JOINT IMPLEMENTATION PROJECT DESIGN DOCUMENT FORM
Version 01 - in effect as of: 15 June 2006

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SECTION A. General description of the project

A.1. Title of the project:

Title of the project: «Rehabilitation of the District Heating System of Public Stock Company «WESTA-DNEPR»

Version of the PDD: 01

Date of the document: 23.12.2011

Sectoral scope(s):

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

(3) Energy demand.

Purpose of the documents submission.

For obtaining of the Letter of Approval by the owner of source at which the JI project is planned to be implemented under the procedure of Kyoto protocol.

A.2. Description of the project:

The main idea of the project is to reduce fuel consumption in particular reducing consumption of natural gas (imported to Ukraine) and fuel oil, electricity consumption due to replacing old boiler house to new one with modern equipment and due to modernization district heating system on the territory of PSC "WESTA-DNEPR" and also in the surrounding area of the plant PJSC "DMZ" which is served by this boiler house. The result of the implementation of a new boiler house with modern equipment will be significant reduction of fuel and electricity consumption that will reduce greenhouse gas emissions.

Additional factor that stimulates project implementation, is poor quality services of heat supply with failures, is continuous deterioration of heat generating and distribution equipment, followed by the efficiency drop, simultaneously with increase of losses, fuel consumption and emission levels.

PSC "WESTA-DNEPR" (Dnipropetrovsk) is a modern high-tech plant which produces starter lead-acid batteries of the new generation of design, project capacity of the plant is 3 million conventional batteries a year, put into operation in late 2004.

PSC "WESTA-DNEPR" was created under large-scale innovative national significance project "Development and production of new autonomous integrated energy systems using solar energy systems, wind power and energy batteries" in pursuance of the Cabinet of Ministers of Ukraine (CMU), adopted in 2002[1]. The project underwent Complex State Expertise and CMU in 2003 was recognized as "a priority and especially important for the state." In the production of more than 47 introduced their new technical solutions protected by patents of Ukraine and Russia.

[1] http://www.uazakon.com/document/spart08/inx08196.htm

Previously, enterprises JSC "WESTA-DNEPR" and PJSC "DMZ" supplied with heat from existing separately standing boiler house. In the old boiler house was installed 2 steam boilers DKVR 10/13 and 3 hot-water boilers KVGM-50. Boiler equipment and boilers morally and physically obsolete, boiler efficiency was 75%. Heat supply network from the existing boiler house to consumers length of more than 1 km is in poor condition located outside the main area of the enterprise. Thus, the decision to build a new boiler house with modern boilers with high efficiency was made.

PJSC "DMZ" and PSC "WESTA-DNEPR" have signed an agreement of joint activities that they engage non-profit joint activities in field of building and operating the district heating system (heat boiler-house) of production area. PSC "WESTA-DNEPR", according to the agreement with PJSC "DMZ", decided to finance the reconstruction of boiler-house with the aim to modernize district heating system in the joint territory with PJSC "DMZ".

The project «Rehabilitation of the District Heating System of Public Stock Company «WESTA-DNEPR» was initiated in 2006. The Project provides the construction of modular gas boiler house for district heating of PJSC "DMZ" and PSC "WESTA-DNEPR". The project includes boiler house and heat supply network that are part of PSC "WESTA-DNEPR" and PJSC "DMZ", in particular an old factory boiler house with 5 boiler and a new module boiler house with 2 boilers.

PJSC "DMZ" fulfills annual minimal repairing of the DH system to keep it working. Particularly it executes repairing of network's parts and boilers that might cause accidents. More economically feasible and realistic scenario without carbon credits sales is a baseline scenario with very slow reconstruction activity than to make a major overhaul of the heating system. Minimal annual repairing doesn't lead to drooping 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 approximately same level. This scenario is less environmentally favorable for the near future (including first commitment period 2008-2012), since GHGs emissions of Supplier will continue to be kept at the same level or even higher, but economically such scenario is more attractive.

Therefore, the baseline scenario is the same as the scenario that acting befor the implementation of the project activity - annual minimum repair DH system for its work.
Project scenario is the implementation of the project on construction a modern module boiler house and decommissioning of old boiler house.

There will be two heat boilers firm "Buderus", heating capacity 11,200 kW each will be installed. Boilers are equipped with gas burner with forced air supply for combustion gas. Boilers are equipped with control systems.

The project employs the increase in fuel consumption efficiency to reduce greenhouse gas emissions relative to current practice. Over 11 million m^3 of natural will be saved annually starting from 2011. Such reduction of fuel consumption is based on increase of the boiler efficiencies, energy consuming equipment, reduction of heat losses in networks.

The following activities will ensure fuel saving:

- Rehabilitation of the 1 boiler-house with 5 installed boilers;
- Replacement of 5 outdated boilers by 2 new ones;
- Implementation of water conditioning;
- Implementation of advanced pump system;
- Implementation of new heat exchangers;
- Replacement of heat distributing network;
- Improving of the network organization;

Estimated project annual average reductions of GHG emissions, in particular CO_2, are 55.681 thousand tons in 2008-2012 comparing to business-as-usual or baseline scenario.

Implementation of the project will provide substantial economic, environmental, and social benefits to the plant. Social impact of the project is positive since after project implementation the heat supply service will be improved.

Environmental impact of the project is expected to be very positive as emission of the exhaust gases such as CO_2, NO_x, and CO will be reduced. Also due to better after-implementation service, some part of population will cease to use electric heaters thus reducing electricity consumption, which is related to power plants emissions of CO_2, SO_x, NO_x, CO and particulate matter.

PSC "WESTA-DNEPR" purchases all the necessary inputs, including fuel, electricity, water, etc, it has the primary interest in the reduction of specific fuel consumption that can be achieved by the implementation of the project.

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)	PSC «WESTA-DNEPR»	No
The Netherlands	Ohana LLP	No

Public Stock Company «WESTA-DNEPR» is the project host.

A.4. Technical description of the project:

A.4.1. Location of the project:

The Project is located in Dnipropetrovsk City in the Central part of Ukraine on the territory of the plant PJSC "DMZ"

A.4.1.1. Host Party(ies):

Ukraine

The project is located on the territory of Ukraine.(see fig.1).

Ukraine is an Eastern European country that ratified the Kyoto Protocol to UN FCCC on February 4th, 2004, enters into the list of the countries of the Annex 1 and is eligible for the Joint Implementation projects.

Fig.1 The map of Ukraine with neighboring countries

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

Dnipropetrovsk region

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

49000 Dnipropetrovsk City
The territory of Dnipropetrovsk City is - 405 км^2.

The population of the Dnipropetrovsk City is 1002.492 thousand inhabitants (2011).

A.4.1.4. Detail of physical location, including information allowing the unique identification of the project (maximum one page):

The boiler house of PSC "WESTA-DNEPR" is located in the Dnipropetrovsk City in the territory of PJSC "DMZ". It is located in the following geographical coordinates: 48° 26′ 0.58″ N, 34° 58′ 23.27″ E [2].

Dnipropetrovsk city climate is mild-continental with mild winter and warm summer[3]. The average temperatures is +8.5°C, the lowest in January – (-5.5°C), the heist in July – (+21.3°C).

The project boundaries include old and new boiler-houses and heat distribution networks that supply heat and hot water to the objects. In the old boiler house was installed 2 steam boilers DKVR 10/13 and 3 hot-water boilers KVGM-50. The heat distribution networks from the boiler to consumers were located outside

[2] http://toolserver.org/~geohack/geohack.php?language=ru&pagename=%D0%94%D0%BD%D0%B5%D0%BF%D1%80%D0%BE%D0%BF%D0%B5%D1%82%D1%80%D0%BE%D0%B2%D1%81%D0%BA&params=48.433493_N_34.97313_E_type:city#.D0.A4.D0.BE.D1.82.D0.BE.D0.B3.D1.80.D0.B0.D1.84.D0.B8.D0.B8

[3] http://www.meteoprog.ua/ru/climate/Dnipropetrovsk/

the main territory, stretching more than 1 km. The new boiler is located in the existing building manufacturing plant #117 in one-floor part of it. The technology part of the project provides installation of the two hot-water boilers Logano S825L capacity 11200kW each (firm "Buderus", Germany).
Volume of the project involves:

- Replacement of the 1 boiler-house by 1 new modular boiler house;
- Replacement of 5 outdated boilers by 2 new ones;
- Implementation of water conditioning;
- Implementation of advanced pump system;
- Implementation of new heat exchangers;
- Replacement of heat distributing network;
- Dismantling of old boiler house.

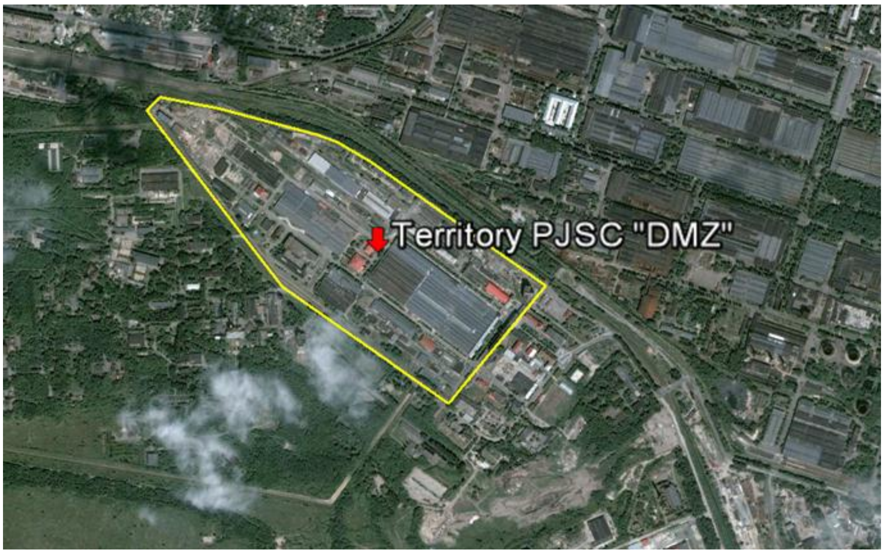

Fig.2 Plant PJSC "DMZ" on the map of Dnipropetrovsk City (latitude 48 °26'1.35"S longitude:

34 °58'31.53" N)

Fig.3 Location of boilers house by PSC "WESTA-DNEPR" on the territory of PJSC "DMZ" (latitude 48°26'3.59"S longitude 34°58'16.58"N)

A.4.2. Technology(ies) to be employed, or measures, operations or actions to be implemented by the project:

The project provides for the construction of the internal gas boiler heating system for heating and ventilation of companies: PJSC "DMZ" and PSC "WESTA-DNEPR".

There will be two heat boilers firm "Buderus" type Logano S825L, heating capacity 11,200 kW each will be installed.

Indicators	Unit measurement	Capacity
Nominal heating capacity	kW	11200
Volume of water in the boiler	l	9960
Hydraulic resistance of flow of water through boiler	mbar	40
Permissible excess pressure of water in the boiler	bar (kgf/cm2)	6(6)
The maximum water temperature at the outlet from the boiler	°C	110
Gas consumption at nominal heat (Q^{p}_{n}=8050 kkal/nm3)	nm^3/hour	1250
Efficiency	%	92...95
Temperature of outgoing gases - At rated load (100%) - At partial loads (60%)	°C	 190 160
Weight of boiler	kg	16400
The required pressure (the need for traction) on boiler	pas	0

Table.1 Technical data of the boiler Logano S825L

Boilers are equipped with safety, control valves and security instruments that comply with the requirements of the current standard documentation. SNiP II-35-76 "Boilers", DBN B.2.5-20-2001 "Gas supply", DNAOP 0.00-1.08-94 " Rules of the device usage and the safe operation of the steam vapor pressure not exceeding 0.07 MPa, water boilers, water heaters and water heating at a temperature not higher than 115 ° C".

Boiler Logano S825L is equipped with gas burner "Weishaupt" type WKG80/3-A ZM-ILN with forced air supply for combustion gas (Table 2).

Type of burner	WKG80/3-A ncn.ZM-lLN
Nominal capacity	11200 kW
Gas usage (*LHV = 33705* kJh/nm3 *(8050* kJh/nm3*)*	417 nm^3/hour
Gas pressure to burner	50mbar
Air pressure to the burner	80±200Pas
Diameter (conditional) of joining pipeline	100mm
The diameter of the gas ramp	100mm

Fuel	Natural gas
Nominal temperature of the air	25±15°C
Sizes: length, width, height	2578x905x1123
Weight burner	200 kg

Table.2 Technical characteristics of burner

Boilers are equipped with control systems Logamatic 4311 -in the first boiler (presenter) and Logamatic 4312 (slave) – in the second boiler – on second boiler: applying the above control systems to automate all processes related to ensuring proper and safe operation of boiler.

Boilers are equipped with automatic control and regulation of the burner and automatic security, providing trouble-free operation of the boiler and burner.

Stopping of gas feeding to the burner is performed by protection device (double solenoid valve) in the following cases

- When improperly raising or lowering the gas pressure;
- When fading torch burner;
- When improperly reducing the air pressure to the burner;
- In an emergency increase or decrease of level of water in the boiler;
- When you stop the fan burner.

For safe operation of equipment and pipelines provided abortions blower and pipelines.
Internal pipelines are laid open, installation and commissioning of pipelines of natural gas is in compliance with DBN B.2.5- 20-2001 "Gas supply", «Safety rules of gas supply systems in Ukraine» (DNAOP 0.00-1.20-98).

At the feed pipe heating circuit were installed network pumps and Three-way mixer with electric actuators (3 units); On the back line - mechanical filter. Temperature regulation of the coolant is released to the heating circuit of the heating system on schedule according to the outside air temperature. Changing the coolant temperature in the feeding line of heating circuit is performed by three three-way mixers by mixing cold water from a return line.

Adjust heat boiler outlet is performed automatically by changing the power burner (1st and 2nd degree burn) first slave, then the lead boiler or a complete shutdown first slave, then the lead boiler.

Regulation of supply of heat boiler is performed automatically by changing the power of burner (1st and 2nd degree of burn) first slave, then the lead boiler or a complete shutdown first slave, then the lead boiler. The switching on of boilers made in reverse order.
Producible heat transfer agent is water with temperature of 90 °C -65 °C. The circulation of heat transfer agent in the system is carried out heat pumps firm "Wilo" (Germany) and "Crono Line". To compensate for thermal expansion of agent tanks are installed membrane firm "EIbi" (Italy) type ERS capacity of 5000l. Recharge of network is provided chemically purified water, which is prepared in water-preparatory unit firm GLACK and heated in a heat exchanger RTA-51-R-5000 the company "Opeks" tap water.

The source of gasification of boiler-house is an existing, underground steel pipeline medium pressure 630 mm in diameter, laid on the Budivelnikiv street. For gasification of boiler-house provides for laying pipeline underground medium pressure gasket with polyethylene pipes PE model number SDR-17.6 per SSU.2.7-73-98 with a diameter of 225x12, 8mm. To reduce the working pressure (50 mbar) project provides installation of a pressure regulator in front of each boiler, which comes together with gas burner. Commercial metering gas for boiler-house provides on the base of ultrasonic gas meter course G1000 Du150mm, for technological gas before each boiler provides installation of ultrasonic meter course G1000 Du100mm. The withdrawal of combustion products is carried out by flues connected to individual chimneys Du800mm height 25.0 m.

Chimney height is determined by the results of assessment of environmental impact (part of the project EIA) and DBN B.2.5-20-2001 «Gas supply».

Electricity supple to build in boiler in buildings 117 is performed from the existing internal transformer substations TS number 35, according to specifications of PJSC “DMZ”, № 5900/7-91 of 11.10.06, by two cable lines 0,4 kV.

According to the degree of reliability, the power load to customers is the first and second categories of EMP (ukr ПУЕ). The installed capacity and estimated electricity consumers load are:

Main project data:
Pinst.= 276,6 kW
Pcalc.= 251,2 kW
Annual loss of electricity is:
Wr = 1320MWh.

Power of electricity consumers of boiler is provided from input-distribution board type VKSH-023/600 with device ABP and automatic switches for input and lines. To account the electricity on inputs, there are 3 phase electronic meters type transformer switching type EMS are set, accuracy class 1.0 active and reactive energy in both directions.

Thus, the main measures, which will be used to improve the efficiency of the heating system of PSC "WESTA-DNEPR" , are the following:

- Replacement of existing generated heat equipment to new one;
- Replacement of obsoleted boilers by highly efficient gas-fired ones with integrated burners will result in efficiency increasing from 71-85% up to 90-94%.
- Consecutive transition of heating systems to preliminary isolated pipes;
- Technical re-equipment of central heat point with heat exchangers;
- Installation of automatic regulation system;
- Use of modern devices of the heat account; monitoring systems of heat networks; the control, management and automation of warmly generating object;
- Creation of optimum systems of monitoring and power audit of object of power system.
- Dismantling.

Main stages of the project implementation are shown in the table below:

№	**Stages of the project**	**Period**
1	Designing of the new boiler house	01/02/2007- 31/10/2007
2	Construction of the new boiler house	01/03/2007- 31/10/2007
3	Launch work and test operation	01/11/2007-30/04/2008
4	Rehabilitation and construction of new engineering networks of the new boiler house	01/07/2007- 30/10/2007
5	Dismantling of old industrial boiler house	01/08/2008 – 31/05/2009
6	Dismantling of old engineering networks	01/08/2008 – 30/11/2009

Fig.4 Boiler house PSC "WESTA-DNEPR"

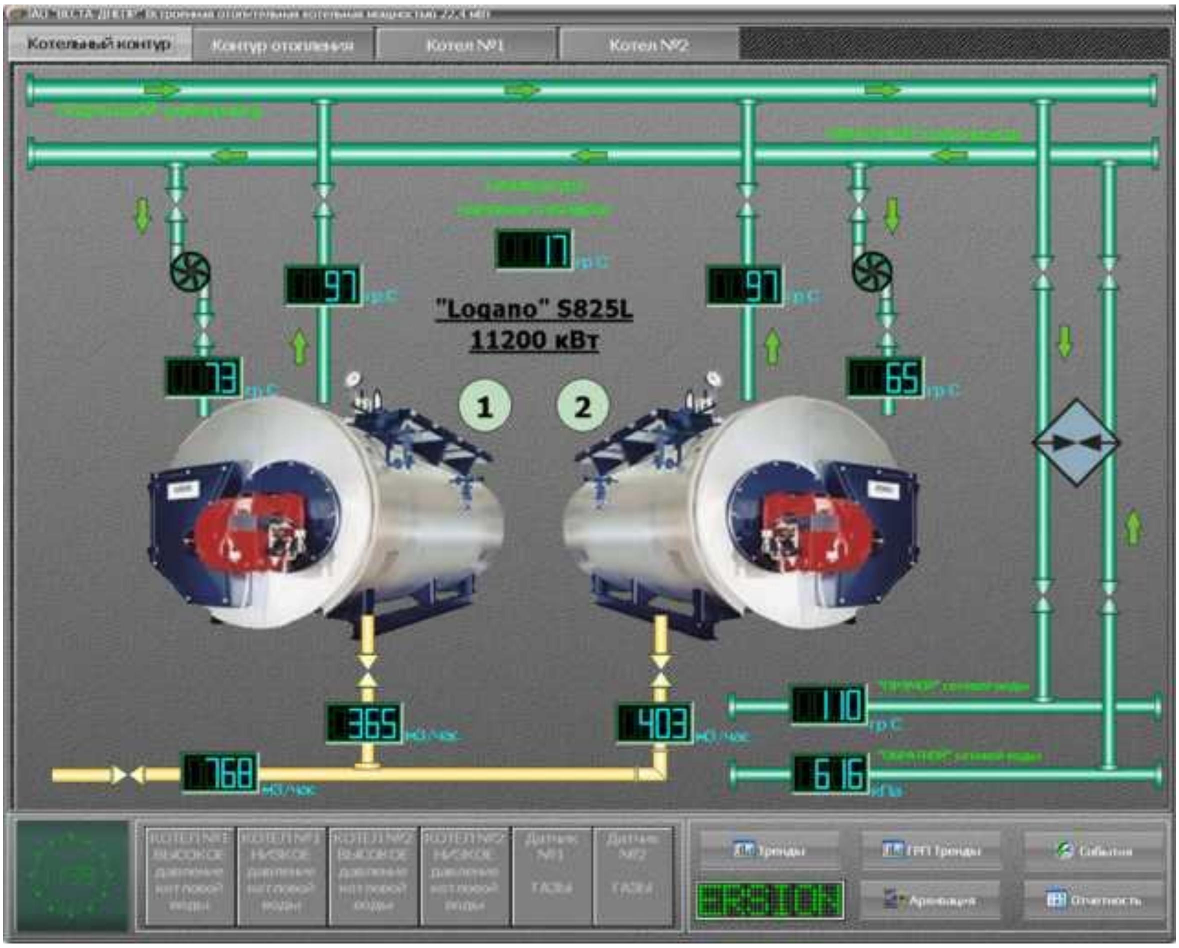

Fig.5 Boiler contour

Fig.6 Boiler «Buderus» S825L

These technologies are already approved but some of them are not widespread. Therefore, there might be some bottlenecks, which are typical when implementing the new technologies and equipment.

Taking into account the overall economic situation, it is not likely that the project technology will be substituted with any more efficient technology in the next 20 - 30 years.

As to the first commitment period from 2008 to 2012, it is ensured that there is absolutely no risk that this technology will be substituted by any other technology during this time.

The program of training

As far as the main activity of PSC «WESTA-DNEPR» will not change in course of the JI project implementation, the special technical trainings for personnel are not necessary. The technical personnel of the enterprise has sufficient knowledge and experience for implementation of the project activity and maintenance of the usual equipment.

In cases of the new (never used at this enterprise before), equipment installation, the company - producer of this equipment should provide trainings for personnel.

PSC «WESTA-DNEPR» provides personnel retraining according to the labour protection norms. The enterprise has the Labour protection department, which is responsible for raising the level of personnel skills and trainings.

The special training on the data collection according to Monitoring plan for this project was hold by Developer, and the special group that consisted of representatives of PSC «WESTA-DNEPR» was organized.

Based on the agreement of 27.02.2007 № 033.02.07 service center of general contractor (designer) of building modular boiler house LLC "Energopolis", Dnipropetrovsk, in November 2007 provided training in 72 hours with staff of each working shift (4 shifts).

The program of maintenance service

Maintenance service and operation of the project equipment is provided by staff PSC "WESTA-DNEPR".

A.4.3. Brief explanation of how the anthropogenic emissions of greenhouse gases by sources are to be reduced by the proposed JI project, including why the emission reductions would not occur in the absence of the proposed project, taking into account national and/or sectoral policies and circumstances:

The project activities including construction of a new boiler house, will increase energy efficiency of PJSC "DMZ" DH system, thus enabling it to produce the same amount of heat energy with less fuel consumption. Additionally it will produce electric power with less specific fuel consumption. Reduced fuel consumption will lead to reduction of CO_2 emissions.

In the absence of the proposed project, all equipment, including the old low efficient one but still workable for a long life period, will operate in as-usual mode, and any emission reductions will not occur.

This project requires a unconventional approach to performance and facing obstacles regarding economic attractiveness of the project. In section B of the project documents is shown that emission reductions will not happen if the project will be implemented.

A.4.3.1. Estimated amount of emission reductions over the crediting period:

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

	Years
Length of the crediting period	2 months
Year	Estimate of annual emission reductions in tonnes of CO_2 equivalent
2007	26336
Total estimated emission reductions in 2007 (tonnes of CO_2 equivalent)	**26336**
Annual average of estimated emission reductions in 2007 (tonnes of CO_2 equivalent)	**26336**

Table.3 Estimated amount of CO_2e Emission Reductions for 2007

	Years
Length of the crediting period	5
Year	Estimate of annual emission reductions in tonnes of CO_2 equivalent
2008	59286
2009	54293
2010	58267
2011	51067
2012	55728
Total estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	**278641**

Annual average of estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	**55728**

Table.4 Estimated amount of CO_2e Emission Reductions over the crediting period

	Years
Length of the crediting period	5
Year	Estimate of annual emission reductions in tonnes of CO_2 equivalent
2013	55728
2014	55728
2015	55728
2016	55728
2017	55728
Total estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	**278640**
Annual average of estimated emission reductions after the crediting period (tonnes of CO_2 equivalent)	**55728**

Table.5 Estimated amount of CO_2e Emission Reductions after the crediting period

	Years
Length of the crediting period	15
Year	Estimate of annual emission reductions in tonnes of CO_2 equivalent
2018	55728
2019	55728
2020	55728
2021	55728
2022	55728
2023	55728
2024	55728
2025	55728
2026	55728
2027	55728
2028	55728
2029	55728
2030	55728
2031	55728
2032	55728
Total estimated emission reductions from 2018 to 2032 (tonnes of CO_2 equivalent)	835920
Annual average of estimated emission reductions from 2018 to 2032 (tonnes of CO_2 equivalent)	55728

Table.6 Estimated amount of CO_2e Emission Reductions after the crediting period

Thus the estimated amount of emission reductions over the commitment period (2008-2012) is **278641** tons of CO_2e.

Description of formulae used to estimate emission reductions is represented in section B.

A.5. Project approval by the Parties involved:

The project has already supported by the local authorities, namely the Executive Committee of the Dnepropetrovsk Council , the State Department of Environmental Protection in the Dnipropetrovsk region, the regional department of the State Inspection on Energy Efficiency in the Dnipropetrovsk region, Dnepropetrovsk Regional Service of the Ukrainian State Investment Expertise, Inspectorate of State Architectural and Construction Control in the Dnipropetrovsk region and others, because organizational risks are minimized.

The project has already received a Letter of Endorsement from the Designated Focal Point of Ukraine (State Environmental Investment Agency) №747/23/7 of 22.03.2012.

According to the national Ukrainian procedure, the LoA by Ukraine is expected after the project determination.

SECTION B. Baseline

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

In accordance with appendix B to decision 9/CMP.1 of the JI guidelines and following the guidance on criteria for baseline setting and monitoring[4] version 3, the baseline is chosen and described below, using the following step-wise approach.

Step 1 Indication and description of the approach chosen regarding baseline setting

Project participants may select either:
(a) An approach for baseline setting and monitoring developed in accordance with appendix B of the JI guidelines (JI specific approach); or
(b) A methodology for baseline setting and monitoring approved by the Executive Board of the clean development mechanism (CDM), including methodologies for small-scale project activities, as appropriate, in accordance with paragraph 4(a) of decision 10/CMP.1, as well as methodologies for afforestation/reforestation project activities.

There is no approved CDM baseline and monitoring methodology which is applicable – without revisions – to outdated district heating systems. Therefore, a JI specific approach (a) is applied. The most appropriate methodology AM0044 can be used for the project «Rehabilitation of the District Heating System of PSC «WESTA-DNEPR» because the project has some differences and inconsistencies with the conditions of the applicability of this methodology.

JI specific approach

According to the JI guidelines:
(a) The baseline for a JI project is the scenario that reasonably represents the anthropogenic emissions by sources or anthropogenic removals by sinks of GHGs that would occur in the absence of the proposed project. A baseline shall cover emissions from all gases, sectors and source categories listed in Annex A of the Kyoto Protocol, and anthropogenic removals by sinks, within the project boundary;
(b) A baseline shall be established:
  (i) on a project-specific basis and/or using a multi-project emission factor;
  (ii) in a transparent manner with regard to the choice of approaches, assumptions, methodologies, parameters, data sources and key factors;
  (iii) taking into account relevant national and/or sectoral policies and circumstances, such as sectoral reform initiatives, local fuel availability, power sector expansion plans, and the economic situation in the project sector;
  (iv) in such a way that emission reduction units (ERUs) cannot be earned for decreases in activity levels outside the project activity or due to force majeure;
  (v) taking account of uncertainties and using conservative assumptions;
(c) Project participants shall justify their choice of baseline.

The main cause of impossibility of methodology AM0044 using for baseline calculation is no data for thermal energy output, because of thermal energy meters absence on the majority of boiler houses included in the project. 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 expenditure in the municipal boiler-houses. Only the fuel consumption is registered on a regular basis. It makes practically impossible the application of AM0044 (version 01) methodology which basic moment is monitoring of the value $EG_{PJ, i, y}$

[4] http://ji.unfccc.int/Ref/Documents/Baseline_setting_and_monitoring.pdf

(thermal energy output of project boiler i in year y) - page 9 of Methodology AM0044 (version 01), 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 period $EG_{BL,\ his,\ i}$ (average historic thermal energy output from the baseline boiler "i").

To calculate the project will be used "Methodological tool" developed by the Institute of Engineering Ecology Ltd which is based on the basis of permanent monitoring of fuel consumption and of the account of various other factors, such as connection or disconnection of the consumers, change of fuel heating value, weather change, ratio of the heat consumption for heating, etc.

The "Methodological tool" has two important advantages in comparison with the methodology AM0044 (at least for Ukrainian conditions):

- It takes into account the quality of heat supply (heating and hot water supply). Almost annually 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, and hot water supply is insufficient or absent. As the purpose of JI projects, including the current project, is the GHG (CO_2) emission reduction under the conditions of not worsening in any circumstances of the social conditions of population, the issue of approaching of the heat supply quality to the normative one is extremely important. Therefore, the amount of the fuel consumption for the 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 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 period (baseline) in view of the fact that in Ukraine at the majority of the 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.

However, as it was mentioned before in this PDD, the majority of boiler houses in Ukraine are not equipped with devices for heat-carrier expenditure definition or heat meters. There is only one parameter that is regularly and with high precision defined in the boiler houses – fuel consumption.

The Methodological tool is based on the permanent measuring of the fuel consumption and amendments for possible parameters changes in baseline in comparison with reporting year. The variable parameters may be the changes in lower heating value of fuels, quality of heating service, weather changes, changes in customers' number, 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 reporting period, change in fuel quality, disconnection of some consumers, and other factors, and could lead to artificial overestimation of ERUs amount.

The Methodological tool is designed for DH projects with in conditions of Ukraine, already approved by the accredited independent entities in the process of determination similar projects, such as "Rehabilitation of the District Heating System in Donetsk Region" [5], "District Heating System Rehabilitation of Chernigiv Region" [6], "Rehabilitation of the district heating system of Crimea" [7], "Rehabilitation of the District Heating System in Kharkiv City"[8], "Rehabilitation of the District Heating System in Donetsk City" [9] and many others is most acceptable, accurate and in accordance with the principle of conservatism, and most fully consistent with the goals, objectives and mind of the Kyoto protocol.

The baseline study will be fulfilled every year of the emission reduction purchasing, to correct adjustment factors which have an influence at the baseline. For more detailed information see section D.1.

Step 1: Identify technically feasible baseline scenario alternatives to the project activity

Alternatives to the baseline scenario should include all technically feasible options which are realistic and credible. These options should include the JI project activity not implemented as a JI project.

Step 2: Eliminate baseline options that do not comply with legal or regulatory requirements

On the basis of the alternatives that are technically feasible and in compliance with all legal and regulatory requirements, the project participant should establish a complete list of barriers that would prevent alternatives to occur in the absence of JI. Show that the identified barriers would not prevent the implementation of at least one of the alternatives to the proposed JI project activity.

Step 3: Eliminate baseline alternatives that face prohibitive barriers

If there are several potential baseline scenario candidates that do not face barriers: (1) either choose the most conservative (results in least emissions) alternative as the baseline scenario; or (2) choose the economically most attractive alternative (using Step 4).

Step 4: Identify the most economically attractive baseline scenario alternative (optional)

Determine which of the remaining project alternatives that are not prevented by any barrier is the most economically or financially attractive, and thus is the most plausible baseline scenario.

Step 2 Application of the approach chosen

Plausible future scenarios will be identified in order to establish a baseline.

Sub-step 2a. Identify technically feasible baseline scenario alternatives to the project activity

The baseline scenario alternatives should include all technically feasible options which are realistic and credible. These options should include the JI project activity not implemented as a JI project. The options are:

- Status quo

The first version of Baseline scenario is a business-as-usual scenario with minimum reconstruction works balanced by overall degradation of DH system. For this Baseline scenario there are no barriers (no investment barrier since this scenario doesn't require the attraction of additional investments, and no

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[5] http://ji.unfccc.int/JIITLProject/DB/I71KB95JEW3XSFWSOSHFZG2TA5VUSF/details

[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

[9] http://ji.unfccc.int/JIITLProject/DB/GGJ0ASSCFDDL304D4MCZL09L4ZW9PO/details

technological barrier since the equipment is operated by existing skilled personnel, and additional re-training is not required), and represent the common practice in Ukraine.

- Reconstruction without Joint Implementation mechanism

The second version of Baseline scenario is construction of a modern module boiler house without JI mechanism. In this case there exist both investment barrier since this scenario requires the attraction of large additional investments, and due to very large payback time and high risks it is not attractive for investments, and as well the technological barrier since operation of the new modern equipment will require additional re-training of personnel. Rehabilitation of heat supply equipment in order to improve its efficiency is not a common practice in Ukraine.

- Exclusion from the project any non-key type of measures:

The third version of Baseline scenario is the shortened project activity, without any of the non-key type of activity, for example elimination of automatic system or choice of a remote location of new boiler house etc., from the project. Also in the new boiler house can be installed support equipment are not a foreign manufacturer, but Ukrainian, which will lead to increase of electricity consumption. All of this makes project economically less attractive, with the longer pay back period.

Thus, the first version was chosen for Baseline scenario.

Step 2: Exclude the basic options are not relevant legislate and regulatory requirements

According to The Laws of Ukraine “On licensing of the separate types of activity” (№ 1775-III, from June 01, 2000) and “On heat energy supply” (№ 2633-IV from 02.06.2005); Ukrainian Government Regulation "On introduction of changes to the Government Regulations №1698 from 14.11.2000 and №756 from 04.07.2001" №549 from 19.04.2006 and "On approval of the list of licensing bodies" №1698 from 14.11.2000, execution of economic activity in fields of heat energy production, distribution and supply require a license that is issued by Ministry of Housing and Municipal Economy of Ukraine.

PSC «WESTA-DNEPR» has such licenses.

The Project «Rehabilitation of the District Heating System of Public Stock Company «WESTA-DNEPR» has been prepared according to The Law of Ukraine from 01.07.1994 №74/94-VR “On energy saving” and The Law of Ukraine from 22.12.2005 №3260-IV “On changes in The Law of Ukraine “On energy saving”.

The alternatives, which are: to continue business-as-usual scenario, to make reconstruction works without JI mechanism and to implement shortened project activity, without any of the non-key type of project activity, are in compliance with the mandatory laws and regulations.

It should be noted that there is no local legislation regarding the time of boilers replacement and maximum lifetime permitted for boilers. It is common practice to exploit boilers which was installed in 70 th. and even 50-60th and earlier in Ukraine, if they pass the technical examination pass by the authorized body (“Derzhnagliadohoronpratsi”) While specific permissions and licenses may be required, each of the options above can comply with legal and regulatory requirements. Therefore, each of these options is technically feasible and can comply with legal or regulatory requirements.

Step 3: Eliminate baseline alternatives that face prohibitive barriers

Sub-step 3a: On the basis of the alternatives that are technically feasible and in compliance with all legal and regulatory requirements, the project participant should establish a complete list of barriers that would prevent alternatives to occur in the absence of JI. For each of the alternatives to the situation existing prior to the implementation of the project, the barriers are listed below.

Investment barriers

Total capital investments that are required for this project is about 2.2 million (Operating costs are not included in the project because it is believed that they remain at the same level or even decrease due to lower costs for new equipment).

Technological barriers

1. Not all proposed technologies are widely approved already. Qualification of operational personal for implementation of the new technologies may be not sufficient to provide proper activity implementation in time.

Most of enterprisers in Ukraine fulfill annual minimal repairing of the DH system to keep it working. Particularly they execute repairing of network's parts and boilers that might cause accidents. The most economically feasible and realistic scenario without carbon credits sales is a very slow reconstruction activity, instead of making a major overhaul of the heating system.

Most of proposed technologies are widely used in Ukraine for the similar JI projects. For example boilers replacement, network replacement with pre-insulated pipes, installation of frequency controllers/

2. Risk of technological fault: the risk of fault of process / technology to local conditions is much higher than for other technologies that provide services or final products in comparison to those proposed by project activities .Efficiency of installed equipment could be lower than was claimed by producers or equipment may have substantial defects.

3. Available amount of natural gas. Last years Ukraine faced with incomplete delivery of natural gas from Russian Federation. Ukrainian Government realized attempts to decrease dependence from Russian natural gas delivery.

Organizational barriers

The management experience in implementation of JI projects is absent, including international collaboration, determination, verification, registration, monitoring of similar projects and so on.

Identified barriers would prevent the implementation of the proposed project activity as well as of the other alternatives - to make reconstruction works without JI mechanism and to shortened project activity, without any of the non-key type of project activity.

Sub-step 3b: Show that the identified barriers would not prevent the implementation of at least one of the alternatives to the proposed JI project activity.

Since the barriers identified above, directly related to investment in modernization of district heating , in PSC "WESTA-DNEPR" there are no barriers to the further operation of district heating the same level.The status quo does not face any barriers. All alternatives to the status quo face realistic and credible barriers that would prevent their implementation without registration as a JI project activity.

Therefore the continuation of the status quo is the only remaining alternative and is selected as baseline scenario. As there is only one alternative to the project scenario, step 4 is not necessary.

Step 4: Identify the most economically attractive baseline scenario alternative (optional)

Not necessary, as there is only one alternative to the project scenario after step 3.

Conclusion

In conclusion, the baseline scenario is the continuation of the status quo, which is the continuation of the situation before the project was installed, without construction modern modular boiler house and new heat supply network with dismantling the old equipment.

Baseline Calculation

Calculation of baseline emissions is carried out for each baseline period based on the formula given below.

$E_i^b = E_{1i}^b + E_{cons\ i}^b$, (Equation 1)

where:
E_{1i}^b – CO_2 emissions due to fuel consumption for heating and hot water supply service for an i boiler-house in the base period, t CO_2e;
$E_{cons\ i}^b$– CO_2 emissions due to electric power consumption from greed by the i boiler-house in the base period, t CO_2e.

For each i boiler-house:

$E_1^b = LHV_b*Cef_b*B_b$; (Equation 2)

$E_{cons}^b = P_b*CEF_c$, , (Equation 3)

where:

LHV_b – lower heating value of fuel in the baseline scenario, MJ/m^3 (MJ/kg);
Cef_b – carbon dioxide emission factor of fuel combustion in the baseline scenario, kt CO_2/TJ;
B_b – fuel consumption by a boiler-house in the baseline scenario, ths m^3 or tons;
P_b – electric power consumption by a boiler-house where energy saving measures are scheduled to be implemented, MWh;
CEF_c – carbon dioxide emission factors for reducing electricity consumption in Ukraine[10], tCO_2e/MWh;

[$_b$] index – related to the base period;

If any boiler-house consumes more than one type of fuel, the calculations of E are to be made for each type of fuel separately, and results are to be summed.

According to the Dynamic Baseline assumption, the efficient value of E_1^b may be defined as follows:

$E_{1i}^b = E_{hi}^b, + E_{wi}^b$,, (Equation 4)

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[10] *For the years 2008-2011 – NEIA Orders No.43 dated 28.03.2011, No.62 dated 15.04.2011, No.63 dated 15.04.2011,No.75 dated 12.05.2011*

http://neia.gov.ua/nature/control/uk/publish/category?cat_id=111922 where the first term describes emissions from fuel consumption for heating, and the second one – from fuel consumption for hot water supply.

For the case when in the base period the hot water supply service was provided (independent of this service duration, $(1-a_b) \neq 0$), the formulae for E_1^b is:

$E_1^b = LHV_b*Cef_b*[B_b*a_b*K_1*K_h + B_b*(1-a_b)*K_1*K_w]$, (Equation 5)

where the first term in brackets describes fuel consumption for heating, and the second one – fuel consumption for hot water supply.

For the case when in the base period the hot water supply service was absent at all ($(1-a_b) = 0$), and in the reporting period this service was provided (due to improvement of heat supply service quality for population), the formulae for E_1^b is:

$E_1^b = LHV_b*Cef_b*[B_b*a_b*K_1*K_h + B_r*(1-a_r)*K_1*K_{w0}]$, (Equation 6)

where:
LHV_b – lower heating value, MJ/m^3 (MJ/kg);
Cef_b – carbon dioxide emission factor, kt CO_2/TJ;
$B_{b,r}$ – amount of fuel consumed by a boiler-house, ths m^3 or tons per period;
K_1, K_h, K_w, K_{w0} – adjustment factors;
$a_{b,r}$ – portion of fuel (heat), consumed for heating purposes;
$(1-a_r)$ – portion of fuel (heat), consumed for hot water supply services;
$[_b]$ index – related to the base period;
$[_r]$ index – related to the reporting period.

$a_b = L_h^b*g*N_h^b / (L_h^b*g*N_h^b+L_w^b*N_w^b)$; (Equation 7)
$a_r = L_h^r*g*N_h^r / (L_h^r*g*N_h^r+L_w^r*N_w^r)$, (Equation 8)

where:
L_h, L_w – maximum connected load to the boiler-house, that is required for heating and for hot water supply service, MW;
g – recalculating factor for average load during heating period (is determined for each boiler-house on historical base, usually is in the range 0,4 – 0,8);
N_h, N_w – duration of heating period and period of hot water supply service per period, hours.

Adjustment factors:

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

$K_1 = LHV_b / LHV_r$, (Equation 9)

2. Adjustment factors for heating should be used for creation the Dynamic Baseline which takes into account changes of the external factors such as weather conditions, heating area, etc.

Fuel consumption for heating is proportional to the required amount of heat during heating period, Q_h:

$B_h = B_b*a_b = Q_h / LHV_b*\eta$, (Equation 10)

where η is overall heating system efficiency.

According to the assumption of the Dynamic Baseline, the required amount of heat in the base period for correct comparison should be reduced to real conditions (external to the project) in the reporting period:

$Q_{h\,br} = Q_{h\,b} * K_h = Q_{h\,r}$, (Equation 11)

where:
$Q_{h\,br}$ – required heat for Dynamic Baseline, is assumed equal to Q_r – required heat in the reporting period,
$Q_{h\,b}$ – required heat in the base period,
K_h – averaged adjustment factor for heating.

From this equation it is possible to determine the averaged adjustment factor:
$K_h = Q_{h\,r} / Q_h$, (Equation 12)

Required amount of heat for heating of buildings during a year, according to the "Codes and regulations on rationing of fuel and heat energy for heating of residential and public buildings, as well as for communal and domestic requirements in Ukraine. KTM 204 Ukraine 244-94"[11], is determined by [ibid, equation 2.17]:

$Q_h = F_h * k_h * (T_{in} - T_{out}) * N_h$, (Equation 13)

where:
Q_h – required amount of heat for heating, kWh;
F_h – heating area of buildings, m^2;
k_h – average heat transfer factor of buildings, kW/m^2*K;
T_{in} – average inside temperature for the heating period, K (or ^0C);
T_{out} – average outside temperature for the heating period, K (or ^0C);
N_h – duration of the heating period per period, hours.

Then:
$K_h = (F_{h\,r} * k_{h\,r}) * (T_{in\,r} - T_{out\,r}) * N_{h\,r} / F_{h\,b} * k_{h\,b} * (T_{in\,b} - T_{out\,b}) * N_{h\,b}$, (Equation 14)

2.1. K_2 (temperature change factor):

$K_2 = (T_{in\,r} - T_{out\,r}) / (T_{in\,b} - T_{out\,b})$, (Equation 15)

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

$K_3 = (F_{h\,r} * k_{h\,r}) / F_{h\,b} * k_{h\,b} = [(F_{h\,r} – F_{h\,t\,r} – F_{h\,n\,r}) * k_{h\,b} + (F_{h\,n\,r} + F_{h\,t\,r}) * k_{h\,n}] / F_{h\,b} * k_{h\,b}$, (Equation 16)

where:
$F_{h\,b}$ – heating area of buildings in the base period, m^2;
$F_{h\,r}$ – heating area of buildings in the reporting period, m^2;
$F_{h\,n\,r}$ – heating area of new buildings connected to DH system (assumed with the new (improved) thermal insulation) in the reporting period, m^2;
$F_{h\,t\,r}$ – heating area of buildings (previously existed in the base period) in reporting period with the renewed (improved) thermal insulation, m^2;
$k_{h\,b}$ – average heat transfer factor of heated buildings in the base period, W/m^2*K;
$k_{h\,r}$ – average heat transfer factor of heated buildings in the reporting period, W/m^2*K;
$k_{h\,n}$ – heat transfer factor of heated buildings with the new thermal insulation (new buildings or old ones with improved thermal insulation), W/m^2*K.

2.3. K_4 (heating period duration change factor):

$K_4 = N_{h\,r} / N_{h\,b}$ (Equation 17)

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[11] Codes and regulations on rationing of fuel and heat energy for heating of residential and public buildings, as well as for communal and domestic requirements in Ukraine. KTM 204 Ukraine 244-94. Kyiv, 2001, 376 p.

where:
$N_{h\,b}$ – duration of the heating period in the base period, hours;
$N_{h\,r}$ – duration of the heating period in the reporting period, hours.

Thus,

$K_h = K_2 * K_3 * K_4$, (Equation 18)

3. Adjustment factors for hot water supply service should be used for creation the Dynamic Baseline which takes into account changes of the external factors such as weather conditions, number of customers, etc.:

Fuel consumption for hot water supply service is proportional to the required amount of heat during the service rendered period, Q_w:

$B_w = B_b*(1-a_b) = Q_w / LHV_b *\eta$, (Equation 19)

where η is overall hot water supply system efficiency.

According to the assumption of the Dynamic Baseline, the required amount of heat for hot water supply service in the base period for correct comparison should be reduced to real conditions (external to the project) in the reporting period:

$Q_{w\,br} = Q_{w\,b}*K_w = Q_{w\,r}$, (Equation 20)

where:
$Q_{w\,br}$ – required heat for hot water supply service for Dynamic Baseline, is assumed equal to $Q_{w\,r}$ – required heat for hot water supply service in the reporting period,
$Q_{w\,b}$ – required heat for hot water supply service in the base period,
K_w – averaged adjustment factor for hot water supply service.

From this equation it is possible to determine the averaged adjustment factor:
$K_w = Q_{w\,r} / Q_{w\,b}$. (Equation 21)

The components of K_w may be illustrated by correlation of heat used for hot water supply service in the base and reporting periods:

$Q_w = n_w*v_w*N_w$, (Equation 22)

where:
Q_w – required amount of heat for hot water supply service, kWh;
n_w – average number of service's customers, personal accounts;
v_w – standard specific discharge of hot water per personal account (in heat units, kWh/h);
N_w – duration of the service period per period, hours.

Then:
$K_w = n_{w\,r}*v_{w\,r}*N_{w\,r} / n_{w\,b}*v_{w\,b}*N_{w\,b}$, (Equation 23)

3.1. K_5 (number of customers change factor):

$K_5 = n_{w\,r} / n_{w\,b}$, (Equation 24)

3.2. K_6 (standard specific discharge of hot water per personal account change factor):
$K_6 = v_{w\,r} / v_{w\,b}$, (Equation 25)

At present the standard specific discharge of hot water is valid in Ukraine that was established by the KTM 204 Ukraine 244-94[1] in 1993. and no information is available on any propositions to change it, thus $K_6 = 1$ and does not require special monitoring.

3.3. K_7 (hot water supply period duration change factor):

$K_7 = N_{w\,r} / N_{w\,b}$, (Equation 26)

where:
$N_{w\,b}$ – duration of the hot water supply period in the base period, hours;
$N_{w\,r}$ – duration of the hot water supply period in the reporting period, hours.

Thus,

$K_w = K_5 * K_6 * K_7$. (Equation 27)

3.4. Adjustment factors for hot water supply service in case when there was no hot water supply service in base period, and in the reporting period this service was provided:

Since in case when there was no hot water supply service in base period, number of customers, standard specific discharge of hot water per personal account and duration of hot water supply period in the base period are assumed to be equal to these values in the reporting period,

$K_5 = K_6 = K_7 = 1$. (Equation 28)

Thus

$K_{w0} = 1$.

Status and compliance of the current heating supply systems

The current work of heat supply plant based on gas and fuel oil boilers Ukrainian or Russian production, including two steam boiler DKVR 10/13 and three hot-water boiler KVHM-50. The current efficiency of boilers is 71-85%.

Current distribution networks are characterized by loss of heat more than 50%.

Building a Baseline scenario

Current heating system of the plant is expressed by long deterioration of the heat generating and distributing equipment with a continuous decline in its effectiveness. However, at the same time operative maintenance increases efficiency, which largely compensates for the deterioration and makes annual total emissions level (baseline) the same for years.

Calculation of Baseline Carbon dioxide emission factors

For our calculations we take the CO_2 emission factors from the National Inventories of Ukraine[12]..

		2006	2007	2008	2009	2010	2011	2012
Carbon content of natural gas, tC/TJ	*Cnatural gas,y*	15.300	15.300	15.120	15.110	15.110	15.110	15.110
Carbon content of fuel oil, tC/TJ	*Cfuel oil,y*	21.100	21.100	21.100	21.100	21.100	21.100	21.100
Carbon oxidation factor (natural gas)	*OXIDnatural gas,y*	0.995	0.995	0.995	0.995	0.995	0.995	0.995

12 http://www.neia.gov.ua/nature/control/uk/doccatalog/list?currDir=117395

Carbon oxidation factor (fuel oil)	*OXIDfuel oil,y*	0.990	0.990	0.990	0.990	0.990	0.990	0.990
	CEFnatural gas,y	0.0561	0.0561	0.0554	0.0554	0.0554	0.0554	0.0554
	CEFfuel oil,y	0.0774	0.0774	0.0774	0.0774	0.0774	0.0774	0.0774

For our calculations we take the Lower Heating Value of a fuel (LHV) from the National Inventories of Ukraine[13].

Type of fuel	Average lower heating value of fuel TJ/mln.m^3 (TJ/ths.t)			
	2006	2007	2008	2009-2012
Natural gas	33.85	33.85	34	34.1
Fuel oil	39.98	40.5	39.8	39.9

Table.7 Lower heating value for fuels

Specific indirect carbon dioxide emissions at electricity consumption of electric energy consumers who classified as a 1st class according to the Procedure for determining the classes of consumers, approved by the National Electricity Regulatory Commission of Ukraine from August 13, 1998 № 1052 is selected in accordance with methodology "Ukraine - Assessment of new calculation of CEF", authorized TUV SUD 17.08.2007 and Decree # 62 of the National Environmental Investment Agency of Ukraine" On approval of specific carbon dioxide emission factors in 2008" dated 15/04/2011, Decree # 63 of the National Environmental Investment Agency of Ukraine" On approval of specific carbon dioxide emission factors in 2009" dated 15/04/2011, Decree # 43 of the National Environmental Investment Agency of Ukraine" On approval of specific carbon dioxide emission factors in 2010" dated 28/03/2011 and Decree # 75 of the National Environmental Investment Agency of Ukraine" On approval of specific carbon dioxide emission factors in 2011"[14] dated 12/05/2011.

Year/Type	Parameter ($kgCO_2/kWh$ or tCO_2/MWh)	2006-2007	EF_ 2008	EF_ 2009	EF_ 2010	EF_ 2011
Consumption of 1 class of voltage electricity	**CEF_c**	0.896	1.082	1.096	1.093	1.090

Table.8 Specific indirect carbon dioxide emissions at electricity consumption

The key information and data used to establish the baseline (variables, parameters, data sources etc.) are presented below.

Data/Parameter	**B_b**
Data unit	Ths.m^3
Description	Fuel consumption at a boiler-house. Natural gas
Time of determination/monitoring	Monthly

[13] http://www.neia.gov.ua/nature/control/uk/doccatalog/list?currDir=117395

[14] http://www.neia.gov.ua/nature/doccatalog/document?id=127498

Source of data (to be) used	Gas flow meter
Value of data applied (for ex ante calculations/determinations)	See Supporting document 1.
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Indication of meters is recorded in special paper journals in boiler house
QA/QC procedures (to be) applied	Meters pass periodic calibration and verification under national standards
Any comment	

Data/Parameter	B_b
Data unit	t
Description	Fuel consumption at a boiler-house. Fuel oil
Time of determination/monitoring	Monthly
Source of data (to be) used	Indication of meters is recorded in special paper journals in boiler house
Value of data applied (for ex ante calculations/determinations)	See Supporting document 1.
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Purchasing of fuel oil is realized in accordance with agreement. Consumption of fuel oil is measured by special dimensional tanks using metroshtoki.
QA/QC procedures (to be) applied	N/A
Any comment	

Data/Parameter	LHV_b
Data unit	TJ/mln.m^3 or TJ/ths.t
Description	Lower Heating Value of fuel
Time of determination/monitoring	Once per period
Source of data (to be) used	National Inventory Report of anthropogenic emissions of Ukraine [15]
Value of data applied (for ex ante calculations/determinations)	See table below

Type of fuel	Average lower heating value of fuel TJ/mln.m^3 (TJ/ths.t)			
	2006	2007	2008	2009-2012
Natural gas	33.85	33.85	34	34.1
Fuel oil	39.98	40.5	39.8	39.9

[15] http://www.neia.gov.ua/nature/control/uk/publish/article?art_id=129587&cat_id=124567

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	If the parameter change in the basis document that it will be changed according to new values

Data/Parameter	$\mathbf{T_{out\ b}}$ and $\mathbf{T_{out\ r}}$
Data unit	^0C
Description	Average outside temperature during the heating period
Time of determination/monitoring	Once per heating period. Daily temperature is registered every day of heating period
Source of data (to be) used	Meteorological Centre sends the Report every decade or month for every day of heating season. Reports are filed in special journals
Value of data applied (for ex ante calculations/determinations)	See Supporting document 1.
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Average outside temperature during the heating season is calculated from the daily outside temperature values taken by dispatcher of PSC «WESTA-DNEPR» from Meteorological Centre every day of heating period
QA/QC procedures (to be) applied	N/A
Any comment	

Data/Parameter	$\mathbf{T_{in\ b}}$
Data unit	^0C
Description	Average inside temperature during the heating period
Time of determination/monitoring	Daily temperature is registered every day of heating period
Source of data (to be) used	Journal of records
Value of data applied (for ex ante calculations/determinations)	See Supporting document 1.
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Measurement of thermometer
QA/QC procedures (to be) applied	According to the national legislation
Any comment	

Data/Parameter	$\mathbf{T_{in\ r}}$
Data unit	^0C
Description	Average inside temperature during the heating period

Time of determination/monitoring	Once
Source of data (to be) used	KTM 204 Ukraine 244-94
Value of data applied (for ex ante calculations/determinations)	18
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	

Data/Parameter	$\mathbf{n_{wb}}$ and $\mathbf{n_{wr}}$
Data unit	
Description	Number of Customers for hot water supply service
Time of determination/monitoring	Once
Source of data (to be) used	Data of the company
Value of data applied (for ex ante calculations/determinations)	$\mathbf{n_{wb}} = \mathbf{n_{wr}}$ =0(doesn't exist hot water supply service)
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Data of the company
QA/QC procedures (to be) applied	N/A
Any comment	

Data/Parameter	**$F_{h\,b}$ and $F_{h\,r}$**
Data unit	$м^2$
Description	Heating area
Time of determination/monitoring	Once per period
Source of data (to be) used	Data of the company
Value of data applied (for ex ante calculations/determinations)	$\mathbf{F_{h\,b}} = \mathbf{F_{h\,r}}$ =131164.6
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The information is collected by the certificate of on the property right in accordance with technical passport of building. Total area with balconies and stairs and Heating area are displayed in the special journal
QA/QC procedures (to be) applied	The data is taken for January, 01 for every year
Any comment	

Data/Parameter	$\mathbf{k_{hb}}$
Data unit	kW/m^2*K

Description	Average Heat transfer factor of buildings in baseline
Time of determination/monitoring	Heat transfer factor is recorded ones per period at recording of connection or disconnection of any heating area to boiler-houses included in project.
Source of data (to be) used	SNIP 2-3-79 (1998)
Value of data applied (for ex ante calculations/determinations)	0.63
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	For calculation of Heat transfer factor of buildings for every boiler-house, the method of Weighted average value was used, that depends on heating area of existing buildings and heating area of the new buildings. Values of the heat transfer factor for existing buildings were taken from SNiP 2-3-79 (1998) - not higher than 0.63. Values of the heat transfer factor of new buildings were taken according to State Buildings Norms (B.2.6-31:2006) - not higher than 0.36.
Any comment	

Data/Parameter	$F_{h\ t\ r}$
Data unit	m^2
Description	Heating area of buildings (previously existed in the base period) with the renewed (improved) thermal insulation in the reporting period
Time of determination/monitoring	Once per period
Source of data (to be) used	Data of the company
Value of data applied (for ex ante calculations/determinations)	0, there is no buildings with upgraded thermal insulation in the reporting period
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The information is collected by the certificate of on the property right in accordance with technical passport of building. Total area with balconies and stairs and Heating area are displayed in the special journal
QA/QC procedures (to be) applied	The data is taken for January, 01 for every year
Any comment	

Data/Parameter	$F_{h\ n\ r}$
Data unit	m^2
Description	Heating area of newly connected buildings (assumed with the new (improved) thermal insulation) in the reporting period
Time of determination/monitoring	Once per period
Source of data (to be) used	Data of the company
Value of data applied (for ex ante calculations/determinations)	0, any new building with a new upgraded insulation was not connected to system

Justification of the choice of data or description of measurement methods and procedures (to be) applied	The information is collected by the certificate of on the property right in accordance with technical passport of building. Total area with balconies and stairs and Heating area are displayed in the special journal
QA/QC procedures (to be) applied	The data is taken for January, 01 for every year
Any comment	

Data/Parameter	$\mathbf{k_{h\ n}}$
Data unit	kW/m^2*K
Description	Heat transfer factor of new buildings and buildings with new thermal insulation
Time of determination/monitoring	Once per period
Source of data (to be) used	SBN (B.2.6-31:2006)
Value of data applied (for ex ante calculations/determinations)	0.36
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Value of the heat transfer factor of new buildings were taken from State Buildings Norms (B.2.6-31:2006)
QA/QC procedures (to be) applied	N/A
Any comment	

Data/Parameter	$\mathbf{N_{h\ b}}$ and $\mathbf{N_{h\ r}}$
Data unit	hour
Description	Heating period duration
Time of determination/monitoring	Every month of heating period
Source of data (to be) used	Data of the company
Value of data applied (for ex ante calculations/determinations)	See Supporting document 1.
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	The duration of the Heating period is accepted in accordance with item 7.9.4 of "Rules of technical exploitation of heating equipment and networks. 2007". Beginning and ending of the heating period are determined in every town separately. The heating period begins if the average daily outside temperature is 8 ^oC or lower during 3 days, and finishes if average daily outside temperature is 8 ^oC or higher during 3 days.

Data/Parameter	$\mathbf{N_{w\ b}}$ and $\mathbf{N_{w\ r}}$
Data unit	hour

Description	Duration of the period of hot water supply service
Time of determination/monitoring	Once per month
Source of data (to be) used	Data of the company
Value of data applied (for ex ante calculations/determinations)	$N_{w\,b}$=$N_{w\,r}$=0 (doesn't exist hot water supply service)
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Data of the company
QA/QC procedures (to be) applied	N/A
Any comment	

Data/Parameter	L_h^b and L_h^r
Data unit	Gkal
Description	Maximum connected load to the boiler-house, that is required for heating
Time of determination/monitoring	It is calculated every time for monitoring
Source of data (to be) used	N/A
Value of data applied (for ex ante calculations/determinations)	L_h^b =50 L_h^r =19.26
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Maximum connected load to the boiler-house, that is required for heating, is calculated by PSC «WESTA-DNEPR» for every heating season. It is calculated according to heat demand at outside temperature -25 ^{o}C.
QA/QC procedures (to be) applied	N/A
Any comment	

Data/Parameter	L_w^b and L_w^r
Data unit	Gkal
Description	Maximum connected load to the boiler-house, that is required for providing the hot water supply service
Time of determination/monitoring	It is calculated every time for monitoring
Source of data (to be) used	N/A
Value of data applied (for ex ante calculations/determinations)	L_w^b =L_w^r = 0 (doesn't exist hot water supply service)
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Maximum connected load to the boiler-house, that is required for hot water supply service, is calculated by the company in accordance with the needs of water supply and temperature conditions.
QA/QC procedures (to be) applied	N/A
Any comment	

Data/Parameter	$\mathbf{v}_{w\,r}$ and $\mathbf{v}_{w\,b}$
Data unit	kWh/h
Description	Standard specific discharge of hot water per personal account
Time of determination/monitoring	Once per period
Source of data (to be) used	"KTM 204 Ukraine 244-94" in 1993, and no information is available on any propositions to change it.
Value of data applied (for ex ante calculations/determinations)	$\mathbf{v}_{w\,b}$ /$\mathbf{v}_{w\,r}$ =1
Justification of the choice of data or description of measurement methods and procedures (to be) applied	At present the standard specific discharge of hot water is valid in Ukraine that was established by the "KTM 204 Ukraine 244-94" in 1993, and no information is available on any propositions to change it.
QA/QC procedures (to be) applied	N/A
Any comment	

Data/Parameter	Cef
Data unit	$KtCO_2/TJ$
Description	Carbon dioxide emission factor for different fuels
Time of determination/monitoring	Annualy
Source of data (to be) used	National Inventory Report of anthropogenic emissions of Ukraine [16]
Value of data applied (for ex ante calculations/determinations)	See section B.1.
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	If the parameter changes in the reporting period must be corrected

Data/Parameter	g
Data unit	
Description	Recalculating factor for average load during heating period
Time of determination/monitoring	It is calculated every time for monitoring
Source of data (to be) used	N/A

[16] http://www.neia.gov.ua/nature/control/uk/publish/article?art_id=129587&cat_id=124567

Value of data applied (for ex ante calculations/determinations)	Recalculating factor for average load during heating period is determined for boiler-house on historical base, usually it is in the range (0,4 – 0,8)
Justification of the choice of data or description of measurement methods and procedures (to be) applied	$g = Q_{av}/Q_{max} = F_h*k_h*(T_{in} - T_{out\ av})/F_h*k_h*(T_{in} - T_{out\ min})$ where: g – recalculating factor for average load during heating period; F_h – heating area of buildings, m^2; k_h – average heat transfer factor of heated buildings,(W/m^2*K); T_{in} – average inside temperature for the heating period, K ; $T_{out\ av}$ – average outside temperature for the heating period, K (or ^0C); $T_{out\ min}$ – minimal outside temperature for the heating period, K (or ^0C).
QA/QC procedures (to be) applied	N/A
Any comment	

Data/Parameter	P_b
Data unit	MWh
Description	Electricity consumption
Time of determination/monitoring	Every day
Source of data (to be) used	Electricity supply meters
Value of data applied (for ex ante calculations/determinations)	
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Measurement by Electricity supply meters
QA/QC procedures (to be) applied	N/A
Any comment	

Data/Parameter	CEF_c
Data unit	tCO_2/kWh or tCO_2/MWh
Description	Carbon dioxide emissions factor at electricity consumption from the grid or Factor of specific carbon dioxide emissions
Time of determination/monitoring	Yearly
Source of data (to be) used	DFP Orders
Value of data applied (for ex ante calculations/determinations)	See section B.
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	Contract with indication class of electric energy consumers between WESTA-DNEPR and electric energy supply company is

	provided to the AIE during site visit.

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 JI project:

The anthropogenic emissions of GHG in the project scenario will be reduced due to complex modernization of heat generating and distributing equipment with application of the technologies proposed in the project activities and described above, which include replacement of old obsolete boilers by new ones with higher efficiency, replacement of obsolete coal-fired boilers by the modern gas-fired ones, frequency controllers installation, installation of cogeneration units and heat pump station at the boiler houses, renovation of degraded heat distribution networks with using of the pre-insulated pipes.

Additionality of the project

The demonstration that the project provides reductions in emissions by sources that are additional to any that would otherwise occur uses the following step-wise approach:

Step 1. Indication and description of the approach applied

a) If a JI specific approach is used, please explicitly indicate which of the approaches to demonstrate additionality, defined in paragraph 2 of the annex I to the “Guidance on criteria for baseline setting and monitoring”, is chosen, and provide a justification of its applicability, with a clear and transparent description, as well as references, as appropriate.

b) If an approved CDM baseline and monitoring methodology is used in accordance with paragraph 10 of the .Guidance on criteria for baseline setting and monitoring., please provide clear references (e.g. title of the baseline and monitoring methodology or tool, relevant version of the methodology or tool etc.) and describe why and how it is applicable.

The most recent version of the “Tool for the demonstration and assessment of additionality” version 6.0.0 is used, in accordance with the JI specific approach, defined in paragraph 2 (c) of the annex I to the “Guidance on criteria for baseline setting and monitoring”.

Step 2. Application of the approach chosen

The Ukraine signed the Kyoto Protocol on 15 March 1999, and projects from 1 January 2000 are eligible under JI. The proposed project faces serious barriers as described above and is not considered the baseline scenario. The project was first developed after discussions in 2006 between the project developer and JI experts.

The additionality of the project activity is demonstrated and assessed below with using the last version of “Tool for the demonstration and assessment of additionality” version 6.0.0 which is approved by the CDM Executive Board. Tools include the steps listed below.

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

Because of the similarity of the approaches used to determine the baseline scenario in B.1. and the Additionality Tool, in line with the practice in approved methodologies, e.g. AM0044, Step 1 of the “Tool for the demonstration and assessment of additionality” is ignored. Therefore, as described in B.1 above, the baseline is:

continuation of the status quo, which is a continuation of the situation before the implementation of the *project without building a new modern modular boiler house with new heating network and dismantling of the old boiler house plant with the old network.*

→ Proceed to Step 2 (Investment analysis) or Step 3 (Barrier analysis). (Project participants may also select to complete both steps 2 and 3.)

The project participants select to proceed to Step 3.

Step 3. Barrier analysis

Determine whether the proposed project activity faces barriers that:
(a) Prevent the implementation of this type of proposed project activity; and
(b) Do not prevent the implementation of at least one of the alternatives.

The identified barriers are only sufficient grounds for demonstration of additionality if they would prevent potential project proponents from carrying out the proposed project activity undertaken without being registered as a JI project activity. If JI does not alleviate the identified barriers that prevent the proposed project activity from occurring, then the project activity is not additional.

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

Establish that there are realistic and credible barriers that would prevent the implementation of the proposed project activity from being carried out if the project activity was not registered as a JI activity. Such realistic and credible barriers may include, among others:

(a) Investment barriers
(b) Technological barriers
(c) Barriers due to prevailing practice, inter alia: the project activity is the "first of its kind"
(d) Other barriers

At present there are at least 9 District Heating Rehabilitation Projects with JI mechanism in Ukraine at advansed stages beside this project: for DH systems in Chernihiv region, Donetsk region, AR Crimea, Kharkiv, Dnipropetrovsk, Luhansk, Doneck, Zaporizhya Cities and others[17]. But all these projects are the projects of reconstruction and modernization of the city municipal district heating system with replacement parts only heat supply network and replacement or reconstruction of several boilers in the boiler house, such as in our case is based completely new module boiler house and laid a new modern heat supply network. The proposed project is the first project for the construction of a modern modular boiler house instead of the old with the withdrawal of its operating and dismantling of the borders of one company that for its is a complete replacement of heating system, because there are barriers associated with new technology to replace the entire complex heating system at the company. Register as a JI project activity provides significant additional revenue and attract international expertise, as JI eliminate barriers that arise because of new technology.

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):

There is no barrier to the baseline alternative, the continuation of the situation prior to the implementation

[17] http://www.neia.gov.ua/nature/control/uk/doccatalog/list?currDir=116707&documentList_stind=1

of the project activity. Therefore, the identified barrier does not affect the alternative.

→ ***"If both Sub-steps 3a – 3b are satisfied, proceed to Step 4 (Common practice analysis)".***

Therefore, the project participants select to proceed with Step 4.

Step 4. Common practice analysis

The proposed project type has been demonstrated to be first-of-its-kind (according to Sub-step 3a), therefore, it has been shown that the proposed project type (e.g. technology or practice) has not diffused in the relevant sector and region and is not common practice.

In conclusion, all the steps above are satisfied. The proposed project is not the baseline scenario and is additional.

Step 3. Provision of additionality proofs

No further additionality proofs are needed.

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

The project boundaries include old and new boiler-houses and heat distribution networks that supply heat and hot water to the objects. In the old boiler house was installed 2 steam boilers DKVR 10/13 and 3 hot-water boilers KVGM-50. 2 steam boilers DKVR 10/13 were used for technical purpose, namely, for pre-heating oil to keep it in liquid condition. 2 hot-water boilers KVGM-50 were in service and 1 hot-water boilers KVGM-50 was in reserve, thus heat production level new and old boiler house are approximately at the same level, and their difference is leveled by calculation when entering the coefficients. The heat distribution networks from the boiler to consumers were located outside the main territory, stretching more than 1 km. The new boiler is located in the existing building manufacturing plant #117 in one-floor part of it. The technology part of the project provides installation of the two hot-water boilers Logano S825L capacity 11200kW each (firm "Buderus", Germany).

The spatial extent of the project boundary comprises:

- All equipment installed and used as part of the project activity for the heat generation, and also transportation it to the costumer.
- Ukraine National Electricity Grid and the connected power plants.

The project is limited mainly to boiler and heat supply systems. Reduction of the CO_2 emissions at phases of production and distributions of heat during a heat supply is supposed in the project. Increase of an overall performance of boilers and reduction of losses of heat in heating systems will lead to the common reduction of consumption of fuel by system. The reduced consumption of fuel will lead to reduction of emissions.

Project boundaries for Baseline scenario are represented by dotted line on the graphical picture on the **Fig. 7.**

Greenhouse Gas Sources and Project Boundaries:

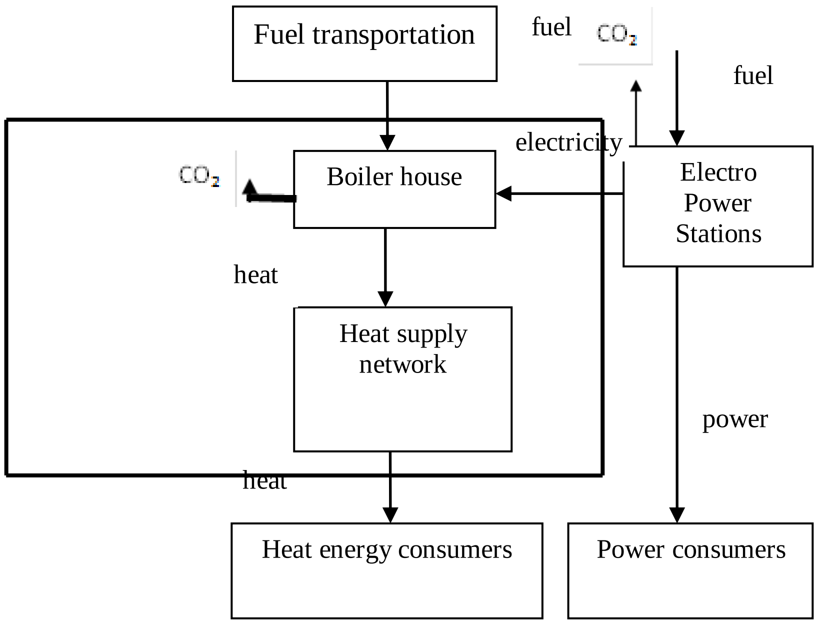

Fig.7 Project boundaries

As shown in the figure, the project boundary for the baseline and project scenariosinclude CO_2 emissions from the boiler house, which owned JSC "WESTA-DNEPR" and JSC "DMZ" from fossil fuel combustion for heating and steam and include CO_2 emissions due to electricity consumption of the grid .

Emissions due to production and transportation of fuel are not included in project boundaries as well.

Direct and Indirect Emissions

Direct on-site emissions: CO_2 from natural gas combustion in boilers (in some cases fuel oil is used as a fuel), NO_x and CO emission from combustion in the existing boilers/ burners.

Direct off-site emissions: CO_2 emissions from power stations due to electricity production to the grid, that consumed by boiler houses, which will be upgraded.

Indirect on-site emissions: none.

Indirect off-site emissions: CO_2 emissions from fuel extraction and transportation.

On-site emissions			
Current situation	Project	Direct or indirect	Include or exclude
CO_2 emissions from fuel combustion in boilers	Reduced CO_2 emissions from fuel combustion in boilers due to increased efficiency and fuel saving.	Direct	Include
CH4, NO_x and CO emission from combustion in existing boilers/ burners	Reduced CH4, NO_x and CO emissions from fuel combustion after boiler / burners' replacement	Direct	Exclude. Minor source, can be neglected

Off-site emissions			
Current situation	Project	Direct or indirect	Include or exclude
CO_2 emissions from power plant(s) due to electricity production to the grid, that is consumed by boiler houses, which will be upgraded.	Reduced CO_2 emissions from power plant(s) due to reduction of electricity consumption by boiler houses	Direct	Include
CO_2 emissions from fuel extraction and transportation.	Reduced CO_2 emissions from fuel extraction and transportation due to fuel saving.	Indirect	Exclude, not under control of project developer

Table.9 Project boundaries and sources of emissions

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 setting: 23.12.2011

Contact information of the entity and persons responsible:
Mr. Tahir Musayev, project manager, Carbon Capital Services Limited,
Email t.musayev@gmail.com Tel/Fax: +38 044 490 6968.
Carbon Capital Services Limited is not a project participant listed in annex 1.

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

The starting date of the project is: 22.02.2007

The starting date of a JI project activity is the date on which the implementation or construction or real action of the project begins. The starting date of the proposed project activity is the date of signing between the PSC «WESTA-DNEPR» and the JSC "DMZ" to jointly work on designing and reconstruction of the free areas building number 117 under the module heating boiler, soon after started the actual installation of equipment.

C.2. Expected operational lifetime of the project:

The minimal **-** 25 years (nominal lifetime of the new equipment for boilers and heat supply network). The real average lifetime of the new network equipment is estimated to be up to 30 – 40 years. Thus the expected operational lifetime of the project may be about 30 years. According to conservatism principle, for further calculations we assume operational lifetime for the project equal to 25 years or 300 months (2007-2032).

C.3. Length of the crediting period:

Start of the crediting period: 01/11/2007.
This is the date of operation start.

0 year 2 months for the pre-2008 period (01/11/2007-31/12/2007).
5 years 0 months for the first crediting period (01/01/2008-31/12/2012).
5 years 0 months for the second crediting period (01/01/2013-31/12/2017).
14 years 0 months for the next crediting period (01/01/2018-31/12/2032).

The first crediting period ends in line with the first commitment period under the Kyoto Protocol. A second crediting period is proposed to cover the 2013-2017 period, which covers most of the remaining lifetime of the project activity. The period prior to the start of the first Kyoto commitment period starts with the start of operation of the project and ends with the start of the first crediting period under Kyoto.

If the past first commitment period under the Kyoto Protocol will be applicable, the crediting period may be expanded up to the end of the expected operational lifetime of the project (24 years and 2 months or 290 months , 2007-2032).

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

In accordance with annex 1 to the JI guidelines and following the guidance on criteria for baseline setting and monitoring[18] the monitoring plan is described below, using the following step-wise approach.

Step 1 Indication and description of the approach chosen regarding monitoring

The JI specific approach (a) is applied.

JI specific approach

In accordance with the guidance the monitoring plan shall provide for:

(i) The collection and archiving of all relevant data necessary for estimating or measuring anthropogenic emissions of GHGs occurring within the project boundary during the crediting period;
(ii) The collection and archiving of all relevant data necessary for determining the baseline of anthropogenic emissions of GHGs within the project boundary during the crediting period;
(iii) The identification of all potential sources of, and the collection and archiving of data on increased anthropogenic emissions of GHGs outside the project boundary that are significant and reasonably attributable to the project during the crediting period. The project boundary shall encompass all anthropogenic emissions of GHGs under the control of the project participants that are significant and reasonably attributable to the JI project;
(iv) The collection and archiving of information on environmental impacts, in accordance with procedures as required by the host Party, where applicable;
(v) Quality assurance and control procedures for the monitoring process;
(vi) Procedures for the periodic calculation of the reductions of anthropogenic emissions by the proposed JI project, and for leakage effects, if any. Leakage is defined as the net change of anthropogenic emissions of GHGs which occurs outside the project boundary, and that is measurable and attributable to the JI project;
(vii) Documentation of all steps involved in the calculations referred to above.

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[18] Guidance on criteria for baseline setting and monitoring, version 03 (JISC 26).

Step 2 Application of the approach chosen

In accordance with the guidance the monitoring plan provides for:

(i) The collection and archiving of all relevant data necessary for estimating or measuring anthropogenic emissions of GHGs occurring within the project boundary during the crediting period; and
(ii) The collection and archiving of all relevant data necessary for determining the baseline of anthropogenic emissions of GHGs within the project boundary during the crediting period.

Data collection about the number of combustion gas, and generated heat is take place continuously by equipment and automatic systems. Based on these data, is calculated the total volume of gas consumed. Monitoring of electricity consumption is continuous. Thus, there is the collection and archiving of all data needed to assess or measure anthropogenic emissions of greenhouse gases within the project crediting period and baseline emissions.

With regards to the emission factor of the electricity system in the Ukraine, the previously established, validated and approved national factor is applied and fixed ex-ante for the crediting period.[26] This factor is subject to monitoring and will be corrected at the stage of writing amonitoring report for the period.

(iii) The identification of all potential sources of, and the collection and archiving of data on increased anthropogenic emissions of GHGs outside the project boundary that is significant and reasonably attributable to the project during the crediting period. The project boundary shall encompass all anthropogenic emissions of GHGs under the control of the project participants that are significant and reasonably attributable to the JI project.

Therefore, leakage emissions are conservatively considered zero.

(iv) The collection and archiving of information on environmental impacts, in accordance with procedures as required by the host Party, where applicable.

The host Party does not require the collection and archiving of information on environmental impacts of this project activity type.

(v) Quality assurance and control procedures for the monitoring process.

All measurements are conducted with calibrated measurement equipment according to relevant industry standards. Consumption of gas, electricity and generated of heat are cross checked against sales receipts.

All monthly data is checked and signed off by the JI Project Manager.

(vi) Procedures for the periodic calculation of the reductions of anthropogenic emissions by the proposed JI project, and for leakage effects, if any. Leakage is defined as the net change of anthropogenic emissions of GHGs which occurs outside the project boundary, and that is measurable and attributable to the JI project.

The reductions of anthropogenic emissions by the proposed JI project are calculated and reported by the JI Project Management Team on a monthly basis.

Leakage equal zero.

Description of the approximate calculation, formulas, parameters, data sources and key factors are presented in D.1.2.2 below. Section D.1.3 are measure of inaccuracy for each parameter.

(vii) Documentation of all steps involved in the calculations referred to above.

All data collected as part of the monitoring are archived electronically and kept at least for 2 years after the last transfer of ERUs for the project. 100% of the data are monitored as indicated in the table below. All measurements are conducted with calibrated measurement equipment according to relevant industry standards.

Procedures identified for corrective actions in order to provide for more accurate future monitoring and reporting

In cases if any errors, fraud, inconsistencies or situations when monitoring data are unavailable will be identified during the monitoring process special commission will appointed by project host management that will conduct a review of such case and issue an order that must also include provisions for necessary corrective actions to be implemented that will ensure such situations are avoided in future.

The project host management will also establish a communication channel that will make it possible to submit suggestions, improvement proposals and project ideas for more accurate future monitoring for every person involved in the monitoring activities. Such communications will be delivered to the project host management who is required to review these communications and in case it is found appropriate implement necessary corrective actions and improvements. Project participant - will conduct periodic review of the monitoring plan and procedures and if necessary propose improvements to the project participants. Also, to prevent the situations in which monitoring data are unavailable, all parameters are fixed and saved on paper and electronically in a database the Owner and Developer of the project separately.

Emergency preparedness for cases where emergencies can cause unintended emissions

The project operation does not foresee any factors or emergencies that can cause unintended GHG emissions. Safe operation of equipment and personnel is ensured by systematic safety training. Procedures for dealing with general emergencies such as fire, major malfunction etc. are developed as part of the mandatory business regulations and are in accordance with local requirements.

Indicator of project performance

The most objective and cumulative factor that will give a clear picture of whether emission reductions really took place – is *fuel saving*. It can be identified as a difference between baseline fuel consumption and fuel consumption after project implementation. If boilers consume fuel at the projected level, than all other relevant indicators such as efficiencies of new boilers and burners as well as heat losses in pre-insulated pipes are adequate.

Verification of project performance indicators

PSC «WESTA-DNEPR» collects data on fuel purchasing for heating in form of fuel bills. Information on saved fuel will be attached to verification reports on a yearly basis (before April 1st for all years of project implementation) with all relevant documentation and historical information on fuel purchasing transactions made by Supplier.

Verification of Emission Reduction Units and Baseline Scenario

The monitoring Methodological tool developed for "District Heating" projects in Ukrainian conditions consists in the following:

For any project year, the baseline scenario may be different due to the influence of external factors such as weather conditions, possible changes of the lower heating value of fuel(s), number of customers, heating area, etc. The Baseline and the amount of ERUs for each project year should be corrected with taking into account these and some other factors.

The following Methodological tool is proposed to be used.

Amount of the Emission Reduction Units (ERUs), t CO_2e:

$$ERUs = \sum[E_i^b - E_i^r] \quad \text{(Equation 29)}$$

The sum is taken over all boiler-houses (i) which are included into the project.

$$E_i^b = E_{1i}^b + E_{cons\ i}^b, \quad \text{(Equation 30)}$$

$$E_i^r = E_{1i}^r + E_{cons\ i}^r, \quad \text{(Equation 31)}$$

where:

E_{1i}^{b} and E_{1i}^{r} – CO_2 emissions due to fuel consumption for heating and hot water supply service for an i boiler-house in the base period and in the reporting period, respectively, t CO_2e;
$E_{cons\ i}^{b}$ and $E_{cons\ i}^{r}$ – CO_2 emissions due to electric power consumption from greed by the i boiler-house in the base period and in the reporting period, respectively, t CO_2e.

For each i boiler-house:

$E_1^{b} = LHV_b*Cef_b*B_b$; (Equation 32)

$E_1^{r} = LHV_r* Cef_r*B_r$; (Equation 33)

$E_{cons}^{b} = P_b*CEF_c$; (Equation 34)

$E_{cons}^{r} = P_r*CEF_c$, (Equation 35)

where:

$LHV_{b,r}$ – lower heating value, MJ/m^3 (MJ/kg);
$Cef_{b,r}$ – carbon dioxide emission factor, kt CO_2/TJ;
$B_{b,r}$ – amount of fuel consumed by a boiler-house, ths m^3 or tons;
P_b – electric power consumption by a boiler-house where energy saving measures are scheduled to be implemented, MWh;
P_r – electric power consumption by a boiler-house with energy saving measures implemented, MWh;
CEF_c – Carbon dioxide emission factors for reducing electricity consumption in Ukraine, tCO_2e/MWh;

[$_b$] index – related to the base period;
[$_r$] index – related to the reporting period.

If any boiler-house consumes more than one type of fuel, the calculations of E are to be made for each type of fuel separately, and results are to be summed.

According to the Dynamic Baseline assumption, the efficient value of E_1^{b} may be defined as follows:
$E_{1i}^{b} = E_{hi}^{b},+ E_{wi}$; (Equation 36)
where the first term describes emissions from fuel consumption for heating, and the second one – from fuel consumption for hot water supply.

For the case when in the base period the hot water supply service was provided (independent of this service duration, $(1\text{-}a_b) \neq 0$), the formulae for E_1^b is:
$E_1^b = LHV_b*Cef_b*[B_b*a_b*K_1*K_h + B_b*(1-a_b)*K_1*K_w]$, (Equation 37)

where the first term in brackets describes fuel consumption for heating, and the second one – fuel consumption for hot water supply.

For the case when in the base period the hot water supply service was absent at all ($(1\text{-}a_b) = 0$), and in the reporting period this service was provided (due to improvement of heat supply service quality for population), the formulae for E_1^b is:

$E_1^b = LHV_b*Cef_b*[B_b*a_b*K_1*K_h + B_r*(1-a_r)*K_1*K_{w0}]$; (Equation 38)

$E_1^r = LHV_r* Cef_r*B_r$, (Equation 39)

where:
$LHV_{b,r}$ – lower heating value, MJ/m^3 (MJ/kg);
$Cef_{b,r}$ – carbon dioxide emission factor, kt CO_2/TJ;
$B_{b,r}$ – amount of fuel consumed by a boiler-house, ths m^3 or tons per period;
K_1, K_h, K_w, K_{w0} – adjustment factors;
$a_{b,r}$ – portion of fuel (heat), consumed for heating purposes;
$(1\text{-}a_r)$ – portion of fuel (heat), consumed for hot water supply services;
$[_b]$ index – related to the base period;
$[_r]$ index – related to the reporting period.

$a_b = L_h^b*g*N_h^b / (L_h^b*g*N_h^b+L_w^b*N_w^b)$; (Equation 40)
$a_r = L_h^r*g*N_h^r / (L_h^r*g*N_h^r+L_w^r*N_w^r)$, (Equation 41)

where:
L_h, L_w – maximum connected load to the boiler-house, that is required for heating and for hot water supply service, MW;
g – recalculating factor for average load during heating period (is determined for each boiler-house on historical base, usually is in the range 0,4 – 0,8);
N_h, N_w – duration of heating period and period of hot water supply service per period, hours.

Adjustment factors:

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

$K_1 = LHV_b / LHV_r$, (Equation 42)

2. Adjustment factors for heating should be used for creation the Dynamic Baseline which takes into account changes of the external factors such as weather conditions, heating area, etc.

Fuel consumption for heating is proportional to the required amount of heat during heating period, Q_h:

$B_h = B_r * a = Q_h / LHV_r * \eta$, (Equation 43)

where η=98% is overall heating system efficiency.

According to the assumption of the Dynamic Baseline, the required amount of heat in the base period for correct comparison should be reduced to real conditions (external to the project) in the reporting period:

$Q_{h\ br} = Q_{h\ b} * K_h = Q_{h\ r}$ (Equation 44)

where:
$Q_{h\ br}$ – required heat for Dynamic Baseline, is assumed equal to Q_r – required heat in the reporting period,
$Q_{h\ b}$ – required heat in the base period,
K_h – averaged adjustment factor for heating.

From this equation it is possible to determine the averaged adjustment factor:
$K_h = Q_{h\ r} / Q_{h\ b}$., (Equation 45)

Required amount of heat for heating of buildings during a year, according to the "Codes and regulations on rationing of fuel and heat energy for heating of residential and public buildings, as well as for communal and domestic requirements in Ukraine. KTM 204 Ukraine 244-94"[19], is determined by [ibid, equation 2.17]:

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19 *Codes and regulations on rationing of fuel and heat energy for heating of residential and public buildings, as well as for communal and domestic requirements in Ukraine. KTM 204 Ukraine 244-94. Kyiv, 2001, 376 p.*

$$Q_h = F_h*k_h*(T_{in} - T_{out})*N_h,$$ (Equation 46)

where:
Q_h – required amount of heat for heating, kWh;
F_h – heating area of buildings, m^2;
k_h – average heat transfer factor of buildings, kW/m^2*K;
T_{in} – average inside temperature for the heating period, K (or ^0C);
T_{out} – average outside temperature for the heating period, K (or ^0C);
N_h – duration of the heating period per period, hours.

Then:
$$K_h = (F_{h\,r}*k_{h\,r})*(T_{in\,r} - T_{out\,r})*N_{h\,r} / F_{h\,b}*k_{h\,b}*(T_{in\,b} - T_{out\,b})*N_{h\,b},$$ (Equation 47)

2.1. K_2 (temperature change factor):

$$K_2 = (T_{in\,r} - T_{out\,r}) / (T_{in\,b} - T_{out\,b}).$$ (Equation 48)

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

$$K_3 = (F_{h\,r}*k_{h\,r}) / F_{h\,b}*k_{h\,b} = [(F_{h\,r} – F_{h\,t\,r} – F_{h\,n\,r})*k_{h\,b} + (F_{h\,n\,r} + F_{h\,t\,r})*k_{h\,n}] / F_{h\,b}*k_{h\,b},$$ (Equation 49)

where:
$F_{h\,b}$ – heating area of buildings in the base period, m^2;
$F_{h\,r}$ – heating area of buildings in the reporting period, m^2;
$F_{h\,n\,r}$ – heating area of new buildings connected to DH system (assumed with the new (improved) thermal insulation) in the reporting period, m^2;
$F_{h\,t\,r}$ – heating area of buildings (previously existed in the base period) in reporting period with the renewed (improved) thermal insulation, m^2;
$k_{h\,b}$ – average heat transfer factor of heated buildings in the base period, W/m^2*K;
$k_{h\,r}$ – average heat transfer factor of heated buildings in the reporting period, W/m^2*K;
$k_{h\,n}$ – heat transfer factor of heated buildings with the new thermal insulation (new buildings or old ones with improved thermal insulation), W/m^2*K.

2.3. K_4 (heating period duration change factor):

$$K_4 = N_{h\,r} / N_{h\,b}$$ (Equation 50)

where:
$N_{h\,b}$ – duration of the heating period in the base period, hours;
$N_{h\,r}$ – duration of the heating period in the reporting period, hours.

Thus,

$K_h = K_2 * K_3 * K_4$ (Equation 51)

3. Adjustment factors for hot water supply service should be used for creation the Dynamic Baseline which takes into account changes of the external factors such as weather conditions, number of customers, etc.:

Fuel consumption for hot water supply service is proportional to the required amount of heat during the service rendered period, Q_w:

$B_w = B_r *(1-a_r) = Q_w / LHV_r *\eta$, (Equation 52)

where η is overall hot water supply system efficiency.

According to the assumption of the Dynamic Baseline, the required amount of heat for hot water supply service in the base period for correct comparison should be reduced to real conditions (external to the project) in the reporting period:

$Q_{w\,br} = Q_{w\,b} * K_w = Q_{w\,r}$ (Equation 53)

where:
$Q_{w\,br}$ – required heat for hot water supply service for Dynamic Baseline, is assumed equal to $Q_{w\,r}$ – required heat for hot water supply service in the reporting period,
$Q_{w\,b}$ – required heat for hot water supply service in the base period,
K_w – averaged adjustment factor for hot water supply service.

From this equation it is possible to determine the averaged adjustment factor:
$K_w = Q_{w\,r} / Q_{w\,b}$. (Equation 54)

The components of K_w may be illustrated by correlation of heat used for hot water supply service in the base and reporting periods:

$Q_w = n_w * v_w * N_w$, (Equation 55)

where:
Q_w – required amount of heat for hot water supply service, kWh;
n_w – average number of service’s customers, personal accounts;
v_w – standard specific discharge of hot water per personal account (in heat units, kWh/h);
N_w – duration of the service period per period, hours.

Then:
$K_w = n_{w\,r}*v_{w\,r}*N_{w\,r} / n_{w\,b}*v_{w\,b}*N_{w\,b}$ (Equation 56)

3.1. K_5 (number of customers change factor):

$K_5 = n_{w\,r} / n_{w\,b}$ (Equation 57)

3.2. K_6 (standard specific discharge of hot water per personal account change factor):
$K_6 = v_{w\,r} / v_{w\,b}$ (Equation 58)

At present the standard specific discharge of hot water is valid in Ukraine that was established by the KTM 204 Ukraine 244-94[1] in 1993. and no information is available on any propositions to change it, thus $K_6 = 1$ and does not require special monitoring.

3.3. K_7 (hot water supply period duration change factor):

$K_7 = N_{w\,r} / N_{w\,b}$ (Equation 59)

where:
$N_{w\,b}$ – duration of the hot water supply period in the base period, hours;
$N_{w\,r}$ – duration of the hot water supply period in the reporting period, hours.

Thus,

$K_w = K_5 * K_6 * K_7$ (Equation 60)

3.4. Adjustment factors for hot water supply service in case when there was no hot water supply service in base period, and in the reporting period this service was provided:

Since in case when there was no hot water supply service in base period, number of customers, standard specific discharge of hot water per personal account and duration of hot water supply period in the base period are assumed to be equal to these values in the reporting period,

$K_5 = K_6 = K_7 = 1.$ (Equation 61)

Thus

$K_{w0} = 1$.

The table of parameters included in the process of monitoring and verification for ERUs calculation, is represented in the Section **D.1.1.1** and **D.1.1.3.** Every year the table with foregoing factors will be updated with account for possible change of these factors, and the dynamic baseline will be developed as well as the amount of ERUs will be calculated**.**

D.1.1. Option 1 – Monitoring of the emissions in the project scenario and the baseline scenario:

D.1.1.1. Data to be collected in order to monitor emissions from the project, and how these data will be archived:

ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
1	Fuel consumption at boiler houses: (**B_r**)	Every Boiler house	Ths.m^3	m	Continuous	100%	The data automatic accounting system and data in the journal (paper and/or electronic)	Fuel consumption at boiler houses is the main data which allows to calculate GHG emissions in the reporting period
2	Power consumption (**P_r**)	Boiler houses and heating points where frequency controllers, new pumps and	MWh	m	Continuous	100%	The data automatic accounting system and data in the journal (paper	Data which allows to calculate GHG emissions in the reporting period

		heat exchangers will be installed					and/or electronic)	
3	Average annual Heating Value of a fuel calculated by Lower Heating Value (**LHV_r**)	National Inventory Report of Ukraine	TJ/mln.m^3	e	Once per period	100%	Registered in the electronic form)	Data which allows to calculate GHG emissions in the reporting period
4	Carbon dioxide emission factor of electri city consumption or Factor of specific carbon dioxide emissions **(CEF_c)**	Orders of the DFP	kgCO_2/kWh or tCO_2/MWh	e	Once per period	100%	Registered in the electronic form)	Data which allows to calculate GHG emissions in the reporting period

According to valid legislation, all measuring equipment in Ukraine should meet the specified requirements of corresponding standards and is subject to the periodical verifying and calibration (usually once per period, for some equipment once per two and three years).

In case of failure of measurement equipment, it should be replaced or repaired as soon as possible. Such cases should be noted in monitoring reports.

D.1.1.2. Description of formulae used to estimate project emissions (for each gas, source etc.; emissions in units of CO_2 equivalent):

$E_i^r = E_{1i}^r + E_{cons\ i}^r$; (Equation 62)

where:

E_{1i}^r – CO_2 emissions due to fuel consumption for heating and hot water supply service for an i boiler-house in the reporting period, t CO_2e;

$E_{cons\ i}^{r}$ – CO_2 emissions due to electric power consumption from greed by the i boiler-house in the reporting period, t CO_2e.

$E_{1i}^{r} = LHV_r * Cef_r * B_{ri}$, (Equation 63)

where:
B_{ri} – amount of fuel consumed by a boiler-house in the reporting period, ths m^3 or tons;
LHV_{ri} – Average annual lower heating value for each type of fuel, MJ/m^3 (MJ/kg)
Cef_i – carbon dioxide emission factor for each type of fuel, ktCO_2/TJ;

$E_{cons\ i}^{r} = P_r * CEF_c$; (Equation 64)

where:
P_r – electric power consumption by the boiler-houses and central heating points with energy saving measures implemented (frequency controllers, new pumps and heat exchangers will be installed), MWh;
CEF_c – Carbon dioxide emission factors for reducing electricity consumption in Ukraine, tCO_2e/MWh;
[$_r$] index – related to the reporting period

D.1.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions of greenhouse gases by sources within the project boundary, and how such data will be collected and archived:

ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

1	Fuel consumption at boiler houses (**B_b**)	Data of the company, boiler house		m	Continuously	100%	Registered in the journal (paper and/or electronic form)	Fuel consumption at boiler houses is the main data which allows to calculate GHG emissions in the base period
1.1	Natural Gas		1000 m^3	m				
1.2	Fuel oil		ton	m				
2	Average annual Heating Value of a fuel calculated by Lower Heating Value (**LHV_b**)	National Inventory Report of Ukraine		e	Once per period	100%	Registered in the electronic form	Data which allows to calculate GHG emissions in the base period
2.1	Natural Gas		TJ/mln.m^3					
2.2	Fuel oil		TJ/ths.t					
3	Average outside temperature during the heating season (**$T_{out\ b}$** and **$T_{out\ r}$**)	Meteorological Service	^{0}C (K)	m, c	Once per reporting period. Daily temperature is registered every day	100%	Report of Meteorological Service (paper and/or electronic form)	Auxiliary data which allows correcting of the dynamic baseline

4	Average inside temperature during the heating season (**$T_{in\ b}$**)	Data of the company	^{0}C (K)	m	Every day of heating period	100%	Registered in paper form	Auxiliary data which allows correcting of the dynamic baseline
5	Average inside temperature during the heating season (**$T_{in\ r}$**)	KTM 204 Ukraine 244-94	^{0}C (K)	e	Once	100%	Registered in electronic form	Auxiliary data which allows correcting of the dynamic baseline
6	Number of Customers (**n_{wb}** and **n_{wr}**)	Data of the company		e	Once	100%	Data of the company (paper and/or electronic)	Auxiliary data which allows correcting the dynamic baseline
7	Heating area (total) (**$F_{h\ b}$** and **$F_{h\ r}$**)	Data of the company	m^2	e	Once	100%	Data of the company (paper and/or electronic)	Auxiliary data which allows correcting the dynamic baseline
8	Average heat transfer factor of heated buildings in the base period (**k_{hb}**)	SNIP 2.3.79 (1998)	kW/m^2*K	e	Once	100%	Data of the company (paper and/or electronic)	Auxiliary data which allows correcting the dynamic baseline

9	Heating area of buildings (previously existed in the base period) with the renewed (improved) thermal insulation in the reporting period (**$F_{h\ t\ r}$**)	Data of the company	m^2	e	Once per period	100%	Data of the company (paper and/or electronic)	Auxiliary data which allows correcting the dynamic baseline
10	Heating area of newly connected buildings (assumed with the new (improved) thermal insulation) in the reporting period (**$F_{h\ n\ r}$**)	Data of the company	m^2	e	Once per period	100%	Data of the company (paper and/or electronic)	Auxiliary data which allows correcting the dynamic baseline
11	Heat transfer factor of buildings with new thermal insulation (**$k_{h\ n}$**)	State Buildings Norms (B.2.6-31:2006)	kW/m^2*K	e	Once per period	100%	Special Reports (electronic)	Auxiliary data which allows correcting the dynamic baseline

12	Heating period duration ($\mathbf{N_{h\,b}}$ and $\mathbf{N_{h\,r}}$)	Data of the company	Hours	m	Once per period	100%	Data of the company (paper and/or electronic)	Auxiliary data which allows correcting the dynamic baseline
13	Duration of period of hot water supply service ($\mathbf{N_{w\,b}}$ and $\mathbf{N_{w\,r}}$)	Data of the company	Hours	m	Once per period	100%	Data of the company (paper and/or electronic)	Auxiliary data which allows correcting the dynamic baseline
14	Maximum connected load to the boiler-house, that is required for heating ($\mathbf{L_h^b}$ and $\mathbf{L_h^r}$)	Data of the company	Gkal	c	Once per period	100%	Data of the company (paper and/or electronic)	Auxiliary data which allows correcting the dynamic baseline
15	Connected load to the boiler-house, that is required for hot water supply service ($\mathbf{L_w^b}$ and $\mathbf{L_w^r}$)	Data of the company	Gkal	c	Once per period	100%	Data of the company (paper and/or electronic)	Auxiliary data which allows correcting the dynamic baseline
16	Standard specific discharge of hot water per personal account ($\mathbf{v_{w\,r}}$ and $\mathbf{v_{w\,b}}$)	Data of the company	kWh/h	e	Once per period	100%	Data of the company (paper and/or electronic)	Auxiliary data which allows correcting the dynamic baseline

17	Carbon dioxide emission factor (**Cef_b** and **Cef_r**)	IPCC	kt CO_2/TJ	e	Once per period	100%	Data of the company (paper and/or electronic)	Auxiliary data which allows correcting the dynamic baseline
17.1	Natural Gas							
17.2	Fuel oil							
18	Recalculating factor for average load during heating period **(g)**	Data of the company		e	Once per period	100%	Special Reports (paper and/or electronic)	
19	Electricity consumption (**P_b**)	Data of the company	MWh	m	Per month	100%	Registered in data journal (in paper and electronic form)	Data which allows to calculate GHG emissions in the base period
20	Carbon dioxide emission factor of electrici ty consumption or F actor of specific carbon dioxide emissions **(CEF_c)**	Orders of the DFP	kgCO_2/kWh or tCO_2/MWh	e	Once per period	100%	Registered in the electronic form)	Data which allows to calculate GHG emissions in the base period

D.1.1.4. Description of formulae used to estimate baseline emissions (for each gas, source etc.; emissions in units of CO_2 equivalent):

$E_i^b = E_{1i}^b + E_{cons\ i}^b$; (Equation 65)

where:
E_i^b – baseline emissions, t CO_2
E_{1i}^b – CO_2 emissions due to fuel consumption for heating and hot water supply service for an i boiler-house in the base period, t CO_2e;
$E_{cons\ i}^b$ – CO_2 emissions due to electric power consumption for an i boiler-house in the base period, t CO_2e.

For the case when in the base period the hot water supply service was provided (independent of this service duration, $(1-a_b) \neq 0$), the formulae for E_1^b is:
$E_1^b = LHV_b*Cef_b*[B_b*a_b*K_1*K_h + B_b*(1-a_b)*K_1*K_w]$, (Equation 66)
where the first term in brackets describes fuel consumption for heating, and the second one – fuel consumption for hot water supply.

For the case when in the base period the hot water supply service was absent at all ($(1-a_b) = 0$), and in the reporting period this service was provided (due to improvement of heat supply service quality for population), the formulae for E_1^b is:
$E_1^b = LHV_b*Cef_b*[B_b*a_b*K_1*K_h + B_r*(1-a_r)*K_1*K_{w0}]$. (Equation 67)

where:
LHV_b – Average annual lower heating value in the base period, MJ/m^3 (MJ/kg);
Cef – carbon dioxide emission factor, KtCO_2/TJ;
B_b – amount of fuel consumed by a boiler-house in the base period, ths m^3 or tons;
K_1, $K_h = K_2* K_3* K_4$; $K_w = K_5 * K_6 * K_7$ – adjustment factors;
a_b – portion of fuel (heat), consumed for heating purposes in the base period;
$(1-a_r)$ – portion of fuel (heat), consumed for hot water supply services in the base period;
a_r – portion of fuel (heat), consumed for heating purposes in the reporting period.

$a_b = L_h^b*q*N_h^b / (L_h^b*g*N_h^b+L_w^b*N_w^b)$; (Equation 68)

where:
L_h^b – maximum connected load required for heating in the base period, Gkal;
L_w^b – connected load required for hot water supply service in the base period, Gkal;
g – recalculating factor for average load during heating period (usually 0.4-0.8);
N_h^b – duration of heating period in the base period , hours

N_w^b – duration of hot water supply service in the base period, hours

$a_r = L_h^r * q * N_h^r / (L_h^r * g * N_h^r + L_w^r * N_w^r)$ (Equation 69)

where:
L_h^r – maximum connected load required for heating in the reporting period, MW;
L_w^r – maximum connected load required for hot water supply service in the reporting period, MW;
g – recalculating factor for average load during heating period (usually 0.4-0.8);
N_h^r – duration of heating period in the reporting period, hours,
N_w^r – duration of hot water supply service in the reporting period, hours.

$K_1 = LHV_b / LHV_r$; (Equation 70)

where:
LHV_b – average annual lower heating value in the base period, MJ/m^3 (MJ/kg);
LHV_r – average annual lower heating value in the reporting period, MJ/m^3 (MJ/kg)

$K_2 = (T_{in\ r} - T_{out\ r}) / (T_{in\ b} - T_{out\ b})$; (Equation 71)

where:
$T_{in\ r}$ – average inside temperature for the heating period in the reporting period, K (or ^0C);
$T_{in\ b}$ – average inside temperature for the heating period in the base period, K (or ^0C);
$T_{out\ r}$ – average outside temperature for the heating period in the reporting period, K (or ^0C);
$T_{out\ b}$ – average outside temperature for the heating period in the reporting period, K (or ^0C)

$K_3 = [(F_{h\ r} – F_{h\ t\ r} – F_{h\ n\ r})*k_{h\ b} + (F_{h\ n\ r} + F_{h\ t\ r})*k_{h\ n}] / F_{h\ b}*k_{h\ b}$; (Equation 72)

where:
$F_{h\ b}$ – heating area in the base period, m^2;
$F_{h\ r}$ – heating area in the reporting period, m^2;
$F_{h\ n\ r}$ – heating area of new buildings connected to DH system (assumed with the new (improved) thermal insulation) in the reporting period, m^2;
$F_{h\ t\ r}$ – heating area of buildings (previously existed in the base period) in reporting period with the renewed (improved) thermal insulation, m^2;

$k_{h\,b}$ – average heat transfer factor of heated buildings in the base period, W/m^2*K;
$k_{h\,n}$ – heat transfer factor of heated buildings with the new thermal insulation (new buildings or old ones with improved thermal insulation), W/m^2*K.

$K_4=N_{hr}/N_{hb}$; (Equation 73)

where:
N_{hb},– duration of heating period in the base period, hours
N_{hr} – duration of heating period in the reporting period, hours

$K_5=n_{wr} / n_{wb;}$ (Equation 74)
where:
N_{wb},– number of customers in the base period;
N_{wr} – number of customers in the reporting period.

$K_6 = v_{w\,r} / v_{w\,b}$; (Equation 75)

where:
$v_{w\,r}$ – standard specific discharge of hot water per personal account in the reporting period, (in heat units, kWh/h);
$v_{w\,b}$ – standard specific discharge of hot water per personal account in the base period, (in heat units, kWh/h).

$K_7 = N_{wr}/ N_{wb}$; (Equation 76)

where:
N_{wr}– duration of hot water supply service in the reporting period, hours.
N_{wb} – duration of hot water supply service in the base period, hours.

$E_{cons}^b = P_b*CEF_c$; (Equation 77)

where:
P_b – electric power consumption by the boiler-houses where energy saving measures are scheduled to be implemented (power consumption of the boiler houses, where frequency controllers, new pumps and heat exchangers will be installed), MWh;
CEF_c – Carbon dioxide emission factors for reducing electricity consumption in Ukraine, tCO_2e/MWh;

[$_b$] index – related to the base period;
[$_r$] index – related to the reporting period.

D. 1.2. Option 2 – Direct monitoring of emission reductions from the project (values should be consistent with those in section E.):

This section is left blank on purpose, as option 1 is chosen.

D.1.2.1. Data to be collected in order to monitor emission reductions from the project, and how these data will be archived:								
ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

There are no data to be collected in order to monitor emission reductions from the project, because emission reductions will be calculated by means of formulae presented in paragraph **D.1.2.2.**

This section is left blank on purpose, as option 1 is chosen.

D.1.2.2. Description of formulae used to calculate emission reductions from the project (for each gas, source etc.; emissions/emission reductions in units of CO_2 equivalent):

Amount of the Emission Reduction Units (ERUs), t CO_2e:

$ERUs = \sum[E_i^b - E_i^r]$; (Equation 78)

The sum is taken over all boiler-houses which are included into the project.

$E_i^b = E_{1i}^b + E_{cons\ i}^b$, (Equation 79)

$E_i^r = E_{1i}^r + E_{cons\ i}^r$, (Equation 80)

where:

E_{1i}^{b} and E_{1i}^{r} – CO_2 emissions due to fuel consumption for heating and hot water supply service for an i boiler-house in the base period and reporting period, t CO_2e;
$E_{cons\ i}^{b}$ and $E_{cons\ i}^{r}$ – CO_2 emissions due to electric power consumption for an i boiler-house in the base period and reporting period, t CO_2e.

D.1.3. Treatment of leakage in the monitoring plan:

Leakage is the net change of anthropogenic emissions by sources and/or removals by sinks of GHGs which occurs outside the project boundary, and that can be measured and is directly attributable to the JI project. Project participants must undertake an assessment of the potential leakage of the proposed JI project and explain which sources of leakage are to be calculated, and which can be neglected. All sources of leakage that are included shall be quantified and a procedure for an ex ante estimate shall be provided.

No leakage is expected. Dynamic baseline (based on collected monitoring data) will exclude all possible leakages.

D.1.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project:

ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

Any occasional leakage emissions (for example, caused by pipes’ leakages, etc.) should be eliminated as soon as possible.

D.1.3.2. Description of formulae used to estimate leakage (for each gas, source etc.; emissions in units of CO_2 equivalent):

No leakages are expected.

D.1.4. Description of formulae used to estimate emission reductions for the project (for each gas, source etc.; emissions/emission reductions in units of CO_2 equivalent):

Formulae presented in D.1.1. 2- D.1.1.4 will be used for monitoring of the emissions in the project scenario and the baseline scenario. They will be used in Monitoring report. The baseline is dynamic and depends on conditions of every reporting period.

D.1.5. Where applicable, in accordance with procedures as required by the host Party, information on the collection and archiving of information on the environmental impacts of the project:

According to the common Ukrainian practice for such type projects, the environmental impact of the project will be estimated by fuel consumption and combustion.

- Law of Ukraine # 1264-XII "On environmental protection" from 25.06.1991
- Law of Ukraine # 2707-XII "On atmospheric air protection" from 16.10.1992.
- Actual rules on emissions limitation: "Norms of limit admissible emissions of pollution agents from stationary sources" – adopted by Ministry for Environmental Protection of Ukraine 27.06.2006, #309 issued Ministry of and registered in Ministry of Justice of Ukraine 01.09.2006, #912/12786.

D.2. 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.
Amount of natural gas consumed by boiler houses. Amount of fuel oil consumed by boiler houses.	Low for gas. Medium for fuel oil	Measuring instruments must be calibrated according to national regulations Meters are the main elements of automatic system which is also complemented by a branded automatic operation control boilers Logano. All sources and forms of information storage on each element of the system and form a system of automatic control in general. The indications of the measurement instruments should be controlled during the regular inspections while the operation time and a gauge which is obviously out of order should be substituted.

Amount of electricity consumed by boiler house.	Low	Measuring instruments must be calibrated according to national regulations. Meters are the main elements of automatic system which is also complemented by a branded automatic operation control boilers Logano. All sources and forms of information storage on each element of the system and form a system of automatic control in general. The indications of the measurement instruments should be controlled during the regular inspections while the operation time and a gauge which is obviously out of order should be substituted.
Outside temperature.	Low	Measuring instruments must be calibrated according to national regulations The indication of the temperature meter has usually hardly any fluctuations and no recalibration is needed. The meter should be initially controlled during the final inspection by the manufacturer and will be checked regularly according to the manufacturer's instructions. The indications of the measurement instruments should be controlled during the regular inspections while the operation time and a gauge which is obviously out of order should be substituted.
Fuel quality (Lower Heating Values).	Low	It is used data from the national inventories of anthropogenic emissions of Ukraine[20]. Quality assurance is not required.
Number of customers (heating area).	Low	Statistic data. No quality assurance is needed.
Average inside temperature during the heating season	Low	Calculated from the sum of returned payments caused by insufficient heating (in case of normative level is not satisfied. No quality assurance is needed.

[20] http://www.neia.gov.ua/nature/control/uk/publish/article?art_id=129587&cat_id=124567

D.3. Please describe the operational and management structure that the project operator will apply in implementing the monitoring plan:

1. Introduction

The project adopts a JI specific monitoring approach. This monitoring plan describes the responsibilities of the JI Project Management Team and the methods and procedures to be adopted to implement the monitoring plan described in the Project Design Document in respect of this project activity.

2. Project Management & Responsibilities

The operational and management structure (as shown in below the figure) and the responsibilities of the principals are as follows. Ultimate responsibility for the project rests with the JI Project Manager.
The operational structure will include operation departments (adjustment and alignment, etc.) of Supplier (PSC «WESTA-DNEPR») and boiler house operation personnel.
The management structure will include management departments of Supplier and specialists of project developer.

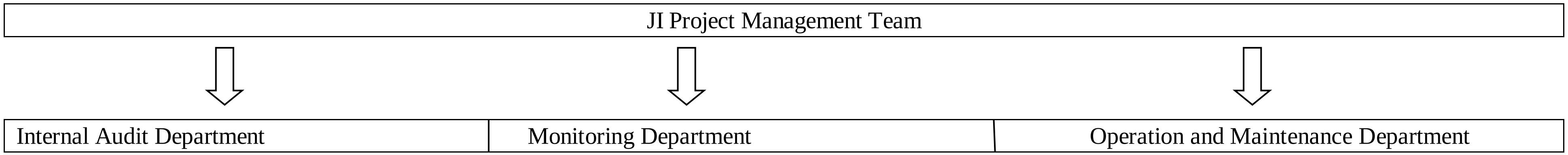

Fig.8 The management structure of the project

The JI Project Manager is responsible for:

- Checking and signing off all project operational-related activities
- Appointing and liaising with the accredited independent entity (AIE)
- Identifying an audit team leader to be appointed by the Chief Engineer or a delegated authority
- Appointing a JI technical team to undertake the operational activities
- Organizing training and refresher courses
- Preparing and supervising a Health and Safety Plan for the JI technical team
- Supervising the work of the JI technical team
- Cross checking reported volumes and sales receipts

The monitoring department is responsible for:

- Monitoring and recording of the relevant parameters

Continuous monitoring and parameters recording is carried out an automated system.Daily monitoring is carried out in the boiler house by team that records all parameters to the record journals.

Operation and maintenance department are responsible for:

- Operation and maintenance of the project infrastructure
- Service and maintenance equipment is performed by technical personnel of boiler house.

3. Data to be monitored and recorded throughout the crediting period

Parameters to be measured	**Monitoring system**	**Reporting**
Natural gas consumption	Electronic(and backup paper) monitoring system, which calculates the amount of natural gas consumption automatically	Reporting of monthly totals
Electricity consumption	Electronic(and backup paper) monitoring system, which calculates the amount of electricity consumption automatically	Reporting of monthly totals
Heat generation	Electronic(and backup paper) monitoring system, which calculates the amount of heat generation automatically	Reporting of monthly totals
Outside temperature during the heating period	Electronic temperature detector. Paper records.	Reporting of heating period

Table.10 Parameters for monitoring and recording

4. Data and parameters used but not monitored throughout the crediting period, but are determined only once (and thus remain fixed throughout the crediting period), and that are available already at the stage of determination regarding the PDD

Conversion factors and standard variables to be used in the calculations:

- Heating area in baseline scenario and reporting period $F_{h\ b}$ =$F_{h\ r}$=131164,6 m^2
- Average Heat transfer factor of buildings in baseline scenario and reporting period $k_{h\ b}$= $k_{h\ r}$ = 0,63 kW/m^2*K
- Heat transfer factor of new buildings and buildings with new thermal insulation, $k_{h\ n}$ =0,36 kW/m^2*K
- Maximum connected load to the boiler-house, that is required for heating, in baseline scenario L_h=50 Gkal
- Maximum connected load to the boiler-house, that is required for providing the hot water supply service, in baseline scenario and reporting period $L_{w\ b}$= $L_{w\ r}$ =0 (doesn't exist hot water supply service)
- Maximum connected load to the boiler-house, that is required for providing the hot water supply service, in project scenario L_h=19,26 Gkal
- Average inside temperature during the heating period, K (or ^{0}C) T_{in}= 18^{0}C
- Number of Customers for hot water supply service , personal accounts in baseline scenario and reporting period $n_{w\ b}$ = $n_{w\ r}$ =0(doesn't exist hot water supply service)
- Standard specific discharge of hot water per personal account change factor K_6= 1
- Duration of the heating period in the baseline scenario, hours N_{hb}=3880 hours/yr

5. Monitoring System

This project will involve monitoring the electricity and natural gas consumption, heat generation and parameters of district heating system. All the equipment should be serviced, calibrated and maintained in accordance with the original manufacturer's instructions and keep complete records.

Calibrations

All measurement equipment are calibrated and checked for accuracy by a qualified third party in accordance with manufacturer's recommendations and industry standard. Calibrations will take place so that equipment has a valid calibration certificate.

A list of measurement sensors will be maintained showing the location, type, date installed and date calibration expires on a form. A list of spare sensors held in stock will also be kept showing type, date delivered and calibration expiry date.

6. Data collection and handling

All controlled data are fixed by operational staff of boiler house in paper form and by automatic monitoring system electronically.

All data collected as part of the monitoring are archived electronically and kept at least for 2 years after the last transfer of ERUs for the project in accordance with Order #36-E dated 24/04/2011 of WESTA-DNEPR JSC. 100% of the data are monitored as indicated in the table below. All measurements are conducted with calibrated measurement equipment according to relevant industry standards.**7.**

7. Reporting

The operator transmits copies of completed worksheets on a regular basis while maintaining originals on file.
The project operator should prepare a brief annual report which should include: information on overall project performance, emission reductions generated and verified and comparison with targets, etc. The report can be combined with the periodic verification report.

8. Training

It is the responsibility of the operator to ensure that the required capacity and internal training is made available to its technicians to enable them to undertake the tasks required by this monitoring plan. Energopolis, Ltd is responsible for design, engineering and installation works execution by its own personnel or with help of subcontractors. Energopolis, Ltd will provide on the job training when the new equipment are being installed.

D.4. Name of person(s)/entity(ies) establishing the monitoring plan:

Contact information of the entity and persons responsible:
Mr Tahir Musayev, project manager Carbon Capital Services Limited,
Email t.musayev@gmail.com Tel/Fax: +38 044 490 6968.
Carbon Capital Services Limited is not a project participant listed in annex 1.

SECTION E. Estimation of greenhouse gas emission reductions

E.1. Estimated project emissions:

Assessment of emissions in the baseline scenario and in the project scenario was chosen for emission reduction calculations.

Calculation of project emissions is based on CO2 emissions from natural gas combustion in boilers to generate heat for heating services and electricity consumption from the national grid.

$E_i^r = E_{1i}^r + E_{cons\ i}^r$; (Equation 81)

where:
E_{1i}^r – CO_2 emissions due to fuel consumption for heating and hot water supply service for an i boiler-house in the reporting period, t CO_2e;
$E_{cons\ i}^r$ – CO_2 emissions due to electric power consumption from greed by the i boiler-house in the reporting period, t CO_2e.

$E_{1i}^r = LHV_r * Cef_r * B_{ri}$, (Equation 82)

where:
B_{ri} – amount of fuel consumed by a boiler-house in the reporting period, ths m^3 or tons;
LHV_{ri} – Average annual lower heating value for each type of fuel, MJ/m^3 (MJ/kg)
Cef_i – carbon dioxide emission factor for each type of fuel, ktCO_2/TJ;

$E_{cons\ i}^r = P_r * CEF_c$; (Equation 83)

where:
P_r – electric power consumption by the boiler-houses and central heating points with energy saving measures implemented (frequency controllers, new pumps and heat exchangers will be installed), MWh;
CEF_c – Carbon dioxide emission factors for reducing electricity consumption in Ukraine, tCO_2e/MWh;
[$_r$] index – related to the reporting period

Year	Due to fuel consumption, tCO_2e	Due to electricity consumptio n, tCO_2e	Total, tCO_2e
2007	1758	160	1918
2008	4415	512	4927
2009	3253	503	3756
2010	4062	505	4567
2011	3325	593	3918
2012	3764	528	4292
2008-2012	18819	2641	21460
2013	3764	528	4292
2014	3764	528	4292
2015	3764	528	4292
2016	3764	528	4292
2017	3764	528	4292
2018	3764	528	4292
2019	3764	528	4292

2020	3764	528	4292
2021	3764	528	4292
2022	3764	528	4292
2023	3764	528	4292
2024	3764	528	4292
2025	3764	528	4292
2026	3764	528	4292
2027	3764	528	4292
2028	3764	528	4292
2029	3764	528	4292
2030	3764	528	4292
2031	3764	528	4292
2032	3764	528	4292
2007-2032	95857	13361	109218

Table.11 Emissions in the project scenario.

Note: Project emissions are conservatively rounded up to whole tonnes.

E.2. Estimated leakage:

Not applicable. Leakage is considered zero.

E.3. The sum of E.1. and E.2.:

Project Emissions + Leakages

Year	Total Project GHG emissions, tCO_2e	Total Leakages, tCO_2e	Total, t CO_2e
2007	1918	0	1918
2008	4927	0	4927
2009	3756	0	3756
2010	4567	0	4567
2011	3918	0	3918
2012	4292	0	4292
2008-2012	21460	0	21460
2013	4292	0	4292
2014	4292	0	4292
2015	4292	0	4292
2016	4292	0	4292
2017	4292	0	4292
2018	4292	0	4292
2019	4292	0	4292

2020	4292	0	4292
2021	4292	0	4292
2022	4292	0	4292
2023	4292	0	4292
2024	4292	0	4292
2025	4292	0	4292
2026	4292	0	4292
2027	4292	0	4292
2028	4292	0	4292
2029	4292	0	4292
2030	4292	0	4292
2031	4292	0	4292
2032	4292	0	4292
2007-2032	109218	0	109218

Table.12 The project Emissions and leakages.

E.4. Estimated baseline emissions:

The formulas used to estimate the baseline anthropogenic emissions by sources of greenhouse gas emissions using the baseline methodology, description of calculations by these formulas and all the assumptions used are described in Section B.1 and D.1
For any project period, the baseline scenario may be different due to the influence of external factors such as weather conditions, possible changes of the lower heating value of fuel(s), number of customers, heating area, etc. The Baseline and the amount of ERUs for each project year should be corrected with taking into account these and some other factors.

Year	**Due to fuel consumption, tCO_2e**	**Due to electricity consumption, tCO_2e**	**Total, tCO_2e**
2007	25046	3208	28254
2008	61005	3208	64213
2009	54841	3208	58049
2010	59626	3208	62834
2011	51777	3208	54985
2012	56812	3208	60020
2008-2012	284061	16040	300101
2013	56812	3208	60020
2014	56812	3208	60020
2015	56812	3208	60020
2016	56812	3208	60020
2017	56812	3208	60020
2018	56812	3208	60020
2019	56812	3208	60020
2020	56812	3208	60020
2021	56812	3208	60020
2022	56812	3208	60020

2023	56812	3208	60020
2024	56812	3208	60020
2025	56812	3208	60020
2026	56812	3208	60020
2027	56812	3208	60020
2028	56812	3208	60020
2029	56812	3208	60020
2030	56812	3208	60020
2031	56812	3208	60020
2032	56812	3208	60020
2007-2032	1445347	83408	1528755

Table.13 Emissions in the baseline scenario.

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

Emission Reductions = (Baseline Emissions) ─ (Project Emissions+Estimated leakages)
Amount of the Emission Reduction Units (ERUs), t CO_2e:

$ERUs = \sum[E_i^b - E_i^r]$ (Equation 84)

The sum is taken over all boiler-houses (i) which are included into the project.
$E_i^b = E_{1i}^b + E_{cons\ i}^b$, (Equation 85)
$E_i^r = E_{1i}^r + E_{cons\ i}^r$, (Equation 86)

where:
E_{1i}^b and E_{1i}^r – CO_2 emissions due to fuel consumption for heating and hot water supply service for an i boiler-house in the base period and in the reporting period, respectively, t CO_2e;
$E_{cons\ i}^b$ and $E_{cons\ i}^r$ – CO_2 emissions due to electric power consumption from greed by the i boiler-house in the base period and in the reporting period, respectively, t CO_2e.

More detailed information is given in Section D.1.

During the project implementation will reach different emission reduction at different stages of project implementation.

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

Year	Estimated project emissions (tonnes of CO_2 equivalent)	Estimated leakage (tonnes of CO_2 equivalent)	Estimated baseline emissions (tonnes of CO_2 equivalent)	Estimated emission reductions (tonnes of CO_2 equivalent)
2007	1918	0	28254	**26336**
Total (tonnes of CO_2 equivalent)	**1918**	**0**	**28254**	**26336**

Table.14 Estimated balance of emissions under the proposed project in 2007

Year	Estimated project emissions (tonnes of CO_2 equivalent)	Estimated leakage (tonnes of CO_2 equivalent)	Estimated baseline emissions (tonnes of CO_2 equivalent)	Estimated emission reductions (tonnes of CO_2 equivalent)
2008	4927	0	64213	**59286**
2009	3756	0	58049	**54293**
2010	4567	0	62834	**58267**
2011	3918	0	54985	**51067**
2012	4292	0	60020	**55728**
Total (tonnes of CO_2 equivalent)	**21460**	**0**	**300101**	**278641**

Table.15 Estimated balance of emissions under the proposed project over the crediting period

Year	Estimated project emissions (tonnes of CO_2 equivalent)	Estimated leakage (tonnes of CO_2 equivalent)	Estimated baseline emissions (tonnes of CO_2 equivalent)	Estimated emission reductions (tonnes of CO_2 equivalent)
2013	4292	0	60020	**55728**
2014	4292	0	60020	**55728**
2015	4292	0	60020	**55728**
2016	4292	0	60020	**55728**
2017	4292	0	60020	**55728**
Total (tonnes of CO_2 equivalent)	**21460**	**0**	**300100**	**278640**

Table.16 Estimated balance of emissions under the proposed project for period from 2013 to 2017

Year	Estimated project emissions (tonnes of CO_2 equivalent)	Estimated leakage (tonnes of CO_2 equivalent)	Estimated baseline emissions (tonnes of CO_2 equivalent)	Estimated emission reductions (tonnes of CO_2 equivalent)
2018	4292	0	60020	**55728**
2019	4292	0	60020	**55728**
2020	4292	0	60020	**55728**
2021	4292	0	60020	**55728**
2022	4292	0	60020	**55728**
2023	4292	0	60020	**55728**
2024	4292	0	60020	**55728**
2025	4292	0	60020	**55728**
2026	4292	0	60020	**55728**
2027	4292	0	60020	**55728**

2028	4292	0	60020	**55728**
2029	4292	0	60020	**55728**
2030	4292	0	60020	**55728**
2031	4292	0	60020	**55728**
2032	4292	0	60020	**55728**
Total (tonnes of CO_2 equivalent)	**64380**	**0**	**900300**	**835920**

Table.17 Estimated balance of emissions under the proposed project for period from 2018 to 2032

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.

PSC «WESTA-DNEPR» has the necessary Environmental Impact Assessment for new construction according to Ukrainian legislation. Environmental Impact Assessment is a part of detailed engineering work «Reconstruction part of the housing number 117 under the modular boiler house» which is designed Energopolis Ltd in 2007.

Overall, the project «Rehabilitation of the District Heating System of Public Stock Company «WESTA-DNEPR» will have a positive effect on environment. Following points will give detailed information on environmental benefits.

1. Project implementation will allow saving over 11 million Nm^3 of natural gas and over 7 ton of fuel oil per period starting from 2008. Natural gas and fuel oil are a non-renewable resources and its economy is important.

2. Project implementation will reduce CO_2 emissions by 50 thousand tons per period starting from 2008 due to increased boilers efficiencies, achieved through installation of up-to-date boiler equipment, particularly new boilers, heat exchangers and installation of pre-insulated networks pipes instead of existing regular networks pipes.

3. Due to fuel economy and new environmentally friendlier technologies of fuel combustion, project implementation will reduce emissions of SO_x, NO_x, CO and particulate matter (co-products of combustion).

4. It is expected that due to a better service PJSC "DMZ" plant will reduce electricity consumption from electric heaters thus reducing power plants emissions of CO_2, SO_x, NO_x, CO and particulate matter.

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

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

Effects on air environment

Fundamental constructive solution on reducing of the nitric oxides emission is a system that limits period of flue gases staying in the hottest area and favors reduction of NOx illumination by means of this.

The boilers are supplied with gas burners with automated control ensuring optimal full combustion, high heat emission, perfect security during launch, operation and stop of the boiler, as well as boiler protection in emergency modes.

All equipment of the boiler house is characterized by reliability, security, long operation life, low fuel consumption, high quality of manufacturing. Boilers, burners can be upgraded to the extent of growth of technology. In the event of necessity replacement of individual assemblies and elements by the improved ones is possible.

The boilers and gas supply system of the boiler house are equipped with security and control automation.

Mechanical and natural ventilation is provided to comply with regulatory requirements on ventilation

The project implementation will have positive effect on ambient air:

1) Reduction of NO_x, SO_x, CO and PM due to application of cleaner technologies at boiler houses;

2) Reduction of electricity consumption results in lower emissions of the same air pollutants;

3) Heat stress on the atmosphere (due to lower temperatures of flue gases);

4) Lower emissions per unit of fuel at the same load on boiler house.

Measures for compliance with regulatory requirements on environmental conditions and environmental safety

To protect ambient air from pollution with emissions of the designed boiler house following measures are provided:

- Use of natural gas only as a fuel;

- Use of modern high-efficient boilers, which ensure automated mode of fuel burning that substantially reduces emission of harmful substances in the air;

- Control of accurate adherence to the boiler’s operation schedule, control equipment operation;

- Control of ambient air pollution, control of noise level;

- Organization of measures to ensure compliance with established standards of emissions.

Control of compliance with regulations on maximum permissible discharge (BCB) is provided for by means of instrumental determination of emissions quantity at the sources of contaminants emission not less often than once in a year by specialized agencies on a contractual basis.

Effects on water environment

Impact on the water medium is present. Impact on water resources is will be the same as in baseline scenario. The existing technology of heat energy production exploited at the objects of PSC «WESTA-DNEPR» foresees discharging of waste water to the sewage network with obligatory chemical control in accordance to Water Code of Ukraine, GOST 28.74-82 “Hygienic regulations and quality control”, SNiP 4630-92 on determining maximum concentration limits for internal water bodies. Discharge of wastewater to the open water bodies will not take place.

Principal design solutions adopted in the project ensure:

• supply of water with necessary quality and parameters to the process equipment, for the utility and everyday needs and for the needs of firefighting;

• water consumption accounting;

• regulatory sanitary conditions of the workers;

• prevention of pollution of water and air environment.

The boiler house operation will not result in pollution or exhaustion of surface water and groundwater; there is no need of special water-protective measures development.

Project implementation will have positive environmental effect. It will allow to decrease the water consumption and as a result – to decrease the amount of waste water.

Effects on geological environment

Geological environment conditions have not been evaluated during construction of the integrated boiler house due to its placement on the territory of existing PJSC "DMZ".

Effects on soil

Considering projected boiler house location in the existing building № 117 of PJSC «DMZ», construction and use of it exclude possibility of negative influence and harm to the land resources of the area and plantations, as well as it will not effect soil conditions and will not result in change of their mechanical, water-physical and other properties.

Project provides for neighborhood improvement.

Dustbins' placing is provided for collection of domestic waste.

Refuse bins' placing is provided by the project for cleanness maintenance in the neighborhood.

All waste produced by the enterprise is to be utilized.

On the ground of the aforesaid we can conclude that projected integrated boiler house operation will not affect soil conditions, will not result in change of their mechanical, water-physical and other properties.

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

Effects on biodiversity

Impact on biodiversity is not present.

There are no objects of nature reserves in the area of effect of the integrated boiler house. According to «Register of natural reserves of Dnipropetrivsk region» objects of nature reserve are absent in the analyzed area.

Natural vegetation of this area is almost wholly made with artificial plantation of forest shelter belts.

Considering the fact that this area is characterized by almost total lack of preserved natural landscapes, animal species who are flexible in their choice of place of habitation and adapted to life in transformed and being actively transformed by man territories prevail in fauna.

Planned activity in whole as anthropogenic process has negative influence on flora and fauna by means of noise manufacturing, atmospheric air pollution.

Impact of the emissions to the atmospheric air on flora and fauna of the area, considering ground concentration of the contaminants, is almost insensible, and planned activity will not result in exhaustion or degradation of the plant and faunistic associations formed in this area.

On the territory of the foreseen influence of the boiler house there is lack of populations or individual representatives of the red-listed endangered species of fauna and flora.

The boilers to be installed have high rate of fuel usage and therefore low consumption of natural gas. Besides, individual boiler houses have a number of advantages as compared with conventional heat supply sources:

- has minimal extent of the heating system and therefore minimal heat losses and fuel consumption;

- installed boilers have small capacity, and illumination and contaminants (nitric and carbon oxides) emission is minimal.

Alternative to the adopted is heat supply from existing heat sources, which is not practical in terms of natural gas consumption and quantity of contaminants emission to the atmosphere.

Evaluation of emergency situations

There are no units in the integrated boiler house which can produce material contaminants emission, dangerous for people's life, in case of emergency.

The following can result in emergency situations with negative environmental effects:

• natural disaster;

• fire;

• destruction of the boiler elements or fuel supplying system during their operation due to operational imperfection, manufacturing quality or destruction in repair or other works.

Significant negative environmental impact can be caused by fire in the boiler house premises that results in material quantity of combustion products emission to the atmosphere, as well as to the soil – with water when fire is extinguished.

Fire alarm system, fire passages and approaches for fire-fighting vehicles are provided for fast elimination of the seats of fire.

Fire-prevention post is provided for in the boiler house premises for placement of personal fire-extinguishing means in required by fire safety regulations quantity.

Repair and construction works both in the boiler house and in the area of fuel supply should be conducted strictly by work orders with all necessary precautions excluding possibility of destruction of the boiler house and fuel supply system equipment, as well as fire initiation.

Boiler equipment should be operated in strict compliance with its operation guidelines, safety and fire safety regulations by high-qualified operational staff.

Description of measures on emission regulation during particularly adverse weather conditions (AWC)

This project stipulates special measures on atmosphere protection from emissions in case of dangerous weather conditions.

According to RD 52.04.52-85 the measures for sources can be developed in three modes depending on pollution extent.

The measures of mode I have organizational and technical nature and do not demand capital investment (reduction of emission by up to 20%).

The measures of mode II include the measures of mode I and additional measures of mode II (reduction of emission by 25-40%). Reduction of emission during this period can be achieved by means of fuel supply reducing.

The measures of mode III include measures, which should ensure temporary reduction of contaminants emission to the atmosphere by 40-60%.

Due to minor contaminants emission, impossibility of fuel supply reduction and stop or equipment productivity reduction of the designed boiler house only mode I measures are provided for.

List of the measures for temporary emission reduction during AWC period is set forth in the table 19 below

Warning degree	Measures on emission reduction	Reduction of contaminants emission
1	Intensification of monitoring of accurate adherence to the operational schedule of the equipment	Exclusion of emission that exceeds design performance caused by breach of the operational schedule

Table.18 List of the measures for temporary emission reduction during AWC period

Sanitary protection zone

Sanitary regulations do not provide for organization of regulatory sanitary protection zone for the boiler houses. SPZ can be provided for in case of presence of material contaminants emission (for big boiler houses and heat stations) on the basis of calculation of contaminants dispersion in the atmosphere.

Performed dispersion calculation has indicated that maximal ground concentration of the contaminants in the atmosphere from designed boiler house emission is substantially lower than MPC, therefore this project does not stipulate change of existing sanitary protection zone of PJSC «DMZ».

Measures on reduction of in-plant noise, other harmful factors

Population of existing residential housing can be object of impact of possible physical influences from operation of the integrated heating boiler house of PSC «WESTA-DNEPR».

Principal physical influence is noise of the boiler equipment installed in the boiler house premises. For the purpose of reduction of the noise sources effects on environment and creating of acoustical comfort conditions the following planning and engineering measures are provided:

• placement of the boiler units in separate integrated room, structures of which have sufficient soundproof and sound-absorbing ability;

• use of filler structures with high soundproof ability;

• installation of equipment on the vibration-reducing support and connection of the fans to the air ducts through flexible connectors;

• stuffing of the chinks and holes with soundproof materials during pipelines and engineering services construction;

• placing of sound attenuators in the chimneys and others.

Other harmful factors: electromagnetic and ionizing radiation, ultrasound and others are absent.

Evaluation of effects of projected activity on anthropogenic environment

Speaking about effects on anthropogenic environment one should consider individual characteristics of diverse substances, atmospheric pollution with which is accompanied by direct or indirect adverse effect on anthropogenic environment.

Corrosion that holds the first place by degree of effect on anthropogenic environment has serious economic consequences.

If metal corrodes slowly in clean air even in conditions of high humidity, acid components substantially increase speed of this process.

Nitric oxides increase corrosive activity of the atmosphere, as combined with moisture they produce nitric acid (so-called «acid rains»). In the presence of ultraviolet radiation rather complicated process of destruction of the polymeric materials (plastics, paints) and elastomers (rubber) takes place due to which their service life is dramatically reduced.

Carbon dioxide (CO_2) is discharged during fuel combustion, it plays important role in terms of problems of local and regional air pollution.

On the global scale presence of CO_2 in the atmosphere acts like «protective shield» reducing heat losses of the planet. «Greenhouse effect» connected with its presence is important factor of temperature regulation of the Earth.

Effects on the conditions, anthropogenic environment of the carbon oxides and methane (CO і CH_4) consist in change of some properties of the elastomers (rubber – elasticity loss) and polymeric materials (plastics – destruction of intermolecular bonds).

Besides, damage to concrete occurs with high humidity conditions and carbonic acid production.

Mercuric compounds that are produced during gaseous fuel burning are trace elements. They have virtually no effect on objects of this anthropogenic environment as mercury is the least active one of the metals group and its quantity in emissions from burned fuel is minor. Mercury though is biological poison and has cumulative properties, i.e. ability to accumulate in tissues of the living organisms.

Sources of the designed boiler house will emit minor quantity of nitric and carbon oxides, methane and mercury to the atmosphere (≈9,29 t / year), that do not virtually affect conditions of the anthropogenic environment, as well as not more than 5000 t / year of gases having greenhouse effect.

Evaluation of environmental effects during construction

Process of construction (building) of the projected boiler house will not result in any significant impact on environment, because:

- There is no need of construction of the buildings (premises);

- due to use of small-sized equipment there is no need of substantial volume of cargo transportation;

- execution of building and assembling works with use of preassembled modules of heat-mechanic equipment manufactured at the manufacturing plants and assembly sectors of the construction company is provided for; welding works are reduced to a minimal level due to equipment supply by preassembled modules, primary use of flanged, threaded connections, etc.

- flame works (metal cutting with gas burners, hard bitumen transformation to liquid phase etc.) should be executed at fire safe distance from oiled surfaces or tanks with oil, trees, bushes and other objects that are inflammable with flame or heat; transportation of bulk solids should be performed in closed packing (e.g. sacks) or in pile of bulk cargo with device of dustproof film covering; construction waste is to be transported to the dump.

Integrated assessment

Of the effects of projected activity on environment and description of residuals.

Construction of the integrated boiler house will allow to secure effective heat supply and comfort microclimate in the premises of PJSC «DMZ» and PSC «WESTA-DNEPR» with minimal fuel consumption and therefore with minimal emissions to the atmosphere.

The integrated boiler house will emit minor quantities of nitric and carbon oxides, methane and mercury (≈ 9,29 t / year) to the atmosphere, that will virtually have no sensible effect on air environment condition. Crude waste water discharge to the basins is absent.

Factory and domestic waste is utilized.

Noise level of the installed equipment is substantially lower than normative rates.

Other harmful factors: factory waste, electromagnetic and ionizing radiation, ultrasound, vibration, etc. – are absent.

Waste utilization

During operation of the integrated heating boiler house following waste is produced:

- solid domestic waste of maintenance staff;

- wiping cloth;

- luminous tube lamps.

Quantity and utilization mode of the waste are presented in the table 20.

№	Waste designation	Quantity	Hazard class	Mode of utilization
1	Lamps containing mercury, piece / year	Up to 10	1	Is transferred for utilization to «Tsentr Merkurii» LLC
2	Domestic waste, t / year	up to 0,675	4	Is transferred for utilization to «Ekologiia» LLC
3	Wiping cloth, t	Up to 0,05	3	

Table.19 Quantity and utilization mode of the waste

The lamps containing mercury are stored in factory packing and in metal containers.

Waste is stored in plastic bags and in metal containers. Therefore all waste produced at the plant is subject to utilization.

It should be mentioned that nitric oxide concentration in smoke fumes is very minor and is not subject to treatment with any known at the present moment industrial method, so no measures for reducing of nitric oxides emission are provided in this project.

Waste generation, treatment and disposal are present. In the process of project implementation the generation of waste will occur after disassembling of physically and morally obsolete equipment, burners, pipes, etc. Also there will occur some construction waste due to destruction of boiler settling, boiler house foundations, etc.

Possible recycling of the old equipment will by definition have a positive effect on the environment.

According to the "Law on waste products", (article 17) "Obligations of economic activity subjects in sphere of waste treatment"
- enterprises must apply statistic reports on waste creating, gathering, transporting keeping, treating, utilizing, decontaminating and excreting.
- provide complete gathering, appropriate keeping and non-admission waste destruction and spoilage, for utilization of which there is an appropriate technology in Ukraine.
Reasoning from aforesaid PSC «WESTA-DNEPR» delivers old equipment to metal recycling.

Comparison of types and levels of the environmental effects shows that upon launching of the integrated heating boiler house of PSC «WESTA-DNEPR» located at 34 Budivelnykiv str. in Dnipropetrivsk conditions of the area will remain unchanged.

Therefore it is possible to draw a conclusion on the integrated boiler house construction from ecological perspective.

SECTION G. Stakeholders' comments

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

As project activity won't provide negative influence on environment and negative social effect, special public The authorities of Dnipropetrovsk city have expressed the support for the project. Since the project activity _ does not provide the negative impact on the environment and the negative social impact of the government expressed its support for this project.The project has already supported by the local authorities, namely the Executive Committee of the Dnepropetrovsk Council , the State Department of Environmental Protection in the Dnipropetrovsk region, the regional department of the State Inspection on Energy Efficiency in the Dnipropetrovsk region, Dnepropetrovsk Regional Service of the Ukrainian State Investment Expertise, Inspectorate of State Architectural and Construction Control in the Dnipropetrovsk region and others.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

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Annex 2

BASELINE INFORMATION

The key information and data used to establish the baseline (variables, parameters, data sources etc.) are presented below.

Data/Parameter	**B_b**
Data unit	Ths.m^3
Description	Fuel consumption at a boiler-house. Natural gas
Time of determination/monitoring	Monthly
Source of data (to be) used	Gas flow meter
Value of data applied (for ex ante calculations/determinations)	See Supporting document 1.
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Indication of meters is recorded in special paper journals in boiler house
QA/QC procedures (to be) applied	Meters pass periodic calibration and verification under national standards
Any comment	

Data/Parameter	B_b
Data unit	t
Description	Fuel consumption at a boiler-house. Fuel oil
Time of determination/monitoring	Monthly
Source of data (to be) used	Indication of meters is recorded in special paper journals in boiler house
Value of data applied (for ex ante calculations/determinations)	See Supporting document 1.
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Purchasing of fuel oil is realized in accordance with agreement. Consumption of fuel oil is measured by special dimensional tanks using metroshtoki.
QA/QC procedures (to be) applied	N/A
Any comment	

Data/Parameter	$LHV_{b,r}$
Data unit	TJ/mln.m^3 or TJ/ths.t
Description	Lower Heating Value of fuel
Time of determination/monitoring	Once per period

Source of data (to be) used	National Inventory Report of anthropogenic emissions of Ukraine [21]
Value of data applied (for ex ante calculations/determinations)	<table><tr><td rowspan="2">Type of fuel</td><td colspan="4">Average lower heating value of fuel TJ/mln.m^3 (TJ/ths.t)</td></tr><tr><td>2006</td><td>2007</td><td>2008</td><td>2009-2012</td></tr><tr><td>Natural gas</td><td>33.85</td><td>33.85</td><td>34</td><td>34.1</td></tr><tr><td>Fuel oil</td><td>39.98</td><td>40.5</td><td>39.8</td><td>39.9</td></tr></table>
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	If the parameter change in the basis document that it will be changed according to new values

Data/Parameter	$T_{out\ b}$ and $T_{out\ r}$
Data unit	^{0}C
Description	Average outside temperature during the heating period
Time of determination/monitoring	Once per heating period. Daily temperature is registered every day of heating period
Source of data (to be) used	Meteorological Centre sends the Report every decade or month for every day of heating season. Reports are filed in special journals
Value of data applied (for ex ante calculations/determinations)	See Supporting document 1.
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Average outside temperature during the heating season is calculated from the daily outside temperature values taken by dispatcher of PSC «WESTA-DNEPR» from Meteorological Centre every day of heating period
QA/QC procedures (to be) applied	N/A
Any comment	

Data/Parameter	$T_{in\ b}$
Data unit	^{0}C
Description	Average inside temperature during the heating period
Time of determination/monitoring	Daily temperature is registered every day of heating period
Source of data (to be) used	Journal of records
Value of data applied (for ex ante calculations/determinations)	See Supporting document 1.

[21] http://www.neia.gov.ua/nature/control/uk/publish/article?art_id=129587&cat_id=124567

Justification of the choice of data or description of measurement methods and procedures (to be) applied	Measurement of thermometer
QA/QC procedures (to be) applied	According to the national legislation
Any comment	

Data/Parameter	$\mathbf{T_{in\ r}}$
Data unit	^0C
Description	Average inside temperature during the heating period
Time of determination/monitoring	Once
Source of data (to be) used	KTM 204 Ukraine 244-94
Value of data applied (for ex ante calculations/determinations)	18
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	

Data/Parameter	$\mathbf{n_{wb}}$ and $\mathbf{n_{wr}}$
Data unit	
Description	Number of Customers for hot water supply service
Time of determination/monitoring	Once
Source of data (to be) used	Data of the company
Value of data applied (for ex ante calculations/determinations)	$\mathbf{n_{wb}} = \mathbf{n_{wr}}$ =0(doesn't exist hot water supply service)
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Data of the company
QA/QC procedures (to be) applied	N/A
Any comment	

Data/Parameter	$\mathbf{F_{h\ b}}$ **and** $\mathbf{F_{h\ r}}$
Data unit	$м^2$
Description	Heating area
Time of determination/monitoring	Once per period
Source of data (to be) used	Data of the company
Value of data applied (for ex ante calculations/determinations)	$\mathbf{F_{h\ b}} = \mathbf{F_{h\ r}}$ =131164.6

Justification of the choice of data or description of measurement methods and procedures (to be) applied	The information is collected by the certificate of on the property right in accordance with technical passport of building. Total area with balconies and stairs and Heating area are displayed in the special journal
QA/QC procedures (to be) applied	The data is taken for January, 01 for every year
Any comment	

Data/Parameter	**k_{hb}**
Data unit	kW/m^2*K
Description	Average Heat transfer factor of buildings in baseline
Time of determination/monitoring	Heat transfer factor is recorded ones per period at recording of connection or disconnection of any heating area to boiler-houses included in project.
Source of data (to be) used	SNIP 2-3-79 (1998)
Value of data applied (for ex ante calculations/determinations)	0.63
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	For calculation of Heat transfer factor of buildings for every boiler-house, the method of Weighted average value was used, that depends on heating area of existing buildings and heating area of the new buildings. Values of the heat transfer factor for existing buildings were taken from SNiP 2-3-79 (1998) - not higher than 0.63. Values of the heat transfer factor of new buildings were taken according to State Buildings Norms (B.2.6-31:2006) - not higher than 0.36.
Any comment	

Data/Parameter	**$F_{h\,t\,r}$**
Data unit	m^2
Description	Heating area of buildings (previously existed in the base period) with the renewed (improved) thermal insulation in the reporting period
Time of determination/monitoring	Once per period
Source of data (to be) used	Data of the company
Value of data applied (for ex ante calculations/determinations)	0, there is no buildings with upgraded thermal insulation in the reporting period
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The information is collected by the certificate of on the property right in accordance with technical passport of building. Total area with balconies and stairs and Heating area are displayed in the special journal
QA/QC procedures (to be) applied	The data is taken for January, 01 for every year
Any comment	

Data/Parameter	$\mathbf{F_{h\,n\,r}}$
Data unit	m^2
Description	Heating area of newly connected buildings (assumed with the new (improved) thermal insulation) in the reporting period
Time of determination/monitoring	Once per period
Source of data (to be) used	Data of the company
Value of data applied (for ex ante calculations/determinations)	0, any new building with a new upgraded insulation was not connected to system
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The information is collected by the certificate of on the property right in accordance with technical passport of building. Total area with balconies and stairs and Heating area are displayed in the special journal
QA/QC procedures (to be) applied	The data is taken for January, 01 for every year
Any comment	

Data/Parameter	$\mathbf{k_{h\,n}}$
Data unit	kW/m^2*K
Description	Heat transfer factor of new buildings and buildings with new thermal insulation
Time of determination/monitoring	Once per period
Source of data (to be) used	SBN (B.2.6-31:2006)
Value of data applied (for ex ante calculations/determinations)	0.36
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Value of the heat transfer factor of new buildings were taken from State Buildings Norms (B.2.6-31:2006)
QA/QC procedures (to be) applied	N/A
Any comment	

Data/Parameter	$\mathbf{N_{h\,b}}$ and $\mathbf{N_{h\,r}}$
Data unit	hour
Description	Heating period duration
Time of determination/monitoring	Every month of heating period
Source of data (to be) used	Data of the company
Value of data applied (for ex ante calculations/determinations)	See Supporting document 1.
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	The duration of the Heating period is accepted in accordance with item 7.9.4 of "Rules of technical exploitation of heating

	equipment and networks. 2007". Beginning and ending of the heating period are determined in every town separately. The heating period begins if the average daily outside temperature is 8 °C or lower during 3 days, and finishes if average daily outside temperature is 8 °C or higher during 3 days.

Data/Parameter	$\mathbf{N_{w\,b}}$ and $\mathbf{N_{w\,r}}$
Data unit	hour
Description	Duration of the period of hot water supply service
Time of determination/monitoring	Once per month
Source of data (to be) used	Data of the company
Value of data applied (for ex ante calculations/determinations)	$\mathbf{N_{w\,b}}$=$\mathbf{N_{w\,r}}$=0 (doesn't exist hot water supply service)
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Data of the company
QA/QC procedures (to be) applied	N/A
Any comment	

Data/Parameter	$\mathbf{L_h^b}$ and $\mathbf{L_h^r}$
Data unit	Gkal
Description	Maximum connected load to the boiler-house, that is required for heating
Time of determination/monitoring	It is calculated every time for monitoring
Source of data (to be) used	N/A
Value of data applied (for ex ante calculations/determinations)	$\mathbf{L_h^b}$ =50 $\mathbf{L_h^r}$ =19.26
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Maximum connected load to the boiler-house, that is required for heating, is calculated by PSC «WESTA-DNEPR» for every heating season. It is calculated according to heat demand at outside temperature -25 °C.
QA/QC procedures (to be) applied	N/A
Any comment	

Data/Parameter	$\mathbf{L_w^b}$ and $\mathbf{L_w^r}$
Data unit	Gkal
Description	Maximum connected load to the boiler-house, that is required for providing the hot water supply service
Time of determination/monitoring	It is calculated every time for monitoring
Source of data (to be) used	N/A
Value of data applied (for ex ante calculations/determinations)	$\mathbf{L_w^b}$=$\mathbf{L_w^r}$ = 0 (doesn't exist hot water supply service)

Justification of the choice of data or description of measurement methods and procedures (to be) applied	Maximum connected load to the boiler-house, that is required for hot water supply service, is calculated by the company in accordance with the needs of water supply and temperature conditions.
QA/QC procedures (to be) applied	N/A
Any comment	

Data/Parameter	$\mathbf{v_{w\,r}}$ and $\mathbf{v_{w\,b}}$
Data unit	kWh/h
Description	Standard specific discharge of hot water per personal account
Time of determination/monitoring	Once per period
Source of data (to be) used	"KTM 204 Ukraine 244-94" in 1993, and no information is available on any propositions to change it.
Value of data applied (for ex ante calculations/determinations)	$\mathbf{v_{w\,b}}$ **/**$\mathbf{v_{w\,r}}$=1
Justification of the choice of data or description of measurement methods and procedures (to be) applied	At present the standard specific discharge of hot water is valid in Ukraine that was established by the "KTM 204 Ukraine 244-94" in 1993, and no information is available on any propositions to change it.
QA/QC procedures (to be) applied	N/A
Any comment	

Data/Parameter	Cef
Data unit	$KtCO_2/TJ$
Description	Carbon dioxide emission factor for different fuels
Time of determination/monitoring	Annualy
Source of data (to be) used	National Inventory Report of anthropogenic emissions of Ukraine [22]
Value of data applied (for ex ante calculations/determinations)	See section B.1.
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	If the parameter changes in the reporting period must be corrected

Data/Parameter	g

[22] http://www.neia.gov.ua/nature/control/uk/publish/article?art_id=129587&cat_id=124567

Data unit	
Description	Recalculating factor for average load during heating period
Time of determination/monitoring	It is calculated every time for monitoring
Source of data (to be) used	N/A
Value of data applied (for ex ante calculations/determinations)	Recalculating factor for average load during heating period is determined for boiler-house on historical base, usually it is in the range (0,4 – 0,8)
Justification of the choice of data or description of measurement methods and procedures (to be) applied	$g = Q_{av}/Q_{max} = F_h*k_h*(T_{in} - T_{out\ av})/F_h*k_h*(T_{in} - T_{out\ min})$ where: g – recalculating factor for average load during heating period; F_h – heating area of buildings, m^2; k_h – average heat transfer factor of heated buildings,(W/m^2*K); T_{in} – average inside temperature for the heating period, K ; $T_{out\ av}$ – average outside temperature for the heating period, K (or ^0C); $T_{out\ min}$ – minimal outside temperature for the heating period, K (or ^0C).
QA/QC procedures (to be) applied	N/A
Any comment	

Data/Parameter	P_b
Data unit	MWh
Description	Electricity consumption
Time of determination/monitoring	Every day
Source of data (to be) used	Electricity supply meters
Value of data applied (for ex ante calculations/determinations)	
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Measurement by Electricity supply meters
QA/QC procedures (to be) applied	N/A
Any comment	

Data/Parameter	CEF_c
Data unit	tCO_2/kWh or tCO_2/MWh
Description	Carbon dioxide emissions factor at electricity consumption from the grid or Factor of specific carbon dioxide emissions
Time of determination/monitoring	Yearly
Source of data (to be) used	DFP Orders
Value of data applied (for ex ante calculations/determinations)	See section B.

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	

Annex 3

MONITORING PLAN

The monitoring plan is listed in section D.

In this section additional information concerning current monitoring applied is given:

Monitoring plan applied:

The monitoring plan to be applied during the first monitoring period will provide mainly handwritten data. The monitoring and recording has initially followed the conventional processes within the industry. Although the electronic measuring equipment has been installed, no electronic storage of the data took place prior to registration. The data have been manually read from the electronic devices and hand written in journals. This method is the most common practice in Ukraine.

New electronic monitoring equipment and automatic control system at new modular boiler house will be installed as part of the project implementation, in 2007. And an electronically data storage system will be put in operation in 2008.

So there are two monitoring procedures:

1) Manual record of the monitored data from 01/01/2006
2) Electronically record of the monitored data from 2008 (exact date will be presented in the relevant monitoring report).

Monitoring methodology developed for "District Heating" projects in Ukrainian conditions

Monitoring methodology developed for "District Heating" projects in Ukrainian conditions is presented in section D.1.1. of this PDD (Option 1 – Monitoring of the emissions in the project scenario and the baseline scenario).

Formulae for monitoring

Formulae used for computing project emissions, baseline emissions and the total emission reduction are presented in the tables below.

Total emission reduction

The total annual emission reduction is the difference between the baseline emissions and the project emissions.

Formula 1 – Total emission reduction (ERUs)	
	$ER = \sum[E_i^b - E_i^r]$; [t CO_2e]
	ER - Total annual emission reduction [t CO_2e] E^b_i - Baseline CO_2 emissions [t CO_2e] E^r_i - CO_2 emissions in the reporting period [t CO_2e]

Project emissions

Formula 2 –Emissions in the reporting period **(**E^r**)**	
	$E_i^r = E_{1i}^r + E_{cons\ i}^r$; [t CO_2e]
	E_{1i}^r – CO_2 emissions due to fuel consumption for heating and hot water supply service for an i boiler-house in the reporting period, t CO_2e; $E_{cons\ i}^r$ – CO_2 emissions due to electric power consumption from greed by the i boiler-house in the reporting period, t CO_2e.

Formula 3 – CO_2 emissions due to fuel consumption for heating and hot water supply service in the reporting period, (E_{1i}^r)	
	$E_{1i}^r = LHV_r * Cef_r * B_{ri}$, [tCO2-eq.]
	LHV_{ri} – Average annual lower heating value, MJ/m^3 (MJ/kg) Average annual Heating Value is calculated for every town; Cef – carbon dioxide emission factor, ktCO_2/TJ; B_{ri} – amount of fuel consumed by a boiler-house in the reporting period, ths m^3 or tons;

Formula 4 – CO_2 emissions due to electric power consumption from grid in the reporting period ($E_{cons\ i}^r$)	
	$E_{cons\ i}^r = P_r * CEF_c$
	P_r – electric power consumption with energy saving measures implemented, MWh; CEF_c – Carbon dioxide Emission factors for reducing electricity consumption in Ukraine, tCO_2e/MWh;

Baseline emissions

Formula 5 – Baseline emissions **(**E_b)	
	$E_i^b = E_{1i}^b + E_{cons\ i}^b$; [t CO_2e]
	E_{1i}^b – baseline CO_2 emissions due to fuel consumption for heating and hot water supply service, t CO_2e; $E_{cons\ i}^b$ – CO_2 emissions due to electric power consumption from grid, t CO_2e.

Formula 6 – Baseline CO_2 emissions due to fuel consumption for heating and hot water supply service, (E_{1i}^b)	
	For the case when in the base period the hot water supply service was provided (independent of this service duration, $(1-a_b) \neq 0$), the formulae for E_1^b is: $E_1^b = LHV_b * Cef_b * [B_b * a_b * K_1 * K_h + B_b * (1-a_b) * K_1 * K_w]$, where the first term in brackets describes fuel consumption for heating, and the second one – fuel consumption for hot water supply.

	For the case when in the base period the hot water supply service was absent at all ($(1-a_b) = 0$), and in the reporting period this service was provided (due to improvement of heat supply service quality for population), the formulae for E_1^b is: $E_1^b = LHV_b*Cef_b*[B_b*a_b*K_1*K_h + B_r*(1-a_r)*K_1*K_{w0}]$.
	LHV_b – lower heating value in the base period, MJ/m^3 (MJ/kg); Cef – carbon dioxide emission factor, $KtCO_2/TJ$; B_b – amount of fuel consumed by a boiler-house in the base period, ths m^3 or tons; K_1, $K_h = K_2 * K_3 * K_4$; $K_w = K_5 * K_6 * K_7$ – adjustment factors; a_b – portion of fuel (heat), consumed for heating purposes in the base period; $(1-a_b)$ – portion of fuel (heat), consumed for hot water supply services in the base period; a_r – portion of fuel (heat), consumed for heating purposes in the reporting period.

Formula 7 – Portion of fuel (heat), consumed for heating purposes in the base period (a_b)	
	$a_b = L_h^b*q*N_h^b / (L_h^b*g*N_h^b + L_w^b*N_w^b)$;
	L_h^b – maximum connected load required for heating in the base period, Gkal; L_w^b – connected load required for hot water supply service in the base period, Gkal; g – recalculating factor for average load during heating period (usually 0.4-0.8); N_h^b – duration of heating period in the base period , hours; N_w^b – duration of hot water supply service in the base period, hours.

Formula 8 – Portion of fuel (heat), consumed for heating purposes in the reporting period (a_r)	
	$a_r = L_h^r*q*N_h^r / (L_h^r*g*N_h^r + L_w^r*N_w^r)$
	L_h^r – maximum connected load required for heating in the reporting period, MW; L_w^r – connected load required for hot water supply service in the reporting period, MW; g – recalculating factor for average load during heating period (usually 0.4-0.8); N_h^r – duration of heating period in the reporting period, hours; N_w^r – duration of hot water supply service in the reporting period, hours.

Formula 9 – Change in the lower heating value (K_1)	
	$K_1 = LHV_b / LHV_r$
	LHV_b – Average annual lower heating value in the base period, MJ/m^3 (MJ/kg); LHV_r – Average annual lower heating value in the reporting period, MJ/m^3 (MJ/kg)

Formula 10 – Temperature change factor (K_2)

	$K_2 = (T_{in\ r} - T_{out\ r}) / (T_{in\ b} - T_{out\ b})$
	$T_{in\ r}$ – average inside temperature for the heating period in the reporting period, K (or ^0C); $T_{in\ b}$ – average inside temperature for the heating period in the base period, K (or ^0C); $T_{out\ r}$– average outside temperature for the heating period in the reporting period , K (or ^0C); $T_{out\ b}$– average outside temperature for the heating period in the reporting period , K (or ^0C)

Formula 11 – Heating area and building thermal insulation change factor (K_3)	
	$K_3 = [(F_{h\ r} – F_{h\ t\ r}– F_{h\ n\ r})*k_{h\ b} + (F_{h\ n\ r} + F_{h\ t\ r})*k_{h\ n}] / F_{h\ b}*k_{h\ b}$,
	$F_{h\ b}$ – heating area in the base period, m^2; $F_{h\ r}$ – heating area in the reporting period, m^2; $F_{h\ n\ r}$ – heating area of new buildings connected to DH system (assumed with the new (improved) thermal insulation) in the reporting period, m^2; $F_{h\ t\ r}$ – heating area of buildings (previously existed in the base period) in reporting period with the renewed (improved) thermal insulation, m^2; $k_{h\ b}$ – average heat transfer factor of heated buildings in the base period, (W/m^2*K); $k_{h\ n}$ – heat transfer factor of heated buildings with the new thermal insulation (new buildings or old ones with improved thermal insulation), (W/m^2*K).

Formula 12 – Heating period duration change factor (K_4)	
	$K_4=N_{hr}/N_{hb}$
	N_{hb},– duration of heating period in the base period, hours N_{hr} – duration of heating period in the reporting period, hours

Formula 13 – Number of customers change factor (K_5)	
	$K_5 =n_{wr} / n_{wb}$
	N_{wb},– number of customers in base period; N_{wr} – number of customers in the reporting period

Formula 14 – Standard specific discharge of hot water per personal account change factor (K_6)	
	$K_6 = v_{w\ r} / v_{w\ b}$
	$v_{w\ r}$ – standard specific discharge of hot water per personal account in the reporting period, (in heat units, kWh/h); $v_{w\ b}$ – standard specific discharge of hot water per personal account in the base period, (in heat units, kWh/h).

Formula 15 – Hot water supply period duration change factor (K_6)	
	$K_7 = N_{wr} / N_{wb}$
	N_{wr}– duration of hot water supply service in the reporting period, hours. N_{wb} – duration of hot water supply service in the base period, hours.

Formula 16 – CO_2 emissions due to electric power consumption from grid in the base period ($E_{cons\ i}^{b}$)	
	$E_{cons}^{b} = P_b * CEF_c$
	P_b – electric power consumption by the boiler-houses where energy saving measures are scheduled to be implemented in the base period, MWh; CEF_c – Carbon dioxide emission factors for reducing electricity consumption in Ukraine, tCO_2e/MWh.

4. MONITORING OF BASELINE AND PROJECT EMISSIONS

Parameters to be monitored

Monitoring methodology identifies and takes into account the parameters that are need to be measured or monitored at regular intervals. These parameters will then be input into a project Tracking Database, which will be an Excel based spreadsheet that will track GHG emission reductions annually.
Data and parameters used but not monitored throughout the crediting period, but are determined only once (and thus remain fixed throughout the crediting period), and that are available already at the stage of determination regarding the PDD.

Conversion factors and standard variables to be used in the calculations:
- Heating area in baseline scenario and reporting period $F_{h\ b} = F_{h\ r}$=131164.6 m^2
- Average Heat transfer factor of buildings in baseline scenario and reporting period $k_{h\ b} = k_{h\ r}$ = 0.63 kW/m^2*K
- Heat transfer factor of new buildings and buildings with new thermal insulation, $k_{h\ n}$ =0.36 kW/m^2*K
- Maximum connected load to the boiler-house, that is required for heating, in baseline scenario L_h=50 Gkal
- Maximum connected load to the boiler-house, that is required for providing the hot water supply service, in baseline scenario and reporting period $L_{w\ b} = L_{w\ r}$ =0 (doesn't exist hot water supply service)
- Maximum connected load to the boiler-house, that is required for providing the hot water supply service, in project scenario L_h=19.26 Gkal
- Average inside temperature during the heating period, K (or ^0C) $T_{in} = 18^0C$
- Number of Customers for hot water supply service , personal accounts in baseline scenario and reporting period $n_{w\ b} = n_{w\ r}$ =0(doesn't exist hot water supply service)
- Standard specific discharge of hot water per personal account change factor K_6= 1
- Duration of the heating period in the baseline scenario, hours N_{hb}=3880 hours/yr

Data and parameters used but not monitored throughout the crediting period, but are determined only once (and thus remain fixed throughout the crediting period), and that are not available at the stage of determination regarding the PDD.
These data are not exist.

Data and parameters that are controlled during the crediting period.

List of parameters to be monitored are in the table below.

	Symbol	Data variable	Data unit	Measured (m), calculated (c), estimated (e)
1	**(B_r)**	Fuel consumption. Natural Gas		m
2	**(LHV_r)**	Average annual Heating Value of a fuel calculated by Lower Heating Value. Natural Gas	MJ/m^3	e
3	**($T_{out\ r}$)**	Average outside temperature during the heating season	^0C	m, c
4	**($F_{h\ r}$)**	Heating area (total)	m^2	e
5	**($F_{h\ t\ r}$)**	Heating area of buildings (previously existed in the base period) with the renewed (improved) thermal insulation in the reporting period	m^2	e
6	**($F_{h\ n\ r}$)**	Heating area of newly connected buildings (assumed with the new (improved) thermal insulation) in the reporting period	m^2	e
7	**($N_{h\ r}$)**	Duration of the heating period	Hours	m
8	**(L_h^r)**	Maximum connected load to the boiler-house, that is required for heating	Gkal	c
9	**(P_r)**	Electric power consumption by the boiler-houses and heating points where energy saving measures are scheduled to be implemented	MWh	m

Data to be monitored

Data/Parameter	**B_r**
Data unit	$Ths.m^3$
Description	Fuel consumption at a boiler-house. Natural gas
Time of determination/monitoring	Continuously
Source of data (to be) used	Gas flow meter
Value of data applied (for ex ante calculations/determinations)	See Supporting document #1
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Indication of meters is recorded in special paper journals in boiler house and in electronic format by automatic control system
QA/QC procedures (to be) applied	Meters pass periodic calibration and verification under national standards
Any comment	

Data/Parameter	**$LHV_{n.g.}$**
Data unit	TJ/mln.m^3
Description	Lower Heating Value. Natural gas
Time of determination/monitoring	Once per period
Source of data (to be) used	National Inventory Report of anthropogenic emissions of Ukraine [23]
Value of data applied (for ex ante calculations/determinations)	<table><tr><td rowspan="2">Type of fuel</td><td colspan="4">Average lower heating value of fuel TJ/mln.m³ (TJ/ths.t)</td></tr><tr><td>2006</td><td>2007</td><td>2008</td><td>2009-2012</td></tr><tr><td>Natural gas</td><td>33.85</td><td>33.85</td><td>34</td><td>34.1</td></tr></table>
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	If the parameter change in the basis document that it will be changed according to new values

Data/Parameter	**$T_{out\ r}$**
Data unit	^{0}C
Description	Average outside temperature during the heating period
Time of determination/monitoring	Once per heating period. Daily temperature is registered every day of heating period
Source of data (to be) used	Meteorological Centre sends the Report every decade or month for every day of heating season. Reports are filed in special journals
Value of data applied (for ex ante calculations/determinations)	See Supporting document 1.
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Average outside temperature during the heating season is calculated from the daily outside temperature values taken by the company from Meteorological Centre every day of heating period
QA/QC procedures (to be) applied	N/A
Any comment	

Data/Parameter	**$F_{h\ r}$**
Data unit	M^2
Description	Heating area
Time of determination/monitoring	Once per period
Source of data (to be) used	Data of the company

[23] http://www.neia.gov.ua/nature/control/uk/publish/article?art_id=129587&cat_id=124567

Value of data applied (for ex ante calculations/determinations)	$F_{h\ r}$ =131164.6
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The information is collected by the certificate of on the property right in accordance with technical passport of building. Total area with balconies and stairs and Heating area are displayed in the special journal
QA/QC procedures (to be) applied	The data is taken for January, 01 for every year
Any comment	

Data/Parameter	$F_{h\ t\ r}$
Data unit	m^2
Description	Heating area of buildings (previously existed in the base period) with the renewed (improved) thermal insulation in the reporting period
Time of determination/monitoring	Once per period
Source of data (to be) used	Data of the company
Value of data applied (for ex ante calculations/determinations)	See Supporting document 1.
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The information is collected by the certificate of on the property right in accordance with technical passport of building. Total area with balconies and stairs and Heating area are displayed in the special journal
QA/QC procedures (to be) applied	The data is taken for January, 01 for every year
Any comment	

Data/Parameter	$F_{h\ n\ r}$
Data unit	m^2
Description	Heating area of newly connected buildings (assumed with the new (improved) thermal insulation) in the reporting period
Time of determination/monitoring	Once per period
Source of data (to be) used	Data of the company
Value of data applied (for ex ante calculations/determinations)	0, any new building with a new upgraded insulation was not connected to system
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The information is collected by the certificate of on the property right in accordance with technical passport of building. Total area with balconies and stairs and Heating area are displayed in the special journal
QA/QC procedures (to be) applied	The data is taken for January, 01 for every year
Any comment	

Data/Parameter	$N_{h\ r}$
Data unit	hour
Description	Heating period duration

Time of determination/monitoring	Every month of heating period
Source of data (to be) used	Data of the company
Value of data applied (for ex ante calculations/determinations)	See Supporting document 1.
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	The duration of the Heating period is accepted in accordance with item 7.9.4 of "Rules of technical exploitation of heating equipment and networks. 2007". Beginning and ending of the heating period are determined in every town separately. The heating period begins if the average daily outside temperature is 8 ^oC or lower during 3 days, and finishes if average daily outside temperature is 8 ^oC or higher during 3 days.

Data/Parameter	$\mathbf{L_h^r}$
Data unit	Gkal
Description	Maximum connected load to the boiler-house, that is required for heating
Time of determination/monitoring	It is calculated every time for monitoring
Source of data (to be) used	N/A
Value of data applied (for ex ante calculations/determinations)	See Supporting document 1.
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Maximum connected load to the boiler-house, that is required for heating, is calculated by PSC «WESTA-DNEPR» for every heating season. It is calculated according to heat demand at outside temperature -25 ^oC.
QA/QC procedures (to be) applied	N/A
Any comment	

Data/Parameter	$\mathbf{P_r}$
Data unit	MWh
Description	Electricity consumption
Time of determination/monitoring	Continuously
Source of data (to be) used	Electricity supply meters
Value of data applied (for ex ante calculations/determinations)	See Supporting document 1.
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Indication of meters is recorded in special paper journals in boiler house and in electronic format by automatic control system
QA/QC procedures (to be) applied	N/A
Any comment	

Data/Parameter	**CEF_c**
Data unit	$kgCO_2$/kWh or tCO_2/MWh
Description	Carbon dioxide emissions factor at electricity consumption from the grid or Factor of specific carbon dioxide emissions
Time of determination/monitoring	Yearly
Source of data (to be) used	DFP Orders
Value of data applied (for ex ante calculations/determinations)	See section B.
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	

Monitoring equipment

The equipment to be used by the project executor for monitoring of the relevant parameters are summarized in Table 20. The table also provides information on equipment type, calibration and procedures to follow in case of equipment failure.

№	Name	Location	Type of measuring equipment	Manufacturer	Serial/TAG number	Purpose	Date of manufacture	Date of installation	Date of the last calibration	Calibration interval	Accuracy	Calibration authority
Gas meters												
1	Meter gas ultrasonic	The modular boiler house	"Kurs-01"	PKF "Course", Dnipropetrovsk city. Chicherin, 30	01886	Measuring the volume of natural gas	23.05.2007	October 2007 year	26.08.2011	2 year	1,00%	PKF "Course", Dnipropetrovsk city. Chicherin, 30
Electricity meters												
1	Ectricity meter	The modular boiler house	EMS 132.10.1	CJSC "ELGAMA-ELEKTRONIRA" 2057, Lithuania, Vilnius st. Vysoru, 2	504110	Active and reactive power meter in one tariff regime and the 3-phase networks	11.07.2007	October 2007 year	not Applicable	not Applicable	Class 1.0 for active energy class 2.0 for reactive energy	"Ukrmetrteststandard"

2	Electricity meter	The modular boiler house	EMS 132.41.4	CJSC "ELGAMA-ELEKTRONIRA" 2057, Lithuania, Vilnius st. Vysoru, 2	464753	Active and reactive power meter in one tariff regime and the 3-phase networks	17.04.2007	October 2007 year	not Applicable	not Applicable	Class 1.0 for active energy class 2.0 for reactive energy	"Ukrmetrteststandard"
Heat meters												
1	Temperature water-meter	The modular boiler house	CVTU-10M	Firm "Sempal", 03062, Ukraine, Kherson, st. Kulibina, 3	11627	Measurement of tempered heat, volume and temperature of fluids in the pipeline that serves warm and reverse pipelines	24.07.2007	October 2007 year	09.08.2011	2 year	For temperature + / - 0.1 deg. C. For heat - relative accuracy of 0.03%, the limiting relative accuracy of - 0.5%	"Ukrmetrteststandard"

Table.20 Monitoring equipment

Level of uncertainty and accuracies

Possible uncertainty and accuracies for such type project may arise from two main reasins: measurement and stipulation. Measurement accuracy is due to metering equipment inaccuracies. Stipulation occurs when some values are required to complete calculations, but these values cannot be measured directly. In these cases estimates are used in place of actual measurements, and therefore accuracy may be introduced. The stipulation accuracy itself may be estimated based on the expected accuracy of the stipulated values.

The project accuracy can be calculated from the two accuracy components described above. The total project accuracy (Standard Accuracy, SE) can be calculated by taking the square root of the sum of the squares of the individual accuracy components, as below:
$SE = \sqrt{[(\text{measurement accuracy})^2 + (\text{stipulation accuracy})^2]}$

The monitoring plan developed for this project does not rely on any estimates and is therefore free of any stipulation accuracies.

Thus, $SE = \sqrt{[(\text{measurement accuracy})^2 + (0)^2]} = (\text{measurement accuracy})$

Although the project has 10 monitoring points, only 3 of these (quantity of natural gas consumption, power consumption, generated heat) are measured directly. The remaining monitoring points used in calculation of the baseline and project line emissions are taken as statistic data. Furthermore, they are used for adjustment factors calculation. Calculations of adjustment factors are based on reported and base period parameters ratio. For example, temperature change factor is calculated as ratio of inside and outside temperature differences in reported and base periods: $K_2 = (T_{in\ r} - T_{out\ r}) / (T_{in\ b} - T_{out\ b})$. Therefore any accuracy in statistic data will be cancelled.

The four measurement accuracies (maximal values) which impact on the Standard accuracy and their level of accuracy are presented in Table 21.

ID number and data variable	Measurement accuracy (maximal)	Comment
Natural Gas consumption	± 1.0%	Accuracy of data is high due to necessity of information for commercial account purposes.
Power consumption	± 1% , ± 2%	Accuracy of data is high due to necessity of information for account purposes.
Generated heat	For temperature + / - 0.1 deg. C. For heat - relative accuracy of 0.03%, the limiting relative accuracy of - 0.5%	Accuracy of data is high due to necessity of information for account purposes.

Table.21 Measurement accuracy for standard accuracy

5. MONITORING OF ENVIRONMENTAL IMPACTS

Environmental impact was assessed at the beginning of the project_ was made environmental impact assessment. During implementation and operation of the project activities is constantly monitor the emission of pollutants into the atmosphere and hydrosphere.