JI PROJECT MONITORING REPORT

 # UA1000026 / 5

Version 02

March 22, 2012

"Rehabilitation of the District Heating System in Donetsk Region"

CONTENTS

ANNEXES

* Annexes 2-8 are provided on electronic data medium.

SECTION A. General Project activity and monitoring information

A.1. Title of the project activity:

"Rehabilitation of the District Heating System in Donetsk Region"

A.2. JI registration number:

ITL project ID - UA 1000026

A.3. Short description of the project:

The project main goal is fuel consumption reduction, in particular reduction of natural gas (which is imported to Ukraine), coal and oil consumption, by means of district heating system rehabilitation in Donetsk Region, including boiler and distribution network equipment replacement and rehabilitation, and installation of combined heat and power production plants. Such reduction of fuel consumption will result in decrease of greenhouse gas emissions (CO_2 and N_2O). The purpose of the project is sustainable development of the region through implementation of energy saving technologies.

Donetsk region's district heating (DH) utility (system of heat supply enterprises) supplies and sells heat energy in forms of heat, hot water and steam, to local consumers, namely households, municipal consumers and state-owned organizations. It is a natural monopolist of heat production in the region. Heat supply market in the region is stable for years.

The project "Rehabilitation of the District Heating System in Donetsk Region" was initiated in 2004 to rehabilitate Donetsk region's district heating system, including boiler and distribution network equipment replacement and rehabilitation, and installation of combined heat and power production plants (CHP). The project "Rehabilitation of the District Heating System in Donetsk Region" consists of two parts: Rehabilitation of Donetsk Region and Rehabilitation of Donetsk City. 286 boiler-houses with 1297 boilers and 1026 km of heat distributing networks (in the 2-pipe calculation) are involved in the rehabilitation of Donetsk Region and 39 boiler-houses with 193 boilers and 248 km of heat distributing networks (in the 2-pipe calculation) are involved in the rehabilitation of Donetsk City. In total: 325 boiler-houses with 1490 boilers and 1274 km of heat distributing networks (in the 2-pipe calculation) are involved in the project.

Installation of cogeneration units at 10 boiler houses (12 gas-piston units, 0.5-0.63 MW each) in Donetsk region with total installed capacity 7.3 MW and at 6 boiler houses in Donetsk city (6 gas-piston units, 0.38 - 0.5 MW each) with total installed capacity 2.88 MW, in sum 18 gas-piston units with total installed capacity 10.18 MW, is incorporated into the project. Machines made by JSC "Pervomaiskdieselmash" (Ukraine), Deutz (Germany) and Jenbacher (Austria) are considered as potential candidates for installation.

The project employs the increase in fuel consumption efficiency to reduce greenhouse gas emissions relative to current practice.

The following activities will ensure fuel saving:

- Replacement of old boilers by the new highly efficient boilers;
- Upgrading of boilers,
- Upgrading of boilers' burners;
- Installation of heat utilizers, including condensation ones;
- Switching of boiler-houses from coal and fuel oil to natural gas;
- Improving of the network organization, application of the new insulation and the pre-insulated pipes;
- Installation of combined heat and power units;
- Installation of frequency controllers at smoke exhausters and hot water pumps engines.

The PDD for this project Version 05 dated July 23, 2007, was determined by TUV SUD (the Final Determination Report No. 831042 dated August 06, 2007).

Letter of Approval for this project from Ukraine No. 8883/10/10-07 was issued on 10.08.2007[1].

Letter of Approval from the Party of buyer - The Netherlands No. 2007JI03 was issued on 25.10.2007 [2].

In course of preparation for registration of this project the PDD Version 08, dated March 28, 2008 was created.

PDD Version 08 distinguishes from published Version 05 by:

- more detailed description of justification of the baseline chosen;
- GHG emissions reduction are presented in standard table form;
- the additionality of the project activity is demonstrated with using the "Tool for the demonstration and assessment of additionally" that was valid at that time;
- more detailed monitoring plan.

Final Determination Report No. 831042 was re-confirmed by TUV SUD on November 17, 2008.

The National Environmental Investment Agency of Ukraine has confirmed this JI project under Track 1 procedure by the Order No. 83 dated December 23, 2008.

According to collected data the following amount of GHG emission reduction was achieved during the monitoring period:

Year	Baseline emissions, t CO_2e	Project emissions, t CO_2e	Emission Reduction, t CO_2e
2011	1473631	1009205	464426

Table 1. Amount of GHG emission reduction during the monitoring period.

A.4. Monitoring period:

- Monitoring period starting date: 01/01/2011
- Monitoring period closing date: 31/12/2011

[1] *http://www.neia.gov.ua/nature/doccatalog/document?id=116746*
[2] *http://www.neia.gov.ua/nature/doccatalog/document?id=116745*

A.5. Methodology applied to the project activity:

A.5.1. Baseline methodology:

According to the "Guidelines for users of the JI PDD form" version 04[3], the baseline shall be established on a project-specific basis, or where applicable, project participants may opt to apply approved clean development mechanism (CDM) baseline and monitoring methodologies.

In course of development of this JI project **"Rehabilitation of the District Heating System in Donetsk Region"**, in accordance with paragraph 9(a) of the "Guidance on criteria for baseline setting and monitoring", the project specific approach was used, developed in accordance with appendix B "Criteria for baseline setting and monitoring" of the JI guidelines.

This project specific approach is partly similar to the Baseline and monitoring methodology AM0044 "Energy efficiency improvement projects: boiler rehabilitation or replacement in industrial and district heating sectors" (version 1)[4],, however the AM0044 can not be used for the JI project "Rehabilitation of the District Heating System in Donetsk Region" since this project has some differences from applicability conditions of this methodology.

The main complication for implementation of the JI projects on district heating in Ukraine is the practical absence of direct monitoring devices for heat and heat-carrier expenditure in the municipal boiler-houses. Only such main characteristic as fuel consumption is registered on a regular basis. It makes practically impossible the application of AM0044 methodology, which basic moment is monitoring of the value $EG_{PJ,\,i,\,y}$ – the thermal energy output of project boiler i in year y, that should be measured every month by flow-meters (the expenditure of heat-carrier) and thermal sensors (temperatures at the input and output of the boiler, etc.). This also concerns the definition of the average historical value of heat power generation per year $EG_{BL,\,his,\,i}$ (average historic thermal energy output from the baseline boiler "i"), etc.

Besides, in section "Scope of Application" it is mentioned, that the scope of application of the Methodology AM0044 is limited only to the increase of boilers' efficiency by means of their replacement or modernization, and it does not apply to the fuel type switch. At the same time this project includes also such kind of modernization as well as some others such as the replacement of burner equipment, installation of cogeneration units, etc.

Approved Consolidated Methodology ACM0009 "Consolidated baseline methodology for fuel switching from coal or petroleum fuel to natural gas" (version 03.2)[5] proposes the dependences for baseline and reported year emissions quantity definition, that contain determination of Energy efficiency $\varepsilon_{project,i,y}$ and $\varepsilon_{baseline,i}$ for equipment. In the chapter "Baseline emissions" on the page 6 there is an explanation that:

Efficiencies for the project activity ($\varepsilon_{project,i,y}$) should be measured monthly throughout the crediting period, and annual averages should be used for emission calculations. Efficiencies for the baseline scenario ($\varepsilon_{baseline,i}$) should be measured monthly during 6 months before project implementation, and the 6 months average should be used for emission calculations.

However, as it was mentioned before in this report, 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.

In additional, the proposition in ACM0009 to take (by conservatism approach) the baseline efficiency of equipment equal to 100% is unacceptable in "District Heating" type projects, because not only fuel switch, but mainly namely increasing of equipment (boilers) efficiency are implemented in these projects. Accepting of such calculated baseline would lead to essential underestimation of results of implemented measures. And, anyway, as it was shown before, this would not solve the problem with impossibility of monthly measurements for getting energy efficiency $\varepsilon_{project,i,y.}$

Approved Methodology AM0048 "New cogeneration facilities supplying electricity and/or steam to

[3] http://ji.unfccc.int/Ref/Documents/Guidelines.pdf
[4] http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_L4AQZSBA770KNI0BUSG1JVIWCXIFU5
[5] http://cdm.unfccc.int/UserManagement/FileStorage/K4P3YG4TNQ5ECFNA8MBK2QSMR6HTEM

multiple customers and displacing grid/off-grid steam and electricity generation with more carbon-intensive fuels" (version 03)[6] already in its title shows the scope of applicability, that is different from the scope of the "District Heating" projects. In our projects, the cogeneration facilities produce hot water and not steam. Beside this, in according to AM0048 and its monitoring plan, it is necessary to realize, among other measurements, monthly measurement of *SCPCSG,i,y* (Total steam self-generated by project customer 'i' during year 'y' of the crediting period, TJ), measured by the steam meter at the customer 'i'. Thus Methodology AM0048 couldn't be implemented in original. In principle, it could be modified for conditions of hot water generation for heating and hot water supply systems, but this will require modification of monitoring plan with introduction of other parameters that it is necessary to measure and register. But it would be the another methodology, that would require to measure such parameters as heat output, or hot water output with its temperature (in analogy with requirements of Methodology AM0048 to measure steam output, its pressure and temperature.

As it was already mentioned before, the majority of the heat supply enterprises and heat customers in Ukraine are not equipped with heat meters or devices for heat-carrier output (hot water for heating and hot water service) determination.

In view of above mentioned, the specialists of the European Institute for safety, security, insurance and environmental technics "SVT e.V." (Germany) and of the Institute of Engineering Ecology (Ukraine) have developed the project specific approach, which takes into account all activities involved in and the peculiarities of the JI projects on rehabilitation of the district heating systems in Ukraine.

This project specific approach is based on the permanent measuring of the fuel consumption and on amendment of the baseline for possible changes of parameters in a reported year. The changeable parameters may be the Net Calorific Value of fuels, quality of heating service, weather conditions, number of customers, etc. Taking into account only equipment efficiency change does not eliminate the possibilities of undersupply of heat to customers (worsening of heat supply service), and possible weather warming in reported year, change in fuel quality, disconnection of some consumers and other factors could lead to artificial overestimation of ERUs amount. The developed project specific approach eliminates any possibility to depreciate fuel consumption and correspondingly to underestimate GHG emissions due to underdelivery of heat to consumers.

This developed project specific approach has two important advantages (at least for Ukrainian conditions):

- It takes into account the quality of heat supply (heating and hot water supply). Almost every year 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 excess reduction of heat consumption, and, in such a way, of fuel consumption with the purpose of excess increasing of generation of emission reduction units (ERUs) at the project verification.
- Definition of the fuel consumption in base year (baseline) in view of the fact that in Ukraine at the majority of the municipal heat supply enterprises the natural gas is used as a fuel, which consumption is measured constantly by the counters with the high measurement accuracy, seems to be more exact, than definition of the fuel consumption with use of heat power, boiler efficiency and

[6] *http://cdm.unfccc.int/methodologies/DB/Z4R6FBTQ5FMWU76ISIM5M5GJPN4F6Y*

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.

Thus, in contrast to the methodologies AM0044, ACM0009 and AM0048, this project specific approach, developed for "District Heating" projects in Ukrainian conditions and used in JI Projects "District Heating System Rehabilitation of Chernihiv Region", "Rehabilitation of the District Heating System in Kharkiv City", "Rehabilitation of the District Heating System of Crimea", "Rehabilitation of the District Heating System in Luhansk city", etc., as well, is the most appropriate, precise, corresponding to the conservative approach, and in the most closely manner reflects the aims, goals and spirit of Kyoto Protocol.

This project specific approach is presented in section **A.5.2** (**Monitoring methodology**).

A.5.2. Monitoring methodology:

The monitoring JI project specific approach developed for "District Heating system rehabilitation" projects in Ukrainian conditions consists in the following:

For any project year, the baseline is different due to the influence of external factors such as weather conditions, possible changes of the Net Calorific Value of fuel(s), number of customers, heated area, etc. The Baseline and the amount of ERUs for each project year (period) should be corrected with taking into account these and some other factors (the Dynamic Baseline).

The following project specific approach is used.

Total amount of emission reduction units (ERUs), t CO_2e:

$$ERUs = \Sigma[E_{(i)}^{b} - E_{(i)}^{r}]; \quad (1)$$

where:
$E_{(i)}^{b}$ and $E_{(i)}^{r}$ - baseline and project emissions for an (i) boiler-house in the reported year, t CO_2e.

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

For each boiler-house:

Baseline emissions:

$$E^{b} = E_1^{b} + E_{gen}^{b} + E_{cons}^{b}; \quad (2)$$

where:
E_1^{b} – emissions due to fuel consumption for heating and hot water supply service by a boiler-house that would be in the base year in terms of the reported year, t CO_2e;
E_{gen}^{b} – emissions due to electricity generation associated to the project for a boiler-house in the base year (consumed from grid, amount that is substituted in the reported year), t CO_2e;
E_{cons}^{b} – emissions due to electricity consumption by a boiler-house that would be in the base year in terms of the reported year, t CO_2e.

For the case when in the base year the hot water supply service was provided (irrespective of this service duration, $(1-a^{b}) \neq 0$), the formulae for E_1^{b} is:

$$E_1^{b} = NCV^{b}*Cef^{r}*[B^{b}*a^{b}*K_1*K_h + B^{b}*(1-a^{b})*K_1*K_w]; \quad (3)$$

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

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

$$E_1^{b} = NCV^{b}*Cef^{r}*[B^{b}*a^{b}*K_1*K_h + B^{r}*(1-a^{r})*K_1*K_{w0}]; \quad (4)$$

where:
NCV^b – average calorific value of a fuel in the base year, GJ/ ths m^3 (GJ/t);
Cef^r – carbon emission factor for a fuel, tCO_2/GJ;
B^b – fuel consumption by a boiler-house in the base year, ths m^3 (t);
B^r – fuel consumption by a boiler-house in the reported year, ths m^3 (t);
K_1; $K_h = K_2 * K_3 * K_4$; $K_w = K_5 * K_6 * K_7$, K_{w0} – adjustment factors;
a^b – portion of fuel (heat), consumed for heating purposes in the base year;
$(1-a^b)$ – portion of fuel (heat), consumed for hot water supply service in the base year;
a^r – portion of fuel (heat), consumed for heating purposes in the reported year;
$(1- a^r)$ – portion of fuel (heat), consumed for hot water supply service purposes in the reported year.

$$a^b = L_h^b * g^b * N_h^b / (L_h^b * g^b * N_h^b + L_w^b * N_w^b); \quad (5)$$

where:
L_h^b – maximum connected load to a boiler-house, that is required for heating in the base year, MW;
L_w^b – connected load to a boiler-house, that is required for hot water supply service in the base year, MW;
g^b – recalculation factor for average heat load during heating period in the base year;
N_h^b – heating period duration in the base year, hours;
N_w^b – duration of period of hot water supply service in the base year, hours.

$$a^r = L_h^r * g^r * N_h^r / (L_h^r * g^r * N_h^r + L_w^r * N_w^r); \quad (6)$$

where:
L_h^r – maximum connected load to a boiler-house, that is required for heating in the reported year, MW;
L_w^r – connected load to a boiler-house, that is required for hot water supply service in the reported year, MW;
g^r – recalculation factor for average heat load during heating period in the reported year;
N_h^r – heating period duration in the reported year, hours;
N_w^r – duration of period of hot water supply service in the reported year, hours.

$$g^{b,r} = F_h^{b,r} * k_h^b * (T_{in}^{b,r} - T_{out}^{b,r}) / F_h^{b,r} * k_h^b * (T_{in}^{b,r} - T_{out\,min}^{b,r}) = (T_{in}^{b,r} - T_{out}^{b,r}) / (T_{in}^{b,r} - T_{out\,min}^{b,r}); \quad (7)$$

where:
$F_h^{b,r}$ – heated area, m^2;
k_h^b – averaged heat transfer factor of heated buildings in the base year, $kW/(m^2*K)$;
$T_{in}^{b,r}$ – average inside temperature during the heating period, K (or ^0C);
$T_{out}^{b,r}$ – average outside temperature during the heating period, K (or ^0C);
$T_{out\,min}^{b,r}$ – minimal outside temperature during the heating period, K (or ^0C).

$$K_1 = NCV^b / NCV^r; \quad (8)$$

where:
K_1 –calorific value of a fuel change factor;
NCV^b – average calorific value of a fuel in the base year, GJ/ ths m^3 (GJ/t);
NCV^r – average calorific value of a fuel in the reported year, GJ/ ths m^3 (GJ/t).

$$K_2 = (T_{in}^r - T_{out}^r) / (T_{in}^b - T_{out}^b); \quad (9)$$

where:
K_2 – temperature change factor;
T_{in}^r – average inside temperature during the heating period in the reported year, K (or ^0C);
T_{in}^b – average inside temperature during the heating period in the base year, K (or ^0C);
T_{out}^r – average outside temperature during the heating period in the reported year, K (or ^0C);
T_{out}^b – average outside temperature during the heating period in the base year, K (or ^0C).

$$K_3 = [(F_h^r - F_{h\,t}^r - F_{h\,n}^r) * k_h^b + (F_{h\,n}^r + F_{h\,t}^r) * k_{h\,n}] / F_h^b * k_h^b; \quad (10)$$

where:
K_3 – heated area and building heat insulation change factor;
F_h^r – heated area in the reported year, m^2;
F_h^b – heated area in the base year, m^2;
$F_{h\,n}^r$ – heated area of newly connected buildings (assumed with the new (improved) heat insulation) in the

reported year, m^2;
$F_{h\,t}^{\,r}$ – heated area of buildings (previously existed in the base year) with the renewed (improved) heat insulation in the reported year, m^2;
$k_h^{\,b}$ – averaged heat transfer factor of heated buildings in the base year, kW/(m^2*K);
$k_{h\,n}$ – heat transfer factor of buildings with new heat insulation, kW/(m^2*K).

$$K_4=N_h^{\,r}/N_h^{\,b}; \quad (11)$$

where:
K_4 – heating period duration change factor;
$N_h^{\,r}$ – heating period duration in the reported year, hours;
$N_h^{\,b}$ – heating period duration in the base year, hours.

$$K_5=n_w^{\,r}/n_w^{\,b}; \quad (12)$$

where:
K_5 – number of customers of hot water supply service change factor;
$n_w^{\,r}$ – number of customers of hot water supply service in the reported year;
$n_w^{\,b}$ – number of customers of hot water supply service in the base year.

$$K_6=v_w^{\,r}/v_w^{\,b}; \quad (13)$$

where:
K_6 – standard specific discharge of hot water per personal account change factor;
$v_w^{\,r}$ – standard specific discharge of hot water per personal account in the reported year, (heat units, kWh/h);
$v_w^{\,b}$ – standard specific discharge of hot water per personal account in the base year, (heat units, kWh/h).

$$K_7=N_w^{\,r}/N_w^{\,b}; \quad (14)$$

where:
K_7 – duration of period of hot water supply service change factor;
$N_w^{\,r}$ – duration of period of hot water supply service in the reported year, hours;
$N_w^{\,b}$ – duration of period of hot water supply service in the base year, hours.

For the case when in the base year the hot water supply service was absent at all, and in the reported year this service was provided (due to improvement of heat supply service quality for population), number of customers, standard specific discharge of hot water per personal account and duration of period of hot water supply service for baseline are assumed equal to these values in the reported year, and then:

$$K_5 = K_6 = K_7 = 1. \quad (15)$$

Thus

$$K_{w0} = 1. \quad (16)$$

$$E_{gen}^{\,b} = W^b*CEF_g + Q^b*f^b/1000*NCV^r*Cef^r; \quad (17)$$

where:
W_b – scheduled electricity generation by the new CHP units at a boiler-house, MWh;
CEF_g – carbon emission factor for electricity generation in Ukraine, tCO_2e/MWh;
Q_b – scheduled heat energy generation by the new CHP units at a boiler-house, MWh;
f_b – specific natural gas consumption by a boiler-house where CHP units are installed, ths. m^3/MWh;
NCV^r – average calorific value of a fuel, GJ/ ths m^3;
Cef^r – carbon emission factor for a fuel, tCO_2/GJ.

$$E_{cons}^{\,b} = P^b*CEF_c^{\,r}; \quad (18)$$

where:
P^b – electricity consumption by a boiler-house in the base year, MWh;
$CEF_c^{\,r}$ – carbon emission factor for electricity consumption in Ukraine, tCO_2e/MWh.

Project emissions:

$E^r = E_1^r + E_{gen}^r + E_{cons}^r$; (19)

where:
E_1^r – emissions due to fuel consumption for heating and hot water supply service by a boiler-house in the reported year, t CO_2e;
E_{gen}^r – emissions due to electricity generation by cogeneration units (due to fuel consumption) at a boiler-house in the reported year, t CO_2e;
E_{cons}^r – emissions due to electricity consumption by a boiler-house in the reported year, t CO_2e.

$E_1^r = B^r * NCV^r * Cef^r$; (20)

where:
B^r – fuel consumption by a boiler-house in the reported year, ths m^3 (t);
NCV^r – average calorific value of a fuel, GJ/ ths m^3 (GJ/t);
Cef^r – carbon emission factor for a fuel, tCO_2/GJ.

$E_{gen}^r = (W^b - W^r)*CEF_g + [(Q^b - Q^r)*f^b/1000 + B_g]* NCV^r * Cef^r$; (21)

where:
W_b – scheduled electricity generation by the new CHP units at a boiler-house, MWh;
W_r – electricity generation by the installed CHP units, MWh;
CEF_g – carbon emission factor for electricity generation in Ukraine, tCO_2e/MWh;
Q_b – scheduled heat energy generation by the new CHP units at a boiler-house, MWh;
Q_r – heat energy generation by the installed CHP units, MWh;
f_b – specific natural gas consumption by a boiler-house where CHP units are installed, ths. m^3/MWh;
B_g – amount of fuel (gas) consumed by the installed CHP units, ths m^3;
NCV^r – average calorific value of a fuel, GJ/ ths m^3;
Cef^r – carbon emission factor for a fuel, tCO_2/GJ.

$E_{cons}^r = P^r * CEF_c^r$; (22)

where:
P^r – electricity consumption by a boiler-house in the reported year, MWh;
CEF_c^r – carbon emission factor for electricity consumption in Ukraine, tCO_2e/MWh.

[^{b}] – index related to the base year;
[^{r}] – index related to the reported year.

The table of parameters included in the process of monitoring and verification for ERUs calculation, is represented in the Section **B.2.1** and **Annex 1.**

A.6. Status of implementation including time table for major project parts:

The starting date of the project according to PDD is: 01/04/2004.

The starting date of the crediting period is set to the date where the first emission reduction units were generated from the project, that is January 1, 2005. The end of the crediting period is the end of the lifetime of the main equipment, that is minimal 20 years, and correspondingly December 31, 2024. Thus the length of the crediting period is 20 years.

2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
1st Jan - 31st Dec	1st Jan - 31st Dec	1st Jan - 31st Dec	1st Jan - 31st Dec	1st Jan - 31st Dec	1st Jan - 31st Dec	1st Jan - 31st Dec	1st Jan - 31st Dec	1st Jan - 31st Dec	1st Jan - 31st Dec
	Starting date of the project is: 01April 2004								
Base year									
	Boiler-houses equipment rehabilitation								
	Network rehabilitation								
			CHP units installation						
				Frequency controllers installation					
					1 st Kyoto commitment period				
		1 st Monitoring Period			2 nd Monitoring Period	3 rd Monitoring Period	4 th Monitoring Period	5 th Monitoring Period	

Table 2. Status of implementation (according to PDD)

Implementation of boiler houses equipment rehabilitation and network rehabilitation are realized mainly according to project plan with some deviations (delay) from time-table.

Reconstruction of boiler-houses sometimes has insignificant deviations from the project particularly in changes of installed boilers capacity. It was dictated by changes in heat energy demand. In several cases replacement of different (from planned before) diameters of network pipes takes place.

CME "Artemivskteplomerezha" refused to participate in this project.

Implementation of CHP units at RME "Donetskteplocomunenergo" and MCE "Donetskmiskteplomerezha" is postponed because of lack of financing. Installation of CHP units at EMZ, 1, Sadova str. in Enakieve t. and Himik, №24 Sovremenna str. in Slov'yansk t. is finished, but these CHPs are not commissioned yet.

Installation of CHP unit at the 21, Adygeyska str. in Donetsk city was finished in the end of 2007, and it was put in operation in January, 2008.

All of the project stages have not been finished yet.

Table of implemented energy saving measures is presented below.

Implemented energy saving measures	**Volume of performed works (number of boilers, length of network replacement, etc.)**		
	2003-2010	**2011**	**Total**
RME "Donetskteplocomunenergo"			
Boilers replacement			
KSVa-1,25	101	2	**103**
KSVa-2,5	59		**59**
KSVa-0,63	37	1	**38**
KSVa-1,0	5		**5**
KVG- 6,5	5		**5**
KVG-4,65	2		**2**
KVT - 1	13		**13**
KOLVI - 500	2		**2**
KSV-1	1		**1**
RBI - 3,32	4		**4**
RBI - 8900	4		**4**
KST-100	5		**5**
KOSVD - 0,5	2		**2**
KSVD-1,25	2	1	**3**
AOGV-96	9		**9**
AOGV -100	4		**4**
P - 0,5 - 0,8 GN	8		**8**
KVGM - 1,6	1		**1**
Ferroli-100	6		**6**
DKVR - 6,5	1		**1**
Total	**276**	**4**	**280**
Upgrading of boilers		3	**3**
Rehabilitation of network, m	139929	13879	**153808**
Frequency controllers installation	186	1	**187**
Implementation of Individual Heat Supply Stations with new heat exchangers	76		**76**
Installation of CHP units	1	1	**2**
Switching of boiler-houses to gas	20		**20**
Switching of load to the more effective boiler-houses	43	2	**45**
Implementation of heat utilizers	9	3	**12**

MCE "Donetskmiskteplomerezha"			
Boilers replacement			
KVANT-1,5	17		**17**
KVANT-0,8	2		**2**
KATON-0,8	1		**1**
KATON-1,5	9		**9**
KV-0,1	2		**2**
KGPU	1		**1**
KVN-0,29	2		**2**
Viessman		2	**2**
Total	**34**	**2**	**36**
Upgrading of boilers		7	**7**
Rehabilitation of network, m	28344	2913	**31257**
Frequency controllers installation	216		**216**
Implementation of CHP units	1		**1**
Switching of boiler-houses to gas	1		**1**
Switching of boiler-houses' load to the more effective ones	6		**6**
Implementation of heat utilizers	11		**11**

Table 3. Implemented energy saving measures

For detailed information about implemented measures see Annex 2, Annex 3, Annex 5, Annex 6 and Annex 7.

Fig.1. Network rehabilitation with pre-insulated pipes

Fig.2. Boiler KSVa-2,5

A.7. Intended deviations or revisions to the registered PDD:

There were no intended deviations or revisions to the registered PDD.

A.8. Intended deviations or revisions to the registered monitoring plan:

In order to improve the accuracy and applicability of data and calculations, in accordance to the "Guidance on criteria for baseline setting and monitoring" (version 03)[7], the following revisions were made to the registered monitoring plan:

The newly developed officially approved valid country-specific values of parameter 16 "Carbon emission factor" were used for calculations:

For all types of fuels – according to the "National inventory report of Ukraine for 1990 – 2009"[8], instead of the data from table provided in Annex C of the Operational Guidelines for Project Design Documents of Joint Implementation Projects [Volume 1: General guidelines; Version 2.2, The Netherlands, 2003];

For electricity generation and consumption in Ukraine – the values according to the Order of the National Environmental Investment Agency of Ukraine #75 dated 12.05.2011[9]., instead of using the ex-ante data from Table B1 "Baseline carbon emission factors for JI projects generating electricity" and Table B2 "Baseline carbon emission factors for JI projects reducing electricity consumption" of Operational Guidelines for PDD's of JI projects. Volume 1: General guidelines Version 2.3. Ministry of Economic Affairs of the Netherlands, 2004 (ERUPT 4, Senter, the Netherlands)[10], with adding these parameters CEF_c (16.5) and CEF_g (16.6) to the Monitoring plan.

A.9. Changes since last verification:

1 st Monitoring Report was made for period January 1, 2005- December 31, 2007 (Version 04 dated October 27, 2008).
2 nd Monitoring Report was made for period January 1, 2008- December 31, 2008 (Version 02 dated March 25, 2009).
3 rd Monitoring Report was made for period January 1, 2009 – December 31, 2009 (Version 02 dated February 2, 2010).
4 th Monitoring Report was made for period January 1, 2010 – December 31, 2010 (Version 03 dated May 18, 2011).

The further implementation of fuel and energy saving measures at the RME "Donetskteplocomunenergo" and MCE "Donetskmiskteplomerezha" within this project has leaded to additional GHG emission reduction.

The boiler-house Usuriyska str., 22 (#21 in the Project) of MCE "Donetskmiskteplomerezha" is excluded from monitoring process because of implementation of measures that are not foreseen by project activity (electric heat generation equipment is installed at the boiler-house).

[7] *http://ji.unfccc.int/Ref/Documents/Baseline_setting_and_monitoring.pdf*
[8] *http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip*
[9] *http://www.neia.gov.ua/nature/doccatalog/document?id=127498*
[10] *http://ji.unfccc.int/CallForInputs/BaselineSettingMonitoring/ERUPT/index.html*

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SECTION B. Key monitoring activities

B.1. Data measurement

B.1.1. Measurement scheme

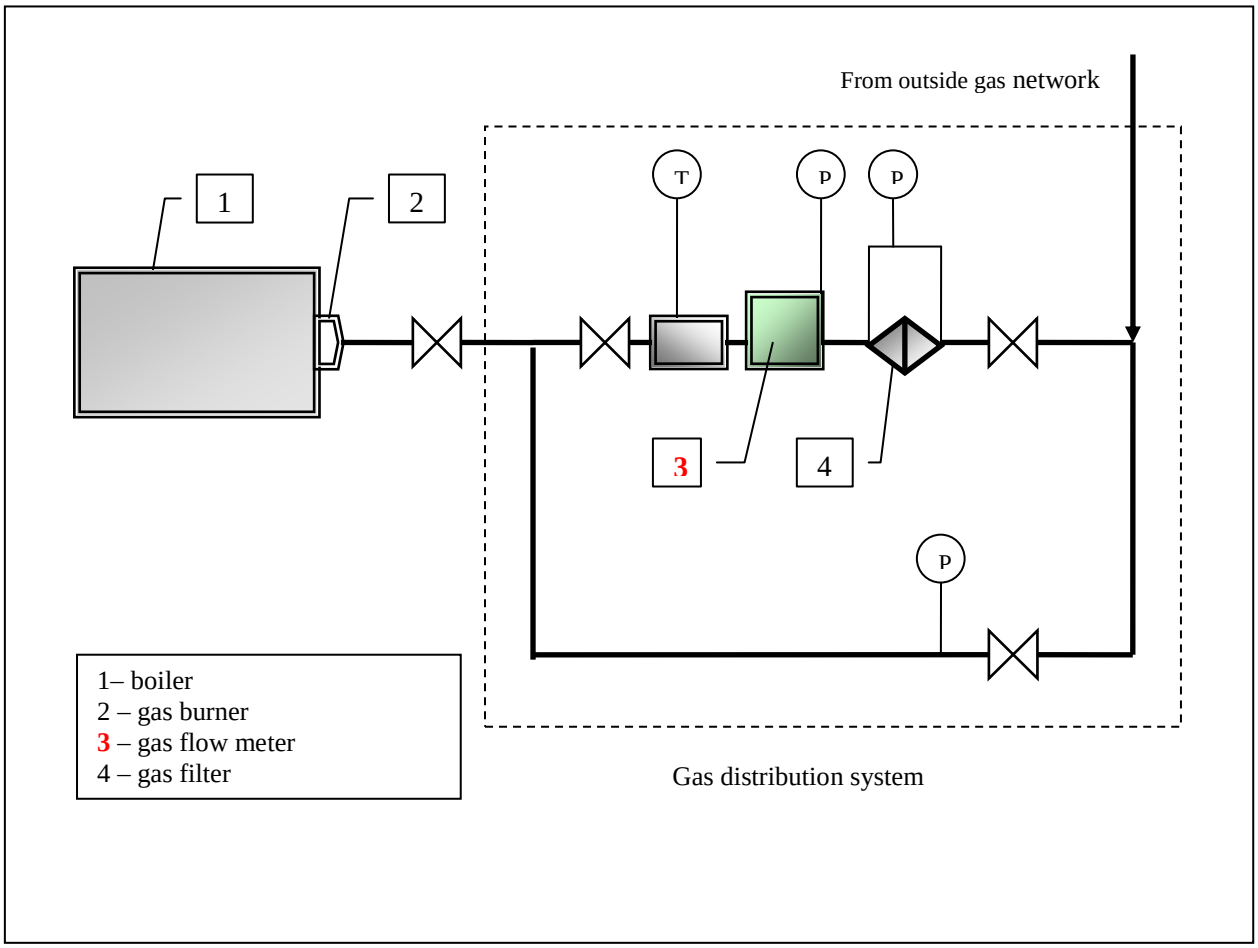
The control and monitoring system comes to fuel consumption measurements. Other parameters are defined by calculations or taken from statistic data. Fuel (natural gas) consumption measurements are realized at the gas distribution units of the boiler-houses. Gas consumption registration is carried out in volume units reduced to standard conditions by means of automatic correction for temperature and pressure. The typical gas distribution unit is shown at the Fig. 3, typical gas flow meter is shown at the Fig. 4.

Fig. 3. Gas distribution unit

Fig. 4. Gas flow meter

The typical scheme of the gas distribution system is shown at the Fig. 5. Usually it consists of the following equipment:

- gas filter;
- control and measuring devices for gas operation pressure measurement and control of pressure differential at the gas filter;
- gas flow meter;
- stop valve;
- bypass facility.



T –temperature of the natural gas;
P - natural gas pressure at a boiler-house gas-input.

Fig. 5. Typical scheme of gas distribution system

The typical scheme of monitoring system for boiler-house where the CHP unit is installed is shown at the Fig. 6. It consists of the following equipment:

GFM – gas flow meter;
HFM – heat flow meter with sensors;
GEM - generated electricity meter;
CP - control panel of gas engine-generator machine

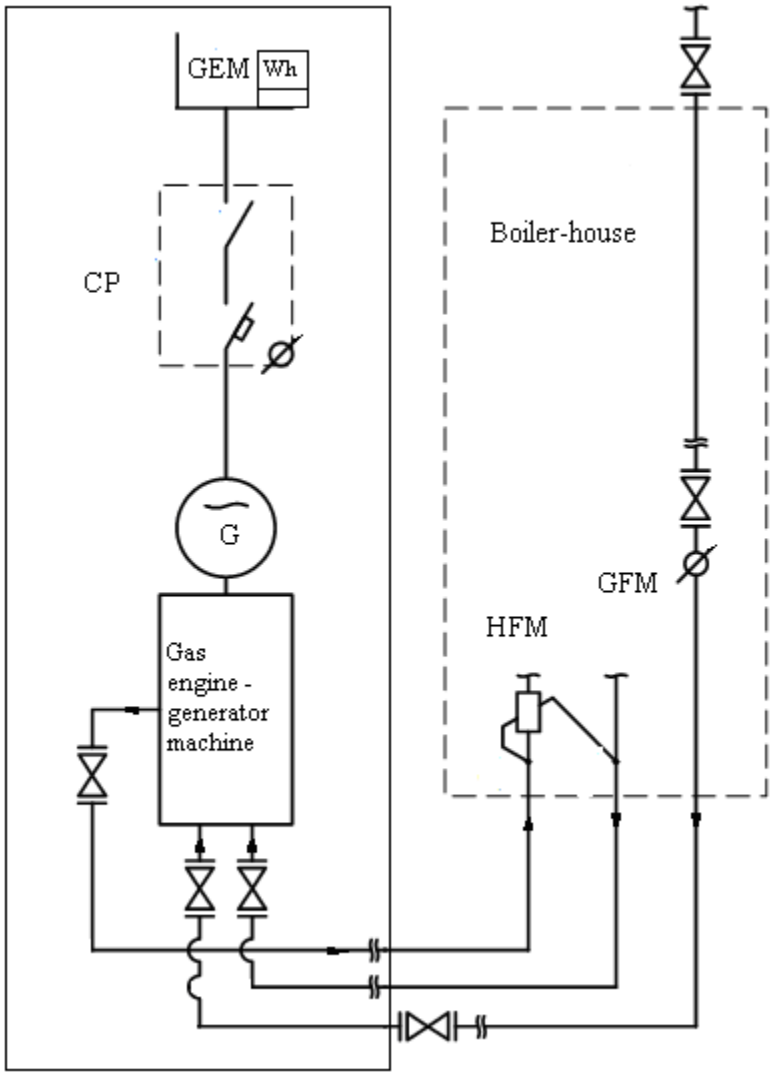


Fig. 6. Typical scheme of monitoring system for boiler-house where the CHP unit is installed

B.1.2. Monitoring equipment types:

For gas consumption measurement the following gas flow meters are used:

Type of gas flow meter	Manufacturer
GMS- G16 … G250	SE "Arsenal plant", Kyiv
RGK-40 … RGK-1000	OJSC "Ivano-Frankivsk plant "Promprylad"", Ivano-Frankivsk
LGK-80 … LGK-650	
Flow measurement complex "Potok"	SPE "Measurement systems", Dnipropetrovsk city
Kurs - 01 - G100…1000	PKF "Kurs" Ltd., Dnipropetrovsk

See Annex 4.

For electricity consumption measurement the following electricity meters are used:

Type of electricity meter	Manufacturer
SL - 7000	Itron (Actaris), France
ACE - 6000	
Меркурий 230А	Incotex, Ltd., Russia
NIK2303	"Nik-Elektronika" Ltd., Kyiv, Ukraine
SA3U-I670	OJSC "LEMZ", Russia
SA3U-I670M	
SA4-I672M	
SA4-I678	
SA4U-672M	
SA4U-I672M	
SA4U-I678	
SR4U-I673M	
SA4-195	SE "Kharkivskyi zavod elektroaparatury", Kharkiv
SO -197	
CR	OJSC Koncern "Aksion", Russia
ST-EA01	SSPE "Ob'ednannia Komunar", Kharkiv
CE 6803 V	OJSC "Koncern Energomira", Russia
F68700	
SE-302	

See Annex 5 and Annex 6.

For measurement at the CHP unit the following meters are used

Purpose	Type	Serial No.	Manufacturer
Electricity generation measurement	SA4U-I672M	971405	OJSC "LEMZ", Russia
Heat energy generation measurement	CALMEX N2	1320-06 1319-06	
Gas consumption measurement	G-160 LGK – 80 1:20 0,2 Ex	5861	OJSC "Ivano-Frankivsk plant "Promprylad""

B.1.3. Calibration procedures:

According to the requirements of the State Standard of Ukraine № 2708:2006 "Metrology. Calibration of measuring equipment. The organization and procedure"[11], all measuring equipment in Ukraine should meet the specified requirements and is to be inspected (calibrated) periodically.

Information on calibration of the used measuring equipment is provided in Annex 4, 5 and 6.

[11] http://oscill.com/files/27082006.pdf

B.1.3. Involvement of Third Parties:

Measurement equipment calibration was carried out by:

SE "Donetskstandartmetrologiya";
SE "Gorlovskiy CSM";
Enakieve branch of SE "Donetskstandartmetrologiya";
Kramatorsk branch of SE "Donetskstandartmetrologiya";
Mariupol branch of SE "Donetskstandartmetrologiya";
Makiivka branch of SE "Donetskstandartmetrologiya".

B.2. Data collection:

Data used for monitoring the emission reductions are presented in the table in Section B.2.1 (List of fixed default values, variables and attached values) and in Annex 1 (Data), Annex 2 (GHG emission reduction at the RME "Donetskteplocomunenergo" due to reducing of fuel consumption), Annex 3 (GHG emission reduction at the MCE "Donetskmiskteplomerezha" due to reducing of fuel consumption) Annex 5 (GHG emission reduction at the RME "Donetskteplocomunenergo" due to reducing of electricity consumption), Annex 6 (GHG emission reduction at the MCE "Donetskmiskteplomerezha" due to reducing of electricity consumption) and Annex 7 (GHG emission reduction at the MCE "Donetskmiskteplomerezha" due to electricity generation by the CHP unit) of this report.

The table in Section B.2.1 contains all default values, variables and attached values that have been used in calculating emission reductions in this monitoring report.

B.2.1. List of fixed default values, variables and attached values:

	Symbol	Data variable	Data unit	Measured (m), calculated (c), estimated (e)
1	($\mathbf{B^b}$) and ($\mathbf{B^r}$)	Fuel consumption by a boiler house:		m
1.1		- Natural Gas	ths m^3	
1.2		- Coal	ton	
1.3		- Heavy oil	ton	
1.4		- Light oil	ton	
2	($\mathbf{NCV^b}$) and ($\mathbf{NCV^r}$)	Average calorific value of a fuel:		m, c
2.1		- Natural Gas	MJ/m^3	
2.2		- Coal	MJ/kg	
2.3		- Heavy oil	MJ/kg	
2.4		- Light oil	MJ/kg	
3	($\mathbf{T_{out}^b}$) and ($\mathbf{T_{out}^r}$)	Average outside temperature during the heating period	^0C	m, c
4	($\mathbf{T_{in}^b}$) and ($\mathbf{T_{in}^r}$)	Average inside temperature during the heating period	^0C	m, c
5	($\mathbf{n_w^b}$) and ($\mathbf{n_w^r}$)	Number of customers of the hot water supply service		c
6	($\mathbf{F_h^b}$) and ($\mathbf{F_h^r}$)	Heated area (total)	m^2	c
7	($\mathbf{k_h^b}$)	Averaged heat transfer factor of heated buildings in the base year	$W/(m^2*K)$	Normative documents

8	($\mathbf{F_{h\,t}^{r}}$)	Heated area of buildings (previously existed in the base year) with the renewed (improved) heat insulation in the reported year	m^2	c
9	($\mathbf{F_{h\,n}^{r}}$)	Heated area of newly connected buildings (assumed with the new (improved) heat insulation) in the reported year	m^2	c
10	($\mathbf{k_{h\,n}}$)	Heat transfer factor of buildings with the new heat insulation	$W/(m^2*K)$	Normative documents
11	($\mathbf{N_h^b}$) and ($\mathbf{N_h^r}$)	Duration of the heating period	hours	m
12	($\mathbf{N_w^b}$) and ($\mathbf{N_w^r}$)	Duration of the hot water supply period	hours	m
13	($\mathbf{L_h^b}$) and ($\mathbf{L_h^r}$)	Maximum connected load to a boiler-house, that is required for heating	Gcal/hour	c
14	($\mathbf{L_w^b}$) and ($\mathbf{L_w^r}$)	Connected load to a boiler-house, that is required for hot water supply service	Gcal/hour	c
15	($\mathbf{v_w^r}$) and ($\mathbf{v_w^b}$)	Standard specific discharge of hot water per personal account	kWh/h	Normative documents
16		Carbon emission factor		Normative documents
16.1	($\mathbf{Cef^r}$)	- Natural Gas	kt CO_2/TJ	
16.2	($\mathbf{Cef^r}$)	- Coal	kt CO_2/TJ	
16.3	($\mathbf{Cef^r}$)	- Heavy oil	kt CO_2/TJ	
16.4	($\mathbf{Cef^r}$)	- Light oil	kt CO_2/TJ	
16.5	($\mathbf{CEF_c^r}$)	- Electricity consumption in Ukraine	t CO_2e/ MWh	
16.6	($\mathbf{CEF_g^r}$)	- Electricity generation in Ukraine	t CO_2e/ MWh	
17	($\mathbf{B_g}$)	Fuel consumption by cogeneration units at a boiler-house	ths. m^3	m
18	($\mathbf{W^b}$) and ($\mathbf{W^r}$)	Scheduled electricity generation by the new CHP units and electricity generation by the installed CHP units in the reported year, MWh	MWh	c/m
19	($\mathbf{Q^b}$) and ($\mathbf{Q^r}$)	Scheduled heat energy generation by the new CHP units and heat energy generation by the installed CHP units in the reported year, MWh	MWh	c/m
20	($\mathbf{P^b}$) and ($\mathbf{P^r}$)	Electricity consumption	MWh	m

B.2.2. Data concerning GHG emissions by sources according to the project activity:

See Annex 1, Annex 2, Annex 3, Annex 5, Annex 6 and Annex 7 to this monitoring report.

B.2.3. Data concerning GHG emissions by sources according to the baseline:

See Annex 1, Annex 2, Annex 3, Annex 5, Annex 6 and Annex 7 to this monitoring report.

B.2.4. Data concerning leakage:

There were no leakage effects associated with this project.

B.2.5. Data concerning environmental and social impacts:

Implementation of project "Rehabilitation of the District Heating System in Donetsk Region" has a positive effect on environment. Following points give detailed information on environmental benefits.

1. Project implementation allowed to save over 90 million m^3 of natural gas, 997 tones of light oil, about 45 thousand tones of coal and over 18 GWh of electricity during 2011.

2. Due to fuel and electricity saving and implementation of new environmentally friendlier technologies of fuel combustion, project activity has reduced emissions of SO_x, NO_x, CO and particulate matter (co-products of combustion).

There are no negative social impacts associated with the project

B.3. Data processing and archiving (including software used):

Registration of natural gas consumption at boiler houses of RME "Donetskteplocomunenergo" and MCE "Donetskmiskteplomerezha is carried out by the following scheme:

1. Natural gas consumption is measured by gas flow meter, installed at a boiler-house. All boiler-houses are equipped with gas flow meters.

2. The majority of boiler-houses are equipped with automatic correctors for gas temperature and pressure. Gas consumption is registered automatically. Every day operator of a boiler house makes registration of daily gas consumption in the special paper journal "Journal of registration of boiler-house's operation parameters", see Fig. 7.

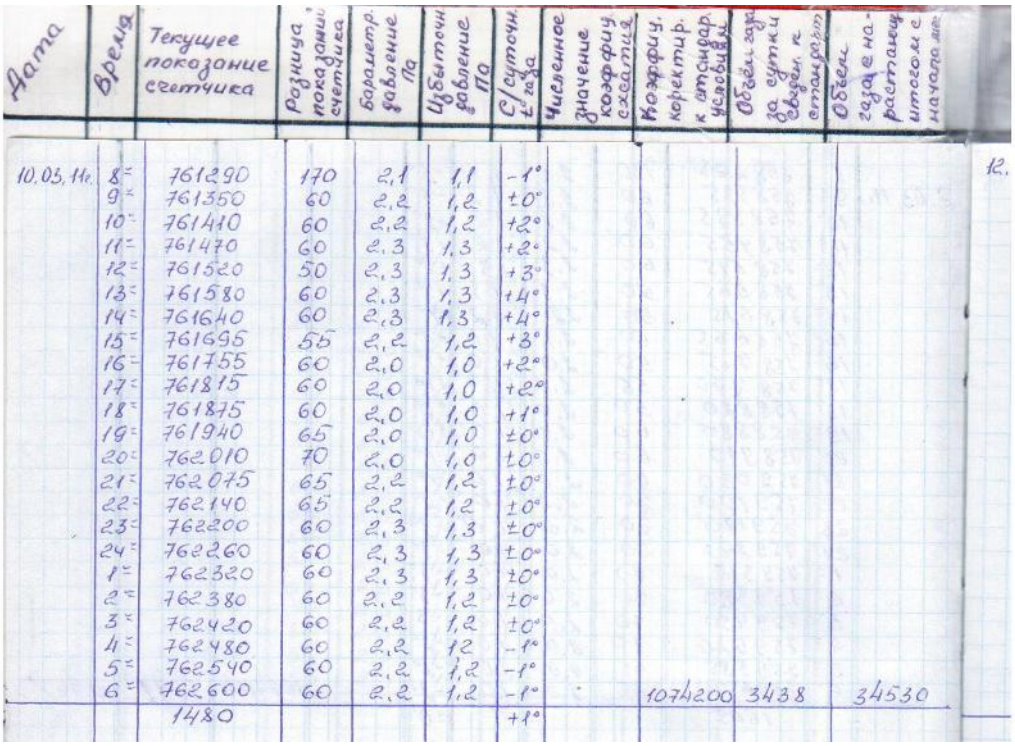
3. At the boiler-houses that are not equipped with gas volume correctors, operator of a boiler house every 2 hours registers parameters of natural gas (temperature and pressure) in the paper journal "Journal of registration of boiler-house's operation parameters". These parameters are used to bring gas consumption to standard conditions.

4. Every day operators transfer values of gas consumption to calculating centers of the Generation Branches of RME "Donetskteplocomunenergo" and MCE "Donetskmiskteplomerezha". The united server is installed at the MCE "Donetskmiskteplomerezha" account center (Fig. 8). It allows taking values of all controlled parameters for every day of monitoring period.

5. Every month the account centers transfer data to gas suppliers.

Data monitored and required for emission reductions calculation and verification, according to paragraph 37 of the JI guidelines, are to be kept for two years after the last transfer of ERUs for the project. In accordance with this, the General director of RME "Donetskteplocomunenergo" has issued the Order No. 149 dated 22.04.2011 "On creation of the operation team and period of storage of documents", in

which the personnel of the created operation team is established, and keeping of the primary documentation for two years after the last transfer of ERUs for the project is appointed.



Дата	Время	Текущее показание счетчика	Разница показаний счетчика	Барометр. давление Па	Избыточ. давление ПО	С/суточн. t°газа	Числ. значение коэффиц. расхода	Коэффиц. коррект. к станд. условиям	Объем газа за сутки по счетчику	Объем газа на начало суток
10.03.11г.	8=	761290	170	2,1	1,1	-1°				12.
	9=	761350	60	2,2	1,2	±0°				
	10=	761410	60	2,2	1,2	+2°				
	11=	761470	60	2,3	1,3	+2°				
	12=	761520	50	2,3	1,3	+3°				
	13=	761580	60	2,3	1,3	+4°				
	14=	761640	60	2,3	1,3	+4°				
	15=	761695	55	2,2	1,2	+3°				
	16=	761755	60	2,0	1,0	+2°				
	17=	761815	60	2,0	1,0	+2°				
	18=	761875	60	2,0	1,0	+1°				
	19=	761940	65	2,0	1,0	±0°				
	20=	762010	70	2,0	1,0	±0°				
	21=	762075	65	2,2	1,2	±0°				
	22=	762140	65	2,2	1,2	±0°				
	23=	762200	60	2,3	1,3	±0°				
	24=	762260	60	2,3	1,3	±0°				
	1=	762320	60	2,3	1,3	±0°				
	2=	762380	60	2,2	1,2	±0°				
	3=	762420	60	2,2	1,2	±0°				
	4=	762480	60	2,2	12	-1°				
	5=	762540	60	2,2	1,2	-1°				
	6=	762600	60	2,2	1,2	-1°		1074200	3438	34530
		1480				+1°				

Fig. 7. Paper journal for natural gas consumption registration

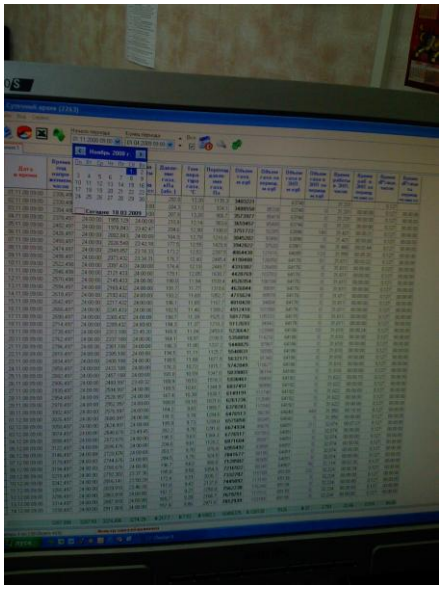


Fig. 8. United server of the MCE "Donetskmiskteplomerezha" account center

Scheme of data collection for Monitoring Report is presented at the Fig. 9.

B.4. Special event log:

n.a.

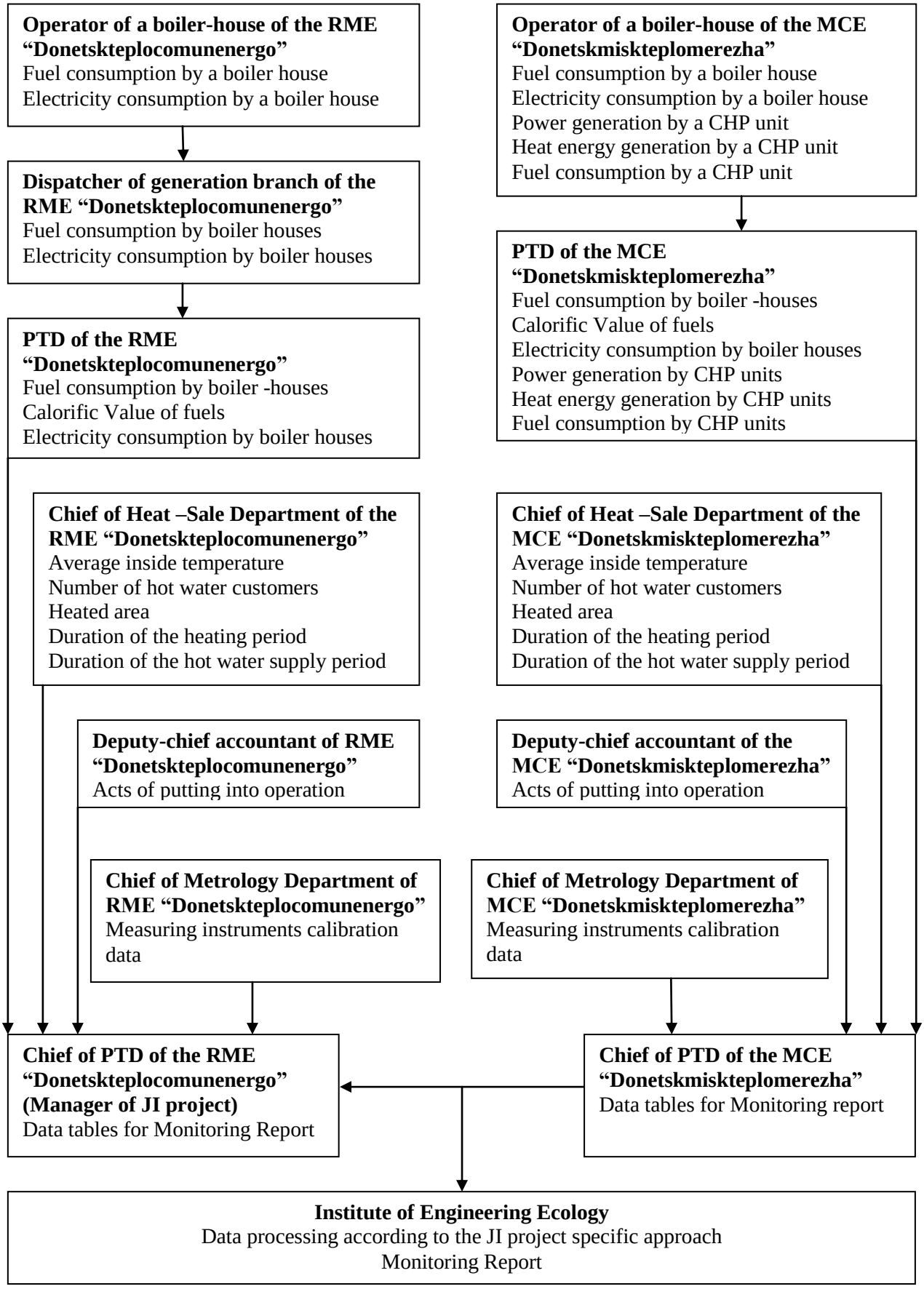


Fig. 9. Scheme of data collection for Monitoring Report

SECTION C. Quality assurance and quality control measures

C.1. Documented procedures and management plan:

C.1.1. Roles and responsibilities:

The Director General of the RME "Donetskteplocomunenergo", Mr. Vasyl Vorotyntsev, appointed a responsible person, Ms. Victoriya Kucherenko, Deputy director on investments and strategic development of RME "Donetskteplokomunenergo", for the implementation and management of the monitoring process at the RME "Donetskteplocomunenergo". Ms. Kateryna Pahomova, senior engineer of perspective development department of RME "Donetskteplokomunenergo", is responsible for data collection, measurements, calibration, data recording and storage.

The Director of the MCE "Donetskmiskteplomerezha" Mr. Viktor Rogachev appointed a responsible person, Ms. Valentyna Skoryk, engineer of generation department, for the implementation and management of the monitoring process at the MCE "Donetskmiskteplomerezha". Mrs. Valentyna Skoryk is responsible for supervising data collection, measurements, calibration, data recording and storage.

Dr. Vladimir Gomon, Managing Engineer of the European Institute for safety, security, insurance and environmental technics, is responsible for baseline and monitoring JI project specific approach development.

Dr. Dmytro Paderno, Deputy director of the Institute of Engineering Ecology, is responsible for baseline and monitoring JI project specific approach development.

Ms. Kateryna Korinchuk, scientific researcher of the Institute of Engineering Ecology, is responsible for data processing.

C.1.2. Trainings:

As far as the main activity of the RME "Donetskteplocomunenergo" and the MCE "Donetskmiskteplomerezha" is not changed in course of the JI project implementation, the special technical trainings for personnel are not necessary. The technical personnel of the enterprises have 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, for example: cogeneration units, foreign produced boilers, etc.) equipment installation, the company - producer of this equipment should provide trainings for personnel.

For example, JSC "Pervomaiskdieselmash" – the producer of cogeneration units – during all period of operation of engines-generators usually renders to purchasers of their equipment all kinds of service:

- Performance of mounting, starting-up and adjustment works, commissioning;
- Training of the attendants on service regulations at object of the customer or at industrial base of the factory;
- Guarantee and after guarantee service;
- Performance on place of operation maintenance service as well as current, average and major overhauls, including on units without their putting out of operation;
- Delivery of spare parts to place of operation.

The RME "Donetskteplocomunenergo" and the MCE "Donetskmiskteplomerezha" provide personnel retrainings according to protection of labour norms. The enterprises have the Labour protection departments, which are responsible for raising the level of personnel skills and trainings.

In course of the JI project development (starting from 2004), specialists of the Institute of Engineering Ecology and then also of the European Institute for safety, security, insurance and environmental technics carried out a comprehensive consultations and trainings for involved representatives of the RME

"Donetskteplocomunenergo" and the MCE "Donetskmiskteplomerezha" on the necessary data collection according to Monitoring plan for the project.

In October 2007 the European Institute for safety, security, insurance and environmental technics carried out a comprehensive training "Organization and training of special group for necessary data collection according with Monitoring plan".

The group consisted of staff of the RME "Donetskteplocomunenergo"and the MCE "Donetskmiskteplomerezha", in particular

RME "Donetskteplocomunenergo":

Victoriya Kucherenko - Head of generation department;
Katerina Pahomova - engineer of generation department;
Anatoliy Shulga - engineer of generation department;
MCE "Donetskmiskteplomerezha":
Valentina Skorik - engineer of generation department;
Vadym Kulik – Head of generation department;
Oksana Ermachenko – engineer of heat-energy resources department.

C.2. Involvement of Third Parties:

There were no third parties involved for quality assurance and quality control measures.

C.3. Internal audits and control measures:

Manager of the JI project, Deputy General director on investments and strategic development Ms. Victoriya Kucherenko controls and checks up the adequacy of the data collection mechanism and the reliability of parameters of the Monitoring plan and other information on project implementation.

C.4. Troubleshooting procedures:

Any problem occurring that concerns this project is to be reported immediately to the project manager, who takes the appropriate measures.

SECTION D. Calculation of greenhouse gas emission reductions

D.1. Formulae used:

In this section the formulae used for computing project emissions, baseline emissions and the total emission reduction are documented.

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)	
	$ERUs = \sum[E_{(i)}^{b} - E_{(i)}^{r}]$
	$E_{(i)}^{b}$ – baseline emissions for an (i) boiler-house in the reported year, t CO_2e; $E_{(i)}^{r}$ – project emissions for an (i) boiler-house in the reported year, t CO_2e.
	The sum is taken over all boiler-houses (i) which are included into the project

Project emissions

Formula 2 – Project emissions in the reported year (E^r)	
	$E^r = E_1^r + E_{gen}^r + E_{cons}^r$
	E_1^r – emissions due to fuel consumption for heating and hot water supply service by a boiler-house in the reported year, t CO_2e; E_{gen}^r – emissions due to electricity generation by cogeneration units (due to fuel consumption) at a boiler-house in the reported year, t CO_2e; E_{cons}^r – emissions due to electricity consumption by a boiler-house in the reported year, t CO_2e.

Formula 3 –Emissions due to fuel consumption for heating and hot water supply service by a boiler-house in the reported year (E_1^r)	
	$E_1^r = B^r * NCV^r * Cef^r$
	B^r –fuel consumption by a boiler-house in the reported year, ths m^3 (t); NCV^r – average calorific value of a fuel in the reported year, GJ/ ths m^3 (GJ/t); Cef^r – carbon emission factor for a fuel, tCO_2/GJ.

Formula 4 –Emissions due to electricity generation by cogeneration units (due to fuel consumption) at a boiler-house in the reported year ($E_{gen\ i}^r$)	
	$E_{gen}^r = (W^b - W^r)*CEF_g + [(Q^b - Q^r)*f^b/1000 + B_g]* NCV^r * Cef^r$
	W_b – scheduled electricity generation by the new CHP units at a boiler-house, MWh; W_r – electricity generation by the installed CHP units, MWh; CEF_g – carbon emission factor for electricity generation in Ukraine, tCO_2e/MWh; Q_b – scheduled heat energy generation by the new CHP units at a boiler-house, MWh; Q_r – heat energy generation by the installed CHP units, MWh;

	f_b – specific natural gas consumption by a boiler-house where CHP units are installed, ths. m^3/MWh; B_g – amount of fuel (gas) consumed by the installed CHP units, ths m^3; NCV^r – average calorific value of a fuel, GJ/ ths m^3; Cef^r – carbon emission factor for a fuel, tCO_2/GJ.

Formula 5 – Emissions due to electricity consumption by a boiler-house in the reported year (E_{cons}^r)	
	$E_{cons}^r = P^r * CEF_c^r$
	P^r – electricity consumption by a boiler-house in the reported year, MWh; CEF_c^r – carbon emission factor for electricity consumption in Ukraine, tCO_2e/MWh.

Baseline emissions

Formula 6 – Baseline emissions in the reported year (E_b)	
	$E^b = E_1^b + E_{gen}^b + E_{cons}^b$
	E_1^b – emissions due to fuel consumption for heating and hot water supply service by a boiler-house that would be in the base year in terms of the reported year, t CO_2e; E_{gen}^b – emissions due to electricity generation associated to the project for a boiler-house in the base year (consumed from grid, amount that is substituted in the reported year), t CO_2e; E_{cons}^b –emissions due to electricity consumption by a boiler-house that would be in the base year in terms of the reported year, t CO_2e.

Formula 7 – Emissions due to fuel consumption for heating and hot water supply service by a boiler-house that would be in the base year in terms of the reported year (E_1^b)	
	For the case when in the base year the hot water supply service was provided ($(1-a^b) \neq 0$): $E_1^b = NCV^b * Cef^r * [B^b * a^b * K_1 * K_h + B^b * (1-a^b) * K_1 * K_w]$ For the case when in the base year the hot water supply service was absent at all ($(1-a^b) = 0$), and in the reported year this service was provided (due to improvement of heat supply service quality for population): $E_1^b = NCV^b * Cef^r * [B^b * a^b * K_1 * K_h + B^r * (1-a^r) * K_1 * 1]$.
	NCV^b – average calorific value of a fuel in the base year, GJ/ ths m^3 (GJ/t); Cef^r – carbon emission factor for a fuel, tCO_2/GJ; B^b –fuel consumption by a boiler-house in the base year, ths m^3 (t); B^r – fuel consumption by a boiler-house in the reported year, ths m^3 (t); 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 year; $(1-a^b)$ – portion of fuel (heat), consumed for hot water supply service in the base year; a^r – portion of fuel (heat), consumed for heating purposes in the reported year; $(1- a^r)$ – portion of fuel (heat), consumed for hot water supply service purposes in the reported year.

Formula 8 – Portion of fuel (heat), consumed for heating purposes in the base year (a^b)	
	$a^b = L_h^b * g^b * N_h^b / (L_h^b * g^b * N_h^b + L_w^b * N_w^b)$
	L_h^b – maximum connected load to a boiler-house, that is required for heating in the base year, MW; L_w^b – connected load to a boiler-house, that is required for hot water supply service in the base year, MW; g^b – recalculation factor for average heat load during heating period in the base year; N_h^b – heating period duration in the base year, hours; N_w^b – duration of period of hot water supply service in the base year, hours.

Formula 9 – Portion of fuel (heat), consumed for heating purposes in the reported year (a^r)	
	$a^r = L_h^r * g^r * N_h^r / (L_h^r * g^r * N_h^r + L_w^r * N_w^r)$
	L_h^r – maximum connected load to a boiler-house, that is required for heating in the reported year, MW; L_w^r – connected load to a boiler-house, that is required for hot water supply service in the reported year, MW; g^r – recalculation factor for average heat load during heating period in the reported year; N_h^r – heating period duration in the reported year, hours; N_w^r – duration of period of hot water supply service in the reported year, hours.

Formula 10 – Recalculation factor for average heat load during heating period ($g^{b,r}$)	
	$g^{b,r} = (T_{in}^{b,r} - T_{out}^{b,r}) / (T_{in}^{b,r} - T_{out\ min}^{b,r})$
	$T_{in}^{b,r}$ – average inside temperature for the heating period, ^{0}C ; $T_{out}^{b,r}$ – average outside temperature for the heating period, ^{0}C; $T_{out\ min}^{b,r}$ – minimal outside temperature for the heating period, ^{0}C.

Formula 11 – Calorific value of a fuel change factor (K_1)	
	$K_1 = NCV^b / NCV^r$
	NCV^b – average calorific value of a fuel in the base year, GJ/ ths m^3 (GJ/t); NCV^r – average calorific value of a fuel in the reported year, GJ/ ths m^3 (GJ/t).

Formula 12 – 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 during the heating period in the reported year, ^{0}C; T_{in}^b – average inside temperature during the heating period in the base year, ^{0}C; T_{out}^r – average outside temperature during the heating period in the reported year, ^{0}C; T_{out}^b – average outside temperature during the heating period in the base year, ^{0}C.

Formula 13 – Heated area and building heat insulation change factor (K_3)	
	$K_3 = [(F_h^r - F_{ht}^r - F_{hn}^r)*k_h^b + (F_{hn}^r + F_{ht}^r)*k_{hn}] / F_h^b*k_h^b$
	F_h^r – heated area in the reported year, m^2; F_h^b – heated area in the base year, m^2; F_{hn}^r – heated area of newly connected buildings (assumed with the new (improved) heat insulation) in the reported year, m^2; F_{ht}^r – heated area of buildings (previously existed in the base year) with the renewed (improved) heat insulation in the reported year, m^2; k_h^b – averaged heat transfer factor of heated buildings in the base year, kW/(m^2*K); k_{hn} – heat transfer factor of buildings with new heat insulation, kW/(m^2*K).

Formula 14 – Heating period duration change factor (K_4)	
	$K_4=N_h^r/N_h^b$
	N_h^r – heating period duration in the reported year, hours; N_h^b – heating period duration in the base year, hours.

Formula 15 – Number of customers of hot water supply service change factor (K_5)	
	$K_5 = n_w^r / n_w^b$
	n_w^r – number of customers of hot water supply service in the reported year; n_w^b – number of customers of hot water supply service in the base year.

Formula 16 – 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 reported year, (heat units, kWh/h); v_w^b – standard specific discharge of hot water per personal account in the base year, (heat units, kWh/h)

Formula 17 – Duration of period of hot water supply service change factor (K_7)	
	$K_7 = N_w^r / N_w^b$
	N_w^r – duration of period of hot water supply service in the reported year, hours; N_w^b – duration of period of hot water supply service in the base year, hours.

Formula 18 –Emissions due to electricity generation associated to the project for a boiler-house in the base year (consumed from grid, amount that is substituted in the reported year) ($E_{gen\ i}^{b}$)	
	$E_{gen}^{b} = W^{b}*CEF_{g} + Q^{b}*f^{b}/1000* NCV^{r}* Cef^{r}$
	W_b – scheduled electricity generation by the new CHP units at a boiler-house, MWh; CEF_g – carbon emission factor for electricity generation in Ukraine, tCO_2e/MWh; Q_b – scheduled heat energy generation by the new CHP units at a boiler-house, MWh; f_b – specific natural gas consumption by a boiler-house where CHP units are installed, ths. m^3/MWh; NCV^r – average calorific value of a fuel, GJ/ ths m^3; Cef^r – carbon emission factor for a fuel, tCO_2/GJ.

Formula 19 –Emissions due to electricity consumption by a boiler-house that would be in the base year in terms of the reported year (E_{cons}^{b})	
	$E_{cons}^{b} = P^{b}*CEF_{c}^{r}$
	P^b – electricity consumption by a boiler-house in the base year, MWh; CEF_c^r – carbon emission factor for electricity consumption in Ukraine, tCO_2e/MWh.

D.2. GHG emission reductions:

D.2.1. Project emissions:

Project emissions consist of:

1. Emissions due to fuel and electricity consumption for heating and hot water supply service at the RME "Donetskteplocomunenergo" in the reported year.
2. Emissions due to fuel and electricity consumption for heating and hot water supply service at the MCE "Donetskmiskteplomerezha" in the reported year.

Project emissions, t CO_2e	**2011**
RME "Donetskteplocomunenergo"	596511
MCE "Donetskmiskteplomerezha"	412694
Total	**1009205**

Table 3. Project emissions

See Annex 8.

D.2.2. Baseline emissions:

Baseline emissions consist of:

1. Emissions due to fuel and electricity consumption for heating and hot water supply service at the RME "Donetskteplocomunenergo" in the base year, corrected according to the actual conditions in the reported year (the dynamic baseline).
2. Emissions due to fuel and electricity consumption for heating and hot water supply service at the MCE "Donetskmiskteplomerezha" in the base year, corrected according to the actual conditions in the reported year (the dynamic baseline).

Baseline emissions, t CO_2e	**2011**
RME "Donetskteplocomunenergo"	921381
MCE "Donetskmiskteplomerezha"	552250
Total	**1473631**

Table 4. Baseline emissions

See Annex 8.

D.2.3. Leakage:

There were no leakage associated with the project.

D.2.4. Summary of the emissions reductions during the monitoring period:

Emission Reduction, t CO_2e	**2011**
RME "Donetskteplocomunenergo"	324870
MCE "Donetskmiskteplomerezha"	139556
Total	**464426**

Table 5. Total Emission Reductions

See Annex 8.

D.3. Deviation of the actual emissions reductions from estimated in the registered PDD, if any:

According to the results of the Monitoring Report for the project "Rehabilitation of the District Heating System in Donetsk Region" for 2011, the actual achieved GHG emission reductions are larger than it was indicated as prognosis estimation in the PDD.

The main reasons of the difference between the prognosis estimation of emission reductions in the PDD and the actual emission reductions in the Monitoring Report are:

1) Application of the principally different approaches and methods for prognosis estimation of GHG emission reductions in the PDD and for calculation of the actually achieved GHG emission reductions in the Monitoring Report (both approaches are described in details in the PDD), in particular impossibility of taking into account in the PDD of the actual conditions in reported period, etc.;

2) Application of the strictly conservative approach for estimation of emission reductions in the PDD: the minimum assured (on the basis of the known results of similar measures) effect from implementation of all energy saving measures was accepted, and in some cases, when it was impossible to define it concretely in numbers, was not taken into account in the calculations in the PDD, although it obviously must be positive;

3) Application in course of calculations in the Monitoring Report of the values of the carbon emission factors for electricity generation and consumption in Ukraine according to the valid Order of the National Environmental Investment Agency of Ukraine, which are substantially higher than used in the PDD according to the normative documents valid before.

4) In connection with participation in the JI project, in the course of the project realization the system of responsibility of every employee from an operator to the technical director for optimum consumption of fuel and energy resources at the enterprise was established, as a result of which the off-scheduled monitoring of all key parameters of work of the system as a whole is conducted at the objects of the enterprise, in particular the gas-air correlation during fuel combustion, compliance of temperature conditions of the heat carrier, optimization of partition of load by the boilers at boiler-houses, etc., as well as additional and concomitant measures for emission reduction are implemented.

Thus, the actually achieved GHG emission reductions, under compliance with all proper conditions of the heat supply services, necessarily will be larger than the prognosis estimations.

Annex 1 – Data

The data in this Annex 1 are presented in accordance with Parameter 1-20 in the Monitoring plan.

Parameter Number	Parameter Name
1	Fuel consumption by a boiler house:
1.1	- Natural Gas
1.2	- Coal
1.3	- Heavy oil
1.4	- Light oil
2	Average calorific value of a fuel
2.1	- Natural Gas
2.2	- Coal
2.3	- Heavy oil
2.4	- Light oil
3	Average outside temperature during the heating period
4	Average inside temperature during the heating period
5	Number of customers of the hot water supply service
6	Heated area (total)
7	Averaged heat transfer factor of heated buildings in the base year
8	Heated area of buildings (previously existed in the base year) with the renewed (improved) heat insulation in the reported year
9	Heated area of newly connected buildings (assumed with the new (improved) heat insulation) in the reported year
10	Heat transfer factor buildings with new heat insulation
11	Duration of the heating period
12	Duration of the hot water supply service period
13	Maximum connected load to a boiler-house, that is required for heating
14	Connected load to a boiler-house, that is required for hot water supply service
15	Standard specific discharge of hot water per personal account
16	Carbon emission factor
16.1	- Natural Gas
16.2	- Coal
16.3	- Heavy oil
16.4	- Light oil
16.5	- Electricity consumption in Ukraine
16.6	- Electricity generation in Ukraine
17	Fuel consumption by cogeneration units at a boiler-house
18	Scheduled electricity generation by the new CHP units and electricity generation by the installed CHP units in the reported year
19	Scheduled heat energy generation by the new CHP units and heat energy generation by the installed CHP units in the reported year
20	Electricity consumption

Parameter number and name	**1.1.** Fuel consumption by a boiler house. Natural Gas
Description	Natural gas consumption by boiler houses
Value in monitoring period	456344.68 ths. m^3. The detailed data of natural gas consumption by every boiler-house are presented in Annex 2 and Annex 3.
Monitoring method	Gas flow meters
Recording frequency	Registered every day and calculated once per year
Background data	Instrument readings are registered in the paper journals at every boiler-house.
Calculation method	n.a.
Comment	According to the conservative approach, the volume of consumed natural gas was corrected by measurement error. Natural gas consumption in the reported year that used for Project emissions calculations was increased proportionally to the level of accuracy of gas flow meters installed at the every boiler-house. See Annex 2, Annex 3 and Annex 4.

Parameter number and name	**1.2.** Fuel consumption by a boiler house. Coal
Description	Coal consumption by boiler houses
Value in monitoring period	5267.61 t The detailed data of coal consumption by every boiler-house are presented in Annex 2 and Annex 3.
Monitoring method	Purchasing of coal is realized in accordance with invoices. Amount of coal is measured by wheelbarrows and pails, and then is converted to weight
Recording frequency	Registered every day and calculated once per year
Background data	Coal consumption is registered in the paper journals at every boiler-house. Invoices are filed in special journals.
Calculation method	n.a.
Comment	n.a.

Parameter number and name	**1.3.** Fuel consumption by a boiler house. Heavy oil
Description	Heavy oil consumption by boiler houses
Value in monitoring period	1249.67 t The detailed data of heavy oil consumption by every boiler-house are presented in Annex 2.
Monitoring method	Purchasing of Heavy oil is realized in accordance with invoices. Consumption of Heavy oil is measured by measured tare – torque tanks with rod, and then is converted to weight
Recording frequency	Registered every day and calculated once per year
Background data	Heavy oil consumption is registered in the paper journal Invoices are filed in special journals.
Calculation method	n.a.
Comment	Heavy oil is consumed only by the boiler house №25 Svyati gory "Sonyachniy" in Slov'yansk town.

Parameter number and name	**1.4.** Fuel consumption by a boiler house. Light oil
Description	Light oil consumption by boiler houses
Value in monitoring period	0 t
Monitoring method	Purchasing of Light oil is realized in accordance with invoices. Consumption of Light oil is measured by measured tare – torque tanks with rod, and then is converted to weight
Recording frequency	Registered every day and calculated once per year
Background data	Light oil consumption is registered in the paper journal Invoices are filed in special journals.
Calculation method	n.a.
Comment	Light oil was consumed only by boiler houses #14 and #15 in Vuglegirsk town. They were switched to gas in 2007.

Parameter number and name	**2.1.** Average calorific value of a fuel. Natural Gas
Description	Average calorific value of natural gas calculated by net calorific value
Value in monitoring period	The detailed data for every boiler-house are presented in Annex 2 and Annex 3
Monitoring method	Accepted in accordance with reference or telephone message from natural gas supplier or independent chemical lab analysis report. Independent chemical lab analysis is used in questionable cases. It is used rarely
Recording frequency	Data is provided by natural gas suppliers monthly. Registered every month and calculated once per year.
Background data	Registered in the paper journal
Calculation method	Weighted average value
Comment	n.a.

Parameter number and name	**2.2.** Average calorific value of a fuel. Coal
Description	Average calorific value of coal calculated by net calorific value
Value in monitoring period	The detailed data for every boiler-house are presented in Annex 2 and Annex 3
Monitoring method	Accepted in accordance with quality certificate from coal supplier's or independent chemical lab analysis report. Independent chemical lab analysis is used in contentious cases. It is used rarely
Recording frequency	Quality certificate is given by coal supplier's for every consignment
Background data	Certificates are filed in special journals
Calculation method	Weighted average value
Comment	n.a.

Parameter number and name	**2.3.** Average calorific value of a fuel. Heavy oil
Description	Average calorific value of heavy oil calculated by net calorific value
Value in monitoring period	37.66 MJ/kg
Monitoring method	Accepted in accordance with quality certificate from heavy oil supplier's or independent chemical lab analysis report. Independent chemical lab analysis is used in contentious cases. It is used rarely
Recording frequency	Quality certificate is given by heavy oil supplier for every consignment
Background data	Certificates are filed in special journals
Calculation method	Weighted average value
Comment	n.a.

Parameter number and name	**2.4.** Average calorific value of a fuel. Light oil
Description	Average Calorific Value of Light oil calculated by Net Calorific Value
Value in monitoring period	There was no Light oil consumption in 2011.
Monitoring method	n.a.
Recording frequency	n.a.
Background data	n.a.
Calculation method	n.a.
Comment	n.a.

Parameter number and name	**3.** Average outside temperature during the heating period
Description	Average outside temperature during the heating period
Value in monitoring period	See Annex2 and Annex 3
Monitoring method	Average outside temperature during the heating period is calculated by RME "Donetskteplocomunenergo" and MCE "Donetskmiskteplomerezha" from the values of daily outside temperature taken by dispatchers of RME "Donetskteplocomunenergo" and MCE "Donetskmiskteplomerezha" from Donetsk Meteorological Centre at 10 to 11 a.m. every day of heating period. The information is sent to district heating productive units of RME "Donetskteplocomunenergo" located in different towns.
Recording frequency	Average outside temperature is calculated once per year. Daily outside temperature is recorded every every day of heating period
Background data	Meteorological Centre every month sends the Report for every day of heating period. Reports are filed in special journals
Calculation method	Average value
Comment	n.a.

Parameter number and name	**4.** Average inside temperature during the heating period
Description	Average inside temperature in the heated buildings during the heating period.
Value in monitoring period	18 ^{o}C
Monitoring method	Sum of returned payments
Recording frequency	Once per heating period
Background data	Accounting documents
Calculation method	According to item 5 of the "Order for recalculation of payment for rendering the centralized heating, cold and hot water supply services in cases of their non- rendering or non-full rendering, quality decrease" confirmed by the Order of Cabinet of Ministries of Ukraine No. 151 dated 17.02.2010[12], enterprise makes the return payment of: – 5% from payment for every degree from 18 to 12 ^{o}C; – when inside temperature is lower than 12 ^{o}C, the payment is to be returned completely. Therefore the inside temperature is calculated by formulae: If R = 0 (according to conservative approach, R < 0.05 is assumed for the baseline): $\mathbf{T_{in\,b}}$ = 18 ^{o}C. If 0.05 < R ≤ 0.3: $\mathbf{T_{in\,b}}$ = 18 – (R/0.05) [^{o}C]; If 0.3 < R < 1: $\mathbf{T_{in\,b}}$ = 12 ^{o}C is accepted. where: R - part of returned payment of NP; NP – amount of normative payment.
Comment	n.a.

Parameter number and name	**5.** Number of customers of hot water supply service
Description	Number of customers of hot water supply service for every boiler house
Value in monitoring period	See Annex2 and Annex 3
Monitoring method	Statistics of RME "Donetskteplocomunenergo" and MCE "Donetskmiskteplomerezha"
Recording frequency	Customers update the contracts for hot water supply service with balance-owners (ZhEK) once per year. ZhEKs give to RME "Donetskteplocomunenergo" and MCE "Donetskmiskteplomerezha" personal accounts of customers once per year. Contracts with organizations and legal entities are concludes directly with RME "Donetskteplocomunenergo" and MCE "Donetskmiskteplomerezha".
Background data	The information is collected in special electronic journals "Registration of income from population" (for inhabitants). For organizations and legal entities such information is taken from contracts concluded with them
Calculation method	n.a.
Comment	The data is taken for January, 01 of the next to reported year

[12] http://zakon2.rada.gov.ua/laws/show/151-2010-%D0%BF

Parameter number and name	**6.** Heated area (Total)
Description	Heated area for every boiler house
Value in monitoring period	19737059 m^2 The detailed data of heated area for every boiler-house are presented in Annex 2 and Annex 3.
Monitoring method	Statistics of RME "Donetskteplocomunenergo" and MCE "Donetskmiskteplomerezha"
Recording frequency	The revise is made in case of new contracts with Customers or in case of contracts break.
Background data	The information is collected at the sales departments of district heating productive units of RME "Donetskteplocomunenergo" and MCE "Donetskmiskteplomerezha" in every town by the certificates of owners or balance-owners (ZhEK) in accordance with technical passport of building Total area with balconies and stairs and heated area are displayed in the special journal
Calculation method	n.a.
Comment	The data is taken for January, 01 of the next to reported year

Parameter number and name	**7.** Averaged heat transfer factor of heated buildings in the base year
Description	Averaged heat transfer factor of buildings existed in the base year
Value in monitoring period	Assumed 0.63 $W/(m^2*K)$
Monitoring method	Normative documents
Recording frequency	Once after the end of the base year
Background data	SNiP 2-3-79 (1998)[13], table 1a
Calculation method	n.a.
Comment	n.a.

Parameter number and name	**8.** Heated area of buildings (previously existed in the base year) with the renewed (improved) heat insulation in the reported year
Description	Heated area of reconstructed buildings with application of new heat insulation
Value in monitoring period	0 m^2
Monitoring method	Statistics of RME "Donetskteplocomunenergo" and MCE "Donetskmiskteplomerezha"
Recording frequency	Once per year
Background data	Documents of RME "Donetskteplocomunenergo" and MCE "Donetskmiskteplomerezha"
Calculation method	n.a.
Comment	There were no reconstructed buildings with application of new thermal insulation in the operation area of boiler-houses RME "Donetskteplocomunenergo" and MCE "Donetskmiskteplomerezha"

[13] *http://www.snip-info.ru/Snip_ii-3-79_%281998%29.htm*

Parameter number and name	**9.** Heated area of newly connected buildings (assumed with the new (improved) heat insulation) in the reported year
Description	Heated area of newly connected buildings with application of the new heat insulation
Value in monitoring period	0 m^2
Monitoring method	Statistics of RME "Donetskteplocomunenergo" and MCE "Donetskmiskteplomerezha"
Recording frequency	Once per year
Background data	Documents of RME "Donetskteplocomunenergo" and MCE "Donetskmiskteplomerezha"
Calculation method	n.a.
Comment	There were no new buildings connected to boiler-houses of RME "Donetskteplocomunenergo" and MCE "Donetskmiskteplomerezha"

Parameter number and name	**10.** Heat transfer factor of new buildings and buildings with new heat insulation
Description	Heat transfer factor of buildings with new heat insulation
Value in monitoring period	Assumed 0.36 W/(m^2*K)
Monitoring method	Normative documents
Recording frequency	Once per year
Background data	State Buildings Norms B.2.6-31:2006[14], Table 1
Calculation method	n.a.
Comment	n.a.

Parameter number and name	**11.** Heating period duration
Description	Heating period duration for every boiler house
Value in monitoring period	The detailed data of Heating period duration are presented in Annex 2 and Annex 3.
Monitoring method	Statistics of RME "Donetskteplocomunenergo" and MCE "Donetskmiskteplomerezha"
Recording frequency	Once per year
Background data	The nominal duration (beginning and ending) of the heating period is defined for every town separately, in accordance with item 7.9.4 of "Rules of technical exploitation of heating equipment and networks. 2007" [15]. 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. The actual duration of the heating period is taken from statistics of RME "Donetskteplocomunenergo" and MCE "Donetskmiskteplomerezha".
Calculation method	Sum of durations from the beginning of the calendar year till date of ending of the heating season, and from date of beginning of the new heating season till ending of this calendar year
Comment	n.a.

[14] http://dbn.at.ua/load/1-1-0-13
[15] http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?page=6&nreg=z0197-07

Parameter number and name	**12.** Duration of the hot water supply period
Description	Duration of the period of hot water supply service for every boiler house.
Value in monitoring period	The detailed data on duration of the period of hot water supply service are presented in Annex 2 and Annex 3
Monitoring method	Statistics of RME "Donetskteplocomunenergo" and MCE "Donetskmiskteplomerezha"
Recording frequency	Once per year
Background data	Documents of RME "Donetskteplocomunenergo" and MCE "Donetskmiskteplomerezha"
Calculation method	Total duration of the hot water supply service rendering time per the calendar year
Comment	n.a.

Parameter number and name	**13.** Maximum connected load to the boiler-house, that is required for heating
Description	Maximum connected load to the boiler-house that is required for heating.
Value in monitoring period	The detailed data of maximum connected load to the boiler-house, that is required for heating for every boiler-house, are presented in Annex 2 and Annex 3
Monitoring method	Statistics of RME "Donetskteplocomunenergo" and MCE "Donetskmiskteplomerezha"
Recording frequency	Once per year.
Background data	Documents of RME "Donetskteplocomunenergo" and MCE "Donetskmiskteplomerezha"
Calculation method	Maximum connected load to the boiler-house, that is required for heating, is calculated by RME "Donetskteplocomunenergo" and MCE "Donetskmiskteplomerezha" for every heating period. It is calculated according to heat demand at outside minimal temperature set in KTM 204 Ukraine 244-94[16], Annex 1: Donetsk city – (-25) ^{o}C Amvrosiivka town - (-25) ^{o}C Volnovaha town - (-25) ^{o}C Dokuchaevsk town - (-25) ^{o}C Dzerzhynsk town - (-25) ^{o}C Dmytrove town - (-23) ^{o}C Druzhkivka town - (-26) ^{o}C Enakieve town - (-25) ^{o}C Kirovske town - (-25) ^{o}C Kostyantinivka town - (-26) ^{o}C Kramatorsk town - (-26) ^{o}C Krasniy Lyman town - (-22) ^{o}C Starobesheve uv. - (-25) ^{o}C Ukrayinsk town - (-23) ^{o}C Slov'yansk town - (-25) ^{o}C Snizhne town - (-25) ^{o}C Torez town - (-25) ^{o}C

[16] *http://www.twirpx.com/file/153194/*

	Chartsyzsk town - (-26) ^{o}C Shahtarsk town - (-25) ^{o}C Yasynuvata town - (-25) ^{o}C Average for Donetsk Region - (-23) ^{o}C.
Comment	n.a.

Parameter number and name	**14.** Connected load to the boiler-house, that is required for hot water supply service
Description	Connected load to the boiler-house, that is required for providing the hot water supply service
Value in monitoring period	The detailed data of connected load that is required for hot water supply service for every boiler-house are presented in Annex 2 and Annex 3
Monitoring method	Statistics of RME "Donetskteplocomunenergo" and MCE "Donetskmiskteplomerezha"
Recording frequency	Once per year
Background data	Documents of RME "Donetskteplocomunenergo" and MCE "Donetskmiskteplomerezha"
Calculation method	Connected load to the boiler-house, that is required for hot water supply service, is calculated by RME "Donetskteplocomunenergo" and MCE "Donetskmiskteplomerezha" every year according to contracts with consumers.
Comment	n.a.

Parameter number and name	**15.** Standard specific discharge of hot water per personal account
Description	Standard specific discharge of hot water per personal account
Value in monitoring period	Standard specific discharges of hot water per personal account for different types of consumers are presented in Table 2.10 of. "KTM 204 Ukraine 244-94"
Monitoring method	Normative documents
Recording frequency	Once per year
Background data	Table 2.10 of. "KTM 204 Ukraine 244-94"
Calculation method	n.a.
Comment	At present the standard specific discharge of hot water is valid in Ukraine that was established by the "KTM 204 Ukraine 244-94", and no information is available on any propositions to change it

Parameter number and name	**16.** Carbon emission factor
Description	Carbon emission factor for different fuels, for electricity generation and consumption in Ukraine.
Value in monitoring period	Cef (natural gas) = 0.0554 kt CO_2/TJ; Cef (coal) = 0.0928 kt CO_2/TJ; Cef (heavy oil) = 0.0774 kt CO_2/TJ; Cef (light oil) = 0.0733 kt CO_2/TJж CEF_g = 1.063 t CO_2/ MWh CEF_c = 1.227 t CO_2/ MWh
Monitoring method	Normative documents
Recording frequency	Once per year.
Background data	For all fuels the data from the "National inventory report of Ukraine for 1990 – 2009"[17] (determined for 2009) were used. For natural gas the data from the Table P2.6, for coal - from the Table P2.12, for heavy oil - from the Table P2.32 (code 320 taken for category 1.A.1.a), for light oil - from the Table P2.32 (code 500 taken for category 1.A.1.a) were used. The values of the carbon emission factors for electricity generation and consumption in Ukraine was taken according to the Order of the National Environmental Investment Agency of Ukraine #75 dated 12.05.2011[18].
Calculation method	Carbon emission factors for all fuels (kt CO_2/TJ) were calculated by carbon content of fuels (t C/TJ) multiplied by the ratio of molar masses of carbon dioxide (CO_2) to carbon (C).
Comment	n.a.

Parameter number and name	**17.** Fuel consumption by the cogeneration units at a boiler-house
Description	Fuel (natural gas) consumption by the cogeneration units.
Value in monitoring period	179.11 ths. m^3.
Monitoring method	Gas flow meter
Recording frequency	Registered every day and calculated once per year
Background data	Instrument readings are registered in the paper journals at boiler-house.
Calculation method	n.a.
Comment	During 2011 only one CHP unit was in operation at the MCE "Donetskmiskteplomerezha" at boiler-house 21, Adygeyskaya str.

[17] *http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip*
[18] *http://www.neia.gov.ua/nature/doccatalog/document?id=127498*

Parameter number and name	**18.** Scheduled electricity generation by the new CHP units and electricity generation by the installed CHP units in the reported year
Description	Scheduled electricity generation by the new CHP units is monitoring to determined Baseline emissions and electricity generation by the installed CHP units in reported year is monitoring to determined Project emissions
Value in monitoring period	Scheduled electricity generation – 4000 MWh. Actual electricity generation in 2011 - 476 MWh.
Monitoring method	Electricity meter
Recording frequency	Registered every day and calculated once per year
Background data	Electricity generation is registered in the paper journal
Calculation method	n.a.
Comment	During 2011 only one CHP unit was in operation at the MCE "Donetskmiskteplomerezha" at boiler-house 21, Adygeyskaya.

Parameter number and name	**19**. Scheduled heat energy generation by the new CHP units and heat energy generation by the installed CHP units in reported year
Description	Scheduled heat energy generation by the new CHP units is monitoring to determined Baseline emissions and heat energy generation by the installed CHP units in reported year is monitoring to determined Project emissions
Value in monitoring period	Scheduled heat energy generation – 5440 MWh. Actual heat energy generation in 2011 – 807.12 MWh.
Monitoring method	Heat energy meter
Recording frequency	Registered every day and calculated once per year
Background data	Heat energy generation is registered in the paper journal
Calculation method	n.a.
Comment	During 2011 only one CHP unit was in operation at the MCE "Donetskmiskteplomerezha", at boiler-house 21, Adygeyskaya.

Parameter number and name	**20.** Electricity consumption
Description	Electricity consumption by the boiler-houses was determined at the boiler-houses where frequency controllers were installed.
Value in monitoring period	102521 MWh The detailed data on electricity consumption by every boiler-house are presented in Annex 5 and Annex 6.
Monitoring method	Electricity meter
Recording frequency	Registered every day and calculated once per year
Background data	Electricity consumption is registered in the paper journal at every boiler-house.
Calculation method	n.a.
Comment	According to the conservative approach, the volume of consumed electricity was corrected by measurement error. Electricity consumption in the reported year that used for Project emissions calculations was increased proportionally to the level of accuracy of electricity meters installed at the every boiler-house. See Annex 5 and Annex 6.