Sustainable Energy and Climate Action Plan (SECAP)

Balti municipality

2016-2030

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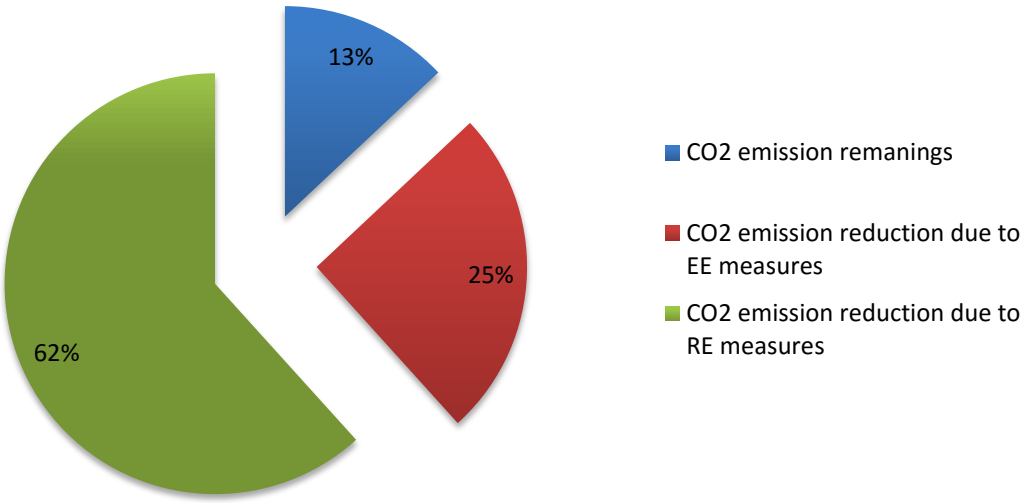
Executive Summary

Sustainable Energy and Climate Action Plan (SECAP) is a key document in which a Municipality of Balti outlines how it intends to reach its commitments. It defines mitigation and adaptation actions to achieve the targets, together with time frames and assigned responsibilities. The new integrated Covenant of Mayors for Climate and Energy was launched by the European Commission on 15 October 2015 during a Ceremony in the European Parliament in Brussels. New signatories now pledge to reduce CO2 emissions by at least 40% by 2030 and to adopt an integrated approach to tackling mitigation and adaptation to climate change.

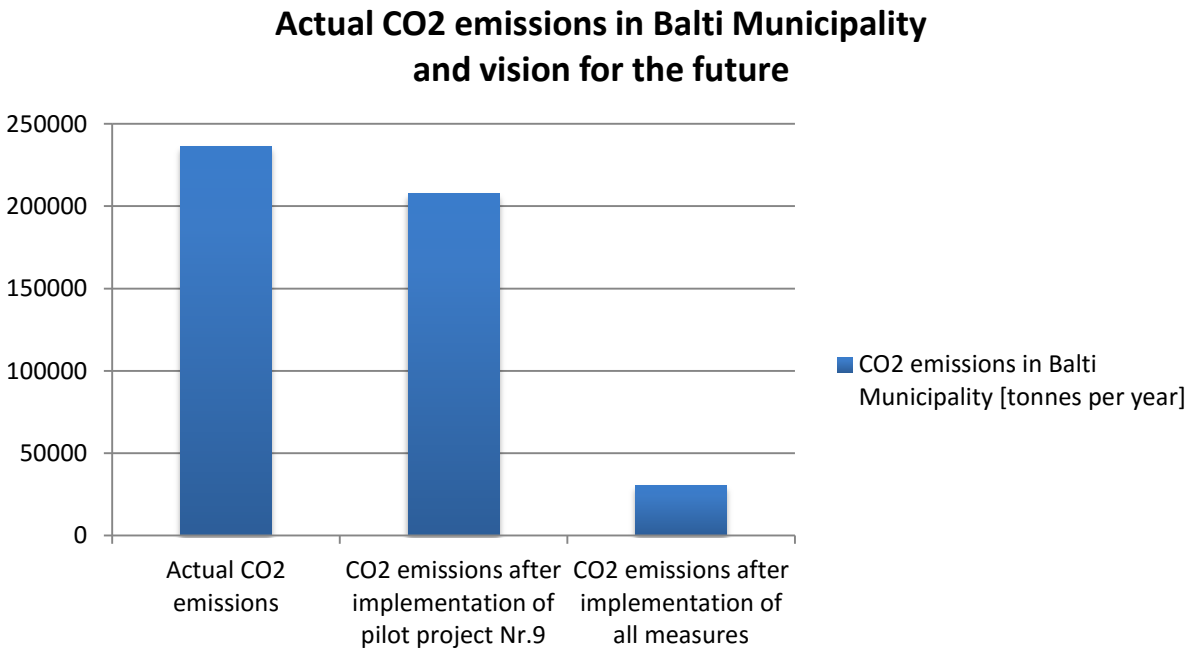
A Sustainable Energy and Climate Action Plan (SECAP) outlines the key actions Balti Municipality plans to undertake. This report is setting out the actions to reduce carbon emissions by 87% till 2030. By implementing proposed measures, the following targets will be achieved:

- 27% energy savings through the implementation of energy efficiency measures;
- 28% of energy will be produced from renewable energy sources.

Calculated CO2 reduction target through implementation of SECAP in 2030



SECAP specifies short-term and long-term measures. Short-term measures include the launch of a pilot project for rehabilitation of the district Nr.9, that will guide the implementation of long-term measures for entire Municipality.



Based on collected and analyzed data, Municipality of Balti has a great perspective in GHG emission reduction.

A crucial element of the SECAP will be to strengthen community involvement, ongoing engagement with key stakeholders and partners, also great social impact will be achieved.

1. BALTI MUNICIPALITY OVERVIEW

General characteristics

Balti is located on the river Raut, a tributary of the Dniestr, on a hilly landscape in the northern part of the Republic of Moldova (Coordinates: 47°46'N 27°55'E). Balti is a major industrial, cultural and commercial centre and transportation hub in the northern region, also called *"the northern capital"*. It represents the second-largest city in terms of area and economic importance after Chisinau. The city is one of the five Moldovan municipalities. The municipality covers an area of 78.0km², of which the city proper 41.42km², the village Elizaveta (an eastern suburb) 9.81km², and the village Sadovoe (a north-western suburb) 26.77km².

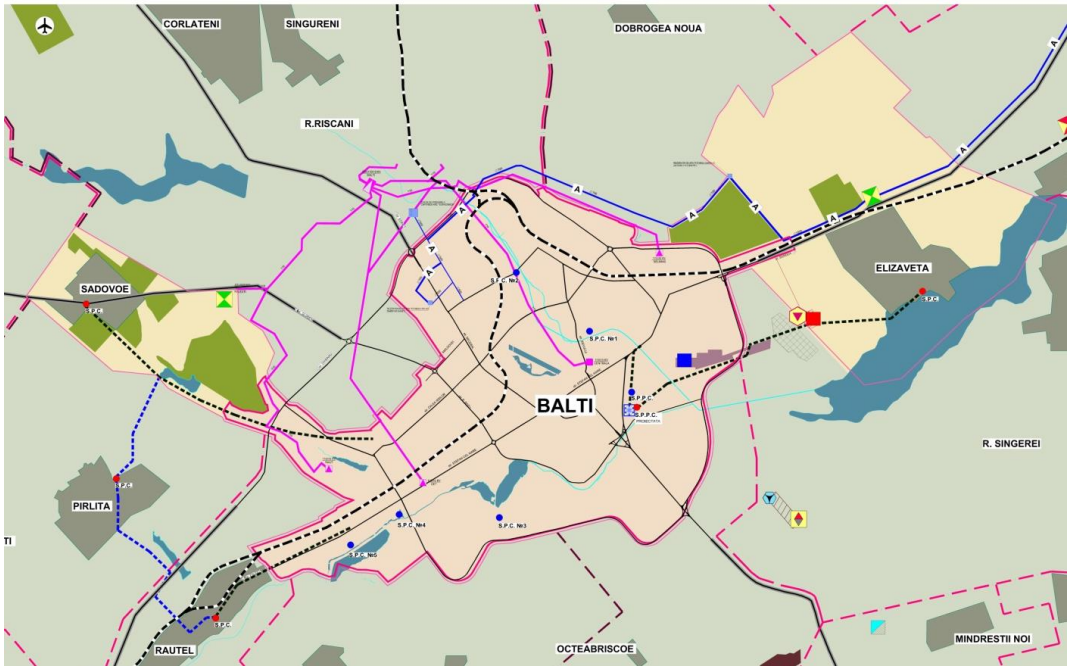


Figure I. Map of the Balti Municipality.

Climate

Balti has a moderate continental climate, summers are generally hot and winters mild. Mean annual temperature equals to + 9.2°C, with - 3.4°C in January and + 21.3°C in July. The annual sum of precipitation makes 529mm, mostly during summer and fall. Dominant winds are from

the north-east or the north-west at about 2-5m/s. The all-time maximum temperature registered in the city was + 38°C, the all-time minimum - 32°C.[1]

Hydrography

Balti municipality is located in the middle of the Balti steppe south-line. Existing landforms in the past have been exposed to strong levelling through prolonged erosion. Relief formation was influenced by hydrographic network consisting of rivers and several creeks Raut and Rautel. Running waters are represented by rivers, streams and springs. The city is crossed by two rivers: Raut and Rautel-total length within the territory of Balti is 17km, two streams Copaceanca and Flamanda, inflows of the river Raut and Lakes.[2]

Ground waters for rural areas are the main source of potable water for domestic use. They come to the surface through springs. Most are neat and manicured. There is also a natural deposit of the mineral waters (Izvoras).

Geology

A seismic condition of the territory is determined by the focal point of Vrancea, situated at approximately 250km away from the town (Romanian Moldova, at the bottom of the Carpathians.). The seismic activity in the area reaches up to 7 magnitude (Richter scale).[3]

Vegetation and agriculture

The agriculture overwhelmingly dominates traditional vegetation. The region is a traditional agricultural area, favoured by several factors, such as the black earth (earth with a very high natural fertility), and a high degree of deforestation.

Population

In terms of population, it is the third-largest city after Chisinau and Tiraspol. According to the NBS (National Bureau of Statistics) "Preliminary number of resident population in the Republic of Moldova as of 1st January 2016", the population in the Balti municipality is the following:[4]

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[1] Source: World Weather Information Service.

[2] Ghidul orașelor din Republica Moldova. 2004, p. 10.

[3] Ilieș, Ion. Sistemul integrat de monotirizare seismică România-Republica Moldova.*Akademos*, nr. 1 (20), martie 2011, p. 62 - 69. Accesat 28 iunie 2011.

(thou. Persons)

Balti Municipality	150,7
Balti City	145,8
Villages (Communes)	4,9

According to the "Average age of the population, in territorial aspect, as of January 1, 2007-2015", [5] in Balti Municipality the median age of men is - 36.7, and women - 40.3.

Number of population in Balti Municipality according to the sex and age, at the beginning of the year 2015 is the following: [6]

Age	Male	Female
0-9	7533	7 092
10-19	6 909	6 666
20-29	13 438	14 465
30-39	12 628	13 798
40-49	9 312	11 138
50-59	9 755	12 570
60-69	5 896	8 714
70-79	2 619	4 582
80+	916	2 211

[4] BNS: Number of resident population in the Republic of Moldova as of 1st January 2016, in territorial aspect.

[5] BNS: Average age of the population, in territorial aspect, as of January 1, 2007-2015.

[6] BNS: Populatia stabila pe raioane, virste, medii si sexe la inceputul anului, 2007-2015.

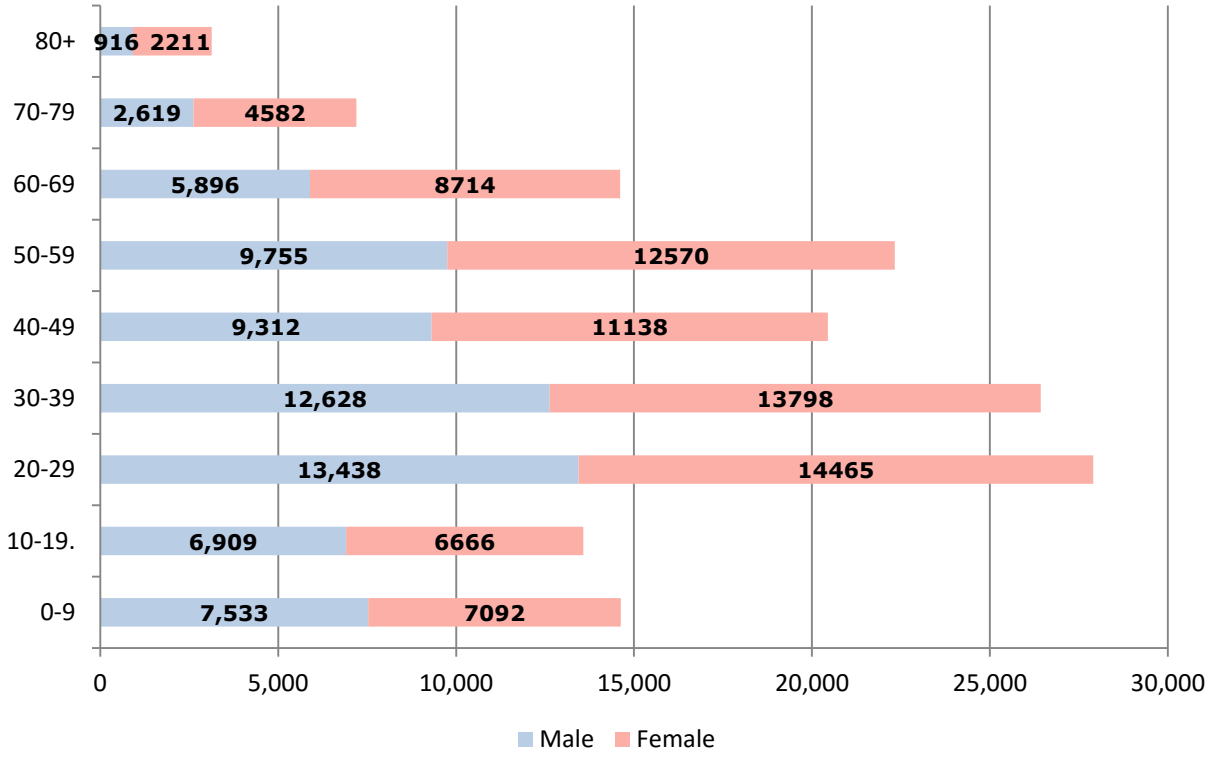

Figure 2. Balti Municipality Population by sex, age, at the beginning of the year 2015

The natural movement of population is characterized by demographic processes (such as birth, death, marriage, divorce). Based on data obtained from the management of integrated information flow (IIF), administered jointly by the Ministry of Justice, Ministry of Health, Ministry of Information Technology and Communications and the National Bureau of Statistics, in Balti Municipality can be seen a light natural increase of population by 3.65% (birth rates equals to 50%, while death rates are 46.35%). As specified in BNS "Vital statistics rates by Indicators in 2014 Mun. Balti", [7] the vital statistic rates are the following:

(Unit: Per 1000 population)

Birth rate	Mortality rate	Natural increase
9.6	*8.9*	*0.7*

[7] Vital Statistics Rates, In Territorial Aspect, 2003-2014

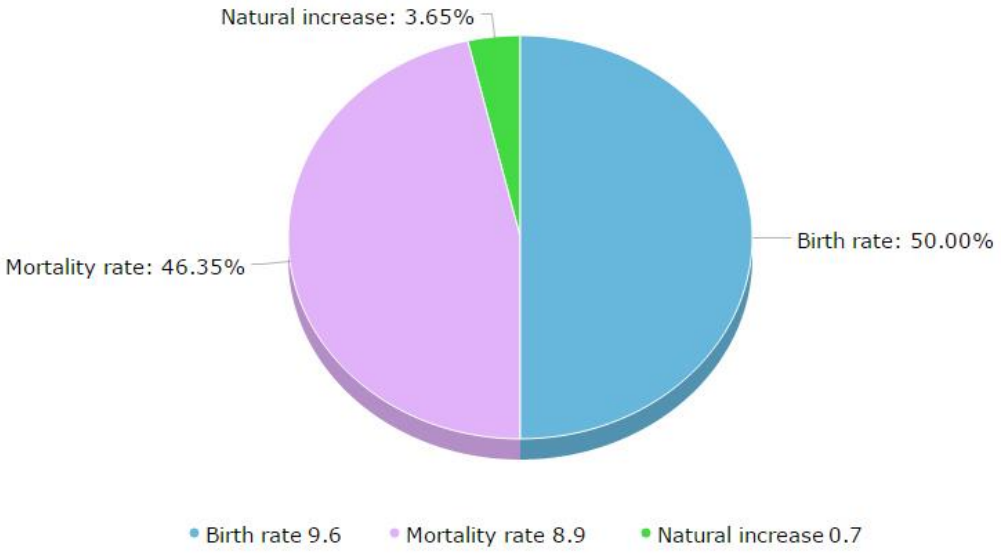

Figure 3. Vital Statistics rates by Indicators in Balti Municipality, 2014 (per 1000 population)

Ethnic composition of the population in Balti Municipality reveals that Moldovans, the majority of the population, represent 52.4%. Together with Moldovans live Ukrainians – 23.7 %, Russians – 19.2%, Romanians – 1.8%, Gagauz – 0.2%, Bulgarians – 0.2 % and other nationalities. As indicated in the official ethnicity statistics, the main nationalities, in Balti Municipality, on 2004 is the following: [8]

Ethnicity	Number	%
Moldovan	66877	52.4
Ukrainian	30288	23.7
Russian	24526	19.2
Romanian	2258	1.8
Bulgarian	297	0.2
Gagauz	243	0.2
other	2 889	2,3
not declared	183	0.1

[8] (Moldovan) Official Ethnicity Statistics

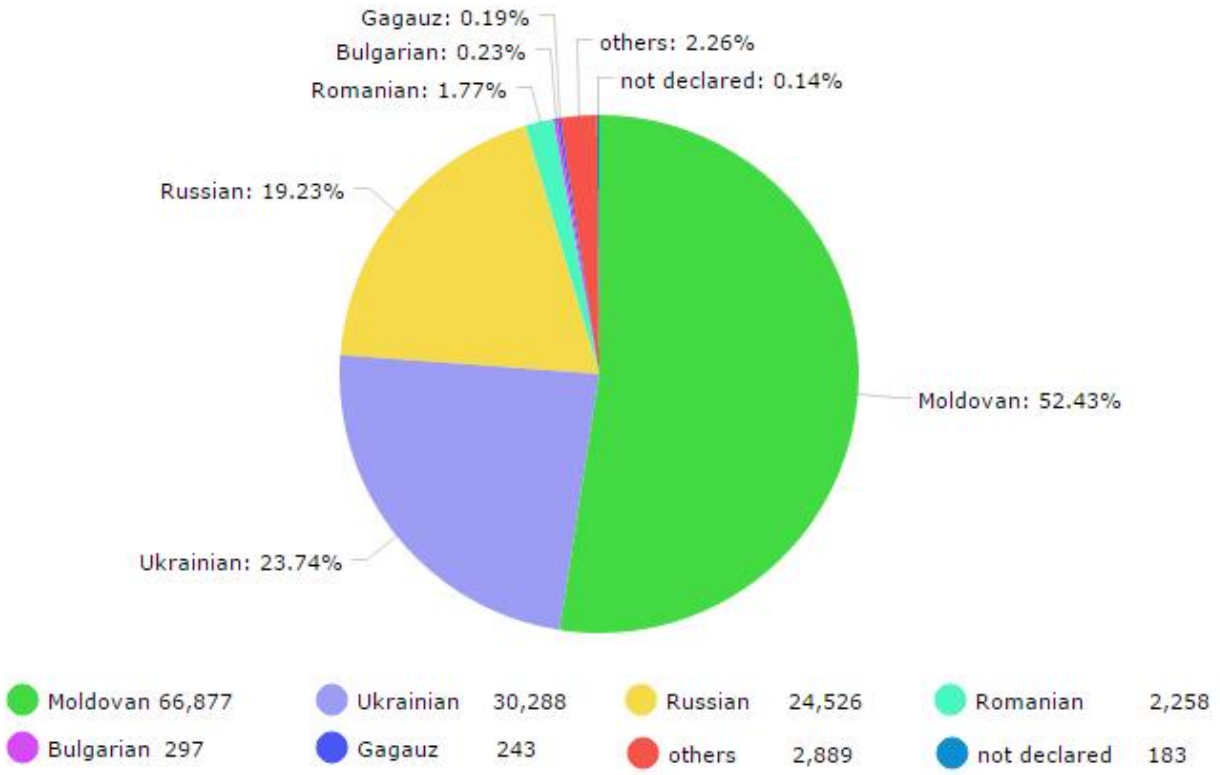

Figure 4. Ethnic groups in Balti Municipality on 2004

Industry and economic agents

According to the Balti Ecological Agency, in total, there are registered 408 economical agents (347 are in industrial sector and 61 in energetic), that represent source of local atmosphere pollution, which have more than one stationary sources of pollution.

In addition, one of Moldova's free economic zones (FEZ) - FEZ "Balti", operates near Balti City. It was created in 2010 for a period of 25 years. FEZ "Balti" is composed of four areas: subzone 1 (2.02 ha), subzone 2 (10.35 ha), subzone 3 (110 ha) and subzone 4 (12 ha). In 2013, it had 28 residents. Total investments since the establishment of the FEZ amount to USD 39.3 million.[9]

2. OVERALL STRATEGY

As one of the biggest industrial cities of Moldova, Municipality of Balti has a huge impact on the environment. The key objective of the Balti Municipality is to achieve the CO2 emissions reduction up to 40% till 2030.

[9] FEZ

A. Objectives and Targets

Several major targets have been defined due to real situation analysis.

Management area	Objective	Target		Measure	
Development of a smart system for infrastructure	Raise environmental awareness through implementation of eco-friendly solutions	T.1	District heating modernization	T.1_M.1	Replacement of district heating distribution system *(for district №9)*
				T.1_M.2	Replacement of district heating distribution system for Balti Municipality *(except district №9)*
				T.1_M.3	Installation of individual heating plants with automatic control in buildings *(for district №9)*
				T.1_M.4	Installation of individual heating plants with automatic control in buildings *(except district №9)*
		T.2	Electricity grid modernization	T.2_M.1	Placing the electricity grid in underground concrete conduit channels *(for district №9)*
				T.2_M.2	Placing the electricity grid in underground concrete conduit channels for Balti Municipality *(except district №9)*
				T.2_M.3	Wind farm creation
		T.3	Transport	T.3_M.1	Vehicles electrification.
				T.3_M.2	Implementation of cycling infrastructure – bicycle parking's *(for Balti Municipality)*. *(please also see chapter roads and traffic management)*
				T.3_M.3	Smart parking *(for district №9)*
				T.3_M.4	Smart parking for Balti Municipality *(except district №9)*
		T.4	Roads	T.4_M.1	Roads reconstruction *(for district №9)*
				T.4_M.2	Roads reconstruction for Balti Municipality *(except district*

					№9)
		T.5	Lighting	T.5_M.1	Implementation of pedestrian lighting in total amount of 320 units based on LED technologies *(for district №9)*.
				T.5_M.2	Replacement of existing inefficient lanterns for street lighting to LED, in total amount of 4000 units *(for Balti Municipality)*.
		T.6	Traffic Management	T.6_M.1	Replacement of 104 traffic lights to LED.
				T.6_M.2	Installation of 274 traffic lights based on LED technologies for cycle lanes.
		T.7	Buildings	T.7_M.1	Insulation of buildings envelope, replacement of windows and doors *(for district №9)*.
				T.7_M.2	Installation of photovoltaic panels on the roofs of public buildings *(for district №9)*.
				T.7_M.3	Insulation of buildings envelope, replacement of windows and doors for Balti Municipality *(except district №9)*.
				T.7_M.4	Installation of photovoltaic panels on the roofs of public buildings for Balti Municipality *(except district №9)*.
		T.8	Greening/Landscaping	T.8_M.1	Greening and landscaping *(for district №9)*.
				T.8_M.2	Greening and landscaping for Balti Municipality *(except district №9)*.
		T.9	Water	T.9_M.1	Replacement of water distribution pipe system in underground concrete conduit channels *(for district №9)*
				T.9_M.2	Replacement of water distribution pipe system in underground concrete conduit channels for Balti Municipality *(except district №9)*
		T.10	Wastewater	T.10_M.1	Replacement of wastewater distribution pipe system in underground concrete conduit channels *(for district №9)*
				T.10_M.2	Construction of biogas production plant based on sludge and

				organic waste *(for Balti Municipality)*
			T.10_M.3	Replacement of wastewater distribution pipe system in underground concrete conduit channels for Balti Municipality *(except district №9)*
		T.11 Solid wastes	T.11_M.1	Creation of Integrated Solid Wastes Management Center *(for Balti Municipality)*.
		T.12 Implementation of techniques and methods for the CO2 reduction and monitoring.	T.12_M.1	Measurement of CO2 emissions before and after the measures to estimate the impact *(for district №9)*
			T.12_M.2	Installation of CO2 sensors and monitoring system with data storage *(for district №9)*
			T.12_M.3	Guideline Development of CO2 reduction in case of subsequent growth *(for Balti Municipality)*
			T.12_M.4	Measurement of CO2 emissions before and after the measures to estimate the impact for Balti Municipality *(except district №9)*
			T.12_M.5	Installation of CO2 sensors and monitoring system with data storage for Balti Municipality *(except district №9)*

B. Current framework and vision for the future

B1. District heating

B1.1 District heating current framework

District heating is one of the largest carbon dioxide emission sources in the city. Municipality of Balti is supplied with heat from 3 different sources:

- „CET-Nord" JSC – state owned organisation, combined heat and power plant (CHP) which covers 94% of total city heat supply needs.
- „TermoGaz-Balti" ME – municipal organisation, heat plants cover 5% of total city heat supply needs.
- „CFM" – state owned organisation of Moldavian railways, heat plant covers 1% of total city heat supply needs.

At the present time, due to high thermal energy cost, almost 31% of city consumers have been disconnected from district heating and have autonomous gas boilers.

In Fig.5 is presented the ratio of heating supply covered by each source.

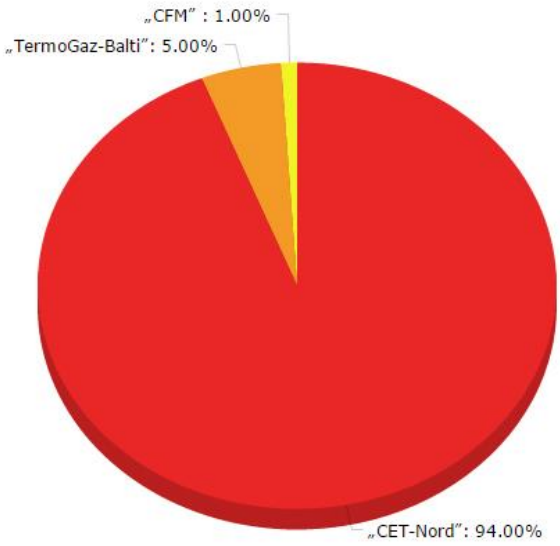

Figure 5. Heating supply ratio specified for each source

All the pipeline distribution system is based above the ground, major part of the pipeline insulation is in a very bad condition or doesn't exist at all, the average estimated heat losses are about 15% from total produced heat.

District hot water system (DHW) doesn't exist, almost all consumers which don't have autonomous gas boilers, have installed electricity boilers.

State-owned organisation "CET-Nord" JSC (North CHP - combined heat and power plant), is the main producer and supplier of heat in Balti Municipality, which covers 94% of total city heat supply needs. The company operates one of the three major CHP plants in Moldova and a coal-fired Heat Only Boiler.

Main Characteristics of the CHP: [10]

- Installed electric power- 24.0 MW
- Determined heat power- 342.0 Gcal/h
- Operation - for heating purposes
- Heating supply system – closed

In Table1 are presented characteristics of „CET-Nord" JSC district heating system grid.

Table 1. *„CET-Nord" JSC district heating system grid*

DN [mm]	**Underground length, supply and return [m]**	**Above the ground length, supply and return [m]**	**Total length, supply and return [m]**
25	16	103	119
32	—	474	474
40	260	2501	2761
50	2264	22449	24713
70	2064	17386	19450
80	2891	18487	21378
100	4282	17386	21668
125	2756	7524	10280
150	6574	12878	19452
200	8698	5654	14352
225	61	252	313
250	5570	2067	7637

[10] Cet-Nord Productive Capacity

300	8931	2687	11618
350	545	—	545
400	16958	4947	21905
500	2983	10478	13461
600	64	1000	1064
700	66	4140	4206
800	—	1210	1210

North CHP has received a €7 million loan from the European Bank for Reconstruction and Development (EBRD) to modernize district heating. With a potential investment grant of €3 million from the Eastern Europe Energy Efficiency and Environment Partnership (E5P), the total financing of €10 million will be extended to the state-owned company "CET-Nord" JSC. The company will use the financing to upgrade its district heating system, increase energy efficiency, reduce operating costs and CO2 emissions. Individual heating sub-stations will be installed in residential buildings, allowing customers to control heat supply and reduce energy waste. In addition, three energy-efficient combined heat and power generation plants will be installed. The heat generation system will be modernised to reduce losses and a coal-fired boiler will be converted to use locally sourced environmentally friendly biomass fuel. The EBRD has also partnered with the Swedish International Development Cooperation Agency (Sida) which funded a study to determine the feasibility of this investment and will provide further funds to support "CET-Nord" JSC's corporate development programme and the implementation of the project.[11]

Municipal Enterprise "Termogaz-Balti" operates from 2003. Main occupation of "Termogaz-Balti" ME is providing individuals and legal entities with thermal energy, also is involved with public utility networks, reconstruction of interior and exterior heating systems, installations of heating systems, of technological equipment; commissioning, adjustment and maintenance of objects and natural gas systems, with the gas pressure up to 0.3 MPa. On the balance of "Termogaz-Balti" ME there are 7 boilers running on natural gas. Boiler plants of municipal

[11] EBRD. News

enterprises currently supply heat: to 57 apartment buildings, 14 houses of private sector and 10 of municipal facilities, including schools and kindergartens.

In Table2 are presented characteristics of „TermoGaz-Balti" ME district heating system grid.

Table 2. *„TermoGaz-Balti" ME district heating system grid.*

DN [mm]	Underground length, supply and return [m]	Above the ground length, supply and return [m]	Total length, supply and return [m]
32	—	214	214
40	356	685	1041
50	842	1589	2431
70	270	1016	1286
80	866	601	1467
100	518	100	618
125	360	—	360
150	1906	1894	3800

"CFM" is a state enterprise of the railway transport. "CFM" owns CHP plant that serves needs of the one small residential estate of the Balti Municipality, and loco depot of the State Railway. In the following Table3, it is presented characteristics of „CFM" district heating system grid.

Table 3. *„CFM" district heating system grid*

DN [mm]	Underground length, supply and return [m]	Above the ground length, supply and return [m]	Total length, supply and return [m]
25	—	99	99
32	16	224	240
40	42	367	409
50	71	1056	1127
70	106	126	232
80	11	277	288
100	198	1472	1670
150	—	616	616
200	34	32	66
250	123	731	854
300	—	73	73

The total length and diameters of district heating network system of Balti Municipality is presented in the following Table 4.

Table 4. *The total length and diameters of district heating network system of Balti Municipality*

DN, [mm]	Total length, supply and return, [m]
25	218
32	928
40	4211
50	28271
70	20968
80	23133
100	23956
125	10640
150	23868
200	14418
225	313
250	8491
300	11691
350	545
400	21905
500	13461
600	1064
700	4206
800	1210

B1.2 District heating vision for the future

Balti is an industrial city with a lot of factories. At present, each factory has its own heating source, but most of the pipeline distribution system remained from the past district heating,

which actually leads to a lot of energy losses and to a high cost of thermal energy to final consumer.

The next solutions have been defined after the real situation analysis:

- **Replacement of district heating distribution system.**

The primary target is to reduce the energy losses through the district heating distribution system. The energy losses through distribution system are estimated at 15%. First step to be done is to minimize heating needs of the final consumer. (for more information, please see Chapter Buildings) Therefore, the existing old pipes with poor insulation, which are mostly placed above the ground, should be removed on new, well insulated pipes in underground concrete conduit channels, placed under the roads.

Technical characteristics of the distribution pipes and their insulation should correspond, at least, to the following: for distribution pipes should be used electric-welded pipes of high quality steel (type 20) with three layers of protective coating based on extruded polyethylene or polypropylene. Insulation should be from polyurethane covered with polyethylene, with thermal conductivity not more than λ=0,038W/mK at 100°C. In thermal insulation should be installed line remote control for permanent monitoring of the leakages.

The total length, diameters and prices for reconstructed heating network system of Balti Municipality is presented in the following Table 5.

Table 5. *The total length, diameters and prices for reconstructed heating network system of Balti Municipality*

Pipe DN, [mm]	Polyurethane diameter [mm]	Total length, supply and return, [m]	Insulated pipe price [euro/m]	Concrete conduit channel price [euro/0,5·m]	Total price without labour and VAT [euro]
25	110	218	7	11	3924
32	110	928	8	11	17632
40	110	4211	8	11	80009
50	125	28271	9	11	565420
70	140	20968	11	11	461296
80	160	23133	12	12	555192

100	180	23956	14	12	622856
125	225	10640	20	12	340480
150	250	23868	25	12	883116
200	315	14418	33	12	648810
225	400	313	46	25	22223
250	400	8491	63	25	747208
300	450	11691	75	26	1180791
350	450	545	90	26	63220
400	560	21905	112	35	3220035
500	710	13461	157	44	2705661
600	800	1064	243	44	305368
700	900	4206	318	44	1522572
800	1000	1210	374	46	508200

Calculation of estimative investments:

Description	**Euro**
Total estimated price for materials	14.454.000,00
Total estimated price for labour including hard digging works and evacuation of remaining (35%)	5.059.000,00
Total estimated price for materials and labour	19.513.000,00
VAT (20%)	3.903.000,00
Total estimated price for materials and labour, for a complete and functional system for Balti Municipality	23.416.000,00

- **Installation of individual heating plants with automatic control in buildings**

In each building will be installed individual heating plant with automatic control which will be connected directly to the district heating system. This measure will exclude overheating, and will provide distribution of heat agent according to the demand.

Summarized table:

Target and Measure	**Period of investment**	**Description**	**Euro**	**Calculated reduction of energy consumption [MWh/year]**	**Calculated CO_2 emission reduction [tonnes/year]**
T.1_M.1	Short term	Replacement of	1.053.700,00	881	111,89

	investment	district heating distribution system *(for district №9)*			
T.1_M.2	Long term investment	Replacement of district heating distribution system for Balti Municipality *(except district №9)*	22.362.300,00	17865	2268,85
T.1_M.3	Short term investment	Installation of individual heating plants with automatic control in buildings *(for district №9)*	670.000,00	550,6	69,92
T.1_M.4	Long term investment	Installation of individual heating plants with automatic control in buildings *(except district №9)*	7.410.000,00	11165,3	1418,00

Note: The calculation of expected CO2 emissions reduction is based on the methodology presented in chapter 3.5.1, of Part II "Baseline emissions inventory" for combined CHP. The calculated emission factor for heating is 0,127 [t·CO_2/MWh].

B2. Electricity grid

B2.1 Electricity grid current framework

"RED-Nord" JSC is a state owned enterprise that provides electricity transmission services in Balti Municipality. The company manages the security of the power system, in real time, and co-ordinates the supply of and demand for electricity, in a manner that avoids fluctuations in frequency or interruptions of supply. The company was founded in 1997 and is based in Balti. Currently the

company has 10 branches, including 9 of electricity (Rezina, Soldanesti, Floresti, Sangerei, Falesti, Glodeni, Riscani, Ungheni and Balti) and one branch for electrical equipment repair.[12]

Electricity grid actual data for Balti Municipality is presented in the table below:

Table 6 *Electricity grid actual data for Balti Municipality*

№	Indicator	Measure unit	Data from 2015
1	Length of electricity grid till 10kV	km	272,9
	Length of electricity grid 0,4kV	km	199,9
2	The total amount of electricity sent to grid	MWh/year	181984
3	Electricity losses in grid	MWh/year	13157,44
		%	7,23

B2.2 Electricity grid vision for the future

The Electricity sector involves the generation, transmission, and distribution of electricity. The electricity sector is the largest source of GHG emissions globally, due mainly to carbon dioxide (CO2) released from the combustion of fossil fuels for the production and supply of electricity. Mostly, the electricity grid is in good condition, it can be seen from electricity actual losses in the grid. After the real situation analysis the following solutions have been defined:

- Placing the grid in underground concrete conduit channels, under the roads, thus unauthorized connections to the electricity grid can be excluded, and lifetime period of the grid, by excluding deterioration caused by weather and environment, will be improved.

Description	Euro
Total estimated price for materials	5.203.000,00
Total estimated price for labour including hard digging works and evacuation of remaining (35%)	1.821.050,00
Total estimated price for materials and labour	7.024.050,00
VAT (20%)	1.404.810,00
Total estimated price for materials and labour, for a complete and functional system	8.428.860,00

[12] "RED-Nord" JSC

- **Creation of wind farm**

Renewable energy sources are believed to reduce drastically GHG emissions. This measure implies that the wind farms creation will cover all electricity needs of the Balti Municipality.

Average annual wind speed in Balti Municipality, at 80 meters height is 11m/s. The creation of a wind farm with total installed power of 45MWh is foreseen. The wind farm will include 15 wind turbines, with generator size of 3MWh each and 90m hub height.

Annual production of electricity is expected to be 210240MWh/year.

Summarized table:

Target and Measure	Period of investment	Description	Euro	Calculated reduction of energy consumption [MWh/year]	Calculated CO_2 emission reduction [tonnes/year]
T.2_M.1	Short term investment	Placing the electricity grid in underground concrete conduit channels *(for district №9)*	380.000,00	128,3	83,78
T.2_M.2	Long term investment	Placing the electricity grid in underground concrete conduit channels for Balti Municipality *(except district №9)*	8.048.860,00	2729,8	1782,56
T.2_M.3	Long term investment	Wind farm creation	127.500.000,00	210240	137286,7

Note: The calculation of expected CO2 emissions reduction is based on the methodology presented in chapter 3.4.4, of Part II "Baseline emissions inventory" and according to National IPCC emission factor for electricity based on JRC report, 2014. The calculated emission factor for electricity is 0,653 [t·CO_2/MWh].

B3. Transport

B3.1 Transport current framework

As it was mentioned before Balti is a major transportation, cultural and economical hub. The main traffic goes through the roads round the city (M14, R13, R14, R15), and through the city itself (Str. Stefan cel Mare, Iorga, Decebal).

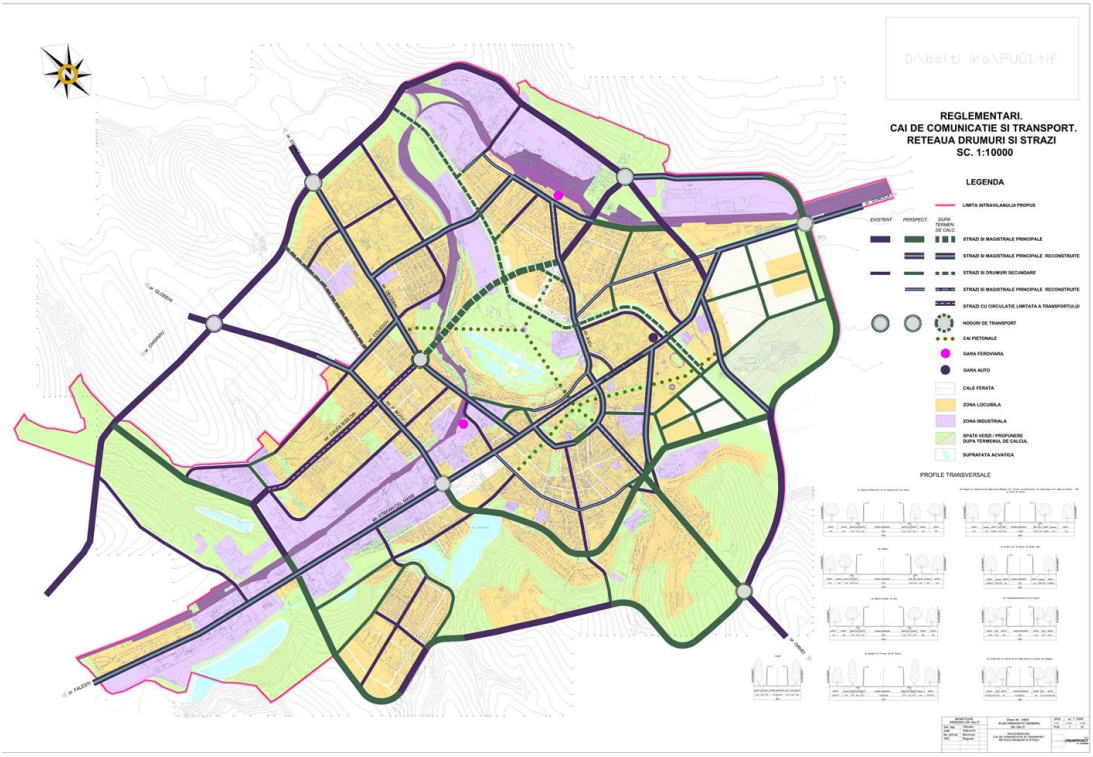

Figure 6. Map of the Balti Transportation Network.

Buses

The Balti city has Inter-City Bus Stations that provide regular bus connections to almost any city and village in Moldova, as well as numerous European and international connections.

For public use there are such means of transportation as busses, minibuses, trolleybuses, and taxis. Balti "Bus Depot" JSC has in total 101 busses (17 busses with busload 40 and more passengers, 59 busses with busload up to 40 passengers, and 25 minibuses with busload up to 25 passengers). In the whole, operating life of the transport unit expired as a result emissions do not meet requirements of the normative base.

Trolleybuses

Balti trolleybus management was formed in 1972, it was reorganised in 1992 into “Balti Trolleybus” Municipal Enterprise. In total there are four trolleybus lines, and all of them intersect the downtown. The operational length of trolleybus lines is 38km. Trolleybus depot counts 30 trolleybuses, 23 of which are newly procured through the loan from the European Bank for Reconstruction and Development (EBRD) and a grant from the European Union. The purchase of the new vehicles is part of an EBRD and EU project to modernize public transportation in Balti for which the EBRD has provided a €3 million loan and the EU contributed a €1.6 million capital expenditure grant from its

Railway

There are two railway stations in the city. The main one is the north station (Gara de Nord also called Balti-Slobozia); the other, subcentral, south station (Gara de Sud Nord also labeled on tickets as Balti Orash - meaning Balti Town).

Railway is presented by the sole railway operator in the Republic of Moldova, “CFM” State Enterprise. "CFM" SE is responsible for passenger and cargo transportation, as well as railway infrastructure maintenance within the country. The total length of the network managed by "CFM" SE (as of 2009) is 1232km. [13]

The entire network is single track and is not electrified. There are regular rail connection to Ocnita (north), Rezina (east) and Ungheni (south-east), as well as to Chisinau. There are two railroad stations: Balti-City Station and Balti –Slobozia Station, both serve internal and international traffic. Annually cross-town pass 7665 trains.

Most of the rolling stock used by "CFM" SE was manufactured during Soviet times. The most widespread type of traction unit is Soviet-built triple section 3TE10M (sometimes only 1 or 2 sections are used). Other popular types of locomotives are M62 and 2TE10L.

Table 7 *Land transport registered in Balti Municipality*

Vehicle type	**Units**	**%**
Cars	27216	69,2
Trucks	9561	24,3

[13] Railway of Moldova. Retrieved April 9,2009

Tractors	360	0,9
Motorcycles	870	2,2
Buses	1346	3,4
Total	**39353**	**100%**

Airport

Blati city also has two operational airports Balti International Airport and Balti-City Airport.

Balti International Airport, also known as Balti-Leadoveni International Airport is located 15km north of the city center (near the village Corlateni), and represents the second largest airport of Moldova, servicing cargo and charter passengers flights. Balti International Airport can be easily accessed by car, exiting Balti in the northern direction.

Balti International Airport was built in 1980 since then it became the most important airport in the north of Moldova. Balti International Airport used to be a home base for Tu-134 and Tu-154 passenger jets, and different modifications of Antonov jets have used the runway for cargo.

Balti International Airport is officially certified, but as of October 2007, it does not operate regular passenger flights. Currently is closed for runway reconstruction, but can operate both charter passenger and cargo flights, even large aircraft can land.

Runway Detail: [14]

Runway Length	2.240 meters (can be extended up to 500 meters)
Runway Width	42 meters
ILS (Instrument Landing System)	Yes
PCN (Pavement Classification Number)	016 RAWT
Surface / Pavement	Concrete

PCN details:

PCN-Value	16
Pavement class	[R] Rigid Pavement
Subgrade class	[A] High Strength
Tyre pressure class	[W] High Pressure (no limit)

[14] Information on airports worldwide

Evaluation	[T] Technical Evaluation

Balti International Airport could be internationally important, as the nearest airports in Romania (Iasi) and Ukraine (Chernovtsy) and especially in Moldova (Chisinau) are competitive and economically viable only because of credit subventions and strong state protectionism. Balti International Airport could be a first hub for low-cost airlines in Moldova and in the whole Southeast Europe region. Important development perspectives also appear in the cargo field, which would generate economic growth for the whole northern region of Moldova, but even possibly for the neighbouring regions of Ukraine and Romania.[15]

A second airport, Balti-City Airport (a regional airport) is located on the Eastern outskirts of the city and is used for small aircrafts. Currently Balti-City Airport and its heliport are used for municipal and regional public service needs, agriculture, emergency service and pilot training.

Air transport is specified in Table 8 below:

Table 8. *Air transport*

Aircraft type	**Units**
Planes	1
Helicopters	6

Summary on fuel consumption in Balti Municipality

In Table 9 is presented the data regarding the fuel consumption in Municipality of Balti received from Balti Ecology Agency.

Table 9. *Fuel consumption in Municipality of Balti*

Transport type	**Fuel type**	**Annual consumption [tons per year]**
Vehicles	Petrol	5739,2
	Diesel	10005,6
	Liquefied Petroleum Gas	4666,5
	Compressed Natural Gas	1701,3
Trains	Petrol	1442,7

[15] Wikipedia, Balti International Airport

Aircrafts	Diesel	80,0

B3.2 Transport vision for the future

Transport plays an important role in everyday live by providing access to different destinations while creating the conditions to support economic growth. The transport sector, in fact, is one of the fastest growing sectors among all emissions sources. Considering these dynamics, the role of the transport sector in achieving climate change and sustainable development action is fundamental.

As one of the severe CO_2 emissions is accounted for by transport sector, among of priorities should be the adoption of technologies and practices that are cost-effective, by doing so, sustainable gains can be achieved. Thus opportunities may be achieved by implementing the measures described below:

- **Through vehicles electrification.**

This measure implies creation of Municipal bus fleet. Therefore 30 via plug in hybrid buses purchase, and construction of electric vehicle charging station is foreseen.

The estimated investments for 30 units of hybrid buses is €3 million.

The estimated investment for construction of an electric vehicle charging station is €36 thousands.

- **Through implementation of cycling infrastructure.**

Cycling has number of benefits such as health (a convenient and practical way to combine regular exercise into busy days.); environmental (uses minimal fossil fuels and is a pollution-free mode of transport); economic and social (bicycles are more affordable to run and by); bikes do less damage to road surfaces than cars.

Plans call for the construction of bicycle parking's at train stations, at bus terminals to facilitate a combination of cycling and public transport, and near administrative buildings.

Heavy traffic flow is responsible for low car speed (around 15-20km), that also results in traffic jams thus creating a difficulty in finding a car parking slot during daytime. By creating cycling infrastructure (please also see chapter roads and traffic management), use of bicycles becomes more reasonable.

- **Through smart parking implementation**

City parking lots is an enormous issue that affects everyone through environmental impact, and quality of life. Smart parking can be considered a foundation for smart cities. Through implementation of smart parking, emissions can be reduced due to reduction of time spent in search of a parking lot. Smart parking represents an automatic controlled construction for 12 car parking spaces, which occupies just 2 parking spaces on the ground.

Within the pilot project of District Nr.9, the installation of 4 smart parking boxes is foreseen; also 80 more smart parking boxes for the entire city.

Summarized table:

Target and Measure	Period of investment	Description	Euro	Calculated reduction of energy consumption [MWh/year]	Calculated CO_2 emission reduction [tonnes/year]
T.3_M.1	Short term investment	Vehicles electrification	3.036.000,00	119,31	31,85
T.3_M.2	Short term investment	Implementation of cycling infrastructure. *(please also see chapter roads and traffic management)*	8.000,00	5526,61	1446,72
T.3_M.3	Short term investment	Smart parking *(for district №9)*	1.325.760,00	28,03	6,98
T.3_M.4	Long term investment	Smart parking for Balti Municipality *(except district №9)*	26.515.200	560,64	139,56

Note: The calculation of expected CO2 emissions reduction is based on standard methodology presented in Part II "Baseline emissions inventory". The emission factor for petrol is 0,249 [t·CO_2/MWh] and diesel is 0,267 [t·CO_2/MWh], (from IPCC, 2006). Conversion factor for petrol is 9,2 [kWh/l] and diesel is 10,0 [kWh/l], (from EMEP/EEA 2009; IPCC, 2006).

B4. Roads

B4.1 Roads current framework

From 2011 “DRSU Balti” Municipal Enterprise, executes operational control of municipal roads, repair, modernization, development and exploitation of public roads for the purposes of traffic safety; operates municipal property such as bridges, roads, storm water drainage, bus stops. According to the recent data, total length of the roads in Balti municipality, with the medium width of the road – 7m, equals to 236127m.

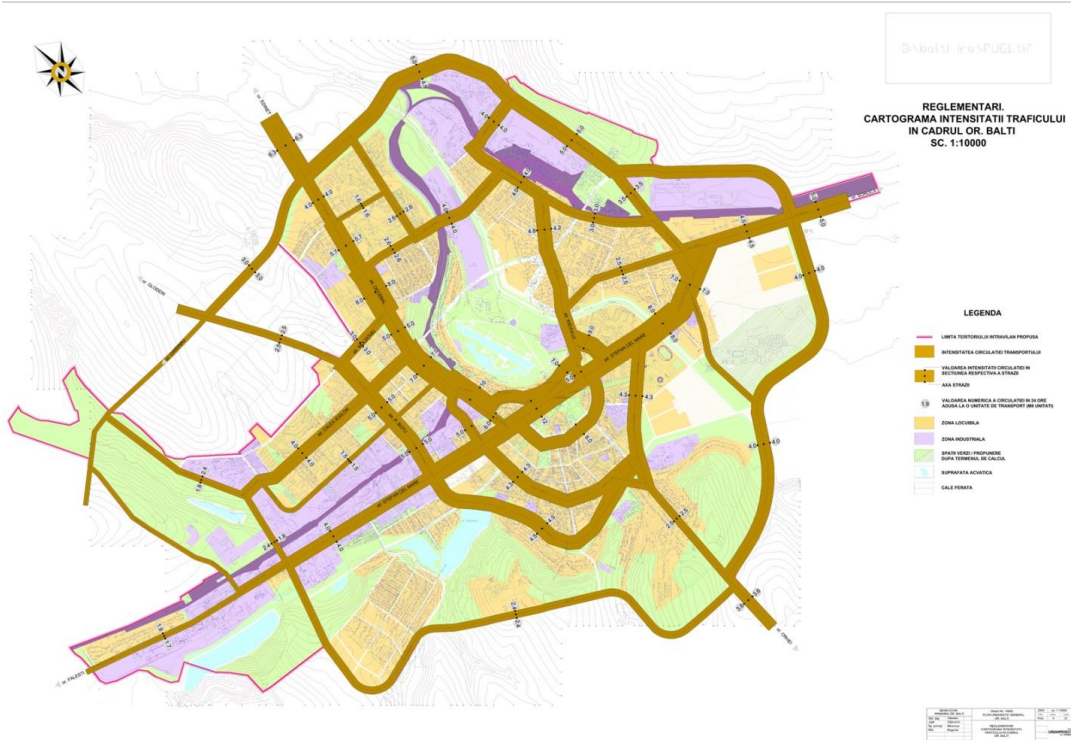

Figure 7. Map of the Balti Traffic Intensity.

B4.2 Roads vision for the future

It is planned to reconstruct all the roads in the city. The necessity of implementation of this measure is foreseen to protect other measures like replacement of engineering networks and elaboration of cycling infrastructure that comprises bicycle tracks.

It is planned to construct cycle tracks on both sides of the road with a minimum width of 1m each. Cycle lanes are supposed to be painted in green colour to indicate a separate lane for bicycles.

Summarized table:

Target and Measure	Period of investment	Description	Euro
T.4_M.1	Short term investment	Roads reconstruction *(for district №9)*	4.800.000,00
T.4_M.2	Long term investment	Roads reconstruction for Balti Municipality *(except district №9)*	185.700.000,00

B5. Lighting

B5.1 Lighting current framework

Street lighting is an essential public service that provides a safer environment during night-time for drivers, bike riders, and pedestrians. Street lighting can be considered as a protective method which provides economic and social benefits in urban areas; can increase the quality of life by artificially extending the hours in which it is light so that activity can take place. Balti Municipality has 278 km of city street lighting power lines, 85 km of which are bare aluminium wire that are placed mostly on main city streets.

Light Emitting Diode (LED) technology for street lighting is a foundational solution that helps to enhance quality of life, and improve infrastructure in an efficient and cost-effective manner. Thus within the framework of the modernization of street lighting system and energy saving program, the budget funds, road traffic safety, improving living standards and citizen's safety in the Balti municipality, 7000 energy-efficient LED-street lighting where set up, and 4000 more lamps need to be replaced.

B5.2 Lighting vision for the future

Main objective consists in replacement of existing inefficient lanterns for street lighting (4000 items) and implementation of pedestrian lighting (320 units) with the efficient Light Emitting Diode (LED) bulbs.

Summarized table:

Target and Measure	Period of investment	Description	Euro	Calculated reduction of energy	Calculated CO_2 emission reduction

				consumption [MWh/year]	[tonnes/year]
T.5_M.1	Short term investment	Implementation of pedestrian lighting in total amount of 320 units based on LED technologies *(for district №9)*.	288.000,00	111,36	71,72
T.5_M.2	Short term investment	Replacement of existing inefficient lanterns for street lighting to LED, in total amount of 4000 units.	1.400.000,00	2400	1567,2

Note: The calculation of expected CO2 emissions reduction is based on the methodology presented in chapter 3.4.4, of Part II "Baseline emissions inventory" and according to National IPCC emission factor for electricity based on JRC report, 2014. The calculated emission factor for electricity is 0,653 [t·CO_2/MWh].

B6. Traffic Management

Traffic management involves planning, monitoring and control or influencing of traffic. It aims to: maximize the effectiveness of the use of existing infrastructure; to ensure reliable and safe operation of transport; to address environmental goals; and ensure fair allocation of infrastructure space (road space, rail slots, etc.) among competing users.[16]

B6.1 Traffic management current framework

Traffic lights are important for traffic control, also for improving air quality as there is a reduction of car emissions when a vehicle travels at a steady pace. More air pollution is emitted when a vehicle is braking, stopping, or accelerating. These devices also play a role in road safety. Traffic lights also stimulate in using public transport and making bicycle and pedestrian traffic more attractive and save, as the road may be potentially life threatening to cross a busy street.

At the moment in Balti Municipality there are 274 units of traffic lights, 196 of which are LED. There are also pedestrian signals in amount of-66 units, 40 of which are LED.

[16] TRKS

B6.2 Traffic management vision for the future

With rising energy prices, energy efficient traffic lights becoming more attractive which also favours the energy supply security and tackling climate change. The financial savings from efficient traffic lights are based on the reduction of energy used and maintenance costs, relative to older models. Therefore replacement of 26 units of traffic lights for pedestrians and 78 units for car traffic is planned.

As one of the planned measure is to create cycling infrastructure, traffic lights for cycling has to be foreseen. The number of necessary traffic lights for cycling was estimated in accordance with the number of the traffic lights for cars, in total amount of 274 units based on LED technologies.

Summarized table:

Target and Measure	Period of investment	Description	Euro	Calculated reduction of energy consumption [MWh/year]	Calculated CO_2 emission reduction [tonnes/year]
T.6_M.1	Short term investment	Replacement of 104 traffic lights to LED.	64.480,00	51,17	33,41
T.6_M.2	Long term investment	Installation of 274 traffic lights based on LED technologies for cycle lanes.	169.880,00	134,8	88,02

Note: The calculation of expected CO2 emissions reduction is based on the methodology presented in chapter 3.4.4, of Part II "Baseline emissions inventory" and according to National IPCC emission factor for electricity based on JRC report, 2014. The calculated emission factor for electricity is 0,653 [t·CO_2/MWh].

B7. Buildings

B7.1 Buildings current framework

In Balti municipality, buildings contribute to a considerable share of the energy consumption. Building sector includes municipal, residential, industrial and other commercial buildings (offices, shops, hotels, etc.). The total fund of residential sector in Balti municipality counts 808 buildings, including 187 units that are in inventory of privatized apartments owners association (total number of associations - 106), the rest 621 are in inventory of municipality. The residential sector mostly consists of 3 - 5 storied buildings, constructed from limestone, without

thermal insulation. There are also several 9 -storied buildings (type series M - 90 and M - 92) from concrete panels without thermal insulation. Residential sector is in a good condition without any structural defects, that means that the energy efficiency measures can be implemented.

B7.2 Buildings vision for the future

Buildings are critical in the move to a low carbon economy. The average U value for existing walls and roofs is 1,4÷1,7[W/m^{2}K], for windows U=2,8÷3,2[W/m^{2}K]. Primarily greenhouse gas emissions from this sector comes from heating.

The next solutions have been defined after the real situation analysis:

- **Insulation of buildings envelope, replacement of windows and doors.**

Before applying measures for replacement of district heating network, heat demand has to be reduced. Thus insulation of envelope, replacement of windows and doors is foreseen for residential and public buildings.

The insulation of walls has to be done with Rockwool of 100mm thickness and λ=0,044[W/mK] with a density at least of 75[kg/m^3] according to SM SR EN 1602 or better.

Insulation of roof has to be done with extruded polystyrene (XPS) of 100mm thickness and λ=0,035[W/mK] with a density at least of 300[kg/m^3] according to SM SR EN 1602, covered with concrete metal framed tie and water proofing layer from bituminous materials.

Replacement of existing windows and doors to windows and doors with non-recyclable PVC frame, with 7 cameras, reinforced metal U type frame of 1,2mm thickness covered with plastic layer, without thermal bridges. Double glazed low emissivity (Low-e) windows 4-20-4 [mm].

U-value for windows has to be maximum 1,4[W/m^{2}K], and for doors maximum U=1,8[W/m^{2}K].

The selected materials and their technical characteristics are based on good engineering practices, and are in-line with local normative documentation.

- **Installation of photovoltaic panels on the roofs of public buildings.**

It is planned to install photovoltaic panels on the roofs of kindergartens and schools. Considering the fact that there a lot of available space around these buildings and their roof types (flat roof), there is a possibility to install photovoltaic panels with maximum packing density. Electricity will be delivered directly into the grid.

Summarized table:

Target and Measure	Period of investment	Description	Euro	Calculated reduction of energy consumption [MWh/year]	Calculated CO_2 emission reduction [tonnes/year]
T.7_M.1	Short term investment	Insulation of buildings envelope, replacement of windows and doors *(for district №9)*.	5.650.000,00	7789,5	989,26
T.7_M.2	Short term investment	Installation of photovoltaic panels on the roofs of public buildings *(for district №9)*.	1.200.000,00	648	423,14
T.7_M.3	Long term investment	Insulation of buildings envelope, replacement of windows and doors for Balti Municipality *(except district №9)*.	119.900.000	165310,5	20994,43
T.7_M.4	Long term investment	Installation of photovoltaic panels on the roofs of public buildings for Balti Municipality *(except district №9)*.	21.300.000,00	11520	7522,56

Note: The calculation of expected CO2 emissions reduction is based on the methodology presented in chapter 3.4.4 and 3.5.1, of Part II "Baseline emissions inventory" for combined CHP and according to National IPCC emission factor for electricity based on JRC report, 2014. The calculated emission factor for electricity is 0,653 [t·CO_2/MWh]. The calculated emission factor for heating is 0,127 [t·CO_2/MWh].

B8. Greening/Landscaping

B8.1 Greening/Landscaping current framework

Urban greening and landscaping plays an important role in reducing CO2 emissions, as vegetation in urban green space can absorb CO2 in the atmosphere through photosynthesis. Thus cities need as much green infrastructure as possible, it creates oxygen, sequesters carbon, and improves mental health and well-being.

Green spaces in Balti municipality are managed by the state enterprise Balti Forestry Agency that is subordinated to Agency "Moldsilva"- the central public administration body on state policy in forestry and hunting in the country. Agency "Moldsilva" is subordinated directly to the Government of the Republic of Moldova and performs its activity according to Governmental decision Nr.150 from 02.03.2010.[17]

Figure 8. Urban Greening map of the Balti

Balti Forestry Agency SE manages of 979 hectares of parks, places of recreation, out of which 497 hectares are available within the city area. On each hectare are growing 4500 trees and shrubs. Within the Balti city boundaries there are about 250 000 trees. The main types of planted trees are: poplar, birch, oak, chestnut, maple, and various fruit trees.

[17] HOTĂRÎRE Nr. 150 din 02.03.2010

B8.2 Greening/Landscaping vision for the future

Urban green space plays a key role in regulating the global carbon cycle and reducing atmospheric CO2. This measure implies site improvement by laying the lawn. By implementing this measure a number of goals can be achieved:

- Absorbs CO_2 emission, in average 1 square meter of lawn absorbs 3,48kg of CO2 per year;
- Reflect hit thereby creating a lower ambient temperature;
- Improves quality of life.

Summarized table:

Target and Measure	Period of investment	Description	Euro	Calculated reduction of energy consumption [MWh/year]	Calculated CO_2 emission reduction [tonnes/year]
T.8_M.1	Short term investment	Greening and landscaping *(for district №9)*.	516.500,00	–	261
T.8_M.2	Long term investment	Greening and landscaping for Balti Municipality *(except district №9)*.	10.960.000,00	–	5277,5

B9. Water

B9.1 Water current framework

Dniester River is a drinking water source for Balti Municipality. Water supply is performed through water line "Soroca-Balti". Municipal Enterprise Agency "Apa - Canal Balti" provide Balti municipality with drinking water through27 pumping stations including 83 running pumps. The quality of water corresponds to normative requirements. The pipeline distribution system has an excessive wear which leads to frequent leakages, damaging roads and other engineering infrastructure.

The length and diameters of existing water pipeline distribution system are presented in Table 10.below:

Table 10. *The length and diameters of existing water pipeline distribution system*

DN, [mm]	Length [m]
25	584
50	27161
63	174
65	671
80	1271
100	45985
110	5111
140	1589
150	40249
160	3773
200	22003
225	1132
250	10885
300	20543
315	12139
350	3917
400	16729
500	17861
600	7905
800	11591
900	1825
1000	1510

B9.2 Water vision for the future

By replacing the old water distribution pipe system, which level of deterioration is almost everywhere more than 100%, we can avoid leakages and save at least 5% of total pumped water from the station. Pipe distribution system will be installed in underground concrete conduit channels, placed under the roads.

The pipe should be polyethylene type covered with protective coat to exclude mechanical deformation, PN 16.

The total length, diameters and prices for reconstructed water distribution system of Balti Municipality is presented in the following Table 11.

Table 11. *The total length, diameters and prices for reconstructed water distribution system of Balti Municipality*

DN, [mm]	Length [m]	Pipe price [euro/m]	Concrete conduit channel price [euro/m]	Total price without labour and VAT [euro]
25	584	2	11	7592
50	27161	3	11	380254
63	174	3	11	2436
65	671	3	11	9394
80	1271	4	12	20336
100	45985	8	12	919700
110	5111	10	12	112442
140	1589	13	12	39725
150	40249	15	12	1086723
160	3773	16	12	105644
200	22003	26	12	836114
225	1132	33	25	65656
250	10885	41	25	718410
300	20543	51	26	1581811
315	12139	63	26	1080371
350	3917	81	26	419119
400	16729	102	35	2291873
500	17861	159	44	3625783
600	7905	258	44	2387310
800	11591	416	46	5355042
900	1825	526	52	1054850
1000	1510	649	54	1061530

After replacing the old water distribution pipe system, it is expected to exclude leakages through distribution system. The estimated losses through the distribution system are 320.000m³ of water per year.

Taking into account the fact that there is no calculation methodology of carbon emissions reduction during flow attenuation, the calculation of carbon emissions reduction is done based on saved energy during water supply process.

According to Government Decision Nr.164 "Methodology determination, approval and application of tariffs for public water supply, sewage and wastewater treatment" from 29.11.2004,[18] consumed electricity in process of water supply for water losses in distribution system is 936,56MWH/year.

Calculation of estimative investments:

Description	Euro
Total estimated price for materials	23.162.115,00
Total estimated price for labour including hard digging works and evacuation of remaining's (35%)	8.106.740,00
Total estimated price for materials and labour	31.268.855,00
VAT (20%)	6.253.771,00
Total estimated price for materials and labour, for a complete and functional system	37.522.626,00

Summarized table:

Target and Measure	Period of investment	Description	Euro	Calculated reduction of energy consumption [MWh/year]	Calculated CO_2 emission reduction [tonnes/year]
T.9_M.1	Short term investment	Replacement of water distribution pipe system in underground concrete conduit channels *(for district №9)*	1.688.500,00	44,13	28,82
T.9_M.2	Long term investment	Replacement of water distribution pipe system in underground concrete conduit	35.834.126,00	892,43	582,75

[18] ANREC164/2004

		channels for Balti Municipality *(except district №9)*			

Note: The calculation of expected CO2 emissions reduction is based on the methodology presented in chapter 3.4.4, of Part II "Baseline emissions inventory" and according to National IPCC emission factor for electricity based on JRC report, 2014. The calculated emission factor for electricity is 0,653 [t·CO_2/MWh].

B10. Waste Water

B10.1 Waste Water current framework

Republic of Moldova inherited a well-developed network of water infrastructure from the Soviet period. Balti Treatment Engineering has started in 1964. The construction was carried out in two stages: in 1970- primary treatment was put in commission; in 1977 - biological treatment was put in commission. Balti Municipality waste water treatment plant operates with an anaerobic digestion, plant system consists of six pumping stations and pressure manifold with a total length of 5.9 km. [19]

Wastewater treatment plant is operated by LLC «Glorin Inginering» as from 01.12.2013 and according to the contract of concession, specializes in the exploitation and development of the wastewater treatment plants in Balti city. In 2014 LLC «Glorin Inginering» carried out such modifications as: secondary settling basin and, three pumping stations were totally repaired.

Average annual processed volume is about 438000 tones, of which 97% is water and 3% is sludge. Its operating lifetime expired years ago, and sediment collectors are in a very poor condition. Waste water treatment plant in Balti has its own laboratory that helps to conduct the monitoring of wastewater.

The wastewater pipeline system has an excessive wear.

The length and diameters of existing wastewater pipeline distribution system are presented in Table 12. below:

Table 12. *The length and diameters of existing wastewater pipeline distribution system*

DN, [mm]	Length [m]
76	105

[19] Gloring Inginering

100	6633
140	4568
150	29338
160	3046
200	31072
250	13532
300	13704
315	31
350	2348
400	18322
500	12224
600	4922
700	1122
800	8334
1000	4797
1200	1002
1500	1142
1600	1564

B10.2 Waste Water vision for the future

The next solutions have been defined after the real situation analysis:

- **Replacement of wastewater pipe system.**

By replacing the old wastewater pipe system, which lifetime has already exceeded, we will avoid regular leakages. This measure doesn't directly lead to CO_2 emissions reduction, its major purpose is to protect other measures. Pipe system and collectors will be installed in underground concrete conduit channels, placed under the roads.

The pipes should be polyethylene reinforced multilayered, selected in accordance with requirements (pressure or non-pressure networks).

The total length, diameters and prices for reconstructed water distribution system of Balti Municipality is presented in the following Table 13.

Table 13. *The total length, diameters and prices for reconstructed water distribution system of Balti Municipality*

DN, [mm]	Length [m]	Pipe price [euro/m]	Concrete conduit channel price [euro/m]	Total price without labour and VAT [euro]
76	105	2	12	1470
100	6633	2	12	92862
140	4568	3	12	68520
150	29338	3	12	440070
160	3046	5	12	51782
200	31072	7	12	590368
250	13532	12	25	500684
300	13704	18	26	602976
315	31	19	26	1395
350	2348	22	26	112704
400	18322	28	35	1154286
500	12224	42	44	1051264
600	4922	58	44	502044
700	1122	105	46	169422
800	8334	158	46	1700136
1000	4797	211	54	1271205
1200	1002	256	58	314628
1500	1142	445	72	590414
1600	1564	450	74	819536

Calculation of estimative investments in wastewater network:

Description	Euro
Total estimated price for materials	10.035.766,00
Total estimated price for labour including hard digging works and evacuation of remains (35%)	3.512.518,00
Total estimated price for materials and labour	13.548.284,00
VAT (20%)	2.709.657,00
Total estimated price for materials and labour, for a complete and functional system	16.257.941,00

- **Construction of biogas production plant based on sludge and organic waste.**

This measure has to be applied together with "Construction of solid waste sorting plant".

In wastewater which comes from Balti Municipality, 97% is considered water and 3% is sludge. Through flotation the sludge will be separated from water and send, together with organic wastes *(please see Chapter: Solid Wastes),* into fermentation tanks, where the biogas will be produced. Production of biogas from sludge and organic wastes is called Duplex system. Produced biogas will be burned to produce electricity, which will be sold directly into the electricity grid.

On the average the Duplex system stations produces 9kWh of electricity per year, per 1 inhabitant. The expected production of electricity is 1356,3MWh/year.

Summarized table:

Target and Measure	Period of investment	Description	Euro	Calculated reduction of energy consumption [MWh/year]	Calculated CO_2 emission reduction [tonnes/year]
T.10_M.1	Short term investment	Replacement of wastewater distribution pipe system in underground concrete conduit channels *(for district №9)*	731.600,00	–	–
T.10_M.2	Short term investment	Construction of biogas production plant based on sludge and organic waste	7.500.000,00	1356,3	885,66
T.10_M.3	Long term investment	Replacement of wastewater distribution pipe system in underground concrete conduit channels for Balti Municipality *(except district №9)*	15.526.341,00	–	–

Note: The calculation of expected CO2 emissions reduction is based on the methodology presented in chapter 3.4.4, of Part II "Baseline emissions inventory" and according to National IPCC emission factor for electricity based on JRC report, 2014. The calculated emission factor for electricity is 0,653 [t·CO_2/MWh].

B11. Solid Wastes

B11.1 Solid Wastes current framework

The main problems of waste management in the Balti Municipality are quite similar to those across Republic of Moldova. The most common problem is spontaneous and illegal dumps. Household waste management has an unplanned and chaotic character. Very severe is the problem of polygons overloading, also most ramps do not meet sanitary-hygienic and ecological requirements. To reduce the dump overloading, the garbage is constantly ignited, that contradicts all applicable environmental regulations.

B11.2 Solid Wastes vision for the future

Based on actual situation of solid wastes in Balti Municipality, it was decided, to create an Integrated Solid Wastes Management Centre, which will consist of:

- Solid waste sorting plant;
- Electrical waste shredding plant;
- Bio-hazardous medical waste treatment plant.

Through the implementation of Solid Wastes Management Centre, the next targets will be achieved:

- recovery and recycling of materials
- removal of Bio-hazardous waste from dumps
- reduction of the overall amount of waste to be deposited, which will improve the lifetime of the landfill.

Summarized table:

Target and Measure	Period of investment	Description	Euro	Calculated reduction of energy consumption [MWh/year]	Calculated CO_2 emission reduction [tonnes/year]

T.11_M.1	Short term investment	Creation of Integrated Solid Wastes Management Center *(for Balti Municipality)*.	1.643.000,00	–	22610

Note: The calculation of expected CO2 emissions reduction is based on the IPCC methodology "EMISSIONS FROM WASTE INCINERATION". http://www.ipcc-nggip.iges.or.jp/public/gp/bgp/5_3_Waste_Incineration.pdf

B12. Implementation of techniques and methods for CO2 reduction and monitoring

At the moment, Balti Municipality doesn't keep records regarding CO_2 emissions. There are several methods to collect data regarding CO_2 emissions in the territory, but the most precise is measurement.

Direct measurement of CO2 emissions has to be done, before and after the implementation of the measures to estimate the impact, in the same parts of the city, on the same height and in the same day time, year.

After obtaining the measured data with the real impact, it will be compared with the calculated emissions reduction SECAP, in order to establish future strategy.

Also a properly designed sensors network with storage and processing of real-time data will be installed. The collected data has to be analyzed, and based on results specific actions have to be taken according to recommendations which will be specified in a "Guideline of CO2 reduction in case of subsequent growth". The collected data (MEI) will be attached to the implementation report.

Summarized table:

Target and Measure	Period of investment	Description	Euro	Calculated reduction of energy consumption [MWh/year]	Calculated CO_2 emission reduction [tonnes/year]
T.12_M.1	Short term investment	Measurement of CO2 emissions before and after the measures to	1.000,00	–	–

		estimate the impact *(for district №9)*			
T.12_M.2	Short term investment	Installation of CO2 sensors and monitoring system with data storage *(for district №9)*	280.000,00	–	–
T.12_M.3	Short term investment	Guideline Development of CO2 reduction in case of subsequent growth *(for Balti Municipality)*	2.000,00	–	–
T.12_M.4	Long term investment	Measurement of CO2 emissions before and after the measures to estimate the impact for Balti Municipality *(except district №9)*	21.200,00	–	–
T.12_M.5	Long term investment	Installation of CO2 sensors and monitoring system with data storage for Balti Municipality *(except district №9)*	5.900.000,00	–	–

C. Organisational and financial aspect

On 4 of February Balti Municipality has signed the memorandum of cooperation with NGO "Asstreia" with the aim to build a consortium and to represent Balti Municipality interests towards local and foreign financing sources. After signing the memorandum 11 experts from NGO "Asstreia" have been involved in elaboration of SECAP 2030 for Balti Municipality.

Overall estimated budget is 619.386.447,00 euro, consists of:

Short-term investment (till 2020) is 32.238.540,00 euro;

Long-term investment (till 2030) is 587.147.907,00 euro.

Several financing sources have been defined:

- Local donors: National State Budget, Local Budget of Balti Municipality, Energy Efficiency Fund, Ecological Fund.
- External donors: Sweden (SIDA), Germany (GIZ), Covenant of Mayors, Horizon 2020, USAID, International Climate Initiative (IKI).

Technical supervision of works execution will be provided by Technical Experts from Balti City Hall. NGO "Asstreia" will provide TA in submission of reports regarding the implementation and monitoring.

3. Baseline Emission Inventory

Sustainable Energy Action Plan (SEAP) template

BASELINE EMISSION INVENTORY

1) **Inventory year** 2016

For Covenant signatories who calculate their CO2 emissions per capita, please precise here the number of inhabitants during the inventory year:

Instructions

2) **Emission factors**

Please tick the corresponding box:

- [x] Standard emission factors in line with the IPCC principles
- [ ] LCA (Life Cycle Assessment) factors

Emission reporting unit

Please tick the corresponding box:

- [x] CO2 emissions
- [ ] CO2 equivalent emissions

3) **Key results of the Baseline Emission Inventory**

Green cells are compulsory fields

Grey fields are non editable

Covenant of Mayors for Climate & Energy

ASSTREIA NGO ASSOCIATION FOR APPLIED SOCIAL STUDIES

A. Final energy consumption

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

Category	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	6125	40239	15681	0	0	0	0	0	0	0	0	0	0	0	0	62045
Tertiary (non municipal) buildings, equipment/facilities	96031	17547	0	0	0	0	0	0	0	0	0	0	0	0	0	113578
Residential buildings	71153	176532	132814	0	0	0	0	0	0	0	0	0	0	0	0	380499
Municipal public lighting	2865	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2865
Industries (excluding industries involved in the EU Emission trading scheme - ETS)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal buildings, equipments/facilities and industries	176174	234318	148495	0	0	0	0	0	0	0	0	0	0	0	0	558987
TRANSPORT:																
Municipal fleet	5810	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5810
Public transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Private and commercial transport	0	0	22967	59731	0	100056	52800	0	0	0	0	0	0	0	0	235554
Subtotal transport	5810	0	22967	59731	0	100056	52800	0	0	0	0	0	0	0	0	241364
Total	**181984**	**234318**	**171462**	**59731**	**0**	**100056**	**52800**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**800351**

Municipal purchases of certified green electricity (if any) **[MWh]:**	
CO2 emission factor for certified green electricity purchases (for LCA approach)**:**	

B. CO2 or CO2 equivalent emissions

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

Category	CO2 emissions [t]/ CO2 equivalent emissions [t]															
			Fossil fuels								Renewable energies					
	Electricity	Heat/cold	Natural gas	Liquid gas	Heating Oil	Diesel	Gasoline	Lignite	Coal	Other fossil fuels	Biofuel	Plant oil	Other biomass	Solar thermal	Geothermal	Total
BUILDINGS, EQUIPMENT/FACILITIES AND INDUSTRIES:																
Municipal buildings, equipment/facilities	4000	5110	3168	0	0	0	0	0	0	0	0	0	0	0	0	12278
Tertiary (non municipal) buildings, equipement/facilities	62708	2228	0	0	0	0	0	0	0	0	0	0	0	0	0	64937
Residential buildings	46463	22420	26828	0	0	0	0	0	0	0	0	0	0	0	0	95711
Municipal public lighting	1871	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1871
Industries (excluding industries involved in the EU Emission trading scheme - ETS)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subtotal buildings, equipments/facilities and industries	115042	29758	29996	0	0	0	0	0	0	0	0	0	0	0	0	174796
TRANSPORT:																
Municipal fleet	3794	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3794
Public transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Private and commercial transport	0	0	4639	13559	0	26715	13147	0	0	0	0	0	0	0	0	58060
Subtotal transport	3794	0	4639	13559	0	26715	13147	0	0	0	0	0	0	0	0	61854
OTHER:																
Waste management																
Waste water management																
Please specify here your other emissions																
Total	118836	29758	34635	13559	0	26715	13147	0	0	0	0	0	0	0	0	236650

Corresponding CO2-emission factors in [t/MWh]	0,653	0,127	0,202	0,227	0	0,267	0,249	0	0	0	0	0	0	0	0
CO2 emission factor for electricity not produced locally [t/MWh]	0,653														

Covenant of Mayors for Climate & Energy

ASSTREIA NGO ASSOCIATION FOR APPLIED SOCIAL STUDIES

C. Local electricity production and corresponding CO2 emissions

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

Locally generated electricity (excluding ETS plants , and all plants/units > 20 MW)	Locally generated electricity [MWh]	Energy carrier input [MWh]											CO2 / CO2-eq emissions [t]	Corresponding CO2-emission factors for electricity production in [t/MWh]
		Fossil fuels					Steam	Waste	Plant oil	Other biomass	Other renewable	other		
		Natural gas	Liquid gas	Heating oil	Lignite	Coal								
Wind power	0													
Hydroelectric power	0													
Photovoltaic	0													
Combined Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0		
Other *Please specify: _____*	0	0	0	0	0	0	0	0	0	0	0	0		
Total														

D. Local heat/cold production (district heating/cooling, CHPs...) and corresponding CO2 emissions

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

Locally generated heat/cold	Locally generated heat/cold [MWh]	Energy carrier input [MWh]										CO2 / CO2-eq emissions [t]	Corresponding CO2-emission factors for heat/cold production in [t/MWh]
		Fossil fuels					Waste	Plant oil	Other biomass	Other renewable	other		
		Natural gas	Liquid gas	Heating oil	Lignite	Coal							
Combined Heat and Power	234318	0		0	0	0	0	0	0	0	0	29758	0,127
District Heating plant(s)	0	0	0	0	0	0	0	0	0	0	0	0,0	0
Other *Please specify: _____*	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	234318											29758	

4. Planned actions and measures for the full duration of the plan (2030)

№	Measure		Responsible department, person or company	Implementation [start & end time]	Estimated costs <u>per measure</u> <u>[euro]</u>	Estimated energy saving / increased renewable energy production [MWh/year]	Estimated CO2 reduction [tonnes/ year]
1	T.1_M.1	Replacement of district heating distribution system *(for district №9)*	ASSTREIA NGO	2016-2018	1.053.700,00	881	111,89
2	T.1_M.2	Replacement of district heating distribution system for Balti Municipality *(except district №9)*	ASSTREIA NGO	2020-2028	22.362.300,00	17865	2268,85
3	T.1_M.3	Installation of individual heating plants with automatic control in buildings *(for district №9)*	ASSTREIA NGO	2016-2018	670.000,00	550,6	69,92
4	T.1_M.4	Installation of individual heating plants with automatic control in buildings *(except district №9)*	ASSTREIA NGO	2020-2028	7.410.000,00	11165,3	1418,00
5	T.2_M.1	Placing the electricity grid in underground concrete conduit channels *(for district №9)*	ASSTREIA NGO	2016-2018	380.000,00	128,3	83,78

6	T.2_M.2	Placing the electricity grid in underground concrete conduit channels for Balti Municipality *(except district №9)*	ASSTREIA NGO	2020-2028	8.048.860,00	2729,8	1782,56
7	T.2_M.3	Wind farm creation	ASSTREIA NGO	2024-2030	127.500.000,00	210240	137286,7
8	T.3_M.1	Vehicles electrification	ASSTREIA NGO	2017-2019	3.036.000,00	119,31	31,85
9	T.3_M.2	Implementation of cycling infrastructure. *(please also see chapter roads and traffic management)*	ASSTREIA NGO	2018-2019	8.000,00	5526,61	1446,72
10	T.3_M.3	Smart parking *(for district №9)*	ASSTREIA NGO	2017-2019	1.325.760,00	28,03	6,98
11	T.3_M.4	Smart parking for Balti Municipality *(except district №9)*	ASSTREIA NGO	2020-2030	26.515.200,00	560,64	139,56
12	T.4_M.1	Roads reconstruction *(for district №9)*	ASSTREIA NGO	2017-2019	4.800.000,00	–	–
13	T.4_M.2	Roads reconstruction for Balti Municipality *(except district №9)*	ASSTREIA NGO	2020-2029	185.700.000,00	–	–
14	T.5_M.1	Implementation of pedestrian lighting in total amount of 320 units based on LED technologies *(for district №9)*.	ASSTREIA NGO	2017-2018	288.000,00	111,36	71,72
15	T.5_M.2	Replacement of existing inefficient lanterns for	ASSTREIA NGO	2016-2018	1.400.000,00	2400	1567,2

		street lighting to LED, in total amount of 4000 units.					
16	T.6_M.1	Replacement of 104 traffic lights to LED.	ASSTREIA NGO	2016-2018	64.480,00	51,17	33,41
17	T.6_M2	Installation of 274 traffic lights based on LED technologies for cycle lanes.	ASSTREIA NGO	2018-2030	169.880,00	134,8	88,02
18	T.7_M.1	Insulation of buildings envelope, replacement of windows and doors *(for district №9)*.	ASSTREIA NGO	2016-2018	5.650.000,00	7789,5	989,26
19	T.7_M.2	Installation of photovoltaic panels on the roofs of public buildings *(for district №9)*.	ASSTREIA NGO	2016-2018	1.200.000,00	648	423,14
20	T.7_M.3	Insulation of buildings envelope, replacement of windows and doors for Balti Municipality *(except district №9)*.	ASSTREIA NGO	2020-2028	119.900.000,00	165310,5	20994,43
21	T.7_M.4	Installation of photovoltaic panels on the roofs of public buildings for Balti Municipality *(except district №9)*.	ASSTREIA NGO	2020-2028	21.300.000,00	11520	7522,56
22	T.8_M.1	Greening and landscaping *(for district №9)*.	ASSTREIA NGO	2018-2019	516.500,00	–	261

23	T.8_M.2	Greening and landscaping for Balti Municipality *(except district №9)*.	ASSTREIA NGO	2022-2030	10.960.000,00	–	5277,5
24	T.9_M.1	Replacement of water distribution pipe system in underground concrete conduit channels *(for district №9)*	ASSTREIA NGO	2016-2018	1.688.500,00	44,13	28,82
25	T.9_M.2	Replacement of water distribution pipe system in underground concrete conduit channels for Balti Municipality *(except district №9)*	ASSTREIA NGO	2020-2028	35.834.126,00	892,43	582,75
26	T.10_M.1	Replacement of wastewater distribution pipe system in underground concrete conduit channels *(for district №9)*	ASSTREIA NGO	2016-2018	731.600,00	–	–
27	T.10_M.2	Construction of biogas production plant based on sludge and organic waste	ASSTREIA NGO	2016-2019	7.500.000,00	1356,3	885,66
28	T.10_M.3	Replacement of wastewater distribution pipe system in underground concrete conduit channels for Balti Municipality *(except district*	ASSTREIA NGO	2020-2028	15.526.341,00	–	–

		№9)					
29	T.11_M.1	Creation of Integrated Solid Wastes Management Center *(for Balti Municipality)*.	ASSTREIA NGO	2016-2019	1.643.000,00	–	22610
30	T.12_M.1	Measurement of CO2 emissions before and after the measures to estimate the impact *(for district №9)*	ASSTREIA NGO	2016-2019	1.000,00	–	–
31	T.12_M.2	Installation of CO2 sensors and monitoring system with data storage *(for district №9)*	ASSTREIA NGO	2016-2019	280.000,00	–	–
32	T.12_M.3	Guideline Development of CO2 reduction in case of subsequent growth *(for Balti Municipality)*	ASSTREIA NGO	2016-2020	2.000,00	–	–
33	T.12_M.4	Measurement of CO2 emissions before and after the measures to estimate the impact for Balti Municipality *(except district №9)*	ASSTREIA NGO	2019-2030	21.200,00	–	–
34	T.12_M.5	Installation of CO2 sensors and monitoring system with data storage for Balti Municipality *(except district №9)*	ASSTREIA NGO	2024-2030	5.900.000,00	–	–

35	Previous target	Modernization of street lightning based on LED technologies. (7 000 units)	Balti City Hall	Implemented	—	2405	1645
36	Previous target	Realization of EBRD project «Trolley busses for Beltsy», renovation of trolleybus fleet (23 trolley busses) and related infrastructure.	Balti City Hall	Implemented	—	480	328
37	Previous target	Installation ITP in medical institutions, residential buildings, schools and kindergartens (192 units)	Balti City Hall	Implemented partially (142 units installed)	—	12721	2544