It is approved
decision of Polotsk city council of deputies
of March 26, 2012

SUSTAINABLE ENERGY ACTION PLAN FOR MUNICIPALITY OF POLOTSK (BELARUS)

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SUSTAINABLE ENERGY ACTION PLAN OF POLOTSK

The city of Polotsk is committed to reduce the green house emissions emitted in the Municipality as well as to increase the air quality of Polotsk through the promotion of energy saving measures and the promotion of the use of the renewable energies as a base for the sustainable development of the City. **This study does not take into account the industry sector.**

1. OVERALL CO_2 EMISSION REDUCTION TARGET

The objective of the Sustainable Energy Action Plan of Polotsk is to reduce a 20% the CO_2 emissions per inhabitant by 2020 through the execution of measures oriented to reduce the consumption and the promotion of renewable energies in the territory of the municipality of Polotsk.

According to energy diagnosis current energy consumption trends show that the energy demand and electricity is growing in the last decade, around 2,78 % average per year.

The objective of reducing 20% the green house emissions per inhabitant by 2020 with respect to the baseline year in global terms. This is the main challenge of the SEAP: to overcome the increasing energy demand tendency and invert it to reach 20% reduction of the green house gas emissions per inhabitant with respect to the baseline year 2010.

The total emission of CO2 in 2010 is 0.168 MtCO2, so 20% off that value would it mean a reduction of 0.034 MtCO2 by the year 2020. Therefore the overall objective of the SEAP is to reduce a total of 76,444.5 tCO2/year by 2020.

Based on the baseline energy inventory and the previous prediction hypothesis in a “non-acting” scenario the energy consumption in Polotsk would pass from 886.63 GWh in 2010 to 1,061.66 GWh in 2020. Therefore the overall objective of the SEAP is to reduce a total of 385.08 GWh/year by 2020, which means reducing the energy consumption in a 45,5% with respect a “non-acting” scenario in 2020.

2. LONG-TERM VISION. PRIORITY AREAS OF ACTION, MAIN TRENDS AND CHALLENGES

The objective that the SEAP seeks is to improve the security of the supply and diversification, to promote the sustainable development and to generalize the energy access and to optimize the energy costs. All this to achieve the main goal which is to reduce a 20% the CO_2 emissions per inhabitant by 2020.

The SEAP objectives follow the principles of the SMART acronym Specific, Measurable, Achievable, Realistic, and Time-bound. The target of Energy Audit has the following conditions of being SMART:

S: Focus on specific target group
M: Quantify the target audit volume (m2, number of companies, % of energy use, etc.)/set baseline
A: Encourage to implement recommended measures, e.g. by offering financial incentives
R: Ensure that sufficient qualified auditors have been assigned and financial incentives are in place to carry out audits
T: Link the quantified target to a target period

3. ORGANIZATIONAL AND FINANCIAL ASPECTS

In this section it is described the management and financial aspects of the Sustainable Action Plan of Polotsk.

3.1. Coordination and organizational structures created/assigned

Strong political support is essential to ensure the success of the process, from SEAP design to implementation and monitoring. This is why the SEAP must be approved by the Municipal Council (or equivalent decision making body). The SEAP will be coordinated by City Council Building of Polotsk that will define and assign the responsibility of the execution to one or several City Council Building Services and other stakeholders once the SEAP has been approved by the Plenary of the City Council Building of Polotsk.

Adoption of decisions by the Polotsk City Executive Committee that set goals and regulate activities of the city institutions in relation to energy saving and energy efficiency. Violation or failure to fulfill the goals results into administrative sanctions.

3.2. Staff capacity allocated

It is planned a minimum of 2 man power to coordinate the execution of measures. The Sustainable energy working group is formed for coordinating the execution of measures in Polotsk.

3.3. Involvement of stakeholders and citizens

It will be created an official City Council Building internal energy committee with the heads of departments of the City Council Building.

3.4. Overall estimated budget

The overall estimated budget is under process until all the measures to be taken are properly estimated and defined.

3.5. Foreseen financing sources for the investments within the action plan.

The financing of the actions is foreseen through City local budget, regional budget national program of energy saving, other financing sources.

3.6. Planned measures for monitoring and follow-up

The monitoring is planned to be executed through staff allocated as SEAP coordinators 2 as well as by the feedback obtained from periodical meeting of the internal and external committees.

4. DESCRIPTION OF ACTIONS BY SECTORS

4.1. Buildings, equipment facilities and industries

4.1.1. Municipal Buildings, equipment and facilities

- Introduction of solar thermal facilities in the sports centers and city council public buildings with high hot sanitary water demand.

In 2009, solar batteries were installed in the Polotsk Locomotive Facility; it was the city's first experience in the use of solar units. It showed that in March, when the weather is warm and sunny, water in the container can get as hot as 70ºC

With the installation of solar thermal equipment, sport centers and public buildings with high thermal water demand can save a relevant percentage of fossil fuels consumption.

At least, 70% of the energy used in water warming needs, which is traditionally warmed with gas-oil or propane, shall be warmed by solar thermal modules. That means a very important saving in Municipal current costs. The investment necessary is paid off in a mid-time period. And, of course, it reduces the impact of green house gases that the Municipality produces to the Environment.
This measure should be communicated to the users of the buildings. Besides, they should be informed about the energy saved. Finally, the initiative should be considered an obligation in future buildings with similar characteristics in the Municipality.

It is planned to apply this measure to 5 facilities.

With this measure the estimated saved energy is 200 MWh/year and the estimated reduction of CO_2 is 80 tCO_2/year. (Estimations based on saving of Natural Gas as thermal energy considering an average of 40 MWh used for hot sanitary water and emission factor 0.2 tCO_2/MWh)

Energy saved: 40 MWh/year x 5 facilities = 200 MWh/a
Tons of CO_2 reduced: 0.2 tCO_2/MWh x 200 = 40 tCO_2/a

- Energy auditing of all public buildings of the City Council Building of Polotsk. Implementation of the measures recommended.

This action does not produce savings in emissions by its own, but the actions derived from it are focused in a reduction of energy consumption in Municipal Buildings. Energy audits will inform about not profitable waste in lighting, air conditioning and heating. This will make possible to take into account of the saving adoption of several measures in energy consumption and renewable energy facilities would suppose.

It is planned to apply this measure to 100 facilities.

With this measure the estimated saved energy is 574 MWh/year and the estimated reduction of CO2 is 115 tCO2/year. (Estimations based on saving of Natural Gas as thermal energy considering a mean consumption per building of 28,72 MWh/a and 20% energy saved)

Energy saved: 28.72 x 0.2 x 100= 574 MWh/a
Tons of CO2 reduced: 0.2 tCO2/MWh x 574 = 40 tCO2/a

- Installation of heat recovery HVAC systems of public buildings with high power installed.

Heat recovery systems in air conditioning are very interesting in large installations due to its capacity of recover contained in the air that is being threw away by the air conditioning machines.

Main energy-saving areas of the Polotsk municipal housing economy are:

- Replacement of heating networks
- Replacement of less efficient boilers with more efficient boilers;
- Introduction of automated control systems, monitoring of boiler rooms, heating network, central heating points;
- Monitoring of street lighting systems;
- Introduction of equipment for control over the consumption of fuel and energy resources.

With this measure the estimated saved energy is 1.45 MWh/year and the estimated reduction of CO2 is 0.67 tCO2/year. (Estimations based considering a mean electricity consumption of 8.3 MWh/a per building. Estimated that for an administrative building the HVAC systems consumes approximately the 35% of the electricity consumption and saves 50% of the cooling and heating energy consumption)

It is planned to apply this measure to 1building.

Energy saved: 8.3 x 0.175= 1.45 MWh/a
Tons of CO2 reduced: 0.459 tCO2/MWh x 1.45 = 0.67 tCO2/a

- Modernisation (exchange) of the pumping equipment in boiler houses with the new one.

Figure 1. Boiler house “Borovukha-3”

It is planned to apply this measure to number of pumps - 11 items.

The installation of the netting pump NL 125/400-37-4-12-50Hz ;BL 50/200-15/2 for the heat water ; NL 125/400-37-4-12-50Hz,the installation of recovery pump IPL 50/130-2,2/2,installation of networking pump NL 150/400-45-4-12-50Hz, installation of networking pump NL 80/160-18,5-2-12-50Hz , installation of networking pump IPL 65/175-7,5/2, installation of networking pump IPL 50/185-7,5/2, installation of networking pump IL 32/150-2,5/2, installation of networking pump MHI 802 3, installation of networking pump IL 50/140-4/2

With this measure the estimated saved energy is 5,682 MWh/year and the estimated reduction of CO2 is 2,608.21 tCO2/year. (Estimations based on saving of electrical energy to produce 5,682 MWh/year)

- Modernisation of the heat supply network.

Within three years, Polotsk replaced about 13 km of worn-out heating networks, which allowed to cut heat energy transportation losses by 1.5%. Each year a number of old heat lines are replaced with more energy efficient ones. The result is a reduction of losses during transportation of heat to final consumers.

It is planned to apply this measure to 4,000 m/year of heat network.

With this measure the estimated saved energy is 408 MWh/year and the estimated reduction of CO2 is 82 tCO2/year. (Estimations based on saving of Natural Gas as thermal energy to produce 408 MWh/year)

- Installation of boilers, with usage of wood chips

It is planned to install 3 boilers, each 3 MW, that work on chipped wood. The expected effect is to increase the percentage of local fuels in total consumption of boiler and furnace fuels for heat supply purposes.

With this measure the estimated saved energy is 4,715 MWh/year and the estimated reduction of CO2 is 943 tCO2/year. (Estimations based on saving of Natural Gas as thermal energy to produce 4,715 MWh/year)

- Installation of the boilers of smaller heat and electricity capacity in boiler houses: Borovukha, Trosnitskaya,

It is expected a modernisation of pumping equipment where there will be the following improvements:

- Instalment of boiler with main-line pump.
- Instalment of boiler with main-line pump, use of the equipment in water heating regime, instalment of the stove on local fuels.
- Exchange of the main-line pump from 30kWe to 2 items of 15 kWe.

Republican Energy Saving Program provides for the installation of a boiler that works on local fuels, followed by a turbine-driven generator, in one of the boiler rooms of the Municipal Unitary Enterprise ‘Polotsk Municipal Housing Economy’. This achievement will not only supply heat energy to the residents of one of the city districts, but will also make it possible to produce electric energy, which will be used for the needs of the industry and the population.

With this measure the estimated saved energy is 4,240.00 MWh/year and the estimated reduction of CO2 is 1,946.16 tCO2/year. (Estimations based on saving of electrical energy to produce 4,240.00 MWh/year)

4.1.2. Tertiary (non municipal) buildings, equipment/facilities

- Introduction of solar thermal facilities in the Hospitals and public buildings with high hot sanitary water demand.

Solar thermal energy is a technology for harnessing solar energy for thermal energy (heat). Considering that solar radiation is a free energy, all the thermal production by the installation could be considered as energy saved compared when using conventional energy resources.
At least, 70% of the energy used in water warming needs, which is traditionally warmed with gas-oil or propane, shall be warmed by solar thermal modules. That means a very important saving in Municipal current costs.

This measure should be communicated to the users of the buildings. Besides, they should be informed about the energy saved.

Finally, the initiative should be considered an obligation in future buildings with similar characteristics in the Municipality.

Figure 2. Central Town Polyclinic

It is planned to apply this measure to 1building.

With this measure the estimated saved energy is 40 MWh/year and the estimated reduction of CO2 is 8 tCO2/year. (Estimations based on saving of Natural Gas as thermal energy considering an average of 40 MWh used for hot sanitary water and emission factor 0.2 tCO2/MWh)

Energy saved: 40 MWh/year x 1 facilities = 40 MWh/a
Tons of CO2 reduced: 0.2 tCO2/MWh x 40 = 8 tCO2/a

- Improving the insulation of walls and roofs.

It is proposed to change of lagging because of its passing and repeated re-pairing. Thermal insulation in buildings is an important factor to achieving thermal comfort for its occupants. Insulation reduces unwanted heat loss or gain and can decrease the energy demands of heating and cooling systems.

It is planned to apply this measure to 1building.

With this measure the estimated saved energy is 96 MWh/year and the estimated reduction of CO2 is 19 tCO2/year. (Estimations based on saving of Natural Gas as thermal energy to produce 96 MWh/year)

Energy saved = 159.1 (Plane roof) – 63.6 (roof with garret) = 95,5 MWh/a
Tons of CO2 reduced: 0.2 tCO2/MWh x 95.5 = 19 tCO2/a

- Renovation of windows.

This action involves the reconstruction of windows enclosures with installing manifold glasses plates. The change of windows crosses for manifold glasses plates will allow to adjust the thermal resistance of windows enclosures in accordance with normative requirements.

It is planned to apply this measure to 1building.

With this measure the estimated saved energy is 124 MWh/year and the estimated reduction of CO2 is 25 tCO2/year. (Estimations based on saving of Natural Gas as thermal energy to produce 124 MWh/year)

Energy saved = 205 Kwh/m2 (Heat losses) x 603 m2 (glazing area) = 124 MWh/a
Tons of CO2 reduced: 0.2 tCO2/MWh x 124 = 25 tCO2/a

- Substitution of conventional lights for low-energy lights.

It is proposed with the aim of energy saving to change luminescent lamps LB-40 with electromagnetic actuator having power 40 W for energy saving lamps LSP-2×36 produced by «Lida plant of electrical goods» (Belarus) having power 36 W. Using theses devices of an electronic actuator allows to save 20% of electrical energy.

It is planned to apply this measure to 1building.

With this measure the estimated saved energy is 11 MWh/year and the estimated reduction of CO2 is 5.09 tCO2/year. (Estimations based on saving of electrical energy considering an annual consumption of 45.14 MWh)

Energy saved = 45.14 x 0.2 = 11.12 MWh/a
Tons of CO2 reduced: 0.459 tCO2/MWh x 11.12 = 5.09 tCO2/a

4.1.3. Residential Buildings

- Improving the insulation of walls and roofs.

It is proposed to change of lagging because of its passing and repeated re-pairing. Thermal insulation in buildings is an important factor to achieving thermal comfort for its occupants. Insulation reduces unwanted heat loss or gain and can decrease the energy demands of heating and cooling systems.

Figure 3. Block of flats No. 23 in Marinenko street.

It is planned to apply this measure to 1building.

With this measure the estimated saved energy is 143 MWh/year and the estimated reduction of CO2 is 29 tCO2/year. (Estimations based on saving of Natural Gas as thermal energy to produce 143 MWh/year)

Tons of CO2 reduced: 0.2 tCO2/MWh x 143 = 29 tCO2/a

- Renovation of windows..

Renovating of windows will mean an improvement with respect to energy saving and CO2 emission terms.
It is planned to apply this measure to 1building.

With this measure the estimated saved energy is 14 MWh/year and the estimated reduction of CO2 is 3 tCO2/year. (Estimations based on saving of Natural Gas as thermal energy to produce 14 MWh/year)

Tons of CO2 reduced: 0.2 tCO2/MWh x 14 = 3 tCO2/a

4.1.4. Municipal public lighting

- Installation of LED technology in public lighting

As mentioned before, it is considered necessary the introduction of LED technology and/or other high efficiency technologies in the public lighting. This measure is especially efficient when changing mercury lamps by LED technology.

In that sense, the street lighting policy should tend to the conversion of the traditional lamps into LED.

The estimated saved energy is 18 MWh/year and the estimated reduction of CO2 is 26 tCO2/year. (Estimations based on saving of electrical energy to produce 11 MWh/year)

Tons of CO2 reduced: 0.458 tCO2/MWh x 18 = 8.26 tCO2/a

- Installation of LED technology in traffic lights.

This action considers the introduction of led lighting in traffic lights. The LED´s are replacing the old-style incandescent halogen bulbs rated at between 50 and 100 watts. LED´s are brighter, the LED arrays fill the entire hole and have equal brightness across the entire surface, making them brighter overall. LED bulbs last for years, while halogen bulbs last for months. Also this type of illumination saves a lot of energy.

It is assumed that a traffic light uses 100 Watt bulbs. The light is on 24 hours a day, so it uses 2.4 kilowatt-hours per day. LED bulbs might consume 18 Watts instead of 100, so the power consumption drops by a factor of five or six being 0.432 kilowatt-hours per day.

The points of light to be changed are 88.00

Energy consumed by 88.00 traffic light points using traditional bulbs:
2.4 kilowatt-hours per day x 365 days x 88 points = 77.088 MWh/year

Energy consumed by 88.00 traffic light points using LED´s:
0.432 kilowatt-hours per day x 365 days x 88 points = 13.876 MWh/year

Energy saved= 77.088-13.876 = 63.2 MWh/year

The estimated saved energy is 63.2 MWh/year and the estimated reduction of CO_2 is 28.99 tCO_2/year. (Estimations based on saving of electrical energy to produce 63.2 MWh/year)

- The implementation of the comprehensive street lighting management system in Polotsk.

There are several already implemented activities on increasing of energy efficiency of the municipal lighting system. The first step was done through the installation of automatic street lighting control boxes in 2008. After that municipal authorities replaced incandescent electric bulbs used for illumination of the streetsto sodium arc lamps. Currentlyno incandescent electric bulbsare used for the public lighting.
The following measures and activities are to be conducted for the optimization of the energy consumption in the sphere of public lighting:

1. Replacementofthestreet sodium arc lamps to LED lamps on the central streets of the city.

Currently 23 lamps 70W, 829 lamps 150W, 40 lamps 250W are used for the central and entrance streets of the city. The total annual time of lighting is 3745 hours per year according to the daily schedule of street lighting in Polotsk. The municipality plans to replace all 150W lamps to LED lights 100W and 250W lamps to LED lights of 170W.
The expected reduction of energy consumption is 164,63 MWh/a.
((70*23+829*150+40*250) – (825*100+40*170))*3745\1000000=164,630 MWh/a
The expected reduction of CO_2 emissions - 75,565 t/a
164,630*0,459= 75,565 tCO_2.

2. Replacementofthe street sodium arc lamps to self-contained street lighting:

The new residential district of the city is equipped with 67 lamps 150W. Totalelectricityconsumptionperyearis 67*150*3745\1000000= 37, 6 MWh/a. The installation of 67 self-contained street lights will reduce the electricity consumption on 37,6 MWh/a. This will result the reduction of CO2 emissions: 37,6 * 0,459 = 17,3 tCO2 (0,459 is a CO2 emission factor).

3. Replacement of street decorative lighting with LED lighting.

Polotsk is the oldest city of the Republic of Belarus. It has a lot of architectural landmarks – both ancient, starting with historical landmarks of the 9^{th}-11^{th} centuries, and modern. Polotsk is the touristic center of the Vitebsk region. In the modern world, outdoor decorative lighting is one of the methods to increase touristic attractiveness of a city. At the moment, outdoor lighting of public buildings, architectural landmarks and the city's central avenue is carried out by means of 720 halogen decorative lighting lamps, as well as lamps with incandescent light bulbs. Overall consumption equals to 105 MWh/a. At the same time, further development of tourism, an important branch of the city's strategic development, calls for an increase in the volume of outdoor decorative lighting. Thus, until 2017 it is planned to increase the number of outdoor decorative lamps to 1000 units, while also aiming at decrease of electric energy consumption by 30%.
Thus, comprehensive approach to outdoor decorative lighting and implementation of the planned activities in 2017 envisages decrease of consumption by 31.5 MWh/a:
105*0.3=31.5 MWh/a,
whichwillequalto 14.46 t CO2 per year:31.5*0.459=14.46.

4. Automaticstreetlightcontrolboxes:

In 2008, 12 automatic street light control boxes were installed in Polotsk, resulting in decrease of energy consumption on connected stations by 9.6%.
In order to control street lighting in the whole city, there is a need for another 18 automatic street light control boxes. Installment of this equipment will result in decrease of electric energy consumed by lighting by 245.2 MWh/a:
2554.2 *9.6/100=245.2 (2554.2 – energy consumption on street lighting networks that have not been equipped with automatic street light control boxes, MWh/a; 9.6 – planned decrease of electric energy consumption after installation of automatic street light control boxes, %).

With these activities implemented, total decrease of energy consumption, according to preliminary calculations, will equal to 478.93 MWh/a, while volume of emissions will decrease by 219.83 t CO2.
In order to come up with more precise data and implement required technologies in the most rational and correct way, it is necessary to conduct energy audit of 12 city streets.

- Installation of the light management system in the foyers of the large block houses.

In block houses where control systems are installed, operators have the power to significantly reduce energy consumption, maintenance costs and environmental impact. A lighting management system makes sure that lighting is controlled according to the level of brightness, the form of light distribution during the day and at night, and the daylight conditions.

It is planned to apply this measure to 3,500 lamps.

The estimated saved energy is 67.5 MWh/year and the estimated reduction of CO2 is 30.98 tCO2/year. (Estimations based on saving of electrical energy to produce 67.48 MWh/year)

Tons of CO2 reduced: 0.458 tCO2/MWh x 67.48 = 30.97 tCO2/a

4.1.5. Industries

Private industry is not included in the objective of reduction CO2 emissions and therefore it is not planned measures for this sector.

4.2. Transport

4.2.1. Public transport

- Development and execution of a sustainable Mobility Urban Action Plan.

The big objective is to succeed in the reduction of private car displacements by the optimization of the public transport services in the city and other complementary measures that generate to the citizen the change of the type transport.

Therefore is requested to execute a diagnosis of the mobility status of the city, including most frequent displacements within the city, attraction mobilty centres, main current private car fluxes, traffic congestion key points, simulations of reconfiguration of public transport lines, simulations of reconfiguration of circulation and traffic of private cars with different measures and sceneraios, future parking availability, and freits distribution regulation among others.

It is required to study the mobility of the population and transport in the city to adapt the different public transport services available in order to them to complement and not compete in the same routes. This plan will re-design the public transport with the presence of the tram, the available infrastructures and will create a master plan to execute in the next ten years in order to absorb the generated mobility essential for planning the city of the future.

Among possible measures resulting from this study it might result the creation of park&ride systems, promoting of public transport, alternative fuels to diesel as fuel in public transport bus, subordination of new licences or transfers of taxis to be enviromentally friendly vehicles.

With this measure the estimated saved energy is 17,777 MWh/year and the estimated reduction of CO_2 is 4,717 tCO_2/year. (Estimations based on saving of Diesel as thermal energy to produce 17,777 MWh/year)

Reduction of 20% of the privet car in the modal distribution of mobility. Initial estimation of trips per day =0,268 cars/inhab x 80000x4 displacements day = 85760. 11 months. 5 days/week. 4weeks/month. Mean average path in car 5km. Emissions 250gr/km

- Development of a bicycle system

Nowadays, any city can not be sustainable in terms of mobility if does not bet for the bicycle as the cleanest and healthiest mean of transport. Modern cities are replacing their cars for bikes and closing the city centers to the cars.

4.2.2. Private and commercial transport

- Cycling lanes construction.

Bycicle is a essential mean of transport in the modern and clean cities. Segregated cycle facilities are marked lanes, tracks, shoulders and paths designated for use by cyclists from which motorised traffic is generally excluded. The term includes bike lanes, cycle tracks/separated bike lanes, road shoulders and side paths located within a road right-of-way.

Polotsk has very wide roads where the lanes can be placed painting the paths all over the roads.

It is planned to paint 10 Km of roads.

With this measure the estimated saved energy is 38 MWh/year and the estimated reduction of CO_2 is 11 tCO_2/year. (Estimations based on saving of diesel as thermal energy to produce 38 MWh/year)

Reduction of 20% of the privet car in the modal distribution of mobility. Initial estimation of trips per day =0,268 cars/inhab x 80000x4 displacements day = 85760. 11 months. 5 days/week. 4weeks/month. Mean average path in car 5km. Emissions 250gr/km

4.3. Local electricity production

4.3.1. Photovoltaic

- Feasibility study for implementation of Installation of solar photovoltaic plants in roofs.

It is planned to install 11 Kwp.

But City Council can also install their own photovoltaic plants to produce their own energy. The roofs of some Municipal buildings are a very suitable place for this technology, and a first approach of a little installations of 11 kW each is a good beginning.

4.3.2. Combined heat and power

- Installation of internal combustion engines for the generation of electricity from biogas in the new waste water treatment plant of Polotsk.

There is a huge potential in the exploitation of biogas produced from the waste in water treatment plants to produce electricity.

Installation of internal combustion engines can be used for electricity generation. That energy can be freely used for energy requirements of the water treatment plant.

There is expected to build a new plant in Polotsk. Technical information about has not been provided, therefore it has been estimated that then population of Polotsk is 80,000 inhabitants and the consumption of water is 150 l/per person and day, the volume of wasted water to be treated is 12,000 Nm3/day. This type of facility can produce about 960 Nm3/day, and the production of electricity would be 696 MWh/year.

With this measure the estimated saved energy is 696 MWh/year and the estimated reduction of CO_2 is 319.46 tCO_2/year. (Estimations based on saving of electrical energy to produce 696 MWh/year)

4.3.3. Local district heating

- Renewing the network pipe lines

Within three years, Polotsk replaced about 13 km of worn-out heating networks, which allowed to cut heat energy transportation losses by 1.5%. Each year a number of old heat lines are replaced with more energy efficient ones. The result is a reduction of losses during transportation of heat to final consumers.

With this measure the estimated saved energy is 204 MWh/year and the estimated reduction of CO2 is 54 tCO2/year.

4.4. Land use planning

4.4.1. Strategic urban planning

- Bylaw of energy efficient new buildings.

An obligation to make new buildings with technical energy efficiency criteria in order to get houses that save energy during its life when used by its owners. Governments in concerned countries have made big efforts to adapt their normative to integrate this technical energy efficiency criteria. This measure will generate a saving of approximately 20% of the energy consumed by the new buildings in Polotsk.

Experts believe that construction of energy efficient buildings will make it possible to significantly save fuel and energy resources, as well as to improve the quality and the comfort level of residential buildings. As of today, erection of energy efficient buildings has already begun in a number of regions of Belarus. In 2011, Polotsk plans to construct a ten-storey energy efficient house with 40 apartments. The cost of 1 square meter in this house will be approximately 188 EUR more than in a regular house, while the pay-off period is 2.5-3 years.

With this measure the estimated saved energy is 1,098 MWh/year and the estimated reduction of CO2 is 769.00 tCO2/year.

400 new houses 2012-2020 with saving of 20% in heating, and cooling due to improve in the isolation.

4.4.2. Transport and mobility planning

- Execution of a Urban Cycling Master Plan

It represents a master key in the sustainable mobility policies. It is preceptive a master plan to be followed in order to get comprehensive and efficient net of cycle lanes and other infrastructures and services like bike parkings and the public bicycle rental system.

It should also include a plan for the intermodality of the bicycle. Allowance of the introduction of the bicycle in the tram. Bicycle should be complemented with other means of transport when the distance that citizens must travel is over 8-10 kms. In that cases bus, should make easy to park or travel with the bicycle. It is called, intermodality.

4.4.3. Standards for refurbishment and new development

- Maintenance of agriculture & forest land protected against urban development.

It is necessary to protect the forests and the agriculture in order to preserve them from the urban impact. This is imperative to leave a better planet to the future generations maintaining the carbon dioxide natural offsets. These types of lands act as natural CO2 drains.

There is a measure already executed where the inhabitants are forced to plan 3 trees if they cut off 1 tree.

4.5. Public procurement of products and services

4.5.1. Energy efficiency requirements/standards

- Introduction of Energy Efficiency Criteria in City Council Tenders of Services and Infrastructures.

- Introduction of energy saving equipment and energy saving technologies on public factories.

- Annual city competitions to identify businesses and institutions that have achieved highest performance indicators of social and economic development, one of them being energy saving indicator that shows how efficiently fuel and energy resources are being used by city businesses and institutions.

- Resolution of the Council of Ministers No. 92 dated 25 January 2010. If an organization has the following characteristics: annual consumption of energy resources is more than 1 thousand TCE, the consumption rate of fuel and energy resources is more than 8% lower than the growth rate of industrial production volumes; it gets an inflation index (=pays more) for electricity, heat energy and gas. Monitoring of these parameters is performed by the Polotsk City Executive Committee. Monitoring results: so far, no sanctions have been imposed on any industries of the city

4.5.2. Renewable energy requirements/standards

- Requirement of solar thermal energy bylaw in all new city council facilities with hot sanitary water demand.

Experts believe that the introduction of solar thermal energy bylaw will make it possible to significantly save fuel and energy resources, as well as to improve the quality and the comfort level of residential buildings. An obligation to make new council facilities with technical energy efficiency criteria in order to get houses that save energy during its life when used by its owners.

4.6. Working with citizens and stakeholders

4.6.1. Advisory services

- Creation of staff allocated for the development of the SEAP and for energy saving actions.

Create an advisory municipal service for citizens, commerces interested in saving energy and in the use of renewable energies in their activities and housing.

4.6.2. Awareness raising and local networking

- Introduction of energy saving classes into the curriculum of universities, colleges and vocational schools;

An award to help pupils to aware about energy saving. It will be given the award to the school with highest energy saving in a year.

- Comprehensive public awareness raising campaign with involvement of local media

Awareness Campaings for energy saving, ecodriving, promotion of renewable energy, use of sustainable mobility modes

- 20% emissions reduction commitment for citizens

The objective is to pass the -20% reduction of GHG emissions commitment of the Covenant of Mayors to the awareness citizens through a declaration where they commit to reach this objective in their energy consumption and activity.

With this measure the estimated saved energy is 35,108 MWh/year and the estimated reduction of CO_2 is 33,578 tCO_2/year. (Estimations based on saving of Diesel as thermal energy to produce 3,341 MWh/year)

- Bicycle working group with stakeholders

Social commitment in energy policies is essential to implicate the stakeholders to reduce their energy consumption. In this measure is proposed to create a committee with representative of the citizens in order to enhance cooperation for the development of the bicycle culture in the mobility habits of the citizens.

- Mobility working group with stakeholders

In this measure is proposed to create a committee with representative of the citizens in order to enhance cooperation for the development of the sustainable mobility habits within the citizens.

- Energy comity with stakeholders

This action can be complemented with the following proposals:

-Creation of Energy External Committee of Polotsk with the city stakeholders.

-Creation of Energy Internal Committee of Polotsk with the head of departments of the City Council with most energy consumption in their services.

In order to reduce the city council energy consumption, the services that controls big buildings and lighting service must be implicated in the decision organs.

-Promotion and creation of a energy saving network in a national level share best practices.

This action seeks the same objective than the previous one, considering more cities to share the best practices and extend good policies.

4.6.3. Training and education

- Workshops of energy saving at home

Training courses to help citizens to have saving habits at home. The program will provide participants with information, handouts, and hands-on experience for reducing energy bills through simple conservation measures.

Existing techniques and technologies in energy efficiency retrofitting can reduce home energy use by up to 40% per home and lower associated greenhouse gas emissions

With this measure the estimated saved energy may be 136 MWh/year and the estimated reduction of CO2 is 64 tCO2/year. (Estimations based on saving of Diesel as thermal energy to produce 136 MWh/year)

- Program for the use of the bicycle among students to go to school, high school and higher educational centres.

With this measure the estimated saved energy may be 1,418 MWh/year and the estimated reduction of CO2 is 54 tCO2/year. (Estimations based on saving of Diesel as thermal energy to produce 1,418 MWh/year)

Hypothesis:

11 km/liter * 0.8 kg/liter *40 MJ/kg *5 days/week 4week/month 9 month/year
Emission: 250grCO2/km. Mean average path: 4km. 300 students.

- Energy Saving Family Award

An award to help citizens to aware about energy saving. It will be given the award to the family with highest energy saving in a year.

With this measure the estimated saved energy may be 189 MWh/year and the estimated reduction of CO2 is 89 tCO2/year. (Estimations based on saving of Diesel as thermal energy to produce 189 MWh/year)

- Energy Efficiency Commerce Award

An award to help commerces to aware about energy saving. It will be given the award to the shop with highest energy saving in a year.

With this measure the estimated saved energy may be 189 MWh/year and the estimated reduction of CO2 is 89 tCO2/year. (Estimations based on saving of Diesel as thermal energy to produce 189 MWh/year)

- Actions and conferences programmed within the SURE project

4.7. Other sectors

Here it is included the national measures planed in The Strategy of the Energy Security of the Republic of Belarus. The measured executed at national level will have an impact in Municipality of Polotsk. Because Belarus has limited domestic primary energy resources, therefore optimization of development and operation of the energy sector is one of the priority lines of the legislative, regulatory and organizational reforms.

The strategic goal of energy conservation for the period till 2015 should be reducing GDP energy intensity of the Republic of Belarus by 50 percent in comparison with the level of 2005, and by 60 percent – by 2020.

The main objectives of the strategy are:

- Decrease fuel consumption for production of heat power by 5% by 2020.

- Use municipal waste and sewage sludge so as to replace 80-100 thousand TCE in 2020.

- Design and construct houses (buildings) with primary usage of energy saving technologies.

- Implement the projects of residential, public and administrative energy efficient buildings with adjustable ventilation – both input and extraction ventilation – with one intake of heat carrier into a separate apartment (separate office room) for apartment-by-apartment costing of heat and regulation of heat supply, with utilization of ventilation emissions.

- By 2015, to construct at least 60% of energy efficient residential buildings with specific consumption of heat power for heating and ventilation equaling to not more than 60 KW/h per m² for high-rise and mid-rise buildings (4-9 floors) and 90 KW/h per m² for low-rise buildings (1-3 floors).

- Develop and introduce facilities for utilization of heat from sewage runoffs in residential and administrative buildings.

PILOT ACTION PROPOSED FOR POLOTSK

PILOT ACTION SELECTED:

Substitution of conventional public lighting by high efficient public lighting using LED technology.

It is proposed the installation of a high efficiency street lighting facility based on LED technology. LED lighting is environmentally friendly and it is a very profitable investment because LED lights use only 10% of the energy consumed by incandescent lights, they have a much longer life over 50 times, and maintenance is much cheaper. Furthermore, LED traffic lights are safer than traditional ones because they are visible during the day light time and failures are less frequent.

The location proposed for the installation of LED lighting is unknown, to be decided by the City Council of Polotsk. This solution will give an energy saving estimation between 38-58% of the energy consumption by conventional lighting.

According to Belarusian prices and to IENAS's calculations, the cost of this proposal will be 40 000 EUR for 56 lights, including installation works. Another method of calculation is 12 000 EUR for 1 km of street lighting.

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Energy saving estimation: between 38-58%. 18 MWh/year saved. 8.6 tCO_2/year saved (Estimation based on initial 150W lamp converted into 75W lamps).

Technical recommendations:
Important to choose manufacturers for the equipment with enough experience in the market that can provide guaranteed support services in the life time years of the facility.

- Chip manufacturer: for example CREE (1st world manufacturer)
- Minimum life time guaranteed required for chip: 5 years. Maintenance of at least 70% of the initial flux level at 25ºC of operational temperature during the 5 years period.
- Minimum guarantee for the driver required: 2 years
- Driver recommendations: the maximum operational temperature of the LED must be smaller than the maximum temperature recommended by the chip manufacturer for the nominal current of design of the light point.
- Protection index minimum: 65

- Recommended color temperature: between 3500-5500K.
- Recommended energy efficiency of the lamp: minimum 100 lumen/W for 3500K and 120lumen/W for 5500K
- Recommended chromatic reproduction index: over 70.
- The manufacturer must provide a photometric data sheet of the fixture+lens+chip system.
- Equipments must have CE certified stamp
- The equipment must fulfill the national norms of safety in electricity and electromagnetic compatibility among all the applicable ones.

ALTERNATIVE PILOT ACTIONS PROPOSED:

Installation of a solar photovoltaic facility.

It is proposed the installation of a photovoltaic facility in the roof of a public building or in a shelter in a public square. Photovoltaic is a method of generating electrical power by converting solar radiation into direct current electricity using semiconductors that exhibit the photovoltaic effect. Considering that solar radiation is a free energy, all the electricity production could be considered as energy saved compared when using conventional energy resources to produce electricity.

The location proposed for the installation of the photovoltaic facility could be the “Industrial Building of the car depot”.

Figure 4. Administrative building of CMC “Housing and Public Utilities”.

The estimated budget is 40000 EUROS /284,849,022.28 BYR all taxes included. The installation proposed will have 11Kw peak of total power installed.

Energy saving estimation: 10.2 MWh electricity/year generated from the sun. 4.63 tCO2/year saved.

Technical recommendations:

Important to choose manufacturers for the equipment with enough experience in the market that can provide guaranteed support services in the life time years of the facility.

- Equipments must have CE certified stamp
- The equipment must fulfill the national norms of safety in electricity and electromagnetic compatibility among all the applicable ones.
- Recommended to use a tri-phasic inverter.
- Electrical equipment approved and certified with the CE mark.
- Modules facing South 0º and inclination equal to latitude minus 8º in case of fixed installations located over flat surfaces.
- Take into account the separation of the rows of modules and other potentially shaders elements respecting a minimum distance to ensure the full reception of sun of the modules during peak sun hours of the shortest day of the year (winter solstice).
- Solar field peak power must not exceed 120% of rated power of inverters.
- In order to guarantee that inverters work properly, the electric public network they are connected with, must be stable, according to the technical operational characteristics of the inverters.
- Use modules with manufacturer's warranty of at least 5 years, and a production warranty of at least 25 years. Ensuring 90% of production in the first 12 years and 80% after 25 years of operation.

- Use load-bearing structures made of aluminum profiles, which are lighter and much more resistant over time that those made of steel or other materials. The anchors they are fixed must be strong and secure against the wind action.

- Protect PV power plants against thefts, vandalism and natural disasters through an insurance policy that guarantees the replacement of 100% of the material in that cases. Ensure the installation against cuts in production with the payment of an amount for the energy not generated while the forced stop.

Installation of a solar thermal facility.

It is proposed the installation of a solar thermal facility in the roof of a public building or in a shelter in a public square. Solar thermal energy is a technology for harnessing solar energy for thermal energy (heat). Considering that solar radiation is a free energy, all the thermal production by the installation could be considered as energy saved compared when using conventional energy resources.

The location proposed for the installation could be “”The Polotsk Central City Clinic”.

Figure 5. Central Town Polyclinic

The required area of solar collector: 110/2.86 = 38 m². The cost of 1 m² of solar collector ready for operation (including equipment, system of automated regulation, design, assembly and start-adjusting work) is assessed equal to €600. Necessary investment: 38 · 600 = €22,800

Energy saving estimation: 40 MWhthermal/year saved and obtained from the sun. 8 tCO_2/year saved (Estimations based on 0,2 tCO_2/MWh for substitution of natural gas boilers for the generation of the hot sanitary water).

Technical recommendations:
Important to choose manufacturers for the equipment with enough experience in the market that can provide guaranteed support services in the life time years of the facility.

- It is highly recommended that the equipments have CE certified stamp
- The equipment must fulfill the national norms of safety in thermal equipments, electricity and electromagnetic compatibility among all the applicable ones.
- Avoid over-dimension of the facility (i.e. energy demanded vs energy generated) in the design to avoid overheating of the equipments.
- Important to require the proper isolation of the piping.
- Important to slightly over-dimension the expansion deposit (pressurizer).
- Important to contract a maintenance service of the facility to ensure the efficiency of the equipment and piping.

Installation of a biomass facility.

It is proposed the installation of a biomass facility in a public building or in a residential building. In the last few years the price development of the individual energy sources has shown the advantages of wood chips: this ecological clean way to heat is also economical. The energy source wood is renewable and as a result CO2 neutral. Pellets are made from natural wood.

The location proposed for the installation could be “”The Public Sauna Nº1”.

Figure 6. Public Sauna No. 1

The estimated budget is 40000 EUROS /284,849,022.28 BYR all taxes included. The facility will have a total of 70 KW installed.

Energy saving estimation: around 40%. 200 MWh/year saved. 53 tCO2 saved (Estimations based on substitution of diesel boilers for the generation of heating)

Technical recommendations:

Important to choose manufacturers for the equipment with enough experience in the market that can provide guaranteed support services in the life time years of the facility.

- It is highly recommended that the equipments have CE certified stamp
- The equipment must fulfill the national norms of safety in thermal equipments, electricity and electromagnetic compatibility among all the applicable ones.
- Avoid over-dimension of the facility (i.e. energy demanded vs energy generated) in the design to avoid overheating of the equipments.
- Important to require the proper isolation of the piping.
- Important to slightly over-dimension the expansion deposit (pressurizer).
- Important to contract a maintenance service of the facility to ensure the efficiency of the equipment and piping.

COMPARATIVE BETWEEN ALTERNATIVE PILOT ACTIONS PROPOSED:

	LED lighting	Photovoltaic facility	Thermal facility	Biomass facility
Energy Saved (MWh/year)	18,00	10,20	40	200
CO2 saved (tCO2/year)	8,60	4,63	8,00	53,00

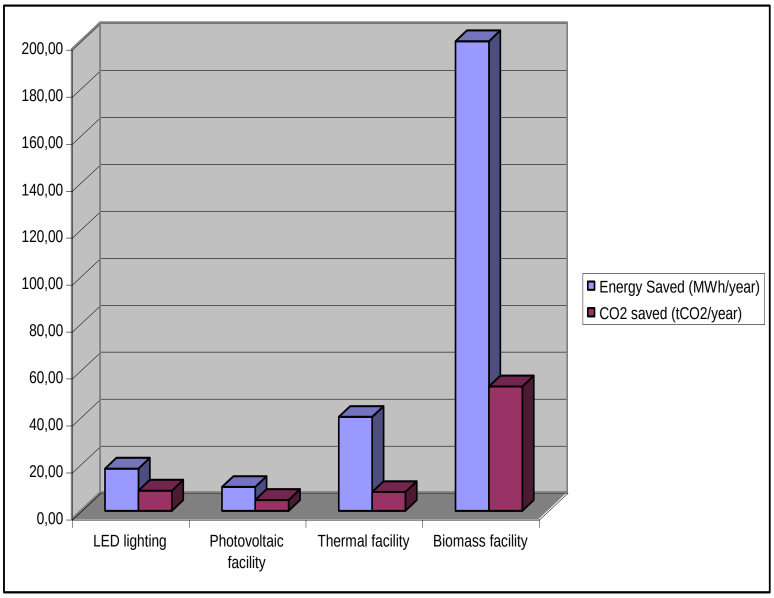

Fig 7. Comparative between pilot actions