

GHG emissions reduction in small and medium cities of Ukraine by improving energy efficiency of their infrastructure

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1. SYNOPSIS

Improving energy efficiency of small and medium cities of Ukraine infrastructure will allow to reduce GHG emissions by 20 million tons CO₂ equivalent or 42% of total GHG emissions in this sector.

2. EXECUTIVE SUMMARY

In 1990, the base year for Kyoto Protocol, Ukraine was the sixth in the world in total volume of carbon emissions. Economic decline and falling industrial output has otherwise caused a reduction in greenhouse gases (GHG) emissions. Therefore, Ukraine has good potential opportunities to participate in so-called “flexible mechanisms” of the Kyoto Protocol. To realise these opportunities it is necessary to improve energy efficiency in the Ukrainian economy. One of the economic branches where this process should be started is municipal energy infrastructure, including heat supply, water supply and sewage, street lighting and transport. Economic decline in Ukraine did not affect GHG emissions reduction in small and medium cities (SMCs) of Ukraine as much as in other economic sectors. SMCs include cities with a total population of 10 to 250 thousand. There are over 400 SMCs in Ukraine with the total population about 18 million people that amounts to more than a half of the Ukrainian urban population. According to current forecasts, if no actions are taken to reduce GHG emissions in SMCs of Ukraine, they will stay at the present level or even increase. Significant potential for GHG emissions reductions at SMCs are due to:

- outdated and worn-out facilities of the following municipal economy sectors – energy, industry, district heating, waste recycling and others;
- lack of funds for planned and preventive repair of these facilities;
- lack of know-how and technical management skills regarding profitable and ecologically friendly measures of GHG emissions reduction in municipal government;
- general lack of information on rational management of energy and natural resources;
- barriers (financial, regulatory, technical) to implementation of GHG emissions reduction measures;
- lack of guidelines for local authorities on policy to reduce GHG emissions and implement corresponding measures.

Unlike ministries and municipalities of large cities, authorities of SMCs of Ukraine don't have enough funds and specialists necessary for research activity and developing measures on GHG emissions reduction. Therefore, with support of the EcoLinks Program, the Berdychiv City Executive Committee, Agency for Rational Energy Use and Ecology (Ukraine) and Econergy International Corporation (USA) in 2000 completed the project “Identifying the Priority Policies and Measures to Mitigate the Impacts of Climate Change in Small and Medium-sized Cities in Ukraine”.

The general goal of the project is to determine (on the basis of the model City of Berdychiv as a typical medium-sized city of Ukraine) priority measures aimed at decreasing GHG emissions in SMCs of Ukraine, identifying barriers to project implementation and ways to overcoming these barriers. Another goal is to compile guidelines which will help local authorities pursue a policy of environmental protection and implement GHG emissions reduction measures.

Adopting this policy will allow to save municipal budget finances and give opportunity to participate in GHG emissions trading. To realise potential for GHG reduction in SMCs of Ukraine, comparatively few typical technical measures should be implemented (with simple pay back not more 5 years), including primarily:

In the sub-sector of heat generation:

- regular adjustment of the main and auxiliary boiler plants equipment;
- timely and regular cleaning of boiler surfaces (e.g. installation of blowers);
- optimum distribution of heat load between boiling units of the boiler plants based on the developed technological operation mode charts;
- transfer of boiler plants from coal into natural gas;
- replacement of obsolete boiler plants main equipment by more modern ones (with efficiency ratio up to 94 %);
- installation of heat recovery equipment at natural gas boiler plants.

In the sub-sector of heat supply:

- replacement of pipelines in heat supply networks by pre-insulated pipe sections;
- organisation and installation of systems for ventilation of unreachable reinforced concrete channels in the heat supply networks;
- control of humidity of insulation covering of heat supply networks;
- organisation of a prompt discovery and elimination of heat carrier leakage;
- installation of modern, highly reliable reinforcement.

In the sub-sector of heat consumption:

- automatic control of heating system;
- additional weather-stripping of windows and doors;
- installation of reflectors behind radiators;
- use of water heat exchangers and automatic controls for hot water supply system;

In the sub-sector of water supply:

- construction of the filtering station for surface water cleaning with rated daily capacity of 12.5 thousand m³ a day;
- implementation of the automated potable water supply control system, which will optimise operation of the pumping stations and provide continuous water supply to the customers;

In the sewage sub-sector:

- modernisation of the sewage pumping stations (5) by replacement of old energy inefficient equipment with the energy efficient one;
- modernisation of sewage collector (600 mm in diameter, 750 m long) using the extrusion method with the technology by “Insituform” Firm;

In the sub-sector of street lighting:

- use of lamps with high performance characteristics.

Existing barriers ordered by level of impact can be divided into general and local barriers. General barriers have an impact on all economic entities – private businesses, public budgeting and finance, and individual households. Local barriers include barriers at the local (municipal) level. It is very difficult to overcome general economic barriers at the local level, but in some cases their impact can be mitigated as a result of appropriate measures.

The most important obstacle to reaching cost-effective results in energy efficiency in all sectors is a lack of funds for investments in energy efficiency projects. Therefore, all factors preventing investment activity are at the same time barriers to energy efficiency improvement. In general, barriers to energy efficiency improvements, which can be mitigated at the level of SMCs of Ukraine, include:

- stagnant or absent organisational structures that could specialise in energy audit and energy management, preparation and implementation of energy efficiency projects and measures, including leasing, installation and maintenance of energy efficiency equipment;
- ineffective forms of ownership in building sector (non-associated majority of building owners) and minor private organisations for keeping and maintaining residential buildings;

- lack of knowledge, information and experience in effective energy consumption control in budgetary and residential spheres that are preliminarily based on unmetered energy consumption;
- difficulties in financing and high value of administering cash flow for conducting a great number of relatively low-cost energy efficiency projects and measures;
- unsatisfactory financial state of major consumers and their lack of liquidity and creditworthiness;
- lack of heat control equipment;
- energy cost feature of local tariff policy, which undermines concern in more effective energy generation, supply and use (first and foremost heat energy).

The table below presents GHG emissions and potential for their reduction through realisation of minimal energy efficiency potential in the infrastructure of SMCs of Ukraine in 1998, that were determined according to IPCC methodology.

Sector	Total GHG emissions of direct effect, thousand ton CO ₂ -equivalent	GHG emissions (direct effect)			Minimal potential of GHG emission reduction, thousand ton CO ₂ - equivalent
		Carbon-dioxide, thousand ton	Methane, ton	Nitrogen protoxides, ton	
Heat supply	40182.26	37841.35	35274.2	290.04	16072.91
Street lighting	712.86	544.023	9.122	544.023	356.4307
Water supply	5435.49	4579.82	76.79	2755.03	3261.29
Transport	1203.36	1127.46	3467.51	9.95	300.8393
Total in sectors of SMCs of Ukraine	47533.97	44092.65	38827.62	3599.043	19991.47
Total in Ukraine	384604.7	262822.8	5285350	34800	

While identifying potential for GHG emission reduction efficiency of some energy saving measures was determined based on expert estimates, and the total efficiency was determined based on the calculations considering cross impact of the various measures that could be used simultaneously.

As a result of the research, the following conclusions have been reached:

- annual volumes of GHG emissions in sectors of economy in SMCs account for 47.5 million tons of CO₂ equivalent, which is 12.35 % of total volume of GHG emissions in Ukraine;
- the potential for GHG emissions reduction in SMCs through realisation of economically feasible measures makes up near 20 million tons of CO₂ equivalent or 42 % of total GHG emissions in these sectors;
- the greatest amount of GHG emissions in SMCs of Ukraine pertain to the district heating, which accounts for 84.5 % of total emissions in SMCs of Ukraine. This sector has therefore a great potential for emissions reduction, more than 16 million ton of CO₂ equivalent or 80 % of total potential of GHG emissions reduction.

Given the above mentioned, the infrastructure of SMCs of Ukraine is supposed to be perspective sector for joint implementation projects.