Indicators.

Impacted Policy Sector	Expected Impact(s)	Likelihood of Occurrence	Expected Impact Level	Timeframe
Buildings	Increased costs for maintenance of the buildings.	Likely	Moderate	Long-term
Transport	Pollution rising by increased number of vehicles	Possible	Moderate	Short-term
Energy	Strong wind and black ice may affect electrical distribution network.	Possible	Low	Short-term
Water	Droughts	Likely	Moderate	4 years
Waste	Waste management fail	Unlikely	Moderate	Short-term
Land Use Planning	Wrong planning (floods)	Unlikely	Low	Short-term
Environment & Biodiversity	Ecosystem degradation	Likely	Moderate	Not known
Health	Increasing mortality rate	Unlikely	Low	Long-term
Civil Protection & Emergency	Reduction of the civil protection and emergency services	Unlikely	Not Known	Not known
Other [please specify]		[Drop-Down]	[Drop-Down]	[Drop-Down]

7. Key actions for the entire duration of the plan (2034)

Table 17. Key actions for the whole duration of the plan (2023-2034)

Key Actions	Area of intervention	Policy instrument	Origin of the action	Responsible body	Implementation timeframe		Implementation cost	Estimates in 2034			Action also affecting adaptation
								Energy savings	Renewable energy production	CO_2 reduction	
					Start	End	€	MWh/a	MWh/a	t CO_2/a	
MUNICIPAL BUILDINGS, EQUIPMENT/FACILITIES							**2,130,750**	**2,921**	**2,599**	**1,442.1**	
Thermal insulation of walls, replacement of old windows and doors, rehabilitation of roofs of public buildings and insulation.	Energy efficiency of public buildings		Local authority	Onitcani Town Hall	2024	2034	800,000	379.0		76.5	
Thermal insulation of walls with biodegradable thermal insulation produced locally from agricultural waste	Energy efficiency of public buildings,		Local authority	Onitcani Town Hall	2024	2034	200,000	95.0		19.1	
Production of biodegradable thermal insulation from agricultural waste	Adaptation to climate change		Local authority	Onitcani Town Hall	2024	2034	150,000	95.0		19.1	

Replacing the old heating system in public buildings	Energy efficiency of public buildings		Local authority	Onitcani Town Hall	2024	2034	57,600	213.0		43.0	
Installation of PVT (photovoltaic-thermal panels) and solar water heating collectors.	Energy efficiency of public buildings,		Local authority	Onitcani Town Hall	2024	2034	120,000		240.0	69.6	
Installation of Independent Energy Systems (SEI) to provide electricity, heating and air conditioning in buildings	Climate change mitigation and adaptation		Local authority	Onitcani Town Hall	2024	2034	375,000		1,501	332.4	
Use of air-to-air or air-to-water heat pumps for heating public buildings and domestic hot water	Energy efficiency of public buildings.		Local authority	Onitcani Town Hall	2024	2034	229,500	1,162.5		515.4	
Installation of the individual heating plant operating on biofuel, their interconnection to the solar heating systems.	Eficiența energetică a clădirilor publice		Local authority	Onitcani Town Hall	2024	2034	24,800	960		194.0	
Establishment of pellet production based on public-private partnership	Energy efficiency of public buildings		Local authority	Onitcani Town Hall	2024	2034	142,850		858	173	

Replacing gas-powered kitchen and laundry appliances in kindergartens and schools with electric appliances	Energy efficiency of public buildings		Local authority	Onitcani Town Hall	2024	2034	31,000	17	Children's safety will improve		
Estimated reduction not associated with any reported actions							0	0	0	0	
PUBLIC BUILDINGS							**2,130,750**	**2,921**	**2,599**	**1,442.1**	
STREET LIGHTING							**217,300**	**57.2**		**25.4**	
Installation of smart street lighting on all streets	Energy efficiency		Local authority	Onitcani Town Hall	2024	2034	217,300	57.2		25.4	
Estimated reduction not associated with any reported actions							0	0	0	0	
LOCAL ELECTRICITY PRODUCTION							**960,000**	**0**	**1,440**	**638.5**	
Photovoltaic energy generation 1.2MW	Electricity production, climate change adaptation		Local authority	Onitcani Town Hall	2024	2034	960,000		1,440	638.5	
Estimated reduction not associated with any reported actions							0	0	0	0	
OTHERS							**6,380,000**	**0**	**0**	**1,862**	

Design and construction of a sewage system together with the wastewater treatment plant	Climate change mitigation		Local authority	Onitcani Town Hall	2024	2034	800,000	The level of environmental protection will increase. The welfare of the population will improve.			
Arrangement of the solid waste storage site	Climate change mitigation and adaptation		Local authority	Onitcani Town Hall	2024	2034	150,000	The level of environmental protection will increase			
Organization of the solid waste collection, transport and storage service	Climate change adaptation mitigation		Local authority	Onitcani Town Hall	2024	2034	100,000	The level of environmental protection will increase. The welfare of the population will improve.			
Planting of 5.6 ha of energy willow	Climate change mitigation and adaptation		Local authority	Onitcani Town Hall	2024	2034	180,000			1,673	
Production of biodegradable thermal insulation	Climate change mitigation and adaptation		Local authority	Onitcani Town Hall	2024	2034	100,000			189.0	
Creation of a wetland in the center of the village with an area of 2.7ha	Climate change mitigation and adaptation		Local authority	Onitcani Town Hall	2024	2034	500,000	The level of environmental protection will increase. The welfare of the population will improve.			
Creation of an exploration area of water sources for health promotion	Climate change mitigation		Local authority	Onitcani Town Hall	2024	2034	700,000	The level of environmental protection will increase. The welfare of the population will improve.			

Creation of a water source exploration area for fish breeding	Climate change mitigation and adaptation		Local authority	Onitcani Town Hall	2024	2034	800,000	The level of environmental protection will increase. The welfare of the population will improve.			
Creation of a recreation area on the banks of the Dniester with an area of 13.40 ha	Climate change adaptation mitigation		Local authority	Onitcani Town Hall	2024	2034	700,000	The level of environmental protection will increase. The welfare of the population will improve.			
Creation of a tourist route involving the "Gamma Field"	Climate change mitigation and adaptation		Local authority	Onitcani Town Hall	2024	2034	1,500,000	The welfare of the population will improve.			
The transformation of the existing football stadium into a multifunctional sports center	Climate change mitigation and adaptation		Local authority	Onitcani Town Hall	2024	2034	300,000	The level of environmental protection will increase. The welfare of the population will improve.			
Planting of 5.0 ha of trees on the bank of the public pond	Climate change mitigation and adaptation		Local authority	Onitcani Town Hall	2024	2034	150,000	The level of environmental protection will increase			
Afforestation of the banks of the Dniester River with an area of 49.3 ha	Climate change mitigation and adaptation		Local authority	Onitcani Town Hall	2024	2034	300,000	The level of environmental protection will increase			
Creation of an area for amateur fishing with an area of 2.3 ha	Climate change mitigation and adaptation		Local authority	Onitcani Town Hall	2024	2034	100,000	The level of environmental protection will increase. The welfare of the population will improve.			
Estimated reduction not associated with any reported actions							0	0	0	0	

TOTAL	**6,380,000**	**0**	**0**	**1,862**	
Total pe PAEDC	**9,688,050**	**2978.2**	**4039**	**3,968**	