JI MONITORING REPORT
(for reporting period 01.01.2008 - 30.06.2012)

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MONITORING REPORT OF JI PROJECT

"Implementation of measures on reduction of energy consumption and greenhouse gas emissions at "ICE "Tekhnogaz" LLC"

Monitoring period:

01/01/2008 – 30/06/2012

Version 02

December 4, 2012

CONTENTS

ANNEXES

[1] Annex 1 is provided in electronic form

SECTION A. General project activity and monitoring information

A.1.Name of the project:

Implementation of measures on reduction of energy consumption and greenhouse gas emissions at "ICE "Tekhnogaz" LLC

Sectoral scope:

Sector 3 – Energy demand
Sector 10 – Fugitive emissions from fuels (solid, oil and gas)

A.2. Information about registration and approval of the project:

Joint Implementation Project (JIP) "Implementation of measures on reduction of energy consumption and greenhouse gas emissions at "ICE "Tekhnogaz" LLC" was determined by Bureau Veritas Certification, Determination report #UKRAINE-det/0798/2012 dated 12/11/2012. The project obtained approval from Ukraine (Letter of Approval #3712/23/7 dated 03/12/2012, issued by the State Environmental Investment Agency of Ukraine). The project was also approved by the Federal Office for the Environment (FOEN) of Switzerland (Letter of Approval No. J294-0485 dated 23/11/2012).

A.3. Brief description of the project:

The main purpose of the project is reduction of greenhouse gas (GHG) emissions as a result of the modernization of the equipment of liquefied carbon dioxide production lines at the "ICE "Tekhnogaz" LLC. Modernization of equipment will reduce specific indicator of energy consumption for the unit of production. The project will also result in lower GHG emissions by heat recuperation of waste energy generated by combustion of natural gas in the production process. The project, initiated by "ICE "Tekhnogaz" LLC, will result into reduction of GHG in the atmosphere and contribute the improvement of the ecological situation in the region.

In general project activity is aimed at:

- Modernization of existing heat generating equipment;
- The use of modern gas and heat metering devices; heat network control systems; systems of control, management and computerization of heat generating facilities;
- Implementation of new energy-efficient and energy-saving technological equipment involved into the production process;
- Computerization of operations and installation of control and metering instruments (CMIs) with data displaying on a central screen and on the computer of a production line.
- Installation of heat exchange equipment for utilization of steam-gas mixture heat and utilization of heated water in heating and ventilation systems;
- Installation of storage tanks for produced overcooled liquid carbon dioxide.

A.4. Monitoring period:

- Date of commencement of the monitoring period: 01/01/2008
- Date of termination of the monitoring period: 30/06/2012

A.5. Methodology applied to the project:

A.5.1. Baseline methodology:

Baseline was chosen according to the requirements of the "Guidance on criteria for baseline setting and monitoring", for the Joint Implementation Project Version 03[2].

Among the approved CDM methodologies similar to the proposed project are the following methodologies:

- AM0044 methodology "Energy efficiency improvement projects: boiler rehabilitation or replacement in industrial and district heating sectors" - Version 01[3];
- AM0068 methodology "Methodology for improved energy efficiency by modifying ferroalloy production facility" - Version 01[4];
- ACM0012 methodology "Consolidated baseline methodology for GHG emission reductions from waste energy recovery projects" - Version 04.0.0[5].

None of the methodologies do not reflect the complex nature of the Joint Implementation Project "Implementation of measures on reduction of energy consumption and greenhouse gas emissions at "ICE "Tekhnogaz" LLC". Thus the proposed project uses the specific approach to JI projects based on requirements to JI projects according to paragraph 9 (a) of "Guidance on criteria for baseline setting and monitoring" (Version 03[6]).

A.5.2.Monitoring methodology:

The proposed project uses the specific approach to JI projects based on requirements to JI projects according to paragraph 9 (a) of "Guidance on criteria for baseline setting and monitoring" (Version 03).

All relevant data related to the calculation of direct methane emission reductions are stored in an electronic database. Each monitoring report will include all necessary information from this database. Initial monitoring data necessary for calculation of GHG emission reductions will be stored in separate sections of the company during the crediting period and at least two years since the last transfer of ERUs within the project.

The table of parameters that will be included in the process of monitoring and verification for ERUs calculation, presented in Section B.2.2.

The monitoring plan includes measures (measurements, maintenance, registration and calibration), which should be implemented to satisfy the requirements of the chosen methodology of monitoring and guarantee the possibility of verification of calculation on GHG emission reductions.

Data and parameters not monitored throughout the whole crediting period, but determined only once:

$FC^{j}_{b,NG}$	Total amount of natural gas consumed in historical period «*j*» in the baseline scenario, ths m^3
$PC^{j}_{b,CO2}$	Amount of production in historical period «*j*» in the baseline scenario, t
$EC^{j}_{b,ELEC}$	Electricity consumption in historical period «*j*» in the baseline scenario, MWh;

[2] http://ji.unfccc.int/Ref/Documents/Baseline_setting_and_monitoring.pdf
[3] http://cdm.unfccc.int/methodologies/DB/XKLX4J2HLMVXZN8DYXH3WLSZNPZKYU
[4] http://cdm.unfccc.int/methodologies/DB/VUJ7B2WM7G0VJADXC5G9QMAE9QW1Q8
[5] http://cdm.unfccc.int/methodologies/DB/L731WMCXLT0WE6ALG5AYAGLTJP7KW7
[6] http://ji.unfccc.int/Ref/Documents/Baseline_setting_and_monitoring.pdf

Data and parameters that are monitored during the whole crediting period:

$PC^{y}_{p,CO2}$	Amount of production in monitoring period «*y*» in the project scenario, t
NCV^{y}_{NG}	Net calorific value of natural gas in monitoring period «*y*», GJ/ths m^3
$EF^{y}_{C,NG}$	Carbon emission factor for natural gas combustion in monitoring period «*y*», tC/TJ
$OXID^{y}_{NG}$	Carbon oxidation factor for natural gas combustion in monitoring period «*y*», relative unit
$EF^{y}_{CO_2,ELEC}$	Indirect carbon dioxide emission factor for electricity consumption by consumers in monitoring period «*y*», t CO_2e /MWh
$HG^{y}_{p,NG,heat,com}$	Total amount of thermal energy generated by the company in monitoring period *«y»* in the project scenario, Tcal
$FC^{y}_{p,NG}$	Total amount of natural gas consumed in monitoring period *«y»* in the baseline scenario, ths m^3

A.6. Status of implementation including project milestones:

Starting date of the project is 01/04/2007, when implementation of measures within the framework of the Joint Implementation Project started. Number of project measures in 2007 was not significant so the starting date of lifetime of the project is 01/01/2008.

This Monitoring Report presents emission reductions achieved during the period of 01/01/2008 – 30/06/2012. In accordance with the PDD version 02, the project implementation schedule for the current monitoring period is shown below (Table 1).

Table 1. Schedule of the main stages of the project in the monitoring period

Main stages of the project	Year				
	2008	2009	2010	2011	2012*
1. Investment stage					
1.1. Implementation of new energy-efficient and energy-saving technological equipment involved into the production process.					
1.2. Modernization of existing heat generating equipment and Installation of heat exchange equipment for utilization of steam-gas mixture heat and utilization of heated water in heating and ventilation systems.					
1.3. Implementation of modern gas and heat metering devices; heat network control systems; systems of control, management and computerization of heat generating facilities.					
1.4. Installation of efficient water purification system.					
1.5. Installation of reservoirs for the storage of liquid overcooled carbonic acid.					
2. Operational stage					

3. Generation of ERUs	

*Period 01/01/2012-30/06/2012

A.7. Deviations from or change of registered PDD:

There aren't any deviations from or changes in the registered PDD.

A.8. Deviations from or change of registered monitoring plan:

There aren't any deviations from or changes in the registered monitoring plan.

A.9. Persons responsible for preparation and submitting of the monitoring report:

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CEP Carbon Emissions Partners S.A. is the project participant.

SECTION B. Key monitoring activities

B.1.1. Applied equipment

Within the core monitoring activities measuring equipment was used, a list of which is given below.

Table 2. List of measuring equipment.

№	Name of measuring equipment	Type of equipment	Number	Accuracy class	Calibration interval	Date of last calibration
1	Electricity meter	CE6803V	0867280600 213018	1	16 years	30/05/2008
2	Heat energy meter	MULTICAL UF	6599925	1	4 years	06/11/2010
3	Gas meter	Rotary gas meter GMS-G160	018474	1	5 years	07/06/2011

To measure the amount of heat energy obtained by recuperation, modern complex MULTICAL UF of "Tehnomir-Energy" LLC[7] company is used. Heat energy meter MULTICAL UF functionally consists of three main elements:

- Heat energy meter MULTICAL 601;
- Temperature sensor type Pt 500;
- Ultrasonic flowmeter ULTRAFLOW 65S/R/T.

Figure 1. Heat energy meter MULTICAL UF

Counter CE6803V of concern "Energomira"[8] is used to measure the amount of consumed electricity.

[7] http://www.kamstrup.com.ua/
[8] http://www.energomera.ru/

Figure 2. Electricity meter CE6803V.

Gas meter GMS-G160 of SE "Arsenal"[9] is used to measure the amount of consumed gas.

B.1.2. Calibration procedure

Measuring equipment for a JI project is subjected to regular verification/calibration in accordance with national procedures.

Periodicity of the control of metrological characteristics of the heat energy meter MULTICAL UF is determined according to the State consumer standard of Ukraine "Measuring instruments listed in the State Register of Ukraine"[10] and is: calibration interval - 4 years, calibration procedure - is not necessary.

Periodicity of the control of metrological characteristics of the electricity meter CE6803V used at the enterprise is determined according to the State consumer standard of Ukraine "Measuring instruments listed in the State Register of Ukraine" and is: calibration interval - 16 years; calibration procedure - is not necessary.

Periodicity of the control of metrological characteristics of the gas meter GMS-G160 used at the enterprise is determined according to the State consumer standard of Ukraine "Measuring instruments listed in the State Register of Ukraine" and is: calibration interval - 5 years; calibration procedure - is not necessary.

As a result of verification (calibration) of measuring equipment certificate that confirms their serviceability is issued.

B.1.3. Involvement of third parties

Verification (calibration) of gas meter is carried out by LLC "RPE" Grempis"[11].

Verification (calibration) of electricity meter is carried out by SE "Arsenal"[12].

Verification (calibration) of heat energy meter is carried out by "Tehnomir-Energy" LLC[13].

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[9] http://zavodarsenal.kiev.ua/
[10] http://www.stand.lutsk.ua/downloads/ZVT.pdf
[11] http://grempis.com.ua/
[12] http://zavodarsenal.kiev.ua/

Engaged organizations have legal authority to conduct state verification (calibration) of the measuring equipment.

B.2. Data collection (data collected in the whole monitoring period)

B.2.1. The operational and management structure in order to enable the project operator implement the monitoring plan.

Operational and management structure to be applied by "ICE "Tekhnogaz" LLC for implementation of monitoring is given below.

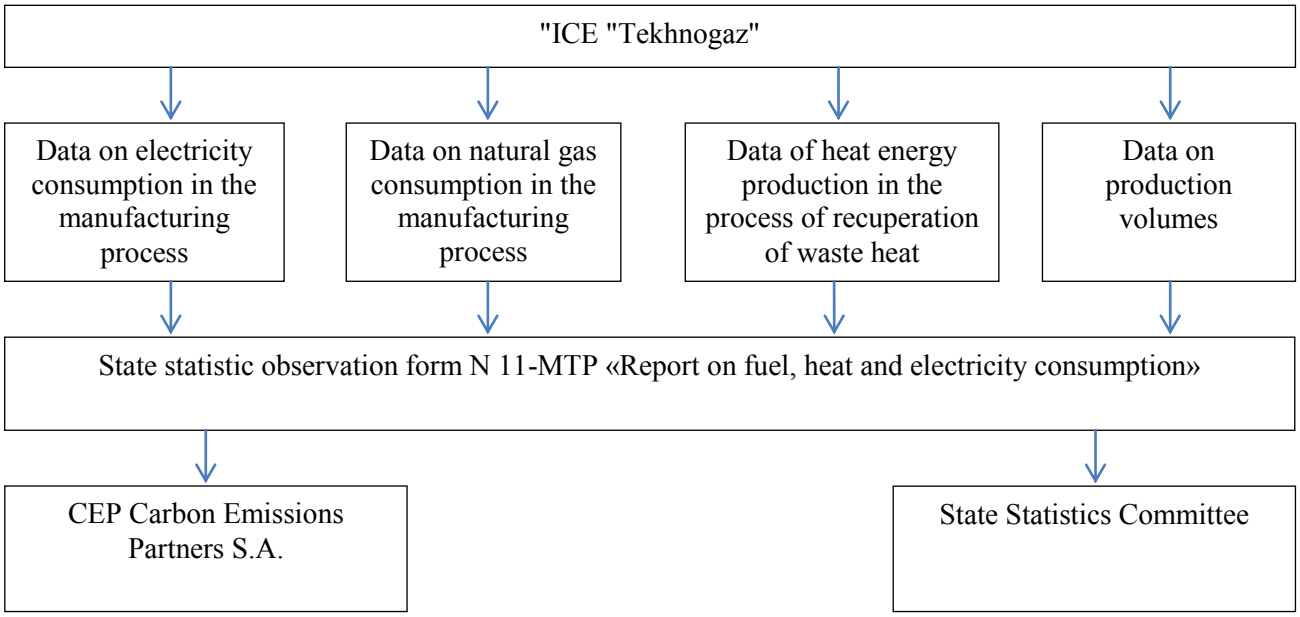

Figure 3. Structure of collection and processing of data within the monitoring activities

The main source of data necessary for the operator to monitor and calculation of GHG emission reductions for the project activity is State statistic observation form N 11-MTP «Report on fuel, heat and electricity consumption». Based on this operational structure and management structure, which is used to implement the project will be integrated into the data collection according to the practice, established at the company that allows to collect source data, consolidate and cross-check, without involving any additional measures and changes in practice, established at the enterprise.

Data monitored and required for verification and further determination will be archived and stored at the company for two years after the transfer of ERUs generated in the project.

B.2.2. List of parameters used in the course of calculation

The parameters given in Table 3-Table 4 are used in the course of calculation.

Table 3. List of fixed parameters that are not monitored in the monitoring period

Parameter identifier	Description	Source of data	Value, data unit	Comments

[13] http://www.kamstrup.com.ua/

$FC^{j}_{b,NG}$	Total amount of natural gas consumed in historical period «*j*» in the baseline scenario	State statistic observation form N 11-MTP «Report on fuel, heat and electricity consumption»	Refer to Excel file Annex 1, ths m^3	N/A
$PC^{j}_{b,CO2}$	Amount of production in historical period «*j*» in the baseline scenario	State statistic observation form N 11-MTP «Report on fuel, heat and electricity consumption»	Refer to Excel file Annex 1, t	N/A
$EC^{j}_{b,ELEC}$	Electricity consumption in historical period «*j*» in the baseline scenario	State statistic observation form N 11-MTP «Report on fuel, heat and electricity consumption»	Refer to Excel file Annex 1, MWh	N/A

Table 4. Parameters that are monitored during the monitoring period and used to calculate emissions in the baseline and project scenario.

Parameter identifier	Description	Source of data	Data unit	Monitoring frequency	Comments
$PC^{y}_{p,CO2}$	Amount of production in monitoring period «*y*» in the project scenario	State statistic observation form N 11-MTP «Report on fuel, heat and electricity consumption»	t	Once in monitoring period	Refer to Excel file Annex 1
NCV^{y}_{NG}	Net calorific value of natural gas in monitoring period «*y*»	"National inventory report of anthropogenic greenhouse gas emissions by sources and removals by sinks in Ukraine in 1990-2010"[14]	GJ/ths m^3	Once in monitoring period	Refer to Excel file Annex 1
$EF^{y}_{C,NG}$	Carbon emission factor for natural gas combustion in monitoring period «*y*»	"National inventory report of anthropogenic greenhouse gas emissions by sources and removals by sinks in Ukraine in 1990-2010"[15]	tC/TJ	Once in monitoring period	Refer to Excel file Annex 1

14 http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2012-nir-13apr.zip

15 http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2012-nir-13apr.zip

$OXID_{NG}^{y}$	Carbon oxidation factor for natural gas combustion in monitoring period «*y*»	"National inventory report of anthropogenic greenhouse gas emissions by sources and removals by sinks in Ukraine in 1990-2010"[16]	relative unit	Once in monitoring period	Refer to Excel file Annex 1
$EF_{CO_2,ELEC}^{y}$	Indirect carbon dioxide emission factor for electricity consumption by consumers in monitoring period «*y*»	Decree of the National Environmental Investment Agency of Ukraine (hereinafter referred to as NEIAU) №62 dated 15/04/2011 "On approval of specific carbon dioxide emission factors in 2008"[17]; - Decree of the National Environmental Investment Agency of Ukraine №63 dated 15/04/2011 " On approval of specific carbon dioxide emission factors in 2009 "[18]; - Decree of the National Environmental Investment Agency of Ukraine №43 dated 28/03/2011 " On approval of specific carbon dioxide emission factors in 2010"[19]; - Decree of the National Environmental Investment Agency of Ukraine №75 dated 12/05/2011 "On approval of specific carbon dioxide	t CO_2e /MWh	Once in monitoring period	Refer to Excel file Annex 1

[16] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2012-nir-13apr.zip

[17] http://www.neia.gov.ua/nature/doccatalog/document?id=127171

[18] http://www.neia.gov.ua/nature/doccatalog/document?id=127172

[19] http://www.neia.gov.ua/nature/doccatalog/document?id=126006

		emission factors in 2011"[20].			
$HG^{y}_{p,NG,heat,com}$	Total amount of thermal energy generated by the company in monitoring period «*y*» in the project scenario	State statistic observation form N 11-MTP «Report on fuel, heat and electricity consumption»	Tcal	Once in monitoring period	Refer to Excel file Annex 1
$EC^{y}_{p,ELEC}$	Electricity consumption in historical period «*j*»	State statistic observation form N 11-MTP «Report on fuel, heat and electricity consumption»	MWh	Once in monitoring period	Refer to Excel file Annex 1
$FC^{y}_{p,NG}$	Total amount of natural gas consumed in monitoring period «*y*» in the project scenario	State statistic observation form N 11-MTP «Report on fuel, heat and electricity consumption»	ths m^3	Once in monitoring period	Refer to Excel file Annex 1

B.2.3. Data concerning leakage

There is no leakage during the project implementation.

B.3. Data processing and archiving

All data on the project " Implementation of measures on reduction of energy consumption and greenhouse gas emissions at "ICE "Tekhnogaz" LLC" will be stored at "ICE "Tekhnogaz" LLC" throughout the crediting period and at least for two years since the last transfer of ERUs in the project.

B.4. Extraordinary situations and disturbances

There were no extraordinary situations in the current monitoring period (from 01/01/2008 to 30/06/2012) at gas distribution networks of "ICE "Tekhnogaz" LLC".

B.5. Procedures for detection and elimination of failures

Failure detection is carried out by microprocessor with subsequent fixation on the monitor and submitting audio signal. If possible, operator of department eliminates this failure with subsequent entry in the operational log. If operator can not eliminate this problem repair works are carried out by engineering services with the entry in the journal of repairs.

B.6. External data (type, source, access)

External data are not used in the monitoring.

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

Section C. Quality assurance and quality control measures

C.1. Documented procedures and management structure

C.1.1. Roles and responsibilities

The structure of data collection and management of the project was provided in Section B.2 of this monitoring report.

C.1.2. Trainings

The project does not provide for the introduction of equipment that would require conduction of additional trainings for the personnel. If such equipment is installed the representatives of equipment manufacturers will conduct trainings on the use and maintenance of the equipment for employees of "ICE "Tekhnogaz" LLC".

C.2. Internal audits and control measures

According to the procedures of quality management, Law of Ukraine “On metrology and metrological activity”[21] means of metering equipment used for monitoring of the project activity are subject to periodic state verification. Personnel of "ICE "Tekhnogaz" LLC" are subject to periodic examination of their knowledge of requirements to:

- collection of data according to the monitoring plan (the collection of data under the monitoring coincides with the usual practice of data collection at the company);
- labour protection.

Each quarter, representatives of project developers, CEP Carbon Emissions Partners S.A., conduct internal audits of the project monitoring system at "ICE "Tekhnogaz" LLC".

C.3. Information on factors of social influence of the project and its influence on the environment

As a result, the project will reduce greenhouse gas emissions that cause the greenhouse effect and climate change. Increase the level of safety of production lines.

[21] http://zakon2.rada.gov.ua/laws/show/113/98-вр

SECTION D. Calculation of GHG emission reductions

D.1. Formulae used for calculation of GHG reductions.

D.1.1.Formulae for calculation of project emissions:

Formulae 1 – GHG emissions in the course of production in monitoring period «*y*» of the project scenario, t CO_2e	
	$PE_p^y = PE_{p,NG}^y + PE_{p,ELEC}^y$
	$PE_{p,NG}^y$ - викиди ПГ від спалювання природного газу для виробництва продукції за моніторинговий період *«y»*, проектного сценарію, (т CO_2-екв); $PE_{p,ELEC}^y$ - викиди ПГ від спалювання викопного палива при виробництві електроенергії, яка споживається для виробництва продукції, за моніторинговий період *«y»*, проектного сценарію, (т CO_2-екв).
	[y]- індекс, що відповідає моніторинговому періоду; *[p]* - індекс, що відповідає проектному сценарію; *[NG]*- індекс, що відноситься до природного газу; *[ELEC]* – індекс, що відноситься до електроенергії.

Formulae 2 – GHG emissions due to natural gas combustion in the course of production in monitoring period «*y*» of the project scenario, t CO_2e	
	$PE_{p,NG}^y = \frac{FC_{p,NG}^y \cdot NCV_{NG}^y \cdot EF_{CO2,NG}^y}{10^3}$
	$FC_{p,NG}^y$ - total amount of natural gas consumed in monitoring period «*y*» of the project scenario, ths m^3; NCV_{NG}^y - net calorific value of natural gas in monitoring period «*y*» of the project scenario, TJ/ths m^3; $EF_{CO2,NG}^y$ - indirect carbon dioxide emission factor for for stationary combustion of natural gas in monitoring period «*y*», t CO_2e /TJ; 10^3 – index to convert GJ to TJ (GJ/TJ).
	[y]- index corresponding to monitoring period; *[CO_2]*- index corresponding to carbon dioxide; *[p]* - index corresponding to the project scenario; *[NG]*- index corresponding to natural gas.

Formulae 3 – indirect carbon dioxide emission factor for for stationary combustion of natural gas in monitoring period «*y*», t CO_2e /TJ

	$EF^{y}_{CO2,NG} = EF^{y}_{C,NG} \cdot OXID^{y}_{NG} \cdot \frac{44}{12}$
	$EF^{y}_{C,NG}$ - carbon emission factor for natural gas combustion in monitoring period «*y*», t C/TJ; $OXID^{y}_{NG}$ - carbon oxidation factor for natural gas combustion in monitoring period «*y*», relative unit; $\frac{44}{12}$ - stoichiometric ratio of carbon dioxide and carbon molecular masses, t CO_2/t C.
	[y]- index corresponding to monitoring period; *[C]*- index corresponding to carbon; *[NG]*- index corresponding to natural gas.

Formulae 4 – GHG emissions due to fossil fuel combustion in the course of generation of electricity consumed in the course of production in monitoring period «*y*» of the project scenario, t CO_2e	
	$PE^{y}_{p,ELEC} = EC^{y}_{p,ELEC} \cdot EF^{y}_{CO2,ELEC}$
	$EC^{y}_{p,ELEC}$ - electricity consumption in monitoring period «*y*» of the project scenario, MW*h; $EF^{y}_{CO2,ELEC}$ - indirect carbon dioxide emission factor for electricity consumption by consumers in monitoring period «*y*» of the project scenario, (t CO_2e / MW*h).
	[y]- index corresponding to monitoring period; *[p]* - index corresponding to the project scenario; *[ELEC]* – index corresponding to electricity.

D.1.2. Formulae for calculation of baseline emissions:

Formulae 5 – GHG emissions in the course of production in monitoring period «*y*» in the baseline scenario, t CO_2e	
	$BE^{y}_{b} = BE^{y}_{b,NG} + BE^{y}_{b,ELEC} + BE^{y}_{b,NG,heat}$
	$BE^{y}_{b,NG}$ - GHG emissions due to natural gas combustion in the course of production in monitoring period «*y*» in the baseline scenario, t CO_2e; $BE^{y}_{b,ELEC}$ - GHG emissions due to fossil fuel combustion in the course of generation of electricity consumed in the course of production in monitoring period «*y*» in the baseline scenario, t CO_2e; $BE^{y}_{b,NG,heat}$ - GHG emissions due to natural gas combustion in the course of thermal energy generation in monitoring period «*y*» in the baseline scenario, t CO_2e.
	[y]- index corresponding to monitoring period; *[b]* - index corresponding to baseline scenario; *[j]* - index corresponding to historical period;

	[NG]- index corresponding to natural gas; *[heat]* - index corresponding to heat generation; *[ELEC]* – index corresponding to electricity.

Formulae 6 – GHG emissions due to natural gas combustion in the course of production in monitoring period «*y*» in the baseline scenario, t CO_2e	
	$$BE^{y}_{b,NG} = \frac{PPER_{NG} \cdot PC^{y}_{p,CO2} \cdot NCV^{y}_{NG} \cdot EF^{y}_{CO2,NG}}{10^3}$$
	$PC^{y}_{p,CO2}$ - total amount of natural gas consumed in monitoring period «*y*» in the baseline scenario, ths m^3; NCV^{y}_{NG} - net calorific value of natural gas in monitoring period «*y*», TJ/ths m^3; $EF^{y}_{CO2,NG}$ - default carbon dioxide emission factor for stationary combustion of natural gas in monitoring period «*y*», t CO_2/TJ; $PPER_{NG}$ - pre-project production efficiency factor of consumption of natural gas in historical period «*j*», (ths m^3 / t CO_2e). 10^3 – index to convert GJ to TJ (GJ/TJ).
	[y]- index corresponding to monitoring period; *[b]* - index corresponding to baseline scenario; *[CO_2]* - index corresponding to carbon dioxide; *[NG]*- index corresponding to natural gas.

Formulae 7 – pre-project production efficiency factor of consumption of natural gas in historical period «*j*», (ths m^3 / t CO_2e)	
	$$PPER_{NG} = \frac{\sum \frac{FC^{j}_{b,NG}}{PC^{j}_{b,CO2}}}{3}$$
	$FC^{j}_{b,NG}$ - total amount of natural gas consumed in historical period «*j*» of the baseline scenario, ths m^3; $PC^{j}_{b,CO2}$ - production in historical period «*j*» of the baseline scenario, t 3 – number of years of historical period, 2004-2006.
	[j]- index corresponding to historical period; *[b]* - index corresponding to baseline scenario; *[CO_2]* - index corresponding to carbon dioxide; *[NG]*- index corresponding to natural gas.

Formulae 8 – default carbon dioxide emission factor for stationary combustion of natural gas in monitoring period «*y*», t CO_2/TJ

	$EF^{y}_{CO2,NG} = EF^{y}_{C,NG} \cdot OXID^{y}_{NG} \cdot \frac{44}{12}$
	$EF^{y}_{C,NG}$ - carbon emission factor for natural gas combustion in monitoring period «*y*», t C/TJ; $OXID^{y}_{NG}$ - carbon oxidation factor for natural gas combustion in monitoring period «*y*», relative unit; $\frac{44}{12}$ - stoichiometric ratio of carbon dioxide and carbon molecular masses, t CO_2/t .
	[y] - index corresponding to monitoring period; *[CO_2]* - index corresponding to carbon dioxide; *[C]* - index corresponding to carbon; *[NG]*- index corresponding to natural gas.

Formulae 9 – GHG emissions due to fossil fuel combustion in the course of generation of electricity consumed in the course of production in monitoring period «*y*» in the baseline scenario, t CO_2e	
	$BE^{y}_{b\ ,ELEC} = PPER_{ELEC} \cdot PC^{y}_{p,CO2} \cdot EF^{y}{}_{CO2,ELEC}$
	$PC^{y}_{p,CO2}$ - amount of production in monitoring period «*y*» of the project scenario, t; $EF^{y}_{CO2,ELEC}$ - indirect carbon dioxide emission factor for electricity consumption by consumers in monitoring period «*y*», t CO_2e /MW*h; $PPER_{ELEC}$ - pre-project production efficiency factor of consumption of electricity in historical period «*j*», (MW*h/ tCO_2e).
	[p] - index corresponding to the project scenario; *[y]* - index corresponding to monitoring period; *[CO_2]* - index corresponding to carbon dioxide; *[ELEC]* – index corresponding to electricity.

Formulae 10 – pre-project production efficiency factor of consumption of electricity in historical period «*j*», (MW*h/ tCO_2e)	
	$PPER_{ELEC} = \frac{\sum \frac{EC^{j}_{b,ELEC}}{PC^{j}_{b,CO2}}}{3}$
	$EC^{j}_{b,ELEC}$ - electricity consumption in historical period «*j*» in the baseline scenario, MW*h; $PC^{j}_{b,CO2}$ - production in historical period «*j*» in the baseline scenario, t; 3 – number of years of historical period, 2004-2006.

	[b] - index corresponding to baseline scenario; *[j]* - index corresponding to historical period; *[CO_2]* - index corresponding to carbon dioxide; *[ELEC]* – index corresponding to electricity.

Formulae 11 – GHG emissions due to natural gas combustion in the course of thermal energy generation in monitoring period «*y*» in the baseline scenario, t CO_2e	
	$BE^{y}_{b,NG,heat} = 4{,}1868 \cdot HG^{y}{}_{p,NG,heat,com} \cdot EF^{y}{}_{CO2,NG}$
	$HG^{y}_{p,NG,heat,com}$ - total amount of thermal energy generated by the company in monitoring period *«y»* of the project scenario, Tcal; 4,1868 – conversion factor Tcal in TJ; $EF^{y}_{CO2,NG}$ - default carbon dioxide emission factor for stationary combustion of natural gas in monitoring period *«y»*, t CO_2e /TJ.
	[y]- - index corresponding to monitoring period; *[b]* - index corresponding to baseline scenario; *[p]* - index corresponding to the project scenario; *[CO_2]* - index corresponding to carbon dioxide; *[NG]*- index corresponding to natural gas; *[heat]* - index corresponding to heat generation.

Formulae 12 – default carbon dioxide emission factor for stationary combustion of natural gas in monitoring period «*y*», t CO_2/TJ
$EF^{y}_{CO2,NG} = EF^{y}_{C,NG} \cdot OXID^{y}_{NG} \cdot \frac{44}{12}$
$EF^{y}_{C,NG}$ - carbon emission factor for natural gas combustion in monitoring period *«y»*, t C/TJ; $OXID^{y}_{NG}$ - carbon oxidation factor for natural gas combustion in monitoring period *«y»*, relative unit; $\frac{44}{12}$ - stoichiometric ratio of carbon dioxide and carbon molecular masses, t CO_2/t C.
[y] - index corresponding to monitoring period; *[CO_2]* - index corresponding to carbon dioxide; *[C]* - index corresponding to carbon; *[NG]*- index corresponding to natural gas.

D.1.3. Formulae for calculation of GHG emission reductions:

Formulae 13 – Quantity of Emission Reduction Units (ERUs)

$ER^y = BE_b^y - PE_p^y$
PE_p^y - total methane emissions of project scenario, in period «*y*», (t CO_2e); BE_b^y - total methane emissions of baseline scenario, in period «*y*», (t CO_2e).
[b] - index corresponding to baseline scenario; *[p]* - index corresponding to project scenario. *[y]* - index corresponding to monitoring period;

D.2. Results of the GHG emission reductions monitoring

D.2.1. GHG emissions in the project scenario

The following GHG emission volumes were achieved in the reporting period as a result of the implementation of measures under the project:

Monitoring period: 01/01/2008 – 30/06/2012	Project emissions (t CO_2e)
2008	155 180
2009	156 871
2010	157 850
2011	158 598
2012	98 003
Total project emissions in the monitoring period (t CO2eq)	726 502

D.2.2. GHG emissions in the baseline scenario

Emissions that would occur in the absence of implementation of measures under the project are the following:

Monitoring period: 01/01/2008 – 30/06/2012	Baseline emissions (t CO_2e)
2008	677 518
2009	693 378
2010	691 962
2011	701 513
2012	446 234
Total baseline emissions in the monitoring period (t CO2eq)	3 210 605

D.2.3. Emission reductions due to the project implementation in the monitoring period:

Emission reductions due to the project implementation are calculated as the difference between the baseline and the project emissions.

Monitoring period: 01/01/2008 – 30/06/2012	Emission reductions (t CO2eq)
2008	522 338
2009	536 507
2010	534 112
2011	542 915
2012	348 231
Total estimated emission reductions in the monitoring period (t CO2eq)	2 484 103