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

CONTENTS

Annexes

SECTION A. General description of the project.

A.1. Title of the project:

"Reduction of greenhouse gases emissions by gasification of Odesa region"
Sectoral scope:
Sector 3 – "Energy demand"
PDD Version: 02
Date August 5, 2011

A.2. Description of the project

The main goal of the project is reduction of greenhouse gas emissions by changing the structure of fuel consumption in industrial, municipal, administrative and private sectors of Odesa region by replacing solid and liquid fuels with natural gas. The project envisages construction and expansion of gas distribution systems (GDS) of Odesa region, which will also improve the energy efficiency of thermal power generation due to the transition of existing thermal power plants to natural gas, and installation of individual heating and hot water supply systems characterized by better efficiency compared to centralized systems. The project initiated by OJSC "Odesagas" will result in the reduction of greenhouse gas emissions into the atmosphere and will improve the environmental situation in the region.
OJSC "Odesagas" is an organization that brings together gas facilities of 26 districts of Odesa region and the city of Odesa, and ensures transportation and supply of natural gas to industrial and household consumers. One of the main objectives of the "Odesagas" enterprise is uninterrupted and safe gas supply to Odesa region consumers, as well as the implementation of advanced solutions for the economical use of natural gas. For the implementation of the above, special attention is paid to the improvement of quality of servicing of gas supply systems, their timely overhaul, gas pipelines protection from electrochemical corrosion and other damage. The Company uses modern robust technology of well-known national and foreign producers in order to ensure stable and safe operation of the gas supply system, maintain the desired working gas pressure.
However, the structure of existing tariffs for gas transportation regulated by the state does not take into consideration amortization and investment needs of gas distribution companies. This hinders the flow of sufficient funds for the purposes of repair, modernization and development of gas networks, procurement of appropriate technological equipment and components.
Therefore the most plausible ***baseline scenario***, which the company may follow, is to continue operating the existing systems of transportation and preparation of energy carrier as well as heating systems that will result in the use by the consumers of less ecological fuel (fuel oil, coal, diesel oil), which will generate a significant amount of greenhouse gases (GHG) when burned. In addition, the continued operation of obsolete equipment (most of which was produced in the USSR) and, consequently, low efficiency of transportation system and of energy consumption system will lead to excessive use of fossil fuel that would nourish the harmful effects of atmospheric pollution by GHG emissions.

The project scenario involves expansion of the territorial gas supply system, which includes construction and reconstruction of:

- Gas distribution networks (GDN);
- Gas control points (GCP), including cabinet-type gas control points (CGCP).

The project envisages modernization of the fuel consumption system of Odesa region through the implementation of measures for transition of thermal units to natural gas and transferring the consumers from centralized to individual heating and hot water supply systems, which, in turn, will lead to the use of more efficient and environmentally friendly fossil fuel (natural gas), improvement of the quality of heating and hot water supply services, reduction of thermal energy consumption through increased efficiency of individual systems in comparison with centralized ones.

In general, the project activity is aimed at:

- Ensuring the supply of gaseous fuels (gasification) to end users through the construction and reconstruction of gas distribution network;
- Replacement of solid and liquid fuels and electricity with natural gas;
- Increase in heat energy efficiency;
- Reduction of greenhouse gases under the Joint Implementation Mechanism (JI).

Project implementation will be carried out within three main sectors of Odesa region: industrial, social and administrative. Nowadays, natural gas consumption does not enjoy strong demand in Odesa region. First of all, this is due to the lack of an extensive gas distribution network that would meet gas demand of consumers of industrial, social (household) and administrative sectors.

Industrial sector

Industry of Odesa region plays a significant role in the structure of economic complex of Ukraine and southern economic region. In the region there are companies producing petroleum products, machinery construction plants, repair and installation of machinery companies, metallurgy and metal processing, chemical and petrochemical, food processing, light industry and other industries companies.

Social (household) sector

The total number of inhabitants of Odesa region at the beginning of the project (in 2003) was 2mln.448.2 thousand persons, according to the State Statistics Committee of Ukraine[1]. Prior to 2003, gasification of region's population was carried out slowly, with connection of a small number of subscribers to the gas distribution network. Thus, the vast majority of Odesa region population are prospective consumers of natural gas.

Administrative sector

Administrative sector of Odesa region plays an important role in the development of the region and provision of necessary resources. Together with the other two sectors, the administrative sector is also an important potential consumer of natural gas.

First of all, the gasification project provides for the construction of the main pipeline system for gasification of consumers of industrial and energy sectors. The project further provides for gasification of consumers in household, administrative and commercial sectors and a gradual transition of households to gas fuel.

For gasification of new territories, new gas distribution networks will be developed and built. This will expand the national gas distribution network.

The history of the project activity

On 17.06.2003 in the meeting of the Management Board of OJSC "Odesagas" the decision to launch the Joint Implementation Project was adopted.

In September 2003 the OJSC Odesa gas started implementing measures for the gasification of Odesa region.

[1] http://stat6.stat.lviv.ua/Mult/Dialog/statfile1_c_files/pasport1.htm?51

On 17.06.2011 the agreement between VEMA S.A. and OJSC "Odesagas" on the elaboration of the Joint Implementation project documentation for the reduction of greenhouse gases by means of Odesa region gasification was signed.
On 24.06.2011 supporting materials relating to the project on reduction of anthropogenic emissions of greenhouse gases were submitted to the State Environmental Investment Agency.
On 26.07.2011 The State Environmental Investment Agency issued a Letter of Endorsement of the Joint Implementation Project "Reduction of greenhouse gases emissions by gasification of Odesa region".

A.3. Project participants:

Party involved	Legal name of the project participant	Please indicate if the Party involved wishes to be considered as project participant (Yes/No)
Ukraine (Host Party)	• OJSC "Odesagas"	No
Switzerland	• VEMA S.A.	No

A.4. Technical description of the project.

A.4.1. Location of the project:

The project is located in Odesa region in the southern part of Ukraine (Fig. 1).

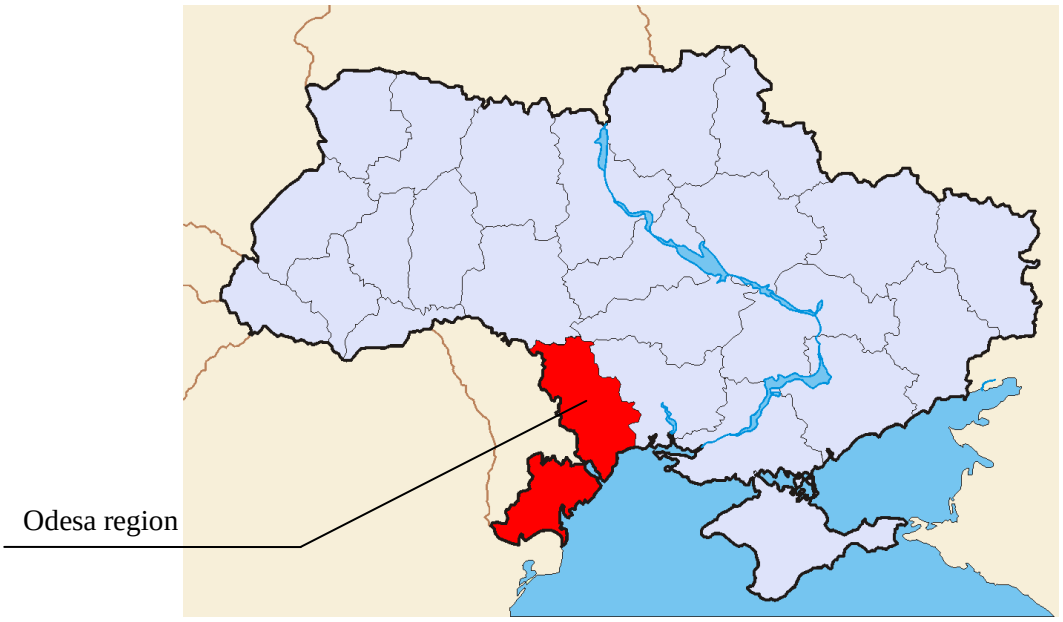

Fig. 1. Location of Odesa region on the map of Ukraine

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[2]. It is listed in the Annex B of the Kyoto Protocol to the UN Framework Convention on Climate Change [3].

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

The project is located in the territory of Odesa region.

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

The JI project encompasses cities and villages of Odesa region.

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

The JI project is being implemented in the territory of Odesa city and Odesa region (30.736522EL, 46.456624 NL[4] are the coorditanes of OJSC "Odesagas" office). Geografical localization of the project is shown in the figure 2.

Fig. 2. Administrative and territorial division of Odesa region.

[2] http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=1430-15

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

[4] http://api.yandex.ru/maps/tools/getlonglat/

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

The project "Reduction of greenhouse gases emissions by gasification of Odesa region" provides for the construction of new and expansion of existing gas distribution systems (GDS), consisting of organizationally and technologically connected facilities, designed to transport natural gas directly from pipelines to individual consumers. GDS will be developed taking into account the type of the gas source, its properties and the degree of purification, the size of the already gasified territory and its building system features, population density, number and nature of industrial and municipal enterprises. Depending on the above factors GDS, which will differ by the method of gas delivery from main pipelines, the type of equipment and facilities of gas distribution networks, communications and remote control systems, will be built. Construction and expansion of GDS involves the construction of new gas distribution networks (GDN) and gas control points (GCP) using modern equipment and technology.

Gas pipelines are the main GDN element. They are classified by the gas pressure, by the purpose of use and by the material (steel, plastic). Depending on the maximum pressure of the transported gas, pipelines are divided into: high pressure gas pipelines of category I - operating gas pressure is above 0.6 MPa (6 kgf/cm^2), high pressure gas pipelines of category II - operating gas pressure is 0.3 MPa (3 kgf/cm^2) - 0.6 MPa (6 kgf/cm^2), medium pressure gas pipelines - operating gas pressure is 0.1 MPa (1kgf/cm^2) - 0.3 MPa (3 kg/cm^2), low pressure gas pipelines - operating gas pressure is up to 0.1 MPa (1kgf/cm^2), inclusive.

Low-pressure gas pipelines are used to transport gas to residential and public buildings, catering companies, as well as to the boiler rooms and consumer services companies. Individual consumers and small heating boiler houses are also connected to low-pressure gas pipelines. Medium and high pressure gas pipelines are used to supply urban distribution networks of low and medium pressure through GCP. They are also designed to supply gas through GCP and local gas control units (GCU) to the pipelines of industrial and utilities companies.

Municipal high-pressure gas pipelines (Fig. 3) are the main arteries that feed big cities. They may be executed as a dead-end schemes, where consumers get gas from only one side, or as circular schemes, when consumers get gas from both sides of a closed circle. They deliver gas through GCP to the medium and high pressure networks, as well as to large industrial companies, manufacturing processes of which require gas pressure of above 0.6 MPa.

For the construction of gas pipelines of high, medium and low pressure it is planned to use:

- Straight seam steel welded pipes that are produced by means of electric welding of a direct joint in parallel to the axis of the tube. These tubes shall be used for the construction of pipelines with operating pressure of up to 1.6 MPa. The project provides for the use of pipes of national producers, made of steel according to the standards SSTU 380-94 and SSTU 1050-88. Typical appearance of a gas pipeline with the use of pumps of such type is shown in the figure 3.

Fig. 3. Low-pressure gas pipeline that was built under the project "Reduction of greenhouse gases emissions by gasification of Odesa region" (Odesa city)

- Polyethylene pipes of domestic production, in particular produced by the "Polimerbud" LLC [5] (Fig. 4).They are designed to supply flammable gas used as feedstock and fuel for industrial and communal purposes, and may be used for construction and repair of gas supply networks. Pipes are produced according to SSTU B V.2.7-73-98 "Polyethylene pipes for supplying combustible gases" [6]made of polyethylene of the PE 80 and PE 100 class, standard dimension ratio SDR 17,6 and SDR 11, the nominal diameters from 20 to 400 mm. Colour of pipes is black with yellow marking stripes.

Fig. 4. Appearance of polyethylene gas pipes of PE type, produced by LLC "Polimerbud"

Detailed specifications of pipes manufactured by LLC "Polimerbud" as well as of connecting elements for polymer pipes can be found on the manufacturer's web-site [7,8] .

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5 http://www.polimerbud.com.ua/index_ukr.html

6 http://www.info-build.com.ua/normativ/detail.php?ID=46127

7 http://www.polimerbud.com.ua/gas_polyethylene_pipes_ukr.html

8 http://www.polimerbud.com.ua/soedinenie_ukr.html

The choice of polyethylene pipes for the expansion of GDS is explained with a number of their operational and technical advantages, namely:

- Resistance to galvanic corrosion, electrical corrosion, to the impact of stray currents;
- Do not require cathodic protection and waterproofing**;**
- Chemical resistance to aggressive substances;
- High elasticity, ductility and tensile strength;
- Smooth inner surface (minimum flow resistance);
- High connection integrity thanks to the polyfusion;
- Simplicity and ease of installation (no need to use sophisticated excavating equipment);
- Relatively low cost of the pipelines construction;
- Significant guaranteed lifetime (50 years).

Technologies of gas pipelines laying, which will be applied in the project:

- underground pipe-laying in trenches and impassable channels (in the soil or in constructional structures of buildings). Access to the pipes during operation is possible only after opening the relevant structures;
- Trenchless construction of underground communications using horizontal directional drilling;
- Overground laying of gas pipelines that may be situated on the ground or above ground at such a level so as not to impede traffic. Overground laying is used on country roads when crossing ravines, rivers, railways and other structures.

The GDN network elements are gas fittings (latches, valves, cork taps). Latches with rising stems and non rising stems are used. The first ones are used for overground installations, the second ones - for underground. Valves are used in cases where high pressure loss can be neglected, for example on impulse lines. Cork taps have a much lower hydraulic resistance than the valves. They are distinguished by the conical stoppers tightening, and could be nongland and gland, and by the method of pipes joining – coupler-joined and flanged. The project envisages the use of gas fittings of European manufacturers Pietro Fiorentini (www.fiorentini.com/), DKG-EAST RT (www.DKGEast.hu).

Fig. 5. Appearance of gas fittings installed under the project "Reduction of greenhouse gases emissions by gasification of Odesa region"(Kotovsk city)

The project envisages installation of gas metering equipment produced by SSPE "Electronmash"[9]and Pietro Fiorentini (www.fiorentini.com/). Meters LIS-1, LIS-1C and LIS-1SK are produced in sizes G2,5, and

[9] http://elektronmash.kiev.ua/gazovi_lichilniki.html

G2,5/G4 and comply with the approved type No. UA-MI/1-1160-2005 (registered in the State register of metering devices admitted to application in Ukraine, under No. U1598-05), as well as with the requirements of SSTU 3336-96, TU U 3.88-14312789.018-2001. The appearance of meters and their main specifications are shown in Figure 6 and Table 1.

Fig. 6. Appearance of the meters produced by SSPE "Electronmash".

Table 1. Specifications of the meters produced by SSPE "Electronmash".

Parameters	Specified values for meter sizes	
	G2,5	G2,5/G4
1. The range of volume flow, m^3/year:- maximum (Q max)	4.0	6.0
- nominal (Q nom)	2.5	4.0
- minimum (Q min)	0.04	
2. Price of the smallest units digit of the measuring indicator, m^3	0.001	
3. Digit capacity of the measuring indicator, m^3	99999.999	
4. Nominal diameter of sleeves, mm, according to SSTU 2485-94	25	
5. Thread of the connecting sleeves, according to SSTU 6357-81	G1-B	
6. The maximum overpressure, kPa	25	
7. Dimensions, mm, up to (length x width x height)	158x108x123 LIS-1, LIS-1S 158 x 108 x 156 LIS-1SK	
8. Weight, kg, not more than	1.0	
9. Internal DC power supply voltage, V	from 3.0 to 3.6	

Meters of the specified type have an internal battery with voltage of 3.6 V, with a decrease to 3.0 V of which the indicator shows a warning signal that the power source has to be replaced with outputting of the appropriate electronic signal pulse on the conversion signal module (CSM). In this case meters do not stop functioning for the next 5-6 months, taking into account the fact that battery life should not be less than the term of periodic inspection of the meter.

The advantages of such meters are as follows:

- Levitation-impulse mode of functioning, when there is no friction of parts surfaces. Consequently, the meter can be used in regions with gas containing oil-paraffin fractions, which adversely affect other types of gas meters;

- serial digital interface, which is used for calibration and verification of meters of the computerized automated installations;
- Outputting of the warning signal that the battery has to be replaced before the meters stop functioning;
- protection from unauthorized impact of magnetic field.

For the remote metering of gas it is planned to install an automated gas metering system (AGMS) produced by SSPE "Electronmash". Automated gas metering system is designed to cover one or more buildings with a total number of subscribers up to 512 for each of the buildings.

AGMS for each building has the following structure (fig.7):

- Apartment meters that are connected directly to the conversion signal module;
- CSM modules, each of which can be connected to 16 gas meters;
- Supermodules for signal conversion (SMSC), each of which can be connected to 32 CSM;
- Radio-frequency transceiver (for AGMS-1) or GSM modem (for AGMS-2) which is connected to the output of the SMPS and which represents the information output of the building;
- Computer (dispatch server), intended for collecting and processing data on gas.

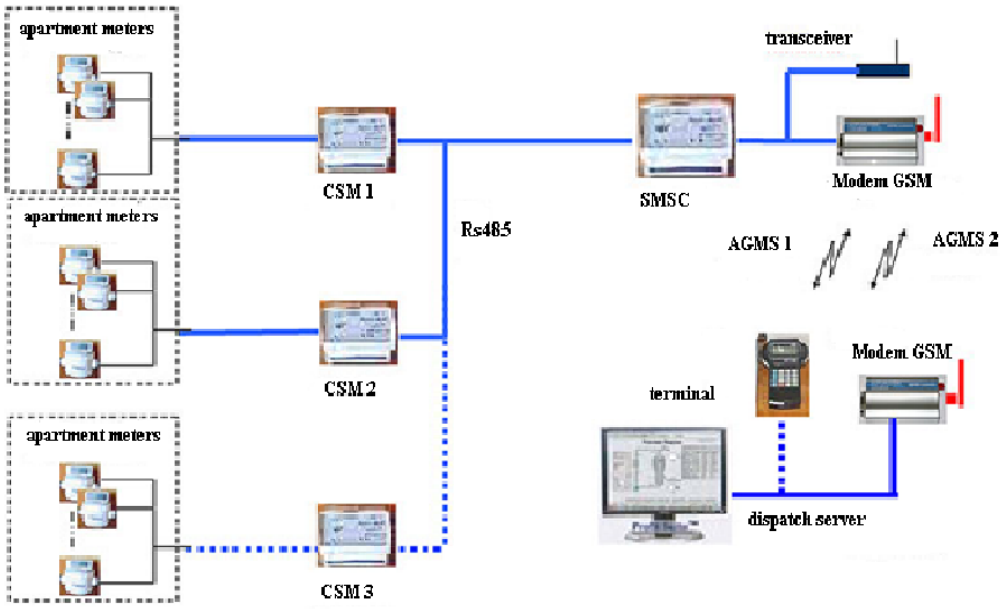

Fig. 7.Scheme of the automated gas metering system

It is planned to buy all necessary equipment for the project from leading Ukrainian and European companies on a tender basis. During the project activity replacement of installed equipment is not planned (except for unscheduled emergency repair works) because its warranty period does not exceed the lifetime of the project.

The project provides for construction of new gas control points, gas control units.

Gas control points (GCP) and gas control units (GCU) are designed to reduce incoming gas pressure to a specified output (working) one and to maintain it at constant level regardless of changes in input pressure and gas consumption rate. Fluctuations in gas pressure at the outlet of the GCP/GCU may be within 10% of

working pressure. Cleaning of gas from impurities, control of input and output gas pressure as well as gas temperature, metering of gas flow is also done in the GCP/GCU.

Depending on the gas pressure at the input, the GCP/GCU are divided into medium (0.1 - 0.3 MPa) and high (0.3 - 1.2 MPa) pressure units.

Gas control points are either located in separate buildings or embedded in the one-story industrial buildings or they can be located in cabinets on outside refractory walls on separately standing supports (Cabinet-type GCP).

Gas control units are located in gasified buildings directly in boiler rooms or shops where the gas consuming units are placed, or in adjacent buildings. Technological schemes of GCP and GCE are similar (fig. 8).

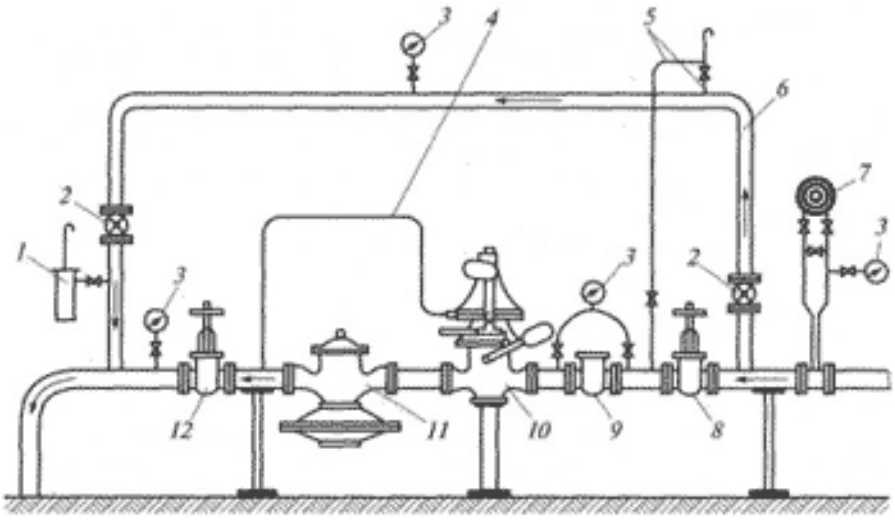

Fig. 8. Technological scheme of gas control point (unit):
1-Safety-reclaimer valve (reclaimer device), 2-latches on bypass line, 3-pressure gauges, 4-impulse-line of a safety shut-off valve; 5-blowoff gas pipeline; 6-bypass line, 7-gas meter, 8 – latch at the inlet, 9 - filter, 10 - safety-shutoff valve (SSV), 11-gas pressure regulator, 12-latch at the outlet.

Three lines can be distinguished in the GCP: the main, bypass (6) and operating. On the main line the gas equipment is located in the following sequence: Shutoff device at the inlet (latch 8); blowoff gas pipeline (5); the filter for gas cleaning from possible impurities (9); safety-shutoff valve (SSV) (10) that automatically shuts off the gas supply with an increase or decrease of gas pressure in the operating line beyond established limits; the gas pressure regulator (11) which reduces the gas pressure in the operating line and automatically maintains it at a specified level regardless of the consumption of gas by consumers; locking device (latch 12) at the outlet of the main line.

On the bypass line there is a blowoff gas pipeline (5) and two locking devices (latches 2), one of which is used for the manual adjustment of gas pressure in the working line during repair works at the main disconnected line.

On the working pressure line (operating line) the safety-reclaimer valve (1) is installed. It serves to discharge gas through a discharge candle into the atmosphere when the gas pressure in the working line increases above the established limits.

The following test equipment is installed in the GCP: thermometers for measuring gas and air temperature in the GCP room, gas meter (7) (gas meter, throttling flow meter), pressure gauges (3) to measure the incoming gas pressure, pressure in the working line, pressure at the inlet and outlet of the gas filter. The project envisages the use of fittings for GCP, GCE of European manufacturers Pietro Fiorentini (www.fiorentini.com/), DKG-EAST RT (www.DKGEast.hu).

The project envisages construction of GCP, which are operated automatically and without permanent maintenance staff.

The project provides for the introduction of gas control points produced by LLC "Promgaz", specifications of which are indicated at the link of the official manufacturer's web-site [10], and their appearance is shown on Fig.9, 10.

Fig. 9. Appearance of the block-type GCP produced by the LLC "Promgaz" installed under the project"Reduction of greenhouse gases emissions by gasification of Odesa region" (Illichivsk city)

Fig. 10. Appearance of the cabinet-type GCP produced by the LLC "Promgaz" installed under the project "Reduction of greenhouse gases emissions by gasification of Odesa region" (urban community Taturino)

The project provides for the construction of cathodic protection stations. Cathodic protection is a modern and effective electrochemical mean of anti-corrosion protection of the GDN. The method is based on the dependence of the corrosion rate from the electrode potential of metal, the potential of which is deliberately shifted from the region of active dissolution. This leads to slowing down of the process of corrosion of metal structures. Shifting of the potential is achieved by connection of the negative pole of external current source to the protected building that serves as the cathode.

The project provides for the construction of cathodic protection stations produced by "Elkon"[11]. The cathodic protection station packaging (fig. 11) ensures:

[10] http://www.promgaz.com.ua/equipment/grp/

- Maintenance of a given load current when changing the network voltage within the range of 170V - 250V interruption of load current;
- automatic maintenance of a given protective potential;
- Recording of time when there is a specified potential at the facility, which is protected,;
- Protection against overloads and short circuits in the load circuit;
- Overvoltage protection during storms;
- Shutting off of the station when the supply voltage decreases below 170V with automatic switch to the operating mode when the voltage is increasing;
- Automatic switching to the operating mode after the complete disappearance and the subsequent appearance of the supply voltage.

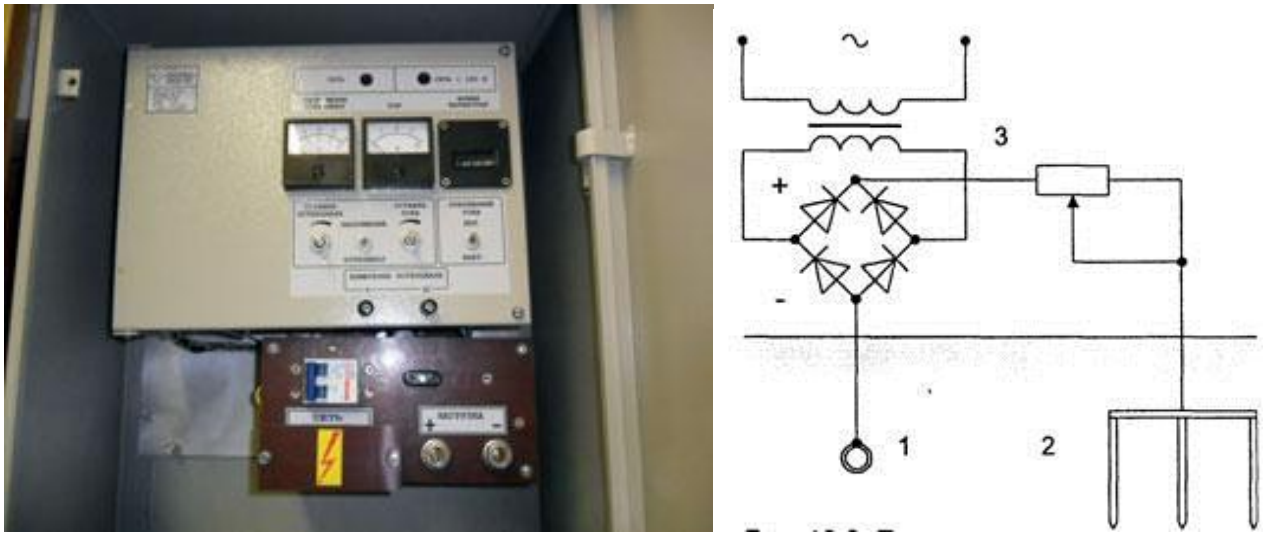

Fig. 11. Appearance of a cathodic protection station "Elkon" and schematic diagram of cathodic protection. 1 – gas pipeline, 2 - anode electrode, 3 - cathodic protection station.

Cathodic protection stations operate on the basis of the electric transducer (PEKZ).
PEKZ (Fig. 12) is designed for anti-corrosion protection of external surfaces of underground metal constructions of various purposes, in particular: pipelines and reservoirs made of carbon and low-alloy steel, main heating-,oil-,gas pipelines and their pipe bends; compressor pipelines, gas control points and pumping stations.

[11] http://esmatech.com.ua/ - scientific-production enterprise «Esma-tech»

Fig.12. Electric cathodic protection transducer PEKZ, produced by "Elkon".

The major milestones of the implementation of the project "Reduction of greenhouse gases emissions by gasification of Odesa region" are given in table 2.

Table 2. Annual project activities implementation schedule under the project in 2003-2012

Phase description				**Year of implementation**
Construction of gas distribution networks (GDN);				
Steel welded pipes	*High pressure, km*	*Medium pressure, km*	*Low pressure, km*	
	52.17	18.77	115.31	2003*
	68.8	59.84	157.098	2004
	41.53	51.29	80.25	2005
	43.69	4.121	131.955	2006
	34.55	30.94	80.068	2007
	16.68	0.157	4.71	2008
	16.38	41.13	61.03	2009
	70.9	28.16	69.88	2010
	80.23	90.58	120.16	2011
	89.1	151.84	170.12	2012
Polyethylene pipes	13.04	6.31	1.7	2003*
	10.15	32.75	3.7	2004
	6.07	19.31	9.18	2005
	19.55	18.79	64.13	2006
	63.54	32.31	40.49	2007
	17.36	16.61	11.26	2008

	61.99	25.17	31.79	2009
	10.38	105.25	70.44	2010
	141.23	185.33	109.09	2011
	192.84	265.41	147.74	2012
Installation of gas meters				
Meters	*Individuals, units*			
	7855			2003*
	6822			2004
	4522			2005
	5666			2006
	7797			2007
	3422			2008
	5673			2009
	2190			2010
	7099			2011
	9048			2012
Construction of gas control points (cabinet-type gas control points), gas control units				
GCP, CTGCP	*High pressure, units*	*Medium pressure, units*		
	5	14		2003*
	11	18		2004
	9	17		2005
	16	15		2006
	21	21		2007
	26	19		2008
	17	15		2009
	43	56		2010
	46	69		2011
	67	84		2012

* Implementation of the project measures started in September 2003.

A.4.3. Brief explanation of how the anthropogenic emissions of greenhouse gases 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:

Project activities provide for construction and expansion of gas distribution systems of Odesa region. In the baseline scenario heat-generating installations of end-consumers will continue to run on solid and liquid fuels and electricity. Such energy resources are characterized by high factor of greenhouse gas emissions in the stationary combustion. The project implementation will promote the transition from solid, liquid fuels to more sustainable fuel - natural gas, which will lead to significant reductions in greenhouse gas emissions. The project also provides for emissions reductions resulting from replacement of electricity, used for heating and hot water supply purposes, with natural gas.

Increase in energy efficiency of thermal plants after gasification will promote decrease in energy consumption, leading to a reduction in greenhouse gas emissions. In particular, significant reduction of emissions will be achieved through increased energy efficiency in households, due to high efficiency of individual heating and hot water supply systems.

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

Table 3. Estimated amount of emission reductions for the period preceding the first commitment period (2004-2007)

	Years
Length of the crediting period	4
Year	Estimate of annual emission reductions in tonnes of CO_2 equivalent
2004	823090
2005	849289
2006	1013783
2007	890005
Total estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	3576167
Annual average of estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	894042

Table 4. 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	938473
2009	914790
2010	982014
2011	982014
2012	982014
Total estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	4799305
Annual average of estimated emission reduction over the crediting period (tonnes of CO_2 equivalent)	959861

Table 5. Estimated amount of emission reductions for the period following the first commitment period (2012-2020)

	Years
Length of the crediting period	8
Year	Estimate of annual emission reductions in tonnes of CO_2 equivalent
2013	982014
2014	982014
2015	982014
2016	982014
2017	982014
2018	982014
2019	982014
2020	982014
Total estimated emission reductions over the crediting period (tonnes of CO_2 equivalent)	7856112
Annual average of estimated emission reduction over the crediting period (tonnes of CO_2 equivalent)	982014

Detailed information about emission reductions calculation can be found in Accompanying document 1.18 (Excel file).
Description of formulas used for preliminary estimation of number of emission reductions units is given in Section D and in the Accompanying document 1.18.

A.5. Project approval by the Parties involved:

The JI project "Reduction of greenhouse gases emissions by gasification of Odesa region" was endorsed by the State Environmental Investment Agency of Ukraine, which is confirmed by the Letter of Endorsement № 1949/23/7 dated 26/07/2011
Upon determination of the project, the PDD and the Determination report will be presented at the State Environmental Investment Agency of Ukraine in order to obtain a Letter of Approval.

SECTION B. Baseline

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

The proposed project uses a specific approach for the determination of JI projects based on approved methodology ACM0009 «Consolidated baseline and monitoring methodology for fuel switching from coal or petroleum fuel to natural gas - Version 3.2».[12]
Dynamic baseline was selected according to the Guidance on criteria for baseline setting and monitoring, Version 02[13]). According to the Guidelines for users of the Joint Implementation Project Design Document Form, Version 04, a stepwise approach is used to describe and justify the baseline chosen:

Step 1. Identification and description of the selected approach for the baseline setting.

In the project documentation in order to describe and justify the baseline chosen a specific approach based on the Joint Implementation requirements in accordance with paragraph 9 (a) of the JI Guidance on criteria for baseline setting and monitoring, Version 02, was used.

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.
The following steps were used to determine the most plausible baseline scenario:
1. Identification of possible alternatives that could be a baseline scenario
2. Justification of exclusion from consideration of alternatives with a low probability from technical and / or economic point of view.
In the process of baseline setting and justification of additionality (Section B.2.) the following key factors were taken into account:

- Government's policies and applicable law in the energy sector;
- Economic situation in the energy sector in Ukraine and forecasted demand for fossil fuels;
- Technical aspects of management and operation of energy supply systems;
- Availability of capital, including investment barriers that are typical for OJSC "Odesagas";
- The local availability of technology / equipment;
- Price and availability of fuel.

Step 2. Application of the selected approach

Selection of the plausible baseline scenario is based on assessment of alternative options for transportation of fossil fuels to end users that potentially could have taken place as of the beginning of the project implementation (2003).
The following alternatives were analysed:

Alternative 1.1: Continuation of existing practice, without the JI project.
Alternative 1.2: The project activities without the use of the Joint Implementation mechanism.
Below is a detailed analysis of each alternative.

[12] http://cdm.unfccc.int/methodologies/DB/2CRBYLJO5JWC9YHBSWJQWYIH2LLGMJ

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

Alternative 1.1

Continuation of existing practice with minimum repairs, while having the general deterioration of gas supply systems.

State of the fuel and energy sector (energy supply systems) in Ukraine.

In the baseline period the state and development trends of energy supply systems in Ukraine were quite unsatisfactory. This was due to flawed principle of pricing for the provision of services, which failed to provide development of subjects of the system, as well as the inflow of investments into the sector (lack of cost-effective modernization of equipment).

Under the existing market model for the supply of fossil fuels, the effective competition among producers and suppliers of fuel could not be achieved, neither did the fuel pricing, which would stimulate providers to improve efficiency and increase investment in energy sector. Neither existing market mechanisms, nor administrative measures did provide the necessary modernization of existing transportation systems. The situation becomes particularly critical given the growth of the need for fossil fuel in the near future, the lack of which represents a threat to safe operation of local heating and hot water supply systems, electricity generation systems, and other consumers of fossil fuels. Inadequate tariff policy also leads to an increase in accounts payable of the suppliers of fossil fuels that result in their bankruptcy or non-transparent privatization. State investment programs in most cases are directed at the administrative and organizational implementations[14]. In addition, there are no conditions for contributing to the inflow of investments both from domestic and foreign investors.

This alternative is the most plausible baseline scenario because:

- It allows for transporting fossil fuels with existing facilities;
- It does not require investment in new equipment.

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

Alternative 1.2

The project activities without the use of Joint Implementation mechanism.

The main obstacle that hinders the implementation of this scenario is an investment barrier, because it requires attracting significant additional funds. Such investment is characterized by a significant payback period and high investment risks.

This alternative can not be considered as the most plausible baseline scenario, as the main obstacle to its implementation is the lack of investment in new manufacturing equipment and high investment risks.

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

Results of the performed investment analysis in Section B2 show that *Alternative 1.2* can not be considered as the most plausible one from a financial point of view. Detailed information relating to analysis of investment barriers is provided in Section B2.

The results of analysis performed in accordance with the "Tools for demonstration and assessment of additionality" (Version 05.2) in section B2 show that the project scenario is additional.

Baseline scenario description

The baseline scenario provides for the continuation of existing practice with minimum repairs, while having the overall deterioration of fossil fuels supply systems. In the absence of the proposed project less sustainable fossil fuel will still be used with significant losses during its transportation and storage. This is a common practice in Ukraine.

[14] http://www.ukrenergo.energy.gov.ua/ukrenergo/control/uk/publish/archive?&cat_id=33495&stind=1

Determination of GHG emissions in the baseline scenario will be performed using a specific approach for joint implementation projects for each year when monitoring of the project activity will take place, in such a way so that to adjust volume of fossil fuel substituted with gas. This will allow for calculation of the volume of greenhouse gas emissions for each project year, in the absence of the project activity.
Detailed information about the algorithm of baseline emissions calculation of baseline parameters is provided in Section D.1. and Annex 2.

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

Data/Parameter	$V^{y}_{gas,PP}$
Unit of measurement	Ths m^3
Description	Total quantity of natural gas combusted in period "y" by an individual
Periodicity of determination/monitoring	Monthly
Source of data (to be) used	Gas meters
Value of data applied (for ex ante calculations/determinations)	Subject to periodical monitoring
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Measurements will be performed by gas meters
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".
Any comment	A cubic meter, reduced to standard conditions (T = 20 degrees, C, P = 101.325 kPa (760 mm. of mercury) and humidity is equal to zero) is taken as the unit of account of gas supplied to individuals and legal entities. Data about the amount of gas consumption by subscribers is the basic Data allowing for calculation of GHG emissions for each year in the project scenario; information will be archived in paper and electronic form

Data/Parameter	$V^{y}_{gas,LE}$
Unit of measurement	Ths m^3
Description	Total quantity of natural gas combusted in period "y" by a legal entity, in the project scenario
Periodicity of determination/monitoring	Monthly
Source of data (to be) used	Gas meters
Value of data applied (for ex ante calculations/determinations)	Subject to periodical monitoring
Justification of the choice of	Measurements will be performed by gas meters

data or description of measurement methods and procedures (to be) applied	
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".
Any comment	A cubic meter, reduced to standard conditions (T = 20 degrees, C, P = 101.325 kPa (760 mm. of mercury) and humidity is equal to zero) is taken as the unit of account of gas supplied to individuals and legal entities. Data about the amount of gas consumption by subscribers is the basic Data allowing for calculation of GHG emissions for each year in the project scenario; information will be archived in paper and electronic form

Data/Parameter	NCV_{fuel}^{y}
Unit of measurement	TJ/ ths t
Description	Net calorific value of fossil fuel of "fuel" type. (Fuel of «fuel» type means coal, wood, fuel oil, diesel oil)
Periodicity of determination/monitoring	Annually
Source of data (to be) used	The national inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine for 1990-2009. Table P.2.24.[15] Data on the type of fossil fuel used by the consumer before the gasification are provided by district administrations and village councils.
Value of data applied (for ex ante calculations/determinations)	Coal (for the population), TJ/ ths t: 21.7; Fuel oil (for heat generation), TJ /ths m^3: 39.8; Diesel oil, TJ /ths m^3: 42.5
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The parameter is used according to the approved CDM methodology ACM0009 and "Guidance on criteria for baseline setting and monitoring». Net calorific value of natural gas that is based on officially approved national data will be used. Data on the type of fossil fuel used by the consumer before the gasification are provided by district administrations and village councils.
QA/QC procedures (to be) applied	Officially approved national data that are actual at the moment of the monitoring report preparation will be used.
Any comment	Data allowing for calculation of GHG emissions in the baseline scenario; information will be archived in paper and electronic form.

[15] http://www.neia.gov.ua/nature/doccatalog/document?id=124939

Data/Parameter	NCV_{gas}^{y}
Unit of measurement	TJ/ mlnm^3
Description	Net calorific value of natural gas
Periodicity of determination/monitoring	Annually
Source of data (to be) used	The national inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine for 1990-2009. Table P.2.24. [16]
Value of data applied (for ex ante calculations/determinations)	33.9
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The parameter is used according to the approved CDM methodology ACM0009 and "Guidance on criteria for baseline setting and monitoring». Net calorific value of natural gas that is based on officially approved national data will be used.
QA/QC procedures (to be) applied	Officially approved national data that are actual at the moment of the monitoring report preparation will be used.
Any comment	According to principle of conservatism minimal calorific value of gas is used.

Data/Parameter	k_{fuel}^{c}
Unit of measurement	tC/TJ
Description	Carbon emission factor when combusting fossil fuel of "fuel" type. (Fuel of «fuel» type means coal, wood, fuel oil, diesel oil)
Periodicity of determination/monitoring	Annually
Source of data (to be) used	The national inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine for 1990-2009. Table P.2.26.[17]
Value of data applied (for ex ante calculations/determinations)	Coal (for the population): 25.3; Fuel oil (for heat generation): 21.1; Diesel oil: 20.2
Justification of the choice of data or description of measurement methods and procedures (to be) applied	According to "Guidance on criteria for baseline setting and monitoring»

[16] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip

[17] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip

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	k^{o}_{fuel}
Unit of measurement	Relative units
Description	Carbon oxidation factor when combusting fossil fuel of "fuel" type
Periodicity of determination/monitoring	Annually
Source of data (to be) used	The national inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine for 1990-2009. Table P.2.27. [18]
Value of data applied (for ex ante calculations/determinations)	Coal (for the population): 0.98; Fuel oil (for heat generation): 0.99; Diesel oil: 0.99
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Carbon oxidation factor when combusting fossil fuel is used to determine the carbon dioxide emission factor by default for stationary combustion of fossil fuels in Ukraine. The data source for this parameter is the National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine, based on approved national data.
QA/QC procedures (to be) applied	Officially approved national data that are actual at the moment of the monitoring report preparation will be used.
Any comment	Data allowing for calculation of GHG emissions in the baseline scenario; information will be archived in paper and electronic form

Data/Parameter	$k_{7,fuel}$
Unit of measurement	kWh/GJ
Description	Specific saving of electric energy in the course of heat carrier transportation to end consumer with account of losses in electrical grids
Periodicity of determination/monitoring	Once at the beginning of the project
Source of data (to be) used	Report «Determination of change of specific energy data of heat supply system in the course of gasification" developed by "UKRENERGOPROM-2" as of June 24, 2011. Also this report received a positive review from the "Institute of Engineering Thermophysics, NAS of Ukraine." The report is provided to the

[18] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip

	State Environmental Investment Agency as a separate accompanying document.
Value of data applied (for ex ante calculations/determinations)	2.016
Justification of the choice of data or description of measurement methods and procedures (to be) applied	This applies only to individuals who were previously connected to central heating system. This factor was determined by analyzing the actual performance characteristics of technological equipment located in different regions of Ukraine (Odesa, Donetsk, Kyiv regions). The use of the factor is possible throughout Ukraine. The specified value (2.016) applies only if consumers switch from centralized heating systems, which ran on fossil fuel of "fuel" type, to gasified centralized or individual systems. Otherwise, the value of 0 is used.
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	$k^{b}_{1,prepfuel}$
Unit of measurement	Relative units
Description	Average efficiency factor that takes into account energy loss in the course of energy carrier preparation in the baseline scenario
Periodicity of determination/monitoring	Once
Source of data (to be) used	Report «Determination of change of specific energy data of heat supply system in the course of gasification". The report is provided to the State Environmental Investment Agency as a separate accompanying document.
Value of data applied (for ex ante calculations/determinations)	

Basic source of heat	Baseline fuel	
	Fuel oil	Coal
Central system	0.965	0.965
Individual system	1	1

Justification of the choice of data or description of measurement methods and procedures (to be) applied	This applies in case of transfer of individual and central heat supply systems to gas. This factor was determined by analyzing the actual performance characteristics of technological equipment located in different regions of Ukraine (Odesa, Donetsk, Kyiv regions).The use of the factor is possible throughout Ukraine. The specified values apply in case of transfer of individual or central heat supply systems to gas. Otherwise, the value of 1 is used.
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	$k^{p}_{1,prepfuel}$
Unit of measurement	Relative units
Description	Average efficiency factor that takes into account energy loss in the course of energy carrier preparation, in the project scenario
Periodicity of determination/monitoring	Once
Source of data (to be) used	Report «Determination of change of specific energy data of heat supply system in the course of gasification". The report is provided to the State Environmental Investment Agency as a separate accompanying document.
Value of data applied (for ex ante calculations/determinations)	Project source of heat: Project fuel / Natural gas; Central system: 0.98; Individual system: 1
Justification of the choice of data or description of measurement methods and procedures (to be) applied	This applies in case of transfer of individual and central heat supply systems to gas. This factor was determined by analyzing the actual performance characteristics of technological equipment located in different regions of Ukraine (Odesa, Donetsk, Kyiv regions).The use of the factor is possible throughout Ukraine. The specified values apply in case of transfer of individual or central heat supply systems to gas. Otherwise, the value of 1 is used.
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	$k^{b}_{3,ef}$
Unit of measurement	Relative units
Description	Average efficiency factor of boiler equipment that takes into account efficiency of thermal generating units in the baseline scenario
Periodicity of determination/monitoring	Once at the beginning of the project
Source of data (to be) used	Report «Determination of change of specific energy data of heat supply system in the course of gasification". The report is provided to the State Environmental Investment Agency as a separate accompanying document.
Value of data applied (for ex ante	Basic source of heat: Baseline fuel

calculations/determinations)	<table><tr><td></td><td>Fuel oil</td><td>Coal</td></tr><tr><td>Central system</td><td>0.79</td><td>0.76</td></tr><tr><td>Individual system</td><td>-</td><td>0.74</td></tr></table>
Justification of the choice of data or description of measurement methods and procedures (to be) applied	This applies in case of transfer of individual and central heat supply systems to gas. This factor was determined by analyzing the actual performance characteristics of technological equipment located in different regions of Ukraine (Odesa, Donetsk, Kyiv regions). Using of the factor is possible throughout Ukraine. The specified values apply in case of transfer of individual or central heat supply systems to gas. Otherwise, the value of 1 is used.
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	$k_{3,ef}^{p}$
Unit of measurement	Relative units
Description	Average efficiency factor of boiler equipment that takes into account efficiency of thermal generating units in the project scenario
Periodicity of determination/monitoring	Once at the beginning of the project
Source of data (to be) used	Report «Determination of change of specific energy data of heat supply system in the course of gasification". The report is provided to the State Environmental Investment Agency as a separate accompanying document.
Value of data applied (for ex ante calculations/determinations)	<table><tr><td rowspan="2">Project source of heat</td><td>Project fuel</td></tr><tr><td>Natural gas</td></tr><tr><td>Central system</td><td>0.92</td></tr><tr><td>Individual system</td><td>0.92</td></tr></table>
Justification of the choice of data or description of measurement methods and procedures (to be) applied	This applies in case of transfer of individual and central heat supply systems to gas. This factor was determined by analyzing the actual performance characteristics of technological equipment located in different regions of Ukraine (Odesa, Donetsk, Kyiv regions).The use of the factor is possible throughout Ukraine. The specified values apply in case of transfer of individual or central heat supply systems to gas. Otherwise, the value of 1 is used.
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

<table>
<tr><td>Data/Parameter</td><td>$k^{b}_{4,pipes}$</td></tr>
<tr><td>Unit of measurement</td><td>Relative units</td></tr>
<tr><td>Description</td><td>Average efficiency factor that takes into account heat energy losses in the course of heat carrier transportation to the end consumer, in the baseline scenario</td></tr>
<tr><td>Periodicity of determination/monitoring</td><td>Once</td></tr>
<tr><td>Source of data (to be) used</td><td>Report «Determination of change of specific energy data of heat supply system in the course of gasification”. The report is provided to the State Environmental Investment Agency as a separate accompanying document.</td></tr>
<tr><td>Value of data applied (for ex ante calculations/determinations)</td><td>
<table>
<tr><td rowspan="2">Basic source of heat</td><td colspan="3">Baseline fuel</td></tr>
<tr><td>Fuel oil</td><td>Wood</td><td>Coal</td></tr>
<tr><td>Central system</td><td>0.844</td><td>0.844</td><td>0.844</td></tr>
<tr><td>Individual system</td><td>0.844</td><td>0.844</td><td>0.844</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>This applies in case of transfer of individual and central heat supply systems to gas. This factor was determined by analyzing the actual performance characteristics of technological equipment located in different regions of Ukraine (Odesa, Donetsk, Kyiv regions).The use of the factor is possible throughout Ukraine.
The specified values apply in case of transfer of individual or central heat supply systems to gas. Otherwise, the value of 1 is used.</td></tr>
<tr><td>QA/QC procedures (to be) applied</td><td>N/A</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>

<table>
<tr><td>Data/Parameter</td><td>$k^{p}_{4,pipes}$</td></tr>
<tr><td>Unit of measurement</td><td>Relative units</td></tr>
<tr><td>Description</td><td>Average efficiency factor that takes into account heat energy losses in the course of heat carrier transportation to the end consumer, in the project scenario</td></tr>
<tr><td>Periodicity of determination/monitoring</td><td>Once</td></tr>
<tr><td>Source of data (to be) used</td><td>Report «Determination of change of specific energy data of heat supply system in the course of gasification”. The report is provided to the State Environmental Investment Agency as a separate accompanying document.</td></tr>
<tr><td>Value of data applied (for ex ante calculations/determinations)</td><td>
<table>
<tr><td>Project source of heat</td><td>Project fuel</td></tr>
<tr><td></td><td>Natural gas</td></tr>
</table>
</td></tr>
</table>

	Central system	0.844	
	Individual system	1	
Justification of the choice of data or description of measurement methods and procedures (to be) applied	This applies in case of transfer of individual and central heat supply systems to gas. This factor was determined by analyzing the actual performance characteristics of technological equipment located in different regions of Ukraine (Odesa, Donetsk, Kyiv regions).The use of the factor is possible throughout Ukraine. The specified values apply in case of transfer of individual or central heat supply systems to gas. Otherwise, the value of 1 is used.		
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	CEF_{elec}^{y}
Data unit	tCO_2/MWh
Description	GHG emission factor when electricity consumption is reduced
Time of determination/monitoring	Annually
Source of data (to be) used	Carbon dioxide emission factors for 2004-2005 are taken from the document issued by the Ministry of economy of Netherland "Operational Guidelines for Project Design Documents of Joint Implementation Projects Volume 1: General guidelines" (ERUPT)[19] - Carbon dioxide emission factors for 2006-2007 are taken from the document "Carbon dioxide emission factors (for energy consumption according to the methodology "Ukraine - Assessment of new calculation of CEF", approved by TUV SUD 17.08.2007)[20]; - Carbon dioxide emission factors for 2008 are taken from Order of the National Environmental Investment Agency of Ukraine (hereinafter - NEIAU) № 62 of 15.04.2011 "On approval of specific carbon dioxide emission factors in 2008[21]"; - Carbon dioxide emission factors for 2009 are taken from the Order of NEIAU # 63 of 15.04.2011 "On approval of specific carbon dioxide emission factors in 2009"[22]; - Carbon dioxide emission factors for 2010 are taken from the Order of NEIAU # 43 of 28.03.2011. "On approval of specific carbon dioxide emission factors in 2010"[23];

[19]http://ji.unfccc.int/CallForInputs/BaselineSettingMonitoring/ERUPT/index.html

[20]http://ji.unfccc.int/UserManagement/FileStorage/46JW2KL36KM0GEMI0PHDTQF6DVI514

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

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

<table>
<tr><td></td><td>- Carbon dioxide emission factors for 2011 are taken from the Order of NEIAU # 75 of 12.05.2011. "On approval of specific carbon dioxide emission factors in 2011"[24];</td></tr>
<tr><td>Value of data applied (for ex ante calculations/determinations)</td><td>
<table>
<tr><th>2004</th><th>2005</th><th>2006-2007</th><th>2008</th><th>2009</th><th>2010</th><th>2011</th></tr>
<tr><td>0.916</td><td>0.896</td><td>0.896</td><td>1.082</td><td>1.096</td><td>1.093</td><td>1.090</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>When developing the joint implementation project national GHG emission factors are used, in case of their absence factors for 2004-2005 are taken from ERUPT, factors for 2006-2007 are taken from the document “Carbon dioxide emission factor” approved TUV SUD</td></tr>
<tr><td>QA/QC procedures (to be) Applied</td><td>Only officially approved factors are used for calculations.</td></tr>
<tr><td>Any comment</td><td>Researches don’t take into consideration production of energy by nuclear power plants</td></tr>
</table>

<table>
<tr><td>Data/Parameter</td><td>$CEF^{y}_{gas,unit}$</td></tr>
<tr><td>Data unit</td><td>t CO_2-eq/ m^3</td></tr>
<tr><td>Description</td><td>Reduced GHG emission factor in the course of natural gas transportation to end consumers</td></tr>
<tr><td>Time of determination/monitoring</td><td>Once at the beginning of the projecty</td></tr>
<tr><td>Source of data (to be) used</td><td>Official data of the Ministry of Fuel and Energy of Ukraine and the national inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine for 1990-2009. Detailed calculation and the reference to the source of data are provided in the accompanying document 1.18 .- Excel file and Annex 3.</td></tr>
<tr><td>Value of data applied (for ex ante calculations/determinations)</td><td>
<table>
<tr><th colspan="4">Reduced GHG emission factor in the course of transportation of 1 m^3 of gas, CEF_{gas}^{unit}, t CO_2/m^3</th></tr>
<tr><td>2003</td><td>2004</td><td>2005</td><td>2006</td></tr>
<tr><td>0.000072</td><td>0.000071</td><td>0.000094</td><td>0.00007</td></tr>
<tr><td>2007</td><td>2008</td><td>2009</td><td>2010</td></tr>
<tr><td>0.000066</td><td>0.000073</td><td>0.000057</td><td>0.000055</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>See Annex 3</td></tr>
<tr><td>QA/QC procedures (to be) Applied</td><td>Calculations are based on the officially approved national data of the Ministry of Fuel and Energy of Ukraine and the national inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine.</td></tr>
</table>

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

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

Any comment	N/A

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 complex modernization of fossil fuel supply by introduction of technologies proposed in the project activity and described above, which include:

- Gas-distribution networks (GDN);
- Gas control points (GCP);
- Cabinet-type gas-control points (CGCP);
- Gas fittings;

Additionality of the project

The additionality of the project activity is demonstrated and assessed with using the "Tool for the demonstration and assessment of additionality"[25] (Version 05.2). 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. Define alternatives to the project activity

There are two alternative variants of this project (which have already been discussed in Section B.1).
Alternative 1.1: continuation of existing situation, without JI project implementation.
Alternative 1.2: project activity without application of 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: Continuation of current practice of exploitation of the existing capacities of OJSC "Odesagas" is the most realistic and credible alternative to the Project implementation, since this variant is associated with minimal costs for OJSC "Odesagas."

According to the Law of Ukraine "On principles of the natural gas market functioning"[26] Article 8, OJSC "Odesagas" and the competent authorities of the government and local self-government shall:

- Ensure efficient use of natural, human and financial resources;
- Ensure the participation in the development and approval of plans of prospective development of pipelines on corresponding territory;
- Promote the development of gas distribution networks;
- Ensure the participation in formation and approval of the list of enterprises, which in the period of seasonal fall of temperature shall be converted to work with reserve fuel;
- Ensure compliance with the legislation of Ukraine in the field of environmental protection.

Article 13. Gas transmission enterprise:

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

[26] http://zakon1.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=2467-17

- is obliged to ensure equal access to its networks for all suppliers and consumers of natural gas;
- during the transportation of natural gas is obliged to comply with the requirements for transportation of gas, set regulations and regulatory documents;
- has the right to transit natural gas through Ukraine, implementation of such activity can not restrict the scope of the enterprise as a participant of the natural gas market.

The current Ukrainian system of tariff establishment for natural gas does not include an investment component for the development of gas distribution networks. According to the Law "On principles of the natural gas market functioning OJSC "Odesagas" is not obliged and unmotivated to build new gas distribution systems at its own expense.

Alternative 1.2: Until now OJSC "Odesagas" has not performed any measures for gasification. Moreover, OJSC "Odesagas" does not have any incentives or funds for implementation of the measures provided for by the Project in the absence of its support by the mechanisms established in article 6 of the Kyoto Protocol to the UN Framework Convention On Climate Change (step 1.2, step 2 and step 3 below). OJSC "Odesagas" does not have any financial incentives to cover such costs for implementation of this Project or similar measures represented in this project, except for possible proceeds received under the mechanism established by article 6 of the Kyoto Protocol to the UN Framework Convention On Climate Change.
Construction, reconstruction and modernization without the use of JI mechanism shall be consistent with mandatory laws and regulations; detailed information on analysis of consistency with the law was made for *Alternative 1.1*, which is similar in context of consistency with mandatory laws and regulations to *Alternative 1.2*.
Outcome of sub-step 1b. Under such circumstances one may say that all scenarios are consistent with current laws and regulatory acts.

Therefore Step 1. is satisfied.
According to the document "Tool for the demonstration and assessment of additionality (Version 05.2)[27] subsequent 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 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, comparative investment analysis and a benchmark analysis. If the project activities and alternatives identified in Step 1 do not receive other financial or economic benefits other than income related to JI, then apply a simple cost analysis (Variant I). Otherwise, use the comparative investment analysis (Variant II) or a benchmark analysis (variant III).
Guidelines for additionality make it possible to perform comparative investment analysis, which compares corresponding financial indices for the most realistic and reasonable investment alternatives (Variant II), or a benchmark analysis (Variant III). For this project it is appropriate to apply analysis using Variation III, under the instructions of guidelines for additionality.
Sub-step 2b–Banchmark analysis.
The proposed project "Reduction of greenhouse gases emissions by gasification of Odesa region" will be implemented by the project participant, OJSC "Odesagas." The approach recommended in cl.6 (a) of

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

Guidelines for additionality provided for using of a discount rate that is determined by considering the average cost of capital (WACC). WACC is calculated as a weighted average cost of own and debt capital. Since detailed information on the structure of financing, capital structure is taken in the form of 50% of own and 50% of debt capital. In accordance with Section 18 of "Guidelines on the assessment of investment analysis ver.05"[28] cost of own capital is calculated as the sum of risk-free rate (3%), the risk premium on investment in own capital (6.5%) and country risk (6.75%)[29]. Thus the cost of own capital is 16.25%. The cost of own capital is estimated at the average cost of credit in foreign currency at the beginning of 2003 according to the NBU, which was 11.75%. Nominal discount rate (WACC) is equal to 14% respectively. And real discount rate (IRR benchmark) is adjusted by inflation index for the eurozone (2.1%)[30] because the calculations infinancial model are carried out in euros, and is equal to 11.66%[31].
If the proposed project (not implemented as a JI project) has a less favorable rate, i.e. lower internal rate of return (IRR), than the total limit level, the project may not be 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.
The project requires investment of approximately UAH 526 mln or EUR 57 million (According to the NBU's rate)[32];

1. The project duration is 18 years (minimal term of the equipment operation);
2. 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[33] and cash inflow associated with the receipt of revenues from providing of services by the enterprise.
Financial Indicators of the project are given below in Table 5.

Table5. Financial indicators of the project

Earnings from gas supply without VAT (thsEURO)	Cash flow (thsEURO)	p (discount rate)	NPV (ths EURO)	IRR (%)	Residual value (ths EURO)
47 783.53	32 484.89	11.66%	-6242.902369	6.8%	42343.82082

The source of prices for the service of gas distribution and supply provided by "Odesagas" (2.32 UAH/ths m^3) is the information provided by the company and NERC of Ukraine Decree N 983 dated 04.09.2002, Kyiv "On

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

[29] http://pages.stern.nyu.edu/~adamodar/pc/archives/ctryprem03.xls

[30] http://www.finfacts.ie/inflation.htm

[31] Accompanying document 3

[32] http://www.bank.gov.ua/Statist/ses.htm

[33] Accompanying document 2

approval of the method of calculating tariffs for the transportation and supply of natural gas for gas supply and gasification companies"[34].

When analyzing the cash flow the IRR is 6.8% that is below the established limit level of IRR which is 11.66%. As a result NPV is negative. Therefore the project can not 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 baseline terms' change. The next two key factors were considered in sensitivity analysis: investment and operational costs and tariff for natural gas transportation. According to the guidelines for additionality (paragraph 17) a sensitivity analysis should be made for key indicators in the range of variation ± 10%.

Sensitivity to changes of investment and operational costs	-10%	0%	+10%
Capital and other costs related to the project (ths EURO)	51878.2102	57642.45577	63406.70135
NPV	-4135.853691	-6242.902369	-8349.951048
IRR	8%	6.8%	5.8%
Sensitivity to changes of tarifffor natural gas transportation	-10%	0%	+10%
Profit for gas supply (ths EURO)	43005.17347	47783.52607	52561.87868
NPV	-7725.660811	-6242.902369	-4760.143928
IRR	5.7%	6.8%	7.9%

Sensitivity analysis was used to assess the sensitivity of the project to changes that may occur during the project implementation and operation. Analysis of changes of tariff for natural gas transportation in the range of -10% and +10% demonstrated that the IRR varies within 5.7% - 7.9%. Analysis of investment and operational costs in the range of -10% and +10% demonstrated that the IRR varies within 8% - 5.8%. Costs considered within the project are high, and their increase 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 Guidelines of additionality the barrier analysis was not conducted.

Step 4: Common practice analysis

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

Analysis of other activity similar to that suggested in the Project demonstrated absence of similar projects in Ukraine.

Existing practice for exploitation of existing capacities represented in the variant of the baseline selected for this Project is the common one for Ukraine. Due to the current practice all connections to the gas distribution

[34] http://zakon.nau.ua/doc/?code=v0983227-02

networks shall be borne by the end users, and the companies engaged in gas supply do not have any incentive to implement new gas supply systems.

Outcome of sub-step 4a: Since there is no similar project in Ukraine, there is no need to conduct analysis of similar project activity.
According to «Tool for the demonstration and assessment of additionality»[35] (Version 05.2) all steps are satisfied but there are still some obstacles.
One of them is additional costs for JI project implementation in:

- Gas-distribution networks (GDN);
- Gas control points (GCP);
- Cabinet-type gas-control points (CGCP);
- Gas fittings;

Barrier associated with the structure of existing tariffs for natural gas supply that are regulated by the state and do not include depreciation and investment needs of the suppliers of natural gas. This situation leads to a constant shortage of funds and the inability to timely implementation of major repairs, ensuring of equipment operation, investment in modernization and infrastructure development.
We conclude that all of the above may prejudice the introduction of the proposed project as well as other alternatives - Partial project activity (implementation of not-all project equipment) without application of Joint Implementation mechanism.
However, one of the alternatives is a continuation of "business as usual." Since the obstacles identified above are directly related to investment in modernization of fossil fuel supply system, OJSC "Odesagas" has no obstacles to further exploitation of networks at the same level. Therefore identified obstacles can not prejudice the introduction of at least one alternative scenario - continuation of "business as usual."
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:

Transportation of fossil fuels to the end consumers is associated with emissions and leakages of the following GHG:

1. GHG emissions due to combustion of fossil fuels by individuals, which include:
   1.1. GHG emissions due to fossil fuel use for boiler-houses' technological needs (fuel oil heating, drying of moulded coal, wood etc);
   1.2. indirect GHG emissions when electricity is used by equipment of boiler-houses for heat carrier supply to the end consumers;
2. GHG emissions due to fossil fuels combustion by legal entities, which include:
   2.1. indirect GHG emissions due to electricity consumption by pumping equipment of boilers for heating system and HWS needs;
   2.2. GHG emissions due to fossil fuel use for boiler-houses' technological needs (fuel oil heating, drying of moulded coal, wood etc);
   2.3. indirect GHG emissions when electricity is used by equipment of boiler-houses for heat carrier supply to the end consumers;
3. GHG emissions due to leakage of methane at technological equipment and end-users place;
4. GHG emissions due to combustion of gas fuel by gas turbine units during transportation of natural gas to end consumers;

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

5.GHG leakages due to petrol combustion by automobile transport during transportation of fuel oil and coal to end consumers.

Table 6 demonstrates the overview of GHG emission sources in the baseline scenario boundary for the project.

Table 6. An overview of all sources of emissions in the baseline scenario

Source	**Gas**	**Included / Excluded**	**Substantiation / explanation**
Baseline emissions			
GHG emissions due to fossil fuel combustion by individuals	CO_2	Included	GHG emissions due to fossil fuel combustion by end consumers. The baseline scenario provides for use of less environmentally friendly fuel (coal, fuel oil, diesel oil). The following emissions will be also taken into account: emissions due to use of fuel for technologically necessary processes of fuel oil heating, drying of moulded coal, etc.; emissions due to fossil fuel transportation to the end consumers that use it as energy carrier for hot water preparation.
GHG emissions due to fossil fuel combustion by legal entities	CO_2	Included	GHG emissions due to fossil fuel combustion by end consumers. The baseline scenario provides for use of less environmentally friendly fuel (coal, fuel oil, diesel oil). The following emissions will be also taken into account: emissions due to use of fuel for technologically necessary processes of fuel oil heating, drying of moulded coal, etc.; GHG emissions, related to the generation of the quantity of electric energy, which will be substituted as a result of project implementation (electricity losses by network and feeding pumps in the process of heat carrier transportation to the end consumer);

Table 7 demonstrates the overview of GHG emission sources in the project scenario boundary.
Table 7. An overview of all sources of emissions in the project scenario

Source	Gas	Included / Excluded	Substantiation / explanation
Project emissions			
GHG emissions due to natural gas combustion by individuals	CO_2	Included	GHG emissions from fossil fuel combustion by end consumers. The project scenario provides for use of more environmentally friendly fuel (natural gas).
GHG emissions due to natural gas combustion by legal entities	CO_2	Included	GHG emissions from fossil fuel combustion by end consumers. The project scenario provides for use of more environmentally friendly fuel (natural gas).
GHG emissions due to methane leakage at technological equipment and end consumers place	CO_2	Included	GHG emissions due to combustion of gas by gas turbine units during transportation of natural gas to end consumers
GHG emissions when transporting gas by gas transportation networks	CH_4	Included	Emissions from methane leakage at technological equipment (fittings nodes, joints, etc.)

Table 8 demonstrates the overview of possible leakage sources in the project and baseline scenarios.
Table 8 An overview of leakage sources in the project and baseline scenarios

Source	Gas	Included / Excluded	Substantiation / explanation
Leakages			
GHG leakages from oil and coal extraction activities, petrol combustion by transport during transportation of fuel oil and coal to end consumer	CO_2	Excluded	Leakages are not under control of the developer; in case of the project implementation they will be completely absent. Are excluded conservatively.

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: 14.07.2011
The baseline has been determined by VEMA S.A., project's developer, and its owner OJSC "Odesagas", supplier of the project.

OJSC "Odesagas":
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Telephone: +38(050)316 53 17
Fax:+38 (0482)723-75-94
e-mail:Info@odgaz.Odesa.ua
Website: http://www.odgaz.Odesa.ua
Gas supplying and gasification enterprise OJSC "Odesagas" is the project participant (Annex 1).

VEMAS.A.:
Geneva, Switzerland.
Fabian Knodel,
Director.
Telephone: (044)-594-48-10
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e-mail:info@vemacarbon.com
Website: www.vemacarbon.com
VEMAS.A. is the project participant (Annex 1).

SECTION C. Duration of the project / Crediting period

C.1. Starting date of the project:

The starting date of the project is deemed to be 17/06/2003 when the meetings of the management board of OJSC "Odesagas" made a decision on JI project development.

C.2. Expected operational lifetime of the project:

Real average life-cycle of new equipment is estimated to be 30 years 0 months.

C.3. Length of the crediting period:

Starting date of the crediting period: 01/01/2004.
The length of the crediting period is 17 years and 0 months (a total of 204 months) including:
- 4 years and 0 months (01/01/2004 - 12/31/2007) during the period preceding the first commitment period under the Kyoto Protocol;
- 5 years and 0 months (01/01/2008 - 12/31/2012) during the first commitment period;
- 8 years and 0 months (01/01/2013- 31/12/2020) after the first commitment period.

Extension of the crediting period beyond 2012 is subject to approval by the host Party.

SECTION D. Monitoring plan

D.1. Description of monitoring plan chosen:

The proposed project uses a specific approach to JI projects based on approved methodology ACM0009 «Consolidated baseline and monitoring methodology for fuel switching from coal or petroleum fuel to natural gas- Version 3.2»[36] and "Guidance on criteria for baseline determination and monitoring" (Version 2) of the Joint Implementation Supervisory Committee - JISC[37], which meets the requirements specified in Regulation 9 / CMP.1., Annex 1, "Criteria for baseline setting and monitoring." Monitoring plan is designed for accurate and clear measurement and calculation of greenhouse gas emissions and is conducted according to practices established at OJSC "Odesagas" for measurement of supplied and consumed natural gas. Project monitoring does not require changes in existing system of accounting and data collection. All relevant data are calculated and recorded and stored within two years after transfer of the last emission reduction units generated by the project.

The monitoring plan includes measures (measurements, maintenance, registration and calibration), which should be taken to satisfy the requirements of the chosen methodology of monitoring and guarantee the possibility of inspection of calculation on GHG emission reduction. The main stages of the monitoring plan are described below.

Data and parameters not monitored throughout the whole crediting period, but determined only once, which are available at the stage of PDD development:

GWP_{CH4}	Global warming potential
$k_{7,fuel}$	Specific saving of electric energy in the course of heat carrier transportation to end consumer with account of losses in electrical grids, kWh/GJ
$k^{b}_{1,prepfuel}$	Average efficiency factor that takes into account energy losses in the course of energy carrier preparation in the baseline scenario, relative units
$k^{p}_{1,prepfuel}$	Average efficiency factor that takes into account energy losses in the course of energy carrier preparation in the project scenario, relative units
$k^{b}_{3,ef}$	Average efficiency factor of boiler equipment that takes into account efficiency of thermal generating units in the baseline scenario, relative units
$k^{p}_{3,ef}$	Average efficiency factor of boiler equipment that takes into account efficiency of thermal generating units in the project scenario, relative units
$k^{b}_{4,pipes}$	Average efficiency factor that takes into account total losses in the heat supply networks in the baseline scenario, relative units

[36] http://cdm.unfccc.int/methodologies/DB/2CRBYLJO5JWC9YHBSWJQWYIH2LLGMJ

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

$k^{p}_{4,pipes}$	Average efficiency factor that takes into account total losses in the heat supply networks in the project scenario, relative units

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

Data and parameters controlled during the whole crediting period:

$V^{y}_{gas,PP}$	Total quantity of natural gas combusted in period "y" by individual, m^3
$V^{y}_{p,gas,LE}$	Quantity of natural gas combusted in period "y" by legal entity, m^3
$L^{y}_{p,los,1}$	Length of gas distribution systems constructed within the project, km
NCV^{y}_{gas}	Net calorific value of natural gas, TJ/ ths m^3
CEF^{y}_{elec}	GHG emission factor when electricity consumption is reduced, tCO_2e/MWh
NCV^{y}_{fuel}	Net calorific value of fossil fuel consumed of "fuel" type (Fuel of "fuel" type means coal, wood, fuel oil or diesel oil)
$k^{c}_{p,gas}$	Carbon emission factor when combusting natural gas (t/TJ)
$k^{o}_{p,gas}$	Carbon oxidation factor when combusting natural gas, relative units
k^{c}_{fuel}	Carbon emission factor when combusting fossil fuel of "fuel" type (Fuel of "fuel" type means coal, wood, fuel oil or diesel oil)
k^{o}_{fuel}	Carbon oxidation factor when combusting fossil fuel of "fuel" type
$EF^{y}_{CH_4,p,los,2}$	On default methane emission factor at technological gas equipment at end consumers place, t CH_4eq/PJ
$EF^{y}_{CH_4,p,los,1}$	On default methane emission factor in the course of natural gas transportation and distribution, t CH_4eq /ths km
$CEF^{y}_{gas,unit}$	Reduced GHG emission factor in the course of natural gas transportation to the end consumers (t CO_2eq/m^3)

D.1.1. Variant 1 – Monitoring of emissions in project and baseline scenarios:

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

Data/Parameter	$V^{y}_{gas,PP}$
Unit of measurement	Ths m^3
Description	Total quantity of natural gas combusted in period "y" by an individual
Periodicity of determination/monitoring	Monthly
Source of data (to be) used	Gas meters
Value of data applied (for ex ante calculations/determinations)	Subject to periodic monitoring
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Measurements will be performed by gas meters
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 "
Any comment	A cubic meter, reduced to standard conditions (T = 20 degrees, C, P = 101.325 kPa (760 mm. of mercury) and humidity is equal to zero) is taken as the unit of account of gas supplied to individuals and legal entities. Data about the amount of gas consumption by subscribers is the basic Data allowing for calculation of GHG emissions for each year in the project scenario; information will be archived in paper and electronic form

Data/Parameter	$V^{y}_{gas,LE}$
Unit of measurement	ths m^3
Description	Total quantity of natural gas combusted in period "y" by a legal

	entity
Periodicity of determination/monitoring	Monthly
Source of data (to be) used	Gas meters
Value of data applied (for ex ante calculations/determinations)	Subject to periodic monitoring
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Measurements will be performed by gas meters
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 "
Any comment	A cubic meter, reduced to standard conditions (T = 20 degrees, C, P = 101.325 kPa (760 mm. of mercury) and humidity is equal to zero) is taken as the unit of account of gas supplied to individuals and legal entities. Data about the amount of gas consumption by subscribers is the basic Data allowing for calculation of GHG emissions for each year in the project scenario; information will be archived in paper and electronic form

Data/Parameter	NCV_{gas}^{y}
Unit of measurement	TJ/mln m^3
Description	Net calorific value of natural gas
Periodicity of determination/monitoring	Annually
Source of data (to be) used	The national inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine for 1990-2009. Table P.2.24[38]

[38] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip

Value of data applied (for ex ante calculations/determinations)	Subject to periodic monitoring
Justification of the choice of data or description of measurement methods and procedures (to be) applied	The parameter is used according to the approved CDM methodology ACM0009 and "Guidance on criteria for baseline setting and monitoring». Net calorific value of natural gas that is based on officially approved national data will be used.
QA/QC procedures (to be) applied	Officially approved national data that are actual at the moment of the monitoring report preparation will be used.
Any comment	Minimal value of gas calorific value is used according to the principles of conservatism

Data/Parameter	$L^{y}_{p,los,1}$
Unit of measurement	km
Description	Length of gas distribution systems constructed within the project
Periodicity of determination/monitoring	Monthly
Source of data (to be) used	Commissioning of gas distribution networks certificate
Value of data applied (for ex ante calculations/determinations)	Subject to periodic monitoring
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Monitoring of the length of constructed gas distribution systems will be carried out by responsible people on the basis of commissioning certificates for each monitoring period
QA/QC procedures (to be) applied	See Section D.2. below
Any comment	Data allowing for calculation of GHG emissions in the project scenario; information will be archived in paper and electronic form

Data/Parameter	$k^{c}_{p,gas}$
Unit of measurement	t C/TJ
Description	Carbon emission factor when combusting natural gas
Periodicity of determination/monitoring	Annually
Source of data (to be) used	The national inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine for 1990-2009. Table P.2.26[39]
Value of data applied (for ex ante calculations/determinations)	Subject to periodic monitoring
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Carbon emission factor when combusting natural gas is used to determine the carbon dioxide emission factor by default for stationary combustion of natural gas in Ukraine. The data source for this parameter is the National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine, based on approved national data.
QA/QC procedures (to be) applied	Officially approved national data that are actual at the moment of the monitoring report preparation will be used.
Any comment	Data allowing for calculation of GHG emissions in the baseline scenario; information will be archived in paper and electronic form

Data/Parameter	$k^{o}_{p,gas}$
Unit of measurement	Relative units
Description	Carbon oxidation factor when combusting natural gas
Periodicity of determination/monitoring	Annually
Source of data (to be) used	The national inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine for

[39] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip

	1990-2009. Table P.2.27[40]
Value of data applied (for ex ante calculations/determinations)	Subject to periodic monitoring
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Carbon oxidation factor when combusting natural gas is used to determine the carbon dioxide emission factor by default for stationary combustion of natural gas in Ukraine. The data source for this parameter is the National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine, based on approved national data.
QA/QC procedures (to be) applied	Officially approved national data that are actual at the moment of the monitoring report preparation will be used.
Any comment	Data allowing for calculation of GHG emissions in the baseline scenario; information will be archived in paper and electronic form

Data/Parameter	$EF^{y}_{CH_4,p,los,1}$
Unit of measurement	t CH_4-e/ths km
Description	On default methane emission factor in the course of natural gas transportation and distribution
Periodicity of determination/monitoring	Annually
Source of data (to be) used	The national inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine for 1990-2009. Table 1.V.2
Value of data applied (for ex ante calculations/determinations)	Subject to periodic monitoring
Justification of the choice of	On default methane emission factor in the course of natural gas

[40] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip

data or description of measurement methods and procedures (to be) applied	transportation and distribution is used for determining of GHG emissions from methane leakage at technological equipment. The data source for this parameter is the National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine, based on approved national data.
QA/QC procedures (to be) applied	Officially approved national data that are actual at the moment of the monitoring report preparation will be used.
Any comment	Data allowing for calculation of GHG emissions in the baseline scenario; information will be archived in paper and electronic form

Data/Parameter	$EF^{y}_{CH_4,p,los,2}$
Unit of measurement	t CH_4e/PJ
Description	On default methane emission factor at technological gas equipment at end consumers place
Periodicity of determination/monitoring	Annually
Source of data (to be) used	The national inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine for 1990-2009. Table 1.V.2
Value of data applied (for ex ante calculations/determinations)	Subject to periodic monitoring
Justification of the choice of data or description of measurement methods and procedures (to be) applied	On default methane emission factor at technological gas equipment and at end consumers place is used for determining of GHG emissions from methane leakage at technological equipment at end consumer place. The data source for this parameter is the National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine, based on approved national data.
QA/QC procedures (to be) applied	Officially approved national data that are actual at the moment of the monitoring report preparation will be used.

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

Data/Parameter	$CEF^{y}_{gas,unit}$
Unit of measurement	tCO_2e/ m^3
Description	Reduced GHG emission factor in the course of natural gas transportation to the end consumers
Periodicity of determination/monitoring	Once at the beginning of the project
Source of data (to be) used	Official data of the Ministry of Fuel and Energy of Ukraine and the National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine. Detailed calculation and the references to data sources are provided in the accompanying document 1.18 .- Excel file and Annex 3.
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	See Annex 3
QA/QC procedures (to be) applied	Calculations are based on officially approved data of the Ministry of Fuel and Energy of Ukraine and the National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine
Any comment	N/A

Data/Parameter	GWP_{CH4}
Unit of measurement	$t\ CO_2e / t\ CH_4$
Description	Global warming potential for methane
Periodicity of determination/monitoring	Once at the beginning of the project

Source of data (to be) used	According to data approved by the IPCC
Value of data applied (for ex ante calculations/determinations)	21
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Global warming potential for methane is determined according to the decision 2/CP.3 and provided in IPCC Guidelines
QA/QC procedures (to be) applied	The value is used for the first commitment period and may subsequently be revised in accordance with Article 5 of the Kyoto Protocol.
Any comment	

Data/Parameter	CEF_{elec}^{y}
Data unit	tCO_2/MWh
Description	GHG emission factor when electricity consumption is reduced
Time of determination/monitoring	Annually
Source of data (to be) used	Carbon dioxide emission factors for 2004-2005 are taken from the document issued by the Ministry of economy of Netherland "Operational Guidelines for Project Design Documents of Joint Implementation Projects Volume 1: General guidelines" (ERUPT)[41] - Carbon dioxide emission factors for 2006-2007 are taken from the document "Carbon dioxide emission factors (for energy consumption according to the methodology "Ukraine - Assessment of new calculation of CEF", approved by TUV SUD 17.08.2007)[42]; - Carbon dioxide emission factors for 2008 are taken from Order of the National Environmental Investment Agency of Ukraine

[41] http://ji.unfccc.int/CallForInputs/BaselineSettingMonitoring/ERUPT/index.html

[42] http://ji.unfccc.int/UserManagement/FileStorage/46JW2KL36KM0GEMI0PHDTQF6DVI514

<table>
<tr><td></td><td>(hereinafter - NEIAU) № 62 of 15.04.2011 "On approval of specific carbon dioxide emission factors in 2008[43]";
- Carbon dioxide emission factors for 2009 are taken from the Order of NEIAU # 63 of 15.04.2011 "On approval of specific carbon dioxide emission factors in 2009"[44];
- Carbon dioxide emission factors for 2010 are taken from the Order of NEIAU # 43 of 28.03.2011. "On approval of specific carbon dioxide emission factors in 2010"[45];
- Carbon dioxide emission factors for 2011 are taken from the Order of NEIAU # 75 of 12.05.2011. "On approval of specific carbon dioxide emission factors in 2011"[46];</td></tr>
<tr><td>Value of data applied (for ex ante calculations/determinations)</td><td><table><tr><th>2004</th><th>2005</th><th>2006-2007</th><th>2008</th><th>2009</th><th>2010</th><th>2011</th></tr><tr><td>0.916</td><td>0.896</td><td>0.896</td><td>1.082</td><td>1.096</td><td>1.093</td><td>1.090</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>When developing the joint implementation project national GHG emission factors are used, in case of their absence factors for 2004-2005 are taken from ERUPT, factors for 2006-2007 are taken from the document “Carbon dioxide emission factor” approved TUV SUD</td></tr>
<tr><td>QA/QC procedures (to be) Applied</td><td>Only officially approved factors are used for calculations.</td></tr>
<tr><td>Any comment</td><td>Researches don’t take into consideration production of energy by nuclear power plants</td></tr>
</table>

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

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

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

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

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

GHG emissions, in the project scenario:

$$PE_p^y = PE_{p,gas,PP}^y + PE_{p,gas,LE}^y + PE_{p,los}^y + PE_{tp,gf}^y, \quad \text{(D.1)}$$

where:

$PE_{p,gas,PP}^y$ - GHG emissions from natural gas combustion by "PP" type consumers during the period «y», in the project scenario (t CO_2e);

$PE_{p,gas,LE}^y$ - GHG emissions from natural gas combustion by «LE» type consumers during the period «y», in the project scenario (t CO_2e);

$PE_{p,los}^y$ - GHG emissions from leakage of methane on production equipment and end-users for period «y», in the project scenario (t CO_2e);

$PE_{tp,gf}^y$ - GHG emissions from gas fuel combustion by gas-turbine installations when transporting natural gas to end consumers (t CO_2e);

$[y]$ - index corresponding to monitoring period;

$[p]$ - index corresponding to project scenario;

$[PP]$ - index corresponding to individual;

$[LE]$ - index corresponding to legal entity.

$$PE_{p,gas,PP}^y = \sum_{pp=1}^{PP} V_{gas,PP}^y * NCV_{gas}^y * EF_{p,gas}^y, \quad \text{(D.2)}$$

where:

$\sum_{pp=1}^{PP} V_{gas,PP}^y$ - Total quantity of natural gas combusted in period «y» by individuals (ths m^3);

NCV_{gas}^y - Net calorific value of natural gas (TJ/ths m^3);

$EF_{p,gas}^y$ - on default carbon dioxide emission factor for permanent combustion of natural gas (t CO_2e /TJ).

$[y]$ - index corresponding to monitoring period;

$[p]$ - index corresponding to project scenario;

$[PP]$ - index corresponding to individual.

$$EF_{p,gas}^y = k_{p,gas}^c * k_{p,gas}^o * 44/12, \quad \text{(D.3)}$$

where:

$k^{c}_{p,gas}$ - Carbon emission factor in the course of natural gas combustion (t C/TJ);

$k^{o}_{p,gas}$ - Carbon oxidation factor in the course of natural gas combustion (relative units);

$44/12$ - stoichiometric correlation of molecular weight of carbon dioxide and carbon, t CO_2e /t C;

$[y]$ - index corresponding to monitoring period;

$[p]$ - index corresponding to project scenario.

$$PE^{y}_{p,gas,LE} = \sum_{le=1}^{LE} V^{y}_{gas,LE} * NCV^{y}_{gas} * EF^{y}_{p,gas}, \quad \text{(D.4)}$$

Where:

$\sum_{le=1}^{LE} V^{y}_{gas,LE}$ - Total quantity of natural gas combusted in period «y» by legal entities, in the project scenario (ths m^3);

NCV^{y}_{gas} - Net calorific value of natural gas (TJ/ths m^3);

$EF^{y}_{p,gas}$ - on default carbon dioxide emission factor for permanent combustion of natural gas (t CO_2e /TJ).

$[y]$ - index corresponding to monitoring period;

$[p]$ - index corresponding to project scenario;

$[LE]$ - index corresponding to legal entity.

$$PE^{y}_{p,los} = PE^{y}_{p,los,1} + PE^{y}_{p,los,2}, \quad \text{(D.5)}$$

where:

$PE^{y}_{p,los,1}$ - GHG emissions from methane leakage at technological equipment in period «y», in the project scenario (t CO_2e);

$PE^{y}_{p,los,2}$ - GHG emissions from methane leakage at equipment of end consumers in period «y», in the project scenario (t CO_2e);

$[y]$ - index corresponding to monitoring period;

$[p]$ - index corresponding to project scenario.

$$PE^{y}_{p,los,1} = \sum L^{y}_{p,los,1} * EF^{y}_{CH_4,p,los,1} * GWP_{CH_4}, \quad \text{(D.6)}$$

where:

$L^{y}_{p,los,1}$ - Length of gas distribution systems constructed under the project (ths km);

$EF^{y}_{CH_4,p,los,1}$ - on default methane emission factor in the course of natural gas transportation and distribution (t CH_4e /ths km);

GWP_{CH4} - global warming potential for methane. It is determined according to the recommendation of Intergovernmental Panel on Climate Change.

$$PE^{y}_{p,los,2} = (\sum_{le=1}^{LE} V^{y}_{gas,LE} + \sum_{pp=1}^{PP} V^{y}_{gas,PP}) * NCV^{y}_{gas} * EF^{y}_{CH_4,p,los,2} * GWP_{CH_4}, \quad (D.7)$$

where:

$\sum_{pp=1}^{PP} V^{y}_{gas,PP}$ - Total quantity of natural gas combusted in period «y» by individuals, (ths m^3);

$\sum_{le=1}^{LE} V^{y}_{gas,LE}$ - Total quantity of natural gas combusted in period «y» by legal entities, in the project scenario (ths m^3);

NCV^{y}_{gas} - Net calorific value of natural gas, (TJ/ths m^3);

$EF^{y}_{CH_4,p,los,2}$ - on default methane emission factor at technological gas equipment at end consumer place (t CH_4e /PJ).

GWP_{CH4} - global warming potential for methane. It is determined according to the recommendation of Intergovernmental Panel on Climate Change.

$[y]$ - index corresponding to monitoring period;

$[p]$ - index corresponding to project scenario;

$[PP]$ - index corresponding to individual;

$[LE]$ - index corresponding to legal entity.

Calculation of GHG emissions (from gas combustion by gas turbine units) during transportation of gas by gas distribution networks:

$$PE^{y}_{tp,gf} = (\sum_{le=1}^{LE} V^{y}_{gas,LE} + \sum_{pp=1}^{PP} V^{y}_{gas,PP}) * CEF^{y}_{gas,unit} \quad (D.8)$$

where:

$\sum_{pp=1}^{PP} V^{y}_{gas,PP}$ - total quantity of natural gas combusted during the period «y» by individuals (ths m^3);

$\sum_{le=1}^{LE} V_{gas,LE}^{y}$ - total volume of natural gas combusted in period "y" by legal entities, in the project scenario(ths m^3).

$CEF_{gas,unit}^{y}$ - Reduced GHG emission factor in the course of natural gas transportation to the end consumers (t CO_{2e}/m^3). Determination of the factor is provided in section of Annex 3 and accompanying Excel file.

CO_2 emission factors for all consumed types of fuel are taken from reports of IPCC[47]or taken in accordance with National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine[48].

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

[48] http://www.neia.gov.ua/nature/doccatalog/document?id=124939

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	$V^{y}_{gas,PP}$
Unit of measurement	ths m^3
Description	Total quantity of natural gas combusted in period «y» by an individual
Periodicity of determination/monitoring	Monthly
Source of data (to be) used	Gas meters
Value of data applied (for ex ante calculations/determinations)	Subject to periodic monitoring
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Measurements will be performed by gas meters
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"
Any comment	A cubic meter, reduced to standard conditions (T = 20 degrees, C, P = 101.325 kPa (760 mm. of mercury) and humidity is equal to zero) is taken as the unit of account of gas supplied to individuals and legal entities. Data about the amount of gas consumption by subscribers is the basic Data allowing for calculation of GHG emissions for each year in the project scenario; information will be archived in paper and electronic form

Data/Parameter	$V^{y}_{gas,LE}$
Unit of measurement	ths m^3
Description	Total quantity of natural gas combusted in period «y» by a legal entity, in the project scenario

Periodicity of determination/monitoring	Monthly
Source of data (to be) used	Gas meters
Value of data applied (for ex ante calculations/determinations)	Subject to periodic monitoring
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Measurements will be performed by gas meters
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"
Any comment	A cubic meter, reduced to standard conditions (T = 20 degrees, C, P = 101.325 kPa (760 mm. of mercury) and humidity is equal to zero) is taken as the unit of account of gas supplied to individuals and legal entities. Data about the amount of gas consumption by subscribers is the basic Data allowing for calculation of GHG emissions for each year in the project scenario; information will be archived in paper and electronic form

Data/Parameter	NCV_{fuel}^{y}
Unit of measurement	TJ/ ths t
Description	Net calorific value of fossil fuel of «fuel» type (Fuel of "fuel" type means coal, wood, fuel oil or diesel oil).
Periodicity of determination/monitoring	Annually
Source of data (to be) used	The national inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine for 1990-2009. Table P.2.24[49].

[49] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip

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	The parameter is used according to the approved CDM methodology ACM0009 and "Guidance on criteria for baseline setting and monitoring». Net calorific value of natural gas that is based on officially approved national data will be used. Data on the type of fossil fuel used by the consumer before the gasification are provided by district administrations and village councils.
QA/QC procedures (to be) applied	Officially approved national data that are actual at the moment of the monitoring report preparation will be used.
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_{gas}^{y}
Unit of measurement	TJ/ mln m^3
Description	Net calorific value of natural gas
Periodicity of determination/monitoring	Annually
Source of data (to be) used	The national inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine for 1990-2009. Table P.2.24[50].
Value of data applied (for ex ante calculations/determinations)	Subject to periodic monitoring
Justification of the choice of data or description of measurement methods and	The parameter is used according to the approved CDM methodology ACM0009 and "Guidance on criteria for baseline setting and monitoring». Net calorific value of natural gas that is

[50] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip

procedures (to be) applied	based on officially approved national data will be used.
QA/QC procedures (to be) applied	Officially approved national data that are actual at the moment of the monitoring report preparation will be used.
Any comment	According to principle of conservatism principles minimal calorific value of gas is used.

Data/Parameter	k_{fuel}^{c}
Unit of measurement	T C/TJ
Description	Carbon emission factor when combusting fossil fuel of "fuel" type. (Fuel of «fuel» type means coal, wood, fuel oil, diesel oil).
Periodicity of determination/monitoring	Annually
Source of data (to be) used	The national inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine for 1990-2009. Table P.2.26[51].
Value of data applied (for ex ante calculations/determinations)	Subject to periodic monitoring
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Carbon emission factor when combusting natural gas is used to determine the carbon dioxide emission factor by default for stationary combustion of natural gas in Ukraine. The data source for this parameter is the National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine, based on approved national data.
QA/QC procedures (to be) applied	Officially approved national data that are actual at the moment of the monitoring report preparation will be used.
Any comment	Data allowing for calculation of GHG emissions in the baseline scenario; information will be archived in paper and electronic form

[51] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip

Data/Parameter	k^{o}_{fuel}
Unit of measurement	Relative units
Description	Carbon oxidation factor when combusting fossil fuel of "fuel" type
Periodicity of determination/monitoring	Annually
Source of data (to be) used	The national inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine for 1990-2009. Table P.2.27[52].
Value of data applied (for ex ante calculations/determinations)	Subject to periodic monitoring
Justification of the choice of data or description of measurement methods and procedures (to be) applied	Carbon oxidation factor when combusting natural gas is used to determine the carbon dioxide emission factor by default for stationary combustion of natural gas in Ukraine. The data source for this parameter is the National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine, based on approved national data.
QA/QC procedures (to be) applied	Officially approved national data that are actual at the moment of the monitoring report preparation will be used.
Any comment	Data allowing for calculation of GHG emissions in the baseline scenario; information will be archived in paper and electronic form

Data/Parameter	$k_{7,fuel}$
Unit of measurement	kWh/GJ
Description	Specific saving of electric energy in the course of heat carrier transportation to end consumer with account of losses in electrical

[52] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2011-nir-08jun.zip

	grids
Periodicity of determination/monitoring	Once at the beginning of the project
Source of data (to be) used	Report «Determination of change of specific energy data of heat supply system in the course of gasification" developed by "UKRENERGOPROM-2" as of June 24, 2011. Also this report received a positive review from the "Institute of Engineering Thermophysics, NAS of Ukraine." The report is provided to the State Environmental Investment Agency as a separate accompanying document.
Value of data applied (for ex ante calculations/determinations)	2.016
Justification of the choice of data or description of measurement methods and procedures (to be) applied	This applies only to individuals who were previously connected to central heating system. This factor was determined by analyzing the actual performance characteristics of technological equipment located in different regions of Ukraine (Odesa, Donetsk, Kyiv regions). The use of the factor is possible throughout Ukraine. The specified value (2.016) applies only if consumers switch from centralized heating systems, which ran on fossil fuel of "fuel" type, to gasified centralized or individual systems. Otherwise, the value of 0 is used.
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	$k^{b}_{1,\,prepfuel}$
Unit of measurement	Relative units
Description	Average efficiency factor that takes into account energy loss in the

<table>
<tr><td></td><td>course of energy carrier preparation, in the baseline scenario</td></tr>
<tr><td>Periodicity of determination/monitoring</td><td>Once</td></tr>
<tr><td>Source of data (to be) used</td><td>Report «Determination of change of specific energy data of heat supply system in the course of gasification”. The report is provided to the State Environmental Investment Agency as a separate accompanying document.</td></tr>
<tr><td>Value of data applied (for ex ante calculations/determinations)</td><td>
<table>
<tr><td rowspan="2">Basic source of heat</td><td colspan="2">Baseline fuel</td></tr>
<tr><td>Fuel oil</td><td>Coal</td></tr>
<tr><td>Central system</td><td>0.965</td><td>0.965</td></tr>
<tr><td>Individual system</td><td>1</td><td>1</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>This applies in case of transfer of individual and central heat supply systems to gas. This factor was determined by analyzing the actual performance characteristics of technological equipment located in different regions of Ukraine (Odesa, Donetsk, Kyiv regions). The use of the factor is possible throughout Ukraine.
The specified values apply in case of transfer of individual or central heat supply systems to gas. Otherwise, the value of 1 is used.</td></tr>
<tr><td>QA/QC procedures (to be) applied</td><td>N/A</td></tr>
<tr><td>Any comment</td><td>Data allowing for calculation of GHG emissions in the baseline scenario; information is archived in paper and electronic form</td></tr>
</table>

Data/Parameter	$k^{p}_{1,\,prepfuel}$
Unit of measurement	Relative units
Description	Average efficiency factor that takes into account energy loss in the course of energy carrier preparation, in the project scenario
Periodicity of	Once

<table>
<tr><td>determination/monitoring</td><td></td></tr>
<tr><td>Source of data (to be) used</td><td>Report «Determination of change of specific energy data of heat supply system in the course of gasification”. The report is provided to the State Environmental Investment Agency as a separate accompanying document.</td></tr>
<tr><td>Value of data applied (for ex ante calculations/determinations)</td><td><table>
<tr><td rowspan="2">Project source of heat</td><td>Project fuel</td></tr>
<tr><td>Natural gas</td></tr>
<tr><td>Central system</td><td>0.98</td></tr>
<tr><td>Individual system</td><td>1</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>This applies in case of transfer of individual and central heat supply systems to gas. This factor was determined by analyzing the actual performance characteristics of technological equipment located in different regions of Ukraine (Odesa, Donetsk, Kyiv regions). The use of the factor is possible throughout Ukraine.
The specified values apply in case of transfer of individual or central heat supply systems to gas. Otherwise, the value of 1 is used.</td></tr>
<tr><td>QA/QC procedures (to be) applied</td><td>N/A</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	$k_{3,ef}^{b}$
Unit of measurement	Relative units
Description	Average efficiency factor of boiler equipment that takes into account efficiency of thermal generating units in the baseline scenario
Periodicity of determination/monitoring	Once at the beginning of the project

<table>
<tr><td>Source of data (to be) used</td><td>Report «Determination of change of specific energy data of heat supply system in the course of gasification”. The report is provided to the State Environmental Investment Agency as a separate accompanying document.</td></tr>
<tr><td>Value of data applied (for ex ante calculations/determinations)</td><td><table>
<tr><td rowspan="2">Basic source of heat</td><td colspan="2">Baseline fuel</td></tr>
<tr><td>Fuel oil</td><td>Coal</td></tr>
<tr><td>Central system</td><td>0.79</td><td>0.76</td></tr>
<tr><td>Individual system</td><td>-</td><td>0.74</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>This applies in case of transfer of individual and central heat supply systems to gas. This factor was determined by analyzing the actual performance characteristics of technological equipment located in different regions of Ukraine (Odesa, Donetsk, Kyiv regions). Using of the factor is possible throughout Ukraine.
The specified values apply in case of transfer of individual or central heat supply systems to gas. Otherwise, the value of 1 is used.</td></tr>
<tr><td>QA/QC procedures (to be) applied</td><td>N/A</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	$k_{3,ef}^{p}$
Unit of measurement	Relative units
Description	Average efficiency factor of boiler equipment that takes into account efficiency of thermal generating units, in the project scenario
Periodicity of determination/monitoring	Once at the beginning of the project
Source of data (to be) used	Report «Determination of change of specific energy data of heat

<table>
<tr><td></td><td>supply system in the course of gasification". The report is provided to the State Environmental Investment Agency as a separate accompanying document.</td></tr>
<tr><td>Value of data applied (for ex ante calculations/determinations)</td><td><table>
<tr><td rowspan="2">Project source of heat</td><td>Project fuel</td></tr>
<tr><td>Natural gas</td></tr>
<tr><td>Central system</td><td>0.92</td></tr>
<tr><td>Individual system</td><td>0.92</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>This applies in case of transfer of individual and central heat supply systems to gas. This factor was determined by analyzing the actual performance characteristics of technological equipment located in different regions of Ukraine (Odesa, Donetsk, Kyiv regions).The use of the factor is possible throughout Ukraine.
The specified values apply in case of transfer of individual or central heat supply systems to gas. Otherwise, the value of 1 is used.</td></tr>
<tr><td>QA/QC procedures (to be) applied</td><td>N/A</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	$k^{b}_{4,pipes}$
Unit of measurement	Relative units
Description	Average efficiency factor that takes into account heat energy losses in the course of heat carrier transportation to the end consumer, in the baseline scenario
Periodicity of determination/monitoring	Once
Source of data (to be) used	Report «Determination of change of specific energy data of heat supply system in the course of gasification". The report is provided

<table>
<tr><td></td><td>to the State Environmental Investment Agency as a separate accompanying document.</td></tr>
<tr><td>Value of data applied (for ex ante calculations/determinations)</td><td>
<table>
<tr><td rowspan="2">Basic source of heat</td><td colspan="3">Baseline fuel</td></tr>
<tr><td>Fuel oil</td><td>Wood</td><td>Coal</td></tr>
<tr><td>Central system</td><td>0.844</td><td>0.844</td><td>0.844</td></tr>
<tr><td>Individual system</td><td>0.844</td><td>0.844</td><td>0.844</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>This applies in case of transfer of individual and central heat supply systems to gas. This factor was determined by analyzing the actual performance characteristics of technological equipment located in different regions of Ukraine (Odesa, Donetsk, Kyiv regions).The use of the factor is possible throughout Ukraine.
The specified values apply in case of transfer of individual or central heat supply systems to gas. Otherwise, the value of 1 is used.</td></tr>
<tr><td>QA/QC procedures (to be) applied</td><td>N/A</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	$k^{p}_{4,pipes}$
Unit of measurement	Relative units
Description	Average efficiency factor that takes into account heat energy losses in the course of heat carrier transportation to the end consumer, in the project scenario
Periodicity of determination/monitoring	Once
Source of data (to be) used	Report «Determination of change of specific energy data of heat supply system in the course of gasification". The report is provided to the State Environmental Investment Agency as a separate

<table>
<tr><td></td><td>accompanying document.</td></tr>
<tr><td>Value of data applied (for ex ante calculations/determinations)</td><td><table>
<tr><td rowspan="2">Project source of heat</td><td>Project fuel</td></tr>
<tr><td>Natural gas</td></tr>
<tr><td>Central system</td><td>0.844</td></tr>
<tr><td>Individual system</td><td>1</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>This applies in case of transfer of individual and central heat supply systems to gas. This factor was determined by analyzing the actual performance characteristics of technological equipment located in different regions of Ukraine (Odesa, Donetsk, Kyiv regions).The use of the factor is possible throughout Ukraine.
The specified values apply in case of transfer of individual or central heat supply systems to gas. Otherwise, the value of 1 is used.</td></tr>
<tr><td>QA/QC procedures (to be) applied</td><td>N/A</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	CEF_{elec}^{y}
Data unit	tCO_2/MWh
Description	GHG emission factor when electricity consumption is reduced
Time of determination/monitoring	Annually
Source of data (to be) used	Carbon dioxide emission factors for 2004-2005 are taken from the document issued by the Ministry of economy of Netherland "Operational Guidelines for Project Design Documents of Joint Implementation Projects Volume 1: General guidelines" (ERUPT)[53]

[53]http://ji.unfccc.int/CallForInputs/BaselineSettingMonitoring/ERUPT/index.html

<table>
<tr><td></td><td>- Carbon dioxide emission factors for 2006-2007 are taken from the document “Carbon dioxide emission factors (for energy consumption according to the methodology "Ukraine - Assessment of new calculation of CEF", approved by TUV SUD 17.08.2007)[54];
- Carbon dioxide emission factors for 2008 are taken from Order of the National Environmental Investment Agency of Ukraine (hereinafter - NEIAU) № 62 of 15.04.2011 "On approval of specific carbon dioxide emission factors in 2008[55]";
- Carbon dioxide emission factors for 2009 are taken from the Order of NEIAU # 63 of 15.04.2011 "On approval of specific carbon dioxide emission factors in 2009”[56];
- Carbon dioxide emission factors for 2010 are taken from the Order of NEIAU # 43 of 28.03.2011. "On approval of specific carbon dioxide emission factors in 2010"[57];
- Carbon dioxide emission factors for 2011 are taken from the Order of NEIAU # 75 of 12.05.2011. "On approval of specific carbon dioxide emission factors in 2011"[58];</td></tr>
<tr><td>Value of data applied (for ex ante calculations/determinations)</td><td><table>
<tr><th>2004</th><th>2005</th><th>2006-2007</th><th>2008</th><th>2009</th><th>2010</th><th>2011</th></tr>
<tr><td>0.916</td><td>0.896</td><td>0.896</td><td>1.082</td><td>1.096</td><td>1.093</td><td>1.090</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>When developing the joint implementation project national GHG emission factors are used, in case of their absence factors for 2004-2005 are taken from ERUPT, factors for 2006-2007 are taken from the document “Carbon dioxide emission factor” approved TUV</td></tr>
</table>

[54] http://ji.unfccc.int/UserManagement/FileStorage/46JW2KL36KM0GEMI0PHDTQF6DVI514

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

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

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

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

	SUD
QA/QC procedures (to be) Applied	Only officially approved factors are used for calculations.
Any comment	N/A

Data/Parameter	$CEF^{y}_{gas,unit}$
Data unit	t CO_2eq/ m^3
Description	Reduced GHG emission factor in the course of natural gas transportation to end consumers
Time of determination/monitoring	Once at the beginning of the projecty
Source of data (to be) used	Official data of the Ministry of Fuel and Energy of Ukraine and the national inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine for 1990-2009. Detailed calculation and the reference to the source of data are provided in the accompanying document 1.18 .- Excel file and Annex 3.
Value of data applied (for ex ante calculations/determinations)	
Justification of the choice of data or description of measurement methods and procedures (to be) applied	See Annex 3
QA/QC procedures (to be) Applied	Calculations are based on the officially approved national data of the Ministry of Fuel and Energy of Ukraine and the national inventory report of anthropogenic emissions by sources and

Reduced GHG emission factor in the course of transportation of 1 m^3 of gas, CEF_{gas}^{unit}, t CO_2/m^3			
2003	2004	2005	2006
0.000072	0.000071	0.000094	0.00007
2007	2008	2009	2010
0.000066	0.000073	0.000057	0.000055

	removals by sinks of greenhouse gases in Ukraine.
Any comment	N/A

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

GHG emissions, in the baseline scenario:

$$BE_b^y = BE_{b,\,fuel,PP}^y + BE_{b,\,fuel,LE}^y, \quad \text{(D.9)}$$

where:

$BE_{b,\,fuel,PP}^y$ - GHG emissions from fossil fuel of "fuel" type combustion by consumers of "PP" type during the period «y», in the baseline scenario (t CO_2e);

$BE_{b,\,fuel,LE}^y$ - GHG emissions from fossil fuel of "fuel" type combustion by consumers of «LE» type during the period «y», in the baseline scenario (t CO_2e);

$[y]$ - index corresponding to monitoring period;

$[b]$ - index corresponding to baseline scenario;

$[fuel]$ - index corresponding to type of fossil fuel (coal, wood, fuel oil or diesel oil);

$[PP]$ - index corresponding to individual;

$[LE]$ - index corresponding to legal entity.

$$BE_{b,\,fuel,PP}^y = \sum_{pp=1}^{PP} V_{fuel,PP}^y * NCV_{fuel}^y * k_{h,\,fuel} * (EF_{b,\,fuel}^y + k_{7,\,fuel} CEF_{elec}^y), \quad \text{(D.10)}$$

where:

$\sum_{pp=1}^{PP} V_{fuel,PP}^y$ - Total quantity of fossil fuel of "fuel" type combusted in period «y» by individual, in the absence of the project (t);

NCV_{fuel}^y - Net calorific value of fossil fuel of "fuel" type, (TJ/ t);

$EF_{b,\,fuel}^y$ - carbon dioxide emission factor on default for permanent combustion of fossil fuel of "fuel" type, in the baseline scenario (t CO_2e /TJ);

$k_{h,\,fuel}$ - adjusting factor;

$k_{7,\,fuel}$ - Specific saving of electric energy in the course of heat carrier transportation to end consumer with account of losses in electrical grids (kWh/GJ).

CEF_{elec}^{y} - GHG emission factor in case of electric power consumption reduction (t CO_2e /MWh);

$[y]$ - index corresponding to monitoring period;

$[b]$ - index corresponding to baseline scenario;

$[fuel]$ - index corresponding to type of fossil fuel;

$[PP]$ - index corresponding to individual.

$$V_{fuel,PP}^{y} = V_{gas,PP}^{y} * \frac{NCV_{gas,}^{y}}{NCV_{fuel}^{y}}, \quad \text{(D.11)}$$

where:

$V_{gas,PP}^{y}$ - Total quantity of natural gas combusted in period «y» by an individual,(ths m^3);

$NCV_{gas,}^{y}$ - Net calorific value of natural gas, (TJ/ t);

NCV_{fuel}^{y} - Net calorific value of fossil fuel of "fuel" type, (TJ/ t);

$[y]$ - index corresponding to monitoring period;

$[b]$ - index corresponding to baseline scenario;

$[gas]$ - index corresponding to natural gas;

$[fuel]$ - index corresponding to type of fossil fuel;

$[PP]$ - index corresponding to individual.

$$EF_{b,fuel}^{y} = k_{fuel}^{c} * k_{fuel}^{o} * 44/12, \quad \text{(D12)}$$

where:

k_{fuel}^{c} - Carbon emission factor in the course of combustion of fossil fuel of «fuel» type (t C/TJ);

k_{fuel}^{o} - Carbon oxidation factor when combusting fossil fuel of "fuel" type (relative units);

$44/12$ - stoichiometric correlation of molecular weight of carbon dioxide and carbon, t CO_2e /t C.

Adjusting factor:

$$k_{h,\,fuel} = \frac{k^{p}_{1,\,prepfuel}}{k^{b}_{1,\,prepfuel}} * \frac{k^{p}_{2,transfuel}}{k^{b}_{2,transfuel}} * \frac{k^{p}_{3,ef}}{k^{b}_{3,ef}} * \frac{k^{p}_{4,\,pipes}}{k^{b}_{4,\,pipes}}, \qquad \text{(D.13)}$$

where:

$k^{b}_{1,\,prepfuel}$ - factor that takes into account energy loss in the course of energy carrier preparation in the baseline scenario. This factor applies in case of transfer of individual and central heat supply systems to gas.

$k^{p}_{1,\,prepfuel}$ - factor that takes into account energy loss in the course of energy carrier preparation in the project scenario. This factor applies in case of transfer of individual and central heat supply systems to gas.

$k^{b}_{3,ef}$ - efficiency factor of boiler equipment that takes into account efficiency of thermal generating units in the baseline scenario. This factor applies in case of transfer of individual and central heat supply systems to gas.

$k^{p}_{3,ef}$ - efficiency factor of boiler equipment that takes into account efficiency of thermal generating units in the project scenario. This factor applies in case of transfer of individual and central heat supply systems to gas.

$k^{b}_{4,\,pipes}$ - efficiency factor that takes into account heat energy losses in the course of heat carrier transportation to the end consumer, in the baseline scenario. This factor applies in case of transfer of individual and central heat supply systems to gas.

$k^{p}_{4,\,pipes}$ - efficiency factor that takes into account heat energy losses in the course of heat carrier transportation to the end consumer, in the project scenario. This factor applies in case of transfer of individual and central heat supply systems to gas.

$$BE^{y}_{b,\,fuel,LE} = \sum_{le=1}^{LE} V^{y}_{fuel,LE} * NCV^{y}_{fuel} * k_{m,\,fuel}, \qquad \text{(D.14)}$$

where:

$\sum V^{y}_{fuel,LE}$ - total quantity of fossil fuel of «fuel» type, combusted during «y» period by legal entity, (t);

NCV^{y}_{fuel} - Net calorific value of fossil fuel of “fuel” type, in the baseline scenario (TJ/ t);

$EF^{y}_{b,\,fuel}$ - on default carbon dioxide emission factor for permanent combustion of fossil fuel of “fuel” type, in the baseline scenario (t CO_2e /TJ);

$k_{m,\,fuel}$ - adjusting factor;

$[y]$ - index corresponding to monitoring period;

$[b]$ - index corresponding to baseline scenario;

$[fuel]$ - index corresponding to type of fossil fuel;

$[LE]$ - index corresponding to legal entity.

$$V^{y}_{fuel,LE} = V^{y}_{gas,LE} * \frac{NCV^{y}_{gas}}{NCV^{y}_{fuel}}, \quad \text{(D.15)}$$

where:

$V^{y}_{gas,LE}$ - Total quantity of natural gas combusted in period «y» by legal entity (ths m^3);

NCV^{y}_{gas} - Net calorific value of natural gas, (TJ/ t);

NCV^{y}_{fuel} - Net calorific value of fossil fuel of "fuel" type, (TJ/ t);

$[y]$ - index corresponding to monitoring period;

$[b]$ - index corresponding to baseline scenario;

$[gas]$ - index corresponding to natural gas;

$[fuel]$ - index corresponding to type of fossil fuel;

$[LE]$ - index corresponding to legal entity.

Adjusting factor:

$$k_{m,fuel} = \frac{k^{p}_{1,prepfuel}}{k^{b}_{1,prepfuel}}, \quad \text{(D.16)}$$

where:

$k^{b}_{1,prepfuel}$ - factor that takes into account energy loss in the course of energy carrier preparation in the baseline scenario. This factor applies in case of transfer of individual and central heat supply systems to gas.

$k^{p}_{1,prepfuel}$ - factor that takes into account energy loss in the course of energy carrier preparation in the project scenario. This factor applies in case of transfer of individual and central heat supply systems to gas.

CO_2 emission factors for all consumed types of fuel are taken from reports of IPCC[59]or taken in accordance with the National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine[60].

D. 1.2. Variant 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):

H/B

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

No leakages connected with the project implementation are expected.

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

[60] http://www.neia.gov.ua/nature/doccatalog/document?id=124939

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**

No leakages are expected.

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

GHG leakage from oil and coal extraction activities, petrol combustion by transport during transportation of diesel oil and coal to end consumer are conservatively excluded. Methane leakage in the course of gas transportation by gas transportation networks are included in the project emissions.

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):

Quantity of Emission Reduction Units (ER), t CO_2e:

$$ER^y = BE_b^y - PE_p^y, \quad \text{(D.17)}$$

where:

BE_b^y - GHG emissions due to use of out dated system of energy carrier supply, in period «y», in the baseline scenario (t CO_2e);

PE_b^y - GHG emissions due to use of new system of energy carrier supply, in period «y», in the project scenario (t CO_2e);

$[y]$ - index corresponding to monitoring period;

$[b]$ - index corresponding to baseline scenario;

$[p]$ - index corresponding to project scenario.

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 concerning the monitoring of the environmental impact of business entities are:

- Ukrainian Law № 1264-XII «On environmental protection"[61] as of 25.06.1991
- Ukrainian Law № 2707-XII «On atmospheric air protection»[62] as of 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 as of 27.06.2006, №309 and registered in the Ministry of Justice of Ukraine as of 01.09.2006, №912/12786.

In the framework of procedures performed at the request of the Law of Ukraine "On State Statistics", the company periodically reports on environmental indicators, in particular environmental department of OJSC "Odesagas" develops quarterly report form № 2-TP (air) that is submitted to the State Statistics.

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.**
$V^{y}_{p,gas,PP}$	Low	Calibration of accounting and metering devices is carried out according to manufacturer's instructions, approved methodologies of verification / calibration of metering equipment and also in accordance with national standards of Ukraine;
$V^{y}_{p,gas,LE}$	Low	Calibration of accounting and metering devices is carried out according to manufacturer's instructions, approved methodologies of verification / calibration of metering equipment and also in accordance with national standards of Ukraine;
$NCV^{y}_{p,gas}$	Low	Net calorific value of natural gas is determined according to the "National inventory of anthropogenic greenhouse gases emissions by sources and removals by sinks of Ukraine", issued by the State Environmental Investment Agency of Ukraine. This document is subject to periodic review and adding of actual data to it.

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

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

$NCV^{y}_{b,\,fuel}$	Low	Net calorific value of natural gas is determined according to the "National inventory of anthropogenic greenhouse gases emissions by sources and removals by sinks of Ukraine", issued by the State Environmental Investment Agency of Ukraine. This document is subject to periodic review and adding of actual data to it.
$L^{y}_{p,los,1}$	Low	The length of gas distribution systems, implemented under the project, assembly and technical service of OJSC "Odesagas" is responsible for collection of information (Commissioning certificate).
$k^{c}_{p,gas}$	Low	Carbon emission factor for combustion of natural gas is determined according to the "National inventory of anthropogenic greenhouse gases emissions by sources and removals by sinks of Ukraine", issued by the State Environmental Investment Agency of Ukraine. This document is subject to periodic review and adding of actual data to it.
$k^{o}_{p,gas}$	Low	Carbon oxidation factor for natural gas combustion is determined according to the "National inventory of anthropogenic greenhouse gases emissions by sources and removals by sinks of Ukraine", issued by the State Environmental Investment Agency of Ukraine. This document is subject to periodic review and adding of actual data to it.
k^{c}_{fuel}	Low	Carbon emission factor for fossil fuel type «fuel» is determined according to the "National inventory of anthropogenic greenhouse gases emissions by sources and removals by sinks of Ukraine", issued by the State Environmental Investment Agency of Ukraine. This document is subject to periodic review and adding of actual data to it.
k^{o}_{fuel}	Low	Carbon oxidation factor for fossil fuels of «fuel» type combustion is determined according to the "National inventory of anthropogenic greenhouse gases emissions by sources and removals by sinks of Ukraine", issued by the State Environmental Investment Agency of Ukraine. This document is subject to periodic review and adding of actual data to it.
$EF^{y}_{CH_4,p,los,1}$	Low	On default methane emission factor at technological gas equipment at end consumers place is determined according to the "National inventory of anthropogenic greenhouse gases emissions by sources and removals by sinks of Ukraine", issued by the State Environmental Investment Agency of Ukraine. This document is subject to periodic review and adding of actual data to it.

$EF^{y}_{CH_4,p,los,2}$	Low	On default methane emission factor in the course of natural gas transportation and distribution is determined according to the "National inventory of anthropogenic greenhouse gases emissions by sources and removals by sinks of Ukraine", issued by the State Environmental Investment Agency of Ukraine. This document is subject to periodic review and adding of actual data to it.
CEF^{y}_{elec}	Low	GHG emission factor when electricity consumption is reduced. When developing the joint implementation project national GHG emission factors are used, in case of their absence factors for 2004-2005 are taken from ERUPT, factors for 2006-2007 are taken from the document "Carbon dioxide emission factor" approved TUV SUD

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 OJSC "Odesagas" for implementation of monitoring is given below in scheme.

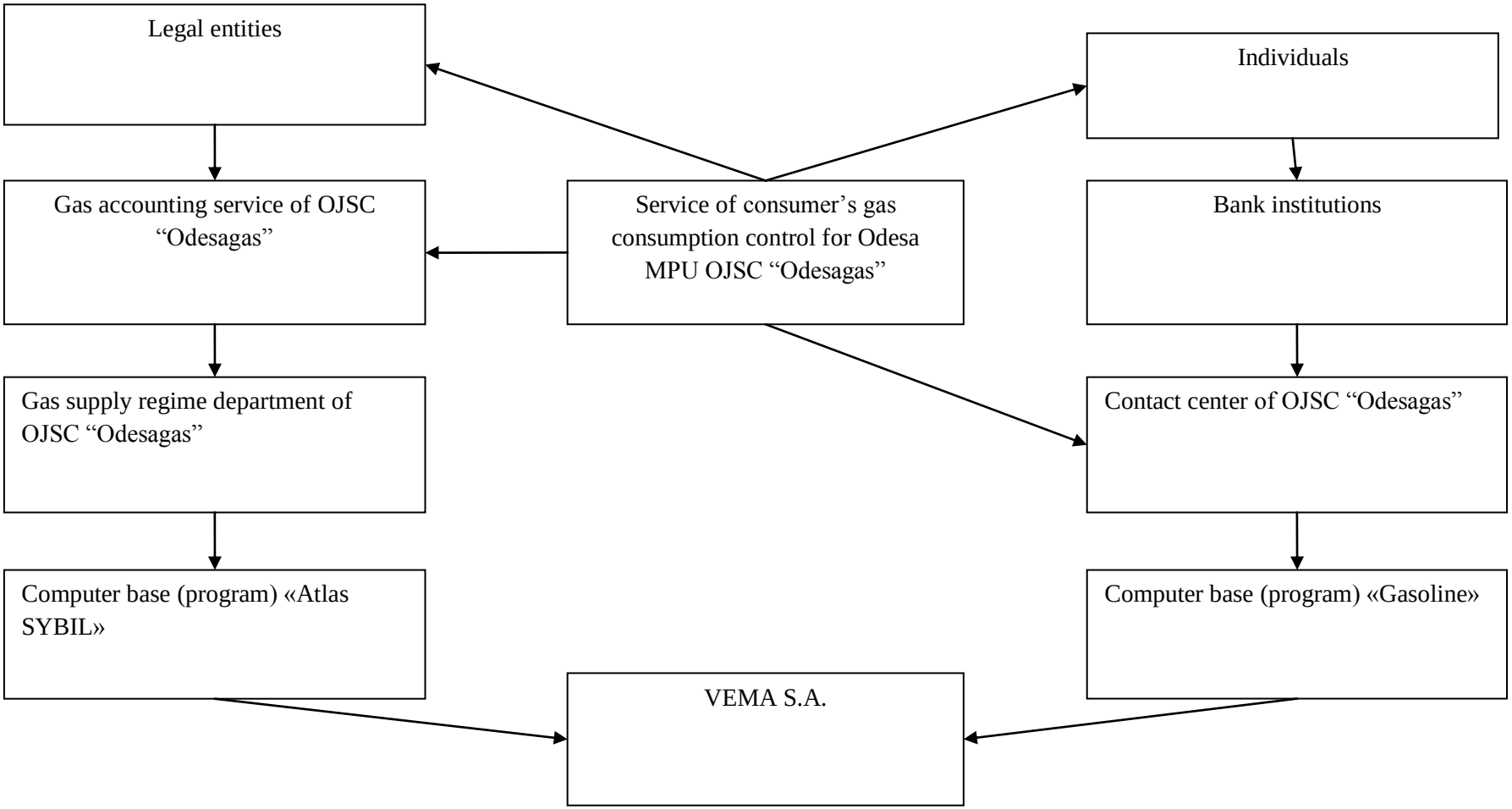

Fig.13. Structure of collection and processing of gas supply data.

Monitoring of natural gas consumption by legal entities.

1. Legal entities supply information on gas consumption to the Gas accounting service every month.
2. Service of consumer's gas consumption control for Odesa MPU conducts monthly inspections of meters, executes the statement signed by the enterprise and transfers it to the Gas accounting service.
3. Gas accounting service provides information to the Gas supply regime department for its processing into basic form by "Atlas SYBIL" program.
4. Indices of gas supply volume processed by "Atlas SYBIL" program are delivered to the project developer «VEMA S.A.».

Monitoring of natural gas consumption by individuals.

1. Service of consumer's gas consumption control for Odesa MPU conducts monthly inspections of meters, executes the statement signed by the individual and transfers it to the Contact center.
2. Bank institutions deliver the information on gas consumption in the form of paid bills to the Contact center of OJSC "Odesagas".
3. Contact center processes received information and bases it into "Gasolina" program.
4. Indices of gas supply volume processed by «Gasolina» program are delivered to the project developer «VEMA S.A.»

The length of gas distribution systems, implemented under the project is determined by the assembly and technical service based on GDN Commissioning certificates.

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

Monitoring plan is determined by the project developer, VEMAS. A., and OJSC "Odesagas".

Gas supplying and gasification enterprise OJSC "Odesagas"
Odesa, Ukraine .
GerasymenkoVitaliy Oleksandrovych,
Director.
Telephone: +38(050)316 53 17
Fax:+38 (0482)723-75-94
e-mail:Info@odgaz.Odesa.ua
Website: http://www.odgaz.Odesa.ua
OJSC "Odesagas" is the project participant (Annex 1).

VEMAS.A.:
Geneva, Switzerland.
Fabian Knodel,
Director.
Telephone: (044)-594-48-10
Fax: (044)-594-48-19
e-mail:info@vemacarbon.com
Website: www.vemacarbon.com
VEMAS.A. is the project participant (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 period 2004-2010 existing data of OJSC "Odesagas" on the actual monitoring parameters values for an appropriate period were used, for the period 2011-2020 predicted data according to the company development plant were used.
Results of calculation are given below in Tables. The calculations are stated in Accompanying document 1 annexed to the PDD.

Table 9. Estimated project emissions for the period preceding the first commitment period (January 1, 2004– December 31, 2007)

Source of emissions	Project emissions (t CO_2equivalent)				
	2004	2005	2006	2007	Total for the period 2004-2007
GHG emissions due to natural gas combustion by individuals	164510	281594	405795	332043	**1183942**
GHG emissions due to natural gas combustion by legal entities	1428909	1276696	1311340	1280016	**5296961**
GHG emissions due to methane leakage at technological equipment and end consumers place	90400	86380	96106	90517	**363403**
GHG emissions due to gas transportation by gas transportation networks	60934	78608	64282	57301	**261125**
Total (t CO_2equivalent)	**1744753**	**1723278**	**1877523**	**1759877**	**7105431**

Table 10. Estimated project emissions during the first commitment period (January 1, 2008 – December 31, 2012)

Source of emissions	Project emissions (t CO_2equivalent)					
	2008	2009	2010	2011	2012	Total for the period 2008-2012
GHG emissions due to natural gas combustion by individuals	381138	396481	483139	483139	483139	**2227036**

GHG emissions due to natural gas combustion by legal entities	1307521	1260732	1313621	1313621	1313621	**6509116**
GHG emissions due to methane leakage at technological equipment and end consumers place	90882	92152	101590	101590	101590	**487804**
GHG emissions due to gas transportation by gas transportation networks	66552	50758	53052	53052	53052	**276466**
Total (t CO_2equivalent)	**1846093**	**1800123**	**1951402**	**1951402**	**1951402**	**9500422**

Table 11. Estimated project emissions for the period following the first commitment period (January 1, 2013. – December 31, 2020)

Sourcemofmemissions	Project emissions (t CO_2equivalent)								
	2013	2014	2015	2016	2017	2018	2019	2020	Total for the period 2013-2020
GHG emissions due to natural gas combustion by individuals	483139	483139	483139	483139	483139	483139	483139	483139	**3865112**
GHG emissions due to natural gas combustion by legal entities	1313621	1313621	1313621	1313621	1313621	1313621	1313621	1313621	**10508968**
GHG emissions due to methane leakage at technological equipment and end consumers place	101590	101590	101590	101590	101590	101590	101590	101590	**812720**
GHG emissions due to gas transportation by gas transportation networks	53052	53052	53052	53052	53052	53052	53052	53052	**424416**
Total (t CO_2equivalent)	**1951402**	**1951402**	**1951402**	**1951402**	**1951402**	**1951402**	**1951402**	**1951402**	**15611216**

Detailed calculations are given in Accompanying documents 1, 1.18.

E.2. Estimated leakage:

GHG leakage from oil and coal extraction activities, petrol combustion by transport during transportation of diesel oil and coal to end consumer are conservatively excluded. Methane leakage in the course of gas transportation by gas transportation networks are included in the project emissions.

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

Since there no leakage is expected under the project the sum of emissions from leakages and from the project activity is equal to emissions from the project activity, the results are given in the tables below.

Table 12. Sum of emission from leakages project activity for the period, preceding the first commitment period (January1, 2004.– December 31, 2012)

Year	Estimated project emissions (t CO_{2e})	Estimated leakages (т CO_2e)	Estimated project emissions and leakages (t CO_2e)
2004	1744753	0	**1744753**
2005	1723278	0	**1723278**
2006	1877523	0	**1877523**
2007	1759877	0	**1759877**
Total (t CO_{2e})	**7105431**	**0**	**7105431**

Table 13. Sum of emission from leakages project activity during the first commitment period (January1, 2008– December 31, 2012)

Year	Estimated project emissions (t CO_{2e})	Estimated leakages (т CO_2e)	Estimated project emissions and leakages (t CO_2e)
2008	1846093	0	**1846093**
2009	1800123	0	**1800123**
2010	1951402	0	**1951402**
2011	1951402	0	**1951402**
2012	1951402	0	**1951402**
Total (t CO_{2e})	**9500422**	**0**	**9500422**

Table 23. Sum of emission from leakages and project activity for the period, following the first commitment period (January 1, 2013 - December 31, 2020)

Year	Estimated project emissions (t CO_{2e})	Estimated leakages (т CO_2e)	Estimated project emissions and leakages (t CO_2e)
2013	1951402	0	**1951402**
2014	1951402	0	**1951402**
2015	1951402	0	**1951402**
2016	1951402	0	**1951402**
2017	1951402	0	**1951402**
2018	1951402	0	**1951402**
2019	1951402	0	**1951402**
2020	1951402	0	**1951402**
Total (t CO_{2e})	**15611216**	**0**	**15611216**

E.4. Estimated baseline emissions:

All results of baseline emissions assessment in the project are provided in Tables15-17.

Table 15. Estimated baseline emissions for the period preceding the first commitment period (January 1, 2004– December 31, 2007)

Source of emissions	Baseline emisions (t CO_2equivalent)				
	2004	2005	2006	2007	Total for the period 2004-2007
GHG emissions due to fossil fuel combustion by individuals	326626	524062	751745	600355	**2202788**
GHG emissions due to fossil fuel combustion by legal entities	2241217	2048505	2139561	2049527	**8478810**
Total (t CO_2equivalent)	2567843	2572567	2891306	2649882	**10681598**

Table 16. Estimated baseline emissions during the first commitment period (January 1, 2008 – December 31, 2012)

Source of emissions	Baseline emisions (t CO_2equivalent)					
	2008	2009	2010	2011	2012	Total for the period 2008-2012
GHG emissions due to fossil fuel combustion by individuals	680567	700101	847256	847256	847256	**3922436**
GHG emissions due to fossil fuel combustion by legal entities	2103999	2014812	2086160	2086160	2086160	**10377291**
Total (t CO_2equivalent)	**2784566**	**2714913**	**2933416**	**2933416**	**2933416**	**14299727**

Table 17. Estimated project emissions for the period following the first commitment period (January 1, 2013. – December 31, 2020)

Source of emissions	Baseline emisions (t CO_2equivalent)								
	2013	2014	2015	2016	2017	2018	2019	2020	Total for the period 2013-2020
GHG emissions due to fossil fuel combustion by individuals	847256	847256	847256	847256	847256	847256	847256	847256	**6778048**
GHG emissions due to fossil fuel combustion by legal entities	2086160	2086160	2086160	2086160	2086160	2086160	2086160	2086160	**16689280**

Total (t CO_2equivalent)	**29334 16**	**29334 16**	**29334 16**	**29334 16**	**29334 16**	**29334 16**	**29334 16**	**29334 16**	**23467328**

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

Project emission reductions = Baseline emissions – (Project emissions + Estimated Leakage).All results of estimation of project emission reductions are given in Table 18-20.

Table18. Estimated emission reductions for the period, preceding the first commitment period (January1, 2004– December 31, 2007)

Year	Emission reductions (t CO_{2e})
2004	823090
2005	849289
2006	1013783
2007	890005
Total (t CO_2 equivalent)	**3576167**

Table19. Estimated emission reductions during the first commitment period (January1, 2008– December 31, 2012)

Year	Emission reductions(t CO_{2e})
2008	938473
2009	914790
2010	982014
2011	982014
2012	982014
Total (t CO_2 equivalent)	**4799305**

Table 20. Estimated emission reductions for the period, after the first commitment period (January 1, 2013 - December 31, 2020)

Year	Emission reductions (t CO_{2e})
2013	982014
2014	982014
2015	982014
2016	982014
2017	982014
2018	982014
2019	982014
2020	982014
Total (t CO_2 equivalent)	**7856112**

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

Table. 21.Table, containing results of emission reductions estimations for the period, preceding the first commitment period (January1, 2004– December 31, 2007)

Year	Estimated project emissions (t CO_{2e})	Estimated leakages (t CO_{2e})	Estimated baseline emissions (t CO_{2e})	Estimated emission reductions (t CO_{2e})
2004	1744753	0	2567843	823090
2005	1723278	0	2572567	849289
2006	1877523	0	2891306	1013783
2007	1759877	0	2649882	890005
Total (t CO2 equivalent)	**7105431**	**0**	**10681598**	**3576167**

Table22. Table, containing results of emission reductions estimations during the first commitment period (January1, 2008– December 31, 2012)

Year	Estimated project emissions (t CO_{2e})	Estimated leakages (t CO_{2e})	Estimated baseline emissions (t CO_{2e})	Estimated emission reductions (t CO_{2e})
2008	1846093	0	2784566	938473
2009	1800123	0	2714913	914790
2010	1951402	0	2933416	982014
2011	1951402	0	2933416	982014
2012	1951402	0	2933416	982014
Total (t CO2 equivalent)	**9500422**	**0**	**14299727**	**4799305**

Table23. Table, containing results of emission reductions estimations for the period, following the first commitment period (January 1, 2013 - December 31, 2020)

Year	Estimated project emissions (t CO_{2e})	Estimated leakages (t CO_{2e})	Estimated baseline emissions (t CO_{2e})	Estimated emission reductions (t CO_{2e})
2013	1951402	0	2933416	982014
2014	1951402	0	2933416	982014
2015	1951402	0	2933416	982014
2016	1951402	0	2933416	982014
2017	1951402	0	2933416	982014
2018	1951402	0	2933416	982014
2019	1951402	0	2933416	982014
2020	1951402	0	2933416	982014
Total (t CO2 equivalent)	**15611216**	**0**	**23467328**	**7856112**

SECTION F. Environmental impacts

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

According to the Ukrainian legislation, projects of new construction of gas distribution networks must include Environmental Impact Assessment (EIA), the basic requirements of which are listed in the State building norms of Ukraine A.2.2-1-2003 "The composition and content of environmental impact assessment (EIA) in the design and construction of plants, buildings and structures" [63].

OJSC "Odesagas" has the necessary Environmental Impact Assessment for all projects on gas distribution network construction in accordance with Ukrainian law. EIA of the projects are developed by subcontracting project-assembling organizations and are transferred by individual departments in of reconstruction projects of OJSC "Odesagas".

Overall, the impact of the project "Reduction of greenhouse gases emissions by gasification of Odesa region" on the environment during the construction work can be assessed as permittable, because the impact is temporary. Project facilities are not included in the list of activities and facilities of environmental hazard.
Completed analysis of the facilities impact of the environment showed that all factors considered, we can conclude that in the normal technical operational mode they will neither cause any negative processes in the environment of the region, nor lead to any negative social and economic consequences and the risk of accidents and their possible impact is minimized.
Facilities included in the project boundaries meet all standards and requirements of the Laws of Ukraine "On air protection"[64] and "On Environmental Protection"[65], and the SSR -96 "Planning and development of human settlements", is environmentally safe and do not make any negative impact on the environment.

Transboundary impacts of the project activities according to their definition in the text of ratified by Ukraine "Convention on transboundary pollution at a great distance," do not take place.

[63] http://www.budinfo.com.ua/dbn/8.htm

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

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

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:

All working projects of gas flowlines and distribution networks to be constructed under this project will be considered and approved by the chief of state administration of the Environment in Odesa region.

Impact on water medium
Impact on water medium is absent.

Impact on air environment
In the operation of project facilities air environment will be influenced by the processes of production and technological (normalized) gas losses–marginal gas leakage when it is possible to ensure reliable operation and conditional normative hermetization of gas pipelines, connecting pieces, fittings, expansion joints, gas equipment, appliances etc. In addition, the industrial-technological gas losses include leakage of gas during manufacturing, maintenance and overhaul, and gas pipe tie-in and connections, installation of fixtures, appliances, equipment that uses gas and connecting parts that do not exceed the norms of gas leakage, established by effective regulations. All the technological gas leakages are included in the project boundary and are accounted as emissions generated within the framework of the project (See Section B, D).

Impact on land use.
To prevent impact on the environment during construction processes measures aimed at restoring the ecological balance are carried out. In order to reduce impact on the environmental all construction and installation works are carried out exclusively within the right-of-way.
Land reclamation is planned on land:
- Trails of the pipeline across the width of the allotment;
- The territory of temporary storage of pipes and ancillary materials;
- Affected land surface on the trails of temporary roads;
- The area around ground facilities affected during construction;
- Other territories in the areas of construction, as a result of the passage of vehicles, clogged and polluted with industrial and domestic waste and oil pipelines.

Technical reclamation of areas includes the following measures:
- Removal and preparation of soil and vegetation layer in the areas of construction;
- Cleaning of construction debris, unused materials, and all contaminants of area remained after the process of dismantling of temporary structures, bases after the completion of works on the trace;
- Restore the topsoil.

Waste generation, their treatment and disposal

According to the Ukrainian Law "On wastes», (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.
- ensure complete collection, appropriate storage and prevention of wastes deterioration, for utilization of which there is corresponding technology in Ukraine.
In the process of construction activities to reduce negative impact on land resources it is provided to equip working areas and building plots with containers for household and construction waste, followed by their removal to authorized solid waste landfills (Table 24).

Table 24. Types of waste that will be created during the construction of the GDS

Name of waste type	Class of hazard	Waste movement
Municipal mixed Waste – 7720.3.1.01	4	Will be taken to solid waste landfill
Waste received in the process of electrodes welding – 2820.2.1.20	4	Will be utilized

Impact on biodiversity
There is no impact on biodiversity.

So, summing up, we can say that the project "Reduction of greenhouse gases emissions by gasification of Odesa region" doesn't have any negative effects on the environment.

SECTION G. Stakeholders' comments

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

In pursuance of requirements of Art. 18 of the Law of Ukraine "On planning and development of areas"[66] and Art. 11 of the Law of Ukraine "On ecological expertise"[67],OJSC "Odesagas" informs the public through local media on the implementation of territory planning.
All obtained comments related to the project implementation were positive. Negative comments and critical comments relating to the project were not made.

[66] http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=1699-14

[67] http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=45%2F95-%E2%F0

Annex 1

CONTACT INFORMATION ON PROJECT PARTICIPANTS

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Annex 2

BASELINE INFORMATION

The baseline was set according to a specific approach to the Joint Implementation (JI) projects, relying on "Criteria for selecting the baseline and monitoring." (version 2) of Joint Implementation Supervisory Committee.

Key information for determining the baseline is presented in the tables below.

Summarized information on key elements of the baseline is presented in the table, which is given below:

Parameter	Description of the parameter	Measured (m), calculated (c), estimated (e)	Value (for the fixed parameter)	Source of data
$V^{y}_{gas,PP}$	Total quantity of natural gas combusted in period «y» by an individual, ths m^3	m	N/A	Gas meters
$V^{y}_{gas,LE}$	Total quantity of natural gas combusted in period «y» by a legal entity, in the project scenario, ths m^3	m	N/A	Gas meters
NCV^{y}_{fuel}	Net calorific value of fossil fuel of «fuel» type (Fuel of "fuel" type means coal, wood, fuel oil or diesel oil)	e	See Section B.1	National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine. Data on the type of fossil fuel used by a consumer before the gasification are provided by district administrations and village councils.
NCV^{y}_{gas}	Net calorific value of natural gas, TJ/ mln m^3	m	See Section B.1.	National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine.
k^{o}_{fuel}	Carbon oxidation factor when combusting fossil fuel of "fuel" type	e	See Section B.1.	Carbon oxidation factor when combusting fossil fuel is used to determine on default carbon dioxide emission

				factor for stationary combustion of fossil fuels in Ukraine. The data source for this parameter is the National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine, based on approved national data.
k^{c}_{fuel}	Carbon emission factor when combusting fossil fuel of "fuel" type. (Fuel of «fuel» type means coal, wood, fuel oil, diesel oil), t C/TJ	e	See Section B.1.	National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine.
$k^{p}_{1,prepfuel}$	Average efficiency factor that takes into account energy loss in the course of energy carrier preparation in the project scenario	e	See section B 1.	Report «Determination of change of specific energy data of heat supply system in the course of gasification".
$k^{b}_{1,prepfuel}$	Average efficiency factor that takes into account energy loss in the course of energy carrier preparation in the baseline scenario	e	See section B 1.	Report «Determination of change of specific energy data of heat supply system in the course of gasification".
$k^{p}_{3,ef}$	Average efficiency factor of boiler equipment that takes into account efficiency of thermal generating units, in the project scenario	e	See section B 1.	Report «Determination of change of specific energy data of heat supply system in the course of gasification".
$k^{b}_{3,ef}$	Average efficiency factor of boiler equipment that takes into account efficiency of thermal generating units, in the baseline scenario	e	See section B 1.	Report «Determination of change of specific energy data of heat supply system in the course of gasification".

$k^{b}_{4,pipes}$	Average efficiency factor that takes into account heat energy losses in the course of heat carrier transportation to the end consumer, in the baseline scenario	e	See section B 1.	Report «Determination of change of specific energy data of heat supply system in the course of gasification".
$k^{p}_{4,pipes}$	Average efficiency factor that takes into account heat energy losses in the course of heat carrier transportation to the end consumer, in the project scenario	e	See section B 1.	Report «Determination of change of specific energy data of heat supply system in the course of gasification".

The baseline is determined by a specific approach based on approved methodology ACM0009 «Consolidated baseline and monitoring methodology for fuel switching from coal or petroleum fuel to natural gas»- Version 3.2 and the Report "Identification of changes of specific energy factors of heat supply system when conducting gasification" developed by "UKRENERGOPROM-2" as of June 24, 2011. Also this report received a positive review from the "Institute of Engineering Thermophysics, NAS of Ukraine."

Excerpt from review "Specific generalized indices derived on the basis of analysis of existing heat supply systems and their further gasification can be used to evaluate the heating system in the territory of Odesa region, including assessment for reducing of greenhouse gas emissions in projects implementation under the Kyoto Protocol ".

Annex 3

MONITORINGPLAN

To determine the monitoring methodology approach for baseline setting and monitoring developed according to Appendix B of the JI guidelines, namely specific JI approach was used. The monitoring plan for this project was established in accordance with "Guidance on criteria for baseline setting and monitoring" (Version 2) of JI Supervisory Committee.

Monitoring plan provides for the following measures:

1. Identification of all potential sources of emissions within the project.
2. Collection of information on greenhouse gas emissions within the project during the crediting period.
3. Assessment of the project implementation schedule.
4. Collection of the information on measurement equipment, its calibration.
5. Collection and archiving information on the impact of project activities on the environment.
6. Data archiving.
7. Determination of the structure of responsibility for project monitoring.
8. Analysis of organization of personnel training.

Accounting program for gas consumers

Full-featured billing system **"Atlas SYBIL"** is designed to automate core processes of organizations that provide gas, heat, electricity and water supply services to the mass. Billing System "Atlas SYBIL" provides a record of services and payments to contractors - legal entities and individuals (the public). "Atlas SYBIL" contains not only billing but also the accounting function, the function of technical accounting and offers a broad analysis of the organization: gas water, heat and electricity consumption control, multidimensional analytical accounting and analysis of services and payments to contractors. More information is listed on the site of the developer (http://www.atlas.ua).

Gasolina is designed to automate call centers when conducting public accounting of settlements for natural gas.

Key system features:

- Conducting of basic and additional information about subscribers;
- Maintaining charges, payments, subsidies, meters data, adjustments of subscribers;
- accumulation in the history of changes about the subscriber (document type "Change");
- Charges are conducted according to all modifications of the subscriber. Thus when accruing the daily state of subscriber is taken into account.
- When accruing with accuracy to a day changing the norms, price of gas, benefits are considered;
- A wide range of reporting.

More information is listed on the site of developer (www.gasolina.com.ua).

"Software Service" is responsible for maintaining of accounting programs of gas subscribers at OJSC “Odesagas”.

Calculation of reduced GHG emission factor when transporting natural gas to end consumers.

$$CEF^{y}_{gas,unit} = \frac{\sum PE_{tp,gf}}{V_{gas,sum}},$$

$CEF^{y}_{gas,unit}$ - reduced GHG emission factor when transporting natural gas to end consumers, tCO_2e/ m^3

$V^{j}_{gas,sum}$ - total volume of transit natural gas transported through Ukraine in year j. (according to the Ministry of Fuel and Energy of Ukraine[68]) bln m^3;

$\sum PE^{j}_{tp,gf}$ - total amount of CO_2 that is released when transporting natural gas to end consumers, tCO_2.

$$\sum PE^{j}_{tp,gf} = \frac{44}{12} * CEF_{tg,gf} * k^{c}_{fuel} * k^{o}_{fuel},$$

$CEF_{tg,gf}$ - total quantity of heat spent on transporting of natural gas through Ukraine, TJ. (according to data from National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine, Table 1 A(a)s3);

$k^{c}_{p,gas}$ - Carbon emission factor when combusting natural gas, t/TJ;

$k^{o}_{p,gas}$ - Carbon oxidation factor when combusting natural gas, relative units.

Calculations are based on approved national data of the Ministry of Fuel and Energy of Ukraine and data from the National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine. Frequency of monitoring of data is annual. Detailed calculations are provided in the accompanying documents 1.18. (Excel file).

Table 1. Annual reduced GHG emission factor when transporting natural gas to end consumers in 2003-2010

Reduced GHG emission factor when transporting 1 m^3 of gas, CEF_{gas}^{unit}, t CO_2/m^3							
2003	2004	2005	2006	2007	2008	2009	2010
0,000072	0.000071	0.000094	0.000070	0.000066	0.000073	0.000057	0.000055

Table 2. Annual total volume transit natural gas transported through Ukraine in 2003-2010 (according to the Ministry of Fuel and Energy of Ukraine[69])

Total volume of transit natural gas transported through Ukraine m^3 of gas, Vgas,sum, bln m^3							
2003	2004	2005	2006	2007	2008	2009	2010
129	137.1	101.9	128.5	115.2	109.9	95.2	98.6

[68] http://mpe.kmu.gov.ua/

[69] http://mpe.kmu.gov.ua/

Table 3. Total quantity of heat spent on transporting of natural gas through Ukraine in 2003-2011, TJ. (according to data from the National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases in Ukraine[22])

Total quantity of heat energy (obtained by natural gas combustion), necessary for transporting of natural gas in gas distribution networks of Ukraine, TJ							
2003	2004	2005	2006	2007	2008	2009	2010
171 173	180 401	176 724	165 090	140 318	148 018	99 412	99 412