Covenant of Mayors
for Climate & Energy

Sustainable Energy and Climate Action Plan (SECAP)

Cotova commune

2022-2030

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1. EXECUTIVE SUMMARY

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

The Covenant of Mayors is a unique move that has brought together a large number of local and regional authorities to draw up action plans and direct investment towards climate change mitigation measures. The new Integrated Covenant of Mayors for Climate and Energy was launched by the European Commission on the 15th of October 2015 at a ceremony in the European Parliament in Brussels. The signatories now promise a reduction in CO_2, 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 association, the Covenant of Mayors for Climate and Energy, is both more ambitious and broader. The signatory localities are committed to taking action to support the implementation of the EU's greenhouse gas reduction target by 2030 and to adopt a common approach to climate change mitigation and adaptation.

In order to translate its political commitment into practical measures and projects, the signatories of the Pact undertake to submit, within two years of the decision of the local council, a Sustainable Energy and Climate Action Plan (SECAP) outlining the key actions to be taken, intends to undertake them. The plan will include a baseline emission inventory to track mitigation actions and an assessment of climate risks and vulnerability. The adaptation strategy can be part of the SECAP or developed and integrated into a separate planning document. This bold political commitment marks the beginning of a long-term process with cities pledging to report every two years on the progress of 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 European Parliament's plenary gave the green light to the EU's commitment to achieving climate neutrality by 2050, ie not emitting more greenhouse gases than it can absorb.

The European Commission adopted on 14 July 2021 a package of proposals to reduce EU climate,

energy, land use, transport and taxation policies, net greenhouse gas emissions by at least 55% by 2030 compared to 1990 levels.

Achieving these emission 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 Pact a reality. The Commission is presenting the legislative tools needed to meet the goals agreed in 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 allow the necessary acceleration of the reduction of greenhouse gas emissions in the next decade. These combine: the application of the emissions trading system in new sectors and the strengthening of the current EU emissions trading system; increased use of renewable energy; greater energy efficiency; faster development of low-emission modes of transport, as well as supporting infrastructure and fuels; 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 Emissions Trading Scheme (ETS) sets a price for carbon emissions and reduces the annual cap on emissions in certain economic sectors. Over the last 16 years, it has contributed to a 42.6% reduction in emissions from electricity production and those generated by energy-intensive industries. Today, the Commission proposes that the overall emission ceiling be further reduced and that the annual emission reduction rate be increased. The Commission also proposes the phasing out of free allowances for aviation and alignment with the Global Carbon Offset and Reduction Scheme for International Aviation (CORSIA) and the inclusion of transport emissions for the first time. in the EU ETS. To address the lack of emission reductions in the road transport and buildings sectors, a new separate emissions trading scheme for the distribution of fuels for road transport and buildings is being set up. The Commission also proposes to increase the financial envelope of the Innovation Fund and the Modernization Fund.

In addition to the substantial expenditure provided for in the EU budget for climate action, Member States should fully channel revenues from the trading of emission allowances to climate and energy projects. Part of the revenue generated by the new system applicable to road transport and the building sector should be allocated to mitigating the potential social impact of this measure on vulnerable households, micro-enterprises and users of the transport means.

The Land Use, Forestry and Agriculture Regulation sets out a general EU target for the elimination

of carbon dioxide through natural absorbents, corresponding to a volume of 310 million tonnes of CO_2 emissions by 2030.

National emission reduction targets require Member States to protect and strengthen their role in absorbing carbon so that the target can be achieved. By 2035, the EU should aim to achieve climate neutrality in the land use, forestry and agriculture sectors, including non-CO_2 agricultural emissions, such as those generated by fertilizer use and animal husbandry. The EU Forest Strategy aims to improve the quality, quantity and resilience of EU forests. The strategy supports foresters and the forest bioeconomy, while focusing on sustainable logging and sustainable use of biomass, 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 of 40% of our energy being produced by renewable energy by 2030. All Member States will contribute to this goal and specific targets are set 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 need to develop support schemes for bioenergy that respect the principle of cascading wood biomass.

In order to reduce total energy consumption, reduce emissions and combat energy poverty, the Energy Efficiency Directive will set a more ambitious mandatory annual target for reducing energy consumption at EU level. It will guide the way in which national contributions are set and will impose on Member States a mandatory annual energy saving target almost double that of today. The public sector will have to renovate 3% of its buildings each year to boost the wave of renovations, create jobs and reduce energy consumption and costs for taxpayers.

A combination of measures needs to be used to address the issue of increasing emissions from road transport, in addition to the trading of emission allowances. Setting stricter standards for CO_2 emissions from cars and vans will accelerate the transition to zero-emission mobility by requiring the average level of new car emissions to be reduced by 55% in 2030 and 100% in 2035 compared to 2021 levels.

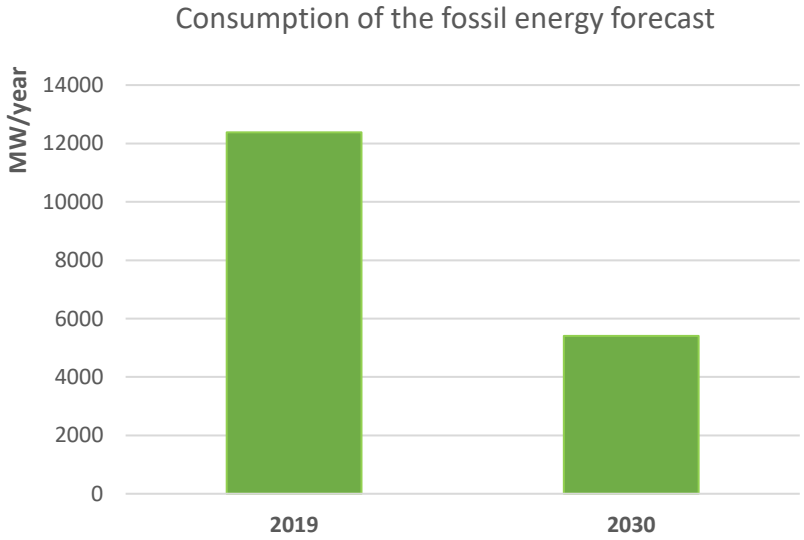
Therefore, all new cars that will be registered from 2035 will have zero emissions. To ensure that drivers anywhere in Europe will be able to charge or refuel their vehicles from a reliable network, the revised Alternative Fuel Infrastructure Regulation will require Member States to expand their

load capacity by aligning it with sales volume zero-emission cars, and to install charging and refueling stations at regular intervals on the main motorways: every 60 km for charging electricity and every 150 km for refueling with hydrogen.

The energy taxation system needs to protect and improve 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 obsolete practices such as the application of tax exemptions and reduced tax rates, practices that currently encourage the use fossil fuels. The new rules aim to reduce the harmful effects of tax competition on energy, helping to ensure a stable income for Member States from green taxes, which are less harmful to growth than taxes on labor income.

The Eastern Partnership Covenant of Mayors Convention localities are committed to actively supporting the implementation of the EU's CO2 reduction target and to adopting an integrated approach to climate change mitigation and adaptation. An action plan for sustainable energy and climate (SECAP) outlines the key mitigation and adaptation actions that the municipality of Cotova intends to take.

The following objectives will be achieved by implementing the proposed measures in Cotova



commune:

1. Estimated fossil energy consumption

- 37% of energy savings will come from the implementation of energy efficiency measures;
- 63% of energy savings will be achieved through the use of renewable energy sources.

CO_2 emissions in the commune of Cotova in 2019 amounted to 1,496 tons or 0.45 t per

inhabitant.

The implementation of the given SECAP will require investments of € 3,022,474 for the years 2022-2030. It will save 1,254MWh of fossil energy and will allow the use of renewable energy in

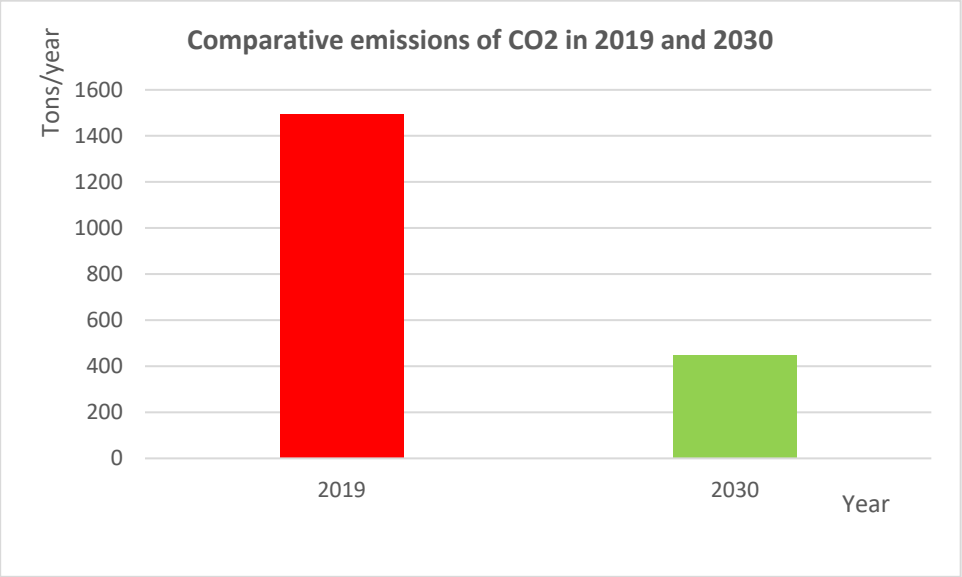


Fig. 2. Reducerea estimată a emisiilor de CO_2

amount of 2,086MWh. All activities will reduce annual CO2 emissions by 1,049 tons (Fig. 2) and will amount to 447 tons or 0.13 t per capita.

This SECAP describes the measures to be taken in the commune of Cotova. Based on the data collected and analyzed, the municipality has an excellent outlook in terms of reducing GHG emissions and weather resistance.

A crucial element of the SECAP will be strengthening community involvement, continued involvement with key stakeholders and partners, and a significant social impact.

1.1 Cotova Commune

Overview

Cotova commune, Drochia district, is located in the northern part of the Republic of Moldova (coordinates: 48 ° 09’33 ” N, 27 ° 57’27 ” E). Cotova is a village and commune in Drochia district.

The commune has an area of about 5.40 square kilometers, with a perimeter of 10.38 km. The

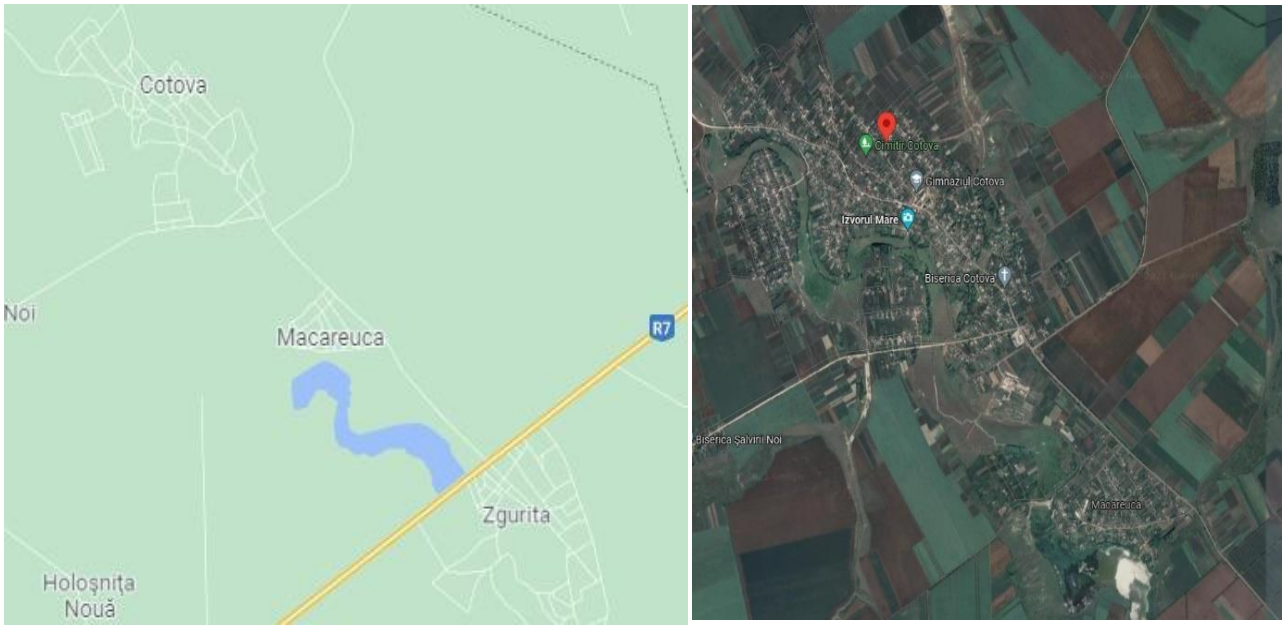


FIG. 3. The settlement of Cotova commune

commune includes Cotova and Măcăreuca villeages as parts. The commune is 24 km from Drochia and 186 km from Chisinau. The village of Cotova was mentioned in a documentary in 1443.

The steps, the hills, the valleys form the relief of the area. The highest point is 175 meters above the level of the Black Sea.

Climate

Cotova commune has a moderate continental climate, with generally hot summers and mild winters.

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

Hydrography

The area is crossed by the Cainari stream, which feeds from springs forming ponds by accumulating water. There are other wet places near the village. Taken together they form the

aquatic resources of the commune. The water in them and the groundwater play an important role in supplying the commune with water resources.

Fig.4. Izvorul Mare from Cotova village

Geology

The seismic state of the territory is determined by the focal point of Vrancea (Romania, at the base of the Carpathians)[1], located approximately 274 km away from the commune. The seismic activity in the area reaches a magnitude of up to 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, rock character. The peculiarities of the climate and the soil favor the general development of agriculture. The growing season usually begins on 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 that contain significant amounts of rich humus. A wide range of vegetables, many types of fruit trees are grown in the area.

[1]Ilieș, Ion. Sistemul integrat de monotirizare seismică România-Republica Moldova.*Akademos*, nr. 1 (20), martie 2011, p. 62 - 69.

Population

In 2019, the number of inhabitants was 3,350 people, according to the village hall, and is presented in the following table 1.

Tabelul 1. Population distribution in Cotova commune by age and gender

Age, years	Men	Women	Total	Percentage of total,%
0-18	239	239	523	15.7
19- 65	1,086	1,301	2,387	71.2
Peste 65	200	285	440	13.1
TOTAL	1,525	1,825	3,350	**100**

According to the table 1, the current demographic situation is favorable, the majority of the population is between 18 and 65 years old, ie is strong and has a potential for employment. The dominant age groups are of working age and represent more than 71% of the total population.

The ethnic structure is relatively homogeneous. The largest ethnic groups are Moldovans/ Romanians - 5,987 (98.88%), Ukrainians -28 (0.46%), Russians - 24 (0.40%).

Tabelul 2. Population distribution in Cotova commune by ethnicity

Nr.	Ethnicity	Number of inhabitants	Percentage, %
1	Moldovans/Romanians	2805	83.72
2	Ukrainian	518	15.45
3	Russian	25	0.76
4	Bulgarian	1	0.03
5	Other	1	0.03
	TOTAL	**3,350**	**100.0**

On the territory of the village there are social facilities: 1 kindergarten, 1 gymnasium, primary school-kindergarten, family doctors' office.

The length of the local roads is 28 km, of which only 4.5 km are paved. About 50% of them are in a satisfactory condition. Most roads are country roads, without rigid cover and without sidewalks.

The residential fund of the village is over 183,300m2. There are 1,833 houses in the village, of which only 5% are equipped with centralized water supply.

Central gasification system is missing.

Fuel, energy and water supply

The commune does not have a centralized gasification system. Public, residential and economic buildings are heated with coal, pellets and wood.

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

There are artesian wells that supply 4,530m3 of water annually and provide 5% of the population and 95% of public buildings.

Entrepreneurship and economic activity

There are 28 economic agents active in the community. All companies are private with the organizational form of limited liability companies and households.

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

2. GENERAL STRATEGY

By joining the Covenant of Mayors for Climate and Energy, the municipality of Cotova voluntarily commits itself to achieving a goal of reducing CO_2 emissions by at least 55% by 2030 compared to 1990 levels, thus sharing a common vision for a sustainable future and committing to developing a low-carbon, resilient, energy-efficient community.

Commitment of the commune to take measures in the fields:

ENERGY EFFICIENCY improving energy use and the use of renewable energy.

CLIMATE CHANGE ADAPTATION AND MITIGATION. The mayor's office is aware that adapting to climate change brings a number of benefits to the village and its 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. Rehabilitating buildings can reduce tenants' energy costs and increase property values. Adaptation projects can create jobs and boost local business.

Co-benefits of local mitigation and adaptation actions to climate change for well-insulated buildings will bring energy savings (mitigation) and adaptation to rising temperatures, cooling through the use of solar systems. Planting trees and green spaces will lead to reduction flooding, land shading, urban cooling (adaptation) and carbon sequestration (mitigation).

This Sustainable Energy and Climate Action Plan (SECAP) is and will be presented implementat prin transpunerea în practică a angajamentului asumat de comună. Următoarele acțiuni cheie sunt planificate să fie întreprinse:

2.1 GOAL AND OBJECTIVES

The goal of Cotova commune is to reduce the influence of human beings 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. Objectives and targets for reducing energy consumption, mitigating and adapting to climate change

Zone of management	Index	Target	Index	Description
Municipal, residential, tertiary buildings, equipment/ facilities	**BE**	The building envelope	BE1	Thermal insulation of walls, replacement of old windows and doors, rehabilitation of roofs of public buildings and insulation.
		Renewable energy for domestic water heating and electricity generation	BE2	Solar water heaters and PVT (photovoltaic thermal panels) installation on roofs and independent units
			BE3	Production of biofuel from energy willow. Use of wood pellets in public and residential buildings
			BE4	Use of air-to-air or air-to-water heat pumps for heating public buildings and obtaining domestic hot water
		Energy efficiency of building heating and domestic hot water	BE5	Replacement of the old heating system in public buildings
			BE6	Installation of the individual heating plant operating on biofuel, their interconnection to the solar heating systems.
			BE7	Replacement of kitchen and laundry appliances running on liquefied gas in kindergarten and school with electrical appliances
Public lighting	**LE**	Energy efficiency of lighting	LE1	Replacing old technology LED lights in buildings
			LE2	Replacing old technology LED lights with street lighting
Local electricity	**PG**	Photovoltaic power generation	PG1	Construction of a 0.7MW commercial photovoltaic farm

production				
Other Climate change mitigation and adaptation	**WW**	Centralized drinking water supply	WW1	Inițierea construcției apeductului comunei
		Wastewater management	WW2	Proiectarea și construirea unui sistem de canalizare împreună cu stația de epurare a apelor uzate
		Solid waste management	WW3	Amenajarea locului de stocare a deșeurilor solide
			WW4	Organizarea serviciului de colectare, transportare și depozitare a deșeurilor solide
	CA	Planting energy willow	CA1	Plantarea a 24.0ha de salcie energetică
		Production of wood pellets	CA2	Stabilirea producției de pelete pe bază de parteneriat public-privat
		Construction of the rainwater catchment area and recreational area on the banks of the Cainar River	CA7	Construirea bazinului de acumulare a apei pluviale de 43.6ha a oglinzii apei
		Afforestation of the banks of the Cainar River	CA4	Plantarea a 6.1ha de copaci pe malul râului Cainar

The following policy instruments have also been defined to implement the measures formulated.

Zone of management	Index	Target	Index	Description
Buildings, Energetic efficiency	**GS**	Grants and subsidies	GS1	Stimulente pentru eficiența energetică și generarea de energie regenerabilă Proiectarea și construcția sistemului de canalizare și a stației de epurare a apelor uzate
	SPF	Secondary financing. Public-private partnership	SPF	Plantarea salciei energetice și producția de pelete Generarea de energie fotovoltaică

2.2 CURRENT SITUATION

The general development strategy of Cotova commune formulated the objectives regarding the improvement of energy efficiency and the use of renewable energies. The National Environmental Strategy for 2013-2023 specifies the rational use of natural resources, the creation of an

intelligent waste management system and ensuring its functioning, reducing the negative impact of economic activity on the environment, etc.

The Energy Strategy of the Republic of Moldova for 2013-2030 ensures the sustainability of the energy sector and measures to mitigate and adapt to climate change, the development of competitive markets and their regional and European integration.

2.2.1 ENERGY CONSUMPTION IN THE COMMUNE

Current situation

Cotova commune has public buildings, in which it operates: the kindergarten (682m2), the family doctor's office (204m2), the former government (344m2), the City Hall building (212m2), the gymnasium (2792m2), Măcăreuca primary school-kindergarten (561m2). The total area of public buildings is 4,795m2.

Energy consumption in public buildings

In 2019, the buildings of Cotova City Hall consumed 70,058 kWh of electricity, 25,000kg (97,500kWh) of pellets, 78m3 (230,880kWh) of firewood and 77,000kg (531,300kWh) of coal. City Hall buildings consumed kWh of energy.

Photo 1. Cotova City Hall building

Photo 3. Gymnasium building

Photo 2. The interior of the Cotova City Hall building

Photo 4. Primary school-kindergartens building

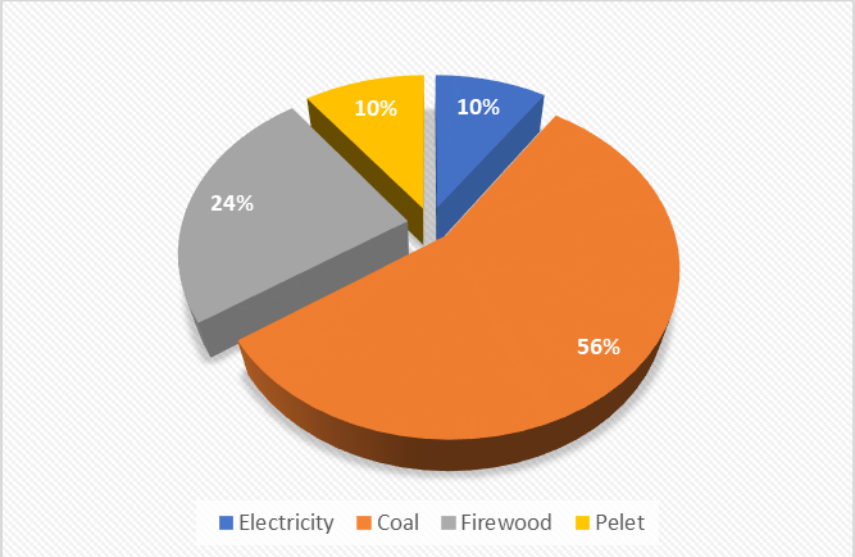


Fig.5. Energy consumption by Cotova City Hall consumers in 2019

The diagram above (fig.5) indicates that energy consumption is dominated by coal consumption in proportion of 57%. Electricity consumption is only 8%. The use of pellets (10%) and is comparable to electricity. The energy obtained from wood is 25%.

Coal, wood and pellets are mainly used for heating. Electricity is mainly used for lighting (including street lighting.

Photo 5. Family doctor's office building

Residential sector and energy consumption

The vast majority of houses are single-storey stone houses and, less frequently, two-storey houses, and represent buildings in the residential sector.

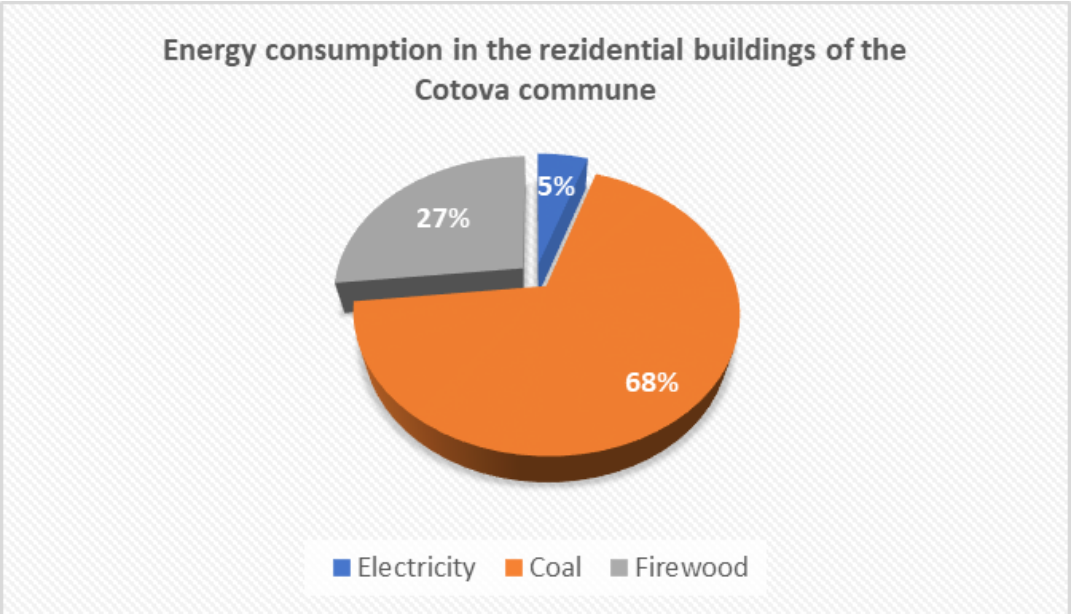


Fig. 6. Distribution of energy consumption in the residential sector in 2019

The average internal area of the houses is about 65m2. Their total number is 1833. In 2019 they consumed 182,152kWh of electricity, 320m3 (947,200kWh) of linear wood, 350t (2415000kWh) of coal.

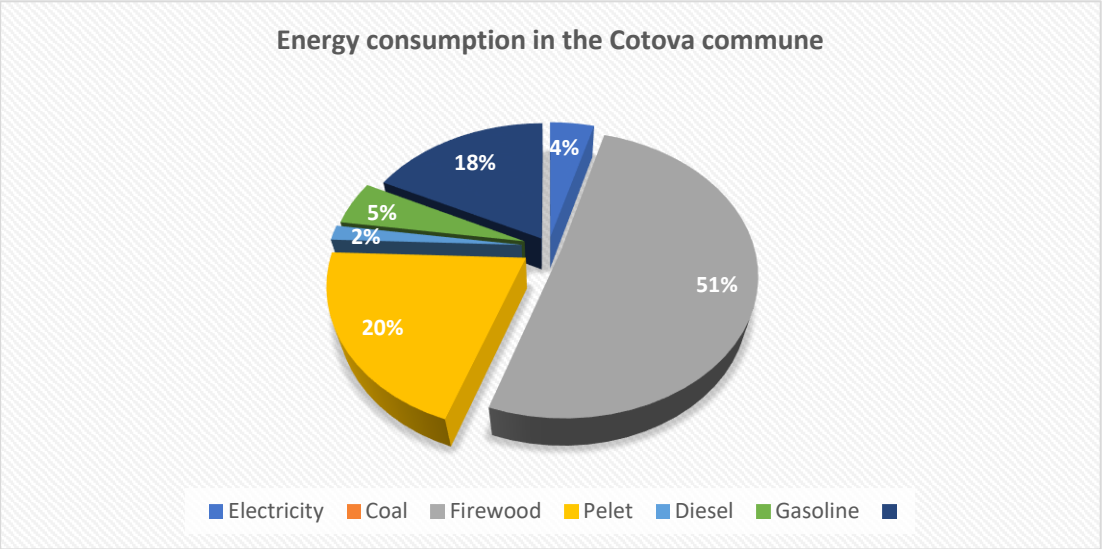


Fig. 7. Energy consumption in Cotova commune in 2019

The residential sector consumes 68% of energy from coal, 5% - electricity, and firewood - 27%.

General energy consumption in Cotova commune

Cotova commune (fig.6) consumes 51% energy from coal, 20% - wood, 17% - gasoline, 5% - diesel, 5% - electricity and 2% - pellets. The total energy consumption in Cotova commune is 5,788,210 kWh.

CO2 emissions in Cotova commune

Calculations show that Cotova commune emits 1,496 tons of CO2 or 0.45 tons per inhabitant annually. Pollution in the public sector (fig.7) comes from the consumption of coal (82%) and electricity (18%).

Most of the pollution comes from the residential sector (fig. 8) and is an indicator of poor development of the commune's economy. It is an indicator of the lack of industries and services. Agricultural products are not processed locally.

Pollution in the residential sector comes from the consumption of coal (92%), electricity (8%) (fig.8). The use of renewable energy can reduce GHG emissions. The village consumes a lot of

firewood, but it could increase the consumption of biomass by obtaining it from the growth of energy willow and in this way would protect the forest.

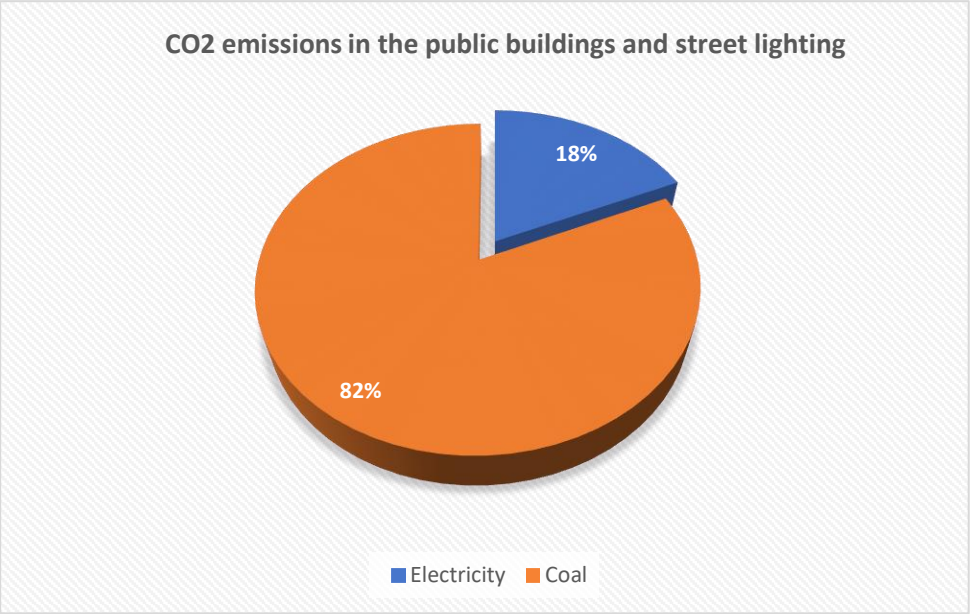


Fig. 8. CO_2 emissions in the public sector in 2019

The general CO2 emissions of the commune (fig. 9) come from coal (70%), petrol (17%), electricity (8%) and diesel (5%).

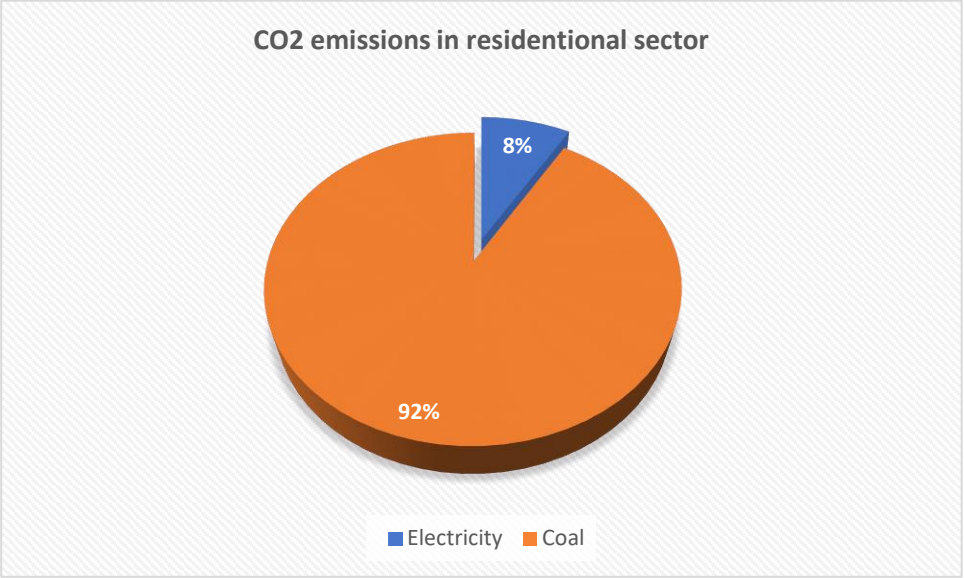


Fig. 9. CO_2 emissions in the residential sector in 2019

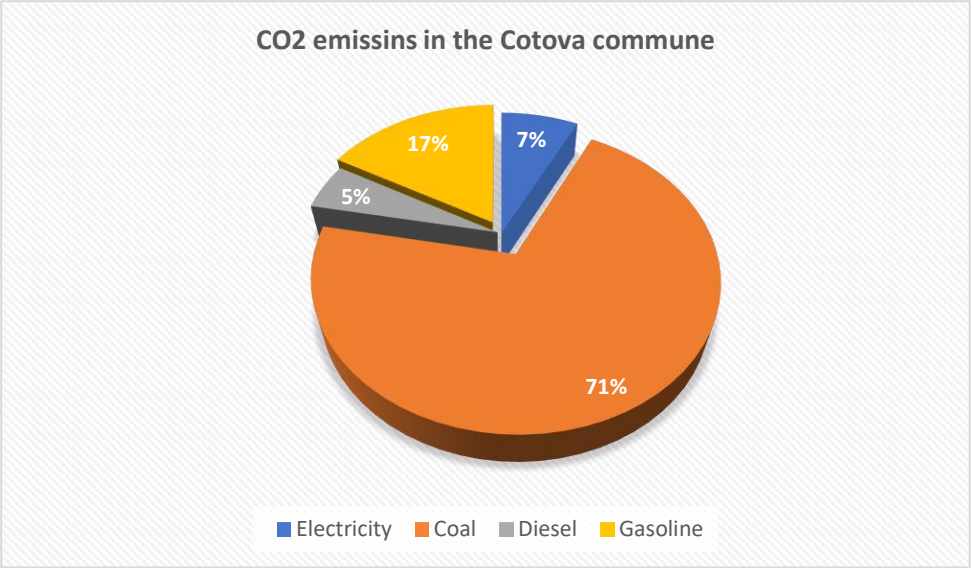


Fig. 10. CO_2 emissions in Cotova commune depending on the type of fuel from 2019

3. VISION OF ACTIONS

3.1 Buildings

Buildings are key to moving to a low-carbon economy. The average value U for existing walls and roofs is 1.4 ÷ 1.7 [W / m2K], for windows U = 2.8 ÷ 3.2 [W / m2K]. Mainly greenhouse gas emissions from this sector come from building heating and domestic hot water heating.

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

BE1, BE2, BE3, BE4 and BE5 refer to the public buildings belonging to the village hall. BE3 also refers to residential buildings.

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

Tabelul 4. Măsuri de eficiență energetică în clădiri

BE	Municipal, residential, tertiary buildings, equipment / facilities	Action
BE1	The building envelope	Thermal insulation of walls, replacement of old windows and doors, rehabilitation of roofs of public buildings and insulation.
BE2	Energy efficiency of building heating and domestic hot water preparation	Solar water heaters and PVT (photovoltaic-thermal panels) installation on roofs and independent units
		Replacement of the old heating system in public buildings
		Production of biofuel from energy willow.

BE3	Installation of the individual heating boiler	Installation of the individual heating plant operating on biofuel, their interconnection to the solar heating systems.
BE4	Use of heat pumps	Use of "air-to-air" or "air-to-water" heat pumps for heating public buildings and obtaining domestic hot water
BE5	Energy efficiency of electrical appliances	Replacement of kitchen and laundry appliances operating in kindergartens and gas schools with electrical appliances
LE	Energy efficiency of lighting systems	Replacing old technology lights with LEDs.

The detailed description of the defined solutions is given below.

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

The first step to apply in any existing engineering system is to reduce energy consumption. This requires the insulation of the building's roof and the replacement of old windows and doors in the first step.

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

Photo 6. The exterior of the primary school -kindergarten building

The roof insulation must be made of mineral wool or extruded polystyrene (XPS) at least 100mm

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 bonding made of concrete and waterproof layer of bituminous material. A good solution would be to use thermal insulation based on biomaterial that will not harm the environment after the expiration of the life of the buildings. There is already a thermal insulation biomaterial with the same properties as the existing or even better ones, but the difference is that when it enters the soil, it rots, preventing pollution.

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

Replacement of old windows and doors should be done with windows and doors with non-recyclable PVC frame, 7-chamber, U-shaped frame made of 1.2 mm thick reinforced metal covered with plastic, without thermal bridges. Low-e 4-20-4 [mm] double glazed windows.

The U value of the windows must be less than 1.4 [W / m2K] and the 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 of the country.

Based on previous experience, heat consumption can be significantly reduced

compared to existing consumption. If the sanitary and hygienic norms are not observed, this reduction will be much smaller.

- **BE2. Solar water heaters and installation of PVT (photovoltaic-thermal panels) on roofs and independent units**

The commune does not have a gas pipeline. Each residential house uses its own boiler or stove, which runs on coal or wood.

Solar irradiation all year round is very favorable for the use of solar collectors for water heating (fig. 12) and photovoltaic panels (PV) for electricity generation (fig. 10,11,13). Moldovan legislation is also favorable.

1kWp of monocrystalline PV panel can generate 1,130kWh of electricity annually (fig. 13) in the photovoltaic farm installed on the ground (fig. 10) and 1,086kWh in the PV systems framed in the roof (fig.12). Hybrid photovoltaic-thermal panels (PVT) include both a solar collector and a

photovoltaic panel that generates electricity and hot water. It is known that photovoltaic panels have a drawback that, as the temperature increases, the electrical efficiency decreases by up to 70%, depending on the temperature. PVT increases its efficiency by cooling and obtaining hot water for household needs. The average annual loss of electricity from temperature and poor irradiation in the locality is 6.42%, according to fig. 11. Experience shows that a PVT panel (1.5m2) can provide 25de liters/day of hot water with the temperature 55°C during warm seaon, that is equal to 281kWh, an annual suplimentary of energy from each panel.

Solar colectors can acumulate more thermal energy from heating dometic and provide houdehold with water with the temperature 60-90°C 7-8 luni per year, solar radiation being 1427kWh/m^2 that means that each quare meter can heat annually about 2.5m^3 of water at the temperature 60°C.

Each public building is expected to have its own solar collector or photovoltaic-thermal panel (PVT) system installed on the roof of the building or on the independent unit. The advantage of the PVT system is that it generates electricity and hot water simultaneously.

The solar collector and PV panels (PVT) must be installed at an angle of 35 ° (optimal) to the

Provided inputs:	
Location [Lat/Lon]:	48.159, 27.955
Horizon:	Calculated
Database used:	PVGIS-SARAH
PV technology:	Crystalline silicon
PV installed [kWp]:	1
System loss [%]:	14

Simulation outputs:	
Slope angle [°]:	35 (opt)
Azimuth angle [°]:	0
Yearly PV energy production [kWh]:	1129.68
Yearly in-plane irradiation [kWh/m^2]:	1426.58
Year-to-year variability [kWh]:	55.33
Changes in output due to:	
Angle of incidence [%]:	-2.88
Spectral effects [%]:	1.32
Temperature and low irradiance [%]:	-6.42
Total loss [%]:	-20.81

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

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 heat the water extra from late February to mid-November.

Examples in the country show that energy consumption for water heating can be reduced by up to 80% by applying this type of measure.

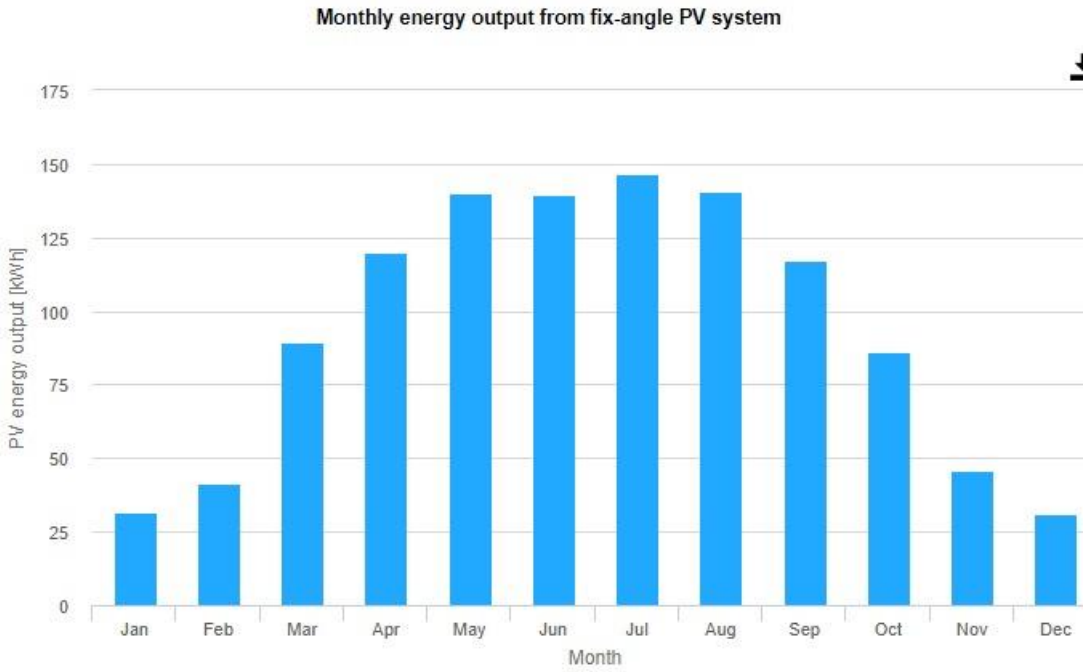


Fig. 12. Monthly electricity generation of the 1kWp monocrystalline (PV) panel free standing

Provided inputs:	
Location [Lat/Lon]:	48.159, 27.954
Horizon:	Calculated
Database used:	PVGIS-SARAH
PV technology:	Crystalline silicon
PV installed [kWp]:	1
System loss [%]:	14

Simulation outputs:	
Slope angle [°]:	30
Azimuth angle [°]:	0
Yearly PV energy production [kWh]:	1086.21
Yearly in-plane irradiation [kWh/m^2]:	1423.78
Year-to-year variability [kWh]:	51.27
Changes in output due to:	
Angle of incidence [%]:	-2.95
Spectral effects [%]:	1.31
Temperature and low irradiance [%]:	-9.78
Total loss [%]:	-23.71

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

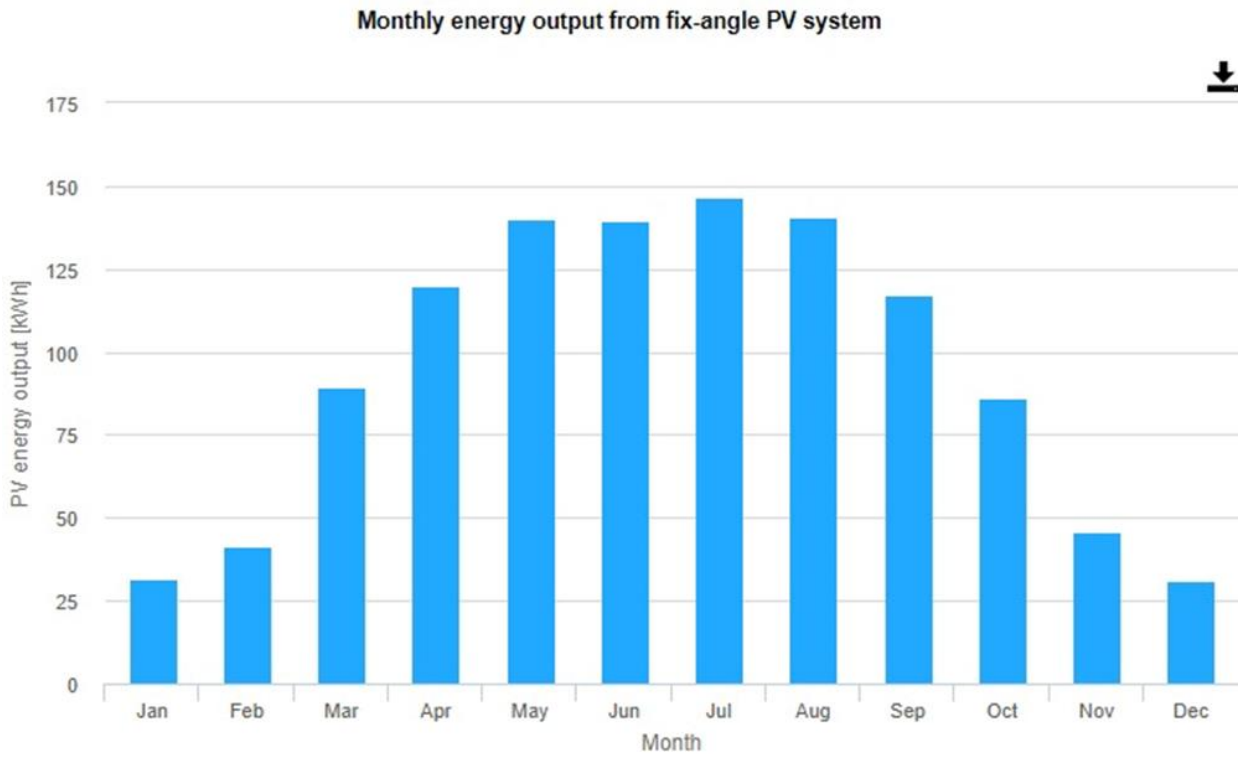


Fig. 14. Monthly electricity generation of the 1kWp monocrystalline (PV) panel integrated in the roof

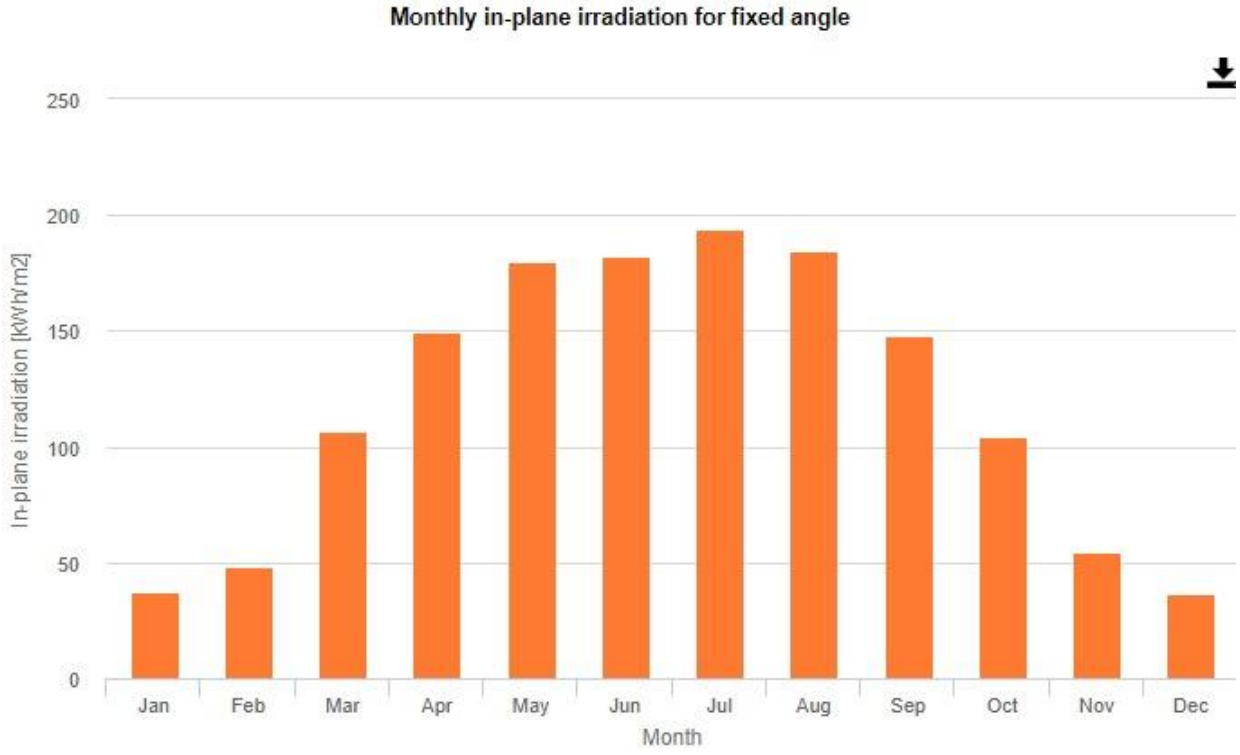


Fig. 15. Monthly solar irradiation per 1m^2 of photovoltaic-thermal panel (PVT)

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

- **BE3. Production of biofuel from energy willow. Usage of wood pellets in public and residential buildings**

There is a plot of land of 24 ha (fig. 20) on the banks of the Cainar stream. This land can be used for energy willow plantations, which once every two to three years will have a yield of 20t/ha of dry material for pellets or chips. The total efficiency of the biofuel can reach 480 tons or 240 tons per year. Biofuel will replace coal and firewood in the heating of public, residential and commercial buildings, improving interior comfort.

It will reduce CO_2 emissions and provide the opportunity for a comfortable life.

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

• It spreads easily from stem cuttings that grow new roots, shoots and leaves.
• Rapid growth rate, produces hardwood biomass 10-15 times faster than local forests.
• After each harvest, new stems re-grow rapidly 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, the unique characteristics of willow make it ideal for a wide range of environmental applications:

• Snow hedges - prevents snow from blowing on roads.
• Vegetable swabs - prevent fertilizers and chemicals from entering ponds and rivers.
• Protects soil resources - prevents erosion and stabilizes river banks.
• Environmental remediation - cleans and restores former industrial sites.
• Vegetable cover - a green alternative for efficient landfilling.
• Rehabilitated biodiversity - the plantation is an ideal location for birds, animals and insects.

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

❖ **BE4. 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 throughout the year, can provide warmth in winter and coolness in the warm season. It can provide the building with domestic hot water all year round. An air source heat pump has three cycles: the heating cycle, the cooling cycle and the defrost cycle. During the heating cycle the heat is taken from the outside air and "pumped" inside it. During the cooling cycle, the process described above is reversed to cool the building during the summer. The heat pump draws heat from the air in the building and pushes it outside.

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

It is necessary to compensate for the consumption of electricity from the commune's own sources with the use of the "air-to-water" or "air-to-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 demand 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 (PVT) is the most feasible option for heating buildings and obtaining DHW. May exclude the use of fuel-based heating system (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 50°C. The simple recovery 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 in the class of passive buildings and transform it from a consumer of heat and electricity into a generator of them. The PVT system will operate in net-metering mode of the network, 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%).

❖ **BE5. Replacement of the old heating system in public buildings**

Replacement of the old heating distribution system is in line with EE Directive 2012/27 / EU.

Heating systems in public buildings were built over 25 years ago with low maintenance. The radiators are made of cast iron. The 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 control systems for heat consumption and control of consumption at the thermal point depending on the outside temperature with the renovation of the heating system.

The basic principle of automatic systems is to control the flow of the heating medium at the temperature measured inside (individual control) or outside the building. When adjusting the power of the boiler, the measurement of the outside air temperature is used, when it is adjusted on the radiators - the internal temperature. As the outside temperature and inside temperature increase, the flow of heat decreases proportionally and vice versa - it increases when the temperature inside the building and the outside air decreases. By reducing the heat flow, the value of the 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.

❖ **BE6. Installation of new individual biofuel heating plants, their interconnection with solar heating systems**

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

The new stations should operate on wood pellets produced locally from energy willow. These will improve heating efficiency and reduce CO_2 emissions.

The interconnection of the thermal power 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 at the boiler inlet can

reduce fuel consumption by up to 80%.

- **BE7. Replacement of kitchen and laundry appliances operating in kindergartens and gas schools with electrical appliances**

Incentives for the replacement of kitchen appliances and laundry for new ones in kindergartens and schools is Directive 2012/27 / EU. The kitchen equipment in the kindergartens and schools of the commune use liquified gas, which creates the danger of accidental explosion. They need to be replaced with electrical appliances, which will eliminate the use of fossil fuels.

- **LE1.1 Replacing old technology LED lights in buildings**

Public buildings are mainly lit with fluorescent lamps that lead to high energy consumption. Tube fluorescent lamps are more efficient than incandescent bulbs, but they contain mercury vapor and are dangerous to humans 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 about 70% of energy.

In addition to saving energy, LED lighting has many advantages over indoor lighting:

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

- LED lamps do not contain dangerous elements and are environmentally friendly;

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

Table 5. Administrative measures for existing buildings

BE1	Buildings	Action
BE11	Energy certification of public buildings	Elaboration and display of energy certificates for municipal buildings that will be rehabilitated
BE12	Regulation of energy efficiency for private buildings	Development and implementation of energy efficiency regulations for existing and new private buildings
BE13	Grants and subsidies	Subsidies / subsidies for replacing old boilers with new ones for private homeowners
BE14	Grants and subsidies	Incentives to replace household appliances with new ones.

To raise awareness, the following solutions have been identified in the private, public and

residential sectors.

- **BE11. Energy certification. Development and display of energy certificates for municipal buildings that need to be modernized**

Placing certificates at the entrances of public buildings will raise awareness and produce more positive effects. The energy certificates displayed on the buildings related to the residential sector will show the owners the real energy consumption of the building and what will be the consumption after rehabilitation, as well as the cost of the measures. They can estimate monthly bill expenses.

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

- **BE12. Regulation of energy efficiency for private buildings**

The mayor's office 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.

- **BE13. Grants and subsidies. Incentives to replace household appliances with new ones**

The mayor's office will look for opportunities to participate in international donor competitions, funds of country and government organizations.

- **BE14. Grants and subsidies**

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

- **B15. Subsidies/Subsidies for replacing old boilers with new biomass boilers for private homeowners**

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

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

All existing boilers use mainly wood and coal with a low efficiency rate, around 60-70%. The new boilers are expected to use biomass with a heat generation efficiency of at least 90%. This measure significantly reduces CO_2 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 on public buildings is shown in the table below.

Tabelul 6. Impactul implementării măsurilor

№	Actions	Investiția estimată, [euro]	Reducerea calculată a consumului de energie, [MWh/year]	Reducerea calculată a emisiilor de CO2, [tones/year]
BE1	Thermal insulation of walls, replacement of old windows and doors, rehabilitation of roofs of public buildings and insulation.	171,908	106.40	21.50
BE2	Solar water heaters and installation of PVT (thermal photovoltaic panels) on roofs and independent units	120,000	240.0	69.6
BE3	Production of biofuel from energy willow. Use of wood pellets in public and residential buildings	142850	858	173
BE4	Use of "air-to-air" or "air-to-water" heat pumps for heating public buildings and domestic hot water	76,500	387.5	171.8
BE5	Replacement of the old heating system in public buildings	14,400	53.4	10.8
BE6	Installation of the individual heating plant, their interconnection to the solar heating systems.	24,800	960	194.0
BE7	Replacement of kitchen appliances in gas and electric schools	15.500	Child safety will be improved	
LE1	Replacing old technology lights with LEDs in buildings	178,937	10,360	32

LE2	Replacing old technology LED lights with street lighting			
PG1	Construction of a 0.7MW commercial photovoltaic park	700,000	840.0	372.4
WW1	Construction of the aqueduct	392,800	The level of environmental protection will increase	
WW2	Design and construction of a sewage system together with the wastewater treatment plant	460,000	The level of environmental protection will increase	
WW3	Solid waste storage facility	50,000	The level of environmental protection will increase	
WW4	Organization of the solid waste collection, transportation and storage service	100,000	The level of environmental protection will increase	
CA1	Planting 24.0ha of energy willow	50,000	The level of environmental protection will increase	
CA2	Establishing the production of pellets on the basis of public-private partnership	50,000	The level of environmental protection will increase	
CA3	Construction of the 43.6ha rainwater storage basin of the water mirror	500,000	The level of environmental protection will increase	
CA4	Planting 6.1ha of trees	20,000	The level of environmental protection will increase	

Note:
The national IPCC emission factor for electricity is 0.4434 [t · CO2 / MWh].
According to Part II "Basic Emission Inventory", the standard IPCC 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 Street lighting

The current situation

Cotova commune has a partially illuminated central street with heavy transport traffic. Its length is 4.0 km. Other side streets are also lit. The total length of the illuminated streets is 15.6 km. High pressure lamps with sodium vapor and 250W mercury vapor are installed. Another 12.4km of streets have no lighting. The total length of the illuminated streets should be 28.0 km, which means that only 56% of the streets are illuminated.

On average, the street lighting operates 3877 hours per year.

So far, the street lighting has been partially funded by the Local Public Administration to

improve the living standards and safety of citizens.

Photo 7. The current state of street lighting

Vision for the future

In order to ensure road and human safety through energy efficient street lighting, the following measure is proposed:

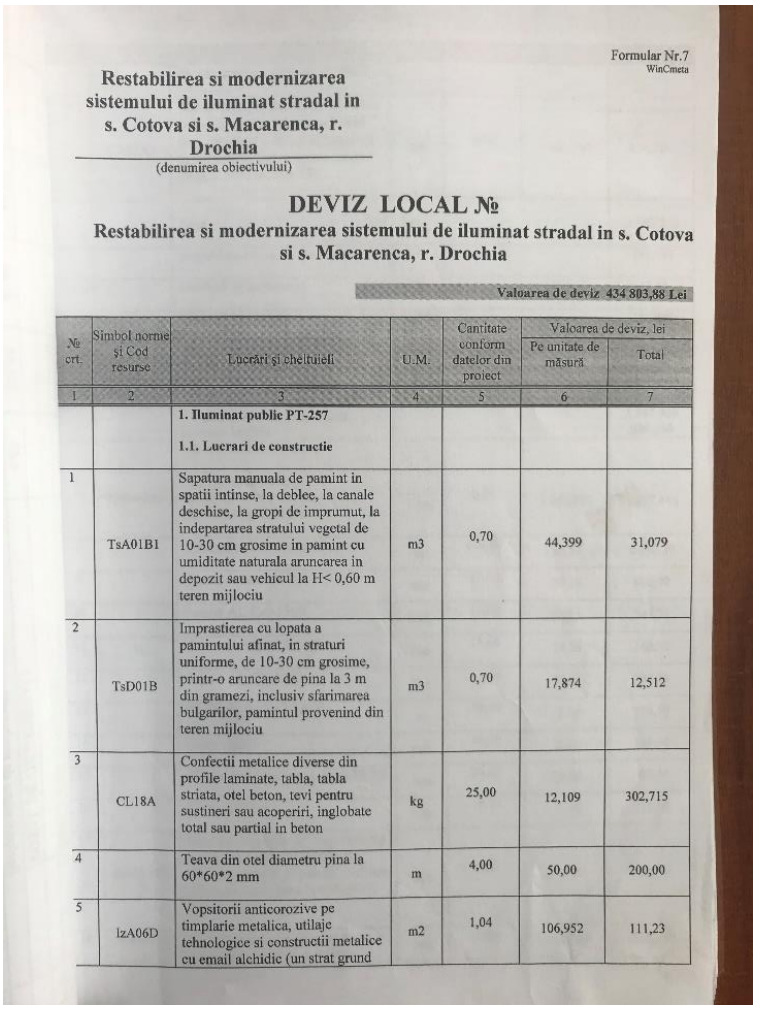
Table 7. Energy efficiency measures in public lighting

LE	Public lighting	Actions
LE1	Energy efficiency of lighting in public buildings	Replacing old technology LED lights in public buildings
LE2	Energy efficiency of street lighting	Install smart street lighting on all streets

The detailed description of the defined solution is given below:

❖ **LE1.2 Replacement of old technological lights with LEDs in street lighting**

Modern street lighting is based on LED lamps and the use of lighting fixtures with them. This technology saves a lot of energy and money on maintenance. In addition, it is widely used with dimming LED lamps, which allow you to control the intensity of the lighting according to the night, pedestrians or cars present and switch to smart lighting.



Formular Nr.7
WinCmeta

Restabilirea si modernizarea sistemului de iluminat stradal in s. Cotova si s. Macarenca, r. Drochia
(denumirea obiectivului)

DEVIZ LOCAL №
Restabilirea si modernizarea sistemului de iluminat stradal in s. Cotova si s. Macarenca, r. Drochia

Valoarea de deviz 434 803,88 Lei

№ crt.	Simbol norme și Cod resurse	Lucrări și cheltuieli	U.M.	Cantitate conform datelor din proiect	Valoarea de deviz, lei	
					Pe unitate de măsură	Total
1	2	3	4	5	6	7
		1. Iluminat public PT-257				
		1.1. Lucrari de constructie				
1	TsA01B1	Sapatura manuala de pamint in spatii intinse, la deblee, la canale deschise, la gropi de imprumut, la indepartarea stratului vegetal de 10-30 cm grosime in pamint cu umiditate naturala aruncarea in depozit sau vehicul la H< 0,60 m teren mijlociu	m3	0,70	44,399	31,079
2	TsD01B	Imprastierea cu lopata a pamintului afinat, in straturi uniforme, de 10-30 cm grosime, printr-o aruncare de pina la 3 m din gramezi, inclusiv sfarimarea bulgarilor, pamintul provenind din teren mijlociu	m3	0,70	17,874	12,512
3	CL18A	Confectii metalice diverse din profile laminate, tabla, tabla striata, otel beton, tevi pentru sustineri sau acoperiri, inglobate total sau partial in beton	kg	25,00	12,109	302,715
4		Teava din otel diametru pina la 60*60*2 mm	m	4,00	50,00	200,00
5	lzA06D	Vopsitorii anticorozive pe timplarie metalica, utilaje tehnologice si constructii metalice cu email alchidic (un strat grund	m2	1,04	106,952	111,23

Photo 8. The title sheet of the street lighting project estimate

Therefore, the street lighting in the commune should be with LED and intelligent control, which, in addition to controlling the light intensity depending on 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, 15.6 km of streets with a total length of 28.0 km are partially illuminated. Another 12.4 km will be illuminated.

Cotova City Hall designed the lighting system of the commune (photo 8). It need to modify the that design according to new technology of the intellegent street lighting.

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

The calculations were performed according to modern methods of the street lighting calculation. The distance between the newly placed poles is considered to be 30m and they will be installed on one side of the street. A total of 940 LED-based luminaires will be installed, of which 520 will

be replaced.

The impact of applying this measure is shown in the table below.

Table 8. The impact of implementing the measure in public lighting

№	Measure	Estimated investment, [euro]	Calculated reduction of energy consumption, [MWh/year]	Calculated reduction of CO2 emissions, [tones/year]
LE1	Replacing old technology LED lights in public buildings	27,846	17.0	7.54
LE2	Replacing old technology LED lights with street lighting	77,191	10,299	4.57
	New LED Street lighting	73,900	44.265	19.62

Note: The national emission factor for electricity is 0,4434 [t · CO_2/MWh].

3.2 Transport

The current situation

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

Photo 9. Zguriţa-Mîndîc road

The village of Cotova is connected to the asphalt road with the village of Macareuca, Mîndîc and Zgurița, and from there with Drochia by the R7 road.

Major pollution from transport comes from local transport of residents and economic agents. Cotova commune owns 650 vehicles, 260 trucks, 62 tractors, 6 combines and 250 motorcycles. Approximately 6,200 vehicles, 2,300 trucks, 1,900 tractors and over 6 combines pass through the village annually.

The major pollution from transport on these motorways, which are national level and regulated by the government, is not taken into account. Other transport sectors in the locality are private, residential and economic in the commune. They are also regulated by the government.

The local road infrastructure contains 28km of streets, of which only 5.0 km are paved. About 50% of the roads are in a satisfactory condition. Most roads are country roads, without rigid cover and without sidewalks, which makes it difficult for the elderly, people with disabilities, mothers with prams and children. Rural roads become impassable in rainy weather, which makes it difficult for people to travel to public institutions, makes it impossible to use personal transport and is an important barrier in providing quality services throughout the commune. Poor road infrastructure can hamper access for emergency services, firefighters and police.

All roads in the commune are shown in fig. 16.

It is estimated that local transport consumes 78.0 tonnes of petrol and 25.2 tonnes of diesel annually. Approximately the same amount of fuel is burned during transit through the commune by transit transport.

3.4 Energy

POWER SUPPLY

The current situation

he National Electric System supplies electricity in the commune of Cotova through the electricity distribution company S.A. "Northern Electricity Supply". S.A. "Red nord" is the sole owner of the distribution networks in the north of the Republic of Moldova.

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

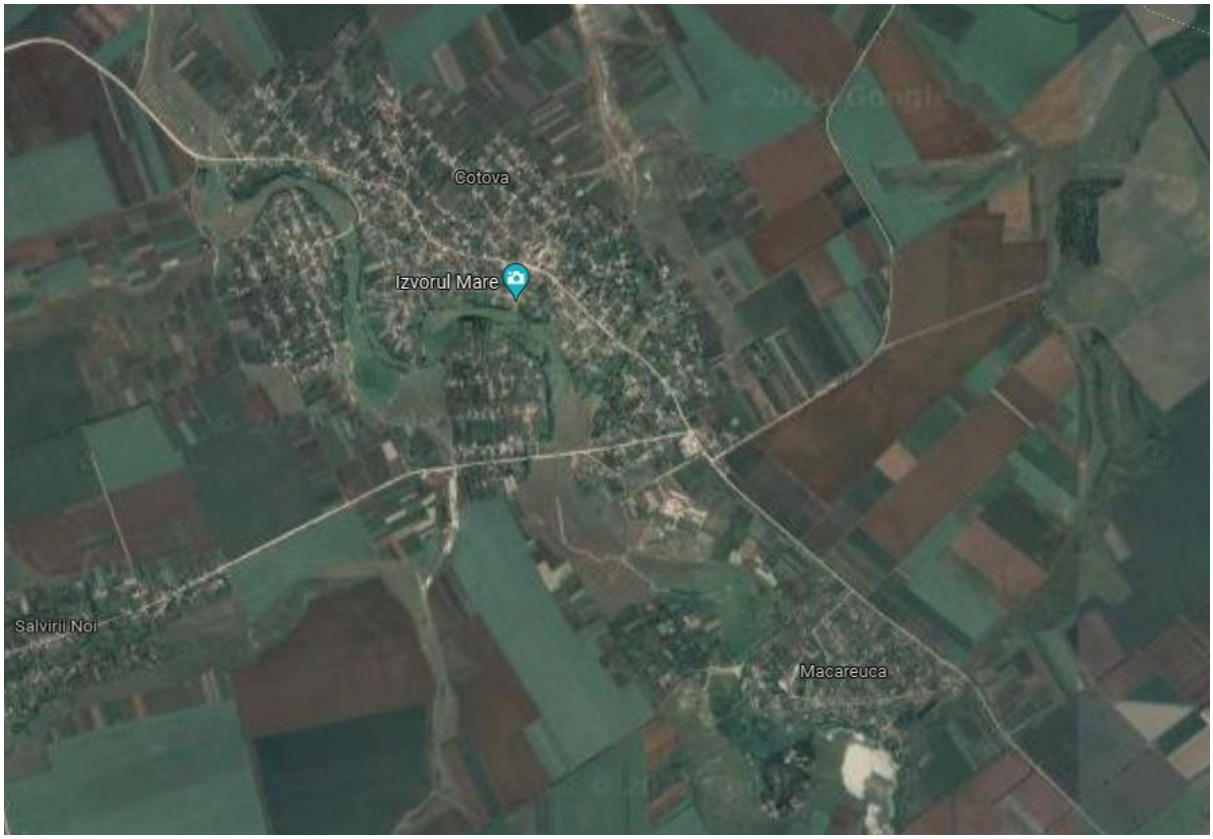


Fig. 16. Roads, streets and transport plan of Cotova village

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

Table 9. Measurement of local electricity production

PG	Local electricity production	Measure
PG1	Photovoltaic farm	Construction of a 0.7MW photovoltaic farm

The detailed description of the defined solutions is given below:

❖ **PG1. Construction of a commercial photovoltaic park of 0.7MWp**

The current legislation[2] of the Republic of Moldova encourages the construction of a photovoltaic park in order to produce clean energy. The town hall owns a large area of unusable land, which is not available for agricultural use. The land with an area of 1.2ha (photo 10, fig.17) in the middle of Cotova village can be used for the construction of a photovoltaic park. The mayor's office will attract investment for its construction. The amount of electricity generated annually is 1,130kWh for every 1 kWp of photovoltaic panel installed (fig. 11).

[2]LEGE Nr. 10 of 26-02-2016 on promoting the use of energy from renewable sources

Table 10. Size of local electricity production

PG	Local electricity production	Measure	The amount of the generated electricity, MWh / an	Reduced emissions of CO2, tons
PG1	Photovoltaic farm	Construction of a 0.7MW commercial photovoltaic farm	840.0	372.4

The advantage of the area is that a 35kV power line passes near the planned park. A 35/10kV power station is close to where energy can be generated in the grid. As shown in Table 10, this action will replace 840,000kWh of fossil electricity annually and reduce CO_2 emissions by 372.4 tonnes.

Photo 10. The land for the location of the photovoltaic park

THERMAL ENERGY

The current situation

The commune does not have a district heating system or domestic hot water system.

The mayor's office intends to plant 24ha of energy willow on the banks of the Căinar stream to reduce the consumption of coal and firewood obtained by cutting down forests. The planned amount of pellets produced should cover the needs of public buildings, companies and households. This action will form the basis of a biofuels market, create new businesses and create jobs.

Fig.17. 0.7MWp photovoltaic farm location

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

The heating stations will be interconnected with the solar water heating installations.

3.3 Water and wastewater

The current situation

Cotova commune does not have a modern aqueduct. The existing one is 4.5 km long.

There is 1 artesian well that supplies the commune with 4,130m3 of water annually and provides 100% of public buildings and only 5% of residential buildings.

The town hall has a technical project for the execution of the commune's aqueduct (photo 11).

The cost estimate indicates the required construction amount of € 392,800.

At the same time, Cotova commune does not have a centralized sewerage system and a wastewater treatment system.

The inhabitants of the commune have 1720 toilets in the yard. The liquid in them enters

directly into the groundwater, polluting them intensely. The public and economic buildings have 175 internal toilets, the contents of which are transported outside the locality being poured on a lot near the commune. This method is as risky as external toilets.

Photo 11. The image of the general scheme from the technical design of the aqueduct

The large number of households in the residential area does not have a centralized sewer system, and wastewater is stored in hand-dug and unprotected outdoor pits, called toilets. As a result, soils and groundwater sources are contaminated.

In addition, wastewater from households adjacent to the Cainar River flows directly into or into groundwater. Industrial and agricultural wastewater are also heavily polluting the environment.

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

Cotova City Hall will initiate the design of the sewage and wastewater treatment system, the indicative scheme of which is presented in fig. 18.

The solution that was defined after the analysis of the situation is presented in table 11 below.

Fig.18. The centerline of the planned sewer system

Table 11. Water, wastewater and solid waste management measures

WW	Name	Measure
WW1	Centralized drinking water supply	Initiation of the design and construction of the commune's aqueduct
WW2	Wastewater management	Design and construction of a sewerage system together with the wastewater treatment plant
WW3	Solid waste management	Arranging the solid waste storage place, creating their collection service
WW4	Solid waste management	Design and construction of a sewerage system together with the wastewater treatment plant

The detailed description of the defined solutions is given below:

WW1. Initiation of the construction of the commune's aqueduct

There is a need to improve the living standards of 1833 households by building a centralized sewer system. The town hall must build a modern aqueduct that would meet the needs of public consumers and residents. The technical execution project is carried out. The mayor's

office must take action to attract investment from development partners by participating in the competitions announced by them.

With the expansion of the water pipe, it is necessary to build a sewer system and a sewage treatment plant. It will solve the problem of environmental pollution with wastewater from inside the commune.

WW2. Design and construction of the sewerage system together with the wastewater treatment plant

There is a need to improve the living standards of 1833 households by building a centralized sewer system. In the residential sector of the village there are over 1,720 toilets outside the buildings that pollute the environment. In addition, in the villages of Cotova and Macareuca are the breeders of birds and birds, which also contribute to pollution.

The town hall must design and build a sewage system together with the treatment plant. The central pipe of the sewer system could be as illustrated in fig. 18, but will be materialized at the design stage. The centralized sewerage system and the wastewater treatment plant will considerably reduce the negative impact on the environment, especially on the Cainar River and the 2 nearby ponds. It will also have a positive impact on groundwater resources and improve people's well-being and health.

Through the construction of the sewerage system and the wastewater treatment plant, the commune will protect the environment from pollution.

3.4 Solid waste

The current situation

A problem of Cotova commune is the storage of manure from about 330 cattle, 84 pigs, 1,770 sheep and goats, 12 horses and over 17,000 poultry. Now animal owners are dumping garbage outside the village, in unauthorized places (photo 12) and on agricultural fields to obtain organic fertilizer.

The mayor plans to create a municipal enterprise for the collection of solid waste, its transportation and storage outside the commune, in the authorized and arranged place. The right place to store them is the collector of the former cattle farm (photo 13). The collectors are made of reinforced concrete, which would prevent liquid from entering the wastewater into groundwater.

Photo 12. Unauthorized storage of solid waste

The surface of the solid waste landfill is 3.8ha (fig.19), located between the villages of Cotova and Macareuca.

❖ **WW3. Solid waste storage facility**

Centralized collection of solid waste, transportation and storage in a specially designed place will change the appearance of the locality, will reduce the impact on the terrestrial environment and groundwater. The place of the landfill is appreciated, it does not require large investments for its execution. It remains for Cotova City Hall to solve the problem of their collection and storage

❖ **WW4. Organization of the solid waste collection, transportation and storage service**

It is necessary to organize the solid waste in an organized manner, to transport it to a specially arranged landfill and to dispose of it properly.

This requires a specialized service, equipped with transport and specialized cars. The minimum number of staff will organize the removal of waste and manure from outside the localities, at the storage place.

Photo 13. The right place to store solid waste

Fig.19. Solid waste storage site plan

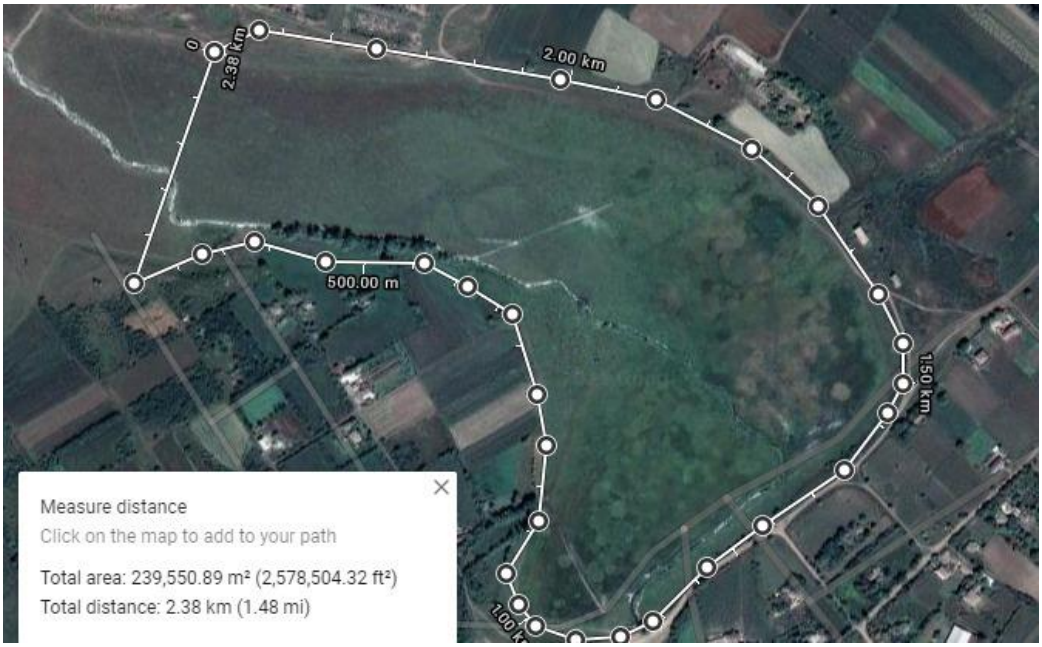
❖ **Solid waste management**

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

3.7 Climate mitigation and adaptation

❖ **CA1. Planting 24 ha of energy willow**

Planting energy willow is an important action to improve climate change mitigation and adaptation. This will make the commune greener, will attenuate the influence of rainfall,



20. Planned 24 ha energy willow plantation

of the consequences of melting snow in winter and spring and of hot air currents in summer. Willow fixes river banks, steep slopes and helps prevent landslides. It also cleans the air. One hectare of willow absorbs over 65 tons of CO_2 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 to conserve ecosystems.

The plantation will retain rainwater and snowmelt which will slow down the evaporation of water during the dry summer period, will positively influence the mitigation and adaptation of climate change. Wildlife, birds and insects will host the plantation by rehabilitating biodiversity.

The town hall has no power to invest in this activity, therefore, it is wise to solve it by implementing the public-private partnership. The town hall can provide land (fig. 20) for the

plantation and the private partner will bear all the expenses for planting and production of biofuel. It also covers the costs of purchasing, caring for, harvesting, transporting and storing the production and marketing of willow pellets. Another option could be considered.

Energy willow is planted only once and is harvested, starting with the second or third year, for 25-30 years. Energy willow can be cut about 12 times every two to three years.

❖ **CA2. Establishing the production of pellets on the basis of public-private partnership**

Establishing the production of wood pellets from energy willow will reduce CO2 emissions in the commune and will contribute to economic growth. It will open the market for biofuels in this area, that most potential customers are in the commune (kindergartens, school, other public buildings and residents). In addition, there is a shortage of wood biofuel in the Republic of Moldova.

The company will create jobs to operate. All this will increase the City Hall budget.

Fig. 21. The area to be developed for recreational purposes

❖ **CA3. Creation of a recreational area on the banks of the Cainar River**

The area is located in the southwest of the village of Cotova. Its surface is 43.0ha (fig.21). Its arrangement includes digging the pond, planting trees around it and arranging places for rest and recreation, creating infrastructure, building rest houses and places for amateur fishing.

The mayor's office has no budget for such an action. An alternative source of funding can be the public-private partnership, where the City Hall will provide the pond and the surrounding land, and the private partner will invest money to build the recreation area.

This measure will accumulate water from springs and rain and will help mitigate climate change, save and spread biodiversity, and help people use a modern form of rest.

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

❖ **CA4. Afforestation of the banks of the Cainar River**

There is a plot of 6.1ha in the meadow and on the hills of the Cainar stream in the southwestern part of the village of Cotova (photo 14,15 and fig.22), which will be used for planting trees. This measure will help mitigate the impact of climate change by absorbing carbon dioxide, keep the

Photo 14. The area to be afforested

area cool during the hot summer, and stop snow and moisture in the winter and spring. In addition, it will improve the well-being of residents as a place to walk and rest.

Photo 15. Image from the area to be afforested

Fig. 22. Plan of the area to be afforested

4. Organizational and financial aspect

The town hall will request funding from various sources to achieve the objectives of SECAP with the prior approval of the Local Council. The commune 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 overall budget needed to implement the actions of the current PAEDC is estimated at 3,022,474 euros by 2030.

Several sources of funding have been defined:

Local donors: the national state budget, the local budget of Cotova commune, the Agency for energy efficiency and the National Ecological Fund.

External donors: Sweden (AIDS), Germany (GIZ), SUDEP, Horizon 2020, USAID, International Climate Initiative (IKI), GHG etc.

The technical supervision of the execution of the works will be ensured by the local consulting companies contracted by the commune City Hall. The submission of the implementation and monitoring reports will be made by the person designated by the City Hall.

3 Baseline Emission Inventory (BEI)

Baseline Emission Inventory		
1) Inventory year	2019	
2) Number of inhabitants in the inventory year	3,350	
3) Emission factors	☑	IPCC
	☐	LCA (Life Cycle Assessment)
4) Emission reporting unit	☑	tonnes CO_2
	☐	tonnes CO_2 equivalent

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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					
		Electricity	Heat/cold	Natural gas	Liquid gas	Heating oil	Diesel	Gasoline	Lignite	Coal	Other fossil fuels	Plant oil	Biofuel	Other biomass	Solar thermal	Geothermal	Total
BUILDINGS, EQUIPMENT/FACILITIES AND INDUSTRIES																	
Municipal buildings, equipment/facilities		70.1								531.3				1178			**1779.3**
Tertiary (non municipal) buildings, equipment/facilities																	**0**
Residential buildings		182.1								2415				679.1			**3,276.2**
Public lighting		20.0															**20.0**
Industry	Non-ETS																**0**
	ETS (not recommended)																**0**
Subtotal		**272.2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2946.3**	**0**	**0**	**0**	**1,857.1**	**0**	**0**	**5,075.6**
TRANSPORT																	
Municipal fleet																	**0**
Public transport																	**0**
Private and commercial transport							292.30	1,021.80									**1314.1**
Subtotal		**0**	**0**	**0**	**0**	**0**	**292.3**	**1021.8**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1314.1**

OTHER	1															
Agriculture, Forestry, Fisheries																**0**
TOTAL	**272.232**	**0**	**0**	**0**	**0**	**292.3**	**1021.8**	**0**	**2946.3**	**0**	**0**	**1857.1**	**0**	**0**	**0**	**6389.7**

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]						
			Fossil fuels				
	Electricity	Heat/cold	Gas	Diesel	Gasoline	Coal	Total
BUILDINGS, EQUIPMENT/FACILITIES AND INDUSTRIES							
Municipal buildings, equipment/facilities	31					188	**219**
Tertiary (non municipal) buildings, equipment/facilities	0					0	**0**
Residential buildings	81					855	**936**
Public lighting	9					0	**9**
Industry 0					0	**0**	**0.00**
Subtotal	**121**	**0**	**0**	**0**	**0**	**1043**	**1164**
TRANSPORT							
Private and commercial transport	0	0	0	78	254	0	332
Subtotal	**0**	**0**	**0**	**78**	**254**	**0**	**332**

OTHER		54	

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	**121**	**0**	**0**	**78**	**254**	**1043**	**1496**

4. Climate risk and vulnerability assessment (RVA)

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

Potential 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]

5. Key actions for the duration of the plan (2030)

Table 17. Key actions for the duration of the plan (2022-2030)

Key Actions	Area of intervention	Policy instrument	Origin of the action	Responsible body	Implementation timeframe		Implementation cost	Estimates in 2030			Action also affecting adaptation
					Start	End	€	Energy savings MWh/a	Renewable energy production MWh/a	CO_2 reduction t CO_2/a	
MUNICIPAL BUILDINGS, EQUIPMENT/FACILITIES							**564,874**	**1,173**	**1,246**	**641**	
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	Cotova City Hall	2022	2030	171,908	106.40		21.50	Adapting to climate change
Solar water heaters and PVT (photovoltaic thermal panels) installation on roofs and independent units	Energy efficiency of public buildings, Adapting to climate change		Local authority	Cotova City Hall	2022	2030	120,000		2 40.0	69.6	Adapting to climate change

Producția de biocombustibil din salcia energetică. Utilizarea peletilor din lemn în clădiri publice și rezidențiale	Eficiența energetică a clădirilor publice, Atenuarea și adaptarea schimbărilor climatice		Local authority	Cotova City Hall	2022	2030	142850		858	173	Adapting to climate change
Utilizarea pompelor de căldură „aer în aer" sau „aer în apă" pentru încălzirea clădirilor publice și obținerea apei calde menajere	Eficiența energetică a clădirilor publice, Atenuarea și adaptarea schimbărilor climatice		Local authority	Cotova City Hall	2022	2030	76,500		387.5	171.8	Adapting to climate change
Înlocuirea sistemului vechi de încălzire în clădirile publice	Eficiența energetică a clădirilor publice		Local authority	Cotova City Hall	2022	2030	14,400	53.4		10.8	
Instalarea centralei individuale de încălzire, interconectare a acestora la sistemele solare de încălzire	Eficiența energetică a clădirilor publice, Atenuarea și adaptarea schimbărilor climatice		Local authority	Cotova City Hall	2022	2030	24,800	960		194.0	

Înlocuirea aparatelor de bucătărie care funcționează pe grădinițe cu gaz și școli cu electrice	Eficiența energetică a clădirilor publice		Local authority	Cotova City Hall	2022	2030	15.500	Child safety will be improved			
Înlocuirea iluminării vechi de tehnologie cu LED-uri în clădirile PUBLICE	Eficiența energetică a clădirilor publice		Local authority	Cotova City Hall	2022	2030	14,400	53.4		10.8	
Estimated reduction not associated with any reported actions							0	0	0	0	
PUBLIC BUILDINGS							**564,874**	**1,173**	**1,246**	**641**	

STREET LIGHTING							**134,800**	**80.8**		**35.8**	
Instalarea iluminatului stradal inteligent pe toate străzile	Energy efficiency		Local authority	Cotova City Hall	2022	2030	134,800	80.8		35.8	
Estimated reduction not associated with any reported actions							0	0	0	0	
LOCAL ELECTRICITY PRODUCTION							**700,000**		**840.0**	**372.4**	

Generarea de energie fotovoltaică 0.7MW	Producția de energie electrică, reducerea și adaptarea schimbărilor climatice		Local authority	Cotova City Hall	2022	2030	700,000		840.0	372.4	Climate change mitigation and adaptation
Estimated reduction not associated with any reported actions							0	0	0	0	
OTHERS							**1,590,000**	**0**	**0**	**0**	
Construcția apeductului	Atenuarea schimbărilor climatice		Local authority	Cotova City Hall	2022	2030	392,800	The level of environmental protection will increase			
Proiectarea și construirea unui sistem de canalizare împreună cu stația de epurare a apelor uzate	Atenuarea schimbărilor climatice		Local authority	Cotova City Hall	2022	2030	460,000	The level of environmental protection will increase			
Amenajarea locului de stocare a deșeurilor solide	Atenuarea și adaptarea schimbărilor climatice		Local authority	Cotova City Hall	2022	2030	50,000	The level of environmental protection will increase			

Organizarea serviciului de colectare, transportare și depozitare a deșeurilor solide	Atenuarea adaptarea schimbărilor climatice		Local authority	Cotova City Hall	2022	2030	100,000	The level of environmental protection will increase			
Plantarea a 24.0ha de salcie energetică	Atenuarea și adaptarea schimbărilor climatice		Local authority	Cotova City Hall	2022	2030	50,000	The level of environmental protection will increase			
Stabilirea producției de pelete pe bază de parteneriat public-privat	Atenuarea și adaptarea schimbărilor climatice		Local authority	Cotova City Hall	2022	2030	50,000	The level of environmental protection will increase			
Construirea bazinului de acumulare a apei pluviale de 43.6ha a oglinzii apei	Atenuarea și adaptarea schimbărilor climatice		Local authority	Cotova City Hall	2022	2030	500,000	The level of environmental protection will increase			
Plantarea a 6.1ha de copaci	Atenuarea și adaptarea schimbărilor climatice		Local authority	Cotova City Hall	2022	2030	20,000	The level of environmental protection will increase			
Estimated reduction not associated with any reported actions							0	0	0	0	
TOTAL							**3,022,474**	**1,254**	**2,086**	**1,049**	