JOINT IMPLEMENTATION PROJECT DESIGN DOCUMENT FORM FOR SMALL-SCALE PROJECTS
Version 01.1 - in effect as of: 27 October 2006

CONTENTS

SECTION A. General description of the small-scale project

A.1. Title of the small-scale project:

"Rehabilitation of the District Heating System in Donetsk City".

Sector of application:

1. Energy (renewable - / non-renewable sources).

Version of Project Document: 03.

Date: 18/10/2010.

A.2. Description of the small-scale project:

Purpose of project activity. The main goal of the project is reducing fuel consumption in district heating system, in particular natural gas (which is imported to Ukraine), and electricity consumption by means of centralized heat supply system rehabilitation in Donetsk city, which includes replacement and rehabilitation of boilers and heat distribution network equipment, as well as installation of heat recovery units and frequency controllers. Such reduction of fuel and electricity consumption will result in decrease of greenhouse gas emissions CO_2. The purpose of the project is sustainable development of the city through implementation of energy saving technologies.

Historical details: Municipal commercial enterprise "Donetskmiskteplomerezha" is one of the main enterprises of heat generation and transportation in Donetsk city. The enterprise sells heat energy in forms of heat and hot water. Generated heat is sold in full to local consumers, namely: to households, municipal consumers and state-owned organizations. The market of this product has been stable for years. Municipal commercial enterprise "Donetskmiskteplomerezha" was established according to the Resolution of the executive committee of Donetsk City Council of national deputies No. 17P as of 11.01.1994. By resolution of Donetsk City Council No. 13/25 as of 27.09.2004 the Municipal commercial enterprise "Donetskmiskteplomerezha" of Donetsk City Council was established and registered by the executive committee of Donetsk City Council on 03.11.2004, identification code: 33257089. According to the decree of Donetsk City Head No. 964 as of 15.10.2004 due to termination of the contract of lease, the integral property complex "Donetsk City Heating Networks", the Municipal commercial enterprise "Donetskmiskteplomerezha" transfered the integral property complex "Donetsk City Heating Networks" into a full economic jurisdiction of Municipal commercial enterprise "Donetskmiskteplomerezha" of Donetsk City Council. Municipal commercial enterprise "Donetskmiskteplomerezha" of Donetsk City Council provides the residential and public buildings with heat and hot water. Share of enterprise's services on the heat supply market in Donetsk city is 85%. At present the enterprise comprises 9 heat districts, located geographically in 9 corresponding administrative districts of the city and operates 170 boiler-houses, 103 heat supply stations, 5 stations of mixing in and 1 cogeneration plant. 568 boiler units of 44 types with the single power equal to 0,2-50 Gcal/hour are installed in boiler-houses. Total maximal calculated heating power of enterprise's boiler-houses is 2537,4 Gcal/hour. Aggregate maximal calculated heat load in the city connected to heat supply system is 1809,9 Gcal/hour, where connected load for hot water supply is 438,2 Gcal/hour. Total length of heating systems is 901,2 km in double pipeline system, including 215,4 km of hot water supply systems. Annual heat energy generation is 2732760,0 Gcal. The enterprise feeds 3866 buildings, 1508 buildings are connected to the hot water supply systems, and it operates 208,4 thous. of private accounts. Heated area is 15208,4 thous. m^2, including 11441,0 thous. m^2 for population. 3259 contracts on heat energy supply are concluded with the legal entities. The enterprise has 5 auxiliary workshops and 6

production departments dealing with preparation and maintaining of mainline production and ensuring its normal production activity.

Description of the project implementation conditions. Unsatisfactory technical state of the heat supply systems in Donetsk city and permanent wear of boiler equipment resulted in increase of ineffective consumption of energy resources (electric energy, natural gas).

In case of absence of the JI project Municipal commercial enterprise "Donetskmiskteplomerezha" will conduct annual minimal repair of heat supply systems in order to ensure their operation. Particularly it executes repairing of pipelines' parts and boilers that might cause accidents. More economically feasible and realistic scenario without unit reduction sales is a baseline scenario with very slow reconstruction activities than to make a major overhaul of the heating systems. Minimal annual repairing doesn't lead to reduction of baseline emissions because of degradation of the whole system with efficiency droop at other objects, the overall actual emissions of Supplier would stay on the same level. This scenario is less environmentally favorable since GHGs emissions of Supplier will continue to be kept at the same level or even higher, but economically such scenario is more attractive.

The project provides for GHG emission reductions due to:
- Replacement of old boilers by new highly efficient boilers;
- Transfer of load from the boiler-houses with outdated equipment to the boiler-houses fitted with highly efficient equipment;
- Upgrading of networks' operation;
- Installation of pre-insulated pipes;
- Installation of frequency controllers at smoke exhausters' electric drives of draught equipment and hot water pumps supply system.

Implementation of the project will provide substantial economic, environmental, and social benefits to the Donetsk city. Social impact of the project is positive since after project implementation heat supply service will be improved.
Environmental impact of the project is expected to be positive as an emission of the greenhouse and toxic gases such as CO_2, NO_x, SO_x and CO will be reduced. Also due to improvement of services, some part of population will cease to use electric heaters thus reducing electricity consumption, which is related to emissions of CO_2, SO_x, NO_x, CO and particulates from fossil-fuel power plants .

Estimated project risks are limited and minimized, since Ukraine has claimed centralized heating and municipal energy sector as a priority for the national energy-saving development.

A.3. Project participants:

Party involved	Legal entity project participant (as applicable)	Please indicate if the Party involved wishes to be considered as project participant (YES/NO)
Ukraine (Host Party)	• Municipal commercial enterprise "Donetskmiskteplomerezha"	No
Switzerland	• "VEMA S.A."	No

A.4. Technical description of the small-scale project:

A.4.1. Location of the small-scale project:

The Project is located in Donetsk region, East of Ukraine **(Figure 1.)**

Figure 1. The map of Ukraine

A.4.1.1. Host Party(ies):

The project is located in Ukraine, Donetsk city

Ukraine is an Eastern European country that ratified the Kyoto Protocol to the UN FCCC on February 4, 2004, and is included in the Annex 1 of the UN FCCC. It is eligible for the Joint Implementation projects.

A.4.1.2. Region/State/Province etc.:

Donetsk Region is situated in the southeastern part of Ukraine. Its area is 26500 km^2 (nearly 4.4% of the whole area of Ukraine), its length from North to South is 270 km, from East to West – 190 km. The population of Donetsk region is 5007,9 thous. inhabitants as of 2007. Administrative center is the city of Donetsk.

Climate of Donetsk region is rather continental, characterized by warm summer and relatively cold winter with changeable snow mantle. Average temperature is: in January -7°C, in July - +19 °C. Average annual amount of precipitations is 524 mm. Thereby heating period is 183 days. Average external temperature of heating season is -1,8°C.

A.4.1.3. City/Town/Community etc.:

Donetsk city

Territory of Donetsk city embraces an area of 358 km^2.
Population of Donetsk is over 948.412 thous. inhabitants.

A.4.1.4. Detail of physical location, including information allowing the unique identification of the small-scale project:

Donetsk city is divided into 9 administrative districts. Municipal commercial enterprise "Donetskmiskteplomerezha" is divided into 9 corresponding branches. It should be noted that the district heating systems from all territorial districts of the Donetsk city are involved in the project (Figure. 2).

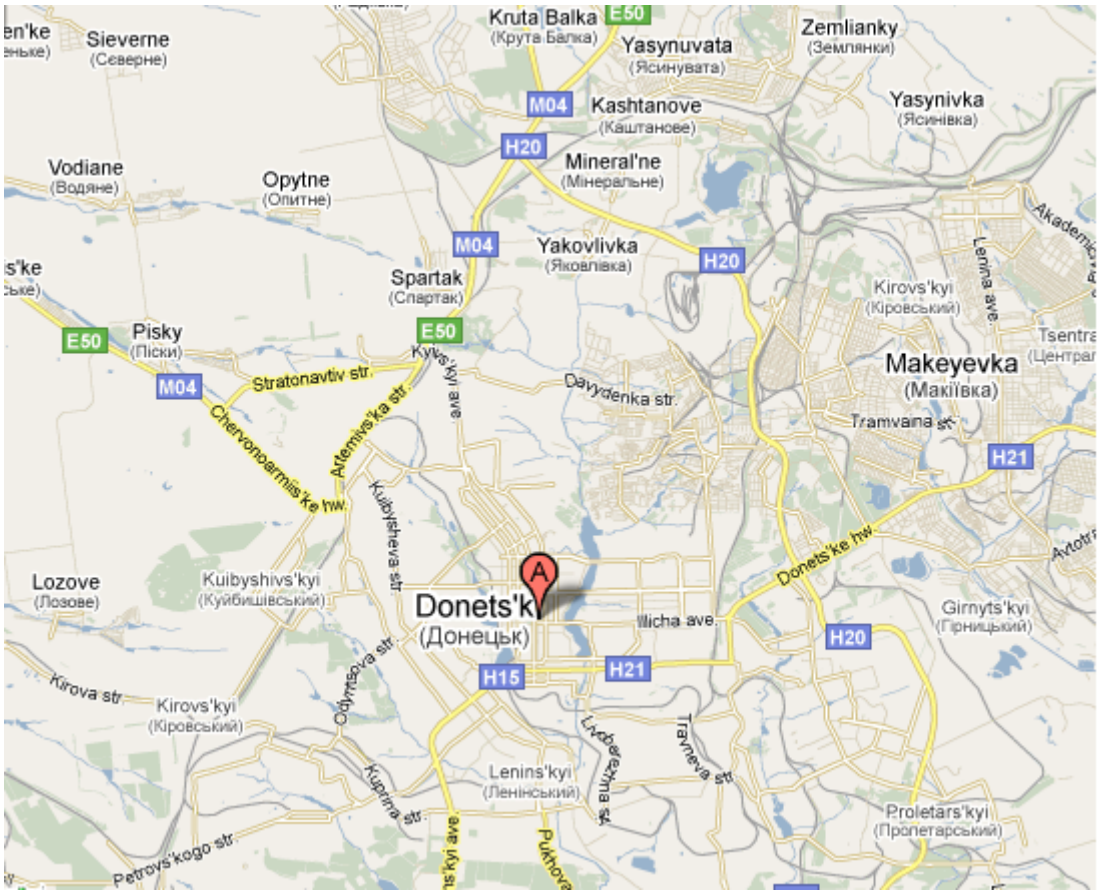

Figure. 2. Map of Donetsk where the project will be implemented

A.4.2. Small-scale project type(s) and category(ies):

Annual average of GHG emission reductions do not exceed 45 000 tons CO2 -equivalent, therefore proposed project belongs to the JI small-scale projects type III – projects that result in emission reductions of less than or equal to 60 000 tons of carbon dioxide CO2 -equivalent annually.
The category for this project is improvement of energy efficiency.

A.4.3. Technology(ies) to be employed, or measures, operations or actions to be implemented by the small-scale project:

Measures aimed at increasing in effectiveness of Municipal commercial enterprise "Donetskmiskteplomerezha" include the following:

- Old operating boilers with low efficiency will be replaced by new highly efficient boilers that will make it possible to increase efficiency from 70-94% to 90-93%. Technical characteristic of new boilers scheduled to be installed are presented at the producer's websites that are listed in Table 2:

Type of boiler	Characteristic of the equipment is given on website:
KSV-150	www.tekom.com.ua/kotel/vk.html
NIISTU	http://www.ezko.ru/catalog/main/prod.php?rc=1171970438&pc=1171977809
Viessmann	www.viessmann.ua
REX-95, 40	http://www.energogaz.su/rexf70/
APK 2102 GN	http://www.promenerg.ru/product/71
Mini-Don	http://teploenergetik.com.ua/products/kotelnie/transportabelnie/

Table 1. Characteristic of the equipment

Figure. 3. Boiler Mini-Don of 94% coefficient of efficiency

Figure. 4. Boiler REX-95 of 96% coefficient of efficiency

- Boilers rehabilitation with burners and automatic equipment replacement.
- Switching load from the boiler houses with obsolete equipment to the boiler houses with highly effective equipment. .
- Contact and surface heat-recovery gas-cleaning apparatuses (utilizers), including developed by the Institute of Engineering Ecology, will be installed in order to utilize and recover the exhaust gases heat as well as the additional heat of steam condensation, occurring when the temperature of exhaust gases fall below dew point. The implementation of this technology will result in increasing the fuel consumption efficiency by 6-8%.
- Rehabilitation of heat distribution networks system will make it possible to decrease loss of heat energy up to 1-2% per 1 km due to pipes replacement of main and distribution circuits of 48-630 mm diameter by pre-insulated pipes.
- Installation of frequency controllers at hot water pumps' motors will result in energy saving. Those regulators make it possible to change actual capacity of the motors depending on connected load, both as during a day when water consumption is changes, and during a year when in summer motors work only for hot water supply.

Installation of frequency controllers at smoke exhausters' electric drives will result in considerably energy saving.
Generalized schedule of such measures implementation is the following:

№	Stage of project	PERIOD
1	Boiler houses rehabilitation	01/2005-12/2011
2	Replacement of old wasteful boilers	01/2005-12/2011
3	Rehabilitation of heat distribution networks	01/2005-12/2011
4	Replacement of burners	01/2005-12/2011
5	Installation of heat recovery units	06/2009-12/2010
6	Installation of frequency controllers	06/2010-12/2011

Table 2. Time schedule of project's implementation

Results to be received after implementation of such technologies and measures given in Appendix 1, 2.

Technologies to be implemented by the project are state-of-the-art technologies in heat supply, have already been tested, will result in much higher efficiency. Taking into consideration general economic circumstances, probability of replacement of technologies proposed in the project by more efficient technologies is too low in the next 20-30 years.

As concerns the first period of commitments of 2008-2012, there are no risks that replacement of technologies proposed in the project by the more efficient technologies is possible within this year.

Since the principal activities of Municipal commercial enterprise "Donetskmiskteplomerezha" don't change when introducing the Joint Implementation (JI) project, special trainings for personnel are not necessary. Technical staff of the enterprise has necessary knowledge and experience for execution of project activities and repair of common equipment.

Municipal commercial enterprise "Donetskmiskteplomerezha" retrains the personnel according to the requirements of Labour protection standards[1]. The enterprise has the Labour Protection Department responsible for professional development and personnal trainings.

In the course of elaboration of JI project the specialists of VEMA S.A. carried out broadened consultations for relevant representatives of Municipal commercial enterprise "Donetskmiskteplomerezha" concerning collection of necessary data according to the Monitoring plan of the project

A.4.4. Brief explanation of how the anthropogenic emissions of greenhouse gases by sources are to be reduced by the proposed small-scale project, including why the emission reductions would not occur in the absence of the proposed small-scale project, taking into account national and/or sectoral policies and circumstances:

Project activity, which includes rehabilitation of boilers, heat distribution networks and installation of heat recovery units will make it possible to increase energy efficiency of heat supply system in Donetsk city, i.e. it will generate the same quantity of heat energy consuming at the same time less quantity of fuel. Fuel saving will be in result of the CO_2 emissions reduction.

In absence of the proposed project all equipment, including the old ineffective but operable equipment, will work in the usual mode for a long time, and no emission reduction will take place.

The Ukrainian Government declared the high priority of heat supply sector for national energy saving policy. This is stated in the State Program of Communal Economics Restructuring and Development for 2004-2010 (Ukrainian Law "On heat supply" No. 2479-VI from 09.07.2010[2]), Ukrainian Law "On energy saving"[3] No. 74/94-VR from 01.07.1994 and Ukrainian Law "About amendments to the Ukrainian Law "On energy saving" No. 1026-V from 16.05.2007. New Law of Ukraine "On heat supply" No. 2633-IV from 02.06.2005[4] regulates all relations on heat supply market. It will not change considerably the current practices of market, but will stipulate more actively the implementation of energy saving and more efficient technologies.

[1] http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=2694-12

[2] http://zakon.nau.ua/doc/?uid=1088.850.2&nobreak=1

[3] http://zakon.nau.ua/doc/?uid=1086.76.8&nobreak=1

[4] http://zakon.nau.ua/doc/?uid=1088.850.2&nobreak=1

A.4.4.1. Estimated amount of emission reductions over the crediting period:

In course of project implementation, the following emission reductions will be achieved at each stage of the project:

	Years
Length of the crediting period	3
Year	Estimated annual emission reductions in tonnes of CO_2 equivalent
2005	33224
2006	36926
2007	39615
Total estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	109765
Annual average of estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	36588

Table 3. Estimated amount of emission reductions before the first commitment period

	Years
Length of the crediting period	5
Year	Estimated annual emission reductions in tonnes of CO_2 equivalent
2008	40602
2009	41574
2010	43451
2011	48263
2012	48263
Total estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	222153
Annual average of estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	44431

Table 4. Estimated amount of emission reductions during the first commitment period

	Years
Length of the crediting period	12
Year	Estimated annual emission reductions in tonnes of CO_2 equivalent
2013	48263
2014	48263
2015	48263
2016	48263
2017	48263
2018	48263
2019	48263
2020	48263

2021	48263
2022	48263
2023	48263
2024	48263
Total estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	579156
Annual average of estimated emission reductions over the crediting period (tonnes of CO_2 equivalent) by post-Kyoto mechanism	48263

Table 5. Estimated amount of emission reductions after the first commitment period

More detailed information is provided in the Appendixes 4.

Description of formulae used for preliminary estimation of emission reductions is presented in section E.1, E.4.

A.4.5. Confirmation that the proposed small-scale project is not a debundled component of a larger project:

The proposed small-scale project is not debundled component of a larger project. In 2004 Municipal commercial enterprise "Donetskmiskteplomerezha" signed the contract that Regional Utility Enterprise "Donetskteplokomunenergo" shall be the representative of Municipal commercial enterprise "Donetskmiskteplomerezha" in respect of implementation of the project "Rehabilitation of the Heating System in Donetsk Region»5. Ownership of GHG emissions from sources that are owned by the Municipal commercial enterprise "Donetskmiskteplomerezha", was transferred. In 2004 management bodies of Municipal commercial enterprise "Donetskmiskteplomerezha" made a decision about creation of the JI project (name: Rehabilitation of the Heating System in Donetsk City") with the GHG emission reduction sources not included in the project "Rehabilitation of the Heating System in Donetsk Region"[5]. All sources of GHG emission reductions, which are declared in the project "Rehabilitation of the Heating System in Donetsk Region" are in the closed access for the developers of project, that is why for determination of sources of GHG emissions, which are not included in the project "Rehabilitation of the Heating System in Donetsk Region", data of Municipal commercial enterprise "Donetskmiskteplomerezha" were used.
All sources of GHG emission reductions under the project "Rehabilitation of the Heating System in Donetsk City" are given in the Table 6:

	Type of boiler-house	**Addresses of the boiler-houses**
1	Apt. #289	9a, Gurova Avenue
2	Apt. #191a	72a, R. Luxemburg Str.
3	Donetsk Polytechnic Institute	135a, Artema Str.
4	Apt. #245	135a, Artema Str.
5	45, Artema Str.	45, Artema Str.
6	43, Artema Str.	43, Artema Str.
	Kalyninskyy district	
7	Apt. #138	6a, Antypova Str.
	Kyevskyy district	
8	Ionina Str.	9б, Ionina Str.
9	CMR	10б, Politboytsov Str.

10	Apt. #287	8б, Chapaeva Str.
	Kuybyshevskyy district	
11	Apt. #756	19, Odyntsova Str.
12	OKVD	107б, Kalinina Str.
	Budyonnovskyy district	
13	g/b No. 2	23a, Donenergo Str.
14	YuESS	18a, Blagoustroyinna Str.
	Petrovskyy district	
15	Apt. #14-67	21в, Arkhitektoriv Str.
16	MR-4	24б, Stakhanova Str.

Table 6. Sources of GHG emission reduction

A.5. Project approval by the Parties involved:

The project has already been supported by the Government of Ukraine, namely by the National Environmental Investment Agency of Ukraine, which has issued a Letter of Endorsement for the JI Project (24.09.2010 №1458/23/7). Thus, the organizational risks for the project are minimized.

After receiving Determination Report from the Accredited Independent Entity the project documentation will be submitted to the National Environmental Investment Agency of Ukraine for receiving a Letter of Approval. Another Letter of Approval will be received from the other party of the project participant.

SECTION B. Baseline

B.1. Description and justification of the baseline chosen:

The proposed Project uses a specific approach for joint implementation projects. At the time when this Project was developed, there was the lack of approved CDM methodologies the such types of the projects. Specific approach that is proposed in the project is similar partially to the methodology "Baseline and monitoring methodology AM0044 (version 01)[5]». However methodology AM0044 (version 01) is not used for the project "Rehabilitation of the District Heating System in Donetsk City", because the project has some differences from applicability conditions of this methodology.

The main reason for impossibility of AM0044 (version 01) use for baseline development is lack of data about heat energy generation because heat energy meters in majority of boiler-houses involved in the project are not available. "SVT e.V." (Germany) and Institute of Engineering Ecology proposed another methodology, that takes into account all measures involved in the project and it's peculiarities. This methodology is presented in section D (monitoring plan). It was already approved for the JI Project in Chernihiv region and for the similar JI Project in Donetsk region.

The main complication for implementation of the JI projects on district heating in Ukraine is the practical absence of monitoring devices for heat and heat-carrier consumption in the municipal boiler-houses. Only the fuel consumption is registered on a regular basis. It makes practically impossible the application of AM0044 methodology which basic moment is monitoring of the value EGPJ, i, y (thermal energy output of project boiler i in year y) - page 9 of Methodology AM0044, which should be measured every month by flow-meters (the expenditure of heat-carrier) and thermal sensors (temperatures at the input and output of the boiler, etc.).

This also concerns the definition of the average historical value of heat power generation per year $EG_{BL, his, i}$ (average historic heat output from the basic boiler "i").

Specific approach applied in the project is based on continuous measurement of fuel consumption and consider other factors, such as connection or disconnection of the consumers, change of net calorific value of fuel, weather change, ratio of the heat consumption for heating and for hot water supply, consumption for own needs etc.

Specific approach applied in the project has two important advantages compared to AM0044 methodology(version 01) (at least for Ukrainian conditions):

- It takes into account the quality of heat supply (heating and hot water supply). Almost annually and for the various reasons (receiving of less amount and high price of the fuel, in particular natural gas which is nearly 95 % of fuel type used in Ukraine for the needs of the municipal heat supply), the consumers receive less than necessary amount of heat, in the result of which the temperature inside the buildings is much lower than normative one. As the purpose of JI projects, including the current project, is the GHG (CO2) emission reduction under the conditions of not worsening in any circumstances of the social conditions of population, the approaching of the normative heat supply quality is extremely important. Therefore, the amount of the fuel consumption after project implementation period is calculated for the conditions of providing the normative parameters of heat supply and at least partially of hot water supply, and in accordance with the monitoring plan, the implementation of continuous control (monitoring) of its quality (measurement of internal temperature in the specific buildings as well as

[5] http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_L4AQZSBA770KNI0BUSG1JVIWCXIFU5

registration of residents' complaints for the poor-quality heat supply) is foreseen. This increases the control for the qualitative heat supply for the consumers and excludes deliberate reduction of heat consumption, and, in such a way, of fuel consumption with the purpose of increasing of generation of GHG emissions reduction units (ERUs) at the project verification.

- Definition of the fuel consumption in base year (baseline) in view of the fact that in Ukraine at the majority of the municipal heat supply enterprises the natural gas is used as a fuel, which consumption is measured constantly by the counters with the high measurement accuracy, seems to be more exact, than definition of the fuel consumption with use of heat power, boiler efficiency and heat value of the fuel. This especially concerns the efficiency, which changes greatly depending on load of boilers, which also changes essentially, and often not automatically but manually, in the heat supply systems within a day and within a year. Averaging of such values without having of the heat account system is fraught with serious discrepancies. Definition of the fuel consumption in the presence of counters requires only data collection and implementation of arithmetic actions.

The project applies specific approach based on the continuous measurement of the fuel consumption and adjustment of baseline to parameter changes in reporting year. The variable parameters may be the changes in calorific value of fuels, quality of heat supply, weather changes, changes in customers quantity, etc. Taking into account only equipment efficiency does not eliminate the possibilities of undersupply of heat to customers (deterioration of heat supply service), and possible weather warming in reported year, change in fuel quality, disconnection of some consumers, and other factors, and could lead to artificial overestimation of ERUs amount.

In view of the above mentioned, in contrast to the methodology AM0044 (version 01), specific approach elaborated for projects of "District heating" (DH) in Ukraine and applied in JI projects "Rehabilitation of the District Heating System in Donetsk City", "Rehabilitation of the District Heating System in Chernigiv city»[6], "Rehabilitation of the District Heating System in Crimea»[7] and "Rehabilitation of the District Heating System in Kharkiv City»[8] is the most appropriate, precise, corresponding to the principle of conservatism, and the most closely reflects the aims, goals and spirit of Kyoto Protocol. .

The baseline study will be carried out for each year of the emission reduction purchasing, in order to correct adjusting factors which have an influence at the baseline. For more detailed information see Section D. 1.

There were three different versions of Baseline scenario, which have been discussed before starting this project.

The first version of Baseline scenario was "business as usual" with minimum reconstruction works balanced by overall degradation of DH system. There are no barriers for implementation of this Baseline scenario (there are no investment barriers since this scenario doesn't require involvement of additional investments; there are no technological barriers, since this equipment is operated by skilled personnel and there is no need to conduct additional retraining). This scenario reflects customary practice in Ukraine.

The second version of Baseline scenario provides for rehabilitation without Joint Implementation mechanism. In such case both barriers exist: investment (since this scenario requires additional

[6] http://ji.unfccc.int/JIITLProject/DB/PWS73YAWOKYQ100MP5TH5U7SN06DYO/details

[7] http://ji.unfccc.int/JIITLProject/DB/KWHXFPDA7LXPLNZ8XUI7GVPWNUTFTO/details

[8] http://ji.unfccc.int/JIITLProject/DB/D2ZYZ533L116F3KQUPMM1N5HR3FT7S/details

considerable investments and has too long payback period and high risks, therefore it is not investment-attractive) and technological barrier (since application of new up-to-date equipment requires additional retraining of the personnel). Heat supply equipment rehabilitation for efficiency increase is not customary practice in Ukraine.

The third version of Baseline scenario was the shortened project activity, without any of the non-key type of activity, for example elimination of frequency controllers, etc., installation from the project. This makes project economically less attractive, with the longer pay back period.
Thus the first version was selected for Baseline scenario.

Status and correspondence of current supply system

Active operation of heat supply system in Donetsk city is based on gas boilers of Ukrainian or Russian manufacturing, including: DKVR-10/13, DKVR-6,5/13, DKVR-4/13, DKVR 2,5/13, DE 10/13, KVGM-50, PTVM-30 M, KVGM-10, KVG-6,5, KVG-4, KVT-1g, KVGM-1,1, TG-3, TGV-8M, TGV-4P, KVANT-0,5, KVANT-0,8, KVANT-1,5, KATON-0,5, KATON-0,8, KATON-1,5, MMZ-0,8, NIISTU-5, E-1/9, and some other types. Detailed information is given in Appendixes 1 (Boilers). Current efficiency of these boilers is 70-87%.

Available distribution networks are characterized by heat loss from 20% to 50%. Detailed information is given in Appendixes 2 (Networks).

Baseline scenario formation

Current operation of heat supply system in Donetsk city is represented in continuous degradation of operation of heat producing and heat distributing equipment with continuous decrease in its efficiency. However at the same time prompt repair increases efficiency, compensating worsening to large extent and equalizes the level of annual total emissions (baseline) during the years.

Calculation of carbon emission factors for baseline

For natural gas (NG) we used CO_2 emission factor from the data table, Table 2.2, Section 2: Stationary fuel combustion, 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Intergovernmental Panel on Climate Change (IPCC), 2006[9]:

Cef: (natural gas)=0,0561 thous. t CO_2 / TJ;

We assume that CO2 emission factor for NG will be the same for period 2004-2012. For our calculations we assume that the Lower heating ing Value of a fuel (LHV) doesn't change during that time, however in the Monitoring Plan the LHV factor will be taken into account for the baseline correction for any reported year until 2012.

The lower heating ing value of NG used by Municipal commercial enterprise "Donetskmiskteplomerezha" will change insignificantly from year to year. Table 5 represents the LHV of the fuel used by the **Supplier** in 2004.

Type of fuel	Averaged lower heating ing value of the fuel	
	Kcal	MJ/m^3
NG	8064	33.76

[9] http://www.ipcc-nggip.iges.or.jp/public/2006gl/russian/pdf/2_Volume2/V2_2_Ch2_Stationary_Combustion.pdf

Table 7.The lower heating value of the fuel

For determination of the lower heating value of natural gas Municipal commercial enterprise "Donetskmiskteplomerezha" applies the data produced by gas-supplying organization on the basis of the certificates of physicochemical parameters. Certificates shall be issued monthly and contain as many values of the lower heating value as it was changed. The lower heating value of natural gas applied for calculation of baseline was estimated as average value of data for 2004.

Calculation of CO_2 conversion factors:

Conversion factor = LHV(lower heating value) * Cef (Carbon emission factor)

Proceeds from 1000 m^3 of natural gas = 33,76 [MJ/m^3]*0,0561 [$KtCO_2/TJ$] = 1,893 t CO_2

Calculation of activities level

Activities level is represented by annual consumption of fuel. 2004 was taken for calculation of the Baseline. This year was one of the typical years both as regards external temperature within heating season and heat energy production and consumption. Consumption of natural gas in base year is given in the Table 8.

Municipal commercial enterprise "Donetskmiskteplomerezha"	Baseline consumption of natural gas, thous. Nm^3/year
Boiler-houses of Municipal commercial enterprise "Donetskmiskteplomerezha"	67380

Table 8. Baseline fuel consumption

Detailed information is presented in Appendix 4.

Calculation of basic carbon emissions

There are two types of GHG emissions included into baseline:

1) GHG emissions of boilers operated by the heat supply system of Municipal commercial enterprise "Donetskmiskteplomerezha" due to historical consumption of fuel in base year 2004.
2) GHG emissions as a result of electric energy production for national electrical grid, consumed by boiler-houses and heat supply stations

Ukraine has united state power grid, therefore average value of Carbon Emission Factor (CEF) is applied for electric power generation.

Carbon Emission Factors (CEF) for 2003-2005 were taken from Table 8 «Basic Carbon Emission Factors for JI projects, decreasing electric energy consumption" of the operational Directive for design document of JI Project (ERUPT 4, Senter, The Netherlands).

Type of project	2003	2004	2005
JI project (electric energy consumption reduction), CEF (tCO_2e/MW*hour)	0,936	0,916	0,896

Table 9. Carbon emission factor (CEF) for Ukrainian national electrical grid, 2006-2012

Carbon Emission Factors (CEF) for 2006-2012 were taken from Table 8 «Emission Factors for Ukrainian electrical grid» from the document «Ukraine – estimation of new CEF calculation», verified by TUV SUD Industrie Service GmbH on 17.08.2007[10].

If other carbon emission factors will be taken for Ukrainian electrical grids, the baseline shall be recalculated for any reporting year according to the monitoring plan (see Section D.1).

Calculation of total annual baseline carbon emissions, which would occur during typical heating season if the heat supply system in Donetsk city remains unchanged, are given in Appendixes 4 (Baseline). They consist of accurate amount of total CO_2 emissions, which would occur during base year (2004), and additional emissions, which will be decreased after energy-saving measures implementation.

Key information for baseline determination is stated in the tables given below.

Data/Parameter	**EF**
Data unit	t CO_2/ t. kWh
Description	Carbon emission factor for Ukrainian electrical grid
Time of determination/monitoring	Once per year
Source of data (to be) used	Research data of Global Carbon B.V.[11]
Value of data applied (for ex ante calculations/determinations)	0,896
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	N/A
Any comment	Researches don't take into consideration production of energy by nuclear power plants

Data/Parameter	**B_b**
Data unit	1000 m^3
Description	Natural gas consumption by boiler-houses, base year
Time of determination/monitoring	daily
Source of data (to be) used	Each boiler-house
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Measurements are taken by gas meters

[10] http://www.encon.sumdu.edu.ua/doc/methodics/emission%20factor%20for%20the%20Ukrainian%20grid.pdf

[11] *Guidance "Standardized emission factors for Ukrainian electrical grid" (version 5, February 02 2007), executed by Global Carbon B.V.*

QA/QC procedures (to be) applied	Equipment is calibrated and inspected according to the quality management procedures "On metrology and metrological activity" [12]
Any comment	Fuel consumption by the boiler-houses is the basic data allowing calculation of GHG emissions in base year ; information shall be archived in paper and electronic form.

Data/Parameter	**LHV_b**
Data unit	MJ/m^3
Description	Heat value of natural gas calculated on the basis of the lower heating value, base year
Time of determination/monitoring	monthly
Source of data (to be) used	Supplier's report or analytical report of chemical laboratory
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	Laboratory is reliable source of the information
Any comment	Data allowing calculation of GHG emissions in base year; information shall be archived in paper and electronic form.

Data/Parameter	**$T_{out, b}$**
Data unit	^0C
Description	Daily external temperature during heating season , base year
Time of determination/monitoring	Once per reporting period. Daily temperature shall be registered every day.
Source of data (to be) used	Report of metrological service
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	Metrological service is reliable source of the information
Any comment	External temperature is the basic data allowing adjustment of baseline; information shall be archived in paper and electronic form

Data/Parameter	**$T_{out, r}$**

[12] http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=1765-15

Data unit	^{0}C
Description	Daily external temperature during heating season, project year
Time of determination/monitoring	Once per reporting period. Daily temperature shall be registered every day.
Source of data (to be) used	Report of metrological service
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	Metrological service is reliable source of the information
Any comment	External temperature is the basic data allowing adjustment of baseline; information shall be archived in paper and electronic form

Data/Parameter	$\mathbf{T_{in, b}}$
Data unit	^{0}C
Description	Average internal temperature during heating season, base year
Time of determination/monitoring	Once per heating season
Source of data (to be) used	Municipal commercial enterprise "Donetskmiskteplomerezha" Average internal temperature will be calculated on the basis of repaid sums caused by insufficient heating (if the standard level is not achieved)
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	Municipal commercial enterprise "Donetskmiskteplomerezha" is reliable source of the information
Any comment	Temperature inside the premises is the basic data allowing adjustment of baseline; information shall be archived in paper and electronic form

Data/Parameter	$\mathbf{T_{in, r}}$
Data unit	^{0}C
Description	Average internal temperature during heating season, project year
Time of determination/monitoring	Once per heating season
Source of data (to be) used	Municipal commercial enterprise "Donetskmiskteplomerezha" Average internal temperature will be calculated on the basis of repaid sums caused by insufficient heating (if the standard level is not achieved)

Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	Municipal commercial enterprise "Donetskmiskteplomerezha" is reliable source of the information
Any comment	Temperature inside the premises is the basic data allowing adjustment of baseline; information shall be archived in paper and electronic form

Data/Parameter	$\mathbf{n_{w,\,b}}$
Data unit	thous. persons
Description	Quantity of consumers, base year
Time of determination/monitoring	Once per year
Source of data (to be) used	Special report produced by Municipal commercial enterprise "Donetskmiskteplomerezha"
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	Municipal commercial enterprise "Donetskmiskteplomerezha" is reliable source of the information
Any comment	Auxiliary data allowing adjustment of baseline; information shall be archived in paper and electronic form

Data/Parameter	$\mathbf{n_{w,\,r}}$
Data unit	thous. persons
Description	Quantity of consumers, project year
Time of determination/monitoring	Once per year
Source of data (to be) used	Report produced by Municipal commercial enterprise "Donetskmiskteplomerezha"
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A

QA/QC procedures (to be) applied	Municipal commercial enterprise "Donetskmiskteplomerezha" is reliable source of the information
Any comment	Auxiliary data allowing adjustment of baseline; information shall be archived in paper and electronic form

Data/Parameter	**$F_{h, b}$**
Data unit	m^2
Description	Total Heating area , base year
Time of determination/monitoring	Once per year
Source of data (to be) used	Report produced by Municipal commercial enterprise "Donetskmiskteplomerezha"
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	Municipal commercial enterprise "Donetskmiskteplomerezha" is reliable source of the information
Any comment	Auxiliary data allowing adjustment of baseline; information shall be archived in paper and electronic form

Data/Parameter	**$F_{h, r}$**
Data unit	m^2
Description	Total Heating area , project year
Time of determination/monitoring	Once per year
Source of data (to be) used	Report produced by Municipal commercial enterprise "Donetskmiskteplomerezha"
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	Municipal commercial enterprise "Donetskmiskteplomerezha" is reliable source of the information
Any comment	Auxiliary data allowing adjustment of baseline; information shall be archived in paper and electronic form

Data/Parameter	**$k_{h, b}$**
Data unit	W/m^2*K
Description	Average heat-transfer factor of the buildings, base year
Time of determination/monitoring	Once per year

Source of data (to be) used	Report produced by Municipal commercial enterprise "Donetskmiskteplomerezha"
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	Municipal commercial enterprise "Donetskmiskteplomerezha" is reliable source of the information
Any comment	Auxiliary data allowing adjustment of baseline; information shall be archived in paper and electronic form

Data/Parameter	$\mathbf{F_{h,\,t,\,r}}$
Data unit	m^2
Description	Heating area of buildings (existed in base year) with improved heat insulation, project year
Time of determination/monitoring	Once per year
Source of data (to be) used	Report produced by Municipal commercial enterprise "Donetskmiskteplomerezha"
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	Municipal commercial enterprise "Donetskmiskteplomerezha" is reliable source of the information
Any comment	Auxiliary data allowing adjustment of baseline; information shall be archived in paper and electronic form

Data/Parameter	$\mathbf{F_{h,\,n,\,r}}$
Data unit	m^2
Description	Heating area of new buildings connected to the heat supply system (it is conceded that such buildings have new improved heat insulation), project year
Time of determination/monitoring	Once per year
Source of data (to be) used	Report produced by Municipal commercial enterprise "Donetskmiskteplomerezha"
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and	N/A

procedures (to be) applied	
QA/QC procedures (to be) applied	Municipal commercial enterprise "Donetskmiskteplomerezha" is reliable source of the information
Any comment	Auxiliary data allowing adjustment of baseline; information shall be archived in paper and electronic form

Data/Parameter	$\mathbf{k_{h,\,n}}$
Data unit	W/m^2*K
Description	Average heat transfer factor of the buildings with new thermal insulation
Time of determination/monitoring	Once per year
Source of data (to be) used	State Building Standards (B.2.6-31:2006)
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	Municipal commercial enterprise "Donetskmiskteplomerezha" is reliable source of the information
Any comment	Auxiliary data allowing adjustment of baseline; information shall be archived in paper and electronic form

Data/Parameter	$\mathbf{N_{h,\,b}}$
Data unit	hour
Description	Duration of heating period, base year
Time of determination/monitoring	Once per year
Source of data (to be) used	Report produced by Municipal commercial enterprise "Donetskmiskteplomerezha"
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	Municipal commercial enterprise "Donetskmiskteplomerezha" is reliable source of the information
Any comment	Auxiliary data allowing adjustment of baseline; information shall be archived in paper and electronic form

Data/Parameter	$N_{h, r}$
Data unit	hour
Description	Duration of heating period, project year
Time of determination/monitoring	Once per year
Source of data (to be) used	Report produced by Municipal commercial enterprise "Donetskmiskteplomerezha"
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	Municipal commercial enterprise "Donetskmiskteplomerezha" is reliable source of the information
Any comment	Auxiliary data allowing adjustment of baseline; information shall be archived in paper and electronic form

Data/Parameter	$L_{h, b}$
Data unit	MW
Description	Maximal connected load for heating services, base year
Time of determination/monitoring	Once per year
Source of data (to be) used	Report produced by Municipal commercial enterprise "Donetskmiskteplomerezha"
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	Municipal commercial enterprise "Donetskmiskteplomerezha" is reliable source of the information
Any comment	Auxiliary data allowing adjustment of baseline; information shall be archived in paper and electronic form

Data/Parameter	$L_{h, r}$
Data unit	MW
Description	Maximal connected load for heating services, project year
Time of determination/monitoring	Once per year
Source of data (to be) used	Report produced by Municipal commercial enterprise "Donetskmiskteplomerezha"
Value of data applied	N/A

(for ex ante calculations/determinations)	
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	Municipal commercial enterprise "Donetskmiskteplomerezha" is reliable source of the information
Any comment	Auxiliary data allowing adjustment of baseline; information shall be archived in paper and electronic form

Data/Parameter	**$L_{w, b}$**
Data unit	MW
Description	Maximal connected load for hot water supply, base year
Time of determination/monitoring	Once per year
Source of data (to be) used	Report produced by Municipal commercial enterprise "Donetskmiskteplomerezha"
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	Municipal commercial enterprise "Donetskmiskteplomerezha" is reliable source of the information
Any comment	Auxiliary data allowing adjustment of baseline; information shall be archived in paper and electronic form

Data/Parameter	**$L_{w, r}$**
Data unit	MW
Description	Maximal connected load for hot water supply, project year
Time of determination/monitoring	Once per year
Source of data (to be) used	Report produced by Municipal commercial enterprise "Donetskmiskteplomerezha"
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	Municipal commercial enterprise "Donetskmiskteplomerezha" is reliable source of the information

Any comment	Auxiliary data allowing adjustment of baseline; information shall be archived in paper and electronic form

Data/Parameter	$v_{w, r}$
Data unit	kWh /h
Description	Standard specific discharge of hot water at personal account, project year
Time of determination/monitoring	Once per year
Source of data (to be) used	Report produced by Municipal commercial enterprise "Donetskmiskteplomerezha"
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	Municipal commercial enterprise "Donetskmiskteplomerezha" is reliable source of the information
Any comment	Auxiliary data allowing adjustment of baseline; information shall be archived in paper and electronic form

Data/Parameter	$v_{w, b}$
Data unit	kWh/h
Description	Standard specific discharge of hot water at personal account, base year
Time of determination/monitoring	Once per year
Source of data (to be) used	Report produced by Municipal commercial enterprise "Donetskmiskteplomerezha"
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	Municipal commercial enterprise "Donetskmiskteplomerezha" is reliable source of the information
Any comment	Auxiliary data allowing adjustment of baseline; information shall be archived in paper and electronic form

Data/Parameter	**Cef**
Data unit	Kt CO_2/TJ
Description	CO_2 emission factor, project year

Time of determination/monitoring	Once, at the beginning of the project
Source of data (to be) used	Intergovernmental Panel on Climate Change, IPCC, 2006 Volume 2, Table 2.2, page 2.17
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	IPCC is reliable source of the information
Any comment	Auxiliary data allowing adjustment of baseline; information shall be archived in paper and electronic form

Data/Parameter	**g**
Data unit	%
Description	Conversion factor for average load within heating period
Time of determination/monitoring	Once per year
Source of data (to be) used	Report produced by Municipal commercial enterprise "Donetskmiskteplomerezha"
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	Municipal commercial enterprise "Donetskmiskteplomerezha" is reliable source of the information
Any comment	Auxiliary data allowing adjustment of baseline; information shall be archived in paper and electronic form

Data/Parameter	**P_b**
Data unit	MWh
Description	Electric energy consumption, base year
Time of determination/monitoring	monthly
Source of data (to be) used	Readings of electricity supply meters installed in boiler-houses
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A

QA/QC procedures (to be) applied	Equipment is calibrated and inspected according to the quality management procedures "On metrology and metrological activity" [13]
Any comment	Data allowing calculation of GHG emissions in base year; information shall be archived in paper and electronic form

B.2. Description of how the anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the small-scale project:

Anthropogenic emissions of greenhouse gases in project scenario will be decreased due to complex modernization of heat-generating and heat-distribution equipment by introduction of technologies proposed in project activity and described above, which include replacement of old boilers by new higher effective boilers, frequency controllers installation and rehabilitation of old heat-distribution systems with application of pre-insulated pipes.

Additionality of the project

The additionality of the project activity is demonstrated and estimated using the specific approach for "Tool for the demonstration and assessment of additionality" [14] (Version 05.2). This manual was elaborated in original for CDM projects, but it may be also applied for JI projects. This tool was applied according to the operating instructions proposed in partially similar methodology "Baseline and monitoring methodology AM0044 (version 01)".

Step 1. Identification of alternatives to the project activity and their conformity with current laws and regulations

Sub-step 1a: Define alternatives to the project activity:

There are three alternative variants of this project (which has been already discussed in Section B.1)

1. The first alternative is continuation of existing situation (there is no project activity or other alternatives), i.e. scenario "business as usual" with implementation of minimal repair works against the background of total degradation of heat supply system.

It should be noted that there is no local legislation in relation to the period of boiler's replacement and their maximal period of operation. Customary practice is exploitation of boilers installed in the seventies and even sixties-fifties and earlier, if they underwent technical examination of the authorized body (State Inspectorate of Labor Protection).

2. The second alternative is rehabilitation (proposed project activity) without application of Joint Implementation mechanism.

3. Third alternative is reduction of project activity, exclusion of any non-key arrangements from project, for example, exclusion of frequency regulation implementation from the project, etc.

Outcome of Step 1a: Three realistic alternative scenarios to the project activity are identified.

Sub-step 1b: Consistency with mandatory laws and regulations:

[13] http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=1765-15

[14] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v5.2.pdf

According to the Ukrainian Law "On licensing of certain types of activities"[15] No.1775-III as of June 01, 2000 and «On heat supply»[16] No. 2633-IV as of June 02, 2005; Decree of the Cabinet of Ministers of Ukraine «On making amendments in the decrees of the Cabinet of Ministers No.1698 dated November 14, 2000 and No.756 as of July 04, 2001» No.549 as of April 19, 2006 and «On approval of licensing authorities» No.1698 as of November 14, 2000, business activity as to production and transportation by the principal and local heat-distribution networks and heat supply shall be licensed by the Ministry of housing and communal services of Ukraine.

Municipal commercial enterprise "Donetskmiskteplomerezha" has such licenses.

Project «Rehabilitation of the District Heating System in Donetsk City» was prepared according to the Ukrainian Law "On heat supply" No.74/94-VR as of July 01, 1994 and No.3260- IV as of December 22, 2005 year «On making amendments in Ukrainian Law about heat supply».
At the same time alternative scenarios, namely scenario "business as usual", rehabilitation without JI mechanisms application and exclusion of any non-key arrangements from the project shall be agreed with compulsory laws and decrees.

Outcome of Step 1b: Alternative scenarios, namely scenario "business as usual", rehabilitation without JI mechanisms application and exclusion of any non-key arrangements from the project shall be agreed with compulsory laws and decrees

Hence, the Step 1 is satisfied.

Step 2. Investment analysis.

Sub-step 2a: Determine appropriate analysis method

In connection with applicable Procedure of setting prices for production, transportation and supply of heat energy and centralized heating and hot water supply[17], reduction of expenses as to fuel for heat energy production will not bring in return to the enterprise, since according to this Procedure reduction of expenses for fuel results in decrease of prices for end consumers. Thus the enterprise doesn't obtain additional revenue, and reduction of expenses for fuel results in decrease of enterprise's revenue due to rate reduction.
Currently effective Procedure of setting prices for production, transportation and supply of heat energy and centralized heating and hot water supply approved by the National Committee of Energy Market Regulation doesn't allow deriving benefit from reduction of natural gas consumption. The whole economic burden related to natural gas consumption is placed on end consumer of the heat energy.
The following steps have been done according to the additionality tools of the CDM Executive Committee "Tool for the demonstration and assessment of additionality[18]" (revision 05.2).

Sub-step 2b: Option I. Apply simple cost analysis

Project implementation will require costs in addition to existing costs for rehabilitation of heat supply system in Donetsk city. Additional costs of Project implementation include the costs of: purchase of new boiler equipment, rehabilitation of existing boilers, replacement of pumping equipment, installation of new heat recovery units, personnel training, maintenance control, systematic data collection, etc. Expenses on implementation and realization of the project "Rehabilitation of the District Heating System in Donetsk City" by Municipal commercial enterprise "Donetskmiskteplomerezha" are:

[15] http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=1775-14
[16] http://zakon.nau.ua/doc/?uid=1088.850.2&nobreak=1
[17] «Procedure of setting prices for production, transportation and supply of heat energy and centralized heating and hot water supply», Decree of the Cabinet of Ministers of Ukraine as of July 10, 2006 No. 955

[18] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v5.2.pdf

- Cost of materials to rehabilitate boilers, 2050954 Euro;
- Cost of works related to replacement of heating system, 2086146 Euro;
- Consulting, other actions, 465000 Euro;
- Other expenses, 232000 Euro.

In total 4834100 Euro will be spent under the project.

Equipment used in this project is the best in the context of Efficiency Factor, quality of execution and applied technical solutions among the materials and equipment available on Ukrainian market. Important parameter of equipment selection was availability of spare parts in Ukraine.
As a result of actual practice all discharges of natural gas shall be borne by end consumers, and Municipal commercial enterprise "Donetskmiskteplomerezha" has not incentive to purchase and install above stated equipment.
At the moment of project's start boiler-houses of Municipal commercial enterprise "Donetskmiskteplomerezha"use old boiler equipment manufactured in the USSR.

Application of Kyoto mechanisms to this project makes these measures economically efficient and is the only way for their implementation.
Municipal commercial enterprise "Donetskmiskteplomerezha" will not receive any direct economic benefit from reduction of natural gas consumption, which is achieved during Project implementation without taking into consideration earnings due to sale of reduction units, since existing tariff system shifts all network's discharges to the end consumers of heat energy.
Since emission reduction does not bring any economic benefit to Municipal commercial enterprise "Donetskmiskteplomerezha" and this project realization doesn't bring any economic benefit to other participants of the project, except for the benefit formed under the Joint Implementation Project (JIP), we can make a conclusion that Project implementation without receiving proceeds under JI project causes obstacles for investments.

Outcome of Step 2: In connection therewith it is obvious that this project is economically unattractive without registration of the project as JI project, which proves additionality of this project.

Therefore Step 2 is satisfied.

Step 3: Barrier analysis

Sub-step 3a: Identify barriers that would prevent the implementation of the proposed CDM project activity:

Investment barriers

Additional expenses on the project realization include the costs of:

Rehabilitation of current boiler equipment;
Purchase and introduction of new boiler equipment;
Purchase and introduction of heat recovery units;
Replacement of old pumps and ventilators by new ones;
Introduction of frequency controllers.
Financial barriers are connected with the structure of existing rates for production and transportation of heat energy regulated by the state, and don't include depreciation and investment needs of heat suppliers. Such situation leads to permanent lack of funds and impossibility of timely performance of capital repair, ensuring of equipment operation, investment into modernization and development of heat supply infrastructure.

Technological barriers

1.Majority of heat supply enterprises in Ukraine conduct annual minimal repair of heat supply systems for operation assurance. In particular, those parts of pipelines and boilers are repaired, which may lead to accidents. More economically possible and realistic scenario without sale of reduction units is the baseline scenario with rather very slow rehabilitation than capital repair of heat supply systems.
Majority of proposed technologies is widely applied in Ukraine for similar JI projects. For example: replacement of boilers and heat grids with application of pre-insulated pipes and introduction of frequency regulation.
2. Efficiency of installed equipment may be less that efficiency declared by the manufacturer. Equipment may have significant defects.
3. Insufficient quantity of supplied gas. In recent years Ukraine encountered short-supply of gas from Russian Federation. Ukrainian Government tries to decrease dependence on gas supply from Russia.

Organizational barriers

Experience in JI projects implementation management including conducting of international negotiations, validation, verification, registration, monitoring, etc. is absent.

Outcome of Step 3a: Identified barriers would prevent from implementation of the proposed project activity as well as of the other alternatives - rehabilitation without JI mechanisms and reduction of project activities subject to exclusion of any non-key measures from the project.

Sub-step 3 b: Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity):

One of the alternatives is continuation of "business as usual". Since the barriers identified above directly relate to investment into modernization of heat supply system in Donetsk, Municipal commercial enterprise "Donetskmiskteplomerezha" doesn't have any obstacles for subsequent exploitation of heat supply system at previous level.

Outcome of Step 3b: Identified barriers can not impede introduction of at least one alternative scenario – continuation of «business as usual».
Therefore Step 3 is satisfied.

Step 4: Common practice analysis

Sub-step 4a. Analysis of other alternatives similar to proposed project activities

It should be noted that heat supply system of Municipal commercial enterprise "Donetskmiskteplomerezha" includes all territorial districts of Donetsk city. Municipal commercial enterprise "Donetskmiskteplomerezha"is the main enterprise in the sphere of heat supply in the city. Its share among other heat supplying enterprises is about 85%. In addition to Municipal commercial enterprise "Donetskmiskteplomerezha", Utility Company "Teplomerezha" operates on the heat supply market in the city of Donetsk. Generally, they operate small-scale local boiler-houses.
At present, in addition to this project there are at least 4 Projects of Heat Supply Systems Rehabilitation with application of JI mechanisms in Ukraine: Heat Supply Systems in Chernigiv region, Donetsk region, Autonomous Republic of Crimea and Kharkiv city. Other CDM (JI) project activity is not included into the Analysis of business-as-usual. Business-as-usual for heat supply enterprises in Ukraine without application of JI mechanisms is to implement only necessary repair of the outdated equipment,

mainly in emergency cases, but not to renew the system. It is possible to obtain additional funds for actual rehabilitation of centralized heat supply system due to application of JI constituent.

Outcome of Step 4a: Analysis demonstrated absence of similar project activity in Ukraine, without JI mechanism.

Conclusion

Taking into consideration the abovementioned one may conclude that the project is additional.

B.3. Description of how the definition of the project boundary is applied to the small-scale project:

Geographical bounds of the project coincide with territory of Donetsk city, divided into 9 administrative districts. Municipal commercial enterprise "Donetskmiskteplomerezha" is divided into 9 corresponding branches. It should be noted that heat supply systems of all territorial districts of Donetsk city are involved in project.

Sources of greenhouse gases and bounds of the project:

Project's bounds for baseline scenario are represented in black rectangle on graphic figure (Figure 5)

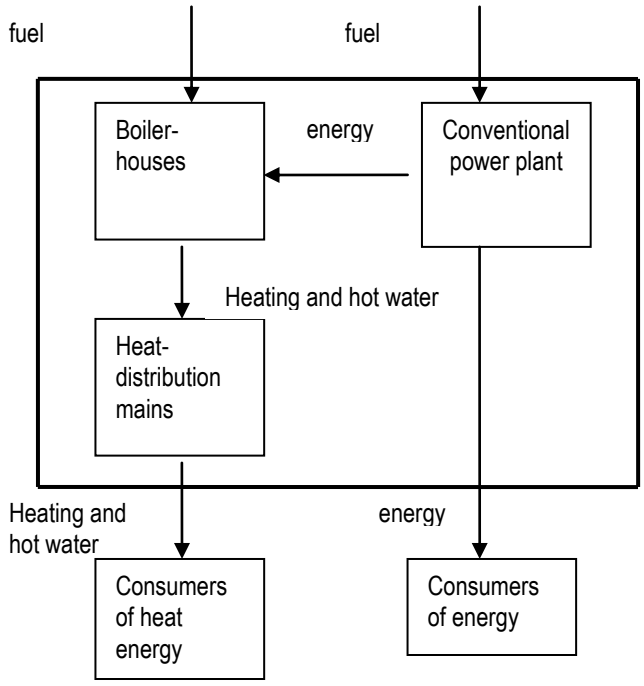

Figure 5. Scheme of the project boundaries for baseline scenario

Project boundaries for project scenario are represented in black rectangle on graphic figure (Figure 6).

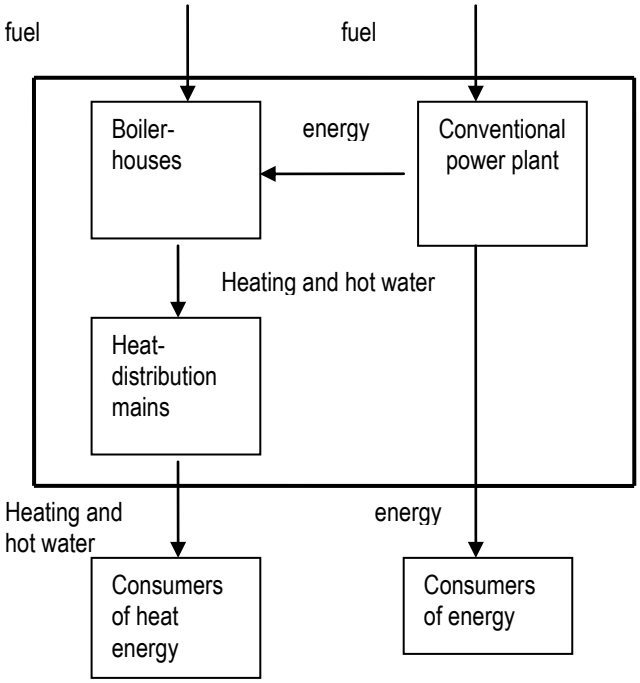

Figure 6. Scheme of the project boundaries for project scenario

As we can see from the figure, the project's boundaries for baseline scenario include GHG emissions of boiler-houses belonging to Municipal commercial enterprise "Donetskmiskteplomerezha" in the process of fuel burning for heating and hot water supply.

Project boundaries for baseline scenario also include CO_2 emissions related to electric energy production for electrical grid in the amount consumed by the boiler-houses for heat and hot water production, wherein energy-saving measures will be introduced.
Indirect external leakage of CO_2, CH_4, N_2O generated by fuel production and its transportation is excluded. Leakage is not controlled by the Municipal commercial enterprise "Donetskmiskteplomerezha" (it is impossible to estimate quantity of leakage), therefore they were excluded.

Generally the project's boundaries for project scenario are unchangeable, but load of some boiler-houses will be transferred to other boiler-houses (see Appendix1).
Table demonstrates view of all emission sources under the baseline and project scenarios.

Scenario	Source of emissions	Emissions	Included or excluded	Explanations
Local emissions				
Baseline	Emissions from power plants when generating electric energy to the national electricity grid	CO_2	Included	Main source of emissions
		CH_4	Excluded	Is not included for simplification reasons. Analysis is conservative
		N_2O	Excluded	Is not included for simplification reasons. Analysis is conservative
		NO_x	Excluded	NOx is not GHG of direct effect
		CO	Excluded	CO is not GHG of direct effect
	GHG emissions from fuel burning in boilers	CO_2	Included	Main source of emissions
		CH_4	Excluded	Is not included for simplification reasons. Analysis is conservative
		N_2O	Excluded	Is not included for simplification reasons. Analysis is conservative
		NO_x	Excluded	NOx is not GHG of direct effect
		CO	Excluded	CO is not GHG of direct effect
Baseline	Emissions from power plants when generating electric energy to the national electricity grid	CO_2	Included	Main source of emissions
		CH_4	Excluded	Is not included for simplification reasons. Analysis is conservative
		N_2O	Excluded	Is not included for simplification reasons. Analysis is conservative
		NO_x	Excluded	NOx is not GHG of direct effect
		CO	Excluded	CO is not GHG of direct effect
	GHG emissions from fuel burning in boilers	CO_2	Included	Main source of emissions
		CH_4	Excluded	Is not included for simplification reasons. Analysis is conservative
		N_2O	Excluded	Is not included for simplification reasons. Analysis is conservative
		NO_x	Excluded	NOx is not GHG of direct effect
		CO	Excluded	CO is not GHG of direct effect

Table 10. Sources of emissions included into and excluded from project boundaries

B.4. Further baseline information, including the date of baseline setting and the name(s) of the person(s)/entity(ies) setting the baseline:

Date of baseline determination: 30/09/2010
Baseline is determined by the VEMA S.A., project's developer, and Municipal commercial enterprise "Donetskmiskteplomerezha", owner of the project.

VEMA S.A.:
Kyiv, Ukraine.

Fabian Knodel,
Director.
Telephone: (+38 044 206 84 43)
Fax: (+38 044 206 84 43)
e-mail: Info-vema@gmail.com
VEMA S.A. participant of the project (stated in Annex 1).

Municipal commercial enterprise "Donetskmiskteplomerezha":
Donetsk, Ukraine.
Viktor Rogachov,
Director.
Telephone: (+38 062 305 46 33)
Fax: (+38 062 382 64 95)
e-mail dgts@teplo.dn.ua
Municipal commercial enterprise "Donetskmiskteplomerezha", participant of the project (stated in Annex 1).

SECTION C. Duration of the small-scale project / crediting period

C.1. Starting date of the small-scale project:

Start of project activity: 09/05/2004
06/02/2004: signing of the contract to the effect that Regional Utility Enterprise "Donetskteplokomunenergo" shall be the representative of Municipal commercial enterprise "Donetskmiskteplomerezha" in respect of JI project.
15/04/2004: the Agreement No. 525 was signed between Regional Utility Enterprise "Donetskteplokomunenergo" and Industrial Ecology Institute for elaboration of the JI project on GHG emissions reduction due to fuel saving when rehabilitating centralized heat supply system in Donetsk region (Regional Utility Enterprise "Donetskteplokomunenergo") and Donetsk city (Municipal commercial enterprise "Donetskmiskteplomerezha"). Name of the project is "Rehabilitation of the District Heating System in Donetsk region»[5].
09/05/2004: management bodies of Municipal commercial enterprise "Donetskmiskteplomerezha" made a decision about creation of one more JI project "Rehabilitation of the District Heating System in Donetsk ciy") with the objects uninvolved in the project "Rehabilitation of the District Heating System in Donetsk region"[5].

C.2. Expected operational lifetime of the small-scale project:

Minimum – 20 years/240 months (nominal operational lifetime of new equipment for boilers and heat grids). Real average life-cycle of new equipment for boilers and heat grids shall be 30-40 years. Thus expected life-cycle of the project shall be over 30 years. Following the principle of conservatism, we will take the life-cycle and corresponding crediting period for further calculations equal to 20 years/240 months (2005-2024).

C.3. Length of the crediting period:

Credited starting date was January 1, 2005. The end date of the crediting period is December 31, 2012. Therefore, length of the crediting period will make 7 years/84 months. If after the first period of commitments under Kyoto Protocol its validity is prolonged, crediting period under the project will be prolonged to December 31, 2025. Taking into account the period preceding the crediting period, the crediting period and the period after its expiration, the total crediting period will make 20 years/240 months.

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

Verification of emission reduction units and baseline scenario
The proposed Project uses a specific approach for joint implementation projects (specific monitoring plan applied in this project was used in JI project "Rehabilitation of Heat Supply Systems in Kharkiv city")[19]: for any project year the baseline scenario may differ due to influence of external factors, such as weather conditions, change of the lower heating value of the fuel, quantity of consumers, etc. We will adjust the Baseline and quantity of Emission Reduction Units for all project years subject to all these factors.

Indicator of project's implementation
The most objective and cumulative factor demonstrating whether the emissions reduction occurred actually, is fuel saving. It may be determined as the difference between basic consumption of fuel and fuel consumption after project's implementation. If boilers consume fuel on project level, then all other indicators, such as efficiency of new boilers' and burners' operation, heat loss at heat distribution networks, shall be corresponding.

Verification of project performance indicators
Municipal commercial enterprise "Donetskmiskteplomerezha"collects and keeps the data relating to fuel acquired for heating in the form of fuel bills. Information about saved fuel will be attached to the verification reports annually with all corresponding documents and historical information about fuel purchase by the Supplier.

We will apply the following methodological approach.

Quantity of emission reduction units (ERUs), t CO_2e:

$$ERU = \sum[E_{i,\,b} - E_{i,\,r}] \quad (1)$$

Sum of all boiler-houses (i), involved in project.

$$E_{i,\,b} = E_{1i,\,b} + E_{cons\ i,\,b}, \quad (2)$$
$$E_{i,\,r} = E_{1i,\,r} + E_{cons\ i,\,r}, \quad (3)$$

where:
$E_{1i,\,b}$ and $E_{1i,\,r}$ –CO_2 emissions due to fuel consumption for heating and hot water supply to (i) boiler-houses in basic and reporting years correspondingly, t CO_2e;
$E_{cons\ i,\,b}$ and $E_{cons\ i,\,r}$ – CO_2 emissions due to electric energy consumption from network by the boiler-house (i) in basic and reporting years correspondingly, t CO_2e.

[$_i$] index – boiler-house;
[$_b$] index – relates to base year;
[$_r$] index – relates to reporting year.

For each boiler-house:

[19] http://ji.unfccc.int/JIITLProject/DB/D2ZYZ533L116F3KQUPMM1N5HR3FT7S/details

$E_{1,\,b} = LHV_b * Cef * B_b$ (4)

$E_{1,\,r} = LHV_r * Cef * B_r$ (5)

$E_{cons\ b} = P_b * CEF$ (6)

$E_{cons\ r} = P_r * CEF$ (7)

where:
LHV – the lower heating value in basic and project, MJ/m^3 (MJ/kg);
Cef – CO_2 emission factor, $KtCO_2$/TJ;
B_b – basic quantity of consumed fuel, 1000 m^3 or tons;
B_r – project quantity of consumed fuel, 1000 m^3 or tons;
CEF – Carbon emission factor in the course of electric energy production in Ukraine, t CO_2e/MW.
P_b – basic consumption of electric energy by the boiler-houses, wherein energy-saving technologies are planned to be implemented, MW*hour;
P_r – project consumption of electric energy by the boiler-houses, wherein energy-saving technologies are implemented, MW*hour;
[$_b$] index – relates to base year;
[$_r$] index – relates to reporting year.

According to the assumption of Dynamic Baseline, value of $E_1^{\,b}$ may be various:

$E_{1i,\,b} = E_{hi,\,b}, + E_{wi,\,b}$; (8)
where the first value describes the emissions due to fuel consumption for heating, and the second value represents fuel consumption for hot water supply.

If there was hot water supply in base year (regardless of service duration, $(1-a_b) \neq 0$), the following formula for $E_{1,\,b}$ shall be applied:

$E_{1,\,b} = LHV_b * Cef * [B_b * a_b * K_1 * K_h + B_b * (1-a_b) * K_1 * K_w]$, (9)
where the first value within brackets describes fuel consumption for heating, and the second value represents fuel consumption for hot water supply

If there was not hot water supply in base year ($(1-a_b) = 0$) at all, and such service appeared in reporting year (owing to improvement of hot water supply to population), the following formula for $E_1^{\,b}$ shall be applied:

$E_{1,\,b} = LHV_b * Cef * [B_b * a_b * K_1 * K_h + B_r * (1-a_r) * K_1 * K_{w0}]$ (10)

$E_{1,\,r} = LHV_r * Cef * B_r$ (11)

where:
LHV – the lower heating value, MJ/m^3 (MJ/kg);
Cef – t CO_2 emission factor, $KtCO_2$/TJ;
B_b – basic quantity of consumed fuel, 1000 m^3 or tons;
B_r – project quantity of consumed fuel, 1000 m^3 or tons;
K_1, K_h, K_w, K_{w0} – adjusting factors;
a – share of fuel (heat) consumed for heating;
(1-a) – share of fuel (heat) consumed for hot water supply;
[$_b$] index – relates to base year;
[$_r$] index – relates to reporting year.

$a_b = L_{h,\,b} * g * N_{h,\,b} / (L_{h,\,b} * g * N_{h,\,b} + L_{w,\,b} * N_{w,\,b})$; (12)

$a_r = L_{h,r} * g * N_{h,r} / (L_{h,r} * g * N_{h,r} + L_{w,r} * N_{w,r})$, (13)

where:
L_h, L_w – maximal load for rendering services as to heating and hot water supply, MW;
g – conversion factor for average heating load during the heating period (shall be determined for each boiler-house on historical basis (usually 0.4-0.8);
N_h, N_w – duration of heating period and hot water supply period per annum, hour;
[$_h$] index – heating;
[$_w$] index – hot water supply;
[$_b$] index – relates to base year;
[$_r$] index – relates to reporting year.

Adjusting factors:

1. K_1 (Factor of the lower heating value change):

$K_1 = LHV_b / LHV_r$ (14)

2. Adjusting factor for heating shall be applied for development of Dynamic Baseline, taking into account all external factors, such as weather conditions, Heating area , etc.

Quantity of fuel consumed for heating is proportional to required heat for heating period, Q_h:

$B_h = B * a = Q_h / LHV * \eta_h$, (15)

where η - total effectiveness of boiler-house.

According to the assumptions as to Dynamic baseline required heat in base year for correct comparison shall be reduced to actual conditions (external conditions of the project) of reporting year:

$Q_{h,b,r} = Q_{h,b} * K_h = Q_{h,r}$ (16)

where:
$Q_{h,b,r}$ – necessary heat for Dynamic baseline; it is conceded to be equal to Q_r – necessary heat for reporting year
$Q_{h,b}$ – necessary heat for base year,
K_h – average adjusting factor for heating.
[$_h$] index – heating;
[$_w$] index – hot water supply;
[$_b$] index – relates to base year;
[$_r$] index – relates to reporting year.

Average adjusting factor may be determined on the basis of such equality:
$K_h = Q_{h\,r} / Q_{h\,b.}$ (17)

Required heat for buildings' heating within the year, according to the "Norms and instructions of fuel and heat energy losses rate setting for heating of dwelling and civil buildings, as well as social needs in Ukraine. KTM 204 Ukraine 244-94"[20], (formula 2.17]:

$Q_h = F_h * k_h * (T_{in} - T_{out}) * N_h$, (18)

[20] *Norms and instructions of rate setting for fuel and heat energy discharge for heating of dwelling and civil buildings, as well as social needs in Ukraine. KTM 204 Ukraine 244-94. Kyiv, 2001, 376 p.*

where:
Q_h – required heatof heat for heating, kW*hour;
F_h – Heating area of premises, m^2;
k_h – average heat transfer factor of the buildings, kW/m^2*K;
T_{in} – average temperature inside the premises during heating period, K (or ^0C);
T_{out} – average external temperature during heating period, K (or ^0C);
N_h – duration of heating period per annum, hour.
[$_h$] index – heating;
[$_{in}$] index – internal temperature;
[$_{out}$] index – external temperature.

Therefore:
$$K_h = (F_{h,r} * k_{h\,r}) * (T_{in,r} - T_{out,r}) * N_{h,r} / F_{h,b} * k_{h,b} * (T_{in,b} - T_{out,b}) * N_{h,b} \quad (19)$$

2.1. K_2 (temperature change factor):

$$K_2 = (T_{in,r} - T_{out,r}) / (T_{in,b} - T_{out,b}) \quad (20)$$

2.2. K_3 (Heating area and thermal insulation change factor):

$$K_3 = (F_{h,r} * k_{h,r}) / F_{h,b} * k_{h,b} = [(F_{hмr} - F_{h,t,r} - F_{h,n,r}) * k_{h,b} + (F_{h,n,r} + F_{h,t,r}) * k_{h,n}] / F_{h,b} * k_{h,b}, \quad (21)$$

where:
$F_{h,b}$ – Heating area of premises in base year, m^2;
$F_{h,r}$ – Heating area of premises in reporting year, m^2;
$F_{h,n,r}$ – Heating area of new buildings connected to the heat supply system (as assumed, with new (improved) thermal insulation) in reporting year, m^2;
$F_{h,t,r}$ – Heating area of buildings (existed in base year) with improved thermal insulation in reporting year, m^2;
$k_{h,b}$ – average heat transfer factor of the buildings in base year, kW/m^2*K;
$k_{h,r}$ – average heat transfer factor of the buildings in reporting year, kW/m^2*K;
$k_{h,n}$ – heat transfer factor of the heated buildings with new thermal insulation (new or old buildings with new thermal insulation), kW/m^2*K;
[$_h$] index – heating;
[$_{in}$] index – internal temperature;
[$_{out}$] index – external temperature.
[$_r$] index – relates to reporting year.

2.4. K_4 (Factor of heating period duration change):

$$K_4 = N_{h,r} / N_{h,b} \quad (22)$$

where:
$N_{h,b}$ – duration of heating period in base year, hour;
$N_{h,r}$ – duration of heating period in reporting year, hour.
[$_h$] index – heating;
[$_b$] index – relates to base year;
[$_r$] index – relates to reporting year.

Thus,

$$K_h = K_2 * K_3 * K_4 \quad (23)$$

3. Adjusting factor for hot water supply shall be used for development of Dynamic Baseline taking into account all external factors, such as weather conditions, quantity of consumers, etc.

Quantity of fuel consumed for hot water supply is proportional to required heat for the period of such service rendering, Q_w:

$$B_w = B*(1-a) = Q_w / LHV*\eta_w, \quad (24)$$

where η - general efficiency of the hot water supply system.

According to the assumptions as to Dynamic baseline required heat of heat in base year for hot water supply (for correct comparison) shall be reduced to actual conditions (external conditions of the project) of reporting year:

$$Q_{w\,b,\,r} = Q_{w,\,b}*K_w = Q_{w,\,r} \quad (25)$$

where:
$Q_{w,\,b,\,r}$ – heat necessary for hot water supply as to Dynamic baseline; it is conceded to be equal to $Q_{w\ \ r}$ – heat necessary for hot water supply in reporting year
$Q_{w,\,b}$ – heat necessary for hot water supply in base year,
K_w – average adjusting factor for hot water supply.
[$_h$] index – heating;
[$_w$] index – hot water supply;
[$_b$] index – relates to base year;
[$_r$] index – relates to reporting year.

Average adjusting factor may be determined on the basis of such equality:

$$K_w = Q_{w,\,r} / Q_{w,\,b.} \quad (26)$$

Component K_w may be determined by the correlation of heat consumed for hot water supply in basic and reporting years:

$$Q_w = n_w*v_w*N_w, \quad (27)$$

where:
Q_w – heat necessary for hot water supply, kW*hour;
n_w – average quantity of consumers, personal accounts;
v_w – standard specific discharge of hot water for personal account (in heat units, kW*hour/hour);
N_w – duration of service rendering per annum, hour.
[$_w$] index – hot water supply.

Thus:
$$K_w = n_{w,\,r}*v_{w,\,r}*N_{w,\,r} / n_{w,\,b}*v_{w,\,b}*N_{w,\,b} \quad (28)$$

3.1. K_5 (Factor of change of consumers' quantity):

$$K_5 = n_{w,\,r} / n_{w,\,b} \quad (29)$$

3.2. K_6 (Factor of change of standard specific discharge of hot water for personal account):

$$K_6 = v_{w,\,r} / v_{w,\,b} \quad (30)$$

At present such standard specific discharge of hot water is effective, which was proposed in KTM 204 Ukraine 244-94[1] in 1993. There is no any information about any changes, therefore $K_6 = 1$ and is not subject to special monitoring.

3.3. K_7 (Factor of change of the duration of hot water supply period):

$$K_7 = N_{w,r} / N_{w,b} \quad (31)$$

where:
$N_{w\,b}$ – duration of the hot water supply period in base year, hour;
$N_{w\,r}$ – duration of the hot water supply period in reporting year, hour.
[$_w$] index – hot water supply;
[$_b$] index – relates to base year;
[$_r$] index – relates to reporting year.

Thus,

$$K_w = K_5 * K_6 * K_7. \quad (32)$$

3.4. Adjusting factor for hot water supply in case, if such service has not been rendered in base year, but was provided in reporting year:

If there was not hot water supply service in base year, values of quantity of consumers, standard specific discharge of hot water, duration of hot water supply period in base year shall be equal to corresponding values in reporting year,

$K_5 = K_6 = K_7 = 1$.

Therefore

$K_{wo} = 1$.

D.2. Data to be monitored:

Data to be checked in section D.1 for monitoring in order to estimate GHG emission reductions for baseline and project scenarios. The following tables contain the data, which will be collected for monitoring of project emission reductions and such data will be archived.

Data/Parameter	**B_r**
Data unit	1000 m^3
Description	Natural gas consumption by boiler-houses, project year
Time of determination/monitoring	daily
Source of data (to be) used	Each boiler-house
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Measurements are executed by gas meters
QA/QC procedures (to be) applied	Equipment is calibrated and inspected according to the quality management procedures "On metrology and metrological activity".
Any comment	Fuel consumption by the boiler-houses is the basic data allowing calculation of GHG emissions in project year ; information shall be archived in paper and electronic form.

Data/Parameter	**LHV_r**
Data unit	MJ/m^3
Description	Heat value of natural gas calculated on the basis of the lower heating value, project year
Time of determination/monitoring	monthly
Source of data (to be) used	Supplier's report or analytical report of chemical laboratory
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	Laboratory is reliable source of the information
Any comment	Data allowing calculation of GHG emissions in project year; information shall be archived in paper and electronic form.

Data/Parameter	**P_r**
Data unit	MW*hour
Description	Electric energy consumption, project
Time of determination/monitoring	Monthly
Source of data (to be) used	Readings of electricity supply meters installed in boiler-houses
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	Equipment is calibrated and inspected according to the quality management procedures "On metrology and metrological activity".
Any comment	Data allowing calculation of GHG emissions in project year; information shall be archived in paper and electronic form

Data/Parameter	**EF**
Data unit	t CO_2/ t. kWh.
Description	Carbon emission factor for Ukrainian electrical grid
Time of determination/monitoring	Once per year
Source of data (to be) used	Research data of Global Carbon B.V.[21]
Value of data applied (for ex ante calculations/determinations)	0,896

[21] *Guidance "Standardized emission factors for Ukrainian electrical grid" (version 5, February 02 2007), executed by Global Carbon B.V.*

Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	N/A
Any comment	Researches don't take into consideration production of energy by nuclear power plants

Data/Parameter	$\mathbf{T_{out, r}}$
Data unit	^{0}C
Description	Daily external temperature during heating season , project year
Time of determination/monitoring	Once per reporting period. Daily temperature shall be registered every day.
Source of data (to be) used	Report of metrological service
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	Metrological service is reliable source of the information
Any comment	External temperature is the basic data allowing adjustment of baseline; information shall be archived in paper and electronic form

Data/Parameter	$\mathbf{T_{in, r}}$
Data unit	^{0}C
Description	Average internal temperature during heating season, project year
Time of determination/monitoring	Once per heating season
Source of data (to be) used	Municipal commercial enterprise Donetskmiskteplomerezha" Average internal temperature will be calculated on the basis of repaid sums caused by insufficient heating (if the standard level is not achieved)
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	Municipal commercial enterprise "Donetskmiskteplomerezha" is reliable source of the information
Any comment	Temperature inside the premises is the basic data allowing adjustment of baseline; information shall be archived in paper and electronic form

Data/Parameter	$\mathbf{n}_{w, r}$
Data unit	thous. persons
Description	Quantity of consumers, project year
Time of determination/monitoring	Once per year
Source of data (to be) used	Special report produced by Municipal commercial enterprise "Donetskmiskteplomerezha"
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	Municipal commercial enterprise "Donetskmiskteplomerezha" is reliable source of the information
Any comment	Auxiliary data allowing adjustment of baseline; information shall be archived in paper and electronic form

Data/Parameter	$\mathbf{F}_{h, r}$
Data unit	m^2
Description	Total Heating area , project year
Time of determination/monitoring	Once per year
Source of data (to be) used	Report produced by Municipal commercial enterprise "Donetskmiskteplomerezha"
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	Municipal commercial enterprise "Donetskmiskteplomerezha" is reliable source of the information
Any comment	Auxiliary data allowing adjustment of baseline; information shall be archived in paper and electronic form

Data/Parameter	$\mathbf{F}_{h, t, r}$
Data unit	m^2
Description	Heating area of buildings (existed in base year) with improved heat insulation, project year
Time of determination/monitoring	Once per year
Source of data (to be) used	Report produced by Municipal commercial enterprise "Donetskmiskteplomerezha"
Value of data applied (for ex ante	N/A

calculations/determinations)	
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	Municipal commercial enterprise "Donetskmiskteplomerezha" is reliable source of the information
Any comment	Auxiliary data allowing adjustment of baseline; information shall be archived in paper and electronic form

Data/Parameter	$\mathbf{F_{h, n, r}}$
Data unit	m^2
Description	Heating area of new buildings connected to the heat supply system (it is conceded that such buildings have new improved heat insulation), project year
Time of determination/monitoring	Once per year
Source of data (to be) used	Report produced by Municipal commercial enterprise "Donetskmiskteplomerezha"
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	Municipal commercial enterprise "Donetskmiskteplomerezha" is reliable source of the information
Any comment	Auxiliary data allowing adjustment of baseline; information shall be archived in paper and electronic form

Data/Parameter	$\mathbf{k_{h, n}}$
Data unit	W/m^2*K
Description	Heat-transfer factor of the buildings with new thermal insulation
Time of determination/monitoring	Once per year
Source of data (to be) used	State Building Standards (B.2.6-31:2006)
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	Municipal commercial enterprise "Donetskmiskteplomerezha" is reliable source of the information
Any comment	Auxiliary data allowing adjustment of baseline; information shall

	be archived in paper and electronic form

Data/Parameter	**$N_{h, r}$**
Data unit	hour
Description	Duration of heating period, project year
Time of determination/monitoring	Once per year
Source of data (to be) used	Report produced by Municipal commercial enterprise "Donetskmiskteplomerezha"
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	Municipal commercial enterprise "Donetskmiskteplomerezha" is reliable source of the information
Any comment	Auxiliary data allowing adjustment of baseline; information shall be archived in paper and electronic form

Data/Parameter	**$L_{h, r}$**
Data unit	MW
Description	Maximal connected load for heating services, project year
Time of determination/monitoring	Once per year
Source of data (to be) used	Report produced by Municipal commercial enterprise "Donetskmiskteplomerezha"
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	Municipal commercial enterprise "Donetskmiskteplomerezha" is reliable source of the information
Any comment	Auxiliary data allowing adjustment of baseline; information shall be archived in paper and electronic form

Data/Parameter	**$L_{w, r}$**
Data unit	MW
Description	Maximal connected load for hot water supply, project year
Time of determination/monitoring	Once per year
Source of data (to be) used	Report produced by Municipal commercial enterprise "Donetskmiskteplomerezha"

Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	Municipal commercial enterprise "Donetskmiskteplomerezha" is reliable source of the information
Any comment	Auxiliary data allowing adjustment of baseline; information shall be archived in paper and electronic form

Data/Parameter	$\mathbf{v_{w, r}}$
Data unit	kWh /h
Description	Standard specific discharge of hot water at personal account, project year
Time of determination/monitoring	Once per year
Source of data (to be) used	Report produced by Municipal commercial enterprise "Donetskmiskteplomerezha"
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	Municipal commercial enterprise "Donetskmiskteplomerezha" is reliable source of the information
Any comment	Auxiliary data allowing adjustment of baseline; information shall be archived in paper and electronic form

Data/Parameter	**Cef**
Data unit	Kt CO_2/TJ
Description	CO_2 emission factor, project year
Time of determination/monitoring	Once, at the beginning of the project
Source of data (to be) used	Intergovernmental Panel on Climate Change, IPCC, 2006 Volume 2, Table 2.2, page 2.17[22]
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and	N/A

[22] http://unfccc.int/2860.php/

procedures (to be) applied	
QA/QC procedures (to be) applied	IPCC is reliable source of the information
Any comment	Auxiliary data allowing adjustment of baseline and project scenario; information shall be archived in paper and electronic form

Data/Parameter	**g**
Data unit	%
Description	Conversion factor for average load within heating period
Time of determination/monitoring	Once per year
Source of data (to be) used	Report produced by Municipal commercial enterprise "Donetskmiskteplomerezha"
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	Municipal commercial enterprise "Donetskmiskteplomerezha" is reliable source of the information
Any comment	Auxiliary data allowing adjustment of baseline and project scenario; information shall be archived in paper and electronic form

The enterprise also provides reports by the following official annual statistical forms:

· 2-tp (air) *Data on protection of atmospheric air*, which contains information on amounts of trapped and neutralized atmospheric pollutants, itemized emissions of specific pollutants, number of emission sources, measures on reduction of emissions into the atmosphere, emissions from particular groups of pollution sources;
2-tp (water resources) *Data on water use*, which presents information on consumption of water, discharge of waste water, and content of pollutants in it, capacity of treatment facilities, etc.;
· 2-tp (waste) *Data on formation, use, neutralization, transportation and placement of industrial and household waste*, which presents the annual balance of waste flow, by waste types and hazard classes.

D.3. Quality control (QC) and quality assurance (QA) procedures undertaken for data monitored:

D.3.1. Quality control (QC) and quality assurance (QA) procedures undertaken for data monitored:

Data *(Indicate table and ID number)*	Uncertainty level of data (high/medium/low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
B_r. Quantity of natural gas consumed by the boiler-houses	*low*	Equipment is calibrated and inspected according to the quality management procedures "On metrology and metrological activity".
P_r. Quantity of electric energy consumed by the boiler-houses.	*low*	Equipment is calibrated and inspected according to the quality management procedures "On metrology and metrological activity".
T_{out}. External temperature.	*low*	Equipment is calibrated and inspected according to the quality management procedures "On metrology and metrological activity".
LHV. Quality of fuel (the lower heating value)	*low*	Equipment is calibrated and inspected according to the quality management procedures "On metrology and metrological activity".
n_w. Quantity of consumers (heated territory).	*low*	Statistical data. Quality assurance is not required.
T_{in}. Average temperature inside the premises during the heating period	*low*	It shall be calculated on the basis of returned payments caused by poor heating (if standard values are not achieved). Quality assurance is not required.

D.4. Brief description of the operational and management structure that will be applied in implementing the monitoring plan:

Operational structure will include Supplier's (Municipal commercial enterprise "Donetskmiskteplomerezha") operational departments (repair-and-renewal operations, etc.) and personnel of boiler-house operation.
Management structure will include administration departments of the Supplier and project's specialists-developers (VEMA S.A.). Further information is provided in Annex 3.

D.5. Name of person(s)/entity(ies) establishing the monitoring plan:

VEMA S.A.:
Kyiv, Ukraine.
Vorobyov Yevgeniy Vasylyovych,
Engineer-developer of JI projects
Telephone: (+38 044 206 84 43)
Fax: (+38 044 206 84 43)
e-mail: vev@vemacarbon.com
VEMA S.A. is project participant (stated in Annex 1)

Municipal commercial enterprise "Donetskmiskteplomerezha":
Borovskyy Vadym Vyacheslavovych
Manager of production-and-technical department
Skoryk Valentyna Anatoliyivna
Engineer of production-and-technical department
Telephone: (+38 062 305 46 33)

Fax: (+38 062 382 64 95)
e-mail dgts@teplo.dn.ua
Municipal commercial enterprise “Donetskmiskteplomerezha” is project participant (stated in Annex 1)

SECTION E. Estimation of greenhouse gas emission reductions

E.1. Estimated project emissions and formulae used in the estimation:

Project emissions

In the course of PDD calculation we took into account only minimally guaranteed effect of all energy-saving measures according to the conservatism principle.

Also emission reduction as a result of introduced measures was calculated only for the next year following implementation of such measures. Actually, the result in the form of emission reduction occurs immediately after implementation of energy-saving measures in the year of rehabilitation, especially if such rehabilitation was conducted at the beginning of the year.

Project emissions from boiler-houses are the sum of actual quantity of fuel used in any reporting year (beginning from 2008), multiplied by corresponding factors of conversion. Actual quantity means the quantity subject to deducted fuel saving due to improvement of the heat supply systems' effectiveness, rehabilitation and liquidation of heat supply stations.

Project emissions consist of 2 types of GHG emissions:

$$E_r = E_{1,r} + E_{2,r} \quad (33)$$

where:

$E_{1,r}$ –CO_2 emissions from heat generating sources operated by the Supplier, t CO_2

$E_{2,r}$ – CO_2 emissions from electric energy generation to the national electricity grid, wherein the energy-saving technologies will be implemented (installed frequency regulation, pumps) , tCO_2.

$$E_{1,r} = \sum ([B_{r(i)} - V_{(i)} - Q1_{(i)}] * LHV_{(i)} * Cef) ; \quad (34)$$

where:

$E_{1,r}$ – project emissions in boiler-houses in each reporting year, t CO_2 ;

$B_{r(i)}$ – fuel consumption in project scenario (for each type of fuel), 1000 m^3 (t);

$V_{(i)}$ – fuel saving due to rehabilitation of heat supply system for each type of fuel, 1000 m^3 (t);

$Q_{1,(i)}$ – fuel saving due to rehabilitation of central heat supply station, for each type of fuel, 1000 m^3 (t);

LHV – the lower heating value in basic and project, MJ/m^3 (MJ/kg);

Cef – CO_2 emission factor, KtCO_2/TJ;

[$_i$] index – boiler-house;

[$_r$] index – relates to reporting year.

$$B_{r(i)} = [B_{b(i)} * LHV_{b(i)} * BBE_i] / [LHV_{r(i)} * PBE_i], \quad (35)$$

where:

BBE_i - Efficiency factor of boilers in base year, %;

PBE_i - Efficiency factor of boilers in project year, %;

LHV – the lower heating value in basic and project, MJ/m^3 (MJ/kg);

[$_i$] index – boiler-house;

[$_b$] index – relates to base year;

[$_r$] index – relates to reporting year.

Parameter BBEi – Efficiency Factor of boilers in base year shall be taken from regime card of each boiler.

Regime cards of boilers shall be filled in on the basis of experimental data obtained in the course adjustment works and shall be located in front of each boiler-house.

$V_{(i)} = B_{b(i)} - B_{b(i)} * (100-L_b)/(100-L_r)$, (36)
where:
$B_{b(i)}$ – fuel consumption in base year (for each type of fuel), 1000 m^3 (t);
L_b – heat loss in heat supply system in baseline scenario, %;
L_r – heat loss in heat supply system in project scenario, %.
[$_i$] index – boiler-house;
[$_b$] index – relates to base year;
[$_r$] index – relates to reporting year.

$E_{2,r} = (P_b – P_{1,r})* CEF$, (37)

where:
P_b – annual consumption of electric energy by the boiler-houses, wherein energy-saving technologies will be implemented (frequency regulation will be installed), MW*hour;
CEF – Carbon emission factor in the course of electric energy consumption decrease, t CO_2e/MW,
$P_{1,r}$ – designed saving of electric energy due to frequency regulation installation, MW*hour;
[$_i$] index – boiler-house;
[$_b$] – index – relates to base year;
[$_r$] – index – relates to reporting year.

Detailed information is given in the Appendixes 1 - 4.

Estimation of project emissions

Year	Project emissions (tCO_2 equivalent)
2005	98240
2006	94538
2007	91849
Total (tCO_2 equivalent)	284627

Table 11. Estimated project emissions for the period from January 01, 2005 to December 31, 2007

Year	Project emissions (tCO_2 equivalent)
2008	90862
2009	89890
2010	88013
2011	83201
2012	83201
Total (tCO_2 equivalent)	435167

Table 12. Estimated project emissions for the period from January 01, 2008 year to December 31, 2012

Year	Project emissions (tCO_2 equivalent)
2013	83201
2014	83201
2015	83201

2016	83201
2017	83201
2018	83201
2019	83201
2020	83201
2021	83201
2022	83201
2023	83201
2024	83201
Total (tCO_2 equivalent)	998412

Table 13. Estimated project emissions for the period from January 01, 2013 year to December 31, 2024

See Appendixes 4.

E.2. Estimated leakage and formulae used in the estimation, if applicable:

No leakage is expected.

E.3. Sum of E.1. and E.2.:

Since there will be no leakage, sum of E.1 and E.2 will be equal to E.1.

E.4. Estimated baseline emissions and formulae used in the estimation:

Baseline emissions

Baseline emissions consist of 2 types of GHG emissions:

1. GHG emissions the boilers operated by Supplier of the project
2. GHG emissions due to electric energy production for state electrical grid consumed by boiler-houses and wherein energy saving measures will be implemented, (installed frequency controllers and pumps)

In the course of PDD calculation we took into account only minimally guaranteed effect of all energy-saving measures according to the conservatism principle.
Also emission reduction as a result of introduced measures was calculated only for the next year following implementation of such measures. Actually, the result in the form of emission reduction occurs immediately after implementation of energy-saving measures in the year of rehabilitation, especially if such rehabilitation was conducted at the beginning of the year.

$$E_b = E_{1,b} + E_{2,b} \quad (38)$$

where:
$E_{1,b}$ – CO_2 emissions from heat generating sources operated by the Supplier, t CO_2;
$E_{2,b}$ – CO_2 emissions from electric energy generation to the national electricity grid, wherein the energy-saving technologies will be implemented (installed frequency regulation, pumps) , tCO_2
[$_b$] index – relates to base year.

1) emissions from heat generating sources operated by the Supplier:

$E1_b = \sum (B_{b(i)} * LHV_{b(i)} * Cef)$, (39)

where:
$B_{b(i)}$ – fuel consumption in baseline scenario (for each type of fuel), 1000 m^3 (т);
$LHV_{b(i)}$ – average lower heating value for each type of fuel, MJ/m^3 (MJ/kg);
Cef – CO_2 emission factor for natural gas, $KtCO_2/TJ$,
Detailed information is given in Appendixes 1.
[$_i$] index – boiler-house ;
[$_b$] index – relates to base year.

2) CO_2 emissions from electric energy generation to the national electricity grid, wherein the energy-saving technologies will be implemented (installed frequency regulation, pumps)

$E_{2,b} = P_b * CEF$, (40)

where:
P_b – annual consumption of electric energy by the boiler-houses, wherein energy-saving technologies will be implemented (frequency regulation will be installed), MW*hour
CEF– Carbon emission factor in the course of electric energy consumption decrease, t CO_2e/MW
[$_b$] index – relates to base year.

Estimation of baseline emissions

Years	Expected baseline emissions (tCO_2 equivalent)
2005	131464
2006	131464
2007	131464
Total (tCO_2 equivalent)	394392

Table 14. Estimated baseline emissions for the period from January 01, 2005 to December 31, 2007

Years	Expected baseline emissions (tCO_2 equivalent)
2008	131464
2009	131464
2010	131464
2011	131464
2012	131464
Total (tCO_2 equivalent)	657320

Table 15. Estimated baseline emissions for the period from January 01, 2008 to December 31, 2012

Years	Expected baseline emissions (tCO_2 equivalent)
2013	131464
2014	131464
2015	131464

2016	131464
2017	131464
2018	131464
2019	131464
2020	131464
2021	131464
2022	131464
2023	131464
2024	131464
Total (tCO_2 equivalent)	1577568

Table 16. Estimated baseline emissions for the period from January 01, 2013 to December 31, 2024

Detailed information is given in Appendixes 4.

E.5. Difference between E.4. and E.3. representing the emission reductions of the project:

Project emission reduction = Baseline emissions - (Project emissions + Estimated leakages) (41)

Years	Expected emission reductions (tCO_2 equivalent)
2005	33224
2006	36926
2007	39615
Total (tCO_2 equivalent)	109765

Table 17. Estimated emissions reductions for the period from January 01, 2005 to December 31, 2007

Years	Expected emission reductions (tCO_2 equivalent)
2008	40602
2009	41574
2010	43451
2011	48263
2012	48263
Total (tCO_2 equivalent)	222153

Table 18. Estimated emissions reductions for the period from January 01, 2008 to December 31, 2012

Years	Expected emission reductions (tCO_2 equivalent)
2013	48263
2014	48263
2015	48263

2016	48263
2017	48263
2018	48263
2019	48263
2020	48263
2021	48263
2022	48263
2023	48263
2024	48263
Total (tCO_2 equivalent)	579156

Table 19. Estimated emissions reductions for the period from January 01, 2013 to December 31, 2024

E.6. Table providing values obtained when applying formulae above:

Year	Expected project emissions (tCO_2 equivalent)	Expected leakage (tCO_2 equivalent)	Expected baseline emissions (tCO_2 equivalent)	Expected emissions reduction (tCO_2 equivalent)
2005	98240		131464	33224
2006	94538		131464	36926
2007	91849		131464	39615
Total (tCO_2 equivalent)	284627		394392	109765

Table 20. Table containing results of emission reductions estimation before the first commitment period

Year	Expected project emissions (tCO_2 equivalent)	Expected leakage (tCO_2 equivalent)	Expected baseline emissions (tCO_2 equivalent)	Expected emissions reduction (tCO_2 equivalent)
2008	90862		131464	40602
2009	89890		131464	41574
2010	88013		131464	43451
2011	83201		131464	48263
2012	83201		131464	48263
Total (tCO_2 equivalent)	435167		657320	222153

Table 21. Table containing results of emission reductions estimation during the first commitment period

Year	Expected project emissions (tCO_2 equivalent)	Expected leakage (tCO_2 equivalent)	Expected baseline emissions (tCO_2 equivalent)	Expected emissions reduction (tCO_2 equivalent)
2013	83201		131464	48263

2014	83201		131464	48263
2015	83201		131464	48263
2016	83201		131464	48263
2017	83201		131464	48263
2018	83201		131464	48263
2019	83201		131464	48263
2020	83201		131464	48263
2021	83201		131464	48263
2022	83201		131464	48263
2023	83201		131464	48263
2024	83201		131464	48263
Total (tCO_2 equivalent)	998412		1577568	579156

Table 22. Table containing results of emission reductions estimation after the first commitment period

SECTION F. Environmental impacts

F.1. Documentation on the analysis of the environmental impacts of the project, including transboundary impacts, in accordance with procedures as determined by the host Party:

According to the Ukrainian rules, the design documentation for the new building, reconstruction and technical re-equipment of industrial and civil objects must include the environmental impact assessment, the main requirements for which are listed in the State Building Norms of Ukraine A.2.2-1-2003.

Municipal commercial enterprise "Donetskmiskteplomerezha" has the necessary Environmental Impact Assessment for its activity according to Ukrainian legislation.

In general, the project "Rehabilitation of the District Heating System in Donetsk City" will have positive effect on the environment. The following clauses provide detailed information about positive effect on the environment:

1. Project implementation will make it possible to save natural gas. Natural gas is exhaustible resource, therefore its saving is of great importance;

2. Due to fuel saving and new ecological technologies of fuel burning, project's implementation will reduce emissions of SO_x, NO_x and CO as well as particulate matters (combustion co-products);

3. It is expected that as a result of improvement of heat supply system population in Donetsk city will reduce consumption of electric energy produced by electric heaters, decreasing thus emissions of CO_2, SO_x, NO_x, CO as well as particulate matters.

Requirements of Environmental Impact Assessment are given in the State Building Norms of Ukraine A.2.2-1-2003.

Municipal commercial enterprise "Donetskmiskteplomerezha" conducts necessary Environmental Impact Assessment in the course of capital rehabilitation of the objects. There is also "Technical report of pollutant emission sources inventory at Municipal commercial enterprise "Donetskmiskteplomerezha" given in Accompanying document. It was executed by Scientific-Commercial Firm "STANDART" LLC in 2007.

F.2. If environmental impacts are considered significant by the project participants or the host Party, provision of conclusions and all references to supporting documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

Impact on water medium

There is influence on water medium. Impact on water resources will be the same as in the baseline scenario. Existing technologies of heat energy production exploited at the objects of Municipal commercial enterprise "Donetskmiskteplomerezha" provide for dewage disposal to drainage network subject to compulsory chemical control. It is provided for in accordance with the Water Code of Ukraine, State Standard 28.74-82 "Hygiene Rules and Quality Control", Building Standards and Rules 4630-92 in relation to determination of maximum permissible concentration for internal water objects. There will be no discharge of sewage to surface water bodies. At present ecological situation stabilized and is in dynamic balance. Each water intake is conducted according to the EII.

Project's implementation will have positive effect. It will enable to decrease water consumption and quantity of waste waters as a result. Decrease in water consumption will be due to replacement of heat distribution networks, that in turn will decrease water leakages from the network. Decrease in waste waters will be due to rehabilitation of heat grid reducing blows and emergency areas.

Impact on air

The project implementation will have positive effect on ambient air:

1) Reduction of NO_x, SO_x, CO emissions and solid particles due to application of more environmental friendly clean technologies in boiler-houses;

2) Reduction of electric energy consumption will lead to the air pollutants emissions reduction.

3) Decrease of heat pollution of the atmosphere (due to decrease of the temperature of combustion gases);

4) Emissions reduction per unit of fuel subject to equal loading of boiler-houses.

Impact on land use.

There is no impact on the land/soil.

Relevant regulation is the sphere of land use is presented by the Land Code of Ukraine. National technological practice/standard: State Standard 17.4.1.02.-83 "Protection of Nature, Soils. Classification of chemical substances for pollution control".

Effects on biodiversity

There is no impact on biodiversity.

Waste generation, their treatment and disposal

There is waste generation, their treatment and disposal. In the process of project implementation the generation of waste will occur after assembling of physically and morally obsolete equipment, burners, pipes, etc. Also there some construction waste will be formed due to dismantling of boilers and construction of biler-houses, etc.

Utilization of old equipment will have positive effect on the environment.

According to the Ukrainian Law "On wastes»[23], (Article 17) «Obligations of business entities' activity in the sphere of wastes disposal»:

- enterprises shall produce the report about formation, collection, transportation, storage, treatment, utilization, destruction and removal of wastes.
- to ensure complete collection, appropriate storage and prevention of wastes deterioration, for utilization of which there is corresponding technology in Ukraine.

Taking into consideration premises, Municipal commercial enterprise "Donetskmiskteplomerezha" sends old equipment to the metal recycling.

[23] http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=187%2F98-%E2%F0

SECTION G. Stakeholders' comments

G.1. Information on stakeholders' comments on the project, as appropriate:

Ukrainian legislation stipulates that for every EIA there shall be a public stakeholder consultation process, where the stakeholder (public) is informed of the proposed project and invited to provide comments.
No stakeholders' comments were received.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

Organisation:	Municipal commercial enterprise "Donetskmiskteplomerezha"
Street/P.O.Box:	Postysheva Str.
Building:	68
City:	Donetsk
State/Region:	
Postal code:	83001
Country:	Ukraine
Phone:	+38(062) 305-46-33
Fax:	+38(062) 382-64-95
E-mail:	dgts@teplo.dn.ua
URL:	
Represented by:	Director
Title:	
Salutation:	
Last name:	Rogachov
Middle name:	Viktor
First name:	Sergiyovych
Department:	
Phone (direct):	+38 (062) 338-08-95
Fax (direct):	+38 (062) 304-72-56
Mobile:	
Direct e-mail:	

Organisation:	VEMA S.A.
Street/P.O.Box:	Route de Tonon
Building:	45
City:	Geneva
State/Region:	
Postal code:	PC 170 CH-1222
Country:	Switzerland
Phone:	+380 (50) 473 55 67
Fax:	
E-mail:	info@vemacarbon.com
URL:	www.emacarbon.com
Represented by:	
Title:	Director
Salutation:	
Last name:	Knodel
Middle name:	
First name:	Fabian
Department:	
Phone (direct):	
Fax (direct):	+380 (44) 206 84 43
Mobile:	
Direct e-mail:	

Annex 2

BASELINE INFORMATION

Key information for baseline determination is stated in the tables given below:

Parameter	$\mathbf{B_b}$
Unit of measurement	1000 m^3
description	Natural gas consumption by boiler-houses, base year
Source of data	each boiler-house
Comments	Fuel consumption by the boiler-houses is the basic data allowing calculation of GHG emissions in base year

Parameter	$\mathbf{LHV_b}$
Unit of measurement	MJ/m^3
description	Heat value of natural gas calculated on the basis of the lower heating value, base year
Source of data	Supplier's report or analytical report of chemical laboratory
Comments	Data allowing calculation of GHG emissions in base year

Parameter	$\mathbf{T_{out, b}}$
Unit of measurement	^0C
description	Daily external temperature during heating season , base year
Source of data	Report of metrological service
Comments	External temperature is the basic data allowing adjustment of baseline;

Parameter	$\mathbf{T_{out, r}}$
Unit of measurement	^0C
description	Daily external temperature during heating season, project year
Source of data	Report of metrological service
Comments	External temperature is the basic data allowing adjustment of baseline;

Parameter	$\mathbf{T_{in, b}}$
Unit of measurement	^0C
description	Average internal temperature during heating season, base year
Source of data	Municipal commercial enterprise "Donetskmiskteplomerezha" Average internal temperature will be calculated on the basis of repaid sums caused by insufficient heating (if the standard level is not achieved)
Comments	Temperature inside the premises is the basic data allowing adjustment of baseline

Parameter	$\mathbf{T_{in, r}}$
Unit of measurement	^0C
description	Average internal temperature during heating season, project year
Source of data	Municipal commercial enterprise "Donetskmiskteplomerezha" Average internal temperature will be calculated on the basis of repaid sums caused by insufficient heating (if the standard level is not achieved)
Comments	Temperature inside the premises is the basic data allowing adjustment of baseline

Parameter	$\mathbf{n_{w, b}}$
Unit of measurement	thous. persons
description	Quantity of consumers, base year
Source of data	Special report produced by Municipal commercial enterprise "Donetskmiskteplomerezha"
Comments	Auxiliary data allowing adjustment of baseline

Parameter	$\mathbf{n_{w, r}}$
Unit of measurement	thous. persons
description	Quantity of consumers, project year
Source of data	Special report produced by Municipal commercial enterprise "Donetskmiskteplomerezha"
Comments	Auxiliary data allowing adjustment of baseline and project scenario

Parameter	$\mathbf{F_{h, b}}$
Unit of measurement	m^2
description	Total Heating area , base year
Source of data	Special report produced by Municipal commercial enterprise "Donetskmiskteplomerezha"
Comments	Auxiliary data allowing adjustment of baseline

Parameter	$\mathbf{F_{h, r}}$
Unit of measurement	m^2
description	Total Heating area , project year
Source of data	Special report produced by Municipal commercial enterprise "Donetskmiskteplomerezha"
Comments	Auxiliary data allowing adjustment of baseline

Parameter	$\mathbf{k_{h, b}}$
Unit of measurement	W/m^2*K
description	Average heat-transfer factor of the buildings, base year
Source of data	Special report produced by Municipal commercial enterprise "Donetskmiskteplomerezha"
Comments	Auxiliary data allowing adjustment of baseline

Parameter	$\mathbf{F_{h, t, r}}$
Unit of measurement	m^2
description	Heating area of buildings (existed in base year) with improved heat insulation, project year
Source of data	Special report produced by Municipal commercial enterprise "Donetskmiskteplomerezha"
Comments	Auxiliary data allowing adjustment of baseline

Parameter	$\mathbf{F_{h, n, r}}$
Unit of measurement	m^2
description	Heating area of new buildings connected to the heat supply system (it is conceded that such buildings have new improved heat insulation), project year
Source of data	Special report produced by Municipal commercial enterprise

	"Donetskmiskteplomerezha"
Comments	Auxiliary data allowing adjustment of baseline

	$\mathbf{k_{h,\,n}}$
Unit of measurement	W/m^2*K
description	Heat-transfer factor of the buildings with new thermal insulation
Source of data	State Building Standards (B.2.6-31:2006)
Comments	Auxiliary data allowing adjustment of baseline

Parameter	$\mathbf{N_{h,\,b}}$
Unit of measurement	hour
description	Duration of heating period, base year
Source of data	Special report produced by Municipal commercial enterprise "Donetskmiskteplomerezha"
Comments	Auxiliary data allowing adjustment of baseline

Parameter	$\mathbf{N_{h,\,r}}$
Unit of measurement	hour
description	Duration of heating period, project year
Source of data	Special report produced by Municipal commercial enterprise "Donetskmiskteplomerezha"
Comments	Auxiliary data allowing adjustment of baseline

Parameter	$\mathbf{L_{h,\,b}}$
Unit of measurement	MW
description	Maximal connected load for heating services, base year
Source of data	Special report produced by Municipal commercial enterprise "Donetskmiskteplomerezha"
Comments	Auxiliary data allowing adjustment of baseline

Parameter	$\mathbf{L_{h,\,r}}$
Unit of measurement	MW
description	Maximal connected load for heating services, project year
Source of data	Special report produced by Municipal commercial enterprise "Donetskmiskteplomerezha"
Comments	Auxiliary data allowing adjustment of baseline

Parameter	$\mathbf{L_{w,\,b}}$
Unit of measurement	MW
description	Maximal connected load for hot water supply, base year
Source of data	Special report produced by Municipal commercial enterprise "Donetskmiskteplomerezha"
Comments	Auxiliary data allowing adjustment of baseline

Parameter	$\mathbf{L_{w,\,r}}$
Unit of measurement	MW
description	Maximal connected load for hot water supply, project year
Source of data	Special report produced by Municipal commercial enterprise "Donetskmiskteplomerezha"
Comments	Auxiliary data allowing adjustment of baseline

Parameter	$\mathbf{v_{w,\,r}}$
Unit of measurement	kWh /h
description	Standard specific discharge of hot water at personal account, project year
Source of data	Special report produced by Municipal commercial enterprise "Donetskmiskteplomerezha"
Comments	Auxiliary data allowing adjustment of baseline

Parameter	$\mathbf{v_{w,\,b}}$
Unit of measurement	kWh/h
description	Standard specific discharge of hot water at personal account, base year
Source of data	Special report produced by Municipal commercial enterprise "Donetskmiskteplomerezha"
Comments	Auxiliary data allowing adjustment of baseline

Parameter	**g**
Unit of measurement	%
description	Conversion factor for average load within heating period
Source of data	Special report produced by Municipal commercial enterprise "Donetskmiskteplomerezha"
Comments	N/A

Parameter	$\mathbf{P_b}$
Unit of measurement	MWh
description	Electric energy consumption, base year
Source of data	Boiler-houses and heat supply station, wherein frequency controllers, new pumps and ventilators will be installed
Comments	Data allowing calculation of GHG emissions due to electric energy production for state electrical grid in baseline scenario

Parameter	**Cef**
Unit of measurement	Kt CO_2/TJ
description	CO_2 emissions factor, base year
Source of data	IPCC, 2006 Volume 2, table 2.2, page 2.17
Comments	Auxiliary data allowing adjustment of baseline

Annex 3

MONITORING PLAN

1. REHABILITATION OF THE DISTRICT HEATING SYSTEM IN DONETSK CITY

This Monitoring Plan describes the specific approach, which will be applied for calculation of obtained GHG emission reduction units (ERUs) in the course of JI project commissioning in the city of Donetsk. Renewal of centralized heat supply system shall result in improvement of system's operation. Each component involved in JI project must lead to GHG emission reduction. GHG emission reduction will be determined by means of methodology represented in the Monitoring Plan.

2. DESCRIPTION OF THE PROJECT

The project covers boiler-houses and heat distribution networks included in Municipal commercial enterprise "Donetskmiskteplomerezha", namely: 16 boiler-houses with 56 boilers and 114,84 km of heat distributing networks.
Measures aimed at increase in effectiveness of Municipal commercial enterprise "Donetskmiskteplomerezha" include the following:

- Old low efficient boilers will be replaced by new highly efficient boilers that will make it possible to increase efficiency from 70-94% to 90-93%. Technical data of new boilers planned to be installed are represented at manufacturers' sites.
- Rehabilitation of boilers with burners and replacement of automated equipment.
- Load transfer from the boilers with old equipment to the boilers fitted with high effective equipment.
- Contact and surface gas-treating heat recovery units will be installed to utilize and regenerate heat of exit gas as well as additional heat of steam generator, which will occur when the temperature of exit gas drops to dew-point. Implementation of such technology will result in increase of the efficiency of fuel consumption up to 6-8%.
- Rehabilitation of heat distribution networks system will make it possible to decrease loss of heat energy up to 1-2% per 1 km due to replacement of pipes of main and distribution circuits of 48-630 mm diameter by pre-insulated pipes.
- Introduction of frequency regulation of electric drives of hot water supply pumps will make it possible to decrease electric energy consumption considerably. Such regulators will enable to change power of electric motors depending on connected load both within the day of water supply change and within the year, when electric motors operates only for hot water supply in summer.

3. MONITORING

In the course of elaboration of the project there were no any approved CDM methodologies for such type of projects. Specific approach proposed by the project is partially similar to methodology "Baseline and monitoring methodology AM0044» (version 01)23 was used.

4. MONITORING OF BASELINE AND PROJECT EMISSIONS

Parameters to be monitored

Methodology identifies and takes into account parameters that are measured and checked at regular intervals. These parameters are entered into Databases (Table in Excel format),wherein annual GHG emission reductions are traced.
The list of parameters to be monitored is given in the table below.

	Symbol	**Parameter**	**Unit of measurement**	**Measured (m), calculated (c) or estimated (e))**
1	(**B_b**) and (**B_r**)	Fuel consumption by boiler-houses (Natural gas)	m^3	m
2	(**LHV_b**) and (**LHV_r**)	Heat value of natural gas calculated on the basis of the lower heating value (Natural gas)	MJ/m^3	m, c
3	(**$T_{out\ b}$**) and (**$T_{out\ r}$**)	Average external temperature during heating season	^0C	m, c
4	(**$T_{in\ b}$**) and (**$T_{in\ r}$**)	Average internal temperature during heating season	^0C	m, c
5	(**n_{wb}** and (**n_{wr}**)	Quantity of consumers		statistics
6	(**$F_{h\ b}$** and (**$F_{h\ r}$**)	Total Heating area	m^2	statistics
7	(**k_{hb}**)	Average heat-transfer factor of the buildings in base year	W/m^2*K	statistics
8	(**$F_{h\ t\ r}$**)	Heating area of buildings (existed in base year) with improved heat insulation	m^2	statistics
9	(**$F_{h\ n\ r}$**)	Heating area of new buildings connected to the heat supply system (it is conceded that such buildings have new improved heat insulation) in reporting year	m^2	statistics
10	(**$k_{h\ n}$**)	Heat-transfer factor of the buildings with new thermal insulation	W/m^2*K	statistics
11	(**$N_{h\ b}$**) and (**$N_{h\ r}$**)	Duration of heating period	hour	m
12	(**$N_{w\ b}$**) and (**$N_{w\ r}$**)	Duration of hot water supply period	hour	m
13	(**L_h^b**) and (**L_h^r**)	Maximal connected load for heating services	MW	c
14	(**L_w^b**) and (**L_w^r**)	Maximal connected load for hot water supply	MW	c

15	($\mathbf{v_{w\,r}}$) and ($\mathbf{v_{w\,b}}$)	Standard specific discharge of hot water at personal account	kWh/hour	"State building norms Ukraine Buildings Public Health Institutions" DBN B.2.2-10-2001[24]
16	(**Cef**)	CO_2 emission factor (Natural gas)	Kt CO_2/TJ	IPCC, 2006 Volume 2, table 2.2, page 2.17
17	**g**	Conversion factor for average load within heating period		statistics
18	($\mathbf{P_b}$) and ($\mathbf{P_r}$)	Electric energy consumption by the boiler-houses and heat supply station, wherein frequency controllers, new pumps and ventilators will be installed	MWh	m

Parameters to be monitored

No. and name of the parameter	**1.1** Fuel consumption by boiler-houses. Natural gas
Description	Fuel consumption by boiler-houses. Fuel consumption by boiler-houses is the main value influencing on emissions estimation. Therefore the most objective and accurate factor indicator of project implementation is fuel consumption change. Fuel consumption changeas a result of project implementation in comparison with basic consumption of fuel will reflect all other corresponding indicators, such as increase in Efficiency Factor of boilers, decrease of losses of heat grids, etc.
Method of monitoring	Gas meters
Recording frequency	Daily
Confirming documents	Readings of meters shall be registered in special paper logs at each boiler-house
Method of calculation	Does not exist
No. and name of the parameter	2.1 Heat value of natural gas
Description	Average heat value of natural gas calculated on the basis of the lower heating value
Method of monitoring	It shall be taken according to the telephone message of gas supplier or report of independent chemical laboratory. Analyses of independent chemical laboratory shall be done in case of any disputable cases. They are used rarely.
Recording frequency	Data shall be provided by the gas supplier; 3 times per month as a rule.
Confirming documents	Registered in special paper logs
Method of calculation	Weighted average value

[24] http://zakon.nau.ua/doc/?uid=1041.2346.0

No. and name of the parameter	3. Average external temperature during heating season
Description	Average daily external temperature during heating season
Method of monitoring	Average external temperature during heating season shall be calculated by Municipal commercial enterprise "Donetskmiskteplomerezha" on the basis of daily external temperature obtained by dispatcher of Municipal commercial enterprise "Donetskmiskteplomerezha" in Donetsk metrological center within the period from 10:00 to 11:00 a.m. on each day of heating period.
Recording frequency	Once per heating season. Daily external temperature shall be registered on every day of heating period
Confirming documents	Metrological center shall send the reports for each day of heating period of each decade on month. Reports shall be sewed in special files.
Method of calculation	Average value

No. and name of the parameter	**4.** Average internal temperature during heating season
Description	Average temperature inside the premises shall be calculated from the amount of returned payments caused by poor heat supply (if the standard level (18 ^{0}C) is not observed). Over 18 ^{0}C – it shall be considered equal to 18 ^{0}C (according to the principle of conservatism), as standard level. below 18 ^{0}C – shall be calculated in the following way.
Method of monitoring	Sum of returned payments
Recording frequency	Once per heating season
Confirming documents	Sum of returned payments
Method of calculation	According to the "Rules of heat and hot water supply" No. 1497 dated 30.12.1997, heat supplying enterprises shall make a fresh accounts in relation to heat supply to the consumers in a quantity less than they need for standard level ensuring. Standard temperature inside the premises shall be at least 18 ^{0}C. Average temperature inside the premises shall be calculated under the following formulas: If R = 0 (according to the principle of conservatism for baseline R < 0.05): $\mathbf{T_{in\,b}}$ = 18 ^{o}C. If 0.05 < R ≤ 0.3 NP: $\mathbf{T_{in\,b}}$ = 18 – (R/5) [^{o}C] If 0.3 NP < R < NP: $\mathbf{T_{in\,b}}$ = 12 – [(R – 0.3 NP)/10] [^{o}C] where: R - % of returned payments with respect to NP; NP – planned charges.

	Therefore is the internal temperature is 18 °C or higher, we assume it as temperature equal to 18 °C according to the principle of conservatism; and if it will be below 18 °C, it shall be calculated from the amount of returned payments according to the abovestated method.

No. and name of the parameter	**5.** Quantity of hot water supply consumers
Description	Quantity of hot water supply consumers for each boiler-house
Method of monitoring	Statistics of Municipal commercial enterprise "Donetskmiskteplomerezha"
Recording frequency	Population, organizations and legal entities shall conclude the contracts directly with Municipal commercial enterprise "Donetskmiskteplomerezha". They shall be renewed once per year.
Confirming documents	Information shall be stored in special electronic files "Registration of earnings from population". As concerns organizations and legal entities such information shall be taken from the contracts concluded with them.
Method of calculation	

No. and name of the parameter	**6.** Total Heating area
Description	Heating area for each boiler-house
Method of monitoring	Statistics of Municipal commercial enterprise "Donetskmiskteplomerezha"
Recording frequency	Recalculation shall be done in case of signing new contracts or cancellation of existing ones
Confirming documents	Information shall be stored in sales department of Municipal commercial enterprise "Donetskmiskteplomerezha" and identified under the certificates of ownership according to the technical certificates of buildings. Total area with balconies and stairs shall be reflected in special logs.
Method of calculation	Data shall be taken on January 01 of each year

No. and name of the parameter	**7.** Average heat-transfer factor of the buildings in base year
Description	Average heat-transfer factor of the buildings for each boiler-house
Method of monitoring	Statistics of Municipal commercial enterprise "Donetskmiskteplomerezha"
Recording frequency	Heat-transfer factor of the buildings shall be recorded once when connecting and disconnecting Heating area s to/from boiler-houses involved in project
Confirming documents	
Method of calculation	For calculation of heat-transfer factor of the buildings for each boiler-house the method of weighted average value was applied, taking into account area of existing buildings and area of new buildings. Value of heat-transfer factor of old buildings was

	taken from Building Norms and Rules 2-3-79 (1998) – less than 0.63. Value of heat-transfer factor of new buildings was taken from State Building Norms (B.2.6-31:2006) – less than 0.36.

No. and name of the parameter	**8.** Heating area of buildings (existed in base year) with improved heat insulation in reporting year
Description	Heating area of rehabilitated buildings subject to implementation of improved insulation of walls
Method of monitoring	Statistics of Municipal commercial enterprise "Donetskmiskteplomerezha"
Recording frequency	Once per year
Confirming documents	
Method of calculation	

No. and name of the parameter	**9.** Heating area of new buildings connected to the heat supply system (it is conceded that such buildings have new improved heat insulation) in reporting year
Description	Heating area of new buildings connected to the heat supply system subject to implementation of improved insulation of walls
Method of monitoring	Statistics of Municipal commercial enterprise "Donetskmiskteplomerezha"
Recording frequency	Once per year
Confirming documents	
Method of calculation	

No. and name of the parameter	**10.** Heat-transfer factor of the buildings with new thermal insulation
Description	Heat-transfer factor of the buildings with new thermal insulation
Method of monitoring	Value of heat-transfer factor of new buildings was taken from State Building Norms (B.2.6-31:2006)
Recording frequency	
Confirming documents	
Method of calculation	

No. and name of the parameter	**11.** Duration of heating period
Description	Duration of heating period for each boiler-house
Method of monitoring	It shall be measured by Municipal commercial enterprise "Donetskmiskteplomerezha"
Recording frequency	Once per year
Confirming documents	Duration of heating period is taken according to the clause 7.9.4 of "Rules of technical maintenance of heating equipment and heat grids, 2007". Commencement and termination of heating period shall be determined separately for each city. Heating period commences when daily average temperature of outdoor air reaches 8 ^{o}C or below within 3 days, and terminates when daily average temperature of outdoor air reaches 8 ^{o}C or hogher within 3 days. According to the Building Norms and Rules 2.01.01-84

	(Climatology in thermal power engineering) duration of heating period for projects' development shall be 183 days, and usually such period lasts from October 15 to April 15.
Method of calculation	

No. and name of the parameter	**12.** Duration of hot water supply period
Description	Duration of hot water supply period for each boiler-house
Method of monitoring	It shall be measured by Municipal commercial enterprise "Donetskmiskteplomerezha"
Recording frequency	Once per year
Confirming documents	Hot water supply is implemented according to the hot water supply schedule for each city. In Donetsk city hot water is supplied during 17 hours and for twenty-four hours at boiler-houses, wherein loading in relation to hot water supply is provide for, or within the whole year or only within heating period. There is the plan of hot water supply cutoff for repair and preventive works for each boiler-house.
Method of calculation	

No. and name of the parameter	**13.** Maximal connected load for heating services
Description	Maximal connected load for heating services
Method of monitoring	It shall be measured by Municipal commercial enterprise "Donetskmiskteplomerezha"
Recording frequency	Once per year
Confirming documents	Maximal connected load for heating services shall be measured by Municipal commercial enterprise "Donetskmiskteplomerezha" for each heating period. It shall be calculated for necessary heat energy under the temperature of -25 ^{o}C.
Method of calculation	

No. and name of the parameter	**14.** Connected load for hot water supply
Description	Connected load for hot water supply
Method of monitoring	It shall be measured by Municipal commercial enterprise "Donetskmiskteplomerezha"
Recording frequency	Once per year
Confirming documents	Maximal Connected load for hot water supply shall be calculated by Municipal commercial enterprise "Donetskmiskteplomerezha"according to the contracts concluded with the consumers
Method of calculation	

No. and name of the parameter	**15.** Standard specific discharge of hot water at personal account
Description	Standard specific discharge of hot water at personal account
Method of monitoring	Normative document
Recording frequency	Once per year

Confirming documents	At present such standard specific discharge of hot water is effective, which has been proposed in KTM 2004 of Ukraine 244-94[25] in 1993. There is no information about any changes, therefore it is not subject to special monitoring.
Method of calculation	

No. and name of the parameter	**16.** CO_2 emission factor
Description	CO_2 emission factor for various fuels
Method of monitoring	Normative document
Recording frequency	Once, at the beginning of the project
Confirming documents	For all types of fuel we use CO_2 emission factor from the table of data given in the Annex C of Operational Directive for JOINT IMPLEMENTATION PROJECT DESIGN DOCUMENT (Section 1: General Directive; Version 2.2) Cef: (natural gas)=0,0561 thous. t CO_2 / TJ;
Method of calculation	

No. and name of the parameter	**17.** Conversion factor for average load within heating period
Description	Conversion factor for average load within heating period
Method of monitoring	Statistics of Municipal commercial enterprise "Donetskmiskteplomerezha"
Recording frequency	Once per year
Confirming documents	Conversion factor for average load within heating period (it shall be determined for each boiler-house on historical basis (usually 0.4-0.8);
Method of calculation	$g = Q_{av}/Q_{max} = F_h*k_h*(T_{in} - T_{out\ av})/F_h*k_h*(T_{in} - T_{out\ min})$ where: g – Conversion factor for average load within heating period; F_h – Heating area of premises, m^2; k_h – Heat-transfer factor of the buildings,(Wt/m^2*K); T_{in} – Average internal temperature during heating season, K (or ^0C); $T_{out\ av}$ – Average external temperature during heating season, K (or ^0C); $T_{out\ min}$ – minimal external temperature during heating period, K (or ^0C).

No. and name of the parameter	**18.** Electric energy consumption by the boiler-houses, wherein frequency regulation are planned
Description	Electric energy consumption by the boiler-houses, wherein frequency regulation are planned
Method of monitoring	Measurement of consumed electric energy by the electricity supply meters

[25] Norms and instructions of fuel and heat energy discharge rate setting for heating of dwelling and civil buildings, as well as social needs in Ukraine. KTM 204 Ukraine 244-94. Kyiv, 2001, 376 p.

Recording frequency	Every day
Confirming documents	Consumption of electric energy shall be: • at boiler-house, wherein the pumps will be replaced; • at boiler-house, wherein the frequency regulation will be installed.
Method of calculation	

Equipment for monitoring

Equipment to be used by the project's developer for monitoring of corresponding parameters is given in Table 1. Table also provides the information about type of equipment, calibration procedure and procedure of actions in case of malfunction.

No. and name of parameter	Equipment	Class of accuracy	Verification body	Frequency	Procedure of actions in case of malfunction
1.1 Natural gas consumption	Gas meter	+/- (0.5…2)% Usually 1%	State Enterprise «Donetsk-standart-metrologiya"	Once per 1-5 years, usually once per 2 years	In cases of malfunctions it is necessary to inform the project's manager or chief engineer hereof. If the malfunctions are not eliminated during 48 hours, it is necessary to appeal to equipment supplier for necessary repair conducting. If the repair is impossible the equipment shall be replaced by equivalent one. Data about malfunctions shall be recorded in the special registration book.
18. Electric energy consumption	Electricity supply meter	+/- (0.2…0.5) % Usually 0.2%	State Enterprise «Donetsk-standart-metrologiya"	Once per 1-5 years, usually once per 4 years	In cases of malfunctions it is necessary to inform the project's manager or chief engineer hereof. If the malfunctions are not eliminated during 48 hours, it is necessary to appeal to equipment supplier for necessary repair conducting. If the repair is impossible the equipment shall be replaced by equivalent one. Data about malfunctions shall be recorded in the special registration book.

Table 1.Equipment for monitoring.

5. MONITORING OF ENVIRONMENT IMPACT

Since the project provides for rehabilitation of existing heat supply system leading to energy effectiveness increase and improvement of environmental impact, and it is not building project, that's

why no negative environmental impact is foreseen. Therefore, pursuant to the Ukrainian legislation, no estimation of environmental impact is required.
Thus monitoring of estimation of environmental impact during implementation and activity of the project is not necessary.

6. PLAN OF PROJECT MANAGEMENT

All responsibility for management and implementation of the project is vested on General Director of Municipal commercial enterprise "Donetskmiskteplomerezha". Director of Municipal commercial enterprise "Donetskmiskteplomerezha", Mr. Rogachov Viktor Sergiyovych appointed responsible persons under the leadership of Valentyna Skoryk, chief engineer of Municipal commercial enterprise "Donetskmiskteplomerezha". Staff of production-and-technical department is also responsible for project's activity.

Eventual obstacles and errors in the course of project's implementation shall be determined and solved by the responsible personnel of production-and-technical department.

Responsibility for data collection

Director of Municipal commercial enterprise "Donetskmiskteplomerezha", Mr. Rogachov Viktor Sergiyovych appointed Valentyna Skoryk, responsible for implementation and monitoring at Municipal commercial enterprise "Donetskmiskteplomerezha". Valentyna Skoryk is responsible for collection, measurement, verification and recording of data and their storage. Fabian Knodel, director of "VEMA S.A." is responsible for baseline development and monitoring. Yevgeniy Vorobyov, engineer of "VEMA S.A.", is responsible for baseline development and monitoring methodology as well as data processing.

Collection of data in relation to fuel consumption shall be as follows:
1. All boiler-houses are equipped with gas meters.
2. Operators of boiler-houses shall record readings of devices in the "Registration log of boiler-house's operation parameters" every day.
3. At boiler-houses not equipped with gas volume correctors the operators shall register the gas parameters in such log for each 2 hours: temperature and pressure. These parameters are necessary for gas discharge reduction to normal conditions.
4. Every day the operators shall transfer the fuel discharge values to the dispatcher of corresponding district branch of Municipal commercial enterprise "Donetskmiskteplomerezha" by phone. Every month they shall produce report in paper form.
5. District branches shall transfer the data to the production-and-technical department of Municipal commercial enterprise "Donetskmiskteplomerezha", wherein they shall be stored and used for making payments with gas suppliers.

Data monitored and required for verification are to be kept for two years after the last transfer of ERUs for the project.

Scheme of data collection for Monitoring Report is demonstrated on Figure 3.

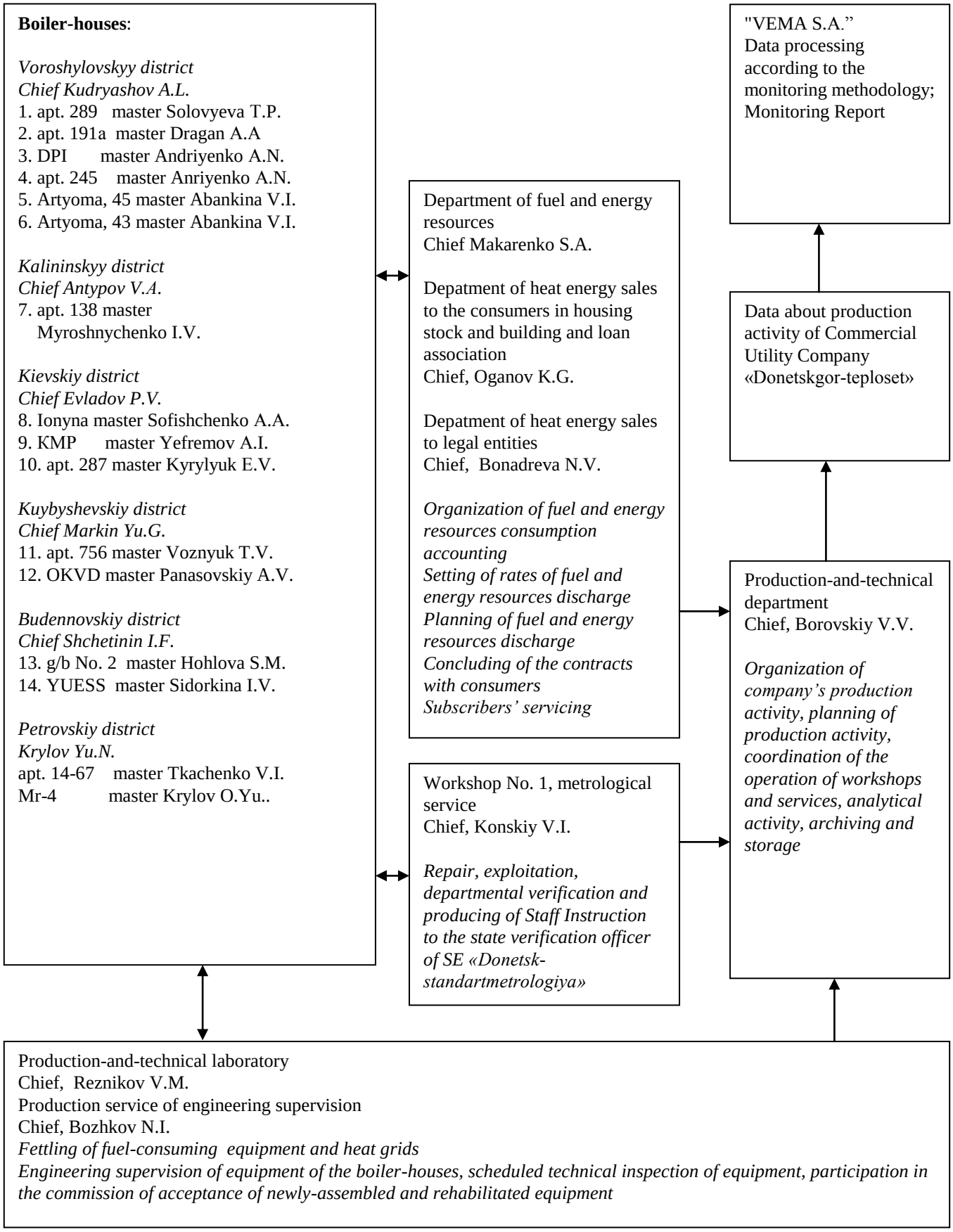

Figure.3. Scheme of data collection for Monitoring Report

Since the principal activities of Municipal commercial enterprise "Donetskmiskteplomerezha" don't change when introducing the Joint Implementation (JI) project, special trainings for personnel are not necessary. Technical personal of the enterprise possesses necessary knowledge and experience for execution of project activities and repair of common equipment.

- In case of new equipment application (such equipment which has not been used by this enterprise before), the manufacturing company shall conduct trainings for personnel.

Municipal commercial enterprise "Donetskmiskteplomerezha" retrains the personnel according to the requirements of Norms of labour protection. The enterprise has the Labour Protection Department responsible for professional development and trainings of the personnel.

In the course of elaboration of JI project (starting from 2004) the specialists of VEMA S.A. carried out broadened consultations for involved representatives of Municipal commercial enterprise "Donetskmiskteplomerezha" about collection of necessary data according to the Monitoring plan of the project.

Responsibility for data management

All collected data shall be delivered by Valentyna Skoryk, the person responsible for collection and storage of data, as well as filling in of advanced tables for monitoring. Yevgeniy Vorobyov is responsible for data processing according to the methodology and preparation of Monitoring Report. Responsibility for data management is represented in the Table 3.

Activity	Responsible person	
	Name	Position and department
Data collection and storage	Borovskyy Vadym Vyacheslavovych	Chief of production-and-technical department, Municipal commercial enterprise "Donetskmiskteplomerezha"
Data collection and storage	Nyeshkova Lyudmyla Viktorivna	Chief of sales department, Municipal commercial enterprise "Donetskmiskteplomerezha"
Data collection and storage	Oganov Kostyantyn Georgiyovych	Chief of subscriber department, Municipal commercial enterprise "Donetskmiskteplomerezha"
Data collection and storage	Konskiy Viktor Ivanovych	Chief of metrology department
Data collection and storage, filling in of advanced tables for monitoring report	Valentyna Skoryk	Engineer of technical development department of industrial safety, Municipal commercial enterprise "Donetskmiskteplomerezha"
Data collection and storage, coordination of verification process	Okhremenko Vitaliy Semenovych	Chief engineer, Municipal commercial enterprise "Donetskmiskteplomerezha"
Data processing, according to the methodology and reports on monitoring	Yevgeniy Vorobyov	Engineer, "VEMA S.A."

Table.3.Responsibility for data management.

- - - - -