JOINT IMPLEMENTATION PROJECT

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

Position of the head of the organization, institution, body, which prepared the document

Director of CEP Carbon Emissions Partners S.A.

_____	_____	**Fabian Knodel**
(date)	(signature)	(name and patronymic, last name)

PS

Position of the economic entity – owner of the source, where the Joint Implementation Project is planned to be carried out

Acting director general of «ICE «Tekhnogaz» LLC

_____	_____	**Koval A.M.**
(date)	(signature)	(surname, name and patronymic of the person)

PS

Vinnytsia 2012

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

CONTENTS

Annexes

SECTION A. General description of the project

A.1. Title 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)

PDD Version: 02.
Date: 08/11/2012.

A.2. Description of the project:

The main goals of project activity

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 line 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.

Short description of the company.

The primary activity of "ICE "Tekhnogaz" LLC is production of industrial gases (liquefied carbon dioxide, of medical and tonnage oxygen, liquid and gaseous nitrogen). The company today is a leading manufacturer and seller of industrial and medical gases in the region. One of the main tasks of the enterprise is an effective and safe manufacturing and implementation of advanced solutions for the economical use of natural gas in manufacturing processes.

Code in the Unified State Register of Enterprises and Organizations of Ukraine – 24901185

Name of activities under the Foreign-Economic Activities Code: 24.11.0 Production of industrial gase; 60.24.0 Road freight transport activities; 45.21.1 Construction of buildings; 51.51.0 Wholesale fuel trade ; 51.55.0 Wholesale chemical product trade; 52.48.9 Retail trade of other not classified nonfood products.

The situation existing prior to the starting date of the project

Prior to the proposed project modernization of existing production equipment was not performed. All funds of enterprise were spent on maintaining of existing production line in working condition, the elimination of local damage and permanent repairs. This hindered the development of energy-saving technologies and thus the reduction of energy consumption in the production process.

The baseline scenario.

The most plausible baseline scenario, which can continue to operate manufacturing of liquefied carbon dioxide production line is the continued operation of the existing old and inefficient equipment production system, which generate a significant amount of GHG in the process of combustion of natural gas. The use of heat recuperation will not occur due to their high cost and the operating conditions.

The baseline scenario provides for the further implementation of current instructions and regulations in the repair of gas pipelines which requires to stop the operation of gas pipeline separating it by tap group at the ends, and gas discharge into the atmosphere. Only after the discharge of natural gas into the atmosphere it is allowed to perform any repair work on the gas pipeline, which involves removing part of the pipeline containing defects and welding the new part. Justification in the baseline scenario is described in Section B.

Project scenario.

The project scenario provides for the modernization of the equipment of liquefied carbon dioxide production line. Modernization of equipment will result in increased efficiency of the entire system and a reduction in specific energy consumption in the production process, which in turn will lead to a reduction of GHG emissions.

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.

Due to the fact that the production technology of liquefied carbon dioxide is connected with large amount of excess heat that is released into the atmosphere, the project provides for its partial utilization by heat recuperators.

Historical details of the development of the JIP.

05/10/2006 – Project design document development when "ICE "Tekhnogaz" LLC started implementation of measures to reduce energy consumption in the production of carbon dioxide.

01/04/2007 – "ICE "Tekhnogaz" LLC started implementation of measures to reduce energy consumption within the framework of the Joint Implementation Project "Implementation of measures on reduction of energy consumption and greenhouse gas emissions at "ICE "Tekhnogaz" LLC".

31/10/2012 – The State Environmental Investment Agency of Ukraine issued a Letter of Endorsement № 3256/23/7.

The project design document of the Joint Implementation Project "Implementation of measures on reduction of energy consumption and greenhouse gas emissions at "ICE "Tekhnogaz" LLC" is developed by CEP Carbon Emissions Partners S.A. according 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) based on:

- Data presented by "ICE "Tekhnogaz" LLC;
- Data of the UN Framework Convention on Climate Change;
- Data of "National inventory report of anthropogenic greenhouse gas emissions by sources and removals by sinks in Ukraine in 1990-2010";
- Data of the National Bank of Ukraine.

A.3. Project participants:

Party involved*	Legal entity project participant (as applicable)	Please indicate if the Party involved wishes to be considered as project participant (Yes/No)
Ukraine (Host Party)	• "ICE "Tekhnogaz" LLC	No
Switzerland	• CEP Carbon Emissions Partners S.A.	No
* Please indicate if the Party involved is a host Party.		

The Developer's company will be the official project owner and managing entity and the responsible body for all administrative affairs of the involved parties in Host and Investor Countries.

A.4. Technical description of the project:

A.4.1. Location of the project:

JIP is implemented on the production lines of two carbon dioxide departments of "ICE "Tekhnogaz" LLC" in Vinnitsa city. Geographical location of the project is presented below.

Fig. 1. Location of "ICE "Tekhnogaz" LLC" on the map of Ukraine

A.4.1.1. Host Party(ies):

The project is located in Ukraine.

Ukraine is an Eastern European country that ratified the Kyoto Protocol to the UN Framework Convention on Climate Change on February 4, 2004[1]. It is listed in the Annex B of the Kyoto Protocol to the UN Framework Convention on Climate Change[2].

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

The project is located in the Vinnytsa region.

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

The project is located in the Vinnytsa city.

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

The project is implemented at production line of two production departments of liquefied carbon dioxide of "ICE "Tekhnogaz" LLC" in Vinnitsa (28.421124 E, 49.227399 N – the coordinates of "ICE "Tekhnogaz" LLC" headquarters).

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

Emission reductions will occur mainly due to the equipment efficiency increase and consequently reduce fuel consumption in the production of liquefied carbon dioxide. Besides emission reductions will occur through the use of waste heat energy through the waste heat recuperators.
The project "Implementation of measures on reduction of energy consumption and greenhouse gas emissions at "ICE "Tekhnogaz" LLC" provides for a comprehensive modernization of the equipment of two liquefied carbon dioxide production line departments.
Activities foreseen by JIP "Implementation of measures on reduction of energy consumption and greenhouse gas emissions at "ICE "Tekhnogaz" LLC" are listed below:

1. Implementation of new energy-efficient and energy-saving technological equipment involved into the production process.

The project provides for installation of equipment of Union Engineering[3], which is leading company in the development and implementation of production lines for the production of industrial gases (especially carbon dioxide).

[1] http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=1430-15
[2] http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?page=1&nreg=995_801
[3] http://www.union.dk/

Fig. 2. Exterior of production systems of carbon dioxide of Union Engineering.

Improvement of the efficiency of the main production equipment would reduce fuel consumption in the production of liquefied carbon dioxide which in turn leads to a reduction of greenhouse gas emissions.

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.

The project provides for installation of new modern heat exchangers that will improve intensity of heat exchange processes in the generation of heat and therefore reduce fuel consumption and thus the amount of emissions reductions.

Also, the project foresees the use of recuperative heat exchangers that will utilize waste heat energy.

Fig. 3. The system of waste heat recuperators.

Heat exchangers designed for heat utilization of exhaust gases and serve to heat water intended for heating and hot water supply. Technical specifications of heat exchangers are listed below.

Table 1. Technical specifications of heat exchangers.

Technical specifications	
The temperature of the exhaust gases from the boiler (furnace), ^{o}C	160-280
The temperature of exhaust gases after heat exchanger, ^{o}C	120-140
Water flow through the heat exchanger, m^3/h	25
Efficiency coefficient of the exhaust gas heat, %	80
Weight, kg	431

3. Implementation of modern gas and heat metering devices; heat network control systems; systems of control, management and computerization of heat generating facilities.

The project provides for installation of modern gas[4] and heat[5] metering devices using radio module and modular software controller for solving problems of automation and control of objects that leads to the possibility of flexible control over energy consumption, and thus its economy.

To ensure high quality and high efficiency of systems all stages of production of carbon dioxide will be controlled fully automated system that will be subject to a Siemens[6] processor unit.

Fig. 4. Siemens processor unit.

4. Installation of efficient water purification system.

Cleaning of feed and circulating water under the project involves the following steps:

- Cleaning from mechanical impurities that will be achieved by effective filtration system;
- Water softening by means of ULTRA LINE[7] system;
- Using the principle of reverse osmosis, which allows to remove 90-95% of salt from the water.

Implementation of water purification is an integral part of implementing an integrated system that will provide a reduction in energy consumption, and thus will reduce GHG emissions.

5. Installation of reservoirs for the storage of liquid overcooled carbonic acid.

[4] http://www.djv-com.com/rus/gas_metering

[5] http://www.djv-com.com/rus/heat_metering

[6] http://www.siemens.com/

[7] http://www.hidrostandarts.lv/?l=2&mu=114

The project foresees the installation of the Wittemann[8] system of cleaning, which provides high-quality carbon dioxide and has high levels of energy efficiency. The system consists of containers that are made of stainless steel to prevent corrosion:

- Storage containers for liquefied carbon dioxide phase;
- The system of air purification and neutralization of odors by using a scrubber filled with potassium permanganate $KMnO_4$;
- Containers with charcoal with special Witt Fill cleansing medium for the removal of odors.

Fig. 5. A typical view of Witteman system of gas cleaning.

The project also provides for establishment of a double column drying of gas. Double column drying will dry carbon dioxide gas to the dew point-70^{o}C and get liquefied carbon dioxide phase.

Implementation of treatment and storage of liquefied carbon dioxide is an integral implementation of a comprehensive system that will ensure reduction of energy consumption, and thus will reduce GHG emissions.

Main milestones and schedule of the main stages of the project are listed below.

Main stages of the project	Year					
	2007	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						

[8] http://www.pureco2nfidence.com/launch/

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 AAUs						
4. Generation of ERUs						

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

The project activity provides for implementation of implementation of measures to improve the efficiency of equipment of two liquefied carbon dioxide production line departments. As a result of the proposed measures a decrease in consumption of fuel for production of liquefied carbon dioxide will take place. This in turn would reduce the amount of fuel used for production, and thus reduce GHG emissions generated during the combustion process. Besides emission reductions will occur as a result of heat recuperation implementation, and as a result of substitution its heat produced by centralized generation companies in the process of gas combustion.

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

Table 2. Estimated amount of emission reductions over the first commitment period (2008-2012)

	Years
Length of the crediting period	5
Year	Estimate of annual emission reductions in tonnes of CO_2 equivalent
2008	522 337
2009	536 506
2010	534 111
2011	542 917
2012	542 917
Total estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	2 678 788
Annual average of estimated emission reductions over the crediting period (tonnes of CO2 equivalent)	535 758

Table 3. Estimated amount of emission reductions for the period following the first commitment period (2013-2020)

	Years
Length of the crediting period	8
Year	Estimate of annual emission reductions in tonnes of CO_2 equivalent
2013	542 917
2014	542 917
2015	542 917
2016	542 917
2017	542 917
2018	542 917
2019	542 917
2020	542 917
Total estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	4 343 336
Annual average of estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	542 917

More detailed information is provided in the Supporting Document 1.

Description of formulas used to estimate emission reduction units is given in Section D and in the Supporting Document 1.

Supporting Documents 1, 2 was granted to Accredited Independent Entity for the purpose of passing determination.

A.5. Project approval by the Parties involved:

A Letter of Endorsement № 3256/23/7 dated 31/10/2012 of the JI project "Reduction of direct methane emissions by implementation of innovative repair methods at technological equipment of Public Joint Stock Company "National Joint Stock Company "Chornomornaftogaz" was issued by the State Environmental Investment Agency of Ukraine.
After analysis of the project, the PDD and Determination report will be submitted to the State Environmental Investment Agency of Ukraine for receiving a Letter of Approval.

SECTION B. Baseline

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

Baseline was chosen according to the requirements of the "Guidance on criteria for baseline setting and monitoring", for the Joint Implementation Project Version 03[9]. According to the Guidelines for users of the Joint Implementation Project Design Document Form, Version 04[10], a stepwise approach is used to describe and justify the baseline chosen:

Stepwise approach was used to justify the baseline scenario:
The following steps were applied to determine the most plausible baseline scenario:
1. Determination of the plausible alternatives that could be the baseline scenario.
2. Justification of ruling out the alternatives that are improbable from technical and (or) economic perspectives.

Step 1. Identification and description of the approach chosen to establish the baseline scenario.

The baseline is determined by the selection of the most plausible scenario from a list and by the description of plausible future scenarios based on conservative assumptions.
To set the baseline scenario for further development of additionality justification in section B.2. we directly took into account:

- The economic situation in the technical gas production sector in Ukraine and forecast demand for products;
- Technical aspects of management and operation of manufacturing systems;
- Availability of capital (including investment barriers), that are typical for "ICE "Tekhnogaz" LLC;
- Local availability of technology / equipment;
- Price and availability of fuel.

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 1.0[11];
- AM0068 methodology «Methodology for improved energy efficiency by modifying ferroalloy production facility» - Version 1.0[12]
- ACM0012 methodology «Consolidated baseline methodology for GHG emission reductions from waste energy recovery projects» - Version 4.0.0[13];

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[14])
A comparative description of the above methodologies and specific approach of the project is listed below.

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

[10] http://ji.unfccc.int/Ref/Documents/Guidelines.pdf

[11] http://cdm.unfccc.int/methodologies/DB/XKLX4J2HLMVXZN8DYXH3WLSZNPZKYU

[12] http://cdm.unfccc.int/methodologies/DB/VUJ7B2WM7G0VJADXC5G9QMAE9QW1Q8

[13] http://cdm.unfccc.int/methodologies/DB/L731WMCXLT0WE6ALG5AYAGLTJP7KW7

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

Table 4. Comparative characteristics close to the project methodologies and selected specific approach.

Title of methodology	Comparative characteristics	
	Methodology	**Specific approach**
AM0044 «Energy efficiency improvement projects: boiler rehabilitation or replacement in industrial and district heating sectors» - Version 1.0	- - Takes into account reduction of energy consumption by improving the efficiency of heat generating equipment; - - Does not include heat recuperation of waste energy production.	- - Takes into account the reduction of energy consumption by improving the efficiency of heat generating equipment, and equipment involved in all stages of carbon dioxide production; - - Takes into account amount of products (carbon dioxide) in the amount of natural gas combusted and conservative rule of useful use of CO_2 from the calculation.
AM0068 «Methodology for improved energy efficiency by modifying ferroalloy production facility» - Version 1.0	- - Takes into account reduction of energy consumption by improving the efficiency of equipment involved in the production. - - The methodology is based on aspects of production namely ferroalloys; - Does not include heat recuperation of waste energy production.	- - Takes into account the reduction of energy consumption by improving the efficiency of heat generating equipment, and equipment involved in all stages of carbon dioxide production; - - The specific approach is based on aspects of production namely carbon dioxide (conservatively eliminates the amount of CO2 emissions obtained by natural gas combustion).
ACM0012 «Consolidated baseline methodology for GHG emission reductions from waste energy recovery projects» - Version 4.0.0	- Include heat recuperation of waste energy production.	- - Takes into account the reduction of energy consumption by improving the efficiency of heat generating equipment, and equipment involved in all stages of carbon dioxide production; - Include heat recuperation of waste energy production.

The specific approach chosen for this project involves the construction in the baseline scenario, based on the following conservative assumptions:

- In calculations of GHG emission reductions produced by measures on introduction of heat recuperation, it is expected that the substituted heat was produced in the process of natural gas combustion on equipment with efficiency equal to 100%. The assumption of the least carbon containing fuel (natural gas) and efficiency of the equipment, equal to 100%, results in a decrease of GHG emission reductions.

Step 2. Application of the approach chosen

Sub-step 2a. Identification and listing of plausible alternative baseline scenarios.

The choice of the plausible baseline scenario is based on assessment of alternative options that potentially could have taken place as of the beginning of the project. To identify all realistic and plausible alternatives all the options that meet the applicable laws and regulations were taken into account. These options are the following alternatives:
Alternative 1.1: Continuation of the current situation, without the JI project implementation.
Alternative 1.2: The proposed project activity without the use of the Joint Implementation mechanism.

Sub-step 2b. Assessment of alternative scenarios

Alternative 1.1
Continuation of existing practice with the introduction of the minimum repair works of production line equipment of liquefied carbon dioxide.
Alternative 1.1, is the most plausible baseline scenario, as :

- There is no investment barriers for this Baseline scenario, because this scenario does not require additional investment;
- There is no technological barriers, because equipment is operated by skilled personnel, and additional retraining is not required;
- Represents the common practice in Ukraine.

Accordingly, *Alternative 1.1* can be viewed as the most plausible baseline.

Alternative 1.2
The project activities without the use of Joint Implementation Mechanism.
In this case there is an investment barrier (see more details in Section B2). because this scenario requires additional substantial investment and has a very long payback period and high risks, so it is unattractive for investors.
Therefore, *Alternative 2.1* can not be regarded as the plausible baseline.

Outcome of step 2.

Analysis of the alternatives described above shows that *Alternative 1.1* is the most plausible.

Results of investment analysis in Section B.2 show that the *Alternative 1.2* cannot be considered as the most attractive alternative from a financial point of view. These assumptions are provided in Section B.2.
The results of the analysis made in accordance with the "Tool for the demonstration and assessment of additionality"[15] (Version 06.0) in section B2 show that the project scenario is additional.
Detailed information on algorithm of calculation of the baseline emissions of baseline parameters are provided in Section D.1 and Appendix 2.

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

[15] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v6.0.0.pdf

Data/Parameter	$PC^{y}_{p,CO2}$
Unit of measurement	t
Description	Amount of production in monitoring period «*y*» in the project scenario
Periodicity of determination/monitoring	Once in monitoring period
Source of data (to be) used	State statistic observation form N 11-MTP «Report on fuel, heat and electricity consumption»
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	To compile the State statistic observation form N 11-MTP «Report on fuel, heat and electricity consumption» indicators of measuring equipment are used
QA/QC procedures (to be) applied	Equipment is calibrated and verified according to the quality management procedures, the law of Ukraine "On metrology and metrological activities"[16].
Any comment	Data allowing for calculation of GHG emissions in the baseline scenario; information will be archived in paper and electronic form

Data/Parameter	NCV^{y}_{NG}
Unit of measurement	GJ/ths m^3
Description	Net calorific value of natural gas in monitoring period «*y*»
Periodicity of determination/monitoring	Once in monitoring period
Source of data (to be) used	"National inventory report of anthropogenic greenhouse gas emissions by sources and removals by sinks in Ukraine in 1990-2010"[17]
Value of data applied (for ex ante calculations/determinations)	<table><tr><td></td><td>2004</td><td>2005</td><td>2006</td><td>2007</td><td>2008</td></tr><tr><td>Natural gas, GJ/ths m^3</td><td>33,82</td><td>33,82</td><td>33,85</td><td>33,85</td><td>33,8</td></tr><tr><td></td><td>2009</td><td>2010</td><td>2011</td><td>2012</td><td></td></tr><tr><td>Natural gas, GJ/ths m^3</td><td>33,8</td><td>33,8</td><td>33,8</td><td>33,8</td><td></td></tr></table>
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	"National Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine in 1990-2010" [18] is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)

[16] http://www.ucrf.gov.ua/uk/doc/laws/1099563058/
[17] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2012-nir-13apr.zip
[18] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2012-nir-13apr.zip

Any comment	Data allowing for calculation of GHG emissions in the baseline scenario; information will be archived in paper and electronic form

Data/Parameter	$FC^{j}_{b,NG}$
Unit of measurement	ths m^3
Description	Total amount of natural gas consumed in historical period «*j*» in the baseline scenario
Periodicity of determination/monitoring	Once in historical period
Source of data (to be) used	State statistic observation form N 11-MTP «Report on fuel, heat and electricity consumption»
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	To compile the State statistic observation form N 11-MTP «Report on fuel, heat and electricity consumption» indicators of measuring equipment are used
QA/QC procedures (to be) applied	Equipment is calibrated and verified according to the quality management procedures, the law of Ukraine "On metrology and metrological activities"[19].
Any comment	Data allowing for calculation of GHG emissions in the baseline scenario; information will be archived in paper and electronic form

Data/Parameter	$PC^{j}_{b,CO2}$
Unit of measurement	t
Description	Amount of production in historical period «*j*» in the baseline scenario
Periodicity of determination/monitoring	Once in historical period
Source of data (to be) used	State statistic observation form N 11-MTP «Report on fuel, heat and electricity consumption»
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	To compile the State statistic observation form N 11-MTP «Report on fuel, heat and electricity consumption» indicators of measuring equipment are used
QA/QC procedures (to be) applied	Equipment is calibrated and verified according to the quality management procedures, the law of Ukraine "On metrology and metrological activities"[20].

[19] http://www.ucrf.gov.ua/uk/doc/laws/1099563058/

[20] http://www.ucrf.gov.ua/uk/doc/laws/1099563058/

Any comment	Data allowing for calculation of GHG emissions in the baseline scenario; information will be archived in paper and electronic form

Data/Parameter	$EF^{y}_{C,NG}$
Unit of measurement	tC/TJ
Description	Carbon emission factor for natural gas combustion in monitoring period «*y*»
Periodicity of determination/monitoring	Once in monitoring period
Source of data (to be) used	"National inventory report of anthropogenic greenhouse gas emissions by sources and removals by sinks in Ukraine in 1990-2010"[21]
Value of data applied (for ex ante calculations/determinations)	See table below
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	"National Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine in 1990-2010" [22] is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
Any comment	Data allowing for calculation of GHG emissions in the baseline scenario; information will be archived in paper and electronic form

	2004	2005	2006	2007	2008
Natural gas, tC/TJ	15,18	15,19	15,22	15,16	15,17
	2009	2010	2011	2012	
Natural gas, tC/TJ	15,2	15,17	15,17	15,17	

Data/Parameter	$OXID^{y}_{NG}$
Unit of measurement	relative unit
Description	Carbon oxidation factor for natural gas combustion in monitoring period «*y*»
Periodicity of determination/monitoring	Once in monitoring period
Source of data (to be) used	"National inventory report of anthropogenic greenhouse gas emissions by sources and removals by sinks in Ukraine in 1990-2010"[23]

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

Value of data applied (for ex ante calculations/determinations)	<table><tr><td></td><td>2004</td><td>2005</td><td>2006</td><td>2007</td><td>2008</td></tr><tr><td>Natural gas, relative unit</td><td>0,995</td><td>0,995</td><td>0,995</td><td>0,995</td><td>0,995</td></tr><tr><td></td><td>2009</td><td>2010</td><td>2011</td><td>2012</td><td></td></tr><tr><td>Natural gas, relative unit</td><td>0,995</td><td>0,995</td><td>0,995</td><td>0,995</td><td></td></tr></table>
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	"National Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine in 1990-2010" [24] is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
Any comment	Data allowing for calculation of GHG emissions in the baseline scenario; information will be archived in paper and electronic form

Data/Parameter	$EC^{j}_{b,ELEC}$
Unit of measurement	MW*h
Description	Electricity consumption in historical period «*j*»
Periodicity of determination/monitoring	Once in historical period
Source of data (to be) used	State statistic observation form N 11-MTP «Report on fuel, heat and electricity consumption»
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	To compile the State statistic observation form N 11-MTP «Report on fuel, heat and electricity consumption» indicators of measuring equipment are used
QA/QC procedures (to be) applied	Equipment is calibrated and verified according to the quality management procedures, the law of Ukraine "On metrology and metrological activities"[25].
Any comment	Data allowing for calculation of GHG emissions in the baseline scenario; information will be archived in paper and electronic form

Data/Parameter	$EF^{y}_{CO_2,ELEC}$
Unit of measurement	t CO_2e /MW*h;
Description	Indirect carbon dioxide emission factor for electricity consumption

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

[25] http://www.ucrf.gov.ua/uk/doc/laws/1099563058/

	by consumers in monitoring period «*y*»
Periodicity of determination/monitoring	Once in monitoring period
Source of data (to be) used	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"[26]; - Decree of the National Environmental Investment Agency of Ukraine №63 dated 15/04/2011 " On approval of specific carbon dioxide emission factors in 2009 "[27]; - Decree of the National Environmental Investment Agency of Ukraine №43 dated 28/03/2011 " On approval of specific carbon dioxide emission factors in 2010"[28]; - Decree of the National Environmental Investment Agency of Ukraine №75 dated 12/05/2011 "On approval of specific carbon dioxide emission factors in 2011"[29].
Value of data applied (for ex ante calculations/determinations)	2008: 1,082; 2009: 1,096; 2010: 1,093; 2011: 1,090
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Data are provided by National Environmental Investment Agency of Ukraine
QA/QC procedures (to be) applied	N/A
Any comment	Data allowing for calculation of GHG emissions in the baseline scenario; information will be archived in paper and electronic form

Data/Parameter	$HG^{y}_{p,NG,heat,com}$
Unit of measurement	Tcal
Description	Total amount of thermal energy generated by the company in monitoring period *«y»* in the project scenario
Periodicity of determination/monitoring	Once in monitoring period
Source of data (to be) used	State statistic observation form N 11-MTP «Report on fuel, heat and electricity consumption»
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	To compile the State statistic observation form N 11-MTP «Report on fuel, heat and electricity consumption» indicators of measuring equipment are used

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

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

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

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

QA/QC procedures (to be) applied	Equipment is calibrated and verified according to the quality management procedures, the law of Ukraine "On metrology and metrological activities"[30].
Any comment	Data allowing for calculation of GHG emissions in the baseline scenario; information will be archived in paper and electronic form

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

Anthropogenic emissions of greenhouse gases in the project scenario will be decreased due to modernization of the equipment of liquefied carbon dioxide production line. Modernization of equipment will improve the efficiency of the whole system and reduce the specific energy consumption in the production, which in turn would reduce GHG emissions. Implementation of technical measures that will lead to a reduction of GHG are described in Section A.4.2.

Additionality of the project

The additionality of the project activity is demonstrated and assessed by using the "Tool for the demonstration and assessment of additionality" (Version 06.0[31]). This manual was elaborated in original for CDM projects, but it may be also applied to JI projects.

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

Sub-step 1a. Definition of alternatives to the project activity

There are three alternatives to this project. (that were described in Section B1)

Alternative 1.1: Continuation of the current situation, without the JI project implementation.

Alternative 1.2: The proposed project activity without the use of the Joint Implementation mechanism.

Outcome of sub-step 1a. Two realistic alternative scenarios to the project activity are identified

Sub-step 1b. Consistency with mandatory laws and regulations
Alternative 1.1 and *Alternative 1.2* comply with:

- Law of Ukraine "On Energy Saving"[32];
- Law of Ukraine "On electric power" N 575/97-VR as of 16/10/1997[33];
- Law of Ukraine "On heat supply" N 2633-IV as of 02/06/2005[34];
- Order of the Cabinet of Ministers of Ukraine "On Approval of the Concept of the State Target Economic Program for Energy Efficiency 2010-2015" N 1446-r as of November 19, 2008[35];

[30] http://www.ucrf.gov.ua/uk/doc/laws/1099563058/

[31] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v6.0.0.pdf

[32] http://www.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=74%2F94-%E2%F0

[33] http://zakon2.rada.gov.ua/laws/show/575/97-%D0%B2%D1%80/page

[34] http://zakon1.rada.gov.ua/laws/show/2633-15

[35] http://www.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=1446-2008-%F0

- Decree of the Cabinet of Ministers of Ukraine "On the regulation of specific consumption of fuel and energy resources in social production" N 786 as of November 15, 1997[36].

Outcome of sub-step 1b. Under such circumstances one may conclude that all scenarios are consistent with current laws and regulatory acts. Therefore Step 1. is satisfied.
According to the document the "Tool for the demonstration and assessment of additionality" (Version 06.0)[37] further justification of additionality shall be performed by means of investment analysis.

Step 2 - Investment Analysis.
The main purpose of investment analysis is to determine whether the proposed project:
(a) is not the most economically or financially attractive, or
(b) is not economically or financial feasible without income from sale of emission reduction units (ERUs) related to the JI project.
Sub-step 2a - Determination of appropriate analysis method.
There are three methods used for investment analysis: a simple cost analysis, a comparative investment analysis and a benchmark analysis. If the project activities and alternatives identified in Step 1 do not receive financial or economic benefits other than income related to JI, then the simple cost analysis (Variant I) is applied. Otherwise, the comparative investment analysis (Variant II) or the benchmark analysis (variant III) are used.
Guidelines for additionality allow for performance of comparative investment analysis, which compares corresponding financial indices for the most realistic and reasonable investment alternatives (Variant II), or the benchmark analysis (Variant III). For this project it is appropriate to apply analysis using Variation III, according to the instructions of "Guidelines on the assessment of investment analysis ver. 05"[38].

Sub-step 2b–Benchmark analysis.
The proposed project "Implementation of measures on reduction of energy consumption and greenhouse gas emissions at "ICE "Tekhnogaz" LLC" use approach recommended in paragraph 12 of the "Guidelines on the assessment of investment analysis ver.05"[39] provides for the use of a discount rate that is determined by considering the weighted average cost of capital (WACC). WACC is calculated as a weighted average cost of own and debt capital. The structure of capital is taken in the form of 50% of own and 50% of debt capital. In accordance with paragraph 18 of the "Guidelines on the assessment of investment analysis ver. 05"[40] cost of own capital is calculated as the sum of risk-free rate, the risk premium on investment in own capital and country risk[41], according to the "Default values for the expected return on equity"[42]. The cost of own capital and listed indexes are given in table below. The cost of debt capital is estimated at the average cost of credit in foreign currency as of 2007 according to the NBU[43]. Cash flow is adjusted by inflation index for the Eurozone[44], because the calculations are made in euros.

Table 5. Initial data for investment analysis.

Nominal discount rate номінальна	13,23%
The average rate on crediting in foreign currency as of 2007	11,70%

[36] http://zakon1.rada.gov.ua/laws/show/786-97-п

[37] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v6.0.0.pdf

[38] http://cdm.unfccc.int/Reference/Guidclarif/reg/reg_guid03.pdf
[39] http://cdm.unfccc.int/Reference/Guidclarif/reg/reg_guid03.pdf

[40] http://cdm.unfccc.int/Reference/Guidclarif/reg/reg_guid03.pdf
[41] http://pages.stern.nyu.edu/~adamodar/pc/archives/ctryprem06.xls
[42] http://cdm.unfccc.int/Panels/meth/meeting/11/049/mp49_an14.pdf
[43] http://www.bank.gov.ua/doccatalog/document?id=51803
[44] http://www.finfacts.ie/inflation.htm

Cost of own capital	14,75%
Starting date of the project	01.04.2007
Operational stage, years	13,0
Expected price per ths ton of CO_2, Euro	0,6
Euro Exchange Rate (2007)	6,9179
Expected price per ton of product, ths Euro	1
Inflation rate in the Eurozone as of 2007	1,90%
Lifetime of the equipment	20
Residual value of the equipment	762673,7784
Risk-free rate	3%
The risk premium on investment real economy	6,50%
The risk premium on investment in foreign economy	5,25%

If the proposed project (not implemented as a JI project) has a less favourable rate, i.e. lower internal rate of return (IRR), than the total limit level, the project may not be considered as financially attractive.

Sub-step 2c – Calculation and comparison of financial indicators.

Financial analysis refers to the time of making investment decisions. The following assumptions were used based on information provided by the company.

1. The project requires investment of approximately 123,7 million euros (according to the NBU rate)[45];
2. The settlement period is 13 years (minimum equipment operational life is 20 years);
3. The residual value is calculated as the result of multiplication of unused resource for initial expenses.

Analysis of cash flow takes into account the cash outflow connected with investments and operating costs[46] and cash inflow associated with the receipt of revenues from providing of services by the enterprise.

Financial Indicators of the project are given below.

Table 6. Financial indicators of the project

Revenues from gas supply without VAT (ths EUR)	Cash flow (ths EUR)	dr (discount rate)	NPV (ths EUR)	IRR (%)	Residual value (ths EUR)
1184852,58	-99573,43477	13,23%	-58 460,78	-2,05%	77898,80

When analyzing the cash flow the IRR that is below the established limit level of IRR (shown in table below). As a result NPV is negative. Therefore the project cannot be considered as financially attractive.

Sub-step 2d: Sensitivity analysis

The sensitivity analysis is conducted to confirm whether the conclusions on the financial / economic attractiveness are enough stable at different substantiated variants of the baseline conditions change. The following two key factors were considered in sensitivity analysis: operational expenses as well as tariff for natural gas transportation. According to the "Tool for the demonstration and assessment of additionality"[47] (paragraph 17) the sensitivity analysis should be made for key indicators in the range of variation ± 10%.

Table 7. Price for gas supply the company

	-10%	0%	+10%
NPV (ths EUR)	-109 146,05	-58 460,78	-7 775,51
IRR (%)	-12,41%	-2,05%	10,73%

[45] http://www.bank.gov.ua/files/Exchange_r.xls

[46] Supporting document 2

[47] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v6.0.0.pdf

Table 8. Investment expenses

	-10%	0%	+10%
NPV (ths EUR)	-63662,04	-58 460,78	-65578,67
IRR (%)	-21,00%	-2,05%	-2,31%

Sensitivity analysis was used to assess the sensitivity of the project to changes that may occur during the project implementation and operation. IRR varies because of changes of prices for natural gas transportation in the range of -10% and +10% demonstrated above. IRR varies because of changes of investment and operational costs in the range of -10% and +10% demonstrated above. Expenditures that are considered in the framework of the project are high, and increase of expenditures will result in a negative NPV. However in case of expected price of the investment and the income from the sale of ERUs the project is viable and will bring enough profit even in case of credit financing of the project and it should make a profit even if the above changes in price of investment take place.

Outcome of Step 2: sensitivity analysis consistently supports (for a realistic range of assumptions) the conclusion that the project is unlikely to be financially / economically attractive.

Step 3: Barrier Analysis

According to the "Tool for the demonstration and assessment of additionality"[48](Version 06.0) the barrier analysis was not conducted.

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

Analysis of other activity similar to the one proposed in the Project demonstrated absence of similar projects in Ukraine.

Outcome of Step 4: There is no need to conduct analysis of similar project activity.

According to the "Tool for the demonstration and assessment of additionality" (Version 06.0) all steps are satisfied.

Conclusion

Based on the above analysis we can conclude that the project is additional.

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

The project boundary according to the specific approach outlined by physical, geographical location of the two liquefied carbon dioxide production line departments of "ICE "Tekhnogaz" LLC. Title documents of equipment (technology production lines, automation systems and control systems, heat recuperators systems, etc.) of the two liquefied carbon dioxide departments are listed in the "List of tittle documents of "ICE "Tekhnogaz" LLC carbon department.

Table below demonstrates the overview of GHG emission sources in the baseline scenario boundary for the project.

Table 9. An overview of all sources of emissions in the baseline scenario

Source	Gas	Included / Excluded	Substantiation / explanation
GHG emissions due to natural gas combustion in the course of production	CO_2	Included	There use less efficient technology in baseline scenario.

[48] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v6.0.0.pdf

GHG emissions due to fossil fuel combustion in the course of generation of electricity consumed in the course of production	CO_2	Included	There use less efficient technology in baseline scenario.
GHG emissions due to natural gas combustion in the course of thermal energy generation	CO_2	Included	The project activity involves heat recovery of waste energy production. In this project the amount of heat produced heat-generating companies in the process of combustion.

Table below demonstrates the overview of GHG emission sources in the project scenario boundary.

Table 10. An overview of all sources of emissions in the project scenario

Source	**Gas**	**Included / Excluded**	**Substantiation / explanation**
GHG emissions due to natural gas combustion in the course of production	CO_2	Included	There use more efficient technology in project scenario that resulting in a decrease of the specific rate of consumption of natural gas per unit of output.
GHG emissions due to fossil fuel combustion in the course of generation of electricity consumed in the course of production	CO_2	Included	There use more efficient technology in project scenario that resulting in a decrease of the specific rate of consumption of electricity per unit of output.

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

Baseline formation date: 25/10/2012

The baseline has been set by CEP Carbon Emissions Partners S.A. and "ICE "Tekhnogaz" LLC

"ICE "Tekhnogaz" LLC
21021, Ukraine, Vinnytsia city, 39 Kosmonavtiv St.
Andriy Mykhailovych Koval,
Acting director general
Telephone: +38 (0432) 52 30 52
Fax: +38 (0432) 52 30 52
e-mail: tekhnogaz.vn@gmail.com
"ICE "Tekhnogaz" LLC is the project participant (stated in Annex 1).

CEP Carbon Emissions Partners S.A.:
Route de Thonon 52, Geneva, Case postale 170 CH-1222 Vésenaz, Switzerland.
Fabian Knodel,
Director.
Telephone: +41 (76) 346 11 57
Fax: +41 (76) 346 11 57
E-mail: 0709bp@gmail.com

CEP Carbon Emissions Partners S.A. is the project participant (stated in Annex 1).

SECTION C. Duration of the project / crediting period

C.1. Starting date of the project:

Starting date of the project is 01/04/2007, when implementation of measures within the framework of the Joint Implementation Project started.

C.2. Expected operational lifetime of the project:

Number of project measures in 2007 was not significant so the starting date of lifetime of the project is 01/01/2008.

Expected operational lifetime of the project in years and months is 12 years or 144 months (from 01/01/2008 to 31/12/2020).

C.3. Length of the crediting period:

Generation of ERUs relates to the first commitment period for 5 years (01/01/2008 – 31/12/2012). Prolongation of the crediting period beyond 2012 is subject to approval by the host Party. Calculations of emission reductions are provided separately for the period before 2012 and after 2012.

If after the first commitment period under the Kyoto Protocol its validity is prolonged, the crediting period under the project will be prolonged by 8 years/96 months until December 31, 2020.

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

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 Sections **D.1.1.1** and **D.1.1.3.**
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, which are available at the stage of PDD development:

$FC^{j}_{b,NG}$	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;

Data and parameters that are not monitored during the crediting period but are identified only once and are not available at the PDD development stage: none

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
$EC^{y}_{p,ELEC}$	Electricity consumption in historical period «*j*», MWh

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

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

Data/Parameter	$FC^{y}_{p,NG}$
Unit of measurement	ths m^3;
Description	Total amount of natural gas consumed in monitoring period «*y*» in the project scenario
Periodicity of determination/monitoring	Once in historical period
Source of data (to be) used	State statistic observation form N 11-MTP «Report on fuel, heat and electricity consumption»
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	To compile the State statistic observation form N 11-MTP «Report on fuel, heat and electricity consumption» indicators of measuring equipment are used
QA/QC procedures (to be) applied	Equipment is calibrated and verified according to the quality management procedures, the law of Ukraine "On metrology and metrological activities"[49].
Any comment	Data allowing for calculation of GHG emissions in the baseline

[49] http://www.ucrf.gov.ua/uk/doc/laws/1099563058/

	scenario; information will be archived in paper and electronic form

Data/Parameter	NCV_{NG}^{y}
Unit of measurement	GJ/ths m^3
Description	Net calorific value of natural gas in monitoring period «*y*»
Periodicity of determination/monitoring	Once in monitoring period
Source of data (to be) used	"National inventory report of anthropogenic greenhouse gas emissions by sources and removals by sinks in Ukraine in 1990-2010"[50]
Value of data applied (for ex ante calculations/determinations)	2004: Natural gas, GJ/ths m^3 = 33,82; 2005 = 33,82; 2006 = 33,85; 2007 = 33,85; 2008 = 33,8 2009: Natural gas, GJ/ths m^3 = 33,8; 2010 = 33,8; 2011 = 33,8; 2012 = 33,8
Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	"National Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine in 1990-2010" [51] is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
Any comment	Data allowing for calculation of GHG emissions in the baseline scenario; information will be archived in paper and electronic form

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

<table>
<tr><td>Data/Parameter</td><td>$EF^{y}_{C,NG}$</td></tr>
<tr><td>Unit of measurement</td><td>tC/TJ</td></tr>
<tr><td>Description</td><td>Carbon emission factor for natural gas combustion in monitoring period «y»</td></tr>
<tr><td>Periodicity of determination/monitoring</td><td>Once in monitoring period</td></tr>
<tr><td>Source of data (to be) used</td><td>“National inventory report of anthropogenic greenhouse gas emissions by sources and removals by sinks in Ukraine in 1990-2010”[52]</td></tr>
<tr><td>Value of data applied
(for ex ante calculations/determinations)</td><td>
<table>
<tr><td></td><td>2004</td><td>2005</td><td>2006</td><td>2007</td><td>2008</td></tr>
<tr><td>Natural gas, tC/TJ</td><td>15,18</td><td>15,19</td><td>15,22</td><td>15,16</td><td>15,17</td></tr>
<tr><td></td><td>2009</td><td>2010</td><td>2011</td><td>2012</td><td></td></tr>
<tr><td>Natural gas, tC/TJ</td><td>15,2</td><td>15,17</td><td>15,17</td><td>15,17</td><td></td></tr>
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</td></tr>
<tr><td>Justification of the choice of data or description of measurement methods and procedures (to be) applied</td><td>N/A</td></tr>
<tr><td>QA/QC procedures (to be) applied</td><td>"National Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine in 1990-2010" [53] is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)</td></tr>
<tr><td>Any comment</td><td>Data allowing for calculation of GHG emissions in the baseline scenario; information will be archived in paper and electronic form</td></tr>
</table>

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

<table>
<tr><td>Data/Parameter</td><td>$OXID_{NG}^{y}$</td></tr>
<tr><td>Unit of measurement</td><td>relative unit</td></tr>
<tr><td>Description</td><td>Carbon oxidation factor for natural gas combustion in monitoring period «y»</td></tr>
<tr><td>Periodicity of determination/monitoring</td><td>Once in monitoring period</td></tr>
<tr><td>Source of data (to be) used</td><td>“National inventory report of anthropogenic greenhouse gas emissions by sources and removals by sinks in Ukraine in 1990-2010”[54]</td></tr>
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<table>
<tr><td></td><td>2004</td><td>2005</td><td>2006</td><td>2007</td><td>2008</td></tr>
<tr><td>Natural gas, relative unit</td><td>0,995</td><td>0,995</td><td>0,995</td><td>0,995</td><td>0,995</td></tr>
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<tr><td>Natural gas, relative unit</td><td>0,995</td><td>0,995</td><td>0,995</td><td>0,995</td><td></td></tr>
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</td></tr>
<tr><td>Justification of the choice of data or description of measurement methods and procedures (to be) applied</td><td>N/A</td></tr>
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<tr><td>Any comment</td><td>Data allowing for calculation of GHG emissions in the baseline scenario; information will be archived in paper and electronic form</td></tr>
</table>

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

Data/Parameter	$EF^{y}_{CO_2,ELEC}$
Unit of measurement	t CO_2e /MW*h;
Description	Indirect carbon dioxide emission factor for electricity consumption by consumers in monitoring period «*y*»
Periodicity of determination/monitoring	Once in monitoring period
Source of data (to be) used	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"[56]; - Decree of the National Environmental Investment Agency of Ukraine №63 dated 15/04/2011 " On approval of specific carbon dioxide emission factors in 2009 "[57]; - Decree of the National Environmental Investment Agency of Ukraine №43 dated 28/03/2011 " On approval of specific carbon dioxide emission factors in 2010"[58]; - Decree of the National Environmental Investment Agency of Ukraine №75 dated 12/05/2011 "On approval of specific carbon dioxide emission factors in 2011"[59].
Value of data applied (for ex ante calculations/determinations)	2008: 1,082; 2009: 1,096; 2010: 1,093; 2011: 1,090
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Data are provided by National Environmental Investment Agency of Ukraine

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

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

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

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

QA/QC procedures (to be) applied	N/A
Any comment	Data allowing for calculation of GHG emissions in the baseline scenario; information will be archived in paper and electronic form

Data/Parameter	$EC^{y}_{p,ELEC}$
Unit of measurement	MW*h;
Description	Electricity consumption in historical period «*j*»
Periodicity of determination/monitoring	Once in historical period
Source of data (to be) used	State statistic observation form N 11-MTP «Report on fuel, heat and electricity consumption»
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	To compile the State statistic observation form N 11-MTP «Report on fuel, heat and electricity consumption» indicators of measuring equipment are used
QA/QC procedures (to be) applied	Equipment is calibrated and verified according to the quality management procedures, the law of Ukraine "On metrology and metrological activities"[60].
Any comment	Data allowing for calculation of GHG emissions in the baseline scenario; information will be archived in paper and electronic form

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

Greenhouse gas emissions under the Project scenario:

[60] http://www.ucrf.gov.ua/uk/doc/laws/1099563058/

$$PE_p^y = PE_{p,NG}^y + PE_{p,ELEC}^y \quad \text{(D1)}$$

$PE_{p,NG}^y$ - GHG emissions due to natural gas combustion in the course of production in monitoring period «*y*» of the project scenario, t CO_2e;

$PE_{p,ELEC}^y$ - 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;

$$PE_{p,NG}^y = \frac{FC_{p,NG}^y \cdot NCV_{NG}^y \cdot EF_{CO2,NG}^y}{10^3} \quad \text{(D2)}$$

$FC_{p,NG}^y$ - 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.

$$EF_{CO2,NG}^y = EF_{C,NG}^y \cdot OXID_{NG}^y \cdot \frac{44}{12} \quad \text{(D3)}$$

$EF_{C,NG}^y$ - carbon emission factor for natural gas combustion in monitoring period «*y*», t C/TJ;

$OXID_{NG}^y$ - 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.

$$PE^{y}_{p,ELEC} = EC^{y}_{p,ELEC} \cdot EF^{y}_{CO2,ELEC} \quad \text{(D4)}$$

$EC^{y}_{p,ELEC}$ - 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.1.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions of greenhouse gases by sources within the project boundary, and how such data will be collected and archived:

Data/Parameter	$PC^{y}_{p,CO2}$
Unit of measurement	t
Description	Amount of production in monitoring period «*y*» in the project scenario
Periodicity of determination/monitoring	Once in monitoring period
Source of data (to be) used	State statistic observation form N 11-MTP «Report on fuel, heat and electricity consumption»
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	To compile the State statistic observation form N 11-MTP «Report on fuel, heat and electricity consumption» indicators of measuring equipment are used

QA/QC procedures (to be) applied	Equipment is calibrated and verified according to the quality management procedures, the law of Ukraine "On metrology and metrological activities"[61].
Any comment	Data allowing for calculation of GHG emissions in the baseline scenario; information will be archived in paper and electronic form

Data/Parameter	NCV_{NG}^{y}
Unit of measurement	GJ/ths m^3
Description	Net calorific value of natural gas in monitoring period «*y*»
Periodicity of determination/monitoring	Once in monitoring period
Source of data (to be) used	"National inventory report of anthropogenic greenhouse gas emissions by sources and removals by sinks in Ukraine in 1990-2010"[62]
Value of data applied (for ex ante calculations/determinations)	

	2004	2005	2006	2007	2008
Natural gas, GJ/ths m^3	33,82	33,82	33,85	33,85	33,8
	2009	2010	2011	2012	
Natural gas, GJ/ths m^3	33,8	33,8	33,8	33,8	

Justification of the choice of data or description of measurement methods and procedures (to be) applied	N/A
QA/QC procedures (to be) applied	"National Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine in 1990-2010" [63] is the official

[61] http://www.ucrf.gov.ua/uk/doc/laws/1099563058/
[62] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2012-nir-13apr.zip
[63] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2012-nir-13apr.zip

	report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
Any comment	Data allowing for calculation of GHG emissions in the baseline scenario; information will be archived in paper and electronic form

Data/Parameter	$FC^{j}_{b,NG}$
Unit of measurement	ths m^3;
Description	Total amount of natural gas consumed in historical period «*j*» in the baseline scenario
Periodicity of determination/monitoring	Once in historical period
Source of data (to be) used	State statistic observation form N 11-MTP «Report on fuel, heat and electricity consumption»
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	To compile the State statistic observation form N 11-MTP «Report on fuel, heat and electricity consumption» indicators of measuring equipment are used
QA/QC procedures (to be) applied	Equipment is calibrated and verified according to the quality management procedures, the law of Ukraine "On metrology and metrological activities"[64].
Any comment	Data allowing for calculation of GHG emissions in the baseline scenario; information will be archived in paper and electronic form

[64] http://www.ucrf.gov.ua/uk/doc/laws/1099563058/

Data/Parameter	$PC^{j}_{b,CO2}$
Unit of measurement	t
Description	Amount of production in historical period «*j*» in the baseline scenario
Periodicity of determination/monitoring	Once in historical period
Source of data (to be) used	State statistic observation form N 11-MTP «Report on fuel, heat and electricity consumption»
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	To compile the State statistic observation form N 11-MTP «Report on fuel, heat and electricity consumption» indicators of measuring equipment are used
QA/QC procedures (to be) applied	Equipment is calibrated and verified according to the quality management procedures, the law of Ukraine "On metrology and metrological activities"[65].
Any comment	Data allowing for calculation of GHG emissions in the baseline scenario; information will be archived in paper and electronic form

Data/Parameter	$EF^{y}_{C,NG}$
Unit of measurement	tC/TJ
Description	Carbon emission factor for natural gas combustion in monitoring period «*y*»
Periodicity of determination/monitoring	Once in monitoring period

[65] http://www.ucrf.gov.ua/uk/doc/laws/1099563058/

<table>
<tr><td>Source of data (to be) used</td><td>“National inventory report of anthropogenic greenhouse gas emissions by sources and removals by sinks in Ukraine in 1990-2010”[66]</td></tr>
<tr><td>Value of data applied
(for ex ante calculations/determinations)</td><td>
<table>
<tr><td></td><td>2004</td><td>2005</td><td>2006</td><td>2007</td><td>2008</td></tr>
<tr><td>Natural gas, tC/TJ</td><td>15,18</td><td>15,19</td><td>15,22</td><td>15,16</td><td>15,17</td></tr>
<tr><td></td><td>2009</td><td>2010</td><td>2011</td><td>2012</td><td></td></tr>
<tr><td>Natural gas, tC/TJ</td><td>15,2</td><td>15,17</td><td>15,17</td><td>15,17</td><td></td></tr>
</table>
</td></tr>
<tr><td>Justification of the choice of data or description of measurement methods and procedures (to be) applied</td><td>N/A</td></tr>
<tr><td>QA/QC procedures (to be) applied</td><td>"National Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine in 1990-2010" [67] is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)</td></tr>
<tr><td>Any comment</td><td>Data allowing for calculation of GHG emissions in the baseline scenario; information will be archived in paper and electronic form</td></tr>
</table>

Data/Parameter	$OXID_{NG}^{y}$
Unit of measurement	relative unit
Description	Carbon oxidation factor for natural gas combustion in monitoring period «*y*»
Periodicity of determination/monitoring	Once in monitoring period

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

<table>
<tr><td>Source of data (to be) used</td><td>“National inventory report of anthropogenic greenhouse gas emissions by sources and removals by sinks in Ukraine in 1990-2010”[68]</td></tr>
<tr><td>Value of data applied
(for ex ante calculations/determinations)</td><td>
<table>
<tr><td></td><td>2004</td><td>2005</td><td>2006</td><td>2007</td><td>2008</td></tr>
<tr><td>Natural gas, relative unit</td><td>0,995</td><td>0,995</td><td>0,995</td><td>0,995</td><td>0,995</td></tr>
<tr><td></td><td>2009</td><td>2010</td><td>2011</td><td>2012</td><td></td></tr>
<tr><td>Natural gas, relative unit</td><td>0,995</td><td>0,995</td><td>0,995</td><td>0,995</td><td></td></tr>
</table>
</td></tr>
<tr><td>Justification of the choice of data or description of measurement methods and procedures (to be) applied</td><td>N/A</td></tr>
<tr><td>QA/QC procedures (to be) applied</td><td>"National Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine in 1990-2010" [69] is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)</td></tr>
<tr><td>Any comment</td><td>Data allowing for calculation of GHG emissions in the baseline scenario; information will be archived in paper and electronic form</td></tr>
</table>

Data/Parameter	$EC^{j}_{b,ELEC}$
Unit of measurement	MWh*h;
Description	Electricity consumption in historical period «*j*»
Periodicity of determination/monitoring	Once in historical period
Source of data (to be) used	State statistic observation form N 11-MTP «Report on fuel, heat

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

	and electricity consumption»
Value of data applied (for ex ante calculations/determinations)	N/A
Justification of the choice of data or description of measurement methods and procedures (to be) applied	To compile the State statistic observation form N 11-MTP «Report on fuel, heat and electricity consumption» indicators of measuring equipment are used
QA/QC procedures (to be) applied	Equipment is calibrated and verified according to the quality management procedures, the law of Ukraine "On metrology and metrological activities"[70].
Any comment	Data allowing for calculation of GHG emissions in the baseline scenario; information will be archived in paper and electronic form

Data/Parameter	$EF^{y}_{CO_2,ELEC}$
Unit of measurement	t CO_2e /MWh;
Description	Indirect carbon dioxide emission factor for electricity consumption by consumers in monitoring period «*y*»
Periodicity of determination/monitoring	Once in monitoring period
Source of data (to be) used	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"[71]; - Decree of the National Environmental Investment Agency of Ukraine №63 dated 15/04/2011 " On approval of specific carbon dioxide emission factors in 2009 "[72];

[70] http://www.ucrf.gov.ua/uk/doc/laws/1099563058/

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

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

	- Decree of the National Environmental Investment Agency of Ukraine №43 dated 28/03/2011 " On approval of specific carbon dioxide emission factors in 2010"[73]; - Decree of the National Environmental Investment Agency of Ukraine №75 dated 12/05/2011 "On approval of specific carbon dioxide emission factors in 2011"[74].
Value of data applied (for ex ante calculations/determinations)	2008: 1,082; 2009: 1,096; 2010: 1,093; 2011: 1,090
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Data are provided by National Environmental Investment Agency of Ukraine
QA/QC procedures (to be) applied	N/A
Any comment	Data allowing for calculation of GHG emissions in the baseline scenario; information will be archived in paper and electronic form

Data/Parameter	$HG^{y}_{p,NG,heat,com}$
Unit of measurement	Tcal
Description	Total amount of thermal energy generated by the company in monitoring period *«y»* in the project scenario
Periodicity of determination/monitoring	Once in monitoring period
Source of data (to be) used	State statistic observation form N 11-MTP «Report on fuel, heat and electricity consumption»
Value of data applied (for ex ante calculations/determinations)	N/A

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

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

Justification of the choice of data or description of measurement methods and procedures (to be) applied	To compile the State statistic observation form N 11-MTP «Report on fuel, heat and electricity consumption» indicators of measuring equipment are used
QA/QC procedures (to be) applied	Equipment is calibrated and verified according to the quality management procedures, the law of Ukraine "On metrology and metrological activities"[75].
Any comment	Data allowing for calculation of GHG emissions in the baseline scenario; information will be archived in paper and electronic form

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

Greenhouse gas emission under the Baseline scenario:

$$BE_b^y = BE_{b,NG}^y + BE_{b,ELEC}^y + BE_{b,NG,heat}^y \quad \text{(D5)}$$

$BE_{b,NG}^y$ - GHG emissions due to natural gas combustion in the course of production in monitoring period «*y*» in the baseline scenario, t CO_2e;

$BE_{b,ELEC}^y$ - 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;

$BE_{b,NG,heat}^y$ - 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.

[75] http://www.ucrf.gov.ua/uk/doc/laws/1099563058/

$$BE^{y}_{b,NG} = \frac{PPER_{NG} \cdot PC^{y}_{p,CO2} \cdot NCV^{y}_{NG} \cdot EF^{y}_{CO2,NG}}{10^3} \quad \text{(D6)}$$

$PC^{y}_{p,CO2}$ - 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.

$$PPER_{NG} = \frac{\sum \frac{FC^{j}_{b,NG}}{PC^{j}_{b,CO2}}}{3} \quad \text{(D7)}$$

$FC^{j}_{b,NG}$ - 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.

$$EF^{y}_{CO2,NG} = EF^{y}_{C,NG} \cdot OXID^{y}_{NG} \cdot \frac{44}{12} \quad \text{(D8)}$$

$EF^{y}_{C,NG}$ - 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

[b] - index corresponding to baseline scenario;

[y] - index corresponding to monitoring period;

[C]- index corresponding to carbon;

[NG]- index corresponding to natural gas.

$$BE^{y}_{b\ ,ELEC} = PPER_{ELEC} \cdot PC^{y}_{p,CO2} \cdot EF^{y}{}_{CO2,ELEC} \quad \text{(D9)}$$

$PC^{y}_{p,CO2}$ - 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.

$$PPER_{ELEC} = \frac{\sum \frac{EC^{j}_{b,ELEC}}{PC^{j}_{b,CO2}}}{3} \quad \text{(D10)}$$

$EC^{j}_{b,ELEC}$ - 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.

$$BE^{y}_{b,NG,heat} = 4,1868 \cdot HG^{y}_{p,NG,heat,com} \cdot EF^{y}_{CO2,NG} \quad \text{(D11)}$$

$HG^{y}_{p,NG,heat,com}$ - 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.

$$EF^{y}_{CO2,NG} = EF^{y}_{C,NG} \cdot OXID^{y}_{NG} \cdot \frac{44}{12} \quad \text{(D12)}$$

$EF^{y}_{C,NG}$ - 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;

[NG]- index corresponding to natural gas.

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

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

N/A

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

N/A

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

D.1.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project:								
ID number *(Please use numbers to ease cross-referencing to D.2.)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

N/A

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

N/A

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

$$ER^y = BE_b^y - PE_p^y \quad \text{(D13)}$$

ER^y – emission reductions due to the project activity in monitoring period «y» (t CO_2eq);

BE_b^y – total estimated GHG emissions in monitoring period «y» in the baseline scenario (t CO_2eq);

PE_p^y – total estimated GHG emissions in monitoring period «y» in the project scenario (t CO_2eq);

[y] – index that corresponds to monitoring period;
[p] – index that corresponds to the project scenario;
[b] – index that corresponds to the baseline scenario.

The Supporting document 1 contains the calculation of baseline and project emissions as well as emission reductions of the project during the monitoring period.

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

The main legislative acts of Ukraine relating to the monitoring of the environmental impact of business entities are:

- Law of Ukraine № 1264-XII "On environmental protection"[76] dated 25/06/1991
- Law of Ukraine № 2707-XII "On atmospheric air protection"[77] dated 16/10/1992.
- Current rules on emission limitation: «Norms of maximum permissible emissions of pollutants from permanent sources» – approved by the Ministry of Environmental Protection of Ukraine dated 27/06/2006, №309 and registered in the Ministry of Justice of Ukraine dated 01/09/2006, №912/12786.

The main areas of environmental protection activities of "ICE "Tekhnogaz" LLC are:

• Protection of air basin.

• Land protection and waste management.

[76] http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=1264-12

[77] http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=2707-12

D.2. Quality control (QC) and quality assurance (QA) procedures undertaken for data monitored:		
Data *(Indicate table and ID number)*	Uncertainty level of data (high/medium/low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
$FC^{y}_{p,NG}$	Low	To compile the State statistic observation form N 11-MTP «Report on fuel, heat and electricity consumption» indicators of measuring equipment are used. Equipment is calibrated and verified according to the quality management procedures, the law of Ukraine "On metrology and metrological activities"[78].
NCV^{y}_{NG}	Low	"National Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine in 1990-2010" [79] is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
$EF^{y}_{C,NG}$	Low	"National Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine in 1990-2010" [80] is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
$OXID^{y}_{NG}$	Low	"National Inventory of anthropogenic GHG emissions by sources and removals by sinks in Ukraine in 1990-2010" [81] is the official report submitted to the secretariat of the UN Framework Convention on Climate Change (UNFCCC)
$EF^{y}_{CO_2,ELEC}$	Low	Data are provided by National Environmental Investment Agency of Ukraine.
$EC^{y}_{p,ELEC}$	Low	To compile the State statistic observation form N 11-MTP «Report on fuel, heat and electricity consumption» indicators of measuring equipment are used. Equipment is calibrated and verified according to the quality management procedures, the law of Ukraine "On metrology and metrological activities"[82].

[78] http://www.ucrf.gov.ua/uk/doc/laws/1099563058/
[79] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2012-nir-13apr.zip
[80] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2012-nir-13apr.zip
[81] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2012-nir-13apr.zip
[82] http://www.ucrf.gov.ua/uk/doc/laws/1099563058/

$PC^{y}_{p,CO2}$	Low	To compile the State statistic observation form N 11-MTP «Report on fuel, heat and electricity consumption» indicators of measuring equipment are used. Equipment is calibrated and verified according to the quality management procedures, the law of Ukraine "On metrology and metrological activities"[83].
$FC^{j}_{b,NG}$	Low	To compile the State statistic observation form N 11-MTP «Report on fuel, heat and electricity consumption» indicators of measuring equipment are used. Equipment is calibrated and verified according to the quality management procedures, the law of Ukraine "On metrology and metrological activities"[84].
$PC^{j}_{b,CO2}$	Low	To compile the State statistic observation form N 11-MTP «Report on fuel, heat and electricity consumption» indicators of measuring equipment are used. Equipment is calibrated and verified according to the quality management procedures, the law of Ukraine "On metrology and metrological activities"[85].
$EC^{j}_{b,ELEC}$	Low	To compile the State statistic observation form N 11-MTP «Report on fuel, heat and electricity consumption» indicators of measuring equipment are used. Equipment is calibrated and verified according to the quality management procedures, the law of Ukraine "On metrology and metrological activities"[86].
$HG^{y}_{p,NG,heat,com}$	Low	To compile the State statistic observation form N 11-MTP «Report on fuel, heat and electricity consumption» indicators of measuring equipment are used. Equipment is calibrated and verified according to the quality management procedures, the law of Ukraine "On metrology and metrological activities"[87].

According to the Law of Ukraine "On metrology and metrological activity"[88], metering devices operating at "ICE "Tekhnogaz" LLC is subject to periodic verification and calibration. The frequency of verification/calibration is set under the manufacturers' manuals, approved methodologies on

[83] http://www.ucrf.gov.ua/uk/doc/laws/1099563058/

[84] http://www.ucrf.gov.ua/uk/doc/laws/1099563058/

[85] http://www.ucrf.gov.ua/uk/doc/laws/1099563058/

[86] http://www.ucrf.gov.ua/uk/doc/laws/1099563058/

[87] http://www.ucrf.gov.ua/uk/doc/laws/1099563058/

[88] http://www.ucrf.gov.ua/uk/doc/laws/1099563058/

verification/calibration of metering devices, as well as the national standards of Ukraine. To ensure conservativeness of the parameters of medium and high level of uncertainty will be carry out permanent regular calibration of metering equipment and use the latest editions of the normative and technical documentation. In the absence of recent editions of the normative and technical documentation their predecessors will be used.

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

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

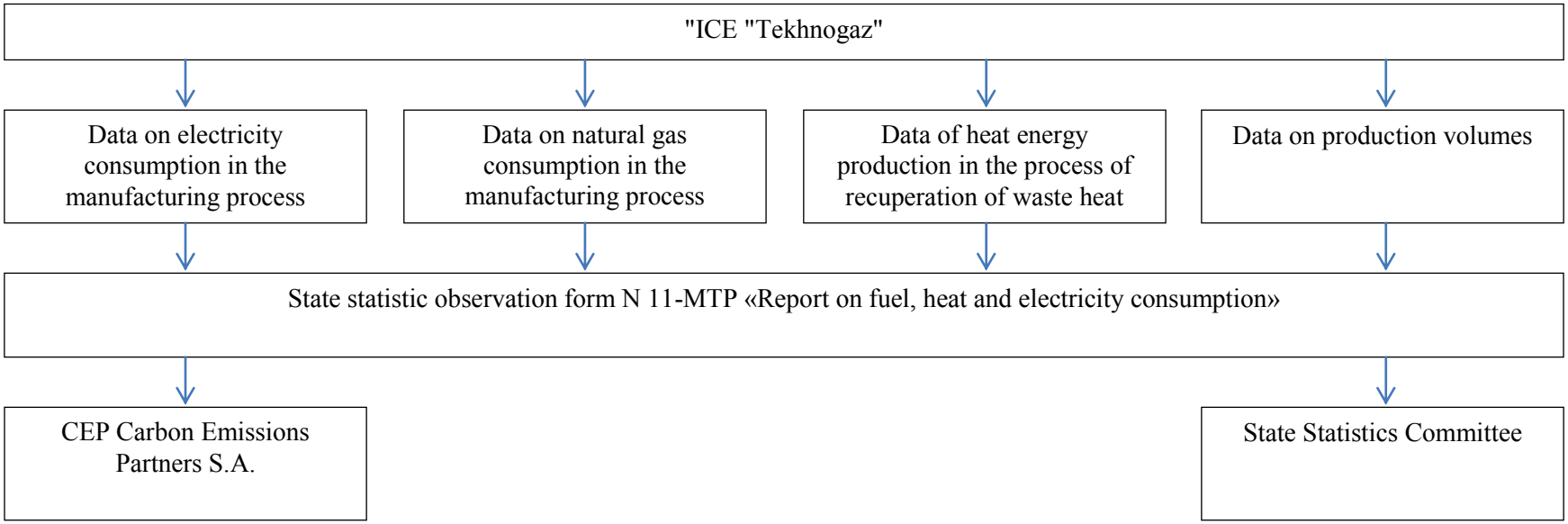

Figure 6. Structure of collection and processing of gas supply data.

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.

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

The monitoring plan and the baseline are set by CEP Carbon Emissions Partners S.A. and "ICE "Tekhnogaz" LLC

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"ICE "Tekhnogaz" LLC is the project participant (stated in Annex 1).

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CEP Carbon Emissions Partners S.A. is the project participant (stated in Annex 1).

SECTION E. Estimation of greenhouse gas emission reductions

E.1. Estimated project emissions:

Project emissions were estimated in accordance with the formulae given in Section D.1.1.2. To estimate emissions for the monitoring period existing data of the company were used.

Results of calculation are provided in the tables below. The calculations are stated in Excel file Supporting document 1 annexed to the PDD.

Table 11. Estimated project emissions for the period January 1, 2008 – December 31, 2012

Year	Estimated project emissions (tonnes of CO_2 equivalent)
2008	155 181
2009	156 872
2010	157 850
2011	158 597
2012	158 597
Total estimated project emissions over the period from 2008 to 2012 (tons of CO_2 equivalent)	**787 097**

Table 12. Estimated project emissions for the period January 1, 2013 - December 31, 2020

Year	Estimated project emissions (tonnes of CO_2 equivalent)
2013	158 597
2014	158 597
2015	158 597
2016	158 597
2017	158 597
2018	158 597
2019	158 597
2020	158 597
Total estimated project emissions over the period from 2013 to 2020 (tons of CO_2 equivalent)	**1 268 776**

E.2. Estimated leakage:

Leakages don't take place.

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

Since no leakages are expected the sum of emissions from leakages and from the project activity is equal to the emissions from the project activity. The results are provided in tables below.

Table 13. Table containing sum of emissions from leakages and project activities for the period January 1, 2008 – December 31, 2012

Year	Estimated project emissions (tons of CO_2 equivalent)	Estimated leakages (tons of CO_2 equivalent)	Total estimated emissions and leakages (tons of CO_2 equivalent)

2008	155 181	0	155 181
2009	156 872	0	156 872
2010	157 850	0	157 850
2011	158 597	0	158 597
2012	158 597	0	158 597
Total emissions (tons of CO_2 equivalent)	**787 097**	**0**	**787 097**

Table 14. Table containing sum of emissions from leakages and project activities for the period January 1, 2013 - December 31, 2020

Year	Estimated project emissions (tons of CO_2 equivalent)	Estimated leakages (tons of CO_2 equivalent)	Total estimated emissions and leakages (tons of CO_2 equivalent)
2013	158 597	0	158 597
2014	158 597	0	158 597
2015	158 597	0	158 597
2016	158 597	0	158 597
2017	158 597	0	158 597
2018	158 597	0	158 597
2019	158 597	0	158 597
2020	158 597	0	158 597
Total emissions (tons of CO_2 equivalent)	**1 268 776**	**0**	**1 268 776**

E.4. Estimated baseline emissions:

Estimated baseline scenario emissions were calculated in accordance with the formulae specified in section D.1.1.4.

Results are provided in the tables below. Calculations are provided in the Excel file Supporting document 1, attached to the PDD.

Table 15. Estimated baseline emissions for the period January 1, 2008 – December 31, 2012

Year	Estimated baseline emissions (tons of CO_2 equivalent)
2008	677 518
2009	693 378
2010	691 961
2011	701 514
2012	701 514
Total baseline emissions over the period from 2008 to 2012 (tons of CO_2 equivalent)	**3 465 885**

Table 16. Estimated baseline emissions for the period January 1, 2013 - December 31, 2020

Year	Estimated baseline emissions (tons of CO_2 equivalent)
2013	701 514

2014	701 514
2015	701 514
2016	701 514
2017	701 514
2018	701 514
2019	701 514
2020	701 514
Total baseline emissions over the period from 2013 to 2020 (tons of CO_2 equivalent)	**5 612 112**

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

Emission reductions are calculated according to formula described in section D.1.4.
Results are provided in the tables below. Calculations are provided in the Excel file Supporting document 1, attached to the PDD.

Table 17. Estimated emission reduction for the period from January 1, 2008 – December 31, 2012

Year	Estimated emission reduction (tones of CO_2 equivalent)
2008	522 337
2009	536 506
2010	534 111
2011	542 917
2012	542 917
Total estimated emission reduction over the period from 2008 to 2012 (tons of CO_2 equivalent)	**2 678 788**

Table 18. Estimated emission reduction for the period January 1, 2013 - December 31, 2020

Year	Estimated emission reduction (tones of CO_2 equivalent)
2013	542 917
2014	542 917
2015	542 917
2016	542 917
2017	542 917
2018	542 917
2019	542 917
2020	542 917
Total estimated emission reduction over the period from 2013 to 2020 (tons of CO_2 equivalent)	**4 343 336**

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

Table 19. Table containing results of estimation of emission reduction for the period from January 1, 2008 to December 31, 2012

Year	Estimated project emissions (tones of CO_2 equivalent)	Estimated leakages (tones of CO_2 equivalent)	Estimated baseline emissions (tones of CO_2 equivalent)	Estimated emission reduction (tones of CO_2 equivalent)
2008	155 181	0	677 518	522 337
2009	156 872	0	693 378	536 506
2010	157 850	0	691 961	534 111
2011	158 597	0	701 514	542 917
2012	158 597	0	701 514	542 917
Total (tones of CO_2 equivalent)	**787 097**	**0**	**3 465 885**	**2 678 788**

Table 20. Table containing results of estimation of emission reduction for the period from January 1, 2013 to December 31, 2020

Year	Estimated project emissions (tones of CO_2 equivalent)	Estimated leakages (tones of CO_2 equivalent)	Estimated baseline emissions (tones of CO_2 equivalent)	Estimated emission reduction (tones of CO_2 equivalent)
2013	158 597	0	701 514	542 917
2014	158 597	0	701 514	542 917
2015	158 597	0	701 514	542 917
2016	158 597	0	701 514	542 917
2017	158 597	0	701 514	542 917
2018	158 597	0	701 514	542 917
2019	158 597	0	701 514	542 917
2020	158 597	0	701 514	542 917
Total (tones of CO_2 equivalent)	**1 268 776**	**0**	**5 612 112**	**4 343 336**

SECTION F. Environmental impacts

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

Transboundary impacts of project activities according to their definitions in the text ratified by Ukraine "Convention on transboundary pollution at a great distance" will not take place. Project implementation does not bring any harmful effects on the environment.

Impact on water medium

There is influence on water medium. Existing technologies of heat energy production exploited at the facilities of "ICE "Tekhnogaz" LLC provide for sewage disposal to drainage network subject to compulsory chemical control. It is provided for in accordance with the Water Code of Ukraine, State Standard 28.74-82 “Hygiene Rules and Quality Control”, Building Standards and Rules 4630-92 in relation to determination of maximum permissible concentration for internal water objects. There will be no discharge of sewage to surface water bodies..

Impact on air

The project implementation will have positive effect on ambient air:

1) Reduction of GHG emissions through the implementation of measures to improve the production equipment for the production of electricity;
2) Reduction of fuel consumption for electricity production and power generation for own needs of power unit will lead to the air pollutants emissions reduction.

Effects on land use

There is no impact on the land/soil.

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

Waste generation, their treatment and disposal

According to the Ukrainian Law “On wastes»[89], (Article 17) «Obligations of business entities’ activity in the sphere of wastes disposal»:

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

During construction works to reduce the negative impact on land it is planed to equip working places and construction sites with containers for household and construction waste with further removal on authorized landfill.

Effects on biodiversity

There is no impact on biodiversity.

We may conclude that зкщоуce doesn’t cause any negative impact on the environment.

[89] http://zakon2.rada.gov.ua/laws/show/187/98-вр

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

As noted above, in the environmental impact assessment, it is clear that the project does not create any adverse environmental impact, but rather has a positive impact on the environment.

SECTION G. Stakeholders' comments

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

Stakeholders' comments on the project are absent because PDD does not include the negative impact on the environment and the negative social effects that the discussion was not necessary.

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

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Annex 2

BASELINE INFORMATION

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).

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

Data/Parameter	Unit of measurement	Description	Value of data applied
$PC^{y}_{p,CO2}$	t	Amount of production in monitoring period «*y*» in the project scenario	Refer to Excel file Supporting document 1
NCV^{y}_{NG}	GJ/ths m^3	Net calorific value of natural gas in monitoring period «*y*»	Refer to Excel file Supporting document 1
$FC^{j}_{b,NG}$	ths m^3	Total amount of natural gas consumed in historical period «*j*» in the baseline scenario	Refer to Excel file Supporting document 1
$PC^{j}_{b,CO2}$	t	Amount of production in historical period «*j*» in the baseline scenario	Refer to Excel file Supporting document 1
$EF^{y}_{C,NG}$	tC/TJ	Carbon emission factor for natural gas combustion in monitoring period «*y*»	Refer to Excel file Supporting document 1
$OXID^{y}_{NG}$	relative unit	Carbon oxidation factor for natural gas combustion in monitoring period «*y*»	Refer to Excel file Supporting document 1
$EC^{j}_{b,ELEC}$	MW*h	Electricity consumption in historical period «*j*»	Refer to Excel file Supporting document 1
$EF^{y}_{CO_2,ELEC}$	t CO_2e /MW*h;	Indirect carbon dioxide emission factor for electricity consumption by consumers in monitoring period «*y*»	Refer to Excel file Supporting document 1
$HG^{y}_{p,NG,heat,com}$	Tcal	Total amount of thermal energy generated by the company in monitoring period «*y*» in the project scenario	Refer to Excel file Supporting document 1

Annex 3

MONITORING PLAN

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).

Monitoring plan provides for the following measures:
1. Collection of information on direct methane emissions within the project during the crediting period.
2. Assessment of the project implementation schedule.
3. Collection of the information on measurement equipment, its calibration.
4. Collection and archiving information on the impact of project activities on the environment.
5. Data archiving.
6. Determination of the structure of responsibility for project monitoring.
7. Analysis of organization of personnel training.

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 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.