УТВЕРЖДАЮ
Заместитель председателя
Рогачевского райисполкома
_____В.С.Корольчук
«__» _____ 2014 г

Energy for Eastern Mayors Project – EuropeAid Program

Sustainable Energy Action Plan

Rogachev - Voblasc of Homel Belarus

Summary

Contacts

City of: Rogachev

Name and Surname: Vasili Karalchuk

Role: Vice Mayor

Phone:

City of: Rogachev

Name and Surname: Larisa Yasenetskaia

Role: Responsible for SEAP

e-mail: lari@list.ru

City of: Rogachev

Name and Surname: Viktor Savkov

Role: Energy specialist

Phone:

Project E4EM: Assistance in the definition of SEAPs for Belarus

Name and Surname: Francesco Tinti

Role: Energy consultant

Phone: +39 (051) 2090477

e-mail: francesco.tinti@unibo.it

Project E4EM: Assistance in the definition of SEAPs for Belarus

Name and Surname: Daniel Caratti

Role: Consultant

Phone: +39 (051) 228048

e-mail: caratti@ecuba.it

Covenant of Mayors for Sustainable Local Energy

On 29th January, 2008, European Commission, General Direction TREN, launched an initiative address to Municipalities from EU member states, namely the Covenant of Mayors (CoM).

The Covenant provides a voluntary commitment of mayors directly with European Commission, to act all measures necessary to reach, at 2020, a reduction of greenhouse gas emissions (tons of equivalent CO_2) at least of 20%, in comparison with 1990 level.

One year after the Covenant signature, Municipalities must present a Sustainable Energy Action Plan (SEAP), capable to reach the ambitious goal.

Since its official launch, the Covenant has encountered an incredible success from all over EU, and since 2010 the CoM initiative has come to involve 11 Eastern Partnership and Central Asian countries in the implementation of local sustainable energy policies, among them Republic of Belarus. A specific program has been launched, named Covenant of Mayors going East (CoM-East). The specific situation that characterizes the 11 countries forced to adapt the methodology for the SEAPs preparation, by using a Business as Usual (BaU) scenario and by referring as baseline a recent year (usually 2010 or 2011), in contrast with 1990, requested by the CoM.

The Rayon of Rogachev, supported by the *Energy for Eastern Mayors* Project, decided to adhere to the Covenant of Mayors on 20th April, 2012 and developed the present Sustainable Energy Action Plan in order to act towards a sustainable development, by cutting CO_2 emissions, by improving energy efficiency objectives and by promoting the use of renewable energy. The objectives of energy efficiency and energy security are a priority for the Republic of Belarus, so that the Action Plan of Rogachev is perfectly placed in the major framework of central energy policy.

SEAP is basically made by two parts:

1. The Baseline Emission Inventory (BEI), which gives information on CO_2 emissions of the territory of the Rayon, quantifies the CO_2 quota to be cut, and focuses on the critical points and on the opportunities for a sustainable development and for the increase of the quota of renewable energy sources in the local energy mix.
2. The Action Plan, which identifies a set of actions to implement before 2020 in order to reach the targets of CO_2 reductions.

In order to effectively quantify the situation and the target in terms of CO_2, the energy consumptions must be transformed in tons of CO_2 emissions, by using the UE official conversion factors for each type of fuel.

In 2011 (the baseline year adopted), the total CO_2 emissions in Rogachev Rayon, populated by 34.700 people, were about 268.817 tons, considering also the industrial sector, which has a big part, overall for electric energy consumption. By assuming that in coming years there will not be a significant increase of population (indeed, in Belarus in recent years the tendency is to leave rural places and to move towards Minsk and other big cities), the target of CO_2 reduction is at least of 53.763 tons, which means that in 2020 the expected CO_2 emissions will be no more than 215.054 tons.

The SEAP is the key instrument for the Rogachev Rayon to reach this goal, by identifying actions in the following sectors:

- Municipal buildings;
- Tertiary buildings;
- Residential buildings;
- Industry;
- Transport;
- Renewable energy sources;
- Municipal lighting

E4EM Project – Energy for Eastern Mayors

The objective of Energy for Eastern Mayors – E4EM Project is to support Municipalities from Belarus, Moldova and Ukraine towards their way to the adoption of energy efficiency criteria and renewable energy sources. The main instrument is the adhesion to the Covenant of Mayors and the realization of the Sustainable Energy Action Plan of the area of territorial competence (Rayon) for each signatory.

Energy for Eastern Mayors Project began on January 2012 and is funded by EuropeAid Program in the framework of Covenant of Mayors going East initiative. Within the Project, up to date many initiative have been realized in three partner countries, such as workshops for CoM promotion, trainings addressed to energy managers and technicians, design and implementation of pilot actions, organization of Energy Days, support to mayors for participation in international events, (among the others: European Union Sustainable Energy Week in Brussels, High Level Covenant of Mayors Forum in Istanbul)

The coordinator of E4EM Project is University of Bologna - Department of Civil, Chemical, Environmental and Materials Engineering, from Italy.

Focusing on the specificity of Belarusian context, the local partners of E4EM are the Rogachev Rayon, in the Gomel Oblast, and the Foundation “Aiutiamoli a Vivere”, an Italian NGO with an official representative in Minsk, named “Planeta Detei”.

Official E4EM website: www.e4em.eu

Figure 1: Home page of E4EM website

Energy issues in the Republic of Belarus

Energy policy

The goal of Belarusian energy policy is to ensure a sustainable energy supply for consumers through improving the energy security of the country, maximizing the efficient use of fuel and energy resources and the potential of the fuel and energy complex and reducing the dependence on energy resources imports in parallel with using the benefits of Belarus' geopolitical position as a transit country for energy trade between Russia and the European Union.

The general goal of entire Belarusian Energy Policy is the reduction of energy intensity of GDP by 2015 of at least 50% from the 2005 level[1]. The main strategic documents that set forth the state policy on energy efficiency and energy saving are as follows:

➢ **The Program of Social and Economic Development of RB for 2011–2015** approved by Decree No. 136 of the President of Republic of Belarus, dated 11 April 2011;

It sets forth the improvement of the energy efficiency of the economy, the introduction of advanced energy efficiency technologies and the promotion of alternative energy with the increasing use of local energy sources. The main indicators of the republic's social and economic development for 2011 – 2015 include a 29%–32% reduction in the energy intensity of GDP by 2015 from the 2010 level and a reduction of at least 50% from the 2005 level.

➢ **The Directive No. 3 of the President of Republic of Belarus** (dated 14 June 2007) Saving and Thrift are the Key Factors of Economic Security of the State

It is of strategic importance for the intensification of efforts in the area of energy efficiency. It provides the basis for new energy saving programs and measures and establishes specific objectives, assignments and responsibilities.

➢ **The Concept of Energy Security of the Republic of Belarus** approved by Decree No. 433 of the President of Republic of Belarus, dated 17 September 2007;

It establishes 12 indicators, including the energy intensity of GDP using Purchasing Power Parity (PPP). The Concept sets forth the followings objectives:

- Reduction in the energy intensity of GDP: 31% in 2010, 50% in 2015 and 60% in 2020, from the 2005 level;
- Provide for an overall increase in fuel and energy saving (under comparable conditions) in 2006 -2010 of at least 7.55 Mtce (Million tons of coal equivalent) and from 2011 - 2015 of at least 7.0 Mtce.

➢ **The Strategy of Energy Potential Development in the Republic of Belarus**, approved by Resolution No. 1180 of the Council of Ministers of Republic of Belarus, dated 9 August 2010.
It is developed for the period of 2011–2015 and until 2020. The Strategy specifies the parameters and mechanisms of the medium-term development in connection with new economic conditions, while keeping the long-term guidelines of the energy policy established in the Concept and Directive No. 3 unchanged. The Strategy is aimed at achieving the following indicators:

- 50% reduction in the energy intensity of GDP (from the 2005 level) by 2015 and 60% by 2020;
- Up to 28–30% increase in the share of domestic energy resources in the boiler and furnace fuel mix in 2015 and up to 32–34% in 2020.

➢ **The National Energy Saving Program for 2011–2015** approved by Resolution No. 1882 of the Council of Ministers of RB, dated 24 December 2010;

It set forth the objective of providing for GDP growth without increasing the fuel and energy consumption; it has a goal of 50% reduction in the energy intensity of GDP from the 2005 level by 2015.

[1] *In-Depth Review of the Energy Efficiency Policy of the Republic of Belarus, Energy Charter Secretariat 2013*

➢ **The National Program of Local and Renewable Energy Sources Development for 2011– 2015** approved by Resolution No. 586 of the Council of Ministers of RB, dated 10 May 2011.

It summarizes and specifies all program documents on local fuels and Renewable Energy Sources (RES) use and set forth areas of activities and indicates the specific measures required to achieve an increase of use of local fuel and energy, including RES, which should reach 2,767 ktce by 2015.

Energy situation

Due to natural and geological conditions, Republic of Belarus cannot cover its demand for energy with domestic resources (small reserves of crude oil, biomass, mainly wood, peat, coal, associated gas and hydro energy). The country has to import fuel and energy mainly from the Russian Federation. The share of the net import of total primary fuel and energy consumption is around 85%. The mineral resources of Belarus for energy use purposes include oil, petroleum gas, peat, lignite and shale.

Oil and gas - Almost all (99%) natural gas is imported. In 2010, natural gas imports were 21.6 billion cubic meters, equal to 63% of the primary energy consumption in the country.

Belarusian oil and associated gas deposits are located in the eastern part of the Pripyat Trough. As of 2010, 75 deposits have been discovered and explored; the largest include Rechitskoye, Ostashkovichskoye and Vishanskoye. Annual oil production amounts to 1,7 - 1,8 Mt.

Peat - Belarus has over 9.000 discovered peat deposits, which contain 4 billion tons of peat, equal to 1.36 billion tons of coal equivalent (tce) The State Program Peat for 2008–2010 and until 2020 determined the economically feasible annual level of peat consumption for fuel purposes and targets for peat fuel use. The related target indicators are as follows: 1,3 Mtce in 2015 and 1,4 Mtce in 2020. In 2010, the actual consumption of peat for fuel purposes was 0,8 Mtce.

Shale - Commercial reserves of shale are concentrated in two deposits Liubanskoye and Turovskoye. 30% of these reserves have been preliminarily explored. The development of shale deposits is only possible through mining. Shale may be used for fuel purposes only after it has been thermally processed using a hard heating agent.

Lignite - The explored reserves of lignite equal 160 Mt. Lignite is used in the form of peat-and-coal briquettes produced from lignite and peat. Currently, the occurrence of Lelchitskoye lignite is being explored and its forecasted reserves are estimated to be 250 Mt.

Wood - Forests, which cover almost 40% of the territory, play a key role in the natural resources of Belarus. Forests cover more than 9,4 million hectares and reserves of standing timber are estimated to be 1,5 bcm; the annual increase in timber exceeds 30,3 million cubic meters (mcm). The potential of wood fuel and industrial wood waste is estimated to be 11,65 mcm (3,1 Mtce) per annum. The production of wood fuel resources by 2015 and 2020 is estimated to reach up to 2,81 Mtce (10,56 mcm) and 3,10 Mtce (11,65 mcm), respectively.

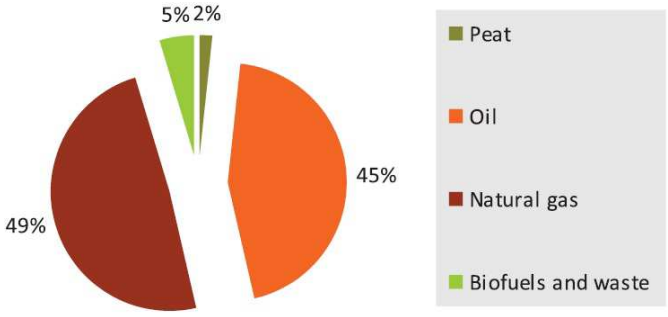

Figure 2: primary energy supply mix in Belarus in 2010[2].

[2] *International Energy Agency Statistics, 2012*

Hydro - The potential of hydro energy in Belarus is estimated to be 2.270 million kWh_e (0,64 Mtce). In 2010, there were 41 operational hydro power plants (HPPs) in the country with a total capacity of 16.1 MW_e (about 3% of the technically feasible potential), which generated 48,6 million kWh_e of electricity annually. The potential capacity of all stream flows in Belarus totals 850 MW_e, including 529 MW_e that are technically feasible and 250 MW_e that are economically feasible

Wind - By 2013, three wind factories are installed with a total power of 3,5 MW_e, responsible for 2.500 MWh_e. a total of 1.840 sites for the location of WPPs have been identified in Belarus, with a theoretical energy potential of 1.600 MW_e and an electricity generation potential of 2,4 billion kWh. According to hydro meteorological surveys, the average annual speed of wind at 10–12 m is 3–4 m/sec. The plan is to construct, by 2015, wind power plant with a total capacity of 440 – 460 MW_e. Furthermore, the plan is to improve the level of wind energy potential use for farms, greenhouses and other agricultural facilities.

Solar - The average annual level of solar radiation in Belarus, taking into account night hours and cloudiness, equals 2.8 $kWh/m^2/d$ and has a conversion efficiency of 12% or 0,3 $kWh_e/m^2/d$. The main areas of solar energy use are solar water heaters in agriculture and in the household sector. In 2010, a domestically manufactured solar water heater with a thermal capacity of 160 kW_t was put into operation in Soligorsk District. Small photovoltaic plants are also in operation, generally stand-alone.

Geothermal - Pripyat Trough and Podlaska-Brest Depression are characterized by the most favorable conditions for the use of thermal waters; the temperature of subsurface waters is 80 °C or higher and their potential in terms of geothermal energy is estimated to be 3 – 6 tce/m^2. Moreover, over 200 geothermal heat pumps with a total capacity of about 16.5 MW_t are being operated for the purposes of supplying heat in various sectors of Belarus' economy.

CO_2 emissions

At 2010 the total emissions of CO_{2eq} in Belarus were about 89.444,38 tons, lower of a 35,7% than 1990 values (139.104,80 tons), but higher of a 7,3% than 2000 values (79.289,73 tons).

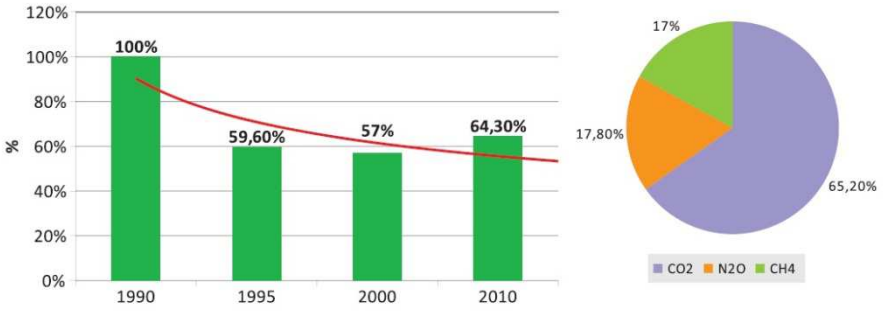

Figure 3: level of CO_{2eq} emissions from 1990 to 2010 and GHG mix[3]

According to official data[4], the actual CO_2 emission factor for electricity production in Belarus is about 0,46 t CO_2 / kWh_e

[3] *Ministry of Natural Resources and Environmental Protection of Republic of Belarus*

[4] *European Bank for Reconstruction and Development, Electricity Emission Factors Review, 2009*

Covenant of Mayors for the city of Rogachev

General introduction and specifics about the city

Rogachev is a town in the Gomel Region of Belarus. It is center of Rahachow District and is located between the rivers Drut and Dneper. The town is first mentioned in 1142 in Russian chronicles. From the late thirteenth century, it was part of the Grand Duchy of Lithuania, and then the Polish-Lithuanian Commonwealth. In 1772 the Rogachev district was annexed by the Russian Empire.

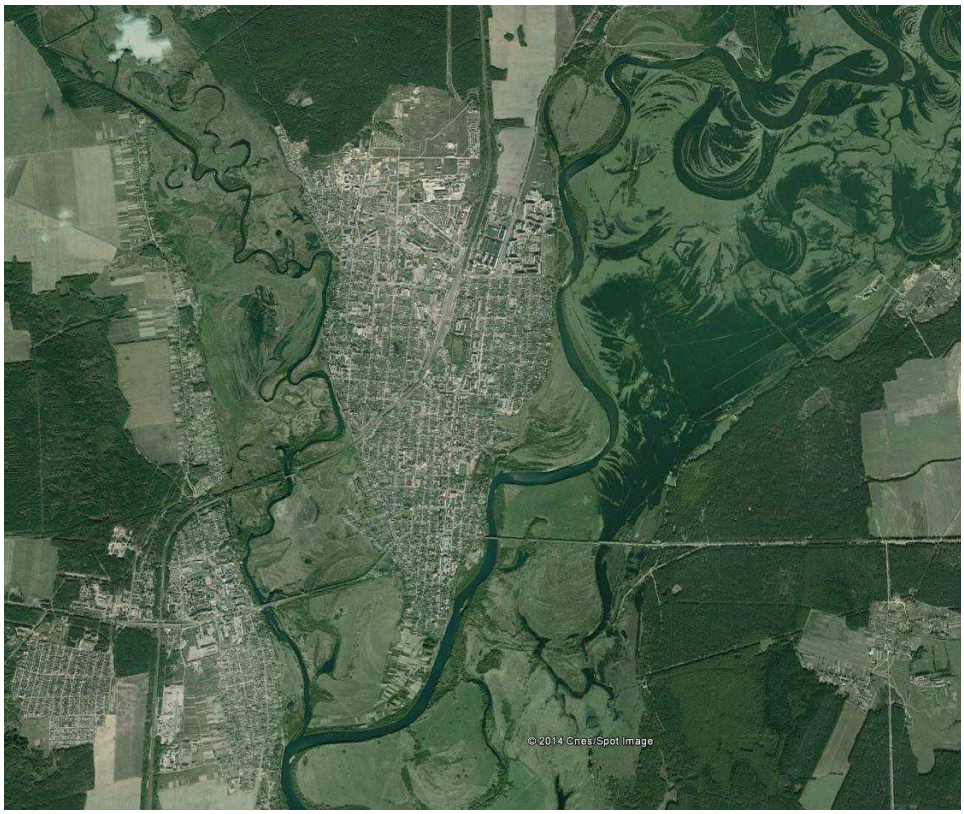

Figure 4: Map of Rogachev, between the two rivers

In 2011, the overall electric consumption of Rogachev Rayon was about 107.177 MWh_e, while the thermal energy consumption was about 1.014.030 MWh_t. In Rogachev town, almost all thermal energy is distributed by district heating network, while in the country individual boilers are most used. In the town live around 34.700 people, while in the countryside live around 25.000 people

The main energy sources used is natural gas, which represents around 80% of the total consumption (fossil fuels + renewable energy, mainly biomass) and almost 95% if considering only fossil fuels

Long-term vision of the city of Rogachev

The long-term vision of Rogachev Rayon lies within the national energy policy and basically wants to improve the energy efficiency of the area and to reduce the energy imports, by a major exploitation of local energy sources, fossils (in particular peat and turf) and renewables (biomass – chip and pellet, and solar, thermal and photovoltaic). In particular, the aim for the coming years is to modernise the district heating network, with the introduction of a new biomass (chip boiler); Rogachev wants to exploit its solar potential in order to increase job potential of the area through the adoption of sustainable energy technologies. It will be strictly connected to an improvement of educational and training programs, with the introduction of theoretical and practical lessons on renewable energy and the consequent creation of new works, such as PV designers and installers.

Rogachev wants also to increase energy efficiency of public sector, with particular reference of school. For this reason, in the aim of Energy for Eastern Mayors Project, one school has been energy renovated in year 2013.

Finally, the improvement of living conditions in the country area is also a priority, which is strictly linked to the promotion of use of renewable energy sources in rural context.

Adoption of LED lamps for public lighting and methane for automotive are two actions directly connected to national energy policy.

Coordination and organizational structures created/assigned

The Rogachev Executive Committee actually is entirely involved in the energy efficiency programs of the Rayon. At the actual moment, three people are directly involved in SEAP realization. The coordination activities should generate the creation of an Energy Point, with people entirely involved in energy topics and charged to coordinate the different Departments.

Involvement of stakeholders and citizens in the area

The involvement of citizens will happen through the organization of the Energy Days, related to the insulation measures and installation of new innovative renewable energy plants on public buildings (such as the energy recovery of school number 4, by E4EM project). Activation of dedicated school programs about renewable energy programs will serve to increase awareness among young people.

Once passing the beginning communication phase, training courses will be operated for designers and workers and Energy Point will act as referee of energy initiatives.

Regarding stakeholders, the main planned activity is to attract foreign investments, by the aid of international banks and funds.

BEI – Baseline Emission Inventory

Methodology

Collection of energy data in order to create the baseline emission inventory can be made by using 3 kind of approaches: Top-Down, Bottom-Up or a mix.

Top-Down approach is generally used when there are not specific data from the Municipal archives (in particular over private consumptions) and so national, or better, regional statistical data are used in order to transfer values according to population and surface.

Bottom-Up approach is used in case of availability at Municipal level (e.g. archives), after all, these data are compared with upper level data in order to validate and fully understand the real situation.

Belarus is a country with a peculiar political and social context, and public data are almost all managed at Rayon level. Oblast level data are protected by national security, so that there is no direct access to these data. Otherwise, at national level many generalist statistics about energy data are public because used as referee for the energy vision and policy of the Republic.

Due the peculiar context, data which are generally unknown for European Municipalities, as managed by private companies (residential buildings, tertiary, private transport, etc..), in Belarus are collected by each Rayon and so available for consultation.

Therefore, Rayon of Rogachev is in possession of all useful data and put them available for the SEAP implementation. Data are then compared to global Belarusian and EU statistics.

The approach used for this Baseline Emission Inventory is a Bottom-Up approach.

In order to transform energy data in emissions data, conversion factors listed in SEAP guidelines are used. Regarding electricity conversion factor, the value has been obtained by official EBRD paper, dated 2009. Regarding biomass conversion factor, at the present the wood sector in Belarus does not meet the environmental sustainability standards of EU, so that the worst value was assigned. One of the main priorities of SEAP, related to objectives at national level, is an improvement of sustainability standards in biomass use, so that a natural decrease of emissions is expected, without changing heat generation systems and by gradually improving the use of biomass.

Regarding data for heating of buildings, it is important to notice that in the Rogachev Rayon, as well as in all Belarus, there is a massive use of district heating networks. Individual boilers are used only outside of the city, in the rural part of the Rayon. Emission factors for district heating network are derived by a weighted average of all fuels used in the municipal boilers.

At the present, in the Rogachev Rayon there is not local electricity production, as well as there is no acquisition of electricity from certified alternative energy sources.

Year 2011 has been chosen as baseline year and it is not expected an increase of population at 2020, respect to actual level (59.700 inhabitants, from whom 34.700 living in the town and around 25.000 living in the countryside)

BEI – Data report

The official COM tables (BEI and SEAP) are listed in the Annex I.

In the following two tables are summarized the results deriving from tables regarding Baseline Emission Inventory, that is energy consumptions, CO_2 emissions and renewable energy produced for the baseline year in 2011, as well as the objectives of reduction.

Baseline divided by sector – Year 2011

Municipal buildings		
Energy consumption [MWh]	CO_2 [t]	Renewable Energy [MWh]
301.832,8	67.480,5	11.855,0
Tertiary buildings		
Energy consumption [MWh]	CO_2 [t]	Renewable Energy [MWh]
262.465,6	**59.715,3**	**1.103,8**
Residential buildings		
Energy consumption [MWh]	CO_2 [t]	Renewable Energy [MWh]
383.806,0	**93.330,7**	**35.662,0**
Transport		
Energy consumption [MWh]	CO_2 [t]	Renewable Energy [MWh]
117.068,6	**27.761,3**	**6.134,7**
Municipal lighting		
Energy consumption [MWh]	CO_2 [t]	Renewable Energy [MWh]
1.530,0	**695,8**	**0,0**
Industry		
Energy consumption [MWh]	CO_2 [t]	Renewable Energy [MWh]
54.504,1	**19.833,3**	**1.582,1**

Table 1: baseline divided by sectors of interventions

Baseline 2011 and objectives 2020 to reach

Baseline 2011		
Energy consumption [MWh]	CO_2 [t]	Renewable Energy [MWh]
1.121.207,3	**268.816,9**	**56.337,6**
Expected population increase at 2020	**0,0%**	
Coefficient	**1,0**	
Scenario in 2020 without actions		
Energy consumption [MWh]	CO_2 [t]	Renewable Energy [MWh]
1.121.207,3	**268.816,9**	**56.337,6**
Objectives for 2020		
Energy savings -20% [MWh]	CO_2 cut -20% [t]	Renewable Energy Increase +20% [MWh]
-224.241,5	**-53.763,4**	**11.267,5**
Scenario in 2020 with actions		
Energyc [MWh]	CO_2 [t]	Renewable Energy [MWh]
896.965,8	**215.053,5**	**67.605,1**

Table 2: Complete baseline 2011 and scenarios for 2020 divided by sectors of interventions

The objective for the year 2020 is therefore represented in the following graph:

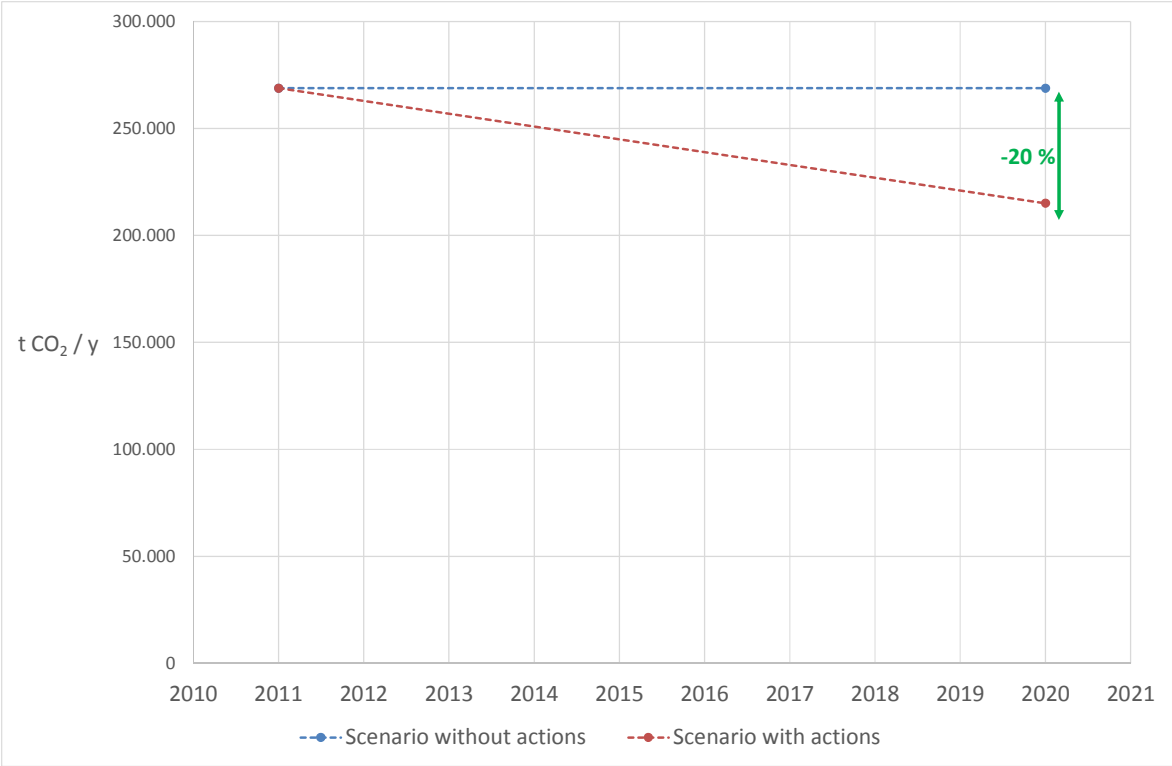

Figure 5: Objective of emissions' reduction for the year 2020

Here follow the graphs representing visually all data contained in the Baseline Emission Inventory

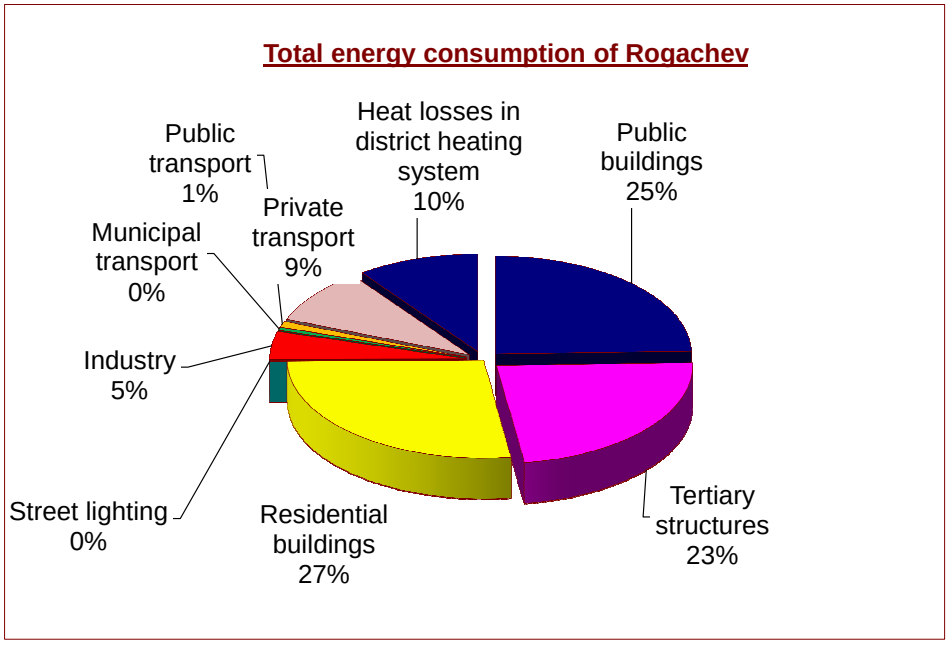

Figure 6: Energy consumptions mix, divided by sector

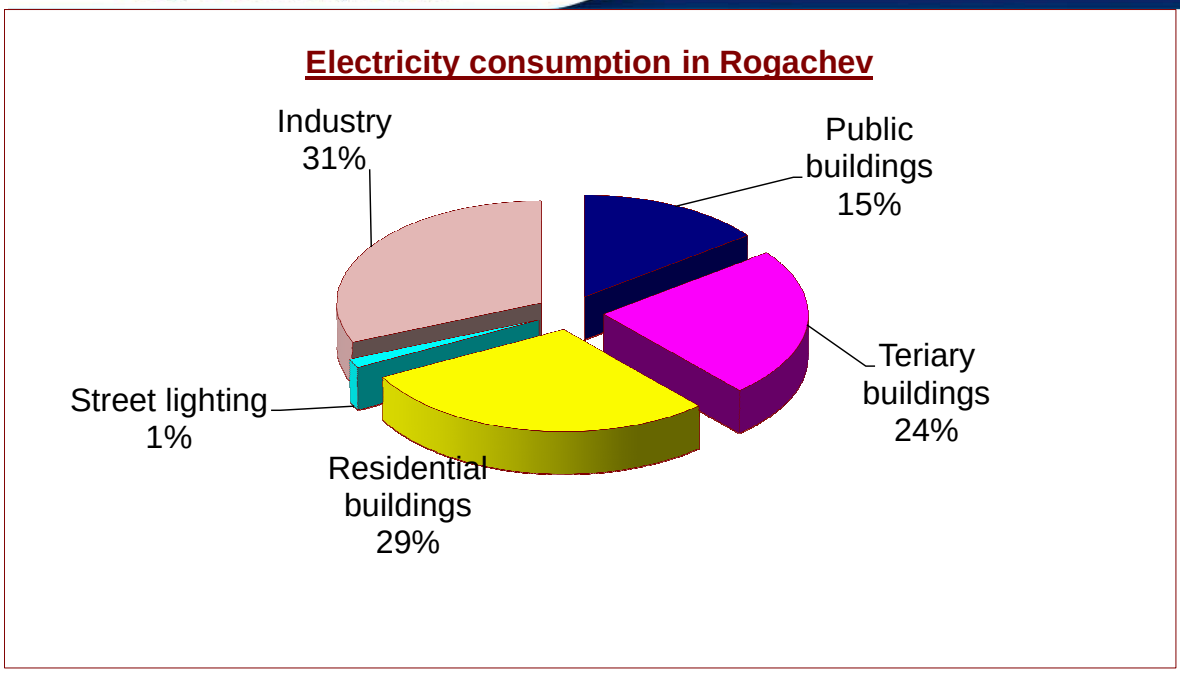

Figure 7: Electric energy consumptions mix, divided by sector

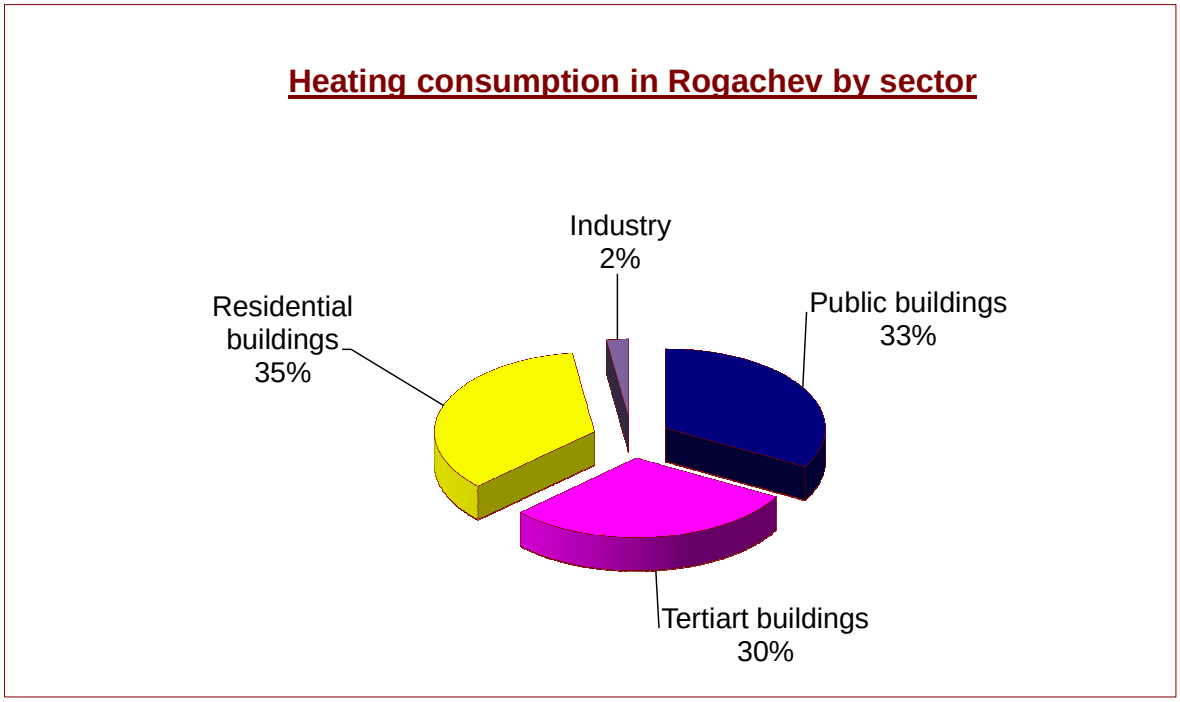

Figure 8: Thermal energy consumptions mix, divided by sector

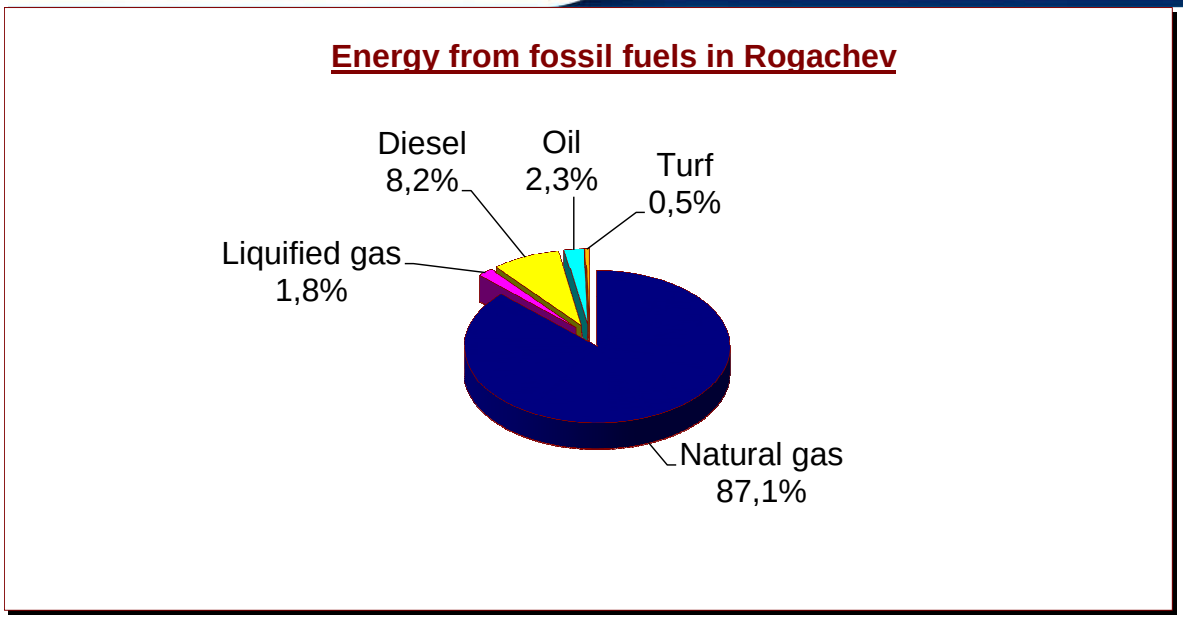

Figure 9: Fossil fuels used for heating

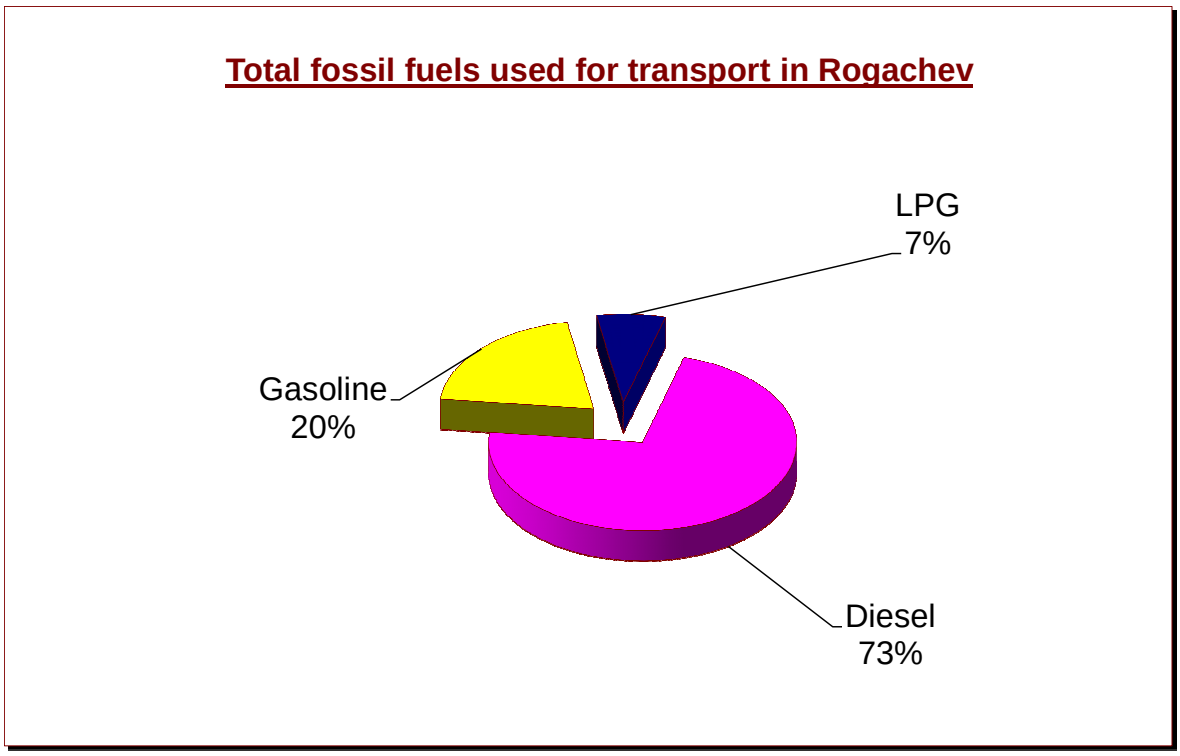

Figure 10: Fossil fuels used for transport

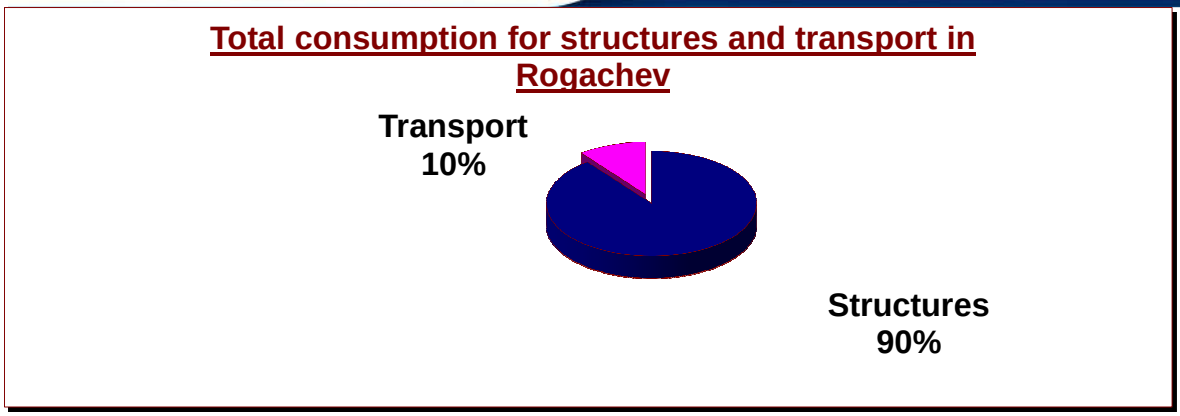

Figure 11: Comparison between transport and buildings consumptions

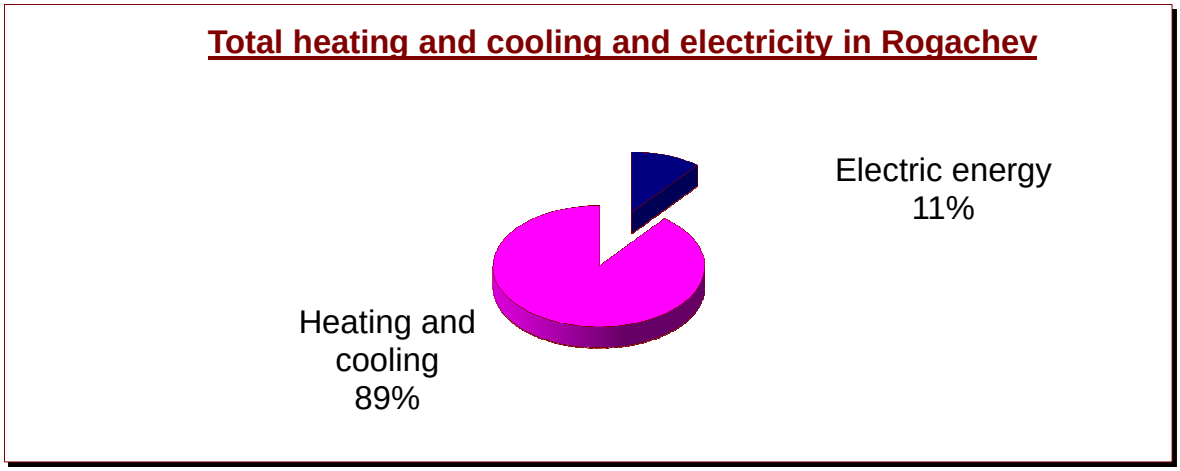

Figure 12: Comparison between electricity and thermal consumptions

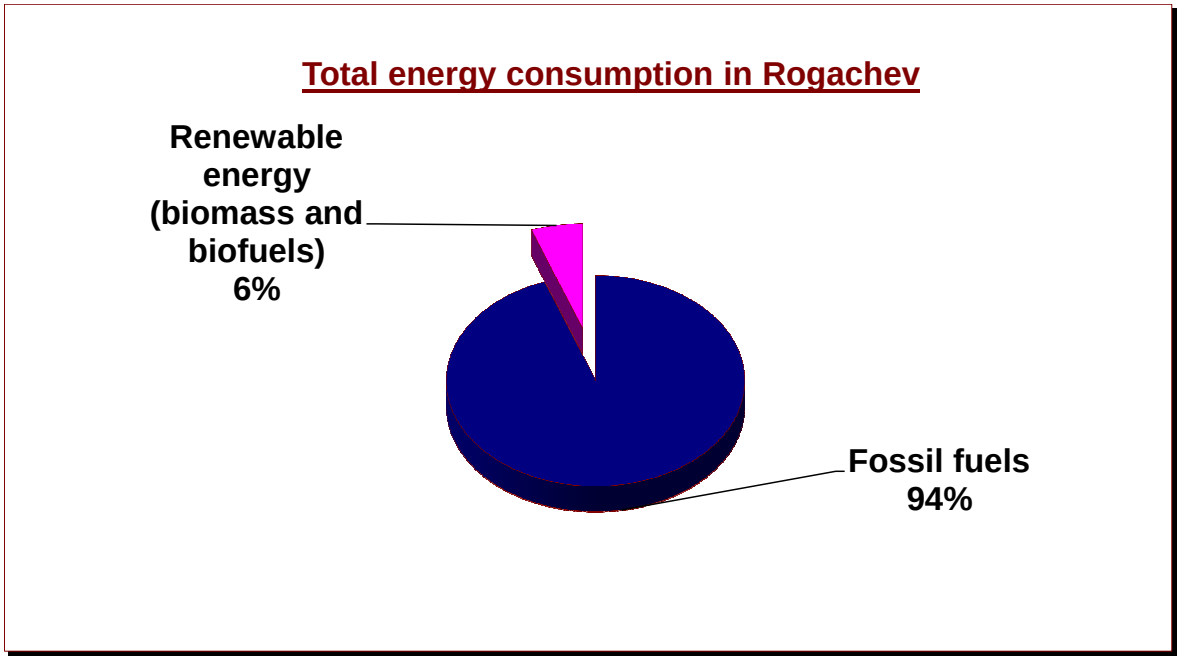

Figure 13: Quota of renewable energy used in total energy consumptions

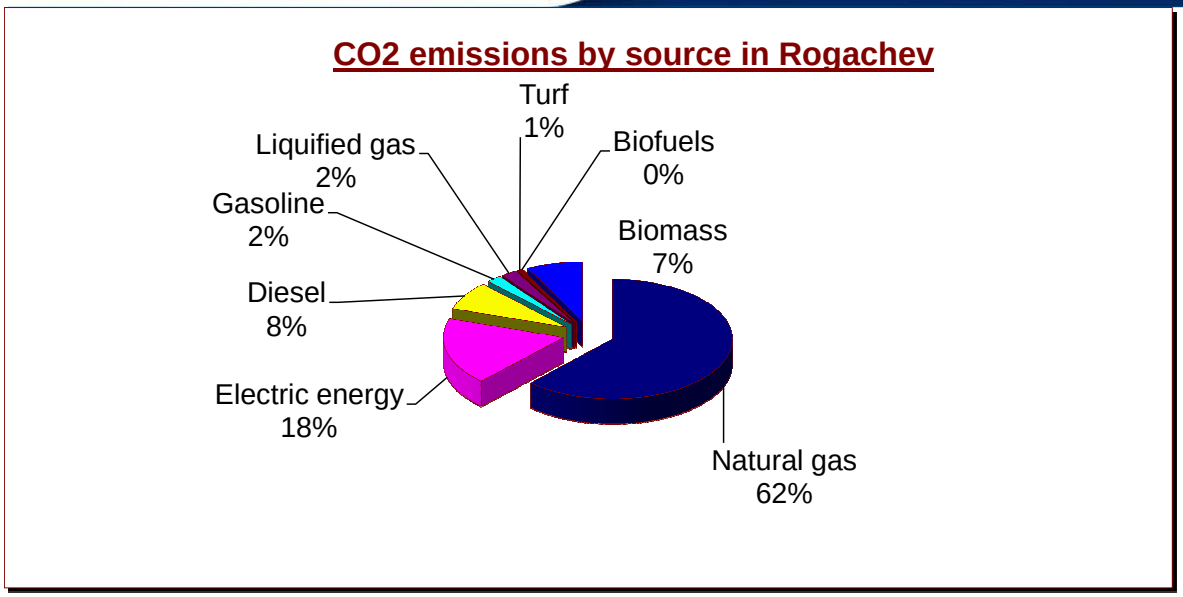

Figure 14: CO_2 emissions mix divided by energy source

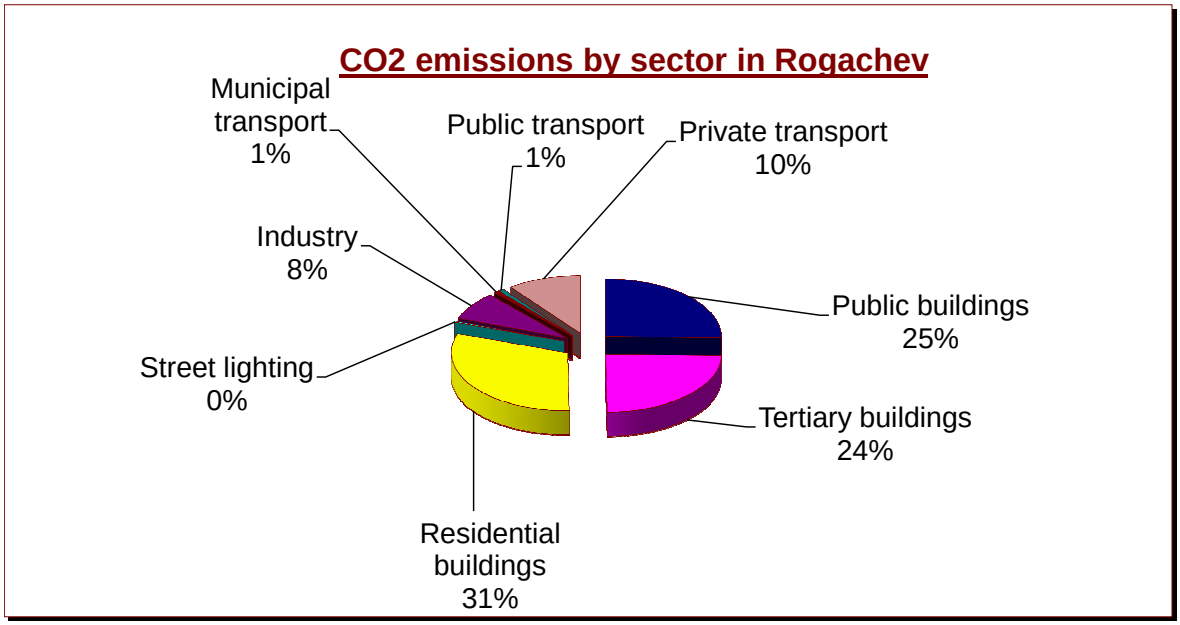

Figure 15: CO_2 emissions mix divided by sector

Finally, here follows the histogram representing the energy and emissions quota of Rogachev, compared to Belarus and to EU

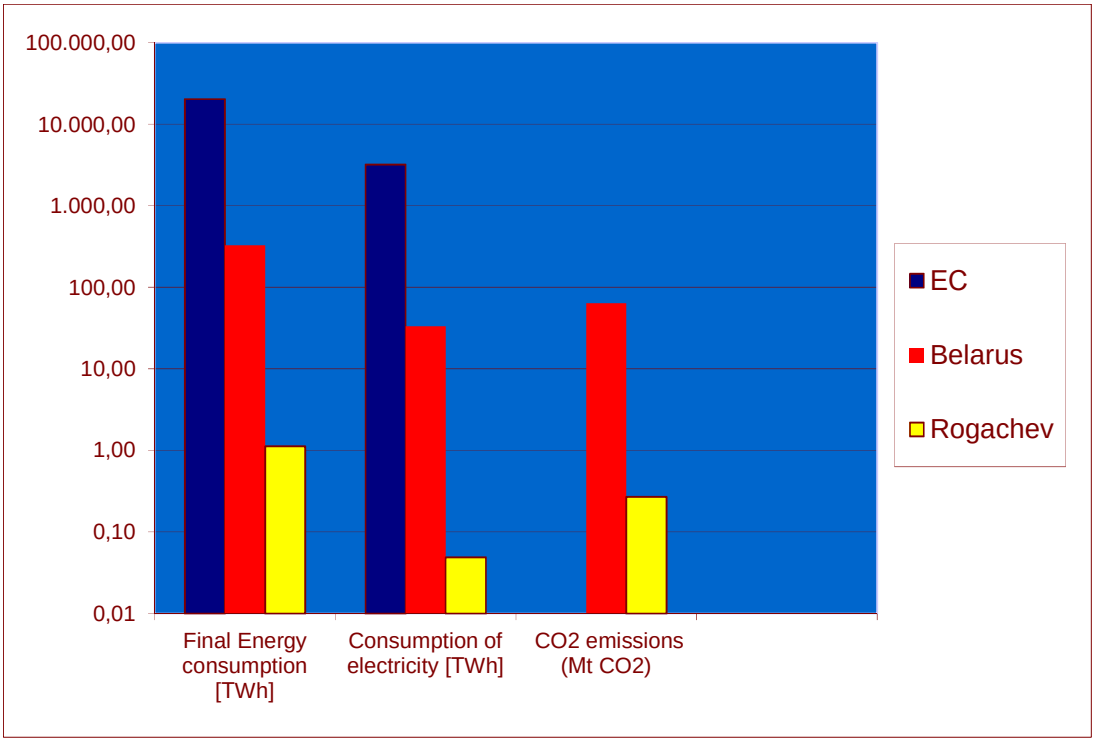

Figure 16: Energy and CO_2 values of Rogachev compared to Belarus and the EU (logarithmic scale)

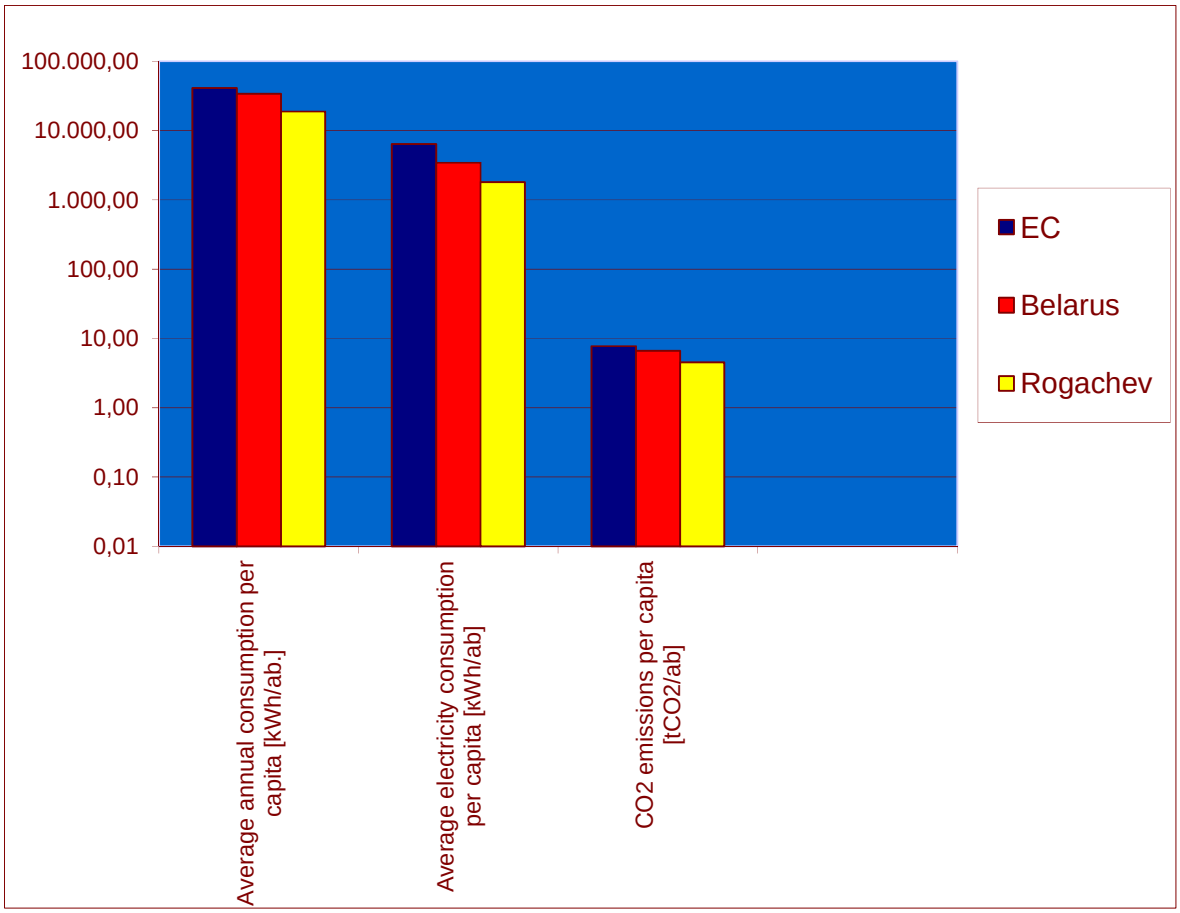

Figure 17: Pro capite energy and CO_2 values of Rogachev, compared to Belarus and the EU (logarithmic scale)

Priorities

The baseline evidence the priority area of intervention in residential sector, both for heating (provided mainly by district heating network) and for electricity.

The Rogachev energy policy must include a high participation of residents and citizens, in order to increase energy efficiency in residential buildings.

On the other hand, the Rayon will implement a deep modernization of their district heating network in several ways, as the substitution of fossil fuels with new environmentally friendly fuels, using also this opportunity as leverage for job's creation.

Actually, Rogachev Rayon does not exploit renewable energy (with the exception of biomass used actually in dated and inefficient plants and biofuels for transport), although have been individuated many potential fields of intervention. A better use, with a great improvement of renewable energy is also a priority.

Finally, a local campaign of Place Marketing in the country (directed to tourist, foreign investors and citizens) is actually under development, by the modernization of campaigns (old Kolkhoz), management of new efficient public transport system, green ways, commercial and industrial international cooperation.

SEAP – Sustainable Energy Action Plan

Methodology

The Sustainable Energy Action Plan is composed by a set of actions planned by 2020, to realize and to monitor in order to reach the -20% of CO_2 emission reduction objective, according to the Baseline Emission Inventory. The general methodology aims to integrate actions already committed at Rogachev by National Government, which intervene on energy situation of the Rayon, such as modernization of district heating network, introduction of LED technology and use of methane gas for automotive, with newly innovative actions, which at the present are not mandatory but can give a strong impulse to renewable energy sector.

Second types of newly innovative actions need pilot projects to verify the real feasibility of plants according to context and boundary conditions, in order to show to citizens and potential stakeholders (both local and international) the potentials for each type of technology, with the final purpose to boost replicability and a "snowball" effect.

Within the program, an increase of awareness and engagement by citizens is fundamental; in fact many actions are planned directly to residential sector – As example an Energy Point will be created in order reach this specific object.

In each actions expected results are indicated in terms of energy savings (MWh), CO_2 emissions avoided (tons) and renewable energy produced (MWh), as well as their percentages, in comparison with baseline data for each target area.

The target areas chosen originate directly from the CoM guidelines are 15, namely:

Action 1. Municipal buildings.
Action 2. Tertiary buildings.
Action 3. Residential buildings.
Action 4. Industry
Action 5. District heating
Action 6. Public lighting.
Action 7. Municipal transport.
Action 8. Public transport.
Action 9. Private and commercial transport.
Action 10. Photovoltaic.
Action 11. Strategic Urban planning.
Action 12. Strategic Urban Mobility Plan.
Action 13. Stakeholder Engagement and awareness campaign.
Action 14. Training.
Action 15. Actions on Sustainable Development

Every action is composed by several sub-actions, planned in order to guarantee the final result.

When possible and already determined by City calculations, the expected budget for each action has been reported, as well as a first estimation of simple payback time of each investment.

Finally, for each sub-action are listed specific indicators, qualitative and/or quantitative, with the purpose to monitor the progress of works and the approach to target objectives.

SEAP – Data report

Here follows an extract from the list of sub-actions.

Sustainable energy action Plan - Rogachev

N°	Sector and activity	The main activities divided by sector	Department and Person in charge	period (start - end)	Approximate cost for activity (€)	Expected energy savings [MWh/y]	Estimated reduction in CO_2 emissions [t/y]	Expected amount of energy produced by renewable sources [MWh/y]	Planned energy savings to 2020 [MWh/y]	Planned CO_2 emissions reduction to 2020 [t/y]
	Buildings / services								63.542	51.885
1	*Municipal buildings and structures*	Substitution of windows in school number 4	Energy for Eastern Mayors Project	2013	30.000	308	73,9		0,03%	0,03%
2		Installation of solar collectors for school number 4	Energy for Eastern Mayors Project	2014	40.000	8,0	1,9	5,0	0,00%	0,00%
3		Installation of solar collectors for high school	Energy for Eastern Mayors Project	2014	30.000	6,0	1,4	3,8	0,00%	0,00%
4		Installation of solar collectors for swimming pool in kindergarten	Energy for Eastern Mayors Project	2014	60.000	15,0	3,6	9,4	0,00%	0,00%
5		Installation of solar collectors for gymnasium "Arochnik"and rehabilitation of roof	Energy for Eastern Mayors Project	2014	55.000	18,8	4,5	11,7	0,00%	0,00%
6		Installation of solar collector for municipal swimming pool and rehabilitation of pipes	Energy for Eastern Mayors Project	2014	125.000	57,6	13,8	36,0	0,01%	0,01%
7		Substitution of windows in public buildings	Rogachev Executive committee	2011-2020	NA	2.000	480,0		0,18%	0,18%
8		Insulation of walls of public buildings	Rogachev Executive committee	2011-2020	2.000.000	6.000	1.440,0		0,54%	0,54%
9		Energy audit in public buildings	Rogachev Executive committee	2013-2020		500	152,2		0,04%	0,06%
10		Creation of an energy management system in all public structures' system	Rogachev Executive committee	2013-2020	1500+(500*active building)	600	182,7		0,05%	0,07%
11		Increase of use of solar collectors for public buildings	Rogachev Executive committee	2015-2020	NA	2.000	480,0	3.500	0,18%	0,18%
12		Increase of efficiency of water pumps from wells	Rogachev Executive committee	2011-2020		500	227,4		0,04%	0,08%
13		Modernization of the medium and low voltage network	Rogachev Executive committee	2013-2020		3.000	1.364,4		0,27%	0,51%
14	*Tertiary sector*	Insulation of walls of tertiary buildings	Rogachev Executive committee	2011-2020		6.000,00	1.440,0		0,54%	0,54%
15		Substitution of windows in tertiary buildings	Rogachev Executive committee	2011-2020		2.000,00	480,0		0,18%	0,18%
16		Increase of use of solar collectors for tertiary buildings	Rogachev Executive committee	2015-2020	NA	2.000	480,0	3.500	0,18%	0,18%
17	*Residential buildings*	Insulation of walls of residential buildings	Rogachev Executive committee	2011 - 2020		6.000	1.440,0		0,54%	0,54%
18		Substitution of windows in residential buildings	Rogachev Executive committee	2011 - 2020		2.000	480,0		0,18%	0,18%
19		Increase of use of solar collectors for residential buildings	Rogachev Executive committee	2015-2020	NA	2.000	480,0	3.500	0,18%	0,18%
20	*Industry*	Energy auditing and primary energy efficiency intervention on industries present in the territory	Private	2014-2020		5.095	1.770,0		0,45%	0,66%
21	*District heating*	Modernization of pumping machines in district heating system	Rogachev Executive committee	2011-2020	53.400	326	148,1		0,03%	0,06%
22		Installation of a chip biomass boiler in the district heating network	Rogachev Executive committee	2013-2020	1.030.534	7.327	1.758,5	14.115,8	0,65%	0,65%
23		Renovation of the grid (4% / year)	Rogachev Executive committee	2011-2020	450.000	140	33,6		0,01%	0,01%
24		Bringing biomass to sustainability	Rogachev Executive committee	2012 - 2020	NA	0	25.101,4		0,00%	9,34%
25	*Public lighting*	Installation of high energy efficiency lamps	Rogachev Executive committee	2012-2013		230	104,4		0,02%	0,04%
26		Increase efficiency of traffic lights	Rogachev Executive committee	2015		77	34,8		0,01%	0,01%
	TRANSPORT:									
27	*Municipal transport*	Transformation of municipal transport from gasoline to methane gas	Rogachev Executive committee				119,0		0,00%	0,04%
28	*Public transport*	Improvement of the use of public transport	Rogachev Executive committee			1.064	274,7		0,09%	0,10%
29		Transformation of public transport from gasoline and diesel to methane gas	Rogachev Executive committee				432,7		0,00%	0,16%
30	*Private and commercial transport*	Improvement of private car's technology	Private	2013-2020		2.927	7.168,4		0,26%	2,67%
31		Realization of a point for sale of methane / LPG gas	Private	2014-2020		0	661,7		0,00%	0,25%
	RENEWABLE ENERGY SOURCES									
32	*Photovoltaic*	Installation of solar photovoltaic on schools	Energy for Eastern Mayors Project	2015	100.000		13,6	30,0	0,00%	0,01%
33		Increase of use of solar photovoltaic for public buildings	Rogachev Executive committee	2015-2021	NA		720,0	3.000	0,00%	0,27%
34		Increase of use of solar photovoltaic for tertiary buildings	Rogachev Executive committee	2015-2021	NA		720,0	3.000	0,00%	0,27%
35		Increase of use of solar photovoltaic for residential buildings	Rogachev Executive committee	2015-2021	NA		720,0	3.000	0,00%	0,27%
	URBAN PLANNING									
36	*Strategic urban planning*	New areas for the development of energy efficiency projects	Rogachev Executive committee	2015-2020		4.000	565,5		0,36%	0,21%
37	*Strategic urban mobility plan*	Optimization of public transport	Rogachev Executive committee	2014		344	88,8		0,03%	0,03%
	WORKING WITH CITIZENS AND STAKEHOLDERS									
38	*Stakeholder engagement and awareness campaign*	Creation of an Energy Point in order to facilitate citizens in EE and RES	Rogachev - Energy Point	2014 - 2020		NA	NA		#VALORE!	#VALORE!
39		Energy days	Energy for Eastern Mayors Project - Energy Point	2014		2.000	635,3		0,18%	0,24%
40		Demonstration activities in terms of energy efficiency and renewable energy	Energy for Eastern Mayors Project - Energy Point	2014-2020		4.000	1.270,7		0,36%	0,47%
41		Information campaign with involvment of local media	Energy Point	2013-2020		1.000	317,7		0,09%	0,12%
42	*Training*	Communication and training of tertiary and industrial operators regarding EE and correct behaviour	Energy Point	2014-2020		700,00	213,1		0,06%	0,08%
	SUSTAINABLE DEVELOPMENT									
43	*Actions on sustainable development*	Creation-facilitation of new GPO (Group Purchasing Organization) for equipment regarding energy efficiency)	Energy Point	2014-2020		6.000	2.728,8		0,54%	1,02%
44		Introduction of high energy efficiency equipment in working places	Energy Point	2012-2020		1.496	680,4		0,13%	0,25%
45		Introduction of high energy efficiency eqipment in living places	Energy Point	2012-2020		1.542	701,4		0,14%	0,26%
					1.073.934,0		TOTAL		73.279,9	56.208,5
							Reduction objectives		224.241,46	53.763,38
					Total estimated cost		Results by applying actions		6,54%	20,91%
									Energy savings	CO_2 reduction

Emission factors	
Electric energy	0,455
District heating	0,240
Fuels average	0,258

Table 3: List of Sub-Actions, related costs and expected results

Globally, 45 sub-actions are planned for the coming years in order to reach the 20-20-20 objectives. Here follows the general description of actions. The complete list is attached in Annex I

Action 1. Municipal buildings

13 sub-actions are planned to set up in this sector.

The first action regards the insulation intervention on School Number 4, made possible by Energy for Eastern Mayors Project.

Secondary, it is planned and already dimensioned different renewable energy plant on different buildings, schools, gymnasium and swimming schools (solar thermal panels).

Starting from these two projects, an energy audit campaign of all public buildings of the town will be put in action, in order to make understand problems and priorities and to make interventions on: windows, walls, roofs, solar collectors.

Moreover, all the water supply network of the town needs to be energy renovated, as well as the low and medium voltage network. It is up to public sector to make actions related to two networks.

Action 2. Tertiary buildings

3 sub-actions are planned to set up in this sector.

Actions directly start from the results gained with the energy monitoring of public buildings. The most economic efficient actions will be repeated on tertiary buildings

Action 3. Residential buildings

3 different sub-actions are planned to set up in this sector

Actions directly start from the results gained with the energy monitoring of public buildings. The most economic efficient actions will be repeated on tertiary buildings

Action 4. Industry

1 sub-actions is planned to set up in this sector

Rogachev aims to energy renovate the industries present in the town, in order to become more competitive. An energy audit campaign of the industries present in the territory will be set up.

Action 5. District heating

4 sub-actions are planned to set up in this sector.

A complete modernization of the network is expected, according to government program.

Rogachev intends to renovate pumping machines and the grid itself (4 % / year). Moreover, there is the intention to install a new chip boiler in the network, thanks to government aid, for the substitution of natural gas with local biomass.

Finally, local biomass has to be harvested and used in a sustainable way, so that local measures are expected to prevent environmental damages.

Action 6. Municipal lighting

2 sub-actions are planned to set up in this sector.

The two actions both follow the governmental policy of renovating public lights and traffic lights, by introducing LED technology.

Action 7. Municipal Transport

1 action is planned to set up in this sector.

The administration aims to transform the public fleet, actually gasoline powered, to methane and LPG gas, according to government program.

Action 8. Public Transport

2 sub-actions are planned to set up in this sector

The main activity regards the implementation and optimization of public transport, with a sensibilization campaign for the use of public transport country.

According to central government strategies, the use of methane gas as cars' fuel will be improved thanks to the realization of new refuelling points.

Action 9. Private Transport

2 sub-actions are planned to set up in this sector

Actual Private fleet is often old and inefficient, the sub-action aims to support the replacement with a newer and more efficient technology in private transport.

Moreover, following government program, Rogachev wants to stimulate the use of methane gas and LPG for transport. A realization of a point for sale, together with the requalification of old ones, is expected in next years.

Action 10. Renewable Energy Sources – Photovoltaic

4 sub-actions are planned to set up in this sector.

According to government strategies and potential incentives, Rogachev wants to exploit its solar potential.

Firstly, Rogachev intends to use the roofs of the schools to install the first pilot plants. This could be the right place to install them, for at least three reasons:

- They are low and large buildings, so that available surface is big
- They are far from city centre, so that there is no shading from other buildings
- By installing solar PV systems, interventions on the roofs are necessary, so that the contemporary insulation will be done.

Once evaluated the real potential of solar power, and once renovated the voltage network, it is expected to repeat the actions on public, tertiary and residential buildings. It is therefore planned to support and facilitate the realization of PV plants by private investors, thanks also to national incentives.

Action 11. Strategic Urban Planning

Action in this field will guarantee the realization of new settlements with a control and rating on Energy label the design and implementation of new green buildings and neighbourhood. Actually there is no a concrete directive in this field.

Action 12. Strategic Urban Mobility Plan

The action aims to support the other sub-actions from the transport sector, encouraging a greener mobility and discouraging the use private cars.

Action 13. Stakeholder Engagement

4 sub-actions are planned to set up in this sector

As already described, citizens play a key role in reaching the CO_2 emission reduction; in order to realize a concrete support in awareness and engagement campaigns the Administration has planned to realize a new Energy Point dedicated to stakeholders, that will organize and manage different sub-actions such as:

- Communication activities and campaigns
- Demonstration activities and energy days
- Realization of purchasing groups at local level
- Realization of markets with products and goods produced at local level

Action 14. Training Activities

Several training courses will be realized in order to ensure a correct collaboration among different sectors and targets:

- Training dedicated to the tertiary and municipal's operators on energy efficiency and the correct use of energy
- Construction field, dedicated to the energy renovation and new building technologies
- Citizens: dedicated to a correct energetic behaviour
- Citizens: dedicated to improve the use and knowledge of computer (the course will be structured using common methodologies such as the European Computer Driving Licence)

Action 15. Other Activities – Actions on sustainable development

3 sub-actions are planned to set up in this sector

They deal mainly with the actions that can be made by private citizens in their everyday life. That means for example the use of energy efficiency equipment in working and living places and the creation of Group Purchasing Organization.

Targets

Targets by sector

Here follow the graph of the results by applying SEAP's actions, divided by three sectors: Buildings, transport, street lighting.

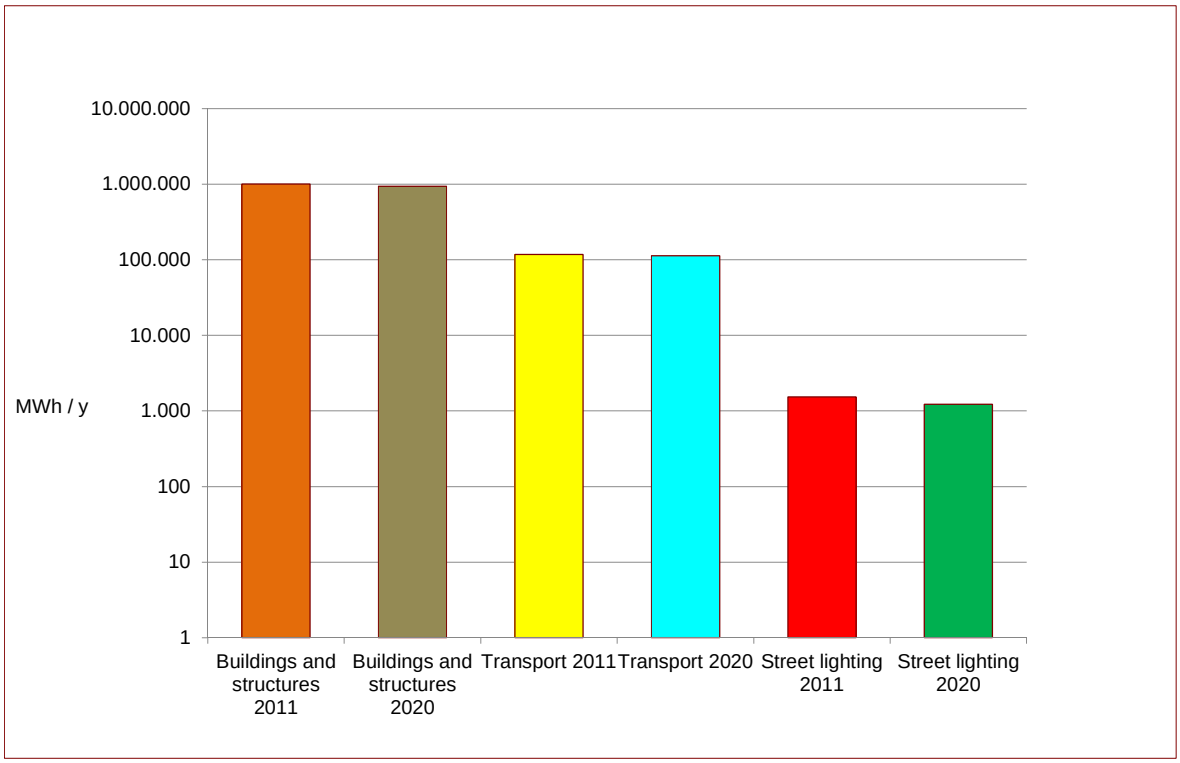

Figure 18: Expected energy savings by applying the actions, divided by sector (logarithmic scale)

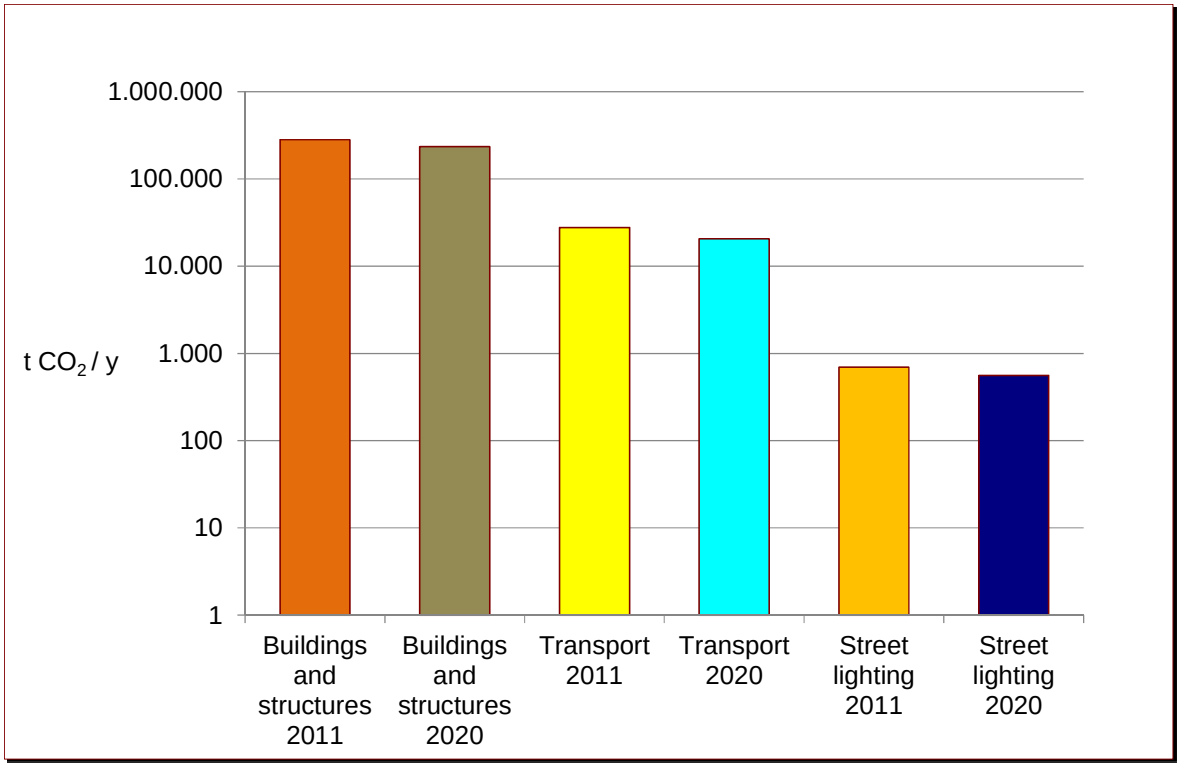

Figure 19: Expected emissions reduction by applying the actions, divided by sector (logarithmic scale)

District heating system is a key structure for the city of Rogachev. Results expected by modernization of the district heating network are presented below:

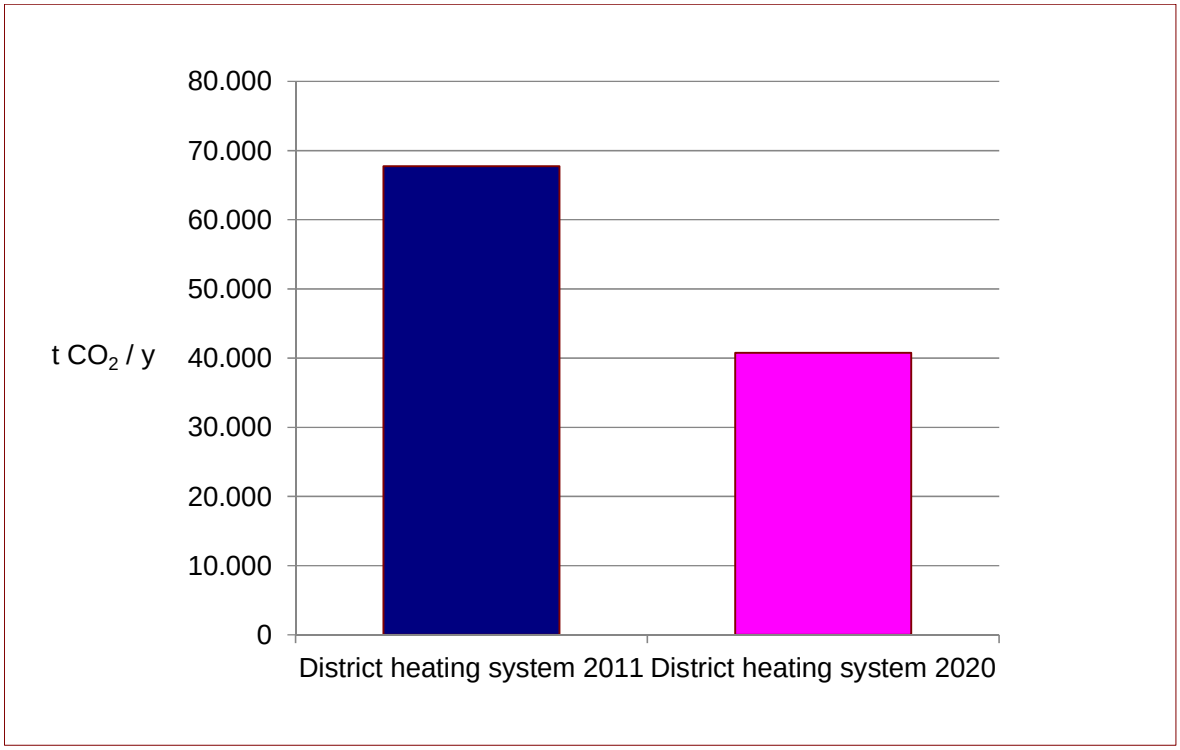

Figure 20: Expected emissions avoided by acting specifically on District Heating network

SEAP provides a strong impulse to renewable energy investments. In the baseline year, the only renewable energy used was biomass for heating purposes. In the year 2020, the expected renewable energy mix will be as follow:

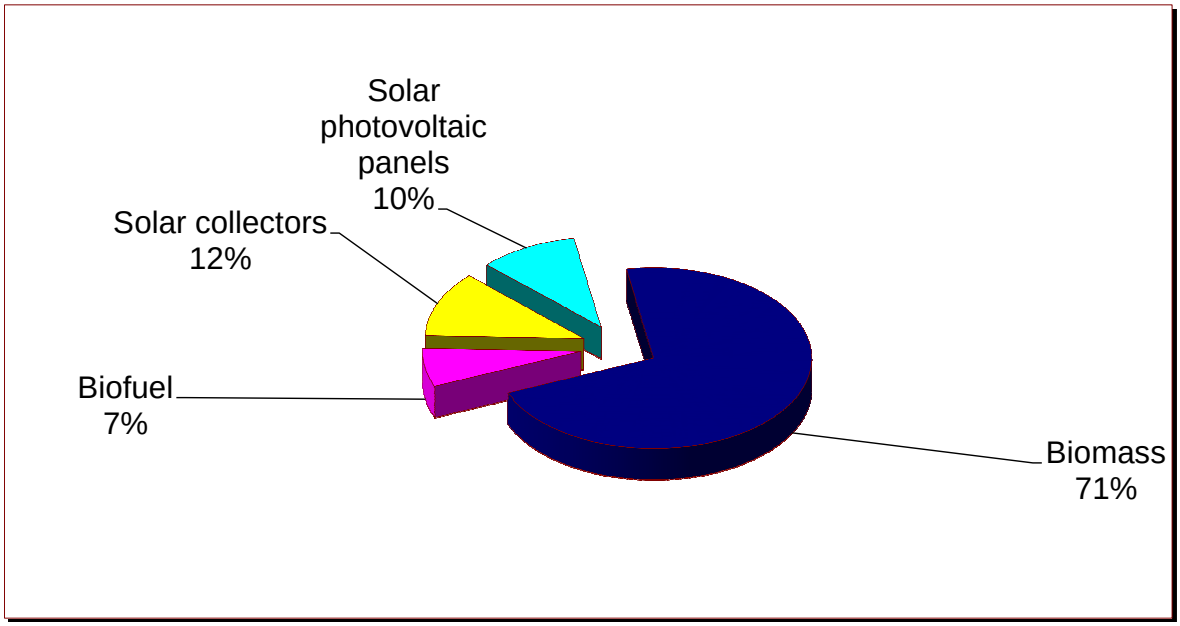

Figure 21: Expected new renewable energy mix, by applying the actions

Targets 20-20-20

The expected results of the SEAP are the following:

- Energy savings: 15,66%
- CO_2 emissions reduction: 47,59%
- Renewable energy increase: 271,74%

Here follow the graphs showing these targets compared to the baseline:

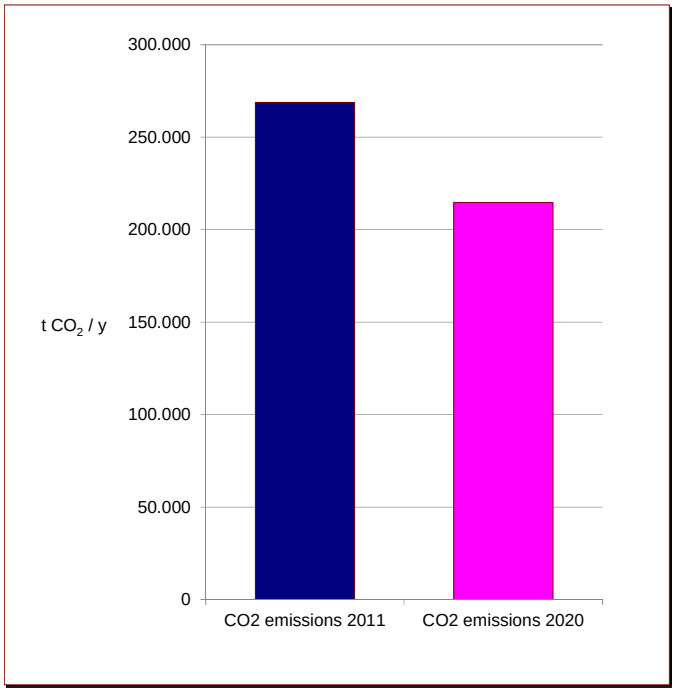

Figure 22: Expected emissions avoided by applying the totality of actions

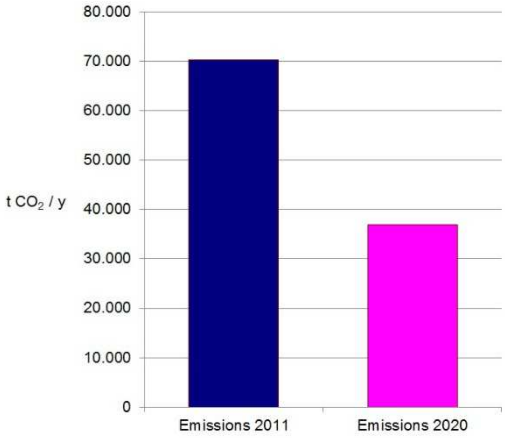

Figure 23: Expected energy savings by applying the actions

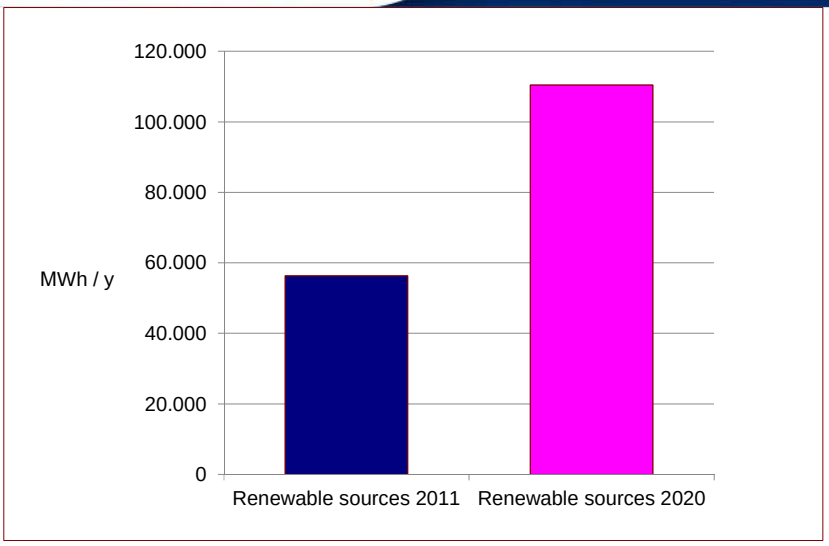

Figure 24: Expected renewable energy increase by applying the actions

MEI – Monitoring Emission Inventory

Monitoring of SEAP progress report is the key factor in energy policy strategy. Regarding monitoring, performance indicators can be divided in two groups:

- Indicators regarding effective implementations of renewable energy sources and energy efficiency interventions in the territory; Rogachev Rayon keeps an archive with all information about urban and energy interventions which happen in town both from municipal, residential and tertiary part, so that it will be easy to verify the progress of SEAP implementation.
- Indicators regarding citizens' awareness and changing behaviour. Not all actions related directly to citizens can be quantified in numbers. The performance indicators will concern mainly the life of the new Energy Point: number of workers in the Energy Point, of citizens accessing the bureau, of information provided, of Energy Days organized, of people trained.
  Regarding specific actions, the following table summarizes the performance indicators for each of them

Sector		Action	Performance Indicator
Municipal buildings, structures	1.1	*Substitution of windows in school number 4*	Number of windows substituted m^2 of windows replaced Number of citizens and students participating to related energy day
	1.2	*Installation of solar collectors for school number 4*	Number of collectors installed m^2 of collectors installed m^2 of related insulation of roofs Number of citizens and students participating to related energy day
	1.3	*Installation of solar collectors for high school*	Number of collectors installed m^2 of collectors installed Number of citizens and students participating to related energy day
	1.4	*Installation of solar collectors for swimming pool in kindergarten*	Number of collectors installed m^2 of collectors installed Number of children using the swimming pool / year
	1.5	*Installation of solar collectors for gymnasium "Arochnyk" and rehabilitation of roof*	Number of collectors installed m^2 of collectors installed m^2 of related insulation of roofs

	1.6	*Installation of solar collectors for municipal swimming pool and rehabilitation of pipes*	Number of collectors installed m^2 of collectors installed m of pipes subsitituted
	1.7	*Substitution of windows in public buildings*	Number of buildings with windows' renovation / year Number of windows substituted / year m^2 of windows replaced / year
	1.8	Insulation of walls in public buildings	Number of buildings with insulation of walls / year m^2 of walls insulated / year
	1.9	*Energy audit of public buildings*	Number of buildings audited / year
	1.10	*Creation of an energy management system in all public structures' system*	Number of buildings inserted in the management system / year
	1.11	*Increase of use of solar collectors for public buildings*	Number of buildings with new solar collectors / year m^2 of solar collectors installed / year
	1.12	*Increase of efficiency of water pumps from well*	Number of pumps substituted / year
	1.13	*Modernization of the medium and low voltage network*	m of network renovated / year
Tertiary buildings, structures	2.1	*Insulation of walls for tertiary buildings*	Number of buildings with insulation of walls / year m^2 of walls insulated / year
	2.2	*Substitution of windows in tertiary buildings*	Number of buildings with windows' renovation / year Number of windows substituted / year m^2 of windows replaced / year
	2.3	*Increase of use of solar collectors for tertiary buildings*	Number of buildings with new solar collectors / year m^2 of solar collectors installed / year
Residential buildings, structures	3.1	*Insulation of walls for residential buildings*	Number of buildings with insulation of walls / year m^2 of walls insulated / year
	3.2	*Substitution of windows in residential buildings*	Number of buildings with

			windows' renovation / year Number of windows substituted / year m^2 of windows replaced / year
	3.3	*Increase of use of solar collectors for residential buildings*	Number of buildings with new solar collectors / year m^2 of solar collectors installed / year
Industry	4.1	*Energy auditing and primary energy efficiency intervention on industries present in the territory*	Number of industries audited / year Number of primary interventions in industry / year
District heating	5.1	*Modernization of pumping machines in district heating systems*	Number of pumps substituted / year
	5.2	*Installation of chip biomass boiler in the district heating network*	Tons of chips burned / year MWh produced / year
	5.3	*Renovation of the grid (4% / year)*	m of grid renovated / year
	5.4	*Bringing biomass to sustainability*	Hectares of wood dedicated to sustainable biomass exploitation Tons of wood waste used as biomass for boilers / year
Municipal/Public lighting	6.1	*Installation of high energy efficiency lamps*	Number of lamps substituted with LED / year
	6.2	*Increase efficiency of traffic lights*	Number of traffic lights substituted with LED / year
Municipal Transport	7.1	*Transformation of municipal transport from gasoline to methane gas*	Number of municipal cars transformed / substituted
Public Transport	8.1	*Improvement of the use of public transport*	Number of passengers/ year
	8.2	*Transformation of public transport from diesel to methane gas*	Number of buses transformed / substituted
Private Transport	9.1	*Improvement of private car's technology*	Percentage of new cars circulating in the rayon / year (estimation)
	9.2	*Realization of a point for sale of methane / LPG gas*	Number of cars using the new point for sale / year (estimation)
Renewable Energy Sources - PV	10.1	*Installation of solar photovoltaic on schools*	kW_p of PV panels installed Number of citizens and students participating to related energy day

			m^2 of related insulation of roofs
	10.2	*Increase of use of solar PV for public buildings*	Number of PV panels installed by public / year kW_p of PV power installed / year kWh of PV energy produced at local level / year
	10.3	*Increase of use of solar PV for tertiary buildings*	Number of PV panels installed by tertiary / year kW_p of PV power installed / year kWh of PV energy produced at local level / year
	10.4	*Increase of use of solar PV for residential buildings*	Number of PV panels installed by private / year kW_p of PV power installed / year kWh of PV energy produced at local level / year
Strategic Urban Development	11.1	*New areas for the development of energy efficiency projects*	Number of energy efficiency buildings constructed / year
Strategic Urban Mobility Plan	12.1	*Optimization of public transport*	Mileage / year
Stakeholder Engagement	13.1	*Creation of an energy point*	Number of people employed in the energy point Number of visitors of energy point / day Number of projects on energy efficiency participating by Rogachev through the Energy Point / year
	13.2	*Energy Days*	Number of energy days organized / year Number of people participating to energy day / year
	13.3	*Demonstration activities in terms of energy efficiency and renewable energy*	Number of people involved in demonstration activities / year Number of people visiting the websites with information about energy production of installed plants / year
	13.4	*Information campaign with involvement of local*	Number of brochures and

		media	leaflets distributed / year Number of articles and extracts comparing in local media / year
Training	14.1	*Communication and training of tertiary and industrial operators*	Number of people working in industry and tertiary sector trained about energy efficiency topics
Other – Sustainable development	15.1	*Creation and facilitation of new Group Purchasing Organizations*	Number of Groups created Number of people involved / Group
	15.2	*Introduction of high energy efficiency equipment in working places*	Number of new equipment bought for working places / year (estimation)
	15.3	*Introduction of high energy efficiency equipment in living places*	Number of new equipment bought for living places / year (estimation)

Table 4: type and value of indicators for the Monitoring Emission Inventory - MEI

Regarding official monitoring of SEAP progress, the indicators to report in the MEI are the same ones of the BEI (as reported in table 2):

- MWh of energy savings
- Tons of CO_2 emissions reduction
- MWh of renewable energy increase

Glossary

SEAP – Sustainable Energy Action Plan: plan for the city in order to reach energy and environmental objectives

BAU – Business as Usual: specific scenario for Eastern countries, in order to consider an actual constant increase of consumptions, in contrast with the past story of the area

BEI – Baseline Emission Inventory: sum of all CO_2 emissions taken at the baseline year

Baseline year: the year chosen as referee for the calculation of the CO_2 reduction target

CO_2 conversion factor: average values used to convert energy consumptions in CO_2 emissions, according to the fuels and energy sources used.

COM East – Covenant of Mayors going East: Initiative related to the Covenant of Mayors for the promotion of energy efficiency and renewable energy sources in the Eastern Neighbourhood and Central Asian countries.

District heating system / network: centralized hot water system able to furnish heat to city buildings.

Electricity CO_2 conversion factor: average value used to convert electricity energy consumption in CO_2 emissions, according to the fossil fuels quota used to produce electricity at national level. It indicates the efficiency and sustainability of a country electricity production network.

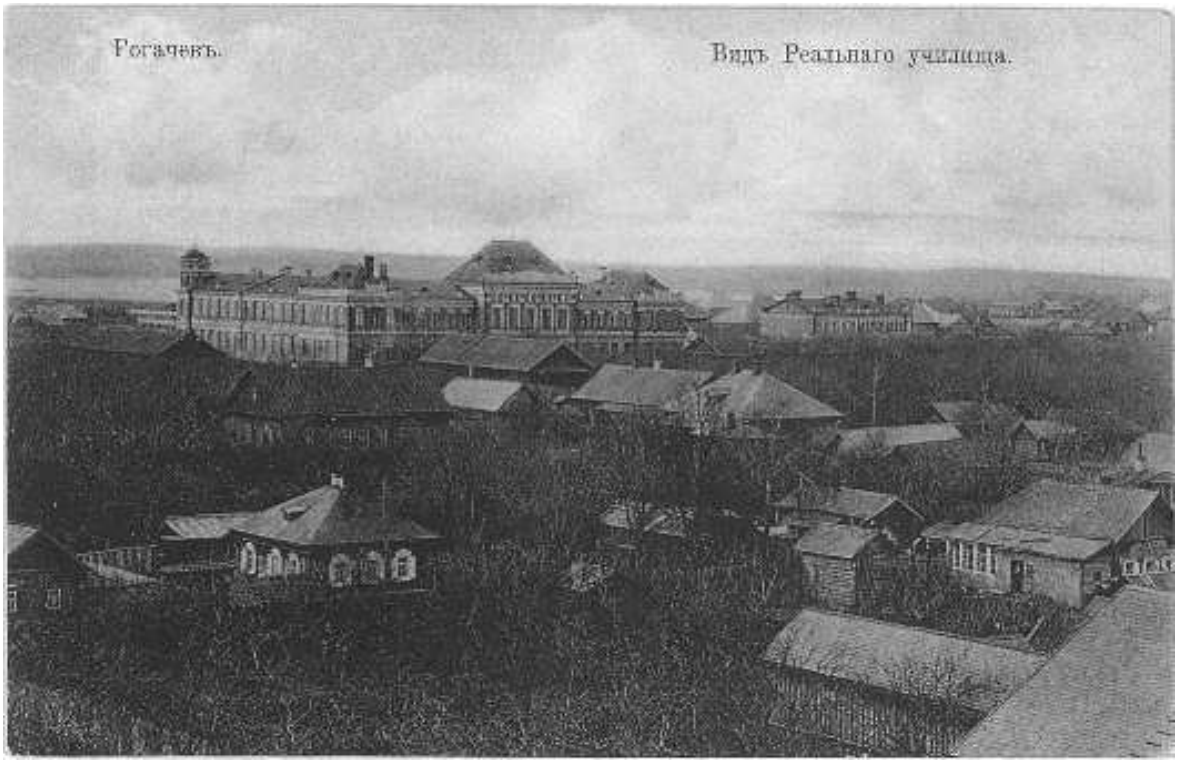

Figure 25: View of Rogachev town

Postcard taken between 1915 and 1920 (contributed by Lowell Nigoff)

Annex I – Expected costs of the main sub-actions

Sector	Sub-Action	Cost (BYR)	Cost (€)	Note
Municipal buildings, structures	Substitution of windows in School number 4	390.000.000	30.000	Energy for Eastern Mayors Project
	Installation of solar thermal collectors on school number 4	520.000.000	40.000	Expectations from EuropeAid policy
	Installation of solar thermal collectors for high school	390.000.000	30.000	Expectations from EuropeAid policy
	Installation of solar collectors for swimming pool in kindergarten	780.000.000	60.000	Expectations from EuropeAid policy
	Installation of solar collectors for gymnasium "Arochnik"and rehabilitation of roof	715.000.000	55.000	Expectations from EuropeAid policy
	Installation of solar collector for municipal swimming pool and rehabilitation of pipes	1.625.000.000	125.000	Expectations from EuropeAid policy
	Installation of solar photovoltaic on school number 4	1.300.000.000	100.000	Expectations from EuropeAid policy
	Insulation of walls of public building	26.000.000.000	2.000.000	
District heating system	Modernization of pumping machines in district heating system	694.200.000	53.400	Government program
	Installation of a chip biomass boiler in the	13.396.942.000	1.030.534	Government program

	district heating network			
	Renovation of the grid (4% / y)	5.850.000.000	450.000	Government program
Stakeholder engagement	Energy Days	26.000.000	2.000	Energy for Eastern Mayors

Total number of sub-actions, with known cost: 13

Total cost: 51.687.142.000 BYR = 3.975.934 €