

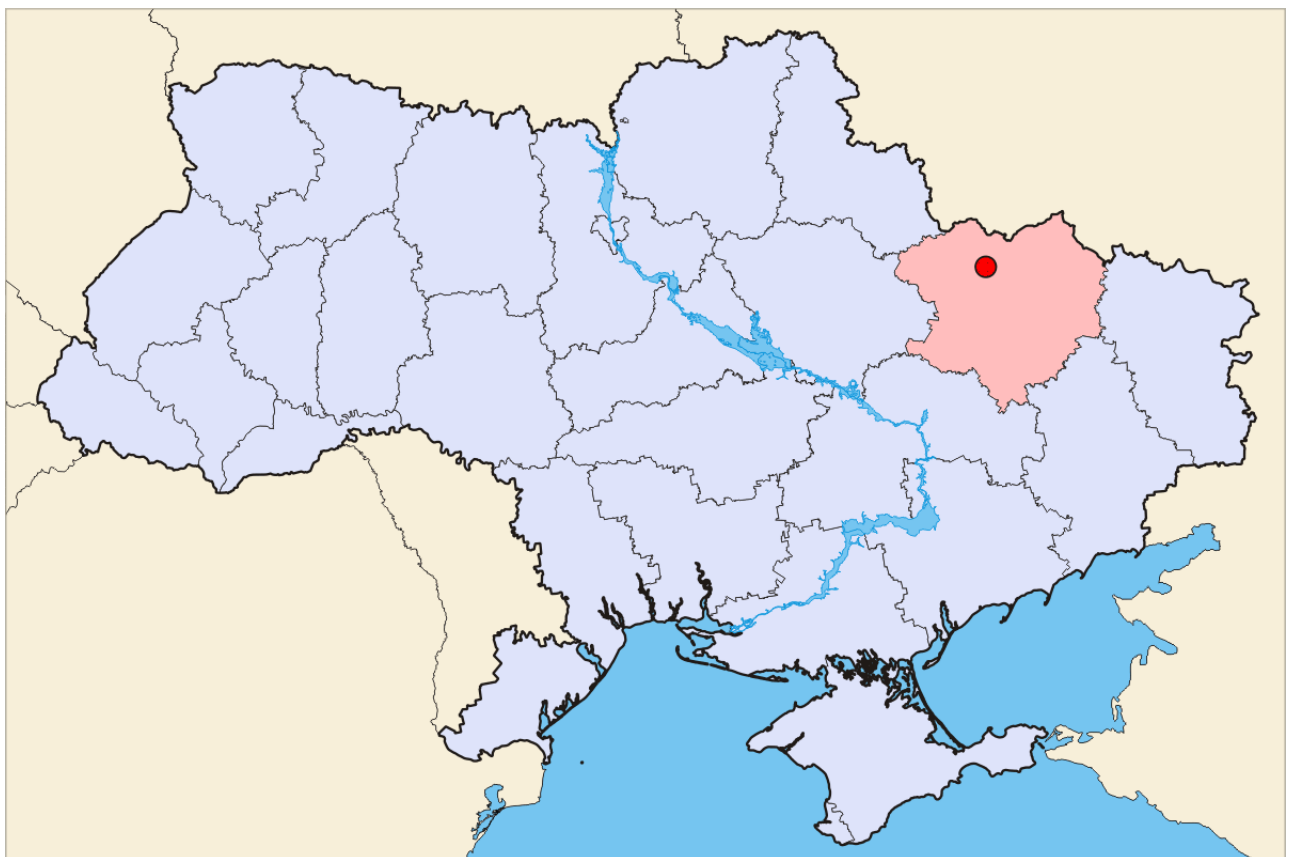
World Bank

# **Affordable Heating, Ukraine**

Strategy Report

Final

May 2009





COWI A/S

Parallelvej 2  
DK-2800 Kongens Lyngby  
Denmark

Tel +45 45 97 22 11

Fax +45 45 97 22 12

[www.cowi.com](http://www.cowi.com)

World Bank

## **Affordable Heating, Ukraine**

Strategy Report

Final

May 2009

Report no. 1  
Version no. 4  
Date of issue 11.05.2009

Prepared ABX, ORX, NBP, INVA, GUWE  
Checked MIKV  
Approved JKP

## Abbreviations and Acronyms

|              |  |
|--------------|--|
| <b>CA</b>    | Condominium Association  |
| <b>CHP</b>   | Combined Heat and Power  |
| <b>CHS</b>   | Central Heating Substation   |
| <b>CMU</b>   | Cabinet of Ministries of Ukraine                                   |
| <b>Gcal</b>  | Gigacalorie  |
| <b>DH</b>    | District Heating   |
| <b>EBRD</b>  | European Bank for Reconstruction and Development                   |
| <b>EC</b>    | European Community   |
| <b>EE</b>    | Energy efficiency  |
| <b>EIB</b>   | European Investment bank   |
| <b>EU</b>    | European Union   |
| <b>HIES</b>  | Household Income and Expenditure Survey                            |
| <b>IFI</b>   | International financial institution                                |
| <b>IHS</b>   | Individual Heating Substation                                      |
| <b>HTW</b>   | Hot Tap Water  |
| <b>HTWS</b>  | Hot Tap Water Supply   |
| <b>IRR</b>   | Internal Rate of Return  |
| <b>JSC</b>   | Joint Stock Company  |
| <b>KCEC</b>  | Kharkiv City Executive Committee                                   |
| <b>KHN</b>   | Communal Enterprise “Kharkiv Heating Network”                      |
| <b>MDI</b>   | Municipal Development Institute                                    |
| <b>MHCS</b>  | Ministry of Housing and Communal Services                          |
| <b>TCE</b>   | Ton of Coal Equivalent<br>1 ton of e.f. = 7000 kcal/kg or 29.3 MJ  |
| <b>UAH</b>   | Ukrainian Hryvnia  |
| <b>UNECE</b> | United Nation Economic Commission for Europe                       |
| <b>VAT</b>   | Value Added Tax  |
| <b>WB</b>    | World Bank   |
| <b>ZhKS</b>  | Housing and Communal Services (Zhylkomservis)<br>Municipal Company |

**National Bank of Ukraine Exchange Rates**

|          | <b>Exchange rate:</b>          |                              |
|----------|--------------------------------|------------------------------|
|          | <b>as of 30 September 2008</b> | <b>as of 2 February 2009</b> |
| USD 1.00 | UAH 4.86                       | UAH 7.70                     |
| EUR 1.00 | UAH 6.98                       | UAH 9.87                     |

## Executive Summary

There is an urgent need to reduce the dependency on natural gas in Ukraine - for climate change reasons, for energy supply security reasons and for affordability reasons. With regard to affordability it is envisaged that energy prices will increase substantially in Ukraine during the next 5-10 years as they gradually move towards the world market price level. Thus, a business-as-usual scenario, where heat consumption per household is unchanged, will inevitably increase the amount of money households have to pay for heat and hot tap water. It will seriously hit low-income households.

The dependency on natural gas may be reduced through the implementation of energy saving measures within the entire district heating system - embracing heat production, transportation, distribution and consumption - thereby increasing overall energy efficiency. No doubt the energy saving potential within the district heating system in Ukraine is big. Not least within residential heat consumption. It is estimated that 20% of the total energy saving potential is concentrated in the system of heat production, transportation and distribution in the district heating system of Kharkiv City. But - an estimated 80% of the total energy saving potential is present in the system of the residential heat consumption. In multi-flat buildings it is possible to reduce heat consumption by 40%.

In order to exploit this energy saving potential it is necessary to:

- develop EE projects (not only on the supply side, also on the demand side) and prepare business plans for their implementation;
- provide finance for investments in the entire district heating system;
- reorganize the structure of supply - possibly, through privatization of certain services, such as housing and communal services;
- organize the owners in the housing sector and give them the incentive and tools to reduce their consumption;
- reshape the current system of direct and indirect subsidies into conditional cash transfers to the truly vulnerable, thereby promoting energy saving measures and improving targeting.

This document provides a strategy for improving the district heating system and hot tap water supply services in Kharkiv City, Ukraine, during 2009-2018 with the aim of exploiting the prevailing energy saving potential along these lines.

It has been developed with technical assistance from the World Bank for Kharkiv City. Kharkiv City Executive Committee (KCEC) will be overall responsible for its implementation, even though many of its actions are to be taken by other stakeholders than the municipality- not least, the Communal Enterprise "Kharkiv Heating Network" (KHN), Housing and Communal Services Municipal Company (ZhKS) and owners in the housing sector.

Deliberately, the strategy pays particular attention to the actions to be taken in the short to mid term - that is, in the period till 2013.

In Kharkiv City, the utility infrastructure is obsolete, individual heat meters are not very common, KHN operation on provision of DH services is loss-making, consumer debts are high, losses in the transportation system and heat consumption are immense, and the use of alternative energy sources is scarce - all of which results in high dependency on natural gas delivered from abroad.

The KCEC has - in cooperation with the KHN, ZhKS and other stakeholders - identified four challenges constituting the starting point for the current strategy:

- Heat consumption shall decline - not least, in the housing sector.
- Technical and financial performance of KHN and ZhKS shall improve.
- Tariffs shall cover costs, including investment costs, of the suppliers.
- Social subsidy programs shall target those truly vulnerable.

All inhabitants in Kharkiv City should have access to good quality services in heating and hot tap water at affordable prices. It is the vision of the strategy.

To achieve this vision - and the accompanying strategic goals - the strategy puts forth a series of actions within five distinctive areas. The five areas are:

### *1. Institutional and Organizational Measures*

Actions are aimed at supporting the creation of owners' organizations in residential buildings, development of a housing maintenance market and introduction of consumption based billing, so that costumers pay in accordance with actual consumption.

### *2. Investment*

Actions are aimed at investments on the supply and demand sides.

### *3. Funding of the Investment Program*

Actions are aimed at increasing revenues through number of actions in-

cluding bringing tariffs to cost recovery level and thereby providing a sound financial basis for the further development of the sector.

#### 4. *Social Protection Measures*

Actions are aimed at improving targeting of existing social subsidy system, while at the same time promoting energy saving measures among low-income households.

#### 5. *Public Awareness Campaign*

Action is aimed at increasing public awareness of possibilities and, not least, benefits of energy saving measures in residential buildings.

The estimated costs of implementing the strategy amount to about USD 2.1 billion. The lion share is linked with the proposed investment program: USD0.9 billion are for investments in heat production, transportation and distribution, whereas USD1.2 billion are for investments in multi-apartment buildings.

The investment projects included in the strategy all have high internal rates of return - from a little more than 10% up to 105% over a period of 20 years.

The strategy will be implemented through a scheme and two city programs:

- Kharkiv Heating Supply Scheme (as per Article 6 of the Law of Ukraine on Heating Supply)
- Affordable Heating Program for Kharkiv for 2009-2018 (to be designed and approved).
- Program to Support Safe Life Activity in the Area of Social Security of the Citizens of Kharkiv for 2007-2010 (to be revised and approved for the period until 2018).

The Government of Ukraine, foremost the Ministry of Housing and Communal Services (MHCS), may assist in many ways in the successful implementation of the strategy. Most important are the following three initiatives:

- improvement of the national regulation for tariff setting and investment promotion;
- improvement of the social subsidy system;
- information and methodological support.

Through these three initiatives the Government of Ukraine may substantially improve the legal and regulatory framework for further progress with respect to district heating and hot tap water supply services throughout Ukraine.

The document contains an implementation plan highlighting deadlines and responsible bodies for each action. Monitoring will be carried out by the KCEC.

## Table of Contents

|          |  |           |
|----------|--|-----------|
| <b>1</b> | <b>Introduction</b>                                | <b>1</b>  |
| <b>2</b> | <b>Challenges</b>                                  | <b>3</b>  |
| 2.1      | Introduce Consumption Based Billing                | 5         |
| 2.2      | Improve Technical and Financial Performance        | 8         |
| 2.3      | Bring Tariffs to Cost Recovery Level               | 11        |
| 2.4      | Improve Social Protection of Low-income Households | 11        |
| <b>3</b> | <b>Vision and Goals</b>                            | <b>16</b> |
| <b>4</b> | <b>Areas and Actions</b>                           | <b>19</b> |
| 4.1      | Institutional and Organizational Measures          | 21        |
| 4.2      | Investments  | 26        |
| 4.3      | Funding of Investment Program                      | 32        |
| 4.4      | Social Protection Measures                         | 43        |
| 4.5      | Public Awareness Campaign                          | 45        |
| <b>5</b> | <b>National Level</b>                              | <b>49</b> |
| 5.1      | Tariff Setting and Investment Promotion            | 49        |
| 5.2      | Social Subsidy System                              | 51        |
| 5.3      | Information and Methodological Support             | 52        |
| <b>6</b> | <b>Implementation Plan</b>                         | <b>53</b> |
| 6.1      | Institutional and Organizational Measures          | 54        |
| 6.2      | Investments  | 55        |
| 6.3      | Funding of the Investment Program                  | 55        |
| 6.4      | Social Protection Measures                         | 57        |
| 6.5      | Public Awareness Campaign                          | 58        |
| 6.6      | Monitoring and Reporting                           | 59        |
| Annex I  | Key Terms  |           |
| Annex II | Investment Projects, IRR                           |           |



|           |                        |
|-----------|------------------------|
| Annex III | Tariffs and Privileges |
| Annex IV  | Municipal Subsidies    |
| Annex V   | References             |

## 1 Introduction

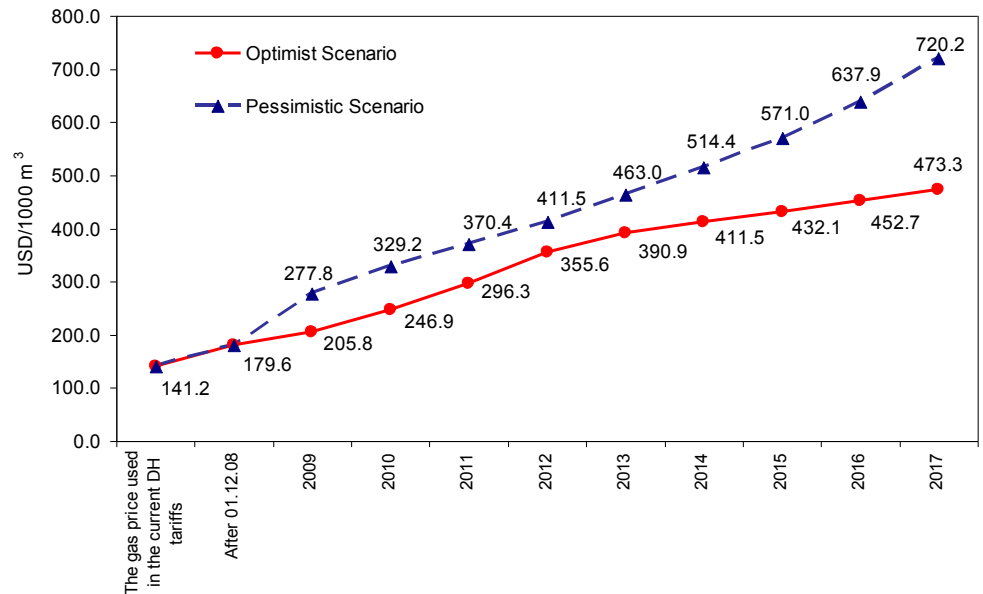
|              |   |
|--------------|---|
| Strategy     | <p>This report provides a strategy for improving the district heating (DH) system and also hot tap water supply (HTWS) services in Kharkiv City, Ukraine. It focuses upon the introduction of demand side efficiency measures at Communal Enterprise “Kharkiv Heating Network”, social protection mechanisms to ensure affordable heat supply and proper monitoring of the strategy to allow for adjustments in the course of strategy implementation.</p>  |
| Timeline     | <p>The strategy covers a 10 years period (2009-2018). Deliberately, the strategy pays particular attention to the actions to be taken in the short to mid term by the key stakeholders in Kharkiv City.</p> <p>Kharkiv City The strategy is developed for Kharkiv City. It is assumed that Kharkiv City Executive Committee (KCEC) will take overall responsibility for its implementation, even though many of its actions are to be taken by other stakeholders than the municipality, including end-users. There are two implications hereof: First, it focuses on what the KCEC may do to improve the DH system in Kharkiv City, even though it also provides advice on how the national regulation could be improved. Second, the strategy is formulated as if the KCEC had already adopted it, even though it is, in fact, nothing but a recommendation made by a project team consisting of independent experts having analyzed the DH system in Kharkiv City since August 2007.</p> |
| Project team | <p>The report has been prepared by COWI A/S and Municipal Development Institute (MDI) under the World Bank Contract No 7144133 regarding the project "Affordable Heating, Ukraine". The project was commenced on 10 August 2007 and will be finalized by 28 February 2009.</p>  |
| Sources      | <p>This strategy is based upon three background documents prepared within the abovementioned project - namely, Status Report, Demand Side Report and Survey Report - experiences made in selected new EU Member States with regard to the introduction of demand side efficiency measures within the DH system and meetings and discussions with representatives of the KCEC and also the Communal Enterprise "Kharkiv Heating Network" (KHN), Housing and Communal Services Municipal Company (ZhKS) and other stakeholders. For information, the three background documents may be obtained from Mr Jesper Karup Pedersen, Project Manager, COWI A/S (jpk@cowi.com), or Ms Olga Romanyuk, Project Manager Assistant, MDI (oromanyuk@mdi.org.ua), upon request.</p>  |

|                 |  |
|-----------------|--|
| Target groups   | <p>The target group of the report consists of experts within KCEC, KHN and ZkKS, whereas the target group of the strategy consists of a much broader audience, including government bodies at the national level, local authorities responsible for DH sector in other cities and regions, experts involved in management of DH sectors all over Ukraine, NGOs, IFIs and donors active in Ukraine and general public in Kharkiv City. In other words, it is the sincere hope of the project team that the KCEC, KHN and ZkHS will support the strategy, make it their own by making some changes and disseminate it widely.</p>  |
| Acknowledgement | <p>The project team would like to make use of this opportunity to thank the KCEC, KHN and ZkHS for valuable support throughout the project implementation. Without their assistance in opening doors, collecting data and information and providing overall guidance the project team would never have managed to prepare this report. However, the project team bears the sole responsibility for the final report, including errors that may have slipped into it.</p>   |
| Organisation    | <p>The report consists of 5 chapters in addition to the current chapter. These 5 chapters constitute the proposed strategy. They are the following:</p> <ul style="list-style-type: none"><li>○ Chapter 2: Challenges;</li><li>○ Chapter 3: Vision and Goals;</li><li>○ Chapter 4: Strategy;</li><li>○ Chapter 5: National Level Recommendations</li><li>○ Chapter 6: Implementation Plan;</li></ul> <p>Five annexes are attached to the report. Annex I defines a few of the key terms used in the report. Annex II contains calculations of the internal rate of return of the recommended investment projects. Annex III includes two tables regarding estimated future tariffs and municipal heat privileges. Annex IV describes an alternative mechanism for the social protection of the population against a sharp increase of natural gas prices. Finally, Annex V lists selected useful references.</p> |

## 2 Challenges

- Essential** A well-functioning district heating (DH) system is essential to the well-being of the inhabitants of Kharkiv City insofar as it is the major source of heating.
- Poor performance** However, the weaknesses of the current DH system in Kharkiv City are plenty. The same is true with regard to the hot tap water supply (HTWS) services that are closely linked to the DH system. This is acknowledged by the Kharkiv City Executive Committee (KCEC) and also the Communal Enterprise "Kharkiv Heating Network" (KHN), who is the main provider of heat and hot water to the housing sector, and the Housing and Communal Services Municipal Company (ZhKS), who is overall responsible for virtually all residential buildings.
- Among others, the utility infrastructure is obsolete, individual heat meters are not very common, KHN operation on provision of DH services is loss-making, consumer debts are high, losses in the transportation system and heat consumption are immense, and the use of alternative energy sources is scarce, all of which results in high dependency on natural gas delivered from abroad.
- Increasing energy prices ahead** On top of this, it is envisaged that energy prices in Ukraine will increase even further during the next 5-10 years as they gradually move towards the world market price level. This will affect Kharkiv City seriously. Not only the KHN, ZhKS and other stakeholders involved in the provision of DH and HTWS services, but also the inhabitants of Kharkiv City. If decisive actions are not taken there is a risk that the DH supply in Kharkiv City will become unsustainable.
- A recent study prepared by the World Bank estimates that by 2017 the natural gas price will have increased to USD 473-720 per 1000 m<sup>3</sup> or 3.4-5.1 times higher as compared to the current natural gas price - depending on whether an optimistic or pessimistic scenario comes through. It is illustrated in Chart 2.1.

Chart 2.1 Natural gas prices will increase (USD/1000 m<sup>3</sup>, VAT included)



Source: World Bank, 2008 (a).

#### Four challenges

Against this background the KCEC has - in cooperation with the KHN, ZhKS and other stakeholders - identified four challenges constituting the starting point for the current strategy for improving the DH system and HTWS services in Kharkiv City in the period till 2018. The four challenges are the following:

- *Introduce consumption based billing.* End-use consumption - not least, in residential buildings - is to be reduced substantially through the introduction of consumption based billing. It is very much linked with the need to install individual meters within the housing sector. Meters aimed at measuring the actual energy consumption for heating and hot water should be installed in all apartments - among others, to ensure that end-consumers will have a strong incentive to energy savings.
- *Improve technical and financial performance.* The overall efficiency of the DH system and HTWS services should be considerably improved through investments, including investment support from the city budget, state budget or other financial sources to energy saving measures in the housing sector, and institutional and organizational changes - to ensure that energy losses within heat transportation, heat consumption per m<sup>2</sup> per year and volume of hot water used are drastically reduced.
- *Bring tariffs to cost recovery level.* Tariffs should gradually be increased so as to ensure that the providers of DH and HTWS services may cover not only O&M costs but also investment costs. Social protection should not be provided through low tariffs for low-income households.
- *Improve social protection of low-income households.* The social protection measures linked with heating should be targeted at low income

households and only those - to ensure that payments to be made for heating and hot water are affordable to all owners and tenants in the housing sector. Thus, a reform of social protection measures is needed.

Obviously, the four challenges are very much interlinked.

In the remaining part of this chapter the challenges are dealt with - one by one. Special attention is paid to the rationale of each of the three challenges.

## 2.1 Introduce Consumption Based Billing

Few meters

End-use consumption is high compared with other European countries. It is caused by large losses, no possibility to regulate, no knowledge about size of consumption and little knowledge about options for energy savings.

The current lack of consumption based billing constitutes a major reason for the high consumption level. A major challenge is to introduce such a system.

Currently, the multi-flat buildings use almost no meters for measuring the actually consumed heat energy. Only some buildings (about 20%) have *building* meters, while *apartment* heat meters are not installed at all. Thus, the technical preconditions for introduction of consumption based billing are absent.

As concerns HTW supply, only one third (32.5%) of users, holders of individual meters, are able to measure the volumes of HTW used.

This picture should change. There are two important reasons for this.

Limited incentive

One reason is that owners and tenants have very limited incentives to energy savings if there are no individual meters installed. Why do an extra effort to save energy if you, by doing so, are not being rewarded? Why invest money in, for instance, walls insulation for energy saving reasons if you know for sure that the resulting reduction in heat consumption per m<sup>2</sup> per year in your apartment will benefit not only you, but all those living in the building block?

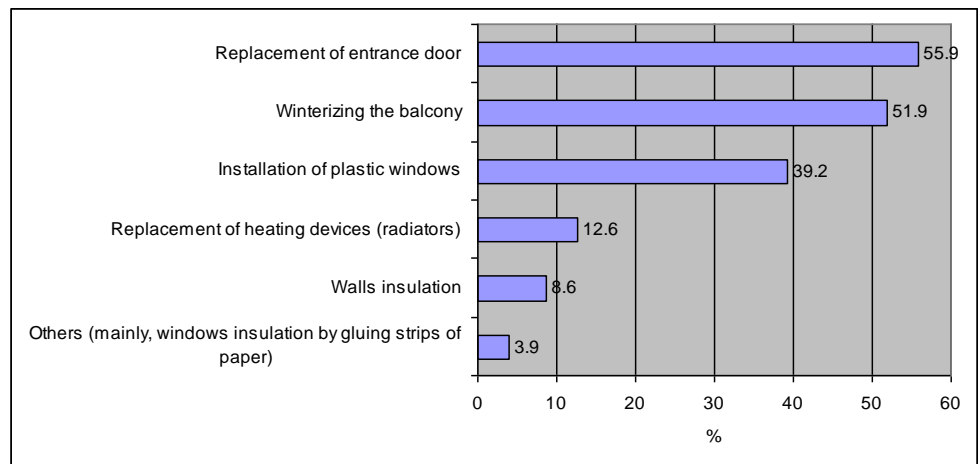
### *Box 2-1 No possibility to lower temperature*

Heat energy radiator distributors and thermostatic regulators are not used by consumers in multi-flat buildings in Kharkiv City. Consumers have no possibility to change temperature regime in their apartments. It follows from a recent survey carried out on behalf of the World Bank.

Unsurprisingly, energy saving measures carried out in the apartments are few. As can be seen from Chart 2.2 most energy saving measures carried out concern replacement of entrance door, winterizing the balcony and installation of plastic windows. The two first mentioned measures have been carried out for other reasons as well - wish to increase security and number of square meters.

It is, however, important to emphasize that many households have installed hot water meters in their apartments and paid for this themselves. According to a recent World Bank survey carried out in Kharkiv City, 35% of the households have installed hot water meters. 97% of these have paid for these themselves. They have done so because it is possible this way to reduce the hot water bill.

*Chart 2.2 Some energy saving measures have been carried out, but only some<sup>1</sup>*

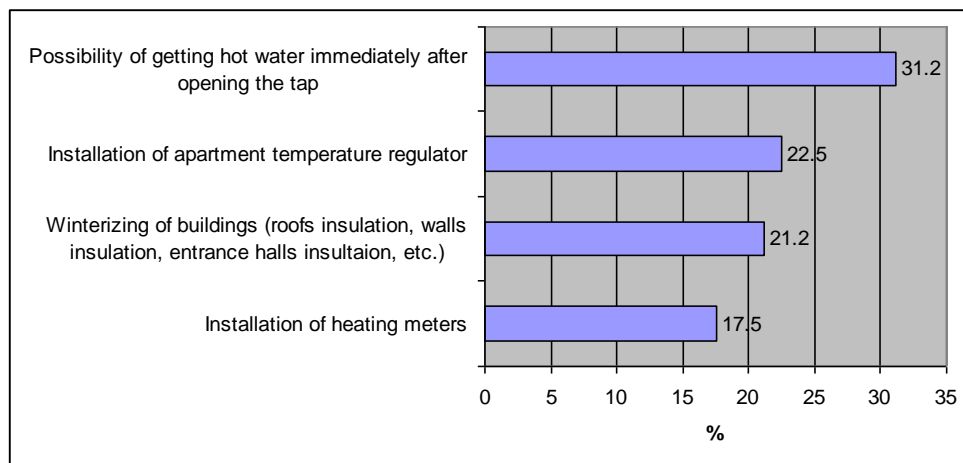


Note: 1) The question asked was: "What have you done in your apartment/house to use heat more efficiently?" Answers are in % of all respondents.

Source: World Bank, 2008(c).

Furthermore, only few households express an interest in carrying out further energy saving measures. This follows from Chart 2.3 overleaf. Depending on the type of measure only 17-30% of households express an interest. But they don't want to pay for this themselves - either through own investments or increased heat and hot water tariffs. It follows also from the recent World Bank survey. No doubt it is linked to the fact that current tariffs do not reflect costs and also that consumers have no economic incentive to carrying out further energy saving measures insofar as consumption based billing is absent.

*Chart 2.3 Interest in implementation of further energy saving measures is limited<sup>1</sup>*



Note: 1) The question asked was: "Are you interested in the implementation of any of these measures?" Answers are in % of all respondents. Only those that answered "Yes" are shown.

Source: World Bank, 2008(c).

*Box 2-2 Consumption of hot water is far above standard*

According to KHN, the actual volume of hot water consumed by the users without meters amounts to 157.3 litres per day per person. It is about 50% more than the established Ukrainian standard (105 litres per day per person).

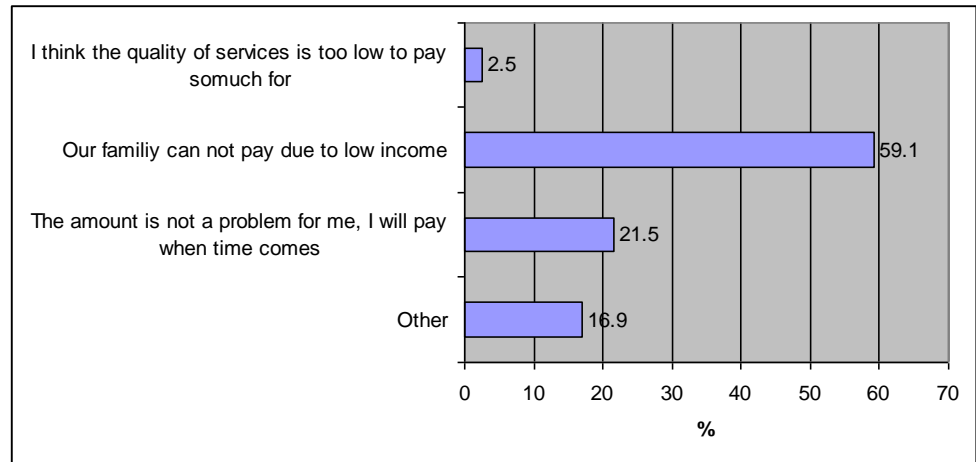
Low payment discipline

Another reason why it is important to install individual meters is that the lack hereof contributes to the prevailing low payment discipline. How can I be sure that my bill is linked to my heat consumption? How can I be sure I don't pay too much? It is a striking feature that private end-consumers account for the lion's share of total payment arrears to the KHN. Likewise, it is a striking feature that well-off households account for more than 60% of payment arrears of private end-consumers, and that most households tend to believe that heat and hot water tariffs are, in fact, too high, when the fact is that they are not sufficiently high to cover production, transportation and distribution costs.

The low payment discipline is however, also linked with affordability. 59% of the households having dept for heat and hot water claim that a major reason for this is that the household income is low. It follows from Chart 2.4.



*Chart 2.4 Reasons for payment arrears are many, but low household income is the most important<sup>1</sup>*



Note: 1) The question asked was: "What is the reason for you having debt for heating and hot water?" Answers are in % of those who have accumulated debt.

Source: World Bank, 2008(c).

## 2.2 Improve Technical and Financial Performance

Two ways

The technical efficiency of the DH system and HTWS services may be improved in two ways - by investments in, among others, demand side efficiency measures and by institutional and organizational changes. The KCEC will pursue both ways to overcome the challenge of improving the overall efficiency.

Infrastructure  
obsolescent

The infrastructure within heat production, transportation and distribution is in general deteriorating. Indications hereof are plenty:

- Most of the boiler houses - which are owned by the KHN and operate on natural gas - date back till the 1960s and 1970s. They were constructed in accordance with the model designs of that time. Today, an estimated 70% of them need to be upgraded and reconstructed and this percentage is increasing each year.
- 32% of heat networks (514 km) are in the state of emergency. About 3% (48 km) need to be urgently replaced and this percentage is increasing each year.
- Currently, there is no practice of using the combined heat and power generation (co-generation).

As a result the DH system and HTWS services suffer from insufficient reliability and efficiency. Frequently breakdowns in the heating network constitute a serious problem. The annual breakdown rate is growing. Today, it exceeds 1.6 breakdowns per km of network in operation.

*Box 2-3 Energy saving project in Vilnius, Lithuania<sup>1</sup>*

|                                 |  |
|---------------------------------|--|
| Area of apartments:             | 4544 m <sup>2</sup>  |
| Total heating area:             | 4864 m <sup>2</sup>  |
| Number of floors:               | 16   |
| Number of apartments:           | 64   |
| Year of construction:           | 1986   |
| Type of construction:           | Monolithic walls, flat roof, wooden windows with double glasses  |
| Energy saving project:          | Replacement of heating substation, walls insulation, windows replacement, glassing of balconies, and renovation of staircase and entrance door |
| Project costs:                  | USD 295,242  |
| Heat energy consumption before: | 615.6 MWh/year   |
| Heat energy consumption after:  | 330.3 MWh/year   |
| Energy savings:                 | 46%  |



Note: 1) The project was launched in 1999 by the owners' association consisting of owners of apartments in the multi-flat building in question. It was finalized in 2004.

Source: Housing and Urban Development Agency, 2008.

#### Demand side efficiency measures

Furthermore, investments in demand side efficiency measures such as individual meters, walls insulation and roofs insulation are new and still few - even though the energy saving potential of these is much higher, in fact, than the energy saving potential within heat production, transportation and distribution. It follows from a recent study carried out by the World Bank in Kharkiv City.

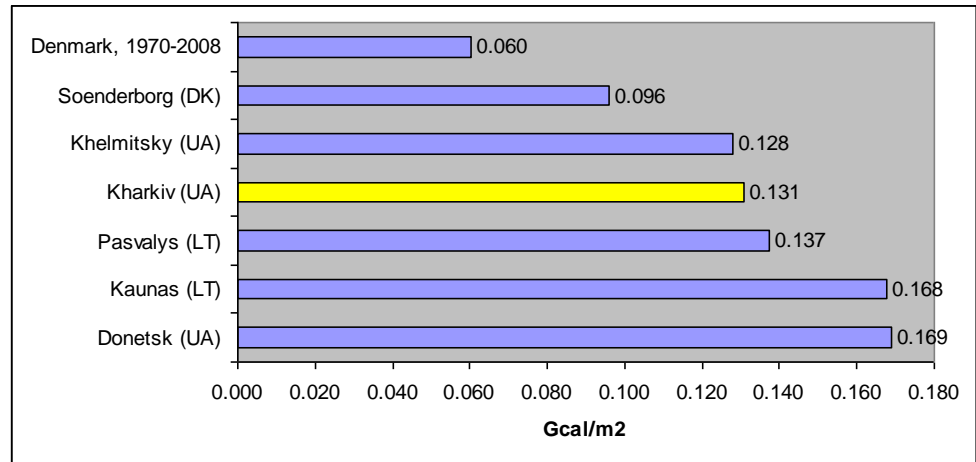
*Box 2-4 Huge energy saving potential in housing*

It is estimated that 20% of the total energy saving potential is concentrated in the system of heat production and transportation in the DH system of Kharkiv City. But - an estimated 80% of the total energy saving potential is present in the system of the residential heat consumption in Kharkiv City. In many multi-flat buildings it is possible to reduce the heat consumption by 40%.

Source: World Bank, 2008 (b).

It follows from Chart 2.5 that Kharkiv City is doing pretty well with regard to energy consumption for heating purposes in residential buildings - as compared to other cities in Lithuania and Ukraine. However, the picture differs if one compares with, for instance, Denmark, where the DH system is common as well. Newly constructed residential buildings in Denmark have, as a maximum, energy consumption for heating purposes of 0.025 Gcal/m<sup>2</sup>. It is more than 5 times lower as the figure for Kharkiv City as of today. Differences in the length of the heating seasons, outdoor temperatures and others explain only a part.

Chart 2.5 Average energy consumption for heating purposes in residential buildings, 2007<sup>1</sup>



Notes: 1) The chart shows average actual heat consumption for heating purposes in residential buildings in selected cities. Please note that methodologies differ. "Denmark, 1970-" concerns residential buildings constructed after 1969; the figure is climate adjusted. The figure for Soenderborg, a town in Denmark, is for 2005, includes heat consumption for hot water and is climate adjusted. Figures for Khelmitsky, Kharkiv and Donetsk in Ukraine are 2007 figures. The figures for Pasvalys and Kaunas in Lithuania are 2006/2007 figures; they concern the heating season 2006/2007.

Sources: COWI; MDI; SBI, "By og Byg dokumentation - 057", Copenhagen, 2008.

In Kharkiv City heat energy is used particularly inefficiently for water heating purposes - among others, due to the hot water recirculation, which has been out of operation for many years. In other words, energy saving potentials are plenty within the housing sector.

#### Box 2-5 How to get hot water?

About 45% of inhabitants in Kharkiv City are not fully satisfied the quality of heating and hot water services. They mainly complain about low temperature in the rooms (72% of those who are not fully satisfied), need to let the water running until it gets sufficiently warm (65%) and low temperature of hot water (61%). Apparently, it is fairly common in households facing the problem with low temperature of hot water after opening the tap letting the water run for up to 10 minutes. 62% of these households inform that this is the case.

Average hot water consumption per household amounted to 8.4 m<sup>3</sup>/month in 2007. Much of this is nothing but loss of water and heat.

Set-up of owner's organizations

Most important with regard to the institutional and organizational changes is the set-up of owner's organizations capable of entering into negotiations and concluding agreements with public authorities, housing maintenance compa-

nies, heat suppliers and commercial banks. Under current Ukrainian legislation, only such organizations are authorized to manage the common property in multi-flat buildings. Thus, the absence of owner's organizations hinders the possibility to apply any comprehensive solution to the issues related to funding and implementation of energy efficiency measures in residential buildings.

There are a limited number of buildings in Kharkiv City that have their owner's organizations, but they are very few. They account for only 4% of all multi-flat buildings in the city. Nevertheless, it is possible to build upon lessons learned by these, when promoting the set-up of further owner's organizations.

Set-up new financing mechanisms

There is also an urgent need to set-up a solid financing mechanism - not least for investments in demand side efficiency measures. Under current legislation the tariffs for the services related to the maintenance of buildings and adjacent territories do not cover the expenses linked with the overhaul repair of residential buildings, including implementation of any energy saving measures. Furthermore, the local budget has rather limited possibilities when it comes to the funding of overhaul repairs of residential buildings. Consequently, there is a need to develop new financing mechanisms that may be used by owner's organizations once set-up to act as a vehicle for an increase in financially sound investments in energy saving measures within the housing sector.

### 2.3 Bring Tariffs to Cost Recovery Level

Not full cost recovery

The heat and hot water tariffs are, as already mentioned, not sufficiently high to cover production, transportation and distribution costs due to the prevailing price setting mechanism that is partly laid down in national legislation. Most important is that the heat tariffs are considerably lagging behind the growth of prices of the key resources (natural gas, electricity, purchased heat, etc.). It makes the core business of KHN and CHP5&6 loss-making, seriously threatens the creditworthiness of KHN and hampers the process of attracting commercial financing to a further development of the DH system and HTWS services.

End-consumers

Implications hereof are plenty - not only for the providers and the quality of services they provide, also for the end-consumers. No doubt a major reason for the fairly high level of per capita energy consumption in Kharkiv City is that tariffs are low and, which is important, consumption based billing is absent.

Increase needed

Consequently, there is an urgent need to change the price setting mechanism, thereby introducing the principle of full cost recovery. It implies that heat and hot water tariffs will increase - even if energy prices were stable. However, it should be done in parallel with the introduction of consumption based billing. If not the increase will not have the desired impact on energy saving.

### 2.4 Improve Social Protection of Low-income Households

Various weaknesses

Access to heat and hot tap water is a basic service to be provided to all segments of the population. Against this background there is a need to improve

the social protection of low-income households in Kharkiv City from further increases in energy prices and hence tariffs that no doubt will occur.

State and city programs

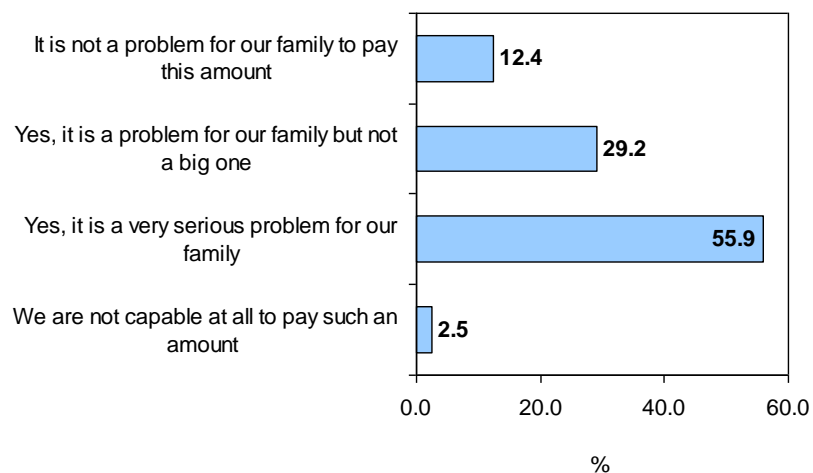
Generally speaking, the state and city programs providing privileges and subsidies to pay for housing and municipal services do not ensure the proper level of social care to low-income households. There are three relevant programs - namely, a state program providing certain privileges, a state program providing housing subsidies and a city program providing privileges and refunds. The state program providing certain privileges is not based on income levels and hence not well-targeted. The housing subsidies program has a number of drawbacks which limit its possibilities to provide efficient protection to the inhabitants in case of tariff increase. In particular, the established share of the mandatory payment (20% of the family aggregate income) is rather high. Furthermore, limited attention is given to the social support of families with children. The city program providing privileges and refunds is not efficient enough, complicated and bulky - both in terms of assistance provision and its management and administration. A major reshaping of the subsidy system is required.

Affordability seems low...

Already today it seems as if heat and hot water tariffs are fairly high for low income groups. The forthcoming increase in energy prices and hence tariffs will only make situation even worse for these groups - unless the social protection measures are considerably improved so as to improve targeting.

The payment for heating services is considered a "very serious problem" by as many as 55.9% of all households according to the recent World Bank survey.

Chart 2.6 For many Kharkiv households the heat bills are high



Note: 1) The question asked was: " Do you think that for your current family budget the heating bills are too high?" Answers are in % of all respondents.

Source: World Bank, 2008(c).

... and so does willingness to pay

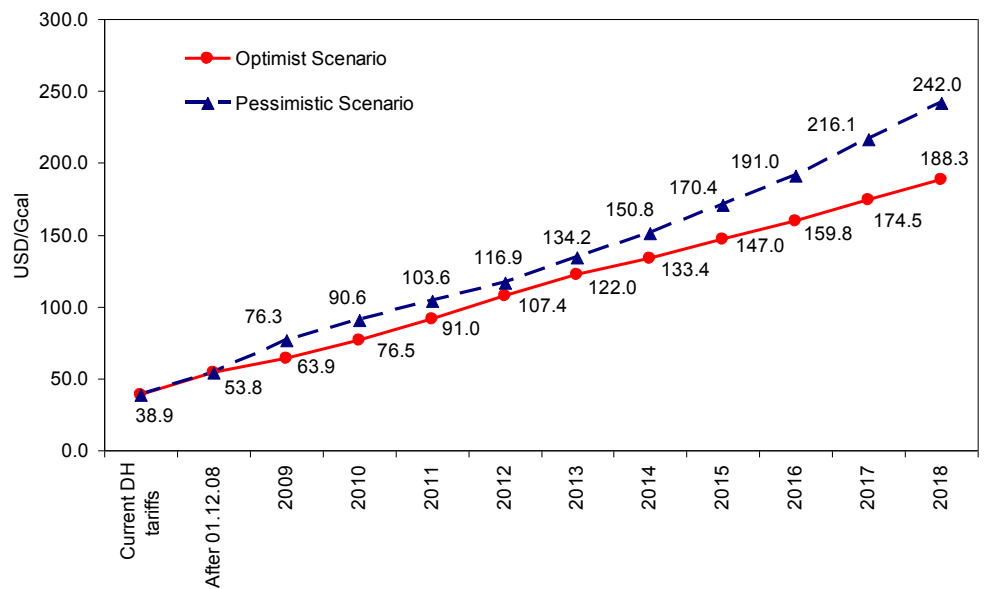
It also seems as if willingness to pay is low. Only 6.2% of households are ready to pay more for a better quality of heating and hot water services. Besides they are not willing to pay that much more. About half of them are ready to increase payment by only up to 25%, whereas the other half are ready to increase pay-

ment by up to 50%. Please note that this is what people answer, when being asked by an interviewer. In fact, their willingness to pay may be higher

Increasing tariffs

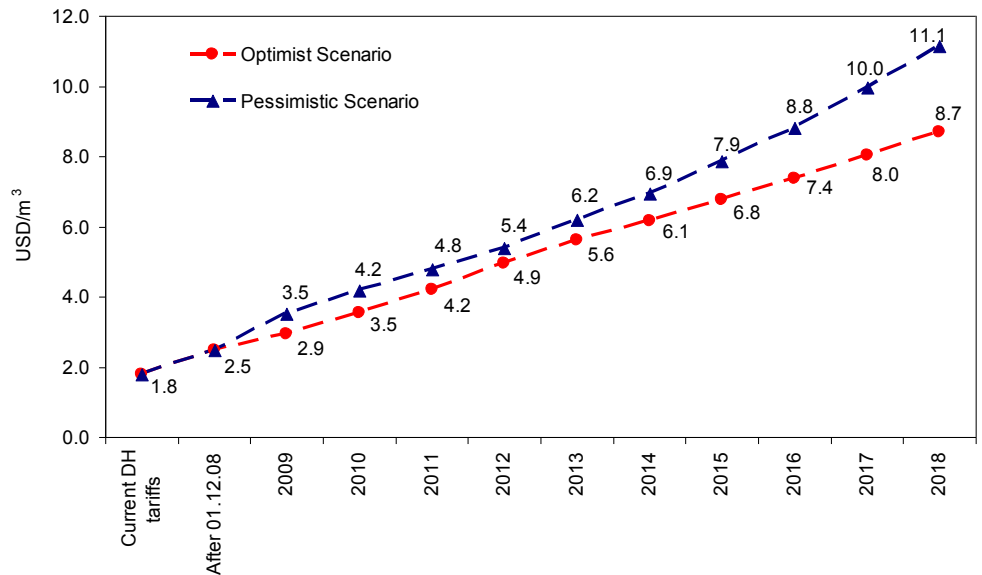
There is, however, no doubt that heat and hot water tariffs will increase - alone due to the abovementioned long-term increase in energy prices. It is estimated that they will have become 4.8-6.2 times higher by 2018 as compared to the current tariffs - depending on the scenario selected. It is shown in Chart 2.7 and below. Heat tariffs for heating services provided to private customers by KHN will increase up to USD 188-242 per Gcal, whereas hot water tariffs will increase up to USD 8.7-11.1 per m<sup>3</sup>.

Chart 2.7 Forecast, heat tariffs for private customers in Kharkiv City (USD/Gcal, VAT included)



Source: World Bank, 2008

Chart 2.8 Forecast, hot water tariffs for private customers in Kharkiv City (USD/m<sup>3</sup>, VAT included)

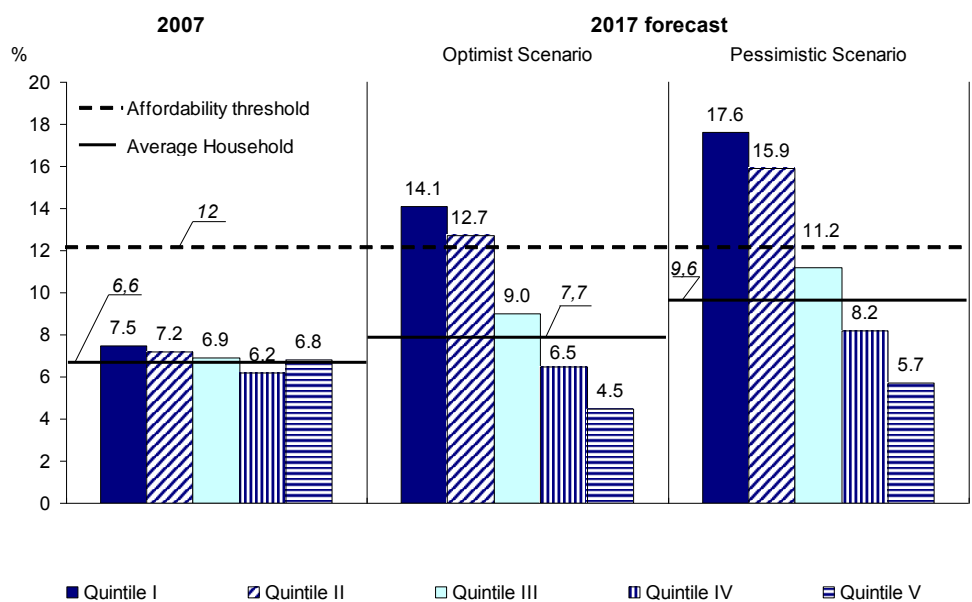


Source: World Bank, 2008

Almost 18% of household income

The impacts hereof to low income households are immense - if the social protection measures are not capable of compensating these for the increase in heat and hot water tariffs. As can be seen from Chart 2.9, which illustrates the impacts of increased heat and water tariffs on income groups, the 20% of the

Chart 2.9 Share of heat and hot water bills in total household expenditures by income groups



Source: World Bank, 2008 (a).

households with the lowest household income (Quintile 1) will have to spend almost 18% of their household income on heating and hot water services in case the pessimistic scenario comes through. This is far above the internationally established affordability threshold of 10-12%. 40% of the households will have to spend 13% or more - independent of which scenario comes through.



### 3 Vision and Goals

#### Vision statement

The vision for the municipality (KCEC) is that all households and public and private buildings have access to good quality services in heating and hot tap water at affordable prices. This will require radical changes in behaviour and substantial investments in infrastructure and building envelope and appliances.

The characteristic features of the DH system in Kharkiv City are as follows:

- DH system is financially sustainable, with acceptable development and planning
- There exists an efficient system for energy resource metering at the generation stage, as well as a system for metering and regulating the heat use by the consumers. Private consumers get high quality heat supply services billed in accordance with the consumption volumes.
- The current system of social protection is well-targeted and ensures access to heat and hot tap water for the low-income households. The tariff remain affordable for the majority of the people, even if the prices sharply go up.
- Introduction of the energy efficiency measures which help to save energy resources and decrease service consumption.
- Jointly with local self-governance bodies and private CHP owners, KHN works on efficient heat energy generation broadly combining natural gas with nontraditional energy sources and cogeneration options, as well as on transportation of the produced heat with minimal possible losses.
- The owner organizations set up in all multi-flat buildings act as the sole heat service customers and ensure proper maintenance of the residential property, in-door heat supply systems, and implementation of energy efficiency measures on residential buildings.

In order to achieve this vision the KCEC will do whatever it can to:

- encourage end-users to change behavior and invest in energy conservation;

|                               |   |
|-------------------------------|---|
|                               | <ul style="list-style-type: none"> <li>○ encourage the KHN to improve technical and financial efficiency in production and distribution of heat and hot tap water;</li> <li>○ make a coordinated and planned effort on reducing specific end-use consumption, securing social justice and improving DH performance.</li> </ul>  |
| Strategic goals               | <p>The strategic goals are the following:</p> <ul style="list-style-type: none"> <li>○ Owner's organizations - or condominium associations (CAs) - established in all multi-flat buildings by 2013.</li> <li>○ All buildings equipped with heating and hot water meters by 2012.</li> <li>○ By 2013, all apartments are equipped with HTW meters.</li> <li>○ All apartments equipped with heating meters by 2018. New buildings are equipped with individual heat meters, whereas existing buildings are equipped with radiator heat distributors.</li> <li>○ By 2018, all apartments are equipped with heating regulators.</li> <li>○ Consumption based billing introduced throughout the housing sector by 2018.</li> <li>○ Energy consumption for heating purposes in residential buildings will go down to 0.080 Gcal/m<sup>2</sup> by 2018 (39 % reduction)</li> <li>○ Average hot water consumption per household will go down to 4.6 m<sup>3</sup>/month by 2018 (45 % reduction)</li> </ul> |
| Areas and actions             | <p>In order to implement the strategy and achieve the vision, an action plan containing a variety of actions within 5 areas has been prepared (see Chapter 4).</p> <p>The action plan has been prepared on the basis of a few guiding principles.</p> <ul style="list-style-type: none"> <li>○ Address challenges by various means.</li> <li>○ Focus on demand side efficiency measures.</li> <li>○ Priority to least-cost investments.</li> </ul>  |
| Linking with other strategies | <p>Furthermore, the strategy will be implemented on the basis of and in accordance with the following acts, strategies and programs:</p> <ul style="list-style-type: none"> <li>○ European Energy Charter signed in Hague on 17 December 1991.</li> <li>○ Law of Ukraine on Energy Saving.</li> <li>○ Energy Strategy of Ukraine for the Period Until 2030 approved by Cabinet of Ministers Resolution No. 145-p of 15 March 2006.</li> <li>○ Ukrainian Energy Strategy Road Map for 2006-2010 approved by the Cabinet of Ministers Resolution No. 436-p of 27 July 2006.</li> </ul>  |

- Program for the Development and Reform of the Municipal and Housing Economy of Kharkiv till 2010.
- EC Directive 2006/32 on energy end-use efficiency and energy services and repealing Council Directive 93/76/EEC.
- EC Directive 2002/91 on energy performance of buildings.

## 4 Areas and Actions

5 areas

The strategy focuses on 5 areas with accompanying actions in each area. Chart 5.1 provides an overview of the 5 areas and the actions within each of these.

*Chart 4.1 5 areas*

| Areas  | Actions  |
|--|--|
| 1. Institutional and Organizational Measures | 1.1 Establishment of Owners Organization<br>1.2 Support to Owners Organization<br>1.3 Development of Housing Maintenance Market<br>1.4 Consumption Based Billing         |
| 2. Investments                               | 2.1 Heat Production, Transportation and Distribution<br>2.2 Heat Consumption   |
| 3. Funding for Investment Program            | 3.1 KNH Tariffs<br>3.2 Maintenance Tariffs<br>3.3 Funding from Local and State Budgets<br>3.4 Credit Financing<br>3.5 Public Private Partnership<br>3.6 Carbon Financing |
| 4. Social Protection Measures                | 4.1 Municipal Privileges to Cover Heating Costs<br>4.2 Support to Investment Costs   |
| 5. Public Awareness Campaigns                | 5.1 Public Education Program on Energy Conservation  |

The 5 areas and the accompanying actions are dealt with in this chapter.

Implementation mechanism

In accordance with Ukrainian legislation, all of the actions will be implemented through a scheme and two city programs that are to be developed and approved.

These are the following

- **Kharkiv Heating Supply Scheme** (as per Article 6 of the Law of Ukraine on Heating Supply).

This documents aims to ground the economic advisability and necessity

to design and build new heating sources and networks and to extend the existing ones.

KHN will use this scheme to reconstruct the city heating supply system, in particular:

- to decrease the capacity of the heating sources per capita;
  - to cut down the length of the heating networks per capita;
  - to replace the heating networks, requiring urgent replacement, by pipes with polyurethane foam insulation or other insulation materials with a similar effect;
  - to reconstruct central heating substations for the distribution of heat for heating and HTW directly in the buildings into IHS with weather regulation of heat consumption;
  - to remove or replace boiler houses;
  - to develop small capacity cogeneration to the extent that it is not too expensive.
- **Affordable Heating Program** for Kharkiv for 2009-2018.

In order to ensure affordability of the heat supply for the population, this city program will include the following aspects:

- energy saving in multi-apartment buildings, including conduction of regularly energy audits;
  - energy saving on the stage of production and transportation of heat energy, including of using of alternative sources of energy;
  - implementation of consumption based billing;
  - energy consumption management;
  - public awareness campaign.
- **The Programme to Support Safe Life Activity in the Area of Social Security** of the Citizens of Kharkiv for 2007-2010 (to be revised and approved for the period until 2018).

In this connection the City Social Security Program will be improved. In particular the following improvements will be made herein:

- replacement of the existing mechanism set for the tariff difference compensation from the local budget by a 30-40-% privileges for the service payment;
- payment of target subsidies to low-income households for the implementation of energy saving measures.

The KCEC will have to take the lead in ensuring that the abovementioned scheme and two city programs are properly improved and implemented.

#### Estimated costs

The estimated total costs of implementing this strategy is about USD 2,130 mln (calculated as of September 2008), including USD 2,110 mln for implementation of the investment program and further USD 17.7-26.7 mln for other strategic actions - specifically:

- USD 0.3 mln for the development of the City Heating Supply Scheme;
- USD 0.05 mln for Affordable Heating Programme development;
- USD 0.02 mln for improvement of “City Programme to Support Safe Activities in the Area of Social Security of Citizens of Kharkiv for 2007-2010”;
- USD 1,200.0 mln for funding of measures aiming to decrease heat consumption in multi-apartment buildings;
- USD 909.8 mln for implementing measures aiming to decrease the energy consumption at the stages of heat production, transportation and distribution;
- USD 17.7-26.7 mln for implementing the municipal privileges for low-income households;
- USD 0.15 mln for implementing a public awareness campaign among residents of the city on possible energy efficiency measures in housing.

### 4.1 Institutional and Organizational Measures

#### Objective

The objective of this area is to ensure the establishment of a reliable institutional and organizational mechanism for providing the citizens of the city with high quality services with regard to DH and HTW.

#### Actions

In order to improve provision of DH services from the institutional and organizational point of view there is a need to form “an organized owner” in multi-apartment buildings. Such institutional form is a CA. Only CAs are authorized to manage the common property in multi-flat apartments and to make decisions on implementation of energy-saving measures.

Establishing of “the organized owner” in the city requires the following:

1. Availability of support of the local self government body to the co-owners at the stage of CAs establishment.

2. Availability of support of the local self government body to the CAs in implementing energy saving measures in multi-flat buildings.
3. Demonopolisation of the offer on the housing maintenance market and development of professional housing management services market;

In addition, to improve the affordability of heating supply services there is need to develop and implement a system of consumption based billing at the level of the city.

#### **4.1.1 Establishment of owners organizations**

Two tasks

To support owners of multi-flat buildings in the establishment of CAs, the municipality shall establish the following:

- special municipality office (CA Support Department);
- special Steering Committee under the municipality to deal with the issues related to the establishment and functioning of CA organizations.

CA Support Department

The CA Support Department should, among others, be in charge of the following:

- providing methodological and legal support to the set up of owner organizations (including provision of document forms and consultations);
- organizing an information campaign;
- coordinating activities of other local authorities related to the setup and functioning of owner organizations;
- supporting owner organizations in preparing ownership titles and user rights to the territories adjacent to the building in accordance with the land legislation, as well as in acquiring or restoring the technical documentation for the building etc.

The information campaign will be aiming at:

- explaining the residents of multi-flat buildings their owner rights and responsibilities related to the maintenance of their building and the adjacent territory, including the in-door water and heat supply networks etc;
- describing the mechanism and possibilities for the residents to make decisions on the management of their shared property and utility services; and
- providing solid information about the powers and responsibilities of owners organizations.

**Steering Committee** The Steering Committee should include representatives of the local municipality, public authorities participating in the registration and support of the co-owner organizations, representatives of the residents of the multi-flat buildings and already set up co-owner organizations and utilities.

The Steering Committee should ensure that difficulties in establishing and operating co-owner organizations are overcome - and also that critical issues between co-owner organizations, utilities, building operation companies, local public executive authorities and municipality bodies are properly dealt with.

#### **4.1.2 Support to owners organizations**

**Organizational and financial support**

The local self government body will provide organizational and financial support to the CAs in carrying out the energy saving measures in multi-flat buildings within the responsibilities defined by the Law of Ukraine on Condominium Associations.

The developers of the Affordable Heating City Program for Kharkiv should take the following issues into account:

- In order to ensure funding of the program by the city there is a need for establishing of a local development fund for mid-term sub lending to the condominium associations)/and/or subsidizing of lending for energy efficiency measures.
- City budget funds should be provided only to the buildings which have established CAs on the condition that co-owners commit themselves to co-finance the energy efficiency measures.
- The city program should allow for partial refunding by the city of the contributions of low-income apartment owners' for implementation of the energy efficiency measures.

#### **4.1.3 Development of housing maintenance market**

**Support**

To ensure professional maintenance of multi-flat buildings run by their owner organizations, the local authorities will be supporting the following:

- Registration of professional managers in a specially designed database, that should be public available.
- Creation of the database of professional management companies that provide services regarding the maintenance and management of the multi-flat residential sector in the city.
- Notification of owner organizations about management companies that express their interest in providing maintenance and management services to the multi-flat buildings in the city.
- Training/courses housing maintenance market specialists.



## De-monopolization

It may be considered to promote the entry of private service providers through the following:

- ZhKS restructuring. It entails the transfer of building operation committees into independent legal entities and further privatization of all or some of them.
- Change of ZhKS functions. The ZhKS could become an agency in charge of promoting the development of a housing maintenance market - mainly, by ensuring that administrative barriers for start-up of private business in the sector are kept to a minimum.

*Box 4-1 Economic regulation of DH suppliers*

**Economic Regulation of DH suppliers**

Supply of district heating is considered a natural monopoly. It is well-known that monopolies require regulation with the aim to avoid abuse of the monopolistic position. It is generally acknowledged that 'state of the art' economic regulation must have focus on ensuring efficiency in operations.

The generic models for economic regulation of DH utilities, privately or publicly owned, are:

- **Cost plus** regulation allows the DH utility to add a fixed amount, determined by the regulator, on top of the cost (operational costs and depreciations) and accumulate this income. Cost plus can be combined with efficiency targets, where the 'plus' is reduced over time by an efficiency factor, the so-called X.
- **Rate of Return (RoR)** regulation allows the DH utility add a return, fixed by the regulator, on the equity capital and accumulate the return. RoR can be combined with requirements to improve the efficiency in production by reducing the RoR by the efficiency factor X over time.
- **Price-cap**, the regulator determines a cap for the price(s) the DH utility legally can charge. The DH utility can accumulate the difference between the cap and the costs. DH utility can charge below the cap. The price cap can be combined with a target for improved efficiency of X over time.
- **Revenue-cap**, the regulator determines the allowed revenue of the DH utility. The difference between the cap and the cost can be accumulated in the DH utility. Revenue caps can be combined with efficiency gains, determined by the regulator.
- **Non-regulated prices**, no regulation of prices or revenues. The DH utilities are only subject competition acts and operational efficiency is based on the competition from other heating sources.

The typical methodology for determining efficiency improvements goals is a benchmarking process. **Benchmarking** is comparative competition in that the DH utility's performance is compared to other companies' performance and

efficiency gains are assessed based on the operator's relative performance. The most efficient operators would be rewarded with extra profits and the least efficient operators would be penalized. Because the operators are actually in different markets, it is important to make sure that the operators' situations are similar so that the comparison is valid. The typical techniques to define the goals are:

- **Best Practise**, based on expert information examples of best practise nationally and internationally. The efficiency goals are determined by comparison with best practise.
- **Yardstick**, based on comprehensive collection of financial data from DH utilities. The regulator calculates benchmarks, for instance based on average costs. Efficiency improvements goals are determined based on the relative position to the benchmark.
- **Long Run Average Incremental Cost** is an artificial benchmark - 'the optimal utility' - defined in technical and financial terms in cooperation between the DH industry and the regulator. Based on this optimal benchmark the efficiency goals for the DH utilities are defined.

#### 4.1.4 Consumption based billing

Two preconditions

Introduction of consumption based billing ensuring that payments depend on the volumes of heat and hot tap water actually consumed will provide end-consumers with an economic incentive to save energy and conduct energy saving measures. The following two preconditions have to be properly met:

- Technical precondition. That is, a 100-% coverage of the population by devices for heat metering in both buildings and apartments and regulation (see also Section 4.2.2).
- Legal precondition. That is, development and adoption of the necessary legal documents at national and local levels allowing implementing and using consumption based billing.

Three tasks

In order to meet these preconditions the following tasks should be carried out:

- The municipality shall pass a decision on mandatory installation of building heat meters in multi-flat buildings. Billing for such buildings should be based on the meter readings.
- The municipality should organize the process of the gradual equipment of apartments with heat meters and regulators, starting with new buildings.
- The municipality should adopt a set of rules defining the mechanisms for the settlement of accounts for the services provided to the users

equipped with heat meters in both buildings and apartments and regulators.

*Box 4-2 What is consumption based billing?*

Consumption based billing requires heat metering at the apartment level. The rationale for consumption based billing is that the household pays for heat according to the measured consumption, and that the household can control its costs through use thermostatic valves, changes in building and changes in behaviour. Experience shows that consumption-based billing supports energy efficiency. See also Box 4-4.

Consumption based billing requires heat metering and can be established in different ways:

- **Building Level Heat Meter.** The heat consumption of an entire building is metered with a heat meter, which is installed at the heat entrance point. The entire building is billed according to the metered heat consumption, which is then allocated to individual apartments through the following methods.
- **Heat Cost Allocator.** Heat metering takes place at the building level. The heat emissions of each individual heat radiator in an apartment are “measured” with evaporative or electronic devices. The total cost of the heat consumption of the building (including the billing costs) is allocated to the individual apartments primarily based on the readings of the allocators.
- **Apartment Level Heat Meter.** The heat consumption of each apartment is measured with a heat meter, which is the most accurate measurement. The apartment-level heat meter can also serve to allocate heat expenses to an individual apartment, but more often it is used for direct billing on a kWh basis.
- **Hot Water Flow Meter.** The amount of hot water circulating through the radiators of individual apartments is measured. This measurement serves as the basis for distributing the building heating costs to the individual apartments.

## 4.2 Investments

Objective

The objective of this area is to achieve the highest efficiency of production, transportation, and distribution of heat energy and hot water, as well as to improve considerably the indicators of energy efficiency in the course of DH and HTW service consumption.

Two actions

The investment program consists of two actions:

- Investment projects in the area of heat production, transportation, and distribution aiming to optimize the production capacities with due consideration of the changed heat consumption by private consumers.
- Investment projects in housing sector (including those defined in Section 4.1).

*Box 4-3 Heat cost allocators*

The use of heat allocators is a simple and recognised method for distribution of cost for energy consumption between apartments in a building. Based on the indication (reading) of the heat allocators, an individual payment can be carried out. The heat cost allocator requires a heat metering at the building level.

There are two types of heat allocators, the evaporation type allocator and the electronic allocator. The evaporation allocator is used in buildings with small radiators and can only be recommended for annual readings due low accuracy.

After installation of the heat allocators, an independent body should read the heat consumption/change the allocator tubes on an annual basis. The company is normally also the responsible the operations: preparation of bills and maintenance. In some cases the district heating utility has trained people for this purpose.

An *evaporative* heat cost allocator consists of a heat conductive body, firmly installed on the radiator, a glass ampoule with evaporative liquid, and a measurement scale which is fixed to the body. Typically once a year, the heat cost allocator has to be “read” and the ampoule replaced. The heat energy emitted from the radiator is proportional to the amount of liquid evaporated from the ampoule.

An *electronic* heat cost allocator consists instead of the ampoule of a battery-powered calculator, which receives signals from temperature sensors. Compared with the evaporative type the electronic heat cost allocators do not register consumption from unused radiators (stand-by evaporation) and store consumption data. The investment cost is however a multiple of the cost of evaporators.

Just like heat energy meters, electronic heat cost allocators can be adapted for remote reading, thus eliminating the need to enter individual apartments for meter reading.

Electronic allocators cost about 10 times the cost for evaporative allocators, but it required no maintenance like the evaporation allocators, which require new evaporation tubes once a year. An electronic meter can work in 10 years without any maintenance.

It should be pointed out that heat allocators are not energy meters but meters transforming the temperature of the radiator to a registration on the heat allocator.

The investment program lists the investment projects that need to be implemented in the next ten years.

The list of recommended investment projects will be specified on the basis of the Heating Supply Scheme to be developed in accordance with this strategy.

#### Estimated costs

The total cost of the investment program to improve efficiency of the use of energy resources in Kharkiv City amounts to about USD 2.1 bln, including USD 0.9 bln of investments needed in the area of heat production, transportation and distribution.

All costs are calculated as of September 2008.

#### Internal Rate of Return

The results of the Internal Rate of Return (IRR) and Net Present value (NPV) calculations made are attached as Annex II. This annex provides information about the assumptions made.

#### *Box 4-4 Energy savings and heat metering*

Investigations have been carried out in several European countries to determine the energy savings that can be achieved due to individual heat metering. Typically, the savings are determined by comparing the consumption of several buildings with individual heat metering with the consumption of similar buildings without individual heat metering.

Energy savings due to heat metering and control have been relatively well documented in Western Europe. They range between 7 and 30%. Thus, the energy savings required to pay back for the cost of metering seem definitely achievable with the simplest heat cost allocators, and in many circumstances also with the other individual heat metering options.

Heat energy savings of about 13-15 % were confirmed by German investigations. Danish studies showed heat energy savings of 11-34 %. On average, energy savings of about 20 % can be expected. A demonstration project in Finland led to savings of only 8 %.

In a large housing development in Poland, heat consumption went down by about 50% between 1996 and 2000. It was however not determined in which extent the heat metering and to which extent the energy savings are caused by thermal insulation.

*Source: World Bank, 2005, pp. 16-18.*

### **4.2.1 Heat Production, transportation and distribution**

#### Three types

It is assumed that investment projects in the area of heat production, transportation and distribution will be aiming at decrease of consumption of energy resources and improvement of the quality of service through:

- 1) upgrade of existing boiler houses and CHP;

|  |  |
|--|--|
| Upgrade of existing boiler houses  | <p>2) implementation of the technology for combined production of heat and power (co-generation facilities);</p> <p>3) upgrade of heat transportation and distribution system.</p>   |
|  | <p>The aim is to eliminate the 26 dilapidated and low-profit boiler houses. It has the potential to save annually 2,900 tce and 850,000 kWh of electricity. Elimination of boiler houses will require about USD 3.7 mln.</p>   |
|  | <p>In addition, it is recommended to reconstruct 30 boiler houses with outdated and depreciated boilers and build 13 km of heating networks to switch the existing heat energy consumers to other sources. Implementation of this project will make it possible to additionally save 3,300 tce and 981,000 kWh of electricity per year. Reconstruction of 30 boiler houses requires approximately USD 6.3 mln.</p> |
| <p>Total costs of the upgrade measures amount to USD 10.0 mln with potential savings of 6,200 tce and 1.8 mln kWh per year.</p>  | Co-generation facilities   |
| <p>The investment program envisages construction of co-generation facilities on three district boiler houses (BH; BH No 4, BH No 5 and BH No 6). Construction of the above facilities will result in the increased consumption of fuel (4,000 tce per year more), but will at the same time help to save USD 1.7 mln per year used to pay for the electricity. The three cogeneration modules are expected to generate 27,625,000 kWh. The tentative cost of works is USD 3.7.</p> |  |
| <p>It is also recommended to construct a co-generation utility on CHP-4. This work is estimated in USD 356.5 mln. The preliminary calculations evidence that the annual consumption of fuel may grow by 279,500 tce with the expected decrease of electricity expenditures may make up USD 119.4 mln per year.</p>   |  |
| <p>The estimated cost of co-generation facilities construction works on all four district boiler houses is USD 360.2 mln. Additional volumes of electricity generation may be reach about 2 bln kWh per year. The excessive electricity may be sold to the grid.</p>   | Upgrade of heat transportation and distribution  |
| <p>In order to upgrade the heat energy transportation and distribution system, it is recommended to replace heating network pipelines by the pre-insulated pipes and automate the heat energy distribution processes.</p>  |  |
| <p>In particular, it is recommended to fully replace the dilapidated networks (running 514 km). Thus, the plan is to replace 131 km of the <b>transmission networks</b>, 260 km of <b>distribution networks</b>, and 123 km of HTW supply networks. This has the potential to annually save 11,700 tce and 468,500 kWh of electricity. The estimated cost of the above works is USD 529.3 mln.</p>   |  |
| <p>The investment program also envisages installation of rotation frequency transformers on 30% of the pumping equipment to regulate supply of cold and hot water to Central Heating Substation and Heat distribution Substations, as well as to ensure quantity-and-quality mode of heat energy distribution. This will provide a possibility for the thriftier use of electricity and will improve the</p>   |  |

quality of HTW supply. Implementation of this measure may help to annually save about 6 mln kWh of electricity. The estimated cost of works is USD 10.2 mln.

The total cost of the transportation and distribution upgrade works can make up USD 539.6 mln with the potential saving of 11,700 tce 6,468,500 kWh of electricity.

#### 4.2.2 Heat consumption

Three types

Investment projects in the area of heat consumption are intended at reduction of the heat energy consumed for the heating of residential buildings and reduction of the HTW consumed by the population through:

- 1) upgrade of the DH systems in residential buildings;
- 2) introduction of individual metering and consumption regulation;
- 3) improvement of heat features of the construction envelopes.

The total cost of the investment programme recommended for the residential buildings in Kharkiv is about USD 1.2 bln.

All of the investment in the residential buildings will highly depend on the availability of the CAs in the city, which will ensure legal approval of these measures in the buildings (see Section 4.1).

Upgrade of DH Systems

The measures listed below are necessary to improve the efficiency of heat use and the quality of DH and HTW supply services in the multi-storey buildings:

- upgrade/installation of individual heating points (IHPs);
- restoration of the heating insulation of internal building networks;
- restoration of the HTW recirculation system<sup>1</sup>.

The investment program envisages: (1) the upgrade/installation of IHPs in 563 buildings of Kharkiv (with 9 and more floors) which make up about 12% of the total number of residential buildings; (2) restoration of 400 km of internal buildings networks; and (3) restoration of the HTW recirculation system (268.8 km).

---

<sup>1</sup> Proper provision of HTW services, improvement of their quality, and decrease of losses can also, as an alternative (as recommended by the Energy Inspection of the city of Kharkiv), be ensured through replacement of the district water supply by installation of electric water heaters in apartments for preparation of hot water. In this case, however, the condition of electric networks should be additionally checked in terms of their ability to sustain higher load which will appear due to massive installation of electric water heaters in apartments. It is also advisable to study the economic appropriateness of such technical changes.

Implementation of the above upgrade measures will make it possible to annually save 23,600 tce (or 2.2% of total tce consumed in 2007) and 3.4 mln kWh of electricity (or 2.1% of total electricity consumed in 2007).

The estimated cost of such works is about USD 58.0 mln with the potential annual saving of heat energy in the amount of 148,200 Gcal (equivalent to USD 36.9 mln per year).

#### Individual metering and consumption regulation

The technical preconditions for the implementation of the consumption based billing (see Section 4.1) can be ensured through implementation of a number of measures. Most important are the following:

- installation of building heat meters (80% of existing buildings);
- installation of heat distributors and thermostatic regulators (on each radiator in all apartments);
- installation of flat HTW meters.

It is assumed that the devices necessary for the consumption based billing will be installed step-by-step:

- first, installation of building meters (by 2012);
- then, installation of apartment meters and regulators (by 2018).

Implementation of these measures will help to save 143,200 of tce (or 13.6% of total tce consumed in 2007) and 20.5 mln kWh of electricity (or 13.0% of total electricity consumed in 2007).

The estimated expenses for the above works make up about USD 132.1 mln with the potential to save annually energy heat in the amount of 900,100 Gcal (equivalent to USD 208.7mln per year).

#### Improvement of heat features

It is expected that heating insulation will help to bring down the indicator of the specific consumption of heat energy for heating to 0.08-0.10 Gcal/m<sup>2</sup> per year. The annual saving of resources may make up 142,800 of tce (or 13.6% of total tce consumed in 2007) and 20.5 mln kWh of electricity (or 13.0% of total electricity consumed in 2007).

The estimated cost of works is about USD 1.0 bln. The total annual saving of energy heat could reach 897,000 Gcal (equivalent to USD 203.6 mln per year).



**Box 4-5**      *Apartment heat meters*

A *heat energy meter* consists of a water flow meter, temperature sensors sensing the temperatures of supply and return water, and an energy calculator. The heat meter has to be inserted into the heating pipe. The flow meters used today are mostly magnetic or ultrasonic. The heat energy meter works physically exact.

The apartment-level heat meter can serve to allocate heat expenses to an individual apartment, but more often it is used for direct billing based on the heat supply contract.

Apartment-level heat meters exhibit higher quality and accuracy compared to heat cost allocators. Investment costs are higher than heat cost allocators, but with decreasing prices, heat meters are now becoming more popular. Most of them can be remotely read and operating expenses are lower.

Modern heat meters display a variety of information, for example kWhs, instant heating capacities, temperatures of heating water, the consumption data for the previous periods and many other features, which make both housing management companies and residents more aware about energy consumption behaviour.

Individual apartment heat meters are mostly used for direct billing of the household. A building meter is not always considered necessary. This depends of the contractual obligations and how energy use in common spaces are allocated.

### 4.3 Funding of Investment Program

#### Objective

The objective of this area is to ensure reliable funding for the investment program - in particular, for:

- the energy saving projects at the stage of heat generation and transportation;
- the energy saving projects in the multi-flat residential sector of Kharkiv.

#### Actions

The actions to be carried out are the following:

- Improvement of KNH heat supply service tariff setting.
- Improvement of tariff setting for maintenance of buildings and adjacent territories service.
- Attraction of funds from the local and state budgets.
- Increased credit financing of capital investments.

- Utilizing carbon finance mechanism through JI and GIS mechanisms.

#### Funding packages

Funding packages of the investments to decrease the energy consumption at the stages of heat production, transportation and distribution, amounting to USD 910.0 mln and also of the investments to decrease heat consumption in multi-apartment buildings, amounting to USD1,200.0 mln, have been prepared (see also Section 4.2). They are presented in Table 4-1 and Table 4-2, respectively.

The funding packages are based upon the forecast made regarding tariffs for 2009-2018 (see Section 4.3.1 below for information about assumptions made).

*Table 4-1 Heat production, transportation and distribution, funding package*

| Source   | Total, mln USD | % of total need |
|--|----------------|-----------------|
| KHN, total - of which:   | 432.0          | 47%             |
| - through profit   | 412.0          | 44%             |
| - through depreciation deductions  | 20.0           | 2%              |
| Other sources (IFI loans, commercial loans, soft loans through state budget, etc.) | 478.0          | 53%             |
| Grand total  | 910.0          | 100%            |

As investment projects in the residential sector will improve the property of the actual owners of multi-flat apartments, such projects should be co-funded by residents, as well as the previous owners of the multi-flat residential facilities - the territorial community. Hence, it is assumed, as can be seen from Table 4-2, residents will co-fund a number of projects to decrease energy consumption in the residential buildings. It follows from Table 4-2 that residents will fund projects for a total accumulated amount of USD 495.0 mln (in all, about USD 1,358.0 per household in the period till 2018); part of this will be loan financed.

*Table 4-2 Heat consumption in multi-apartment buildings, funding package*

| Source   | Total, mln USD | % of total need |
|--|----------------|-----------------|
| Local budget/or Municipal borrowing - of which:                            | 704.4          | 59%             |
| - targeted support to low income households for energy efficiency measures | 42.2           | 3.5%            |
| Residents' funds, including commercial loans                               | 496.0          | 41%             |
| Grand total  | 1,200.0.6      | 100%            |

#### 4.3.1 KNH tariffs

Two-tier tariff to be improved

Current price setting regulation principles are building a good ground for effective price setting practices. The regulation enforces two-tier tariff system that proves to be an effective tool for achieving financial targets by the KHN.

However, current legislation does not provide straightforward rules for automatic tariff adjustment for inflation and, therefore, has to be introduced.

To improve tariff setting practices in the Kharkiv City the following measures are proposed:

- Tariffs for heat energy and KHN services should be reviewed annually. Annex III to this strategy provides a forecast of the DH and HTWS tariffs for the population in the period 2009-2018.
- Tariffs should be adjusted (i.e. indexed) on a monthly basis in order to take properly account of inflation of the main components of the tariff. Such adjustment should be done on the basis of the formula mentioned in the current Tariff Formation Regulation (CMU Decree No. 955 of 10.07.2006).
- The standards set for the consumption of heat energy for heating and HTW should be revised so that may be used when planning service volumes. Implementing investment projects in the residential sector, KHN will have to face the problem of reduced sale of heat energy. In particular, it is estimated that heat energy consumption per 1 m<sup>2</sup> may go down to 0.08-0.1 Gcal/m<sup>2</sup> (the current tariffs are based on the standard of 0.154 Gcal/m<sup>2</sup>), whereas HTW consumption may decrease to 2.0 m<sup>3</sup>/person/month (3.0 m<sup>3</sup>/person/month today).
- The tariffs for hot water have to be recalculated to include the cost of cold water as defined by current legislation
- The pricing system should be improved through introduction of the two-rate heating tariffs not only for private consumers, but also for other consumer groups.

*Box 4-6 Experience of two-tier tariffs in Ukraine*

In October 2007, the current DH and HTW Tariff Formation Regulation established that heating supply companies should use two-tier tariffs for heat energy and heating services, and may also set two-tier tariffs for hot tap water.

In Ukraine, two-tier tariffs for heat energy and heating services have been applied since 2001 in Ternopil, Ivano-Frankivsk, Bila Tserkva and a number of other towns. Recently, such tariffs have also been introduced in Vinnytsa, Chenivtsy, Odessa, Cherkasy, Kovel, Brovary, Boryspil, Korosten, Berdyansk, Lozova, Izyum, Uman, and some other localities.

The positive practice of enacting two-tier tariffs by enterprises in Ukraine shows that a company, calculating its customers' fee on the basis of two-tier tariffs, is able to fully recover its costs, independently of whether an annual sales plan is fulfilled or not.

In Kharkiv City, two-tier tariffs for heating were introduced at the beginning of the 2006-2007 heating season. For certain users, however, application of such tariffs is not fair because two-tier tariffs are only charged to customers who have no meters of service. As a result, the utility gets fully reimbursed only for the part of fixed costs related to the users paying on the basis of two-tier tariffs.

## Tariffs 2009-2018

The tariffs for 2009-2018 have been calculated on the basis of the following key assumptions:

- The sale volumes of heat energy and services remain at the level estimated for the 2006-2007 heating season. The decrease of the sale volumes of services provided to private consumers, which may be achieved through investment measures in the residential sector of Kharkiv, has not been taken into account for the purpose of tariff calculation, since current Price Setting Order does not allow planning of heat sales based on the actual consumption but requires utilities to plan sales of heat energy based on calculations, which have to be made based on norms.
- Expenses for the production and sale of services are rising due to the increase of prices for energy resources (natural gas and purchased electricity), as well as due to the increase of labour remuneration expenditures and other cost items<sup>2</sup>.
- Under the optimistic scenario, the natural gas prices will grow up to USD 206/1000 m<sup>3</sup>, VAT incl, in 2009, and will make up USD 493/1000 m<sup>3</sup>, VAT incl, in 2018. Since December 1, 2008 the price for

<sup>2</sup> The energy resource prices and inflation rates have been forecasted on the basis of Consensus Forecast "Ukraine: Development Prospects (quarterly publication of the Ministry of Economy of Ukraine), 1Q08 issue (the Consensus Forecast)".

gas for residents was USD 179.5/1000 m<sup>3</sup> with VAT and transportation cost (as defined by the CMU Decree #346 of 09.04.2008).

- Under the pessimistic scenario, the natural gas prices will grow up to USD 278/1000 m<sup>3</sup>, VAT incl, in 2009, and will make up USD 813/1000 m<sup>3</sup>, VAT incl, in 2018.
- The electricity tariff will increase 2.6-fold between 2009 and 2018, and will make up USD 0.1/kWh in 2009 and USD 0.23/kWh in 2018.
- Labour remuneration expenses will grow 4.5-fold between 2009 and 2018 due to the forecast increase of the minimal salary at the rate of from 27% to 14% annually.
- Forecast tariffs include profits. Profits make up 12% of the estimated amount of expenditures. This estimate is based on the maximum allowable profit as it is specified by the current Tariff Formation Regulation, including the 9% profits in the tariffs for residential consumers.
- Forecast tariffs take into account the saving of energy resources (natural gas and electricity) due to the introduction of investment projects in the area of heat energy production and transportation. In particular, it is expected that upon their complete implementation by the end of 2018:
  - the specific consumption of tce will make up 156.6 kg of tce/Gcal and will go down by 3% against the 2008 estimate (161.4 kg of tce/Gcal) or by 1.6% against the actual 2007 consumption (159.2 kg of tce/Gcal); and
  - the specific consumption of electricity will make up 23.6 kWh/Gcal and will decrease by 8.6% against the 2008 estimate (25.8 kWh/Gcal) or by 3.5% against the actual 2007 consumption (22,8 kWh/Gcal).

The operational indicators for the electricity saving and increase of consumption of tce due to the construction and commissioning of the co-generation facility on CHP-4 are not taken into account in the tariff calculation. It is envisaged that KHN will be selling the major part of the electricity produced by the CHP-4 co-generation facility.

#### **4.3.2 Maintenance tariffs**

Three measures

In order to improve tariff setting for maintenance of buildings and adjacent territories services the following measures will be taken:

- Annual revision of ZhKS tariffs for achieving cost recovery of maintenance and repair of the internal building heating and HTW networks works (either by tariff review or by applying indexing formula that is not yet envisaged by legislation).

- Revising the list of services in order to include maintenance of apartment meters into the list of services.
- Transfer to non regulated (contract based) prices for the provision of services on housing maintenance (after measures on de-monopolization of supply on the housing maintenance market are made).

*Box 4-7 National Energy Savings Program - Hungary*

In 1999 Hungary initiated the Energy Saving and Efficiency Program (the Energy-Saving-Program), which provides soft loan and direct subsidies. The program offered a 30% non-refundable grant for energy investments in households with a roof of 300.000 HUF in case of single measures and 600.000 HUF in case of complex renovations.

The grant was given for renovations including insulation of walls, doors, windows, roofs, or their complete change, or improving performance or exchange of space or water heating appliances and systems. Due to the high level of interest, the financial resources ran out after a week from the announcement, and 2969 applications were granted.

The program was modified in 2007, and it was prioritized on complex investments, offering a 15% non-refundable grant that could be supplemented with preferential loan. 3437 grants were distributed throughout the year, in a value of 757 mln HUF grant and 2100.8 mln HUF loan.

Since 2008 NEP includes exchange of old non-efficient appliances to efficient domestic electrical appliances.

### **4.3.3 Funding from local and state budgets**

#### Municipal support

Municipal financial support of the energy saving measures will include:

- Targeted (one-time) subsidies to low income households for energy efficiency measures implementation in the buildings (see Section 4.4.2).
- Targeted subsidies to low income households for housing and communal services, including district heating and hot water supply.
- Partial compensation of loans (principal or interest) attracted by the Condominium Associations for energy saving measures implementations (see Section 4.1.2).

#### State support

State funding may be raised for the implementation of the investment measures within the framework of the State Program “On Reforming Housing and Communal Economy for 2004-2010”, the amount of which depends upon annual

budgetary allocations. The state support may be used for different purposes, including softening of loans obtained by KHN for a transition period<sup>3</sup>.

#### EE Fund or ESCO

It is suggested to channel budget support into a financial mechanism supporting energy efficiency improvements in the apartment buildings stock. The financial mechanism could be an Energy Efficiency Fund (EE Fund) or an Energy Service Company (ESCO).

The EE Fund should operate on commercial basis, and provide preferential loans to energy efficiency measures at the buildings and the apartment level. The financing of the fund should be provided by the DH utility, the municipalities and International Financial Institutions.

ESCO's are special energy service companies. The business idea is to invest in energy conservation at the clients premises. The client is expected to back investments to the ESCO based on the obtained savings in energy costs. The ESCO will be responsible for performance contracting on energy saving in the private sector and/or within municipality owned buildings. For the start-up of the ESCO business, IFI's can assist in organising training and consulting services as well as financing the operation costs of the early years of ESCO.

#### 4.3.4 Credit financing

#### Loans

The KHN and municipality will consider the possibility of attracting loans from IFIs such as the EBRD, EIB and World Bank to finance or co-finance parts of the investment program. For this purpose the KHN and municipality will enter into a dialogue with selected IFIs to get information about eligibility rules, region and sector priorities, types of financial instruments offered, terms of lending, project submission procedures and procurement rules of these.

In order to provide a possible lender with convincing evidence that projects are financially viable stand alone projects - that is, projects are capable of generating sufficient cash flow to repay the loan fully and on time - and that they enjoy the support of a financially sound administration, prepared to provide a sovereign or sub-sovereign guarantee, the KHN and municipality are ready to share accounts, business plans, project cash flow calculations and others with a selected IFI if it is decided to opt for a loan from this. Certainly, the solvency of both the KHN and municipality will have to be assessed in such a situation.

#### Grants

Grant money (or grants) received from multilateral and bilateral donors may be used for several purposes in regard to the financing of the investment program. In general, grants may be used to finance:

- supportive measures linked with financially viable KHN projects (business plan preparation, cash flow analyses, skills development, etc.);

<sup>3</sup> Please note that the World Bank does not support non-targeted subsidies such as softening of loans to make district heating cheaper for all customers, not just low-income households.

- investment projects in housing sector under the condition that O&M costs are properly covered by tariffs for maintenance of housing.

#### Matchmaking

The KHN and municipality will try their very best to attract grants for the abovementioned measures and projects - with a view to the possibility of matchmaking with possible loans.

### 4.3.5 Public Private Partnerships

#### Important mechanism

The KCEC considers Public-Private Partnership (PPP) an important possible mechanism suitable for the DH (district heating) sector in Kharkiv City. Thus, it will seriously consider the possibility of launching PPPs within the sector with the aim of improving service levels, increasing efficiency and raising further funds.

#### *Box 4-8 What is PPP?*

PPP has many meanings and the label is used somewhat differently from context to context. The most commonly understood meaning of the term, which is also the one applied here, refers to the infrastructure understanding of the term, i.e. it concerns capital intensive long-term construction projects where private finance, construction, service and/or maintenance elements are bundled into a long-term contract - typically covering a 30-35year period. The relationship is regulated by a contract which allocates risks and responsibilities between the parties.

The different types of PPP approaches can be displayed across a spectrum ranging from full public to full private responsibility for financing, constructing, operating, operating and maintaining assets as well as responsibility for associated risks.

#### Advantages

A number of key benefits of the PPP model can be highlighted. First, an important benefit is that by bundling design and construction with service and maintenance elements the private sector party is incentivized to design and build assets that can be effectively operated and maintained in the long run rather than exclusively focusing on building the asset without consideration of how it can be effectively operated in the long-run. By putting private finance at risk the involved private party will further be incentivized to come up with innovative solutions. Second, there is also a strong incentive for the private party to deliver on time and to the budget because otherwise it will be financially penalized. For instance, in case of delays in the construction period, the private sector party will normally bear the cost. For the same reason, as early analyses suggest, PPP projects are to a higher extent delivered on time and within the budget compared with traditional procurement models. Effectively, the public sector party buys a specific service, within a specific time frame and to a specific price. By having private sector finance at risk, the private sector is thus incentivized to deliver on time and to the budget, and also to come up with innovative solutions. In case of bad performance, the PPP company will be penal-



ized financially. There is thus a continuous incentive to meet the required service and maintenance standards set out by the public sector authority. Throughout the project lifecycle, the asset is moreover properly maintained because the private sector party is obliged to do so under the terms of the PPP contract.

#### Potential pitfalls

Some potential pitfalls can also be highlighted. First, the PPP model is a relatively complex procurement model which means that transaction costs are high. This is in particular the case in relation to the first projects in a country since PPP competences take time to be built up. Second, on the political dimension there may also be the downside that the room for political manoeuvring may be limited for several decades due to the long-term nature of the PPP deals. A focus on contractual flexibility; e.g. by building proper change mechanisms into the PPP agreement is therefore important. Finally, in order to achieve some of the advantages of the PPP model mentioned earlier, it is a prerequisite that the PPP deals are skilfully planned and drafted. Without a sound and viable deal the likelihood of a successful PPP is limited.

#### Organizational and legal aspects

Since PPP deals are highly complex, long-term and capital intensive projects, a pre-requisite for successful PPPs is that an effective and conducive legislative and regulatory framework is in place. The procurement system must be transparent and competitive, since international private sector actors are unlikely to bid for assignments where the regulatory framework is weak. By attracting several bidders, competition is ensured and ultimately also value for money to the public. Further, it may also be an advantage for the public sector to have the institutional capacity to manage PPP deals. Finally political support and political will is important as this will continuously contribute to PPP project progress. Therefore, public authorities may want to take the lead and ensure the right framework conditions for PPP are in place, and that either in-house or external expertise is available so that the public sector can act as an intelligent client. This will make the local market the more attractive for private market players.

#### PPP within the energy sector

Public-private partnerships within the energy sector have successfully been implemented in other countries around the world. In the UK, for instance, PPP energy projects with a total capital value of GBP 112.77m have been implemented with an average capital value of GBP 8,7m.<sup>4</sup> These projects cover, for example, housing energy, combined heat and power plants, waste to energy plants, and energy management schemes (see case example in Box 1).

---

<sup>4</sup> Source: Partnerships UK, [www.partnershipsuk.org.uk](http://www.partnershipsuk.org.uk)

*Box 4-9 Barkantine Energy – An example of PPP*

Aiming at achieving affordable heating to the citizens and a reduction of the amount of energy used, the London Borough of Tower Hamlets (LBTH) decided to install a communal heating network fired by a combined heat and power unit in a housing estate at a point when the old heating systems in the housing estate needed to be replaced. It was named Barkantine Energy. The Council could not afford to fund the scheme themselves and therefore decided to enter into a Design, Build, Finance and Operate (DBFO) PPP arrangement where a private sector actor operates the facility for a 25 year period. The project reached financial close in March 2000. The new facility enables the generating of heating and hot water as well as electricity. The scheme serves approximately 700 dwellings in LBTH. It has reduced the business and residential customer's heating and hot water bills considerably, and further has been estimated to reduce green house emissions by approximately 2,435 tonnes per annum.

Reduction of CO<sub>2</sub> emissions

#### 4.3.6 Carbon financing<sup>5</sup>

Implementation of energy saving projects in the DH system, as well as optimisation of the demand for the heating and HTW supply services will undoubtedly decrease greenhouse emissions.

The estimates of the total reduction of CO<sub>2</sub> emissions by investment program both in the area of heat production, transportation, and distribution, and in the area of consumption are given after this paragraph below. The reduction of CO<sub>2</sub> emissions is estimated on the basis of the emissions factor against the natural gas and electricity consumption<sup>6</sup>. The estimated price per carbon asset unit (i.e. 1 t CO<sub>2</sub>e) is 10 EUR, which reflects the current situation on the carbon market and expectations of potential buyers.

*Expected annual reduction of emissions through the upgrade of the existing boiler houses:*

- due to the natural gas saving: 10 150 000 t CO<sub>2</sub>e;
- due to the electricity saving: 1 600 t CO<sub>2</sub>e.

Potential annual cash flow from the sale of carbon assets: 101.5 mln EUR.

*Expected annual reduction of emissions through construction of co-generation facilities on three boiler houses:*

- due to the natural gas saving: -6 540 t CO<sub>2</sub>e (negative);
- due to the electricity saving: 22 300 t CO<sub>2</sub>e.

Potential annual cash flow from the sale of carbon assets: 157,600 EUR.

<sup>5</sup> This section has been prepared by the World Bank office in Kiev.

<sup>6</sup> See IPCC and GlobalCarbon.

*Expected annual reduction of emissions through installation of a co-generation facility on CHP-4:*

- due to the natural gas saving: -457 000 t CO<sub>2</sub>e (negative);
- due to the electricity saving: 1 614 000 t CO<sub>2</sub>e.

Potential annual cash flow from the sale of carbon assets: 11.57 mln EUR.

*Expected annual reduction of emissions through the upgrade of the heat transportation and distribution system:*

- due to the natural gas saving: 19 120 t CO<sub>2</sub>e;
- due to the electricity saving: 5 800 t CO<sub>2</sub>e.

Potential annual cash flow from the sale of carbon assets: 249,200 EUR.

*Expected annual reduction of emissions through the upgrade of the DH systems in residential buildings:*

- due to the natural gas saving: 38 580 t CO<sub>2</sub>e;
- due to the electricity saving: 3 050 t CO<sub>2</sub>e.

Potential annual cash flow from the sale of carbon assets: 416,300 EUR.

*Expected annual reduction of emissions through introduction of individual metering and consumption regulation in residential buildings and apartments:*

- due to the natural gas saving: 234 100 t CO<sub>2</sub>e;
- due to the electricity saving: 18 370 t CO<sub>2</sub>e.

Potential annual cash flow from the sale of carbon assets: 2.52 mln EUR.

*Expected annual reduction of emissions through improvement of heat features of the construction envelopes:*

- due to the natural gas saving: 233 450 t CO<sub>2</sub>e;
- due to the electricity saving: 18 370 t CO<sub>2</sub>e.

Potential annual cash flow from the sale of carbon assets: 2.52 mln EUR.

Monetization of carbon emission reductions

Carbon financing proves to work only when the underlying debt or equity financing is in place. In case of DH sector emission reductions appear as a by-product of energy efficiency project implementation. Presently, there are two carbon finance mechanisms applicable for this type of project in Ukraine:

- *Joint Implementation* (Art.6, Kyoto Protocol). National Procedure for JI projects is stipulated in the Cabinet of Ministers Decree #718, from August 20, 2008. The key feature of this mechanism is additionality of carbon finance component to the overall project financing in connection with project ability to reduce emissions comparing to the baseline scenario. JI projects generate Emission Reduction Units (ERUs). Usually 30% of advanced payment for contracted ERUs is accessible from Carbon Funds at the implementation stage.
- *International Emissions Trading* (Art.17, KP). This is a flexible mechanism for inter-state trading of Assigned Amount Units (AAUs) allo-

cated to each member-state of the Kyoto Protocol. Estimates show that potential supply is much greater than potential demand for AAUs; therefore buyers require “greening” of AAUs transaction. Greening conditions and underlying activities must be agreed between the buying and selling parties. Cabinet of Ministers has adopted Decree #221, from March 19, 2008, which approves National procedure for Consideration, Approval and Implementation of Environmental (Green) Target Investment Projects during the Kyoto Protocol Commitment Period. DH energy efficiency project can be submitted and approved as “greening activity” and receive compensation for carbon reduction from Ukraine’s sale of AAUs.

When the DH project receives an investment commitment, the project could be proposed to the World Bank Carbon Partnership Facility (CPF) for additional carbon financing. CPF is a new trust fund of the World Bank, which is regime flexible and designed for programmatic activities that ensure large-scale and long-term climate mitigation effect. The key feature of the CPF is that an emission trading period is extended for ten additional years after Kyoto Commitment Period ends.

#### 4.4 Social Protection Measures

|               |  |
|---------------|--|
| Objective     | The objective of this is to establish a reliable social security system for the low income consumers of DH and HTW services so that these services will be affordable to the truly vulnerable segments of population as well in a situation with further increases in natural gas prices and hence tariffs. The system should concentrate upon the truly vulnerable segments of population.  |
| Progress made | Some progress has already been made in this area. In addition to the existing nationwide mechanisms of social security for low-income consumers of utility services (the housing subsidies and privileges programme), Kharkiv City implements its own City Programme to Support Safe Activities in the Area of Social Security of Citizens of Kharkiv for 2007-2010 whereby it offers subsidies to certain socially vulnerable consumers to pay for the DH services. |
| Actions       | <p>The strategy proposes to develop and implement in addition to the nationwide mechanisms of social security (housing and utility subsidies and privileges) city mechanisms for social security of low-income consumers - in particular:</p> <ul style="list-style-type: none"> <li>○ Municipal privileges for the payment of services provided to the low-income consumers (30-40% of the cost of services)<sup>7</sup>.</li> </ul>                                |

<sup>7</sup> While preparing this strategy and aiming to strengthen the social protection of the population and improve the affordability of services against the expected increase of gas prices, the city of Kharkiv was proposed a more efficient and reliable mechanism for social protection of low-income consumers. Such mechanism envisaged provision of additional subsidies from the local budget for the payment of services. According to the calculations, on average from 33,000 to 38,500 families could annually become beneficiaries of such assistance in 2009-2018, while the cost of this programme could make up estimated 312-368

- Targeted subsidies to low-income households for investment needs (i.e. provision of social support to low-income households for the implementation of energy saving measures). That is, these subsidies will not only be well-targeted but also conditional.

For this purpose, the existing City Programme to Support Safe Activities in the Area of Social Security of Citizens of Kharkiv for 2007-2010 needs to be improved. In particular, it is proposed: (1) to replace the mechanism of tariff difference compensation from the local budget by a 30-40% privilege for the payment of services; and (2) to envisage a possibility to pay targeted subsidies to the low-income households for the implementation of energy saving measures.

#### Estimated costs

The additional social support to low-income households from the city budget will require from USD 53-62 mln (30% privilege) to USD 59-68 (40% privilege) for 2009-2018 - in particular:

- The amount required to provide municipal privileges (30-40% of the cost of services) is estimated at USD 17.7-22.6 mln (optimistic forecast) and at USD 19.5-26.1 mill (pessimistic forecast), including USD 0.8-1.1 and USD 1.0-1.4mln, respectively, already in 2009 (see Table III.B in Annex III).
- The targeted subsidies for low-income households for the implementation of energy saving measures may increase by USD 36.0-42.2 mln. It is envisaged that 80% of this funds (about USD 29.0-33.7 mln) will be needed over the first five years of strategy implementation (i.e. in 2009-2013) when the annual need from the local budget for the payment of targeted investment subsidies will make up USD 5.8-6.8 mln, and about USD 1.4-1.7 mln per year in the next five years (2014-2018)<sup>8</sup>.

#### 4.4.1 Municipal privileges to cover heating costs

#### City Programme

It is proposed to improve the current City Programme to Support Safe Activities in the Area of Social Security of Citizens of Kharkiv for 2007-2010. In particular, it is proposed to replace the mechanism of compensations provided from the local budget for the payment for utility services by privileges from the local budget (in the amount of 30-40% of the cost of such services).

#### Assumptions made

The cost of the city assistance program has been calculated on the basis of the following assumptions:

---

mln UAH for the period of 2009-2018, including 19-26 mln UAH which could become needed already in 2009. City authorities, however, consider that under the current economic crisis it would be impossible to implement this programme due to rather limited city budget resources. The above mechanism and the necessary calculations are set forth in Annex V.

<sup>8</sup> Calculations are described in Section 4.2.2. The amount necessary to pay targeted subsidies for low-income families to cover of the investment costs is included into investment costs funded out of local budget (Section 4.3).

- The number of the beneficiaries is defined by the List of Citizens Entitled to Additional Social Guarantees for Utility Services. Such list is annually reviewed by the Labour and Social Security Office of Kharkiv municipality. It is conventionally assumed that in 2009-2018 the number of beneficiaries will make up on average 10,000 people (i.e. it will remain at the level of 2008).
- A monthly heating supply privileges per person will make up USD 9.3 (30% privilege) or USD 12.4 (40% privilege) in 2009.
- The forecasted amount of municipal privileges will increase annually following the increase in the DH and HTWS tariffs for the population (see Tables III.A and III.B in Annex III).

|               |  |
|---------------|--|
| Flexible tool | The proposed mechanism offers a flexible tool to regulate, if necessary, the number of beneficiaries and the cost of the program (depending on the magnitude of the local budget and priorities made by decision makers).  |
| New mechanism | As soon as the economic crisis abates, and the local budget improves, it is recommended to consider introducing a new mechanism of municipal subsidies to low income households for paying for DH services, which is described together with the calculation of the respective costs for 2009-2018 in Annex V. |

#### **4.4.2 Support to investment costs**

|                         |   |
|-------------------------|---|
| Amendment               | As already mentioned, it is proposed to improve the City Programme to Support Safe Activities in the Area of Social Security of Citizens of Kharkiv for 2007-2010 and supplement it with a provision envisaging a possibility to pay target subsidies to low-income families to cover part of the investment expenses on energy saving measures in residential buildings (as a lump sum that is paid to the subcontractors of energy savings works directly).   |
| USD 1,358 per household | It is expected that the recipients of this assistance will include low-income households which enjoy housing subsidies. According to expert assessments, over the period of 2009-2018 the number of such households can be around 26,500 up to 31,000 (on the average per year). The amount of targeted subsidy is estimated at USD 1,358 per household. Total amount of funding from municipal budget needed for providing targeted subsidies to low-income families for covering the investment needs can make USD 36.0-42.2 mln. |

### **4.5 Public Awareness Campaign**

|               |  |
|---------------|--|
| Objective     | The objective of this area is to raise public awareness of possibilities and advantages of carrying out energy saving measures in the housing sector, thereby facilitating a change in the behavior of end-consumers in housing. |
| Progress made | KHN publishes a newspaper "Teplotekhnik" which covers the heating supply issues. The newspaper is available at the sales department. The company direc-  |

tor appears quite often on the local TV speaking about the debts of the KHN and the necessity to bring the tariffs up to a full costs recovery level.

Furthermore, the city administration publishes a research and production periodical called "Energy Saving, Energy and Energy Audit".

The local department of the State Energy Saving Inspection Office actively participates in the implementation of the state energy saving policy. This office each year arranges a children's competition "Saving Energy, Saving Ourselves".

Nevertheless, there is a need for a comprehensive public awareness campaign serving as a supporting tool to the implementation of the other areas and actions of the strategy. This is acknowledged by all stakeholders in Kharkiv City.

#### Action

The Public Awareness Campaign is composed of the following action:

- Development and implementation of a specially designed Public Education Program on Energy Conservation at the city level which will focus on:
  - education of citizens on the principles of energy saving;
  - training of energy saving experts.

#### Estimated costs

The annual expenses for the Public Education Campaign at the level of the city are estimated at about USD 31,000 - but only until 2013. After 2013 the campaign is envisaged to cease to exist.

#### *Box 4-10 Energy efficiency reforms in Latvia*

##### *Energy Audits*

Energy certificate programs has been implemented as demonstration programs During last 5 years Housing Agency has been managing state and commercial sector co-financed energy audits as well organized different promotion activities and educational activities, including conferences on energy efficiency in housing sector. The objectives of the program is provide information to end-users about energy efficiency in building and promote energy efficient measures in dwelling.

*Public buildings.* In order to reduce the consumption of heat may be reduced by 20 - 60%, a modernization program for public buildings has been introduced.

*Multi apartment building.* Municipalities and communities of apartment owners have opportunity to obtain favorable loan for heat insulation of buildings. The project "Heat insulation of buildings for energy saving purposes has been implemented in co-operation between local banks, the government and external assistance. In total EUR 5 mln has been allocated for loans to heat insulation.

Two components

#### **4.5.1 Public education program on energy conservation**

The public education program on energy conservation, the Public Awareness Campaign, will consist of two components -Component A and Component B. In the following these two components are further dealt with.

##### **Component A: Education of citizens on the principles of energy saving**

This component will include the following:

1. Promotion of energy saving through the mass media (TV and radio programmes, articles in newspapers and magazines, leaflets, etc.). The possibilities and advantages of energy saving measures should be highlighted. It may be efficient to arrange TV programs for discussion of energy saving measures with participation of selected energy experts.
2. Organisation of short (1-2 weeks) energy saving courses upon which participants would get the necessary knowledge, broad collection of training and guidance manuals, and a qualification certificate of energy saving experts in the housing sector. It is recommended to arrange such courses on the basis of Kharkiv National Academy of City Economy and the Resource Centre for Energy Saving Technologies.
3. Attraction of the most active citizens to the participation in energy saving measures through establishment of an energy saving public controllers institute (under the auspices of the city administration).
4. Support to already existing or new NGOs addressing energy saving, climate change or related issues in form a network for exchange of ideas and best practices.
5. Wider dissemination of the periodical "Energy Saving, Energy and Energy Audit". Leaders of co-owner organisations and NGOs, city institutions and companies should receive this journal on subscription. Also, city universities should get subscribed to this journal to notify the students on the pressing energy saving problems.

##### **Component B: Training of energy saving experts**

This component will include the following:

1. Introduction of energy saving disciplines into the programs of secondary schools, trade schools and institutions of higher learning.
2. Organisation of university departments educating energy saving experts at trade and higher-learning institutions.
3. Organisation of university departments educating energy auditors at higher-learning institutions.
4. Development of regulation and guidance for the full-fledged education of energy saving experts.



The educational institutions involved in this should be selected on a competitive basis and co-fund the training insofar as they benefit from the assistance in training program development, and the abovementioned tasks should become part of the Affordable District Heating Program for Kharkiv for 2009-2018.

## 5 National Level

MHCS

The Government of Ukraine, foremost the Ministry of Housing and Communal Services (MHCS), may assist in many ways in the successful implementation of the strategy. Most important are the following three initiatives:

- improvement of the national regulation for tariff setting and investment promotion;
- improvement of the social subsidy system;
- information and methodological support.

They are further dealt with below.

Recommendation

It is recommended that the Government of Ukraine takes these three initiatives. To this end the KCEC will enter into a constructive dialogue with the MHCS.

### 5.1 Tariff Setting and Investment Promotion

Various actions

This initiative - aimed at strengthening the national regulation for tariff setting and investment promotion so as to provide economic incentives for energy saving measures throughout Ukraine - is proposed to include the following actions:

- Amendment of Construction Norms and Rules (in Ukrainian the abbreviation is SNiP) in such a way as to envisage mandatory equipment of flats with heat meters and regulators.
- Development and approval of guidelines for calculation of payment for the energy actually consumed by the flats equipped with heat energy distributors and regulators.
- Development and approval of a procedure for the provision of state financial assistance to the operation of co-owner organizations which implement energy saving measures in multi-flat buildings.
- Various amendments to the current legislation on tariff setting and utilities financial management to be prepared by the MHCS for approval of the CMU and/or Supreme Rada of Ukraine - in particular:

- improvement of the mechanism for tariff adjustment/indexation and its use in practice;
  - introduction of mechanisms creating economic incentives to companies to energy savings (e.g. "price cap regulation");
  - improvement of the mechanism for funding of capital investments through the state budget (implementation of a special VAT regime, provision of economic incentives to implement investment projects through private public partnerships, etc);
  - termination of the normative method adopted to plan the heat energy and DH service consumption with introduction of heat energy and DH service metering.
- Introduction of penalties for late payment of customers for the services.
  - Enforcement of the legal framework for energy efficiency in the residential buildings.
  - Design and establishment of a financial mechanism for funding energy saving measures in multi-apartment buildings (e.g. an IFI Loan Fund) to facilitate direct lending to CAs or sub-contracted by CAs companies. It is envisaged that this action consists of the following tasks:
    - The establishment of a MHCS led Inter Agency Task Force comprising representatives of the Ministry of Finance, Ministry of Economy, selected IFIs and donors and possibly others (NGOs, commercial banks, etc.). It shall define:
      - possible lending vehicles of the energy saving measures in multi-apartment buildings;
      - existing practices of funding energy saving measures in multi-apartment buildings;
      - existing institutional, regulatory, financial constraints for lending to CAs or sub-contracted by the CAs companies;
      - strategic actions for overcoming the existing constraints for lending to CAs or sub-contracted by the CAs companies;
      - possible measures of the state financial support of the CAs's borrowing for energy efficiency improvement.
    - Drafting of required legal framework regarding lending to the CAs.

## 5.2 Social Subsidy System

Two actions

This initiative - aimed at improving the social subsidy system with respect to DH and HTWS tariffs to the population so that it targets the truly vulnerable and promotes energy saving measures - consists of two separate actions:

- In the short-term (2009), the utilities subsidy program can be adjusted through the introduction of a lower threshold for mandatory payments (e.g. to the level of 15% of the cumulative household income).
- In the mid-term (till 2013), the existing system of municipal heat privileges and housing subsidies could be replaced by a comprehensive well-targeted social subsidy system for low-income households.

### *Box 5-1 Lithuania energy efficiency programs*

The National Energy Efficiency Program for 2006-2010 has established several programs for modernization and reconstruction of public buildings, schools, libraries, custodial places, cultural centers, academic universities and museums.

Energy efficiency criteria in public procurement procedures have been introduced. According to these rules public institutions shall set minimum energy efficiency standards in technical specifications.

Green procurement is a parallel measure. Public institutions shall apply environmental criteria for public procurements at least for 10% of all executed procurements in 2008, increasing to 25% in 2011.

The Program of Multi-apartment buildings modernization has since 2004 supported efficiency in energy use. About 70 % of multi-apartment buildings constructed before 1993 will be modernized. Thermal energy and fuel consumption in the present housing sector will decrease by 30 %. Owners of multi-apartment buildings supply investment plans and energy audit to Housing and Urban Development Agency and can get 50% reimbursement of investments.

Energy Efficiency Housing Pilot project started in 1996. Municipalities, owners of multi-apartments or private buildings were able to get easy loan for implementation of energy efficiency measures. The program has been successful and increased heating comfort in apartments provided with loans.

VAT reductions from 18% to 9 % is applied to supplies of services relating to construction, renovation and insulation of residential houses which are financed from a number of state sources and dedicated funds.

### 5.3 Information and Methodological Support

#### One action

This initiative - aimed at providing information and methodological support to Kharkiv City and other cities in Ukraine - consists of one action, namely the development and launch of an internet-based portal (or information site) on energy efficiency in multi-apartment buildings. It may include the following:

- Databases with innovation catalogues on energy saving in Ukraine and abroad with the relevant economic estimates:
  - Contacts of producers and suppliers of energy saving equipment and devices, their technical and environmental specifications, prices, implementation organisations;
  - Contacts of companies that can manage multi-flat buildings;
  - Contacts of Energy Auditors;
- Easy access to key documents in Ukraine of importance to energy saving measures in the housing sector. Among others, the user should have easy access to manuals for CA's, reference books, etc. that may be prepared by the MHCS
- Links to domestic and foreign information sites providing operational information and data of those interested in energy efficiency measures in multi-apartment buildings.
- Information about ongoing relevant projects, forthcoming seminars, exhibitions, etc.

## 6 Implementation Plan

**Table** In each of the following sections, a table summarizes the principal actions of the strategy, expected time frame and agencies responsible. Some actions do not require approval of new legal documents, further policy development or feasibility studies, whereas others do. Thus, some actions may be implemented in the short term (2009), whereas others may be implemented in the medium term (till 2013).

**Implementation mechanism** All of the actions will be implemented through a scheme and two city programs highlighted in Table 6-1. These constitute the implementation mechanism.

*Table 6-1 Implementation mechanism*

| <b>Actions</b>  | <b>What?</b>  | <b>When?</b> | <b>Whom?</b>                                     |
|---|---|--------------|--|
| City Heating Supply Scheme  | Development of the Heating Supply Scheme                              | 2009         | KCEC<br>KHN                                      |
| Affordable Heating Programme for Kharkiv for 2009-2018  | Development of Affordable Heating Programme for Kharkiv for 2009-2018 | Q2-Q3 2009   | KCEC<br>Kharkiv National Academy of City Economy |
|   | Approval of Affordable Heating Programme for Kharkiv for 2009-2018    | Q3 2009      | City Council                                     |
| City Programme to Support Safe Activities in the Area of Social Security of Citizens of Kharkiv for 2007-2010 | Amendment and approval of the Programme                               | Q2 - Q3 2009 | KCEC<br>City Council                             |

## 6.1 Institutional and Organizational Measures

Table 6-2 Implementation plan, Institutional and organizational measures

| Actions                                      | What?   | When?    | Whom?                                      |
|--|---|----------|--|
| 1.1 Establishment of Owners Organization     | Establishment of CA's Support Department  | Q2 2009  | City Council / KCEC                        |
|  | Preparation of an action plan for the CA's Support Department   | 2 2009   | CA's Support Department                    |
|  | Establishment of a municipality Steering Committee to support CAs   | Q2 2009  | City Mayor                                 |
|  | Information and explanation campaign  | On-going | CA's Support Department<br>City Mass Media |
| 1.2 Support to Owners Organisations          | Adoption of a city programme envisaging co-funding of the overhaul repairs of multi-flat buildings that have set up CAs   | Q2 2009  | City Council                               |
| 1.3 Development of Housing Management Market | Registration of professional managers on the city information database (e.g. maintained by Zhytlokomservis)   | 2009     | KCEC                                       |
|  | Creation of the database of professional management companies that will be offering their services on the maintenance and management of the city multi-flat residential sector; and   | 2009     | KCEC                                       |
|  | Notification of owner organisations on the management companies that express their interest in providing maintenance and management services to the multi-flat buildings in the city. | 2009     | KCEC                                       |
| 1.4 Consumption Based Billing                | Adoption of a decision on mandatory installation of building meters in all multi-flat buildings and billing on the basis of such meter readers  | Q4 2009  | City Council                               |

|  |  |                |      |
|--|--|----------------|------|
|  | Support to the gradual equipment of flats with heat meters and regulators, starting with new buildings   | Q1 2010 - 2018 | KCEC |
|  | Adoption of the rules defining the mechanisms for the billing of services provided with the availability of heat meters (building and apartment ones) and regulators | 2010           | KCEC |

## 6.2 Investments

Table 6-3 Implementation plan, Investments

| Actions  | What?  | When?     | Whom?       |
|--|--|-----------|-------------|
| 2.1 Heat Production, Transportation and Distribution | Prioritization of the investment projects and design Capital Investment Program of KHN for the period of 2009-2018 | Q3 2009   | KHN         |
|  | Approval of Capital Investment Program of KHN by City Executive Committee  | Q3 2009   | KCEC        |
|  | Ensuring financing for the Capital Investment Program implementation   | Q3 2009   | KHN<br>KCEC |
| 2.2 Heat Consumption                                 | Implementation according to the approved Affordable District Heating Programme for Kharkiv for 2009-2018           | 2010-2018 | KCEC        |

## 6.3 Funding of the Investment Program

Table 6-4 Implementation plan, Funding of the Investment Program

| Actions         | What?  | When?                         | Whom?       |
|-----------------|--|-------------------------------|-------------|
| 3.1 KHN Tariffs | Revise tariffs                                       | At least once a year          | KHN<br>KCEC |
|                 | Approve methodology and adjust tariffs for inflation | Quarterly/Once in half a year | KHN<br>KCEC |
|                 | Introduce two-tier tariffs for all customer groups   | Next tariff review            | KHN<br>KCEC |



|  |   |  |   |
|--|---|--|---|
|  |   |  |   |
|  | Revise heat consumption standards   | Next tariff review   | KHN<br>KCEC                                     |
|  | Include cold water in HW tariff   | Next tariff review   | KHN<br>KCEC                                     |
| 3.2 Maintenance Tariffs                  | Revise tariffs  | At least once a year / or based on the approved order for adjusting to inflation | Zhilkomserve<br>KCEC                            |
|  | Review of the list of services included into the tariffs for the maintenance of buildings and adjacent territories and inclusion of costs for the servicing of the buildings meters | Next tariff review   | Zhilkomserve<br>KCEC                            |
| 3.3 Funding from Local and State Budgets | Prepare business plans for selected projects/apply for financing  | annually   | KHN   |
|  | Prepare business plans for selected projects/apply for financing  | annually   | Zhilkomserve<br>CAs                             |
|  | Funding targeted subsidies (as described in 6.4)  | annually   | City Department of Labour and Social Protection |
| 3.4 Credit Financing                     | Create a city task force for municipal borrowing strategy development   | 2009   | City Council                                    |
|  | Develop a municipal borrowing strategy  | 2009   | City Council                                    |
|  | Prepare business plans for selected projects/apply for financing (e.g. WB, State Budget financing as described in 4.3.3)  | 2009   | KHN   |
| 3.5 PPP                                  | Explore possibilities of introducing PPP  | 2009   | KCEC  |
| 3.6 Carbon Financing                     | Launch dialogue with the World Bank office in Kiev on options available for introducing such carbon financing mechanism   | Q2 2009  | KCEC  |

## 6.4 Social Protection Measures

Table 6-5 Implementation plan, Social protection measures

| Actions   | What?  | When?        | Whom?   |
|---|--|--------------|---|
| 4.1 Municipal Privileges to Cover Heating Costs | <p>Development of the new edition of “City Programme to Support Safe Activities in the Area of Social Security of Citizens of Kharkiv for 2007-2010” :</p> <p>a) amendment in the terms of implementation of City Programme (till 2018);</p> <p>б) replacement the existing mechanism which is used to provide refunds from the local budget by the privileges for the payment of services to low-income people (in the amount of 30-40% of the cost of services).</p> | Q2 - Q3 2009 | City Department of Labour and Social Protection |
| 4.2 Support to Investment Costs                 | <p>As part of the City Programme to Support Safe Activities in the Area of Social Security of Citizens of Kharkiv for 2007-2010”:</p> <p>a) developing a regulation on the provision of municipal Target support for low-income families from the city budget for investment needs (to cover part of the investment expenses related to the implementation of the energy-saving measures)</p>  | Q2 - Q3 2009 | City Department of Labour and Social Protection |
|   | Design and implementation of the software tools for provision of targeted support to low-income families for the investment needs  | Q4 2009      | City Department of Labour and Social Protection |

## 6.5 Public Awareness Campaign

Table 6-6 Implementation plan, Public awareness campaign

| Actions   | What?  | When?    | Whom?  |
|---|--|----------|--|
| 5.1 Public Education Program on Energy Conservation | Establishment of Public Council on Energy Efficiency under the auspices of City Council  | Q2 2009  | City Council   |
|   | Development of Public Education Program on energy conservation (as a component of Affordable District Heating Programme)       | Q2 2009  | Public Council on Energy Efficiency  |
|   | Implementation of Public Education Programme on energy conservation, in particular:  |          | Public Council on Energy Efficiency  |
|   | Promotion of energy conservation via mass media  | On-going | City Mass Media<br>Public Council on Energy Efficiency                                     |
|   | Organization of training courses on energy conservation for management of CAs, housing cooperatives, NGOs and active residents | Q2 2009  | Kharkiv National Academy of City Economy<br>Resource Centre for Energy Saving Technologies |
|   | Establishment of the Union of Energy Saving Public Controllers   | Q3 2009  | City<br>Public Council on Energy Efficiency  |
|   | Development of the Expert Training Programme   | 2009     | Kharkiv National Academy of City Economy<br>Resource Centre for Energy Saving Technologies |
|   | Implementation of the Expert Training Programme  | On-going |  |

## 6.6 Monitoring and Reporting

Successful implementation

A solid monitoring system is of utmost importance to ensure a successful implementation of the strategy. That is to help the KCEC to reach the goals and objectives set in the strategy and make adjustments of the strategy (if need be).

The monitoring system contributes with an objective, transparent, and well-documented evaluation of whether Kharkiv City is on the right track to reach the goals and objectives set. Please note that it is not just a control mechanism.

Monitoring report

The primary output of the monitoring system is an annual monitoring report. It will simply report on achievements made - area by area and action by action - and extent to which the deadlines mentioned in Tables 6.2-6.6 above are met. If they are not met the monitoring report will propose changes to the implementation plan (revised deadline, deletion of action or others).

Annual basis

The monitoring process will be carried out on an annual basis. It is proposed that the process takes place in March-May. It will be carried out by the KCEC.

### *Box 6-1 Why a monitoring system?*

The purpose of the monitoring system is to help to ensure a successful implementation of the strategy and accompanying implementation plan. That is, to help the KCEC in achieving and maybe adjusting the set strategic goals.

The monitoring system contributes with an objective, transparent, and well-documented evaluation of whether Kharkiv City is on the right track to reach the strategic goals and objectives set. If not the action plan may be adjusted.

Thus, the monitoring system is not just a control system. .

## Annex I Key Terms

**Boiler** - A device for generating steam for power, processing or heating purposes - or hot water for heating purposes or hot water supply.

**Carbon dioxide (CO<sub>2</sub>)** - A colorless, odorless, non-poisonous gas that is a normal part of Earth's atmosphere. Carbon dioxide is a product of fossil-fuel combustion as well as other processes. It is considered a greenhouse gas as it traps heat (infrared energy) radiated by the Earth into the atmosphere and thereby contributes to the potential for global warming. The global warming potential (GWP) of other greenhouse gases is measured in relation to that of carbon dioxide, which by international scientific convention is assigned a value of one (1)..

**Cogeneration** - The production of electrical energy and another form of useful energy (such as heat or steam) through the sequential use of energy.

**Combined heat and power (CHP)** - CHP produces heat and electricity simultaneously in a single power plant. Steam or hot water, which would otherwise be rejected when electricity alone is produced, is used for space or process heating.

**Consumption based billing** – A billing system according to which the customer pays for actual consumption.

**District heating (DH)** - DH is a system that provides districts of towns, or whole towns with heating from one or more heat generating plants.

**Energy audit** - A program or activity in which an auditor inspects an enterprise, organization, building, apartment or others and suggests ways energy can be saved.

**Insulation** - Any material or substance that provides a high resistance to the flow of heat from one surface to another.

**Internal Rate of Return (IRR)** - IRR is the discount rate, often used in capital budgeting, that makes the net present value of all cash flows from a particular project equal to zero. The higher a project's IRR, the more desirable it is to undertake the project.

**Local district heating network** is a small system providing heat to a limited number of factory buildings or residential buildings.

**Net Present Value (NPV)** - NPV is the difference between the present value of cash inflows and the present value of cash outflows. NPV is used in capital budgeting to analyze the profitability of an investment or project.

## Annex II Investment Projects, IRR and NPV

This annex provides the results of the Internal Rate of Return (IRR) and Net Present Value (NPV) calculations made for the investment projects included in the areas named Investments and also information about assumptions made (see Section 4.2).

Table II.A provides the results of the IRR and NPV calculations.

The calculations are based on a net cash flow to be generated by each investment project in 2009-2018. As the life cycle of the facilities commissioned due to the implementation of the investment projects exceeds a 10-year period, the calculations are done for the term of life cycle of the investments (20 years on average).

The net cash flow for each of the projects represents a difference between project revenues and costs. The revenues are the saving of the natural gas and electricity as a result of the implementation of the projects within heat production, transportation and distribution - and also of the saving of heat energy as a result of the implementation of the projects in the sphere of heat energy consumption. **In this case costs will include the investment cost plus profit tax cost.**

The **revenues** from each project were calculated on the basis of forecast prices for natural gas and electricity similar to the prices used for the calculation of forecast tariffs for heat energy, and projected tariffs for heat energy. The calculation of the natural gas and heat energy savings are based on the optimistic forecast of natural gas prices (see Chart 2-1 in Chapter 2)<sup>9</sup>. If a pessimistic forecast is used, the savings (i.e. revenues from the projects' implementation) and hence the IRR and NPV will be higher.

**Annual average savings of gas, electricity and heat energy are revenues received as result of investment project implementation (the same revenues which were used for calculating net cash flow and were described above).**

**Annual average *net* savings of gas, electricity and heat energy are the difference between investment projects revenues and operational costs incurred for their implementation (depreciation and profit tax costs).**

---

<sup>9</sup> See World Bank, 2008 (a) for further information about the forecasts made.

Table II.A Investment projects, IRR and NPV, consolidated table, 2009-2018

| No  | Investment Project  | Investment costs, mln USD | Average annual savings of gas and electric energy (accounting for inflation), mln USD / Average annual net savings of gas and electric energy (accounting for inflation), mln USD | Average annual increase in gas and electricity prices, % | IRR for 20 years | NPV, mln USD |
|---|---|---------------------------|---|--|------------------|--------------|
| <b>I. Heat production, Transportation, Distribution</b> |   |                           |   |  |                  |              |
| 1   | <i>Upgrade of existing boiler houses</i>                                    |                           |   |  |                  |              |
| 1.1   | Reconstruction of 30 boiler houses  | 6.3                       | 2.3 / 1.6   | 26.8   | 19.2             | 3.4          |
| 1.2   | Elimination of 26 boiler houses   | 3.7                       | 2.0 / 1.4   | 26.8   | 25.7             | 4.2          |
| 2   | <i>Cogeneration</i>   |                           |   |  |                  |              |
| 2.1   | Construction of 3 cogeneration units at boiler houses                       | 3.7                       | 4.7 / 3.4   | 34.5   | 39.4             | 12.1         |
| 2.2   | Construction of a cogeneration unit at CHP-4                                | 356.5                     | 300.3 / 276.4   | 27.1   | 33.4             | 609.1        |
| 3   | <i>Upgrade of the heat transportation and distribution</i>                  |                           |   |  |                  |              |
| 3.1   | Replacement of transmission networks  | 361.9                     | 2.1 / -11.6   | 25.4   | na               | -183.6       |
| 3.2   | Replacement of distribution networks  | 134.8                     | 4.0 / - 1.2   | 25.4   | na               | -60.6        |
| 3.3   | Replacement of HTW supply networks  | 32.6                      | 0.08 / - 1.1  | 25.4   | na               | -16.9        |
| 3.4   | Installation of rotation frequency transformers on 30% of pumping equipment | 10.3                      | 2.4 / 1.5   | 31.2   | 12.7             | 0.5          |

| Sub-Total I                        |  | 909.8                     |   |   |                  |              |
|------------------------------------|--|---------------------------|---|---|------------------|--------------|
| No                                 | Investment Project   | Investment costs, mln USD | Average annual savings of heat energy, mln USD / Average net annual savings of heat energy, mln USD | Average annual increase of tariffs for heat energy, % | IRR for 20 years | NPV, mln USD |
| <b>II. Heat energy consumption</b> |  |                           |   |   |                  |              |
| 1.                                 | <i>Upgrade of the DH systems in residential buildings</i>          |                           |   |   |                  |              |
| 1.1                                | Construction of individual heating points                          | 23.1                      | 8.8 / 5.8   | 32.8  | 18.5             | 11.9         |
| 1.2                                | Restoration of the HTW recirculation system                        | 31.0                      | 13.5 / 10.1   | 32.8  | 19.5             | 19.4         |
| 1.3                                | Restoration of insulation of internal building networks            | 3.9                       | 14.6 / 11.0   | 32.8  | 105.3            | 45.9         |
| 2                                  | Introduction of the individual metering and consumption regulation |                           |   |   |                  |              |
| 2.1                                | Installation of heat meters/heat cost allocators and regulators    | 113.6                     | 157.3 / 118.0   | 25.4  | 61.7             | 370.0        |
| 2.2                                | Installation of apartment HTW meters                               | 18.5                      | 51.4 / 36.5   | 26.9  | 88.0             | 145.4        |
| 3.                                 | <i>Building insulation</i>   | 1,009.1                   | 203.6 / 152.7   | 25.4  | 12.6             | 23.1         |
| Sub-Total II                       |  | 1,199.3                   |   |   |                  |              |
| <b>Total</b>                       |  | <b>2,109.1</b>            |   |   |                  |              |



## **Annex III Tariffs and Privileges**

This annex provides two tables providing information about the forecasted increase in DH and HTWS tariffs for the population in Kharkiv City and the accompanying forecasted increase in amount of municipal privileges to low-income families. The two tables are Table III.A and Table III.B, respectively.

Table III.A DH and HTWS tariffs for private consumers, Kharkiv City, forecast, 2009-2018<sup>1</sup>

| Indicators                        | 1 Dec 2008 | 2009               | 2010  | 2011  | 2012  | 2013  | 2014  | 2015  | 2016  | 2017  | 2018  |
|-----------------------------------|------------|--------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| <b>Optimist Scenario</b>          |            |                    |       |       |       |       |       |       |       |       |       |
| DH Tariff, USD/Gcal               | 53.8       | 63.9               | 76.5  | 91.0  | 107.4 | 122.0 | 133.4 | 147.0 | 159.8 | 174.5 | 188.3 |
| HTW Tariff, USD/m <sup>3</sup>    | 2.5        | 2.9                | 3.5   | 4.2   | 4.9   | 5.6   | 6.1   | 6.8   | 7.4   | 8.0   | 8.7   |
| Increase against previous year, % | 28.0%      | 18.9% <sup>2</sup> | 19.7% | 18.9% | 18.0% | 13.5% | 9.4%  | 10.1% | 8.7%  | 9.2%  | 7.9%  |
| <b>Pessimistic Scenario</b>       |            |                    |       |       |       |       |       |       |       |       |       |
| DH Tariff, USD/Gcal               | 53.8       | 76.3               | 90.6  | 103.6 | 116.9 | 134.2 | 150.8 | 170.4 | 191.0 | 216.1 | 242.0 |
| HTW Tariff, USD/m <sup>3</sup>    | 2.5        | 3.5                | 4.2   | 4.8   | 5.4   | 6.2   | 6.9   | 7.9   | 8.8   | 10.0  | 11.1  |
| Increase against previous year, % | 28.0%      | 42.0% <sup>2</sup> | 18.7% | 14.4% | 12.8% | 14.7% | 12.4% | 13.0% | 12.1% | 13.1% | 12.0% |

Note: 1) The forecast is based upon the assumption that tariffs cover 100% of O&M costs and include provision for investments of the KHN.

2) Against 1 December 2008 tariffs.

Table III.B Municipal heat privileges to low-income households in Kharkiv City, forecast, 2009-2018 (000 USD)<sup>1</sup>

|                             | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|-----------------------------|------|------|------|------|------|------|------|------|------|------|
| <b>Optimist Scenario</b>    |      |      |      |      |      |      |      |      |      |      |
| 30% of service cost         | 860  | 1029 | 1224 | 1444 | 1640 | 1793 | 1975 | 2147 | 2344 | 2529 |
| 40% of service costs        | 1147 | 1373 | 1632 | 1926 | 2186 | 2391 | 2633 | 2862 | 3125 | 3372 |
| <b>Pessimistic Scenario</b> |      |      |      |      |      |      |      |      |      |      |
| 30% of service costs        | 177  | 212  | 252  | 297  | 337  | 369  | 406  | 442  | 482  | 520  |
| 40% of service cost         | 236  | 282  | 336  | 396  | 450  | 492  | 542  | 589  | 643  | 694  |

Note: 1) A breakdown by percentage share of service costs to be compensated is made.

## Annex IV Municipal Subsidies

This annex provides a proposal prepared by COWI A/S and MDI within the project "Affordable Heating, Ukraine" with the purpose of strengthening the social protection of low-income households in the light of the forthcoming increase in natural gas prices and hence heat tariffs. The city administration, however, believes that it may not be implemented currently due to the worsening of the city budget in the wake of the economic crisis. But, once the economic meltdown has come to a halt, it may be seriously considered.

### Proposal

It is proposed to improve the current City Programme to Support Safe Activities in the Area of Social Security of Citizens of Kharkiv for 2007-2010 for its better targeting, decrease of its cost, and simplification of the assistance procedure.

In particular, it is proposed to cancel the existing mechanism used to provide refunds from the local budget for the payment of housing and utility services and replace it by a targeted city programme.

The programme should:

- cover families with low income indeed, rather than be based on the category principle;
- take into account the incomes of families and their social status;
- be accessible and transparent in terms of definition of needy families;
- have flexible mechanisms to provide assistance in exclusive cases, when a family in need is not able to provide the necessary documents due to the existing circumstances;
- have efficient mechanisms to plan and manage the assistance; and
- be simple in administration.

To develop and implement the city subsidies, it is proposed to use the mechanisms of the state programme for housing subsidies by enhancing its possibilities and eliminating the existing drawbacks (in particular: (1) a rather high threshold for the provision of assistance (15-20%); and (2) limited possibilities to provide subsidies to the families that cannot prove their low-income status with documents).

It is proposed to develop a regulation on the provision of subsidies from the city budget within the framework of the City Programme to Support Safe Activities in the Area of Social Security of Citizens of Kharkiv for 2007-2010.

Such regulation should:

- 1) ensure the provision of subsidies on the basis of a uniform package of documents (the same documents as required for the provision of state subsidies);
- 2) facilitate a decrease of the subsidy threshold by 5% (down from 20% to 15% for all categories of low-income families and from 15% to 10% for the families composed of pensioners and incapacitated individuals). In such a way, the cost of services exceeding 20% of the aggregate income (15% for some categories of low-income families) should be refunded from the state budget with the additional reduction of payments by 5% of the aggregate income compensated from the city budget;
- 3) introduce the possibility to provide city subsidies to low-income families which, due to different reasons, cannot confirm their low-income status with documents (the relevant decisions on such a possibility will be taken by a commission set up by the local council upon examining the well-being of the households in question).

This arrangement will make it possible:

- to decrease the size of payments for the low-income citizens to 15% of the aggregate family income (10% for some categories of low-income families) which essentially improves the assistance efficiency, especially for the families with children, which currently can apply for a subsidy only if the service bill exceeds 20% of their aggregate income.
- to extend the possibilities for provision of subsidies to certain categories of families in exclusive cases due to the existing circumstances;
- to use the available administrative resources and technical means for the implementation;
- to introduce efficient mechanisms to plan and manage the assistance.

With such an arrangement, the estimated value of the city programme for 2007 would have made up USD 3.1 mln, while help could be provided to 38,700 families (for comparison, 56,700 consumers got refunds from the city budget in 2007 for the amount of USD 4.2 mln).

The cost of the city programme has been calculated on the basis of the following assumptions:

- the size of payments for low-income citizens is decreased by 5% of the aggregate family income at the expense of the city budget;
- the number of city subsidy beneficiaries will exceed the number of state subsidy beneficiaries by about 24% due to the decrease of the service affordability threshold; and

- the annual monthly income per one household receiving a subsidy made up USD 134.8 in 2007 and USD 153.5 in 2008 according to the subsidy beneficiaries database.

The forecast cost of the city programme for the low-income families is presented in the Table V.A.

The calculation shows that the number of households that will be receiving municipal subsidies in 2009-2018 may come up to 33,000-38,500 (on average per year).

The amount of funds necessary for the payment of municipal subsidies is in the range from USD 64.2 mln (optimistic scenario) to USD 75.7 mln (pessimistic scenario), including from USD 4.5 to USD 5.4 mln already in 2009. The proposed mechanism offers a flexible tool to regulate, if necessary, the number of beneficiaries and the cost of the programme (depending on the possibilities of the local budget). Thus, assistance can be provided only to those consumers who pay for the services within the limits of 20% of their aggregate income (in particular, assistance can be provided only to families with children as the least protected by the existing targeted assistance programmes).

Table V.A Number of recipients of proposed municipal heat subsidies and total amount, Kharkiv City, forecast, 2009-2018

| <b>Indicators</b>                            | <b>2009</b> | <b>2010</b> | <b>2011</b> | <b>2012</b> | <b>2013</b> | <b>2014</b> | <b>2015</b> | <b>2016</b> | <b>2017</b> | <b>2018</b> | <b>Total</b> |
|--|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|--------------|
| <b>Optimist Scenario</b>                     |             |             |             |             |             |             |             |             |             |             |              |
| Number of recipients (households)            | 41 800      | 42 400      | 41 200      | 39 300      | 35 100      | 30 500      | 27 400      | 25 000      | 23 200      | 23 200      | -            |
| Municipal subsidies (000 USD)                | 4486        | 5370        | 6029        | 6646        | 6811        | 6708        | 6770        | 6852        | 7078        | 7469        | 64218        |
| Municipal subsidies per household (USD/year) | 107         | 127         | 146         | 169         | 194         | 220         | 247         | 274         | 305         | 322         |              |
| <b>Pessimistic Scenario</b>                  |             |             |             |             |             |             |             |             |             |             |              |
| Number of recipients (households)            | 49 900      | 50 400      | 47 100      | 42 900      | 38 800      | 34 700      | 32 000      | 30 000      | 29 000      | 30 200      | -            |
| Municipal subsidies (000 USD)                | 5370        | 6358        | 6893        | 7243        | 7510        | 7613        | 7881        | 8251        | 8848        | 9691        | 75658        |
| Municipal subsidies per household (USD/year) | 108         | 126         | 146         | 169         | 194         | 219         | 246         | 275         | 305         | 321         |              |

## Annex V References

### Publications

Housing and Urban Development Agency: *Success stories*. Vilnius, 2008 (available on [www.bkagentura.lt](http://www.bkagentura.lt)).

World Bank: *Comparison of Heat Cost Allocators with Individual Apartment Level Metering*. Washington, D.C., 2005.

World Bank: *Affordable Heating, Ukraine - Status Report*. Washington, D.C., 2008 (a).

World Bank: *Affordable Heating, Ukraine - Demand Side Report*. Washington, D.C., 2008 (b).

World Bank: *Affordable Heating, Ukraine - Survey Report*. Washington, D.C., 2008 (c).

### Websites

[http://www.london.gov.uk/mayor/strategies/energy/docs/energy\\_strategy04.pdf](http://www.london.gov.uk/mayor/strategies/energy/docs/energy_strategy04.pdf)

<http://www.iea.org/textbase/nptoc/ukraine2006toc-ukr.pdf>

<http://www.iea.org/textbase/nptoc/SlovakRep2005TOC.pdf>

<http://66.102.9.104/search?q=cache:oyDRbcOc5PgJ:www.seenergy.org/download.php%3FFNAME%3D1084511874.upl%26ANAME%3DEtape%2520de%2520parcurs%252015.07.2003.pdf+strategy+energy+Romania&hl=da&ct=clnk&cd=1&gl=dk>

Energy Saving Trust, [http://www.energysavingtrust.org.uk/uploads/documents/housingbuildings/tower\\_hamlets.pdf](http://www.energysavingtrust.org.uk/uploads/documents/housingbuildings/tower_hamlets.pdf)

London Climate Change Agency, [www.lcca.co.uk](http://www.lcca.co.uk)

Partnerships UK <http://www.partnershipsuk.org.uk>