



Sustainable Energy Action Plan for
KAMYANETS-PODILSKIY



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1. Introducing the city

1.1. General information

Kamyanets-Podilskiy is a city of oblast subordination and at the same time it is the centre of Kamyanets-Podilskiy rayon, located in the south of Khmelnytskyi oblast.

Khmelnytskyi oblast is situated in the western part of the Right Bank Region of Ukraine. Oblast borders on Zhytomyr, Rivne, Ternopil, Chernivtsi and Vinnytsya oblasts, and occupies a total area of 20,600 km², which equals 3.3% of the territory of Ukraine.

The territory of Kamyanets-Podilskiy is 27.84 km². The river Smotrych flows through the city, and 20 km away from the city – the river Dniester. Kamyanets-Podilskiy is 101 km away from the oblast centre – the city of Khmelnytskyi.

Current population of the city as of 01.01.2009 is 100,500 people. Kamyanets-Podilskiy consists of the following districts: Stare Misto, Ruski Filvarky, Polski Filvarky, Bilanivka, Novyi Plan, Karvasary, Vydrivka, Pidzamche, Selyshche Smyrnova, Cheryomushki, Selyshche Tsukrovogo Zavodu, Selyshche Pershotravneve, Selyshche Zhovtneve, Zhovtneviy Masyv.

Heating providing company, communal enterprise (CE) “Miskteplovoenergiya”, runs 7 sources of heat energy (6 heating boiler stations and a CHP).

Boiler stations provide heating to housing stock, public utilities, social-cultural and other economic entities of the city.

Energy consumption by the city in 2008-2009

		Electricity (thsd. kW)	Cold water (thsd.m ³)	Natural gas (thsd.m ³)	Heat energy (thsd. Gcal)
Industry	2008	348,130	95.13	23,104.952	-
	2009	167,439	93.643	23,609	-
Budget	2008	13,702	269.8	808.996	33.93
	2009	13,815	249.376	838.611	31.429
Population	2008	43,811	3431.5	25,672.579	166.94
	2009	47,840	2,119.59	25,115.451	160.487
Other	2008	50,813	437.5	41,787.567	5.98
	2009	108,068	342.370	38,681.038	4.181
Total	2008	456,456	4,233.9	91,374.094	206.85
	2009	337,164	2,804.9	88,244.1	196.097

The machinery construction industry includes 13 industrial enterprises.

The metallurgical industry and fabricated metal products industry include 9 enterprises.

The sector of production and distribution of electricity, natural gas and water is represented by the following enterprises: CE "Miskteplovodoenergiya", subsidiary OJSC "Khmelnyskogas" and CREN*.

Food industry includes 7 enterprises, which produce meat, dairy products, bread and baked food, etc.

The industry of other non-metallic mineral products production is represented by 4 enterprises.

Stably work 2 light industry enterprises – collective sewing enterprise and Ukrainian community of deaf people (social enterprise), as well as 5 publishing enterprises.

* city-rayon electricity network

There are 27 communal enterprises operating in Kamyanets-Podilskiy.

The system of city's **transport complex** employs 98 individuals and 14 legal entities providing services in freight transportation, with passenger carrying services provided by 5 legal entities (OJSC "ATP 16808", SOE "Vyeron", LLC "Avtoservis Ltd.", LLC "Trans-Podillya", SB "Kameliya") and 124 individuals, working on 29 routes. General amount of buses, used for passenger transportation, is 243 vehicles.

The books of the City Council hold 183.1 km of communal roads, with the total area of 1,680.6 km² including 101.1 km (55.2%) covered with asphalt, 26.7 km (14.6%) covered with cobblestone and tessellation, 34.3 km (18.7%) covered with black and white crushed stone and 21 km (11.5%) are earth roads. The area of 692.4 km² of roads, according to the regulations, is due for renovations, the area of pavement due for renovations is 187.2 km².

Every year the city accumulates about 100 thsd. m³ of solid waste (SW) and garbage. City landfill site for SW occupies 9 hectares of land within the city boundaries and is held in the books of CE "Spetskomuntrans", which is the only enterprise, specializing in SW management on the basis of agreements signed with the economic entities of the city. The SW landfill site has been exploited since 1958 and no longer meets city's demands.

All parts of the city are supplied with electricity. The length of city's street lighting network is 148 km and it consists of 4900 lighting points. They all require maintenance, routine repairs, and 1500 of lighting points – replacement with modern energy-saving lamps.

On the territory of the city there are 19 bridges, including: 9 made of metal; 4 made of reinforced concrete; 6 made of wood (footbridges).

In order to avert the negative effects of the climate change and to reduce the emissions of GHG in the city of Kamyanets-Podilskiy, we started a campaign, aimed at the reduction of energy resources consumption and at the promotion of their rational usage. To effectively implement energy-saving technologies, as well as to facilitate the transition from fossil fuels to alternative sources of energy, our city entered the “Covenant of Mayors” – a pan-European initiative on improving the energy efficiency of city economy and reduction of CO₂ emissions, initiated by the European Commission.

According to the principles of the “Covenant of Mayors”, the city of Kamyanets-Podilskiy made a commitment to follow the policy of reducing CO₂ emissions by 20% by 2020. At the same time, such policy would allow the city to transform its energy sector in accordance with the principles of sustainable energy development to achieve more rational and economical usage of energy resources. Besides, our city is the member of the Association “Energy Efficient Cities of Ukraine” and is one of the pilot cities of the project “City Heating Provision Reform”, which both provide the opportunity for cooperation with other member-cities and for the experience exchange, as well as introducing best practices in our city.

In 2007 began the monthly monitoring of energy sources consumption in Kamyanets-Podilskiy, which resulted in significant reduction of energy sources consumption in the city.

All activities aimed at energy-saving and improving energy efficiency of the city are carried out by the Department of Housing and Energy-saving Development of the City Council of Kamyanets-Podilskiy – executive authority, established by the City Council, under its control and accountable to it, directly subordinated to the Executive Committee of the City Council and to the Mayor.

The major tasks of the Department are:

- organizing effective management in the sphere of production and provision of housing and utility services;
- further demonopolization of the housing and utility sector, establishing competitive environment in the market of housing and utility services;
- initiating and implementing energy-saving technologies;
- developing methodical approaches to the evaluation of city's housing and utility sector efficiency;
- attracting investments and cooperation with international financing and donor organizations.

1.2. Energy resources, consumed by the city

This part of the Plan describes in detail the city's energy resources consuming objects divided into categories. Besides, it also contains the list of actions, which must be undertaken in order to reach the Strategic Goals of this Plan, namely:

Strategic Goal # 1 - "Achieving 20% saving of all energy resources"...

Strategic Goal # 2 - "Fossil fuels usage reduction by 20%"...

Strategic Goal # 3 - "GHG emission reduction by 20%"...

For the sake of convenience, let's divide all major energy resources of the city into four groups:

1. Electricity
2. Natural gas
3. Water
4. Heating

These are the main consumed types of energy, used both by the city economic entities and by individual citizens in their everyday life.

First, let's look at the statistics on city's consumption of energy resources in absolute figures. This information shows the energy resources

consumption dynamics in the city via the demonstration of data for the period of 2002 – 2009 (2010).

Electricity consumption, kWh:

Consumers	2002	2003	2004	2005	2006	2007	2008	2009	2010
	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh	kWh
Industry	160,143,700	203,451,175	246,531,653	257,659,813	278,663,070	319,344,109	347,904,489	167,331,979	31,462,448
Budget	11,283,900	11,758,834	11,924,118	10,851,408	11,107,186	13,165,482	13,684,026	13,805,307	17,800,782
<i>State budget</i>	N/A	7,258,397	7,418,224	7,681,502	7,081,382	7,680,080	7,713,223	7,902,970	11,744,808
<i>Oblast budget</i>	N/A	635,499	585,937	607,449	589,004	545,834	594,278	589,127	617,474
<i>City budget</i>	N/A	3,864,938	3,919,957	2,562,457	3,436,800	4,939,568	5,376,525	5,313,210	5,438,500
Population	28,721,800	20,947,042	32,031,038	37,870,999	38,582,058	38,858,403	42,296,019	46,083,572	47,533,107
Minzhitlocomungosp (WaterServices and HUO*)	5,803,500	20,510,966	11,264,568	12,551,860	16,669,252	19,497,471	19,107,025	19,920,977	17,801,426
Other (non-industrial and agricultural consumers)		7,369,704	8,818,809	11,709,183	13,400,236	15,971,181	19,538,404	18,838,585	20,855,406
Total	205,952,900	264,037,721	310,570,186	330,643,263	358,421,802	406,836,646	442,529,963	265,980,420	135,453,169

Natural gas consumption, m³:

Consumers	2002	2003	2004	2005	2006	2007	2008	2009
	thsd. m ³	thsd. m ³	thsd. m ³	thsd. m ³	thsd. m ³	thsd. m ³	thsd. m ³	thsd. m ³
Industry	199,775.5	259,373	330,429.2	355,858.9	356,621.7	113,316.9	93,308.7	23,636.9
Budget	17,749.087	854.306	940.984	1,338.729	1,186.631	860.929	786.699	821.56
<i>State budget</i>	17,563.13	620.907	683.383	990.677	787.065	546.081	423.882	461.562
<i>Oblast budget</i>	69.498	78.456	74.297	64.44	57.432	62.684	61.99	53.655
<i>City budget</i>	116.459	154.943	183.304	283.612	342.134	252.164	300.827	306.343
Population	23,819.4	24,432.8	23,767.3	25,524.5	27,410.1	25,076.6	25,672.6	25,115.5
Heating boiler stations	48,595.6	55,764.4	68,699.8	66,890.4	55,147.4	36,907.4	33,016.8	31,021
Total	289,939.587	340,424.506	423,837.284	449,612.529	440,365.831	176,161.83	152,784.799	80,594.96

* Housing and Utility Office

Cold water consumption, m³:

Consumers	2002	2003	2004	2005	2006	2007	2008	2009
	m ³	m ³	m ³	m ³	m ³	m ³	m ³	m ³
Industry	36,659	203,376	179,291	171,311	N/A	N/A	95,130	93,643
Budget	124,054	629,677	597,702	566,773	N/A	N/A	269,800	249,376
<i>State budget</i>	72,189	422,450	396,549	382,426	N/A	N/A	N/A	N/A
<i>Oblast budget</i>	6,250	29,895	35,951	38,740	N/A	N/A	N/A	N/A
<i>City budget</i>	45,615	177,332	165,202	145,607	N/A	N/A	N/A	N/A
Population	1,306,881	5,524,829	5,307,581	4,910,515	N/A	N/A	3,431,500	2,119,590
Other	19,543	203,813	223,712	222,219	N/A	N/A	437,500	342,370
Total	1,487,137	6,561,695	6,308,286	5,870,818	N/A	N/A	4,233,930	2,804,979

Heat energy consumption, Gcal.:

Consumers	2002	2003	2004	2005	2006	2007	2008	2009
	Gcal.	Gcal.	Gcal.	Gcal.	Gcal.	Gcal.	Gcal.	Gcal.
Industry	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Budget	46,388	48,794	43,002	43,238	N/A	N/A	33,930	31,424.7
Population	231,567	242,687	261,498	256,617	N/A	N/A	166,940	165,398.48
Other	40,660	22,646	20,970	21,681	N/A	N/A	5,980	4,180.49
Total	318,615	314,127	325,470	321,536	N/A	N/A	206,850	201,003.67

Schematically the general graph of the city's energy consumption can be seen in Figure 1:

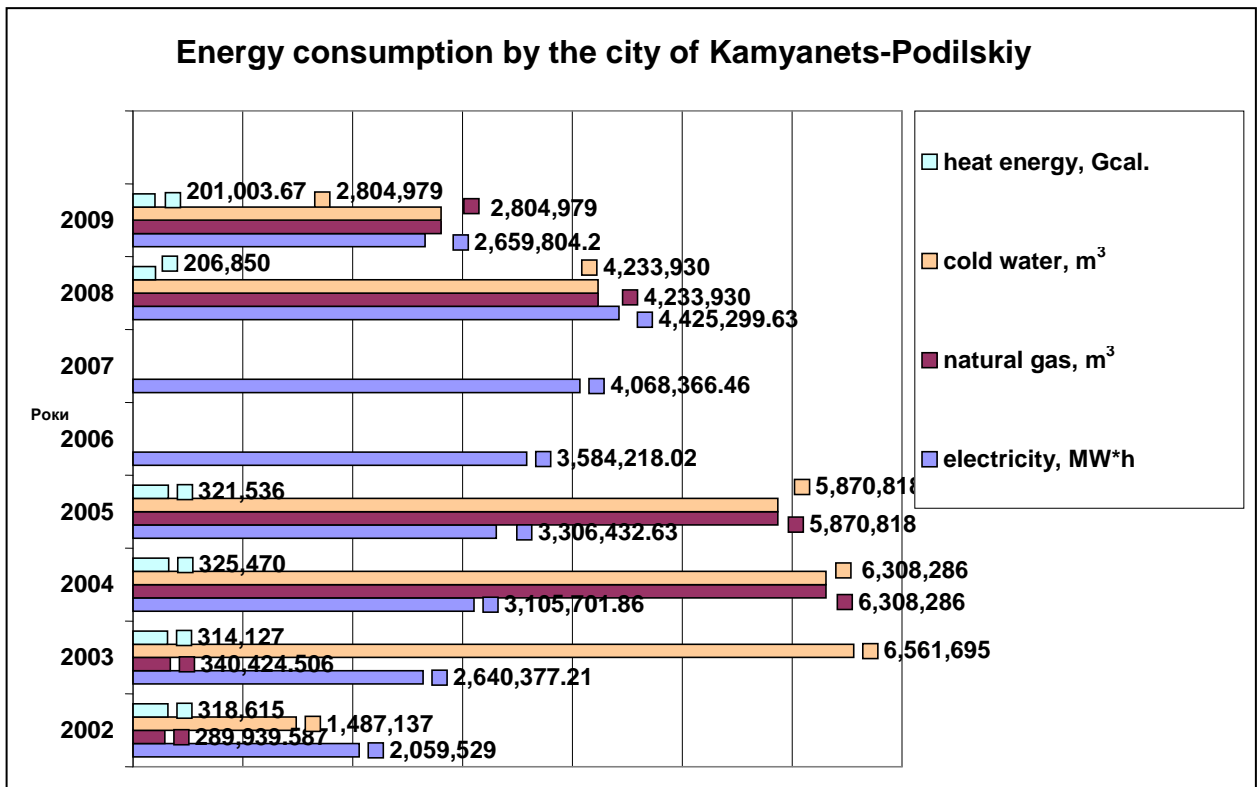


Figure 1.

As we can see, all sectors of city economy – before the financial-economic crisis of 2008 – demonstrated stable trend of increasing absolute figures of consumed resources. If we compare the graph above with the graph of energy resources' price changes, we will see, that in 2002 one item of energy resource cost the city six times less than it does in 2010...

In the following chapters we'll briefly characterize each group of energy resources, used in the city.

1.2.1. Electricity

Current state of the system

The major electricity supplier of Kamyanets-Podilskiy is considered to be the SS-330/110/35 kW "Kamyanets-Podilska".

Provision of electricity to the consumers in Kamyanets-Podilskiy is done by the electric substations:

- SS-110/35/10 kW "Pivnichna", situated in Goloskivske Shose Str, 8 and

is linked to SS “Negin”, SS “Dunayivtsi”, SS “Kamyanets-Podilska-330”;

- SS-110/35/10 kW “Pivdenna”, situated in Franka Str, 42 and is linked to SS “Rykhta”, SS “Orynin”, SS “Kamyanets-Podilska 330”;
- SS-110/10 kW “ZLMK”, situated in Khmelnitske Shose Str, 7 and is linked to SS “Boryshkivtsi”, SS “Dunayivtsi”, SS “Kamyanets-Podilska-330”;
- SS-35/10 kW “Myasokombinat”, situated in Kharchenka Str. and is linked to SS “Kamyanets-Podilska-330”.

According to the data provided by OJSC “Khmelnyskoblenenergo” in 2007 the amount of electricity consumed – 178.414 Mio kWh. (SS “Pivnichna”, “Pivdenna”, “ZLMK”, “Myasokombinat”).

Total maximum capacity is 49 MW.

Electricity distribution between consumers is done by the transmission networks of 110 kW, 35 kW, 10 kW through the substations of the corresponding levels.

The consumers of electricity in Kamyanets-Podilskiy are enterprises of different fields of economy and industrial manufacturing: machinery construction, metallurgy and metal processing, food and light industry, healthcare, housing and utilities consumers and many other consumers.

Planned activities

Due to the expected expansion of housing sector with the planned new housing buildings construction, alongside with the increase of housing comfort qualities, as well as the broadening network for providing cultural and utility services to the population and the growth of industrial and manufacturing enterprises capacity, the consumption of electricity and its workload will grow.

According to the calculations, the workload will increase first almost 1.4 times, and by the estimated period – almost 2.7 times.

Taking into consideration the propositions of the master plan for the city of Kamyanets-Podilskiy, in this project we recommend:

1. To increase the reliability of electricity supply to the city by building an aerial line AL-110 kW “Kamyanets-Podilska-330” – “ZMLK”
2. To reconstruct the same AL-110 kW from pylon#238 to SS “ZMLK”.
3. To reconstruct the same AL-110 kW from pylon #196 to SS “ZMLK” and from pylon#243 to SS “Kamyanets-Podilska-330”, as well as to dismantle the part of aerial line AL-110 kW between pylon#238 and pylon#243.
4. To build a section of double-circuit aerial line AL-110 kW “ZMLK – Pivnichna (pylon#62)”.
5. To reconstruct AL-110 kW “ZMLK – Cement plant (pylon#62)”, as well as to dismantle the part of AL-110 kW from pylon#62.

6. To increase the reliability of electricity supply to the city by replacing worn-out and morally obsolete equipment at SS-110/35/10 kW .
7. In order to cover growing electricity workload during the estimated period, to reconstruct SS-110/35/10 kW “Pivdenna”, replacing current transformer with the transformer of 25 MVA.
8. During the period of the first stage and the estimated period with growing workload – to build new EDP-10/0,4 kW , TSS-10/0,4 kW enclosed-type, cable networks for 10 kW , 0,4 kW and external lighting.
9. During the whole of estimated period it is necessary to reconstruct and expand electricity networks for 10 kW, 0,4 kW , replace worn-out and morally obsolete equipment, introduce energy-saving equipment and technologies.
10. When building on project sites, the existing aerial lines should be taken into consideration, foreseeing either the arranging of technical corridors and security zones, or moving the lines away from the housing construction or transforming them into cable ones.

Security zone from AL-110 kW is 20m, from AL-35 kW – 15m, from AL-10 kW -10m, on both sides of the line, measured from the outer wires.

Connection to electricity network is decided in the course of further planning, in accordance with the technical conditions of the energy-providing organization.

Table. Calculation of electricity workload for economic-utility and communal consumers in Kamyanets-Podilskiy

#	Consumer	Total number of dwellers, thsd. people		Specific norm, kWh per 1 dweller for 1 year		Annual consumption of electricity, Mio kWh		Number of hours with max workload usage		Total workload, thsd. kW	
		1st stage	Estimated period	1st stage	Estimated period	1st stage	Estimated period	1st stage	Estimated period	1st stage	Estimated period
1	Block of flats building (less than 10 storeys) Economic-utility and communal needs of the population	93.8	108.14	760	1,800	71.3	194.7	5,200	5,700	13.7	34.2
2	Block of flats building (more than 10 storeys) Economic-utility and communal needs of the population	0.73	1.88	1,440	2,160	1.1	7.6	5,300	5,800	0.2	1.3
3	Cottage building Economic-utility and communal needs of the population	9.46	9.89	760	1,800	7.2	17.8	5,200	5,700	1.4	3.1
	Total	104.0	120.0			79.6	220.1			15.3	38.6

Table. Calculation of electricity workload for industrial enterprises in Kamyanets-Podilskiy

#	Consumer	Total number of employees, thsd. people	Specific norm, thsd. kWh per 1 person for 1 year	Annual consumption of electricity, Mio kWh	Number of hours with max workload usage	Total workload, thsd. kW
	1st stage					
1	Food industry	1.102	14.0	15.4	4,800	3.2
2	Light industry	0.69	14.0	9.7	4,500	2.2
3	Cellulose/paper production and publishing industry	0.09	23.0	2.1	5,800	0.4
4	Plastic products manufacturing	0.085	33.0	2.8	4,600	0.6
5	Other non-metal mineral products manufacturing	0.4	33.0	13.2	4,600	2.9
6	Metallurgy and metal processing	1.19	25.0	29.8	6,500	4.6
7	Machinery manufacturing	3.075	24.0	73.8	3,800	19.4
8	Production and distribution of heat, electricity	1.22	14.0	17.1	5,000	3.4
9	Other industries	0.08	14.0	1.1	3,600	0.3
	Total in 1st stage:	7.932		165.0		37.0
	Estimated period					
1	Food industry	1.53	16.0	24.5	5,000	4.9
2	Light industry	0.72	16.0	11.5	4,700	2.5
3	Cellulose/paper production and publishing industry	0.12	26.0	3.1	6,000	0.5
4	Plastic products manufacturing	0.12	33.0	4.0	4,600	0.9

5	Other non-metal mineral products manufacturing	0.53	36.0	19.1	4,800	4.0
6	Metallurgy and metal processing	1.642	30.0	49.3	6,800	7.3
7	Machinery manufacturing	4.285	30.0	128.6	4,000	32.1
8	Production and distribution of heat, electricity	1.57	14.0	22.0	5,000	4.4
9	Other industries	0.1	16.0	1.6	3,800	0.4
Total for estimated period		10.617		263.7		57.0

Table. Calculation of total electricity workload in Kamyanets-Podilskiy

#	Consumer	Annual consumption of electricity, Mio kWh		Total workload, thsd. kW	
		1st stage	Estimated period	1st stage	Estimated period
1	Economic-utility and communal needs of the population	79.6	220.1	15.3	38.6
2	Industry	165.0	263.7	37.0	57.0
	TOTAL	244.6	483.8	52.3	95.6

1.2.2. Natural gas

For the preparation of this chapter of SEAP, the following materials were used:

- Data from the Master Plan of the city of Kamyanets-Podilskiy, designed by the RDI of urban development in 2009;
- Data on the gas supply of the city, provided by the branch office on gas supply of the OJSC "Khmelnyskgas";
- Regulatory documents – SBN* B.1-3-97 "Structure, contents, procedure for elaboration and approval of Master Plans for cities", SBN V.2.5-20-2001 "Gas supply".

Current state of the gas supply system

Supplying with gas of Kamyanets-Podilskiy started in 1972. The source of gas supply is the gas pipeline branching from the 1 class gas main pipeline "Dashava-Kyiv".

In the city gas is supplied to:

- 30,629 flats, incl. those with geysers – 9,205 flats; those with gas boilers for heating and hot water – 2,978 flats;
- 3,898 cottages with gas stoves and autonomous system of heating and hot water.

In 2008, the amount of natural gas consumed in the city was 159,647.8 thsd.m³, incl.:

- | | |
|---------------------------------------|----------------------------------|
| - by the population | – 25,672.6 thsd.m ³ ; |
| - by budget organizations | – 809.0 thsd.m ³ ; |
| - by industrial and other enterprises | – 94,129.2 thsd.m ³ ; |
| - by the heat energy sector | – 39,037.0 thsd.m ³ . |

* State Building Normatives

Planned activities

City Master Plan foresees the provision of pipelined natural gas to the following categories of consumers:

- housing in small, medium and multi-storeyed (less than 10-storey) houses – for cooking, heating and hot water;
- cottages – for cooking, heating and hot water;
- trade enterprises, public utilities enterprises;
- industrial sector.

In public institutions, children's and healthcare institutions all thermal food processing is done with electrical appliances.

The level of gas consumption by industrial enterprises is determined by the trend in their prospective development (growth of gross regional product, changes in the number of employees).

The basis for further development and reliable functioning of the city's gas supply system lies in:

- rational usage of existing gas networks and networks under construction or requiring reconstruction;
- reconstruction of existing gas pipe parts (if needed) using new advanced technology;
- construction of new gas distribution pipelines;
- continuing installation of gas meters in apartments and cottages;
- introduction of autonomous sources of heating.

Prospective development of city's gas supply is outlined by further building up of the gas distribution pipeline network, installation of new cabinet-type gas control points (CGCP) in the sites of new and reconstructed housing area.

Proposed building up and interconnection of high pressure street networks in the sites of reconstructed and constructed housing for more reliable and guaranteed gas supply to the consumers.

For the estimated period planned:

- to lay 12 km of gas distribution high pressure pipelines, incl. 4 km in the 1st set;
- to build 7 units of CGCPs, incl. 3 units in the 1st set, using modern technologies and materials, which considerably reduce capital expenses and increases the operating life of gas pipelines.

The amount of planned CGCPs, their locations, the direction of routes of gas distribution pipelines in the project sites, taking into consideration the removal of certain parts of networks from building spots, incl. low-pressure ones, require detailed calculations and are clarified in the further stages of the planning.

It is recommended to develop a hydraulic scheme of city gas supply, taking into consideration the workload of new consumers and provision of stable operation of the gas supply system in general with the involvement of specialized designing

organizations.

Main principles of sustainable development of the city's gas supply are economical, efficient and reliable supply and consumption of gas, along with activities aimed at continuous reduction of its unit costs for the production of one heat unit or one product unit at the enterprises.

The main directions of sustainable development of the city's gas supply:

- reliable supply of gas to the consumers;
- efficient gas consumption;
- application of new technologies in replacing natural gas with alternative types of fuel;
- reducing capital costs of pipelines' construction and repair works.

High reliability of the energy supply system is one of the crucial conditions of ensuring efficient functioning of the city.

Increasing the efficiency of energy usage and energy saving in all sectors of city's economy is an important step towards the solution to energy problem in the city.

Gas supply system is one of the main parts of the energy supply system of the city. Its reliable and guaranteed functioning is the basis for efficient functioning of installed gas-using equipment and its performance.

Main gas-saving measures are:

- reliable and safe functioning of the city's gas supply system – the amount and pressure of natural gas arriving into gas burners must ensure maximum efficiency of gas-using equipment;
- taking timely precautions against accidents and other breakdowns in the system of gas supply. This will allow for avoiding the costs of damages both to the system itself and to the gas-using enterprises;
- introducing a strict control system for the consumption and accountability for consumed gas, both at the enterprises and in housing;
- wide introduction (where appropriate) of autonomous sources of heating – module boiler stations, individual heating plants, converters, which would allow (to certain extent) giving up external heating networks, and, in its turn, would reduce the costs of building and maintaining heating supply systems, as well as expand the possibilities for accountability and control over energy resources consumption;
- measures aimed at reducing gas consumption for heating due to reducing heat loss in housing, public and administrative buildings through the usage of new materials and technologies for insulation systems that keep heat in the buildings;
- installing meters in flats and cottages for heating and hot water pipes, which would stimulate their rational consumption;
- installation of highly efficient gas equipment.

To reduce natural gas consumption it is necessary to improve the structure of fuel-energy balance of the city, taking into consideration the resources of energy saving, incl. alternative types of fuel (raw waste, biogas) with the usage of renewable sources of energy (sun, wind, etc.);

The reduction of capital costs in construction and maintenance of gas pipelines can be achieved through:

- wide introduction of one-stage systems of gas supply to the population via gas pipelines with the usage of CGCPs in buildings, which would allow for the possibility to reduce the diameter of gas distributing pipeline;
- the usage of polyethylene pipes for gas pipelines that do not require insulation with short-supply and expensive anticorrosive material;
- the usage of pipeline reconstruction method for worn out steel gas pipelines, which lies in putting polyethylene pipes inside steel pipelines with or without further increase of gas pressure category. This method allows such worn out gas pipelines to get back to the operational status without digging out the pipelines and destroying road pavement, which considerably cuts the costs of works and allows avoiding traffic problems and pedestrian movement in the place of works.

1.2.3. Heating

Calculations of the heating needs are made on the basis of the following climatic characteristics of the city:

- estimated temperature for heating system design – 20° C;
- average temperature during the heating period – 0,3° C;
- length of the heating period – 180 days.

Current state of the system

As of today, the heat supply to the Kamyanets-Podilskiy consumers is done by the heat energy sources of the CE "Miskteplovodoenergiya", LLC "Podilska Energoservisna Companiya", departmental autonomous boiler stations and individual sources of heat supply.

A wide and well-developed system of centralized heating is subordinated to the **CE «Miskteplovodoenergiya»**. Seven sources of heat energy (6 heating boiler stations and a CHP) provide with heating housing buildings, public buildings and other economic entities of the city. The sources, used by the CE "Miskteplovodoenergiya" are characterized in the table.

Table. Tabulated information on city's boiler stations

Address	Heat capacity, Gcal./h				Fuel
	Installed	Added			
		total	heating	hot water	
1	2	3	4	5	6
123 Timiryazeva Str	37.2	22.587	19.915	2.672	Natural gas
2 Zhukova Str	76.0	43.11	25.301	17.809	Natural gas
20 Suvorova Str	1.72	0.683	0.448	0.235	Natural gas
77a Vokzalna Str	5.16	2.225	1.61	0.615	Natural gas
Molodizhna Str	7.74	8.684	6.436	2.248	Natural gas
43 Vokzalna Str	0.172	0.108	0.108	-	Natural gas
CHP, 42 Franko Str	132.0	71.796	60.927	10.869	Natural gas, black oil (reserve)
Total:	259.992	149.193	114.745	34.448	

Total amount of boilers (mainly water-heating) is 21 items.

In the boiler stations are installed the boilers of the following types: KW-GM-20, DKWR 10/13, TVG-8M, WK-21, WK-32, WK-4, KSVT-3, KGB-100. The boilers started operating in the period of 1974-2004.

Heat energy for heating needs is supplied 24/7 during the period of heating season, hot water supply is done during the heating season (in some parts of the city – all the year round).

Heat energy output regulation is of high quality, according to the heating schedule.

Main fuel used by the boilers and CHP – natural gas; black oil, as a reserve fuel, is used only by the CHP.

The state of buildings of the majority of boiler stations is satisfactory. The equipment of boiler stations in 123, Timiryazeva Str., 2, Zhukova Str and the CHP is morally obsolete and physically worn out (after more than 30 years of operation), but due to the maintenance and timely capital repair works, the performance of boilers is rather efficient.

At the boiler stations of the CE "Miskteplovodoenergiya", the softening of water is done according to the sodium-cationite scheme.

Electric and gas parts of the boiler stations are in satisfactory condition.

Pumping equipment, used by the boiler stations, is mostly of domestic manufacturing and is characterized by high level energy consumption.

With heat energy meters are equipped 98.6% of budget consumers and 56% of housing sector and cost accounting enterprises.

Connecting consumers in the city to heat network is done from CHSS and IHSS:

- Plug-in of heating systems – dependant, except from pumping ones in Pushkinska, 47, Shevchenka 29 and Shevchenka 41.
- Plug-in of hot water supply systems is done through water heaters collaterally.

In the books of the CE "Miskteplovodoenergiya" are 73 km of heat networks, including:

- heating and hot water supply networks – 53 km;
- inlets to the buildings – 16 km;
- non-operating heat networks – 4 km.

Types of heat network construction:

- underground, in reinforced concrete canals – 37.23 km, operating period expectancy – over 15 years;
- overground (to the sugar-producing plant, D 219 mm) – 0.77 km;
- without canals, with the usage of priorly insulated pipes – 15 km.

The CE "Miskteplovodoenergiya" informs, that in fact in 2009 were used 42,188.34 tonnes of oil equivalent.

The following technical problems of the centralized heat supply system were detected in Kamyanets-Podilskiy:

1. Misbalance of the hydraulic regime, low temperature charts;
2. Further operation of 48% of the length of existing heat networks can lead to accidents;
3. High unit costs of the energy resources at certain boiler stations, due to the usage of obsolete equipment;
4. Non-equipment of heat consumers with the heat meters;
5. Big loss of heat energy in the heat networks (up to 13%);
6. Slow rate of energy-saving programme implementation;
7. Insufficient quantity of reliable sectional valves and fittings;
8. Insufficient amount of control-metering devices on heat networks;
9. Partial absence of drainage system of buildings and pipelines, which leads to the flooding of heat networks;
10. Unsatisfactory conditions of inner central heating and hot water supply systems in buildings, which leads to the over-expenditures of energy resources.

At some boiler stations, excess installed capacity is detected, which percentage-wise comes up to:

- the boiler station at 123, Timiryazeva Str. – 24 %;
- the boiler station at 2, Zhukova Str. – 33.6%;
- the boiler station at 20, Suvorova Str. – 53.7%;
- the boiler station at 77a, Vokzalna Str. – 43.7%;
- the boiler station at 43, Vokzalna Str. – 26.3%;
- the CHP at 42, Franka Str. – 37.7%.

At the boiler station in 15, Molodizhna Str., is detected a shortage of installed capacity within the ambit of 31.82%.

Total ***installed heat capacity*** of enterprises, subordinated to the **CE "Miskteplovoenergiya"**, equals **259.992 Gcal./h, added – 149.193 Gcal./h.**

Autonomous heat supply systems

Besides the boiler stations of CE "Miskteplovodoenergiya", in Kamyanets-Podilskiy there are 20 individual autonomous heat supply sources with various forms of ownership.

The characteristics of departmental boiler stations of the housing sector and public buildings of Kamyanets-Podilskiy can be seen in the table below.

Table. Autonomous heat supply sources

#	Owner	Address	Type and amount of boilers	Total heat capacity, kW
1.	Secondary comprehensive school #1	6, Podilskiyi rynok Str.	TMKU-480 MN 120 x 4 items	480
2.	Condominium "Viktoria 56"	56, Grushevskogo Ave.	G-150, 8 items	976
3.	CE "Zhytlovyk"	50, Grushevskogo Ave.	Heating modules MN-120, 8 items	960
4.	LLC "Podilska Energoservisna Companiya"	95, L.Ukrainky Str.	Vitoplex 100, Wiessmann – 2 items	2700
5.	LLC "Podilska Energoservisna Companiya"	12, Shevchenka Str.	Vitoplex 100, Wiessmann – 2 items	2700
6.	LLC "Podilska Energoservisna Companiya"	13, Shevchenka Str.	Vitoplex 100, Wiessmann – 2 items	2700
7.	EC "Miska laznya-1"	15, Tatarska Str.	E1/09 – 2 items	1400
	TOTAL:			11916

Total heat capacity of existing autonomous heat supply sources in the housing sector and public buildings equals **11.916 MW (10.246 Gcal/h)**.

Other autonomous sources are the boiler stations of industrial enterprises with the total installed capacity of 86.4 MW (74.29 Gcal/h). These boiler stations mostly contribute to the technological processes of product manufacturing.

The share of autonomous boiler stations is 6% of Kamyanets-Podilskiy's potential market of heat energy for housing sector consumers.

Planned activities

Heat supply to the buildings, situated outside the operation range of the boiler stations, is provided through the usage of modern technologies – autonomous boiler stations (roof-top, plug-in design). Heat supply to cottages is autonomous, from household gas boilers.

Heat supply to the main group of industrial enterprises remains as is – from their own boiler stations.

Estimated heat consumption by the city's consumers is calculated basing on the provision of:

- block-of-flats housing sector with heating and hot water supply;
- cottage housing sector with heating and hot water supply;
- public buildings with heating, ventilation and hot water supply.

The list of key activities regarding the heat energy sources in Kamyanets-Podilskiy for the estimated periods is tabulated below.

Table. City's planned activities

#	Heat source	Start-up of basic equipment	
		1st stage of construction	Estimated period
1.	CHP in 42, Franka Str.	Introduction of decentralized heat supply systems. Reconstruction of existing heat supply stations. Energy-labelling and heat modernization of budget sector buildings. Replacement of inlet units in buildings.	Transition to water-coal fuel (WCF): a) construction of a department for WCF production; b) reconstruction of 2 units of BP-50-39; c) construction of gas treatment plants; d) construction of fuel pipelines from the WCF department to boilers; e) reconstruction of main networks and pumping substations. Elimination of hot water supply networks. Energy-labelling and heat modernization of housing buildings. Introduction of individual heat supply stations, installation of plate-type heat exchangers.

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#	Heat source	Start-up of basic equipment	
		1st stage of construction	Estimated period
2.	The boiler station at 123, Timiryazeva Str.	<p>Reconstruction of existing heat supply stations.</p> <p>Installation of heat meters.</p> <p>Replacement of disabled and obsolete heat networks.</p> <p>Energy-labelling and heat modernization of budget sector buildings.</p> <p>Replacement of inlet units in buildings.</p>	<p>Re-equipment of the boiler station to the CHSS with the installation of plate-type heat exchangers.</p> <p>Plug-in to the CHP network independently.</p> <p>The boiler station remains as the emergency source on gas fuel.</p> <p>Introduction of individual heat supply stations.</p> <p>Energy-labelling and heat modernization of housing buildings.</p>
3.	The boiler station at 2, Zhukova Str.	<p>Installing of modern automated gas-burning units on existing boilers.</p> <p>Introduction of regulated electric drive draft-blow equipment of the boiler station.</p> <p>Installation of efficient smokestack exhaust gas heat utilizers.</p> <p>Replacement of disabled and obsolete heat networks.</p> <p>Reconstruction of existing heat supply stations.</p> <p>Replacement of inlet units in buildings.</p>	<p>Replacing in distributing centres existing heat exchangers with plate-type ones.</p> <p>Energy-labelling and heat modernization of housing buildings.</p> <p>Introduction of individual heat supply stations.</p>
4.	The boiler station at 77a, Vokzalna Str.	<p>Introduction of regulated electric drive draft-blow equipment of the boiler station.</p> <p>Installation of heat meters.</p> <p>Replacement of disabled and obsolete heat networks.</p> <p>Replacement of inlet units in buildings.</p>	<p>Installation of a water-heating boiler with the capacity of 0.86 Gcal/h.</p> <p>Transferring heat supply system into 2-piped.</p> <p>Energy-labelling and heat modernization of housing buildings.</p>
5.	The boiler station at 15, Molodizhna Str.	<p>Installation of a water-heating boiler with the capacity of 2.58 Gcal/h, that works on gaseous fuel.</p> <p>Introduction of regulated electric drive draft-blow equipment of the boiler station.</p> <p>Replacement of disabled and obsolete heat networks.</p> <p>Energy-labelling and heat modernization of budget sector buildings.</p>	<p>Energy-labelling and heat modernization of housing buildings.</p> <p>Introduction of individual heat supply stations.</p>
6.	The boiler station at 20, Suvorova Str.	<p>Introduction of regulated electric drive draft-blow equipment of the boiler station.</p> <p>Replacement of disabled and obsolete heat networks.</p> <p>Replacement of inlet units in buildings.</p>	<p>Installation of a biofuel boiler with the capacity of 300 kW.</p> <p>Energy-labelling and heat modernization of housing buildings.</p>
7.	The boiler station at 43, Vokzalna Str.	<p>Installation of output heat energy meters.</p>	<p>Energy-labelling and heat modernization of housing buildings.</p>
8.	The boiler station at Kn. Koriatovychi Str. at Matrosova Str.	<p>Installation of 3 gas water-heating boilers Vitomax-100.</p>	<p>Installation of a heat pump (intake of heat from the sewage effluent).</p>

#	Heat source	Start-up of basic equipment	
		1st stage of construction	Estimated period
9.	Roof boiler station at 45, Kn. Koriatovychi Str.	Installation of 2 heating modules, 100 kW each.	

Taking into consideration the objectives of the “National heat supply strategy of Ukraine”, top priority directions, for the development of heat supply system in Kamyanets-Podilskiy, are:

- conducting a complex technical modernization of the heat supply system, reducing the energy consumption of communal infrastructure and housing sector, introducing meters and regulating devices;
- increasing energy efficiency of buildings.

Anticipated costs of the construction for the estimated period is:

- heat supply sources – 242,920.6 thsd.UAH;
- construction (reconstruction) of heat networks – 74,378.95 thsd.UAH.

1.3. Major consumers of city’s energy resources

Major consumers of city’s energy resources can be divided into six target groups. Below we provide the statistical information on each target group with approximate calculation of CO₂ emissions per year.

1.3.1. Target group # 1: Municipal buildings

<u>Municipal buildings</u>	<u>Address</u>	<u>Year of building</u>	<u>Area, m²</u>	<u>Electricity kW h / year</u>	<u>Natural gas/year</u>	<u>Heat m³ / year</u>	<u>GHG emissions (t CO₂-equivalent Gcal / year)</u>	<u>Responsible municipal department</u>
Educational								
Secondary School # 7	27 Zhukova Str	1983	5,181	34,360		364	133.52	Department of education and science
Secondary School # 15	17 Grushevskogo Ave	1964	1,744	18,303		279.9	100.20	Department of education and science
Secondary School # 1	6 Polskiy rynek Str	1957	3,464	38,369	53950		114.84	Department of education and science
Secondary School # 2	2 Knyaziv Koriotovyshiv Str	1937	1,511	9,565		177.4	62.89	Department of education and science
Secondary School # 5	59 L.Ukrainky Str	1972	4,196	32,660		415.9	150.55	Department of education and science
Secondary School # 6	5 Molodizhna Str	1976	5,473	28,145		590.5	208.20	Department of education and science
Educational-Industrial Complex # 8	24 Shevchenka Str 3 Soborna Str	1884 1946	2,372 824	20,665		252.2	91.55	Department of education and science
Educational-Industrial Complex # 9	12 Dragomanova Str	1987 1972 1969	2,440 639 587	54,740		792.8	284.69	Department of education and science

Secondary School # 10	20 Korolenka Str	1962 1979	3,084 1,311	29,332	32540	168.6	128.15	Department of education and science
Secondary School # 11	27b Sportyvna Str	1971	1,260	18,983	54510		110.00	Department of education and science
Educational-Industrial Complex #16	102 Pivnichna Str	1978	7251.9	45,240		423	156.78	Department of education and science
Secondary School #12	19 Budivelnykiv Str	1978	2,709	18,900		620.1	215.39	Department of education and science
Secondary School #13	5 Pushkinska Str	1961	4,089	25,019	41738		87.42	Department of education and science
Gymnasium	17 Chervonoarmijska	1980	5,577	65,264		393.7	152.97	Department of education and science
Educational-Industrial Complex # 17	8 Rozvadovskogo Str	1990	10,452	39,568		662.3	235.95	Department of education and science
Lyceum	29 L.Ukrainky Str	1936	1,744	7,600		132.3	47.04	Department of education and science
Educational-Industrial Complex # 3	11 Panivecka Str	1966	5,602	69,010		534	201.54	Department of education and science
Kindergarten # 1	27b Oryninske shosse Str	1988	1,772	31,570			9.61	Department of education and science
Kindergarten # 2	6 Chernyahivskogo Str	1992	2,295	28,580		254.7	94.81	Department of education and science
Kindergarten# 3	27 Nagirna Str	1963	622	3,867	13610		27.20	Department of education and science
Kindergarten# 5	44a Serednya Str	1980	3,100	48,240	11910		37.46	Department of education and science

Kindergarten# 7	20 Kaliska Str	1980	1,054	28,160		177.7	68.65	Department of education and science
Kindergarten# 8	4 Kosmonavtiv Str	1988	2,285	39,132		378.7	139.94	Department of education and science
Kindergarten# 9	7 Zhukova Str	1989	3,780	40,867		353.7	132.02	Department of education and science
Kindergarten# 15	15, 30 Rokiv Peremogy Str	1988	1,526	30,090		326.8	119.64	Department of education and science
Kindergarten# 16	60 Gagarina Str	1963	938	43,280		215.6	86.07	Department of education and science
Kindergarten# 17	3 Dovga Str	1963	955	27,207			8.28	Department of education and science
Kindergarten# 18	40 Chervonoarmiyska Str	1975	1,341	31,190		166.3	65.72	Department of education and science
Kindergarten# 20	30 Gagarina Str	1971	1,880	56,420		300.9	118.90	Department of education and science
Kindergarten# 21	29 D.Galyckogo Str	1972	3,021	25,786		448.5	159.47	Department of education and science
Kindergarten# 22	21 Molodizhna Str	1973	1,934	32,640		325.1	119.84	Department of education and science
Kindergarten# 23	121 Timiryazeva Str	1976	2,974	38,555		291.5	100.29	Department of education and science
Kindergarten# 30	29 Zhukova Str	1984	2,103	23,917		376.2	134.46	Department of education and science
GCSS (Group of Centralised Support Services)	96a Pivnichna Str	1977	433	29,875		71.7	33.34	Department of education and science

ISEIC (Inter-school Educational-Industrial Complex)	35 Ogienka Str	1981	982	22,328		162.5	61.73	Department of education and science
CAC (Children's art centre)	60 L.Ukrainky Str	1989	605 160 809	8,925		225.6	78.98	Department of education and science
YT (Young technician)	63 L.Ukrainky Str 2 Kosmonavtiv Str 8 Proektna Str	1922 1982 1936	433 371 406	6,283		138.7	48.80	Department of education and science
YTS (Young tourists' station)	3 Dovga Str	1944	247	1,596			0.49	Department of education and science
(ENYC) Environmental naturalistic Youth Centre	47 Timiryazeva Str	1946	440	11,660			3.55	Department of education and science
Sports								
Children and Youth Sports School #1	61 Shevchenka Str	1966	1,338	1,720		166.8	56.91	Department of education and science
Children and Youth Sports School #2	31 Grushevskogo Str	1930	980	10,686		198.9	70.49	Department of education and science
Cultural								
Centralized Library System:				16,491	9,797	166.61	80.08	Department of culture
Central Library	3 Knyaziv Koriotychiv Str	1922	656					Department of culture
Library branch #6 for children	38 L.Ukrainky Str	1917	273.6					Department of culture
Medical/healthcare								
City Hospital # 1				334,542		1,869.99	734.05	Department of Healthcare
Main building	31 Pushkinska Str	1825	23,374					Department of Healthcare
Property and facilities management department	31 Pushkinska Str	1825	169.7					Department of Healthcare

Infectious diseases department	31 Pushkinska Str	1917	350.7					Department of Healthcare
Neurological trauma department	31 Pushkinska Str	1914	736.5					Department of Healthcare
Surgery department (old building)	31 Pushkinska Str	1934	1,988.1					Department of Healthcare
Laboratory	31 Pushkinska Str	1963	236.5					Department of Healthcare
Bacteriological laboratory	31 Pushkinska Str	1977	220.7					Department of Healthcare
Surgery department (new building)	31 Pushkinska Str	1985	3,136					Department of Healthcare
Administrative building	31 Pushkinska Str	1963	427.4					Department of Healthcare
Maternity department	17 Matrosova Str	1994	17,728.8	234,786		968.24	398.82	Department of Healthcare
Therapeutics department	17 Matrosova Str	1985	5,134.5	183,740		914.96	365.26	Department of Healthcare
City polyclinic # 1								Department of Healthcare
Outpatient clinic	30 Franka Str	1988	3,753	34,820		286	107.29	Department of Healthcare
Outpatient clinic	8 Kosmonavtiv Str	1988	380.3	6,147		14.95	6.93	Department of Healthcare
Outpatient clinic	14 Frunze Str	1961	114.4	1,124		15.2	5.48	Department of Healthcare
Outpatient clinic	78 Papanina Str	1968	188.5	3,700	3,723.5		8.25	Department of Healthcare
Outpatient clinic	20 Pavlova Str		103.5	1,203	2,768		5.66	Department of Healthcare
Outpatient clinic	20 Ogienka Str	1966	3,043.3	92,056.42		248.67	112.10	Department of Healthcare
Outpatient clinic	38 Timiryazeva Str	1950	394	1,599			0.49	Department of Healthcare
Outpatient clinic	2 Myru Str	1975	1357	33,160	228	123.5	52.28	Department of Healthcare
Physiotherapy department	27 L.Ukrainky Str	1962	964			184.9	62.51	Department of Healthcare
City Clinic for Children	41 L.Ukrainky Str	1937	1,203	14,787		213.3	76.61	Department of Healthcare

								Healthcare
City Dental Clinic	13 Gagarina Str	1989	2,253.2	32,177		165.4	65.71	Department of Healthcare
Administration								
City Council	1 Maydan Vidrozhennya	1972	4,048	112,638		320	142.48	Executive Committee
Department of Labour and Social Security	26 Shevchenka Str	before 1917	1,999	41,067		86.9	41.88	Executive Committee
Museums&Cultural								
Armenian well museum	Polskyi rynek Str		76					Department of culture
Town Hall museum	Polskyi rynek Str	1967	523					Department of culture
Picture Gallery	11 Pyantytska Str	1982	532					Department of culture
Repository	Virmenskyi rynek Str	1996	629					Department of culture
Archaeology museum	2 Ioanna-Predtechi Str	1986	492					Department of culture
Fortress museum	1 Zamkova Str	1928	4,436					Department of culture
Book collector for libraries	20 Shevchenka Str	1903	4,562	22,473		227.08	83.61	Department of culture
Art School	25 Zhukova Str	1981	2,483.2	3,600		262.28	89.76	Department of culture
Choir	37 Shevchenka Str	1891	588.4	5,049		126.91	44.44	Department of culture
Music School	35 Shevchenka Str	1911	584.6	1,556		48.81	16.97	Department of culture
Art School	4 Uralska Str	1917	493.5	1,657		118.15	40.45	Department of culture
Art School	33 Shevchenka Str	1979	359.4					Department of culture

To increase the energy efficiency of the above mentioned target group, the city implements the program “Increasing the efficiency of energy resources usage in the buildings of city’s budget institutions”.

Within its framework:

- limitations were elaborated for energy resources consumption;
- daily monitoring of energy resources consumption is being conducted;
- control and analysis of efficient usage of energy sources is done on the basis of meters’ showings on working days and on holidays;
- analysis of energy resources consumption by the city’s budget institutions is done regularly and is compared with the analogous periods in previous years.

Total reduction of energy sources consumption in 2009 compared to 2008 in cash equivalent is 1.68 Mio UAH, incl. in the quarantine period from 02.11 till 20.11 – 781.5 thsd. UAH.

On the basis of the received data and conducted analysis, the Action Plan was elaborated for the renovation of budget institutions’ buildings for each individual building, which envisages the sequence of activities, both low-cost and high-tech, aimed at the reduction of energy resources consumption and the improvement of inner conditions of such buildings.

In city’s budget institutions, the replacement of windows and doors was done for the amount of 709 thsd. UAH.

53 energy passports were given for 90 buildings of city’s budget institutions.

Together with the European company “Display®”, were elaborated energy efficiency certificates for the buildings of the city’s budget institutions for 2008 and the elaboration for 2009 is nearing completion. The necessary information data pack, for the elaboration of energy

efficiency certificates for the residential buildings of the village of Pershotravneve, is completed.

Certification of buildings allows raising awareness among owners and dwellers regarding the issues of energy consumption, water consumption and GHG emissions, helping them to make weighed decisions regarding the reduction of consumption of these resources and reduction of the level of harmful impact on the environment.

Following the Edict #1337-p of the CoMU of 16.10.2008 “On measures for reducing electricity consumption by budget institutions”, the city conducted the data collection regarding the existing lighting devices in the buildings of the city’s budget institutions and conducted their analysis for the cost estimate of replacing them with energy efficient ones. Expected yearly saving of electricity, according to the calculations, will be up to 800 thsd. kW with the cost of work at 500 thsd. UAH.

To draw the programme “Reconstruction of the heat and hot water supply system in the buildings of the city’s budget institutions”, the information on different types of individual heat supply stations was gathered and analyzed; the necessary, for calculating, designing and organization of automated individual heat supply stations with independent scheme of plug-in, data pack on the central heating system in the buildings of budget institutions.

1.3.2. Target group # 2: Housing

<u>Housing</u>	<u>Total</u>	<u>Building year</u>	<u>Heat/year</u>	<u>GHG emissions (t CO₂-equivalent / year)</u>	<u>Responsible municipal department</u>
Privately owned					
Private housing	6,696	1964-2005	89,062 Gcal /year		Condominium
cooperative housing	38	1964-2005			
residential condominiums	73	1964-2005			

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residential community property	542	1964-2005		30,108.69	Department of Housing
Multi-storey buildings					
	253	over 50 years			Department of Housing
	210	of 30 to 50 years			
	106	of 20 to 30 years			
	98	of 20 years			
Planned to be put into operation					
	9	2011			
Departmental housing					
	15				
Hostels					
	35				

Activities aimed at the reduction of energy consumption in the housing sector of Kamyanets-Podilskiy are envisaged by the city's targeted programme on capital repair works in the block-of-flats buildings of the city.

Main reasons, for the low energy efficiency of housing buildings in the city, are:

1. Long time underfunding of capital repairs needs in the block-of-flats buildings. In Ukraine, normative-regulatory documents do not envisage making obligatory contributions to the capital repairs of the block-of-flats buildings from the owners of private flats and non-residential premises. As a result, there is no source of regular funding for the capital repairs of such buildings, and there is an accumulated considerable need of funds.

2. Unwillingness of the majority of co-owners of the block-of-flats buildings to participate in funding of capital repairs of the building. Most of flat owners believe that their property rights are limited by their private flats, and not extending to the communal property of the building. As such, they do not see themselves as responsible for the maintenance,

preservation and repairs of such property. Considerable part of citizens expects the state or local community to assume responsibility and provide corresponding funding. Such expectations were proved correct by the sporadic allocation of funding from state and local budget for the repairs of the block-of-flats buildings without the financial involvement of the co-owners of such buildings.

3. Low financial ability of the co-owners of block-of-flats buildings to take part in the funding of capital repairs. Funding, needed for the conducting of capital repair works, considerable exceeds the financial potential of the majority of co-owners of block-of-flats buildings. They are unable to provide the full amount of funding in one go, and its gradual accumulation might take several years.

4. Inability of the co-owners of block-of-flats buildings to make decisions regarding the capital repair works. According to the effective legislation, the decision on conducting capital repair works of the block-of-flats building is within the competence of its co-owners. But in practice, legitimate adoption of such a decision is only possible by the co-owners, who were organized into a Condominium, of which there are only 52 in Kamyanets-Podilskiy.

There are two ways of solving this problem:

- the first variant envisages the allocation of funds for the capital repairs of block-of-flats buildings from the city budget. But the demand for funds exceeds the resources of local budget. Besides, such approach would stimulate further irresponsible attitude of the co-owners of block-of-flats buildings towards their communal property.

- the second, optimal, variant envisages the allocation of funds from the city budget to the co-owners according to the co-financing principle, with the provision of organizational support in conducting capital repair works. The second variant allows involving the co-owners' funds in the

repairs of their buildings, which alleviates the financial load of the city budget and stimulates more responsible attitude of the co-owners towards communal property.

The programme, adopted by the city, is aimed at establishing institutionalized environment and favourable conditions for the conducting and financing of capital repair works in block-of-flats buildings with the involvement of their co-owners' funds. This will be implemented by:

1. Conducting public awareness campaign amongst the city dwellers regarding the co-ownership terms in the block-of-flats buildings, their rights and obligations as co-owners, as well as the principles of establishment and operation of Condominiums, including the principles and funding mechanics of the capital repair works in block-of-flats buildings.
2. Allocating funds to the co-owners from the city budget for conducting capital repair works in the block-of-flats buildings only under the following conditions:
 - there must be a Condominium established in the block-of-flats building. The order of priority in receiving co-financing from the city budget will be defined, other things being equal, by the date of state registration of such a Condominium.
 - the decision on conducting capital repair works and assuming part of the financial responsibility for them must be adopted by no less than $\frac{3}{4}$ of the co-owners of the block-of-flats building.
 - the Condominium must have an adopted long-term plan for capital repair works in the building.
 - the Condominium must have its own repair fund, with no less than 90% of co-owners' contributing to it, in the amount set by

the Condominium, during the period of no less than six months.

- utility services must be timely paid for by no less than 90% of the building's dwellers.

The part of co-financing done from the city budget will not exceed 30% of the total cost estimate of the capital repair works in the block-of-flats building.

Preference would be given to the capital repair works plans, which envisage activities aimed at energy efficiency improvement and provide proof of considerable effect received from such activities.

1.3.3. Target group # 3: Private enterprises

<i>Private enterprises</i>	
Number of small businesses (30.11.2010)	814
<u><i>Number of industrial enterprises:</i></u>	
Extractive industry	6
Manufacturing industry	368
Gas and water distribution	14
-	
<i>2.3.2. Communal enterprises</i>	28

Data on CO₂ emissions is not available.

1.3.4. Target group # 4: Transport and traffic

Transport	Items	km/year	Fuel type	Consumed fuel	GHG emissions (t CO ₂ -equivalent / year)
<i>Municipal transport</i>					

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Municipal buses	243	1,800,000	Diesel	9,460,008	25,914.07
			Gas	2,102,400	4,021.83
Municipal cars		24,916,100	Gasoline	1,533,300	3,500.13
			Diesel	3,697,000	10,127.30
			Gas	1,881,000	3,598.29
			Compressed Gas - m ³	747,000	1,428.99
Waste collection vehicles	53				
Private vehicles					
passenger cars	1,747				
tractors	46				
trucks	331				
bicycles	28				

1.3.5. Target group # 5: Monuments of architecture and museums

Monument	Address	Building year	Area, m ²
Armenian well museum	Polskyi rynek Str.		76
Town Hall museum	Polskyi rynek Str.	1967	523
Picture gallery	11, Pyatnytska Str.	1982	532
Repository	Virmenskyi rynek Str.	1996	629
Archaeology museum	2, Ioanna-Predt. Str.	1986	492
Fortress museum	1, Zamkova Str.	1928	4,436

Data on CO₂ emissions is not available. Besides, mentioned objects are the property of state and local authorities do not influence their energy policies.

1.3.6. Target group # 6: Street lighting

Street lighting	Items	Electricity use	GHG emissions (t CO ₂ -equivalent)	Responsible municipal department
Sources of light:	4,986			Department of Housing
<i>incandescent bulbs</i>	1,000	300 W	333.43	
<i>energy efficient bulbs</i>	3,236	100-150 W	449.57	
<i>projectors</i>	250	50-150 W	27.79	
<i>energy-saving bulbs</i>	500	30 W	16.67	

Installation of energy saving lighting in housing:				Department of Housing
<i>Installed:</i>	102 residential buildings (327 entrances) Lamps: LPO - 2258; ZHPU - 325			
<i>To be installed:</i>	177 residential buildings (611 entrances) Lamps: LPO - 3791; ZHPU - 611	Estimated savings of electricity: 678,020 kW / year.	Estimated GHG cutting: 206.39 kW h / year in CO2-equivalent	

In the books of the JCE "Miskliftsvitlo" there are 4,900 lamps and 155.8 km of electricity transmission lines. In 2009 the enterprise conducted routine repairs of street lighting network spending 112,900 UAH.

Three traffic lights were set up at the cost of 262,000 UAH.

For the installation of City Hall illumination, 13,800 UAH spent.

2. Climate policy “Brussels→Kyiv→Kamyanets-Podilskiy”

2.1. Climate policy of the European Union

The EU has committed to increase the share of energy from renewable sources **to 20%** of the gross energy consumption **by 2020**. This commitment also includes the minimum target of 10% share of biofuel in the gross amount of gasoline and diesel consumption in transportation, which is to be achieved by all member-states of the EU by 2020.

These renewable energy targets are legally binding, which allows initiating certain proceedings in the event of their inobservance. The increase of renewable energy sources production in the EU will stimulate the development of new technologies in this field and will create a demand for knowledge-intensive industries. This will stimulate the creation of new jobs, raise in competitiveness, new opportunities for export trade and economic growth. Wider usage of renewable energy sources further on will have key impact on finding the solution to climate change problems through the reduction of GHG emissions and air pollution. Wider usage of renewable energy sources will make the energy supply of the EU more eco-friendly and at the same time less dependant on imported oil and gas, thus making it more reliable.

Renewable energy can be used for the following:

- electricity production;
- heating and cooling;
- biofuel for transport.

The key EU Directive on the usage of renewable energy sources is the Directive 2009/28/EU regarding the incentives for the usage of energy from renewable sources.

The Directive establishes a general framework for the development of renewable energy sources aimed at achieving the common goal of the share of renewable energy in the gross energy consumption (electricity, heating and cooling), as well as increasing the share of renewable energy used in the transport sector. Every member state has its own individual goals but the common target is 20% share of renewable energy in the gross energy consumption of the EU in 2020. The high hurdle of 20% requires considerable growth in all of the three sectors of renewable energy. It also requires well-coordinated efforts from the governments, industry and public. In order to facilitate the achievement of the targets, each member state must provide incentives and stimulate the energy efficiency of energy saving. Member states also must present a national action plan on renewable energy, with defined national goals with regard to the share of renewable energy in the transport sector, electricity, heating and cooling (conditioning) in 2020.

Besides the establishment of obligatory targeted renewable energy share of the gross energy consumption, the Directive also stipulates that in 2020 each member state must ensure the minimum of 10% renewable energy share of total energy consumption by this country's transport sector in all types of transportation. It also accentuates the necessity of integrating renewable energy sources into the transport sector, building and urban development. The Directive also requires the establishment of such energy prices, which would include external costs of the production and consumption of energy, including, if necessary, environmental, social and healthcare costs. Besides, it establishes the criteria of sustainability for biofuel. Only biofuel, which was produced – either inside

or outside the EU – with the compliance to the sustainable production principles, can be taken into account regarding the achievement of the 10% target. Member states are also expected to introduce measures aimed at facilitation of legalization procedures for the electricity network access and coordination of network access approval with the administrative and planning procedures, which are to stimulate future investments in the renewable energy sources.

2.2. The ambition of Kamyanets-Podilskiy is 20%!

The main objective of City Council's elaboration of the Action Plan is achieving the goal of making Kamyanets-Podilskiy an ecologically clean and attractive city for living, working and recreation. In order to achieve it, it is necessary to ensure the reduction of GHG emissions on the territory of the city. The city authorities established ambitious targets and goals, which surpass national Ukrainian government's ambitions. As such, Ukraine committed to reduce CO₂ emissions in 2020 by 6%. Kamyanets-Podilskiy chose European commitments – we plan to reduce emissions by 20%.

In order to fulfil this commitment, three main strategies for climate protection were defined:

1. Reduction of all energy resources consumption by 20%.
2. Reduction by 20% of the usage of fossil fuels;
3. Reduction of GHG emissions by 20%;

The strategies are closely interrelated, as they envisage the achievement of one general target, but at the same time each of them determines the directions, in which the city authorities plan to move during the nearing 10 years.

Strategic target 1:

“Reduction of all energy resources consumption by 20%”...

Strategic target #1 of the local authorities police is the reduction of all energy resources consumption by 20%. We all notice, that energy isn't always used rationally. And it has its reason, as before people didn't pay much attention to how long the equipment works, often didn't bother to turn off electrical appliances when leaving the room and couldn't care less how many light bulbs are in the lamp, that lights the room. Unfortunately, even now such energy resource wasting exists – some don't monitor electricity consumption out of habit, some don't understand the necessity of it and some are simply not interested. Because of this, the local authorities took up the task of creating public awareness regarding the benefits of rational usage of energy resources, adopt active informational policy and stimulate citizens to save both energy sources and their own finances.

Strategic target 2:

“Reduction by 20% of the usage of fossil fuels”...

Next strategic target is the reduction by 20% of the usage of fossil fuels by 2020 compared to 2007. Introduction of alternative energy sources will allow for: first, gradually refuse the usage of traditional (fossil) sources, which are exhaustive, and second, reduce the amount of CO₂ emissions, as the usage of alternative energy sources, unlike traditional ones, does not pollute the environment with GHG emissions.

Strategic target 3:

“Reduction of GHG emissions by 20%”...

This strategic target defines the reduction of GHG emissions by 20% in 2020 compared to the baseline year of 2007. Within the

framework of this strategy are defined the directions, which do not aim at the reduction of energy resources consumption, but at direct reduction of CO₂ emissions in the environment.

2.3. City's participation in international projects on energy efficiency

The city is very active in the sphere of using international expertise in the reduction of energy consumption of the utility sector and improvement of the general level of energy efficiency:

- signed in Brussels the “Covenant of Mayors”, which is aimed at uniting European local authorities (municipalities) into a voluntary organization for joint struggle against global warming. Signers of the Covenant of Mayors take up voluntary obligations to meet the EU requirements regarding the reduction of CO₂ emissions by 20% minimum through the implementation of energy-saving measures and wider usage of renewable energy sources. The city received an opportunity to participate in the EU grant proposals to achieve this goal;

- the city became a full-fledged partner of the Project “City heat supply reform in Ukraine”, funded by the **USAID and implemented by the** International Resources Group (IRG). Main objectives of this Project include analysis and audit of heat supply systems in cities, improvement of urban energy planning, installation of meters and implementation of energy efficient technologies in buildings, as well as technical support provision to the local authorities with regard to attracting funding and monitoring the programs of central heat supply;

- with the support from the Association “Energy Efficient Cities of Ukraine”, the city took part in the EC funded project “MODEL-CIUDAD” with the European Association of Municipalities “Energy-Cité”. Kamyanets-Podilskiy became one of three cities of Ukraine, which will

receive funding for thermomodernization of one budget building. In December 2009 was approved the list of works to be carried out for thermomodernization of the secondary school #12;

- took part in the implementation of the Project “Building a “passive” house”, organized by the German company GTZ (were chosen to be one of four pilot cities of Ukraine);

- submitted an application and necessary information data pack for the establishment of “energy” partner relationships with the cities of the UK and participation in the corresponding grant proposal of the UK government;

- became a full-fledged partner of the Project “Support to the introduction of energy efficient technologies in Ukraine”, which is implemented by the international public institution “Polish-Ukrainian Cooperation Foundation PAUCI”

3. Baseline substantiation*

3.1. Greenhouse gas emissions inventory in residential sector

3.2. Greenhouse gas emissions inventory in transport sector

3.3. Greenhouse gas emissions in public sector

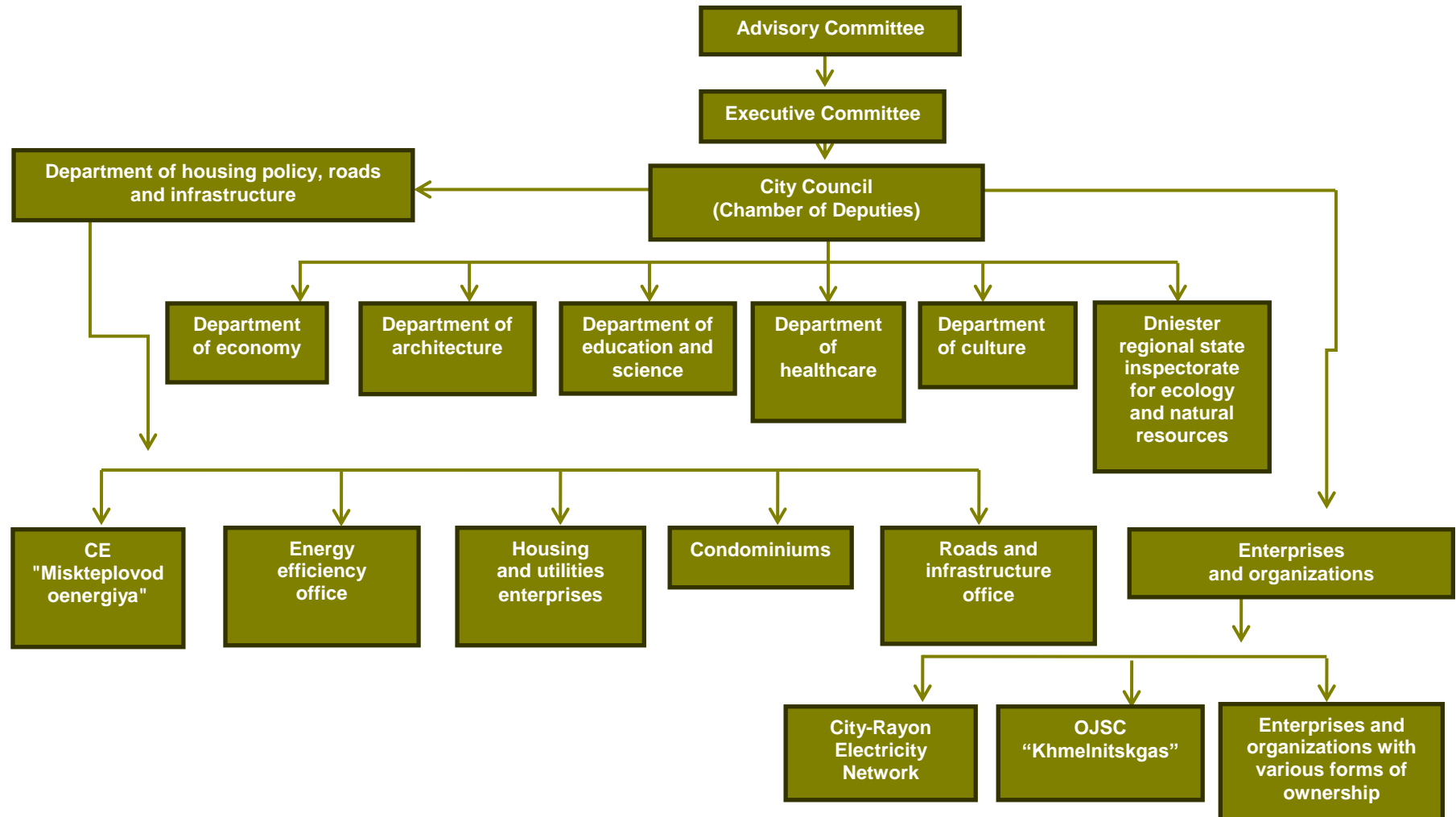
3.4. Dynamics of greenhouse gas emissions in Kamyanets-Podilsky city

3.5. Emissions in Kamyanets-Podilsky city as a share of total emissions in Khmelnytsky region

* There are should be a report of professor Shpak

4. Administrative structure of SEAP implementation

4.1. Organizing structure



4.2. Monitoring and evaluation

Many times local authorities saw that any measures besides implementation also require control. Monitoring the progress of certain processes, it is possible to notice and prevent all sorts of obstacles such as downtime, resource waste, accidents, force majeure, etc.

Monitoring of energy consumption has turned out to be a very useful measure for the implementation of a saving strategy for all kinds of energy resources. As for example, in 2008 Kamyanets-Podilskiy City Council introduced monthly monitoring of energy and water consumption by the institutions financed from the municipal budget. In every such institution, the director appointed an energy manager, who monthly gathers information, draws a report and submits it to the Department of Energy Management of the City Council with the substantiation of energy resources consumption volumes. The senior specialist in energy management summarizes and analyzes received reports. Summarized reports of the senior specialist in energy management are monthly reviewed by the expert commission and on the basis of its recommendations are formed further measures aimed at increasing energy efficiency.

During the planning period, the city authorities envisage the formation of information-analyzing system for the monitoring of energy resources consumption with the help of specialized software and controlling results achieved from the implementation of energy efficiency measures.

Main directions of city policy:

- monthly monitoring of energy sources and water consumption by the institutions financed from the city budget;

- introduction of unitary information system of controlling the consumption of energy sources and water by the budget institutions.

4.3. Regulatory framework

1. United Nations Framework Convention on Climate Change of 09.05.1992, ratified by the Law of Ukraine # 435/96 – BP of 29.10.1996;
2. The Kyoto Protocol to the United Nations Framework Convention on Climate Change of 11.12.1997;
3. “Covenant of Mayors”, initiated by the European Commission, of 15.01.2009;
4. The Law of Ukraine # 74/94 – BP “On energy saving”, adopted by the Verkhovna Rada of Ukraine on 01.07.1994;
5. The Law of Ukraine # 555 – IV “On alternative energy sources”, adopted by the Verkhovna Rada of Ukraine on 20.02.2003;
6. The Law of Ukraine # 2509 – IV “On combined production of heat and electrical energy (co-generation) and utilization of exhaust waste energy potential”, adopted by the Verkhovna Rada of Ukraine on 05.04.2005;
7. The Decree #731 of the Cabinet of Ministers of Ukraine “On comprehensive measures regarding the implementation of National energy programme of Ukraine” of 10.07.1997;
8. “Comprehensive state programme of energy-saving in Ukraine”, approved by the Decree #148 of the Cabinet of Ministers of Ukraine of 05.02.1997;
9. Decree # 505 of the Cabinet of Ministers of Ukraine “On the programme of state support to the development of alternative and

renewable sources of energy, small-scale hydro, as well as heat and power engineering” of 31.12.1997;

10. Edict #1337-p of the CoMU of 16.10.2008 “On measures for reducing electricity consumption by budget institutions”.

5. Action Plan

SECTORS & fields of action	KEY actions/measures per field of action	Responsible department, person or company (in case of involvement of 3rd parties)	Implementation [start & end time]		Estimated costs per action/measure	Expected energy saving per measure [MWh/a]	Expected renewable energy production per measure [MWh/a]	Expected CO2 reduction per measure [t/a]	Energy saving target per sector [MWh] in 2020	Local renewable energy production target per sector [MWh] in 2020	CO2 reduction target per sector [t] in 2020
1. Municipal Buildings											
1.1. Educational	Organizing the "Energy Efficiency Week";	Department of education and science	2011	2020	5	0,2	0	0	1	0	1
	Making "Display" posters and placarding them in the buildings;	Department of education and science	2011	2020	4	0,2	0	0	1	0	1
	Organizing facultative lessons on energy saving in schools (Program "SPARE");	Department of education and science	2011	2020	-	1	0	1	5	0	4
	Introducing modern technologies under the condition of payback period being less than 10 years;	Department of education and science	2011	2020	-	1509	0	1218	6791	0	5480
	Conducting energy monitoring and analysis of energy resources and energy sources consumption;	Department of education and science	2011	2020	15	406	0	328	1827	0	1474

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	Elaborating and introducing limitations;	Department of education and science	2011	2020	-	82	0	66	369	0	298
	Organizing lighting installations in standard rooms, including the provision of propositions;	Department of education and science	2011	2012	-	0,2	0	0	2	0	1
	Organizing quality lighting;	Department of education and science	2011	2013	274	0,95	0	1	8	0	6
	Implementing the "MODEL-CUIDAD" Project (Thermomodernization of the school #16);	Department of education and science	2011	2012	1423	72,106	0	58	613	0	495
	Establishing automated IHS with the adjustment-to-weather option;	Department of education and science	2011	2013	4000	2788	0	2250	22304	0	17999
	Replacing windows and installing recuperators;	Department of education and science	2011	2014	13289	1530	0	1235	11475	0	9260
	Facade insulating;	Department of education and science	2012	2020	16523	1389	0	1121	5556	0	4484
	Installing reflector screens;	Department of education and science	2014	2016	180	430	0	347	2150	0	1735
	Installing warm air curtain;	Department of education and science	2015	2019	160	143	0	115	429	0	346
	Installation of solar collectors to heat water in 8 kindergartens	Department of education and science	2013	2020	1231	138	138	111	483	483	390
1.2. Sports	Organizing the "Energy Efficiency Week";	Department of education and science	2011	2020	5	0,2	0	0	1	0	1

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Making "Display" posters and placarding them in the buildings;	Department of education and science	2011	2020	4	0,2	0	0	1	0	1
Conducting energy monitoring and analysis of energy resources and energy sources consumption;	Department of education and science	2011	2020	15	406	0	328	1827	0	1474
Elaborating and introducing limitations;	Department of education and science	2011	2020	-	82	0	66	369	0	298
Introducing modern technologies under the condition of payback period being less than 10 years;	Department of education and science	2011	2020	-	50	0	40	225	0	182
Organizing lighting installations in standard rooms, including the provision of propositions;	Department of education and science	2011	2012	-	0,2	0	0	2	0	1
Organizing quality lighting;	Department of education and science	2012	2013	2	0,3	0	0	2	0	2
Establishing automated IHS with the adjustment-to-weather option;	Department of education and science	2012	2014	260	80	0	65	560	0	452
Replacing windows and installing recuperators;	Department of education and science	2012	2013	319	48	0	39	360	0	291
Facade insulating;	Department of education and science	2016	2018	340	48	0	39	144	0	116
Installing reflector screens;	Department of education and science	2014	2016	3	15	0	12	75	0	61

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	Installing warm air curtain;	Department of education and science	2015	2019	8	5	0	4	15	0	12
	Installation of solar collectors to heat water in a children's sports school № 2	Department of education and science	2015	2017	28	4	4	3	16	16	13
1.3. Cultural	Organizing the "Energy Efficiency Week";	Department of culture	2011	2020	5	0,2	0	0	1	0	1
	Making "Display" posters and placarding them in the buildings;	Department of culture	2011	2020	4	0,2	0	0	1	0	1
	Conducting energy monitoring and analysis of energy resources and energy sources consumption;	Department of culture	2011	2020	15	406	0	328	1827	0	1474
	Elaborating and introducing limitations;	Department of culture	2011	2020	-	82	0	66	369	0	298
	Introducing modern technologies under the condition of payback period being less than 10 years;	Department of culture	2011	2020	-	503	0	406	2264	0	1827
	Organizing lighting installations in standard rooms, including the provision of propositions;	Department of culture	2011	2012	-	0,2	0	0	2	0	1
	Organizing quality lighting;	Department of culture	2011	2013	26	0,06	0	0	0	0	0
	Establishing automated IHS with the adjustment-to-weather option;	Department of culture	2012	2015	650	193	0	156	1255	0	1012
	Replacing windows and installing recuperators;	Department of culture	2011	2013	1009	131	0	106	1048	0	846

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	Facade insulating;	Department of culture	2013	2020	1648	131	0	106	459	0	370
	Installing reflector screens;	Department of culture	2014	2016	13	150	0	121	750	0	605
	Installing warm air curtain;	Department of culture	2015	2019	52	40	0	32	120	0	97
1.4. Healthcare	Organizing the "Energy Efficiency Week";	Department of healthcare	2011	2020	5	0,2	0	0	1	0	1
	Making "Display" posters and placarding them in the buildings;	Department of healthcare	2011	2020	4	0,2	0	0	1	0	1
	Conducting energy monitoring and analysis of energy resources and energy sources consumption;	Department of healthcare	2011	2020	15	406	0	328	1827	0	1474
	Elaborating and introducing limitations;	Department of healthcare	2011	2020	-	82	0	66	369	0	298
	Introducing modern technologies under the condition of payback period being less than 10 years;	Department of healthcare	2011	2020	-	880	0	710	3960	0	3196
	Organizing lighting installations in standard rooms, including the provision of propositions;	Department of healthcare	2011	2012	-	0,2	0	0	2	0	1
	Organizing quality lighting;	Department of healthcare	2013	2014	88	0,6	0	0	4	0	3
	Establishing automated IHS with the adjustment-to-weather option;	Department of healthcare	2012	2014	1000	1217	0	982	8519	0	6875
	Replacing windows and installing recuperators;	Department of healthcare	2013	2015	3107	676	0	546	4056	0	3273
	Facade insulating;	Department	2017	2019	7229	676	0	546	1352	0	1091

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		of healthcare									
	Equipping lighting sources with movement sensors;	Department of healthcare	2014	2019	14	0,26	0	0	1	0	1
	Installing reflector screens;	Department of healthcare	2014	2016	39	215	0	174	1075	0	868
	Installing warm air curtain;	Department of healthcare	2015	2019	76	85	0	69	255	0	206
	Installation of solar collectors to heat water in the medical and social rehabilitation "Longevity"	Department of Labor and Social Protection	2014	2015	175	58	58	47	290	290	234
1.5. Administration	Organizing the "Energy Efficiency Week";	City Council	2011	2020	5	0,2	0	0	1	0	1
	Making "Display" posters and placarding them in the buildings;	City Council	2011	2020	4	0,2	0	0	1	0	1
	Conducting energy monitoring and analysis of energy resources consumption;	City Council	2011	2020	15	406	0	328	1827	0	1474
	Elaborating and introducing limitations;	City Council	2011	2020	-	82	0	66	369	0	298
	Introducing modern technologies under the condition of payback period being less than 10 years;	City Council	2011	2020	-	125	0	101	563	0	454
	Organizing lighting installations in standard rooms, including the provision of propositions;	City Council	2011	2012	-	0,2	0	0	2	0	1
	Organizing quality lighting;	City Council	2012	2013	27	0,2	0	0	2	0	1

	Establishing automated IHS with the adjustment-to-weather option;	City Council	2013	2013	260	63	0	51	441	0	356
	Replacing windows and installing recuperators;	City Council	2011	2015	434	31,5	0	25	221	0	178
	Facade insulating;	City Council	2016	2018	800	31,5	0	25	95	0	76
	Installing reflector screens;	City Council	2014	2016	10	20	0	16	100	0	81
	Installing warm air curtain;	City Council	2015	2019	8	7	0	6	21	0	17
1.6. Museums	Organizing the "Energy Efficiency Week";	Department of culture	2011	2020	5	0,2	0	0	1	0	1
	Making "Display" posters and placarding them in the buildings;	Department of culture	2011	2020	4	0,2	0	0	1	0	1
	Conducting energy monitoring and analysis of energy resources and energy sources consumption;	Department of culture	2011	2020	15	406	0	328	1827	0	1474
	Elaborating and introducing limitations;	Department of culture	2011	2020	-	82	0	66	369	0	298
	Introducing modern technologies under the condition of payback period being less than 10 years;	Department of culture	2011	2020	-	100	0	81	450	0	363
	Organizing lighting installations in standard rooms, including the provision of propositions;	Department of culture	2011	2012	-	0,2	0	0	2	0	1
	Organizing quality lighting;	Department of culture	2012	2014	9	0,2	0	0	1	0	1
	Installing reflector screens;	Department of culture	2014	2016	5	30	0	24	150	0	121

	Installing warm air curtain;	Department of culture	2015	2019	20	8	0	6	24	0	19
2. Housing											
2.1. Privately owned	Conducting elucidative communication with the public by means of highlighting in mass media actual examples of effectiveness (incl. financial benefits) of implementing elementary actions towards reducing energy consumption and using modern technologies in everyday life;	Energy efficiency office of the Department of housing policy, roads and infrastructure	2011	2020	6	0,5	0	0	2	0	2
	Installation of solar collectors to heat water in the house on Avenue Grushevskogo, 56	Condominium «Victoria»	2015	2016	400	124	124	100	558	558	450
	Introducing modern technologies under the condition of payback period being less than 10 years;	Energy efficiency office of the Department of housing policy, roads and infrastructure; Condominiums; ЖЕО ТСЖББ	2011	2020	-	2900	0	2340	13050	0	10531

2.2. Multi-storey buildings	Conducting elucidative communication with the public by means of highlighting in mass media actual examples of effectiveness (incl. financial benefits) of implementing elementary actions towards reducing energy consumption and using modern technologies in everyday life;	Energy efficiency office of the Department of housing policy, roads and infrastructure	2011	2020	6	0,5	0	0	2	0	2
	Introducing modern technologies under the condition of payback period being less than 10 years;	Energy efficiency office of the Department of housing policy, roads and infrastructure, Condominiums, ЖЕО ТСЖББ	2011	2020	-	2900	0	2340	13050	0	10531
	Transferring to individual heating of houses in Centralna Str., 1 and 18a, as providing them with centralized heating services is economically disadvantageous;	Energy efficiency office of the Department of housing policy, roads and infrastructure	2011	2011	672	3	0	2	27	0	22
	Establishing automated IHS with the adjustment-to-weather option;	Energy efficiency office of the Department of housing	2012	2018	15838	12937	0	10440	64685	0	52201

		policy, roads and infrastructure									
	Installation of solar collectors to heat water in the house on Avenue Grushevskogo, 50	Department of housing policy, roads and infrastructure	2014	2016	400	124	124	100	620	620	500
	Facade insulating;	Energy efficiency office of the Department of housing policy, roads and infrastructure, Condominiums	2011	2014	32000	2780	0	2243	20850	0	16826
	Production of energy passports for buildings	Department of housing policy, roads and infrastructure	2011	2012		0,5	0	0	2	0	2
2.3. Construction	Control over the presence in construction and reconstruction project documentation for urban development objects of chapters foreseeing energy saving and usage of modern technologies and materials;	Office of Urban Development and Architecture	2011	2020	-	5	0	4	23	0	18

	Conducting elucidative communication with the public by means of highlighting in mass media actual examples of effectiveness (incl. financial benefits) of implementing elementary actions towards reducing energy consumption and using modern technologies in everyday life;	Energy efficiency office of the Department of housing policy, roads and infrastructure	2011	2020	6	0,5	0	0	2	0	2
	Introducing modern technologies under the condition of payback period being less than 10 years;	Energy efficiency office of the Department of housing policy, roads and infrastructure; Condominiums; ЖЕО ТСЖББ	2011	2020	-	2900	0	2340	13050	0	10531
2.4. Departmental housing	Conducting elucidative communication with the public by means of highlighting in mass media actual examples of effectiveness (incl. financial benefits) of implementing elementary actions towards reducing energy consumption and using modern technologies in everyday life;	Energy efficiency office of the Department of housing policy, roads and infrastructure	2011	2020	6	0,5	0	0	2	0	2

	Introducing modern technologies under the condition of payback period being less than 10 years;	Energy efficiency office of the Department of housing policy, roads and infrastructure, Condominiums, ЖЕО ТСЖББ	2011	2020	-	2900	0	2340	13050	0	10531
2.5. Hostels	Conducting elucidative communication with the public by means of highlighting in mass media actual examples of effectiveness (incl. financial benefits) of implementing elementary actions towards reducing energy consumption and using modern technologies in everyday life;	Energy efficiency office of the Department of housing policy, roads and infrastructure	2011	2020	6	0,5	0	0	2	0	2
	Introducing modern technologies under the condition of payback period being less than 10 years;	Energy efficiency office of the Department of housing policy, roads and infrastructure, Condominiums, ЖЕО ТСЖББ	2011	2020	-	2900	0	2340	13050	0	10531
3. Enterprises											

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3.1. Private enterprises	Organizing meetings and trainings on energy saving and energy efficiency for the enterprise owners;	Energy efficiency office of the Department of housing policy, roads and infrastructure	2011	2020	18	4,4	0	4	20	0	16
	Obliging enterprises to elaborate "Energy Plans";	Enterprises with various forms of ownership	2011	2020	-	1	0	1	5	0	4
	Introducing modern technologies under the condition of payback period being less than 10 years;	Enterprises with various forms of ownership	2011	2020	-	50	0	40	225	0	182
	Providing various benefits for enterprises, which manufacture innovative energy-saving equipment;	Department of economy of the City Council	2012	2020	-	2	0	2	8	0	6
	Conducting free-of-charge "preliminary energy audit" and providing recommendations according to its findings regarding the reduction of energy consumption in production;	Energy efficiency office of the Department of housing policy, roads and infrastructure	2012	2020	60	44,5	0	36	178	0	144
3.2. Communal enterprises	Obliging enterprises to elaborate "Energy Plans";	Enterprises with various forms of ownership	2011	2020	-	1	0	1	5	0	4
	Introducing modern technologies under the condition of payback	Enterprises with various forms of	2011	2020	-	50	0	40	225	0	182

period being less than 10 years;	ownership									
Implementing, at the CE "Miskteplovodoenergiya", the Project on "Reconstruction of energy-consuming equipment of the water supply and drainage system in the city of Kamyanets-Podilskiy", which is financed by the loan from the IBRD;	CE "Miskteplovo doenergiya"	2011	2025	38000	6,9	0	6	14	0	11
Installing cogenerators at the CE "Miskteplovodoenergiya";	CE "Miskteplovo doenergiya"	2011	2012	20107	9	18	7	77	150	62
Replacing old heating network with new, using effective heat-insulating materials;	CE "Miskteplovo doenergiya"	2011	2014	74379	14	0	11	105	0	85
Installing modern automatic gas-burning units on boilers;	CE "Miskteplovo doenergiya"	2012	2016	8913	25	0	20	150	0	121
Introducing by CE "Miskteplovodoenergiya" of heat pumps on MSPS	CE "Miskteplovo doenergiya"	2014	2015	3161	2,19	6561	2	12	36086	10
Equipping boiler houses with efficient utilizers of heat from smokestack exhaust gases;	CE "Miskteplovo doenergiya"	2014	2018	1585	0,72	0	1	3	0	2
Installing bio-fuel boilers;	CE "Miskteplovo doenergiya"	2017	2019	88	0,36	953	0	1	1906	1
Converting CHPs to	CE	2016	2019	93993	131,4	12359	106	329	308995	265

	water-coal fuel;	"Miskteplovo doenergiya"						8				
4. Transport and traffic												
4.1. Municipal transport	Introducing modern technologies under the condition of payback period being less than 10 years;	Transportation office and Energy efficiency office of the Department of housing policy, roads and infrastructure	2011	2020	-	1	0	1	5	0	4	
	Including into the bidding rules for transportation providers the condition of eco-friendliness of transport, which is to be utilized;	Transportation office of the Department of housing policy, roads and infrastructure	2011	2020	-	1	0	1	5	0	4	
4.2. Private transport	Introducing modern technologies under the condition of payback period being less than 10 years;	Transportation office and Energy efficiency office of the Department of housing policy, roads and infrastructure	2011	2020	-	1	0	1	5	0	4	
	Building a bypass road;	Office of Urban Development and Architecture	2012	2020	-	2	0	2	8	0	6	

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4.3. Pedestrian roads	Introducing modern technologies under the condition of payback period being less than 10 years;	Transportation office and Energy efficiency office of the Department of housing policy, roads and infrastructure	2011	2020	-	1	0	1	5	0	4
	Investigating the possibility for introducing transport-free zones (creating a pedestrian and tourist zone), as well as banning transport in the old city on holidays;	Transportation office of the Department of housing policy, roads and infrastructure	2012	2012	20	1	0	1	8	0	6
	Promoting bicycle riding and establishing a rent-a-bike service;	Transportation office and Energy efficiency office of the Department of housing policy, roads and infrastructure	2012	2013	100	1	0	1	8	0	6
5. Monuments											
5. 1. Armenian Well	Introducing modern technologies under the condition of payback period being less than 10 years;	Department of culture	2011	2020	-	1	0	1	5	0	4
	Providing payment from the budget only for the part of energy resources consumed by the museum, for the	Department of culture	2011	2020	-	0,1	0	0	0	0	0

	other part of consumed resources the museum pays from its own funds;											
5. 2. Town Hall	Providing payment from the budget only for the part of energy resources consumed by the museum, for the other part of consumed resources the museum pays from its own funds;	Department of culture	2011	2020	-	0,1	0	0	0	0	0	0
	Introducing modern technologies under the condition of payback period being less than 10 years;	Department of culture	2011	2020	-	1	0	1	5	0	4	4
5. 3. Picture gallery	Providing payment from the budget only for the part of energy resources consumed by the museum, for the other part of consumed resources the museum pays from its own funds;	Department of culture	2011	2020	-	0,1	0	0	0	0	0	0
	Introducing modern technologies under the condition of payback period being less than 10 years;	Department of culture	2011	2020	-	1	0	1	5	0	4	4
5. 4. Repository	Providing payment from the budget only for the part of energy resources consumed by the museum, for the other part of consumed resources	Department of culture	2011	2020	-	0,1	0	0	0	0	0	0

	the museum pays from its own funds;											
	Introducing modern technologies under the condition of payback period being less than 10 years;	Department of culture	2011	2020	-	1	0	1	5	0	4	
5. 5. Archaeology museum	Providing payment from the budget only for the part of energy resources consumed by the museum, for the other part of consumed resources the museum pays from its own funds;	Department of culture	2011	2020	-	0,1	0	0	0	0	0	
	Introducing modern technologies under the condition of payback period being less than 10 years;	Department of culture	2011	2020	-	1	0	1	5	0	4	
5. 6. Fortress	Providing payment from the budget only for the part of energy resources consumed by the museum, for the other part of consumed resources the museum pays from its own funds;	Department of culture	2011	2020	-	0,1	0	0	0	0	0	
	Introducing modern technologies under the condition of payback period being less than 10 years;	Department of culture	2011	2020	-	1	0	1	5	0	4	
6. Street lighting												

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6. 1. Street lighting	Introducing modern technologies under the condition of payback period being less than 10 years;	CE "Miskliftsvitlo", Department of housing policy, roads and infrastructure	2011	2020	-	2	0	2	9	0	7
	Replacing lighting with energy-saving one;	CE "Miskliftsvitlo"	2011	2015	3594	2,1	0	2	15	0	12
	Upgrading traffic-lights to led-bulbs and installing new traffic-lights;	CE "Miskliftsvitlo"	2011	2012	220	0,5	0	0	4	0	3
	Implementing the Program on inner courts lighting;	CE "Miskliftsvitlo"	2011	2014	100	1,5	0	1	11	0	9
6. 2. Housing lighting	Introducing modern technologies under the condition of payback period being less than 10 years;	CE "Miskliftsvitlo", Department of housing policy, roads and infrastructure	2011	2020	-	2	0	2	9	0	7
	Introducing energy-saving lighting at the entrances to the houses and on the stairs.	Department of housing policy, roads and infrastructure	2011	2015	2743	1,043	0	1	7	0	6
TOTAL:									245387	349103	198028