JI MONITORING REPORT
(for reporting period 01.01.2012 – 31.12.2012)

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MONITORING REPORT OF JI PROJECT

Monitoring period:
01/01/2012 – 31/12/2012

Version 03
September 19, 2013

Reduction of greenhouse gases emissions by gasification of Zakarpattia region

CONTENTS

ANNEXES

[1] Annexes 2, 3.1-3.3 are provided as Excel files as a separate supporting documents

SECTION A. General project activity and monitoring information

A.1. Title of the project:

Reduction of greenhouse gases emissions by gasification of Zakarpattia region
Sectoral scope - 3 “Energy demand”

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

The Joint Implementation Project “Reduction of greenhouse gases emissions by gasification of Zakarpattia region” was determined by Bureau Veritas Certification, Determination Report No. UKRAINE- det/0695/2012 dated 25/10/2012.

The project received approval from Ukraine (the host country for the project) (Letter of Approval No. 3608/23/7, issued by the State Environmental Investment Agency 23/11/2012). The project also received approval from Switzerland, the country-buyer of GHG emissions reductions (Letter of Approval J294-0485, issued by the Federal Office for the Environment (FOEN) on 24/10/2012).

A.3. Brief description of the project:

The main purpose of the project is reduction of greenhouse gas emissions by changing the structure of fuel consumption in industrial, utility, administrative and private sectors by replacing solid and liquid fuels with natural gas.

The project provides for the construction and expansion of gas distribution systems (GDS, which will also improve the energy efficiency of thermal power generation due to the transition of existing heating systems to natural gas. The project initiated by PJSC “Zakarpatgas” will result in the reduction of greenhouse gas (GHG) emissions into the atmosphere and improve the environmental situation in the region.

In addition, within its core business, PJSC “Zakarpatgas” performs planning, construction and repair of underground and surface pipelines, boiler servicing, establishing house internal gas appliances and counters, etc..

The most plausible baseline scenario, which the power complex may follow, is to continue operating the existing systems of transportation and preparation of energy carrier as well as heat supply systems that will result in the use by the end consumers of less ecological fuel (fuel oil, coal), 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 energy consumption system will lead to excessive use of fossil fuel that would cause the harmful effects of atmosphere because of GHG emissions.

The project scenario involves expansion of the territorial gas supply system, which includes construction and reconstruction of the gas distribution networks (GDN) and related equipment. The project provides for modernization of the fuel consumption system by means of transition of heating systems 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 due to increased efficiency of individual systems in comparison with the centralized ones.
In general, the project activity is aimed at:

- Ensuring of the supply of natural gas (gasification) to end users by means of the construction and reconstruction of gas distribution networks;
- Replacement of solid and liquid fuels with natural gas;
- Increase in heat energy efficiency;

- Reduction of greenhouse gases under the Joint Implementation (JI) Mechanism.

A.4. Monitoring period:

- Commencement date of the monitoring period: 01/01/2012
- End date of the monitoring period: 31/12/2012

A.5. Methodology applied to the project:

A.5.1. Baseline methodology:

The project activity is aimed at the reduction of greenhouse gas emissions by changing the structure of fuel consumption in industrial, utility, administrative and private sectors by replacing solid and liquid fuels with natural gas.
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».[2]

Dynamic baseline was chosen according to the requirements of the Guidance on criteria for baseline setting and monitoring, Version 03[3].

In accordance with the determined methodology, baseline GHG emissions are calculated for each year of project monitoring to adjust the volume of fossil fuel substituted with natural gas. This enables calculation of GHG emissions for each project year in the absence of the project activity.

The key indicator of the project implementation is annual natural gas consumption. Project implementation started in late 2003, as provided in the determined PDD version 02.

Emission factor for stationary combustion of natural gas is calculated in accordance with the National Inventory Report of Greenhouse Gas Emissions and Removals in Ukraine.

[2] http://cdm.unfccc.int/methodologies/DB/2CRBYLJO5JWC9YHBSWJQWYIH2LLGMJ
[3] http://ji.unfccc.int/Ref/Documents/Baseline_setting_and_monitoring.pdf

A.5.2. Monitoring methodology:

The proposed project uses a specific approach to JI projects based on approved methodologyACM0009 «Consolidated baseline and monitoring methodology for fuel switching from coal or petroleum fuel to natural gas- Version 3.2»4 and "Guidance on criteria for baseline setting and monitoring" (Version 03) 5 of the Joint Implementation Supervisory Committee - JISC, which meets the requirements specified in Decision 9 / CMP.1., Annex 1, "Guidance on criteria for baseline setting and monitoring." The monitoring plan is designed for accurate and clear measurement and calculation of greenhouse gas emissions and is implemented according to practices established at PJSC «Zakarpatgas» for measurement of supplied and consumed natural gas. Project monitoring does not require any changes in the existing system of data accounting and 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 implemented to satisfy the requirements of the chosen methodology of monitoring and guarantee the possibility of verification of calculation on GHG emission reductions. The main stages of the monitoring plan are described below.

The most objective and cumulative indicator that provides a clear picture of whether emission reduction took place is natural gas consumption. The substitution of fuel oil and coal with natural gas causes GHG emission reductions. In addition, systems of energy carrier transportation, preparation and combustion show higher efficiency while being switched to natural gas irrelevant of external factors.

PJSC “Zakarpatgas” collects and archives data on natural gas consumption in the form of gas bills using Atlas SYBIL software. The information on natural gas consumption is attached to the Monitoring Report as Annexes 3.1-3.3 with the necessary documents.

In accordance with the monitoring methodology described in the determined PDD version 02, the following parameters were collected and recorded throughout the monitoring period for calculation of emission reductions achieved:

1) Data and parameters not controlled throughout the whole monitoring period, but determined only once, which are available at the stage of PDD development:

$\eta_{BL,i}$	Efficiency of stationary coal or fuel oil combustion at consumer “*i*” place, relative units
$\eta_{PJ,i}$	Efficiency of stationary natural gas combustion at consumer “*i*” place, relative units

2) Data and parameters controlled during the whole monitoring period:

$FC_{NG,i,y}$	Total volume of natural gas combusted in period “*y*” by consumer “*i*”, ths m^3
$L_{PJ,y}$	Length of gas distribution systems constructed in the framework of the project, ths km
$NCV_{NG,y}$	Net calorific value of natural gas, GJ/ ths m^3
$NCV_{FF,y}$	Net calorific value of fossil fuel of “*FF*” type, GJ/t (Fuel of “*FF*” type means coal, fuel oil)
$EF_{C,NG,y}$	Carbon emission factor for natural gas combustion, t C/TJ
$OXID_{NG,y}$	Carbon oxidation factor for natural gas combustion, relative units
$EF_{C,FF,y}$	Carbon emission factor for fossil fuel of “*FF*” type combustion. (Fuel of “*FF*” type means coal, fuel oil), t C/TJ

[4] http://cdm.unfccc.int/methodologies/DB/2CRBYLJO5JWC9YHBSWJQWYIH2LLGMJ
[5] http://ji.unfccc.int/Ref/Documents/Baseline_setting_and_monitoring.pdf

$OXID_{C,FF,y}$	Carbon oxidation factor for fossil fuel of "*FF*" type combustion, relative units
$EF_{CH_4,los1,y}$	Default emission factor for methane in the process of natural gas transportation and distribution, t CH_4/ths km
$EF_{CH_4,los2,y}$	Default emission factor for methane at technological gas equipment at end consumer's place, t CH_4/PJ
$EF_{CO_2,GTU,y}$	Reduced GHG emission factor for natural gas transportation to end consumers, t CO_2/m^3
GWP_{CH4}	Global warming potential for methane, t CO_2e/t CH_4

A.6. Status of implementation, including the main stages of the project:

Project implementation started in late 2003, as provided in the determined PDD version 02. Therefore, 01/01/2004 was taken as the starting date of the crediting period.

This Monitoring Report presents emission reductions achieved during the period of 01/01/2012 – 31/12/2012.

The status of the project implementation during the reporting period of 01/01/2012 – 31/12/2012, including its milestones, is provided below (Table 1).

Table 1. Status of project implementation

Measures
Gas distribution networks construction,km
01/01/2012 – 31/12/2012
0.0528705

In 01/01/2012 – 31/12/2012, PE-80, PE-100 polyethylene pipes and SSTU 10704-91[6] with reinforced bituminous mastic sealing under SSTU B.V.2.5.-29:2006[7] were used in construction.
Implementation of project activities is realized according to the project plan provided in the determined PDD version 02.
Detailed information about measures implemented by departments and divisions is provided in Annex 2. Supporting Document 2: Technical registry of gas networks.

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

There are no deviations from or changes in the registered PDD.

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

There are no deviations from or changes in the registered monitoring plan.

[6] http://www.ukrtop.info/gost/8.pdf
[7] http://www.budinfo.org.ua/doc/1810239.jsp

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

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

SECTION B. Key monitoring activities

An approach for baseline setting and monitoring developed according to Appendix B of the JI guidelines, namely specific JI approach was used to determine the monitoring methodology. The monitoring plan for this project was established in accordance with the "Guidance on criteria for baseline setting and monitoring" (Version 03)[8] of JI Supervisory Committee.

Project monitoring comprises measurement of natural gas consumption by end consumers and control over the length of gas distribution networks built under the project. Other parameters are obtained by calculation or sourced from the state statistics or inventory reports.

The monitoring plan provides for the following measures:

1. Collection of information on greenhouse gas emissions within the project during the crediting period.
2. Assessment of the project implementation schedule.
3. Collection of the information on measurement equipment, its calibration.
4. Collection and archiving information on the impact of project activities on the environment.
5. Data archiving.
6. Organization of personnel training.

B.1. Information on types of metering equipment, accuracy class and calibration thereof.

The following gas meters are used for gas consumption metering (*Table 2*):

Table 2. Main types of gas meters

Metering equipment	Type	Manufacturer	Verification/ calibration frequency	Accuracy class
Orifice gas meter	Metrix G4	"APATOR METRIX" S.A.[9], Poland	8 years	±1.5..3.0 %
Orifice gas meter	Metrix G6	"APATOR METRIX" S.A., Poland	8 years	±1.5..3.0 %
Orifice gas meter	Metrix G10	"APATOR METRIX" S.A., Poland	8 years	±1.5..3.0 %
Orifice gas meter	Gallus 2000 G-1,6	ACTARIS[10], France	8 years	±1.5..3.0 %
Orifice gas meter	Gallus 2000 G-2,5	ACTARIS, France	8 years	±1.5..3.0 %
Orifice gas meter	Gallus 2000 G-4	ACTARIS, France	8 years	±1.5..3.0 %
Orifice gas meter	MKM-U G-4	JI Premagaz Kromschreder, Lubny	8 years	±1.5..3.0 %
Orifice gas meter	MKM-U G-6	JI Premagaz Kromschreder, Lubny	8 years	±1.5..3.0 %
Orifice gas meter	ВК G-1,6	Premagaz s.r.o.[11], Slovakia	8 years	±1.5..3.0 %
Orifice gas meter	ВК G-2,5	Premagaz s.r.o., Slovakia	8 years	±1.5..3.0 %
Orifice gas meter	ВК G-4	Premagaz s.r.o., Slovakia	8 years	±1.5..3.0 %
Orifice gas meter	ВК G-6	Premagaz s.r.o., Slovakia	8 years	±1.5..3.0 %
Orifice gas meter	ВК G-10	Premagaz s.r.o., Slovakia	8 years	±1.5..3.0 %

[8] http://ji.unfccc.int/Ref/Documents/Baseline_setting_and_monitoring.pdf
[9] http://www.apator.com.ua/
[10] http://www.actaris.com.ua/rus/index.php
[11] http://www.elster.sk/

Orifice gas meter	G-1,6	«Samhaz [12], Rivne	8 years	±1.5..3.0 %
Orifice gas meter	G-2,5	Samhaz, Rivne	8 years	±1.5..3.0 %
Orifice gas meter	G-4	Samhaz, Rivne	8 years	±1.5..3.0 %
Orifice gas meter	G-16 RS/10	Samhaz, Rivne	8 years	±1.5..3.0 %
Orifice gas meter	BK G-10	Samhaz, Rivne	8 years	±1.5..3.0 %
Orifice gas meter	Vizar G-4	SE «Vizar» Zhuliany Machine Building Plant[13], Vyshneve, Kyiv region	8 years	±1.5..3.0 %

The monitoring report shows the main types of metering devices that are used to meter consumed natural gas. A complete list of metering equipment is not shown in the monitoring report due to a significant number of customers and can be obtained from PJSC “Zakarpatgas”.

A typical domestic gas meter is shown in Figure 1.

Figure 1. A domestic G-2.5 gas meter manufactured by Samhaz

A typical commercial gas meter is shown in Figure 2.

Figure 2. A domestic G-25 gas meter manufactured by Samhaz

[12] http://samgas.com.ua/
[13] http://vizar.bg.ua/

Full list of measuring equipment in connection with a significant number customers is kept at the enterprise.

B.2. Data collection (consolidated data for the whole monitoring period):

Data and parameters subject to periodic monitoring, according to the monitoring plan provided in the PDD version 02, as well as the list of constant values used to calculate emission reductions, are provided in Sections B.2.1. and B.2.2. of the Monitoring Report, as well as in Annex 3.1-3.3.: Calculation of GHG emission under the project "Reduction of greenhouse gases emissions by gasification of Zakarpattia region".

B.2.1. List of fixed and constant values:

Table 3. Fixed parameters not controlled during the monitoring period

<table>
<tr><th>Symbol</th><th>Parameter</th><th>Data source</th><th>Value, data units</th><th>Comments</th></tr>
<tr><td>$\eta_{PJ,i}$</td><td>Efficiency of stationary natural gas combustion at consumer "i"</td><td>Detailed calculation is provided in Annex 3.1-3.3. attached to the PDD version 02</td><td>0.92, relative units</td><td>The parameter is applied in line with ACM0009 approved CDM methodology «Consolidated baseline and monitoring methodology for fuel switching from coal or petroleum fuel to natural gas - Version 3.2»[14].</td></tr>
<tr><td>$\eta_{BL,y}$</td><td>Efficiency of stationary coal or fuel oil combustion at consumer "i"</td><td>ACM0009 Consolidated baseline and monitoring methodology for fuel switching from coal or petroleum fuel to natural gas[15]</td><td><table><tr><th>Heat supply technology</th><th>Value, relative units</th></tr><tr><td>New fuel-oil boiler</td><td>0.9</td></tr><tr><td>New coal boiler</td><td>0.85</td></tr><tr><td>Old fuel-oil boiler</td><td>0.85</td></tr><tr><td>Old coal boiler</td><td>0.8</td></tr></table></td><td>The parameter is applied in line with ACM0009 approved CDM methodology «Consolidated baseline and monitoring methodology for fuel switching from coal or petroleum fuel to natural gas - Version 3.2»[16].</td></tr>
</table>

B.2.2. List of parameters subject to periodic monitoring.

Table 4. Parameters controlled during the whole monitoring period, used in project emission calculation.

Symbol	Parameter	Data source	Data units	Monitoring frequency	Comments
$FC_{NG,i,y}$	Total volume of natural gas combusted in period "*y*" by consumer "*i*"	Gas meters	ths m^3	Monthly	A cubic meter, reduced to standard conditions (T = 20 degrees C, P = 101.325 kPa (760 mm of mercury) and

[14] http://cdm.unfccc.int/methodologies/DB/2CRBYLJO5JWC9YHBSWJQWYIH2LLGMJ
[15] http://cdm.unfccc.int/methodologies/DB/2CRBYLJO5JWC9YHBSWJQWYIH2LLGMJ
[16] http://cdm.unfccc.int/methodologies/DB/2CRBYLJO5JWC9YHBSWJQWYIH2LLGMJ

					relative humidity is equal to zero) is taken as the unit of account of gas supplied to a consumer. Data about the amount of gas consumption by consumers are 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
$NCV_{NG,y}$	Net calorific value of natural gas	The "National inventory report of anthropogenic greenhouse gas emissions by sources and removals by sinks in Ukraine for 1990-2011"[17]	GJ/ ths m^3	Monthly	According to principle of conservatism minimal calorific value of gas is used.
$EF_{C,NG,y}$	Carbon emission factor for natural gas combustion	The "National inventory report of anthropogenic greenhouse gas emissions by sources and removals by sinks in Ukraine for 1990-2011"[18]	t C/TJ	Annually	Data allowing for calculation of GHG emissions in the project scenario; information will be archived in paper and electronic form
$OXID_{NG,y}$	Carbon oxidation factor for natural gas combustion	The "National inventory report of anthropogenic greenhouse gas emissions by sources and removals by sinks in Ukraine for 1990-2011"[19]	Relative units	Annually	Data allowing for calculation of GHG emissions in the project scenario; information will be archived in paper and electronic form

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

Table 5. Parameters that are controlled during the monitoring period and used to calculate emissions in the baseline scenario.

Symbol	Parameter	Data source	Data units	Monitoring frequency	Comments
$FC_{NG,i,y}$	Total quantity of natural gas combusted in period "*y*" by consumer "*i*"	Gas meters	ths m^3	Monthly	A cubic meter, reduced to standard conditions (T = 20 degrees, C, P = 101.325 kPa (760 mm. of mercury) and relative humidity is equal to zero) is taken as the unit of account of gas supplied to a consumer. Data about the amount of gas consumption by consumers are 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
$NCV_{FF,y}$	Net calorific value of fossil fuel of "*FF*" type. (Fuel of "*FF*" type means coal, fuel oil)	The "National inventory report of anthropogenic greenhouse gas emissions by sources and removals by sinks in Ukraine for 1990-2011"[20]	GJ/ t	Annually	The parameter is used according to the approved CDM methodology ACM0009 and "Guidance on criteria for baseline setting and monitoring" Version 03[21]. 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 city administrations.
$NCV_{NG,y}$	Net calorific value of	The "National inventory report of	GJ/ths m^3	Annually	According to principle of

[20] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2012-nir-13apr.zip
[21] http://ji.unfccc.int/Ref/Documents/Baseline_setting_and_monitoring.pdf

	natural gas	anthropogenic greenhouse gas emissions by sources and removals by sinks in Ukraine for 1990-2011"[22]			conservatism minimal calorific value of gas is used.
$EF_{C,FF,y}$	Carbon emission factor for fossil fuel of "*FF*" type combustion. (Fuel of "*FF*" type means coal, fuel oil)	The "National inventory report of anthropogenic greenhouse gas emissions by sources and removals by sinks in Ukraine for 1990-2011"[23]	t C/TJ	Annually	Data allowing for calculation of GHG emissions in the baseline scenario; information will be archived in paper and electronic form
$OXID_{FF,y}$	Carbon oxidation factor for fossil fuel of "FF" type combustion. (Fuel of "*FF*" type means coal, fuel oil).	The "National inventory report of anthropogenic greenhouse gas emissions by sources and removals by sinks in Ukraine for 1990-2011"[24]	Relative units	Annually	Data allowing for calculation of GHG emissions in the baseline scenario; information will be archived in paper and electronic form

Yearly parameter values used to calculate GHG emissions for the project and the baseline scenarios are shown in Annex 3.1-3.3.: Calculation of GHG emission reductions under the project "Reduction of greenhouse gases emissions by gasification of Zakarpattia region"

B.2.3. Data related to leakage:

Table 6. Parameters that are controlled during the monitoring period and used to calculate leakage

Symbol	Parameter	Data source	Data units	Monitoring frequency	Comments
$FC_{NG,i,y}$	Total quantity of natural gas combusted in period "*y*" by consumer "*i*"	Gas meters	ths m^3	Monthly	A cubic meter, reduced to standard conditions (T = 20 degrees, C, P = 101.325 kPa (760 mm. of mercury) and relative humidity is equal to zero) is taken as the unit of account of gas supplied to a

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

					consumer. Data about the amount of gas consumption by consumers are 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
$NCV_{NG,y}$	Net calorific value of natural gas	The "National inventory report of anthropogenic greenhouse gas emissions by sources and removals by sinks in Ukraine for 1990-2011"[25]	GJ/ ths m^3	Annually	According to principle of conservatism minimal calorific value of gas is used.
$EF_{CO_2,GTU,y}$	Reduced GHG emission factor for natural gas transportation to end consumers	Official data of the Ministry of Energy and Coal Industry of Ukraine[26] and the "National inventory report of anthropogenic greenhouse gas emissions by sources and removals by sinks in Ukraine for 1990-2011". Detailed calculation and the reference to the source of data are provided in Annex 3.1-.3.3(Excel files).	t CO_2e/ m^3	Annually	
$L_{PJ,y}$	Length of gas distribution systems constructed in the framework	Acts of commissioning of gas distribution networks	ths km	Monthly	Monitoring of the length of constructed gas distribution systems will be carried out by people

[25] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2012-nir-13apr.zip
[26] http://mpe.kmu.gov.ua/

	of the project				responsible for this activity on the basis of commissioning certificates for each monitoring period
$EF_{CH_4,los1,y}$	Default methane emission factor for natural gas transportation and distribution	The "National inventory report of anthropogenic greenhouse gas emissions by sources and removals by sinks in Ukraine for 1990-2011"[27]. Table 1.B.2	t CH_4/ths km	Annually	Officially approved national data that are effective at the moment of the monitoring report preparation were used.
$EF_{CH_4,los2,y}$	Default methane emission factor at technological gas equipment at end consumers place	The "National inventory report of anthropogenic greenhouse gas emissions by sources and removals by sinks in Ukraine for 1990-2011". Table 1.V.2	t CH_4/PJ	Annually	Officially approved national data that are effective at the moment of the monitoring report preparation were used.
GWP_{CH_4}	Global warming potential for methane	According to data approved by the IPCC	t CO_2e / t CH_4	Annually	The value is used for the first commitment period and may subsequently be revised in accordance with Article 5 of the Kyoto Protocol.

According to the methodology provided in the determined PDD, version 02, indirect extraneous leakage of CO_2, CH_4, N_2O from oil and coal extraction activities, petrol combustion by transport during transportation of diesel oil and coal to end consumer are excluded from a conservative standpoint. According to the determined PDD methane leakage in the course of gas transportation by gas transportation networks are included in the project emissions.

B.2.4. Data relating to environmental and social impact:

PJSC "Zakarpatgas" has the necessary Environmental Impact Assessment for all projects on gas distribution network construction in accordance with Ukrainian law (State Construction Standard of Ukraine A.2.2-1-2003 "The composition and content of materials of environmental impact assessment (EIA) in the design and construction of plants, buildings and structures"[28]). EIA of the projects are developed by subcontracting project and assembly organizations and are transferred to PJSC "Zakarpatgas" in the form of individual sections of reconstruction projects.

Overall, the impact of the project "Reduction of greenhouse gases emissions by gasification of Zakarpattia region" on the environment during the construction work can be assessed as permittable. Project facilities are not included in the list of activities and facilities of environmental hazard. Analysis of the facilities impact of the environment showed that taking into consideration all the factors, in the

[27] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2012-nir-13apr.zip
[28] http://www.budinfo.com.ua/dbn/8.htm

normal technical operational mode they will neither cause any negative processes in the regional environment, nor lead to any negative social and economic consequences, and the risk of emergencies and their possible impact are minimized.
The operation of project facilities is accompanied with production and technological (normalized) gas losses–marginal gas leakage which allow for ensuring reliable operation of gas pipelines, connecting pieces, fittings, expansion joints, gas equipment, appliances etc.
To prevent impact on the environment during construction works measures aimed at restoring the ecological balance are carried out. In order to reduce impact on the environment all construction and assembly works are carried out exclusively within the right-of-way.
Land recultivation 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.

Technical recultivation of areas includes the following measures:

- Removal and preparation of soil and vegetation layer in the areas of construction;
- Cleaning 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;
- Restoring the topsoil.

As part of procedures undertaken at the request of relevant state services, the company reports on environmental performance on a periodical basis. Environmental department of PJSC "Zakarpatgas" develops quarterly reports in accordance with the Form No.2-TP (air) that is provided to local government statistics.

B.3. Emergency situations and procedures for detection and liquidation of malfunctions at PJSC “Zakarpatgas”:

Detection, liquidation and registration of malfunctions and emergency situations at gas networks of PJSC “Zakarpatgas” is carried out according to Safety rules of gas supply systems of Ukraine.[29].

Emergency dispatch service is organized at SPHH for localization and liquidation of emergencies (hereinafter - EDS), its affiliates and positions operate round-the-clock, including weekends and holidays. EDS services shall be provided with a wired connection "04" (from 2009 "104"), connection with special services (fire, ambulance, police, power company, etc.) by means of radio and have the equipment to tape track, electrified gas mnemoscheme high and medium pressure serviced settlements with a population over 50 thousand people, boards pipelines indicating to them all facilities, engineering services on a scale of not more than 1:1000.

There were no emergencies or major malfunctions registered at PJSC “Zakarpatgas” in the reporting period of 01/01/2012 – 31/12/2012.

[29] http://dnop.com.ua/dnaop/act5048.htm

SECTION C. Quality assurance and quality control measures

C.1. Roles and responsibilities:

Operational and management structure to be applied by PJSC «Zakarpatgas» for implementation of monitoring is given below:

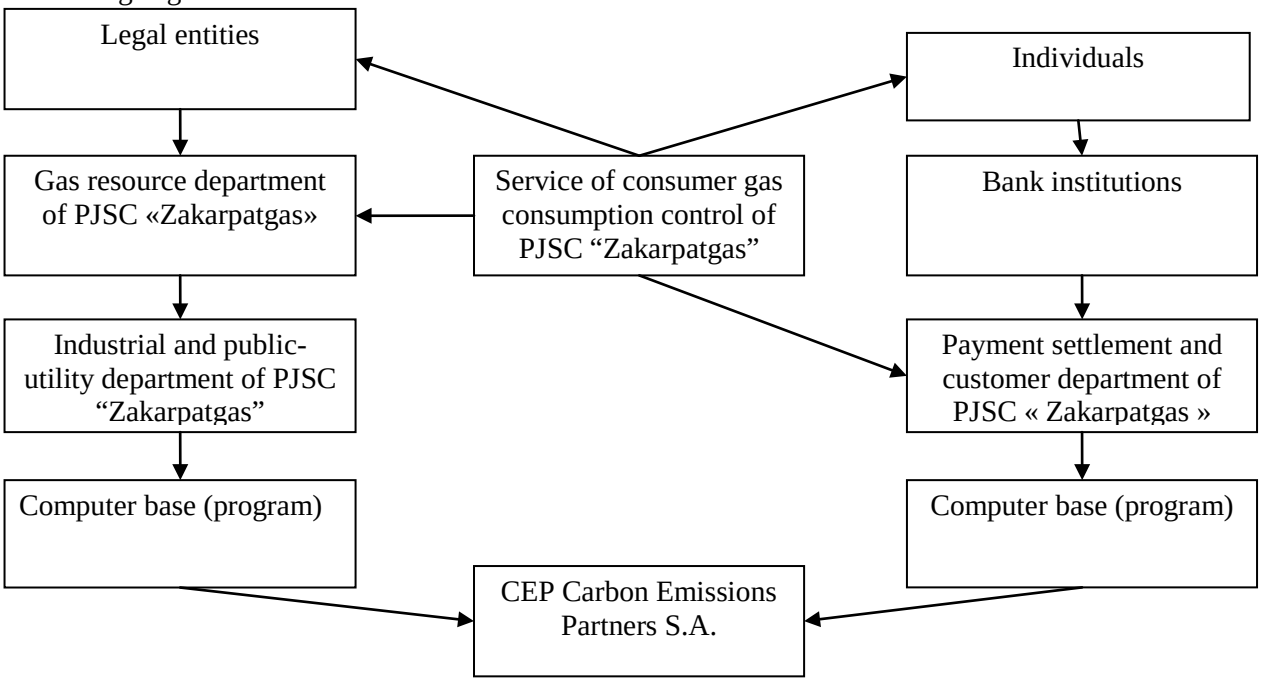

Figure 3. Structure of collection and processing of gas supply data.

Monitoring of natural gas consumption by legal entities.

1. Legal entities supply information on gas consumption to the Gas resource department of PJSC "Zakarpatgas" every month.
2. Gas resource department conducts monthly inspections of meters, executes a certificate signed by the enterprise and transfers it to the Industrial and public-utility department of PJSC "Zakarpatgas".
3. Industrial and public-utility department of PJSC "Zakarpatgas" processes information into basic form by program.
4. Indices of gas supply volume processed by program are delivered to the project developer.

Monitoring of natural gas consumption by individuals.

1. Service of consumer gas consumption control conducts monthly inspections of meters, executes a certificate signed by an individual and transfers it to the Consumers service.
2. Bank institutions deliver the information on gas consumption in the form of paid bills to the Payment settlement and customer department of PJSC "Zakarpatgas".
3. Consumers service processes received information and bases it into program.
4. Indices of gas supply volume processed by program are delivered to the project developer.

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

Project monitoring does not require any changes in PJSC "Zakarpatgas" existing data accounting and collection system.

The data subject to monitoring and required for determination and further verification will be archived and stored at PJSC "Zakarpatgas" for two years after the transfer of emission reduction units generated by the project.

C.2. Trainings:

Since the principal activities of PJSC “Zakarpatgas” are not changed when implementing the Joint Implementation (JI) project and the project monitoring is carried out as a part of practice established at the company, special trainings for personnel are not necessary. Technical personnel of the enterprise possess necessary knowledge and experience to carry out the project implementation and monitoring.

PJSC “Zakarpatgas” retrains personnel in accordance with:

- Gas Supply Safety Regulations of Ukraine;
- Law of Ukraine “On labour protection”;
- Safe Operation Manual for Consumer Electric Facilities;
- Regulations of Construction and Safe Operation of Pressurized Vessels;
- Regulations of Construction and Safe Operation of Lifting Cranes.

In case of new equipment implementation (the equipment which has not been used by this enterprise before), the company-manufacturer or the company-supplier of this equipment shall conduct trainings on the peculiarities of equipment operation for the personnel.

The company holds trainings on gas pipeline emergency localization and liquidation and operation of gas equipment of outdoor and indoor gas pipelines. The enterprise has the Labour Protection Department responsible for professional development and trainings of the personnel.

C.3. Involvement of third parties:

In accordance with paragraph 6 of the Model Agreement on provision of services on gas, approved by NERC on 04.01.2000 № 1[30] (registered by Ministry of Justice 01.02.2000, № 57/4278) maintenance of consumer gas piping (low-pressure gas pipelines, gas meters, gas devices, equipment needed for gas use in the home) is the responsibility of gas transport organization.
Calibration and verification of gas meters entities are performed by relevant departments of these companies. Periodically PJSC "Zakarpatgas" monitors the performance of verification and calibration of gas meters, held by legal entities.

C.4. Internal audits and control methods:

Routine repair of gas networks is carried out once a year; maintenance - once every six months. Repaired gas equipment is regularly examined to ensure that it works properly and is not a source of gas leakage.

In accordance with the procedures of quality management, the Law of Ukraine "On metrology and metrological activity"[31] means of metering equipment used for monitoring of the project activity are subject to periodic state verification. Personnel of PJSC “Zakarpatgas” are subject to periodic examination of their knowledge of requirements to:

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

Each quarter, representatives of project developers, CEP Carbon Emissions Partners S.A., conduct internal audits of the project monitoring system at PJSC “Zakarpatgas”.

Internal audit includes measures on verification of consumed gas accounting and record keeping by Service control over the spending of gas; verification of proper working condition and periodic maintenance of "Gasolina" software; cross-check of data of these program complexes and records of consumed gas, that are kept by the relevant services of the company; checking the timeliness of natural gas meters verification etc.

[30] http://zakon.nau.ua/doc/?uid=1027.51.0
[31] http://zakon2.rada.gov.ua/laws/show/113/98-вр

SECTION D. Calculation of GHG emission reductions

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

D.1.1.Formulae for calculation of project emissions

Formula 1 – total GHG emissions due to natural gas combustion caused by the use of new energy carrier supply system by consumers, in period "*y*" of the project scenario (t CO_2e)	
	$PE_y = \sum_{i=1}^{I} PE_{i,y}$,
	PE_y - total GHG emissions due to natural gas combustion caused by the use of new energy carrier supply system by consumers, in period "*y*" of the project scenario (t CO_2e); $PE_{i,y}$ - GHG emissions due to natural gas combustion caused by the use of the new energy supply system by consumer *i*, in period *y* of the project scenario (t CO_2e). $[y]$ - monitoring period; $[i]$ - consumer; $[I]$ - total number of consumers.

Formula 2 – GHG emissions due to natural gas combustion caused by the use of the new energy supply system by consumer "*i*", in period "*y*" of the project scenario (t CO_2e)	
	$PE_{i,y} = \frac{FC_{NG,i,y} \cdot NCV_{NG,y} \cdot EF_{CO_2,NG,y}}{10^3}$,
	$FC_{NG,i,y}$ - natural gas consumption by consumer "*I*", in period "*y*" of the project scenario (ths m^3); $NCV_{NG,y}$ - net calorific value of natural gas (GJ/ths m^3); $EF_{CO_2,NG,y}$ - carbon dioxide emission factor for stationary combustion of natural gas, in the project scenario (t CO_2/TJ); 1000 – GJ to TJ conversion coefficient (GJ/TJ). $[NG]$ - natural gas; $[y]$ - monitoring period; $[i]$ - consumer.

Formula 3 – carbon dioxide emission factor for stationary combustion of natural gas, in the project scenario (t CO_2/TJ)	
	$EF_{CO_2,NG,y} = EF_{C,NG,y} \cdot OXID_{NG,y} \cdot 44/12$,
	$EF_{C,NG,y}$ - carbon emission factor for natural gas combustion(t C/TJ); $OXID_{NG,y}$ - carbon oxidation factor for natural gas combustion (relative units); $44/12$ - stoichiometric ratio between the molecular weight of carbon dioxide and carbon (t CO_2/t C); $[NG]$ - natural gas; $[y]$ - monitoring period.

D.1.2. Formulae used for calculation of emissions in the baseline scenario:

Formula 4 – total GHG emissions due to fossil fuel combustion caused by the use of the old energy supply system by consumers, in period "*y*" of the baseline scenario (t CO_2e)	
	$BE_y = \sum_{i=1}^{I} BE_{i,y}$,
	BE_y - total GHG emissions due to fossil fuel combustion caused by the use of the old energy supply system by consumers, in period "y" of the baseline scenario (t CO_2e); $BE_{i,y}$ - GHG emissions due to fossil fuel combustion caused by the use of the old energy supply system by consumer *i*, in period "*y*" of the baseline scenario (t CO_2e); $[y]$ - monitoring period; $[i]$ - consumer; $[I]$ - total number of consumers.

Formula 5 – GHG emissions due to fossil fuel combustion caused by the use of the old energy supply system by consumer "*i*", in period "*y*" of the baseline scenario (t CO_2e)	
	$BE_{i,y} = \frac{FC_{FF,i,y} \cdot NCV_{FF,y} \cdot EF_{CO_2,FF,y}}{10^3}$,
	$FC_{FF,i,y}$ - total volume of "*FF*"-type fossil fuel that would have been combusted by consumer "*i*", in period "*y*" of the baseline scenario (t); $NCV_{FF,y}$ - net calorific value of "*FF*"-type fossil fuel(GJ/t); $EF_{CO_2,FF,y}$ - default carbon dioxide emission factor for stationary combustion of "*FF*"-type fossil fuel, in the baseline scenario (t CO_2/TJ); 1000 – GJ to TJ conversion coefficient (GJ/TJ). $[y]$ - monitoring period; $[FF]$ - fossil fuel type; $[i]$ - consumer.

Formula 6 – total volume of "*FF*"-type fossil fuel that would have been combusted by consumer "*i*", in period "*y*" of the baseline scenario (t)	
	$FC_{FF,i,y} = FC_{NG,i,y} \cdot \frac{NCV_{NG,y} \cdot \eta_{PJ,i}}{NCV_{FF,y} \cdot \eta_{BL,i}}$,
	$FC_{NG,i,y}$ - natural gas consumption by consumer "*i*", in period "*y*" of the project scenario (ths m^3); $NCV_{NG,y}$ - net calorific value of natural gas (GJ/ths m^3); $NCV_{FF,y}$ - net calorific value of "*FF*"-type fossil fuel(GJ/t); $\eta_{PJ,i}$ - efficiency of stationary natural gas combustion at the site of consumer "*i*", relative units; $\eta_{BL,i}$ - efficiency of stationary coal or fuel oil combustion at the site of consumer "*i*", relative units; $[y]$ - monitoring period; $[BL]$ - baseline scenario; $[PJ]$ - project scenario; $[NG]$ - natural gas;

	$[FF]$ - fossil fuel type; $[i]$ - consumer.

Formula 7 – default carbon dioxide emission factor for stationary combustion of "*FF*"-type fossil fuel, in the baseline scenario (t CO_2/TJ)
$EF_{CO_2,FF,y} = EF_{C,FF,y} \cdot OXID_{FF,y} \cdot 44/12,$
$EF_{C,FF,y}$ - carbon emission factor for "*FF*"-type fossil fuel combustion (t C/TJ); $OXID_{FF,y}$ - carbon oxidation factor for "*FF*"-type fossil fuel combustion (relative units); $44/12$ - stoichiometric ratio between the molecular weight of carbon dioxide and carbon (t CO_2/t C); $[y]$ - monitoring period; $[FF]$ - fossil fuel type.

D.1.3. Formulae used for calculation of leakage:

Formula 8 – GHG leakage (t CO_2e)
$LE_y = LE_{CO_2,los,y} + LE_{CO_2,GTU,y}$
$LE_{CO_2,los,y}$ - methane leaks at technological equipment and at end consumer's place in period "*y*", in the project scenario (t CO_2e); $LE_{CO_2,GTU,y}$ - GHG leaks due to combustion of gas fuel by gas turbine units in the course of transportation of natural gas to end consumers (t CO_2e); $[y]$ - monitoring period; $[los]$ - methane leaks from technological equipment and at end consumers' place; $[GTU]$ - leaks from gas fuel combustion in gas turbine units during the transportation of gas to end consumers.

Formula 9 – methane leaks at technological equipment and at end consumer's place in period "*y*", in the project scenario (t CO_2e)
$LE_{CO_2,los,y} = LE_{CO_2,los1,y} + LE_{CO_2,los2,y},$
$LE_{CO_2,los1,y}$ - GHG leaks from methane leaks at technological equipment in period "*y*", in the project scenario (t CO_2e); $LE_{CO_2,los2,y}$ - GHG leaks from methane leaks at equipment of end consumers in period "*y*", in the project scenario (t CO_2e); $[y]$ - monitoring period; $[los1]$ - methane leaks from technological equipment; $[los2]$ - methane leaks at end consumers' place.

Formula 10 – GHG emissions from methane leaks at technological equipment in period "*y*", in the project scenario (t CO_2e)
$LE_{CO_2,los1,y} = \sum L_{PJ,y} \cdot EF_{CH_4,los1,y} \cdot GWP_{CH_4}$

	$L_{PJ,y}$ - length of gas distribution systems constructed within the project boundary (ths km); $EF_{CH_4,los1,y}$ - default methane emission factor for natural gas transportation and distribution (t CH_4/ths km); GWP_{CH4} - global warming potential for methane; determined according to the IPCC recommendations (t CO_2e/t CH_4). $[y]$ - monitoring period; $[los1]$ - methane leaks from technological equipment; $[PJ]$ - project scenario.

Formula 11 – GHG emissions from methane leaks at equipment of end consumers in period "*y*", in the project scenario (t CO_2e)	
	$LE_{CO_2,los2,y} = \frac{\sum_1^I FC_{NG,i,y} \cdot NCV_{NG,y} \cdot EF_{CH_4,los2,y} \cdot GWP_{CH_4}}{10^6}$
	$\sum_1^I FC_{NG,i,y}$ - total natural gas consumption in period "*y*" by consumer (ths m^3); $NCV_{NG,y}$ - net calorific value of natural gas (GJ/ths m^3); $EF_{CH_4,los2,y}$ - default methane emission factor at technological gas equipment at end consumer's place (t CH_4/PJ); GWP_{CH4} - global warming potential for methane; determined according to the IPCC recommendations (t CO_2e/t CH_4); 10^6 – GJ to PJ conversion coefficient (GJ/PJ). $[y]$ - monitoring period; $[NG]$ - natural gas; $[i]$ - consumer; $[los2]$ - methane leaks at end consumers' place; $[I]$ - total number of consumers.

Formula 12 – GHG emissions from gas fuel combustion in gas turbine units during the transportation of gas to end consumers (t CO_2e)	
	$LE_{CO_2,GTU,y} = \sum_1^I FC_{NG,i,y} \cdot EF_{CO_2,GTU,y}$
	$\sum_1^I FC_{NG,i,y}$ - total natural gas consumption in period "*y*" by consumer (ths m^3); $EF_{CO_2,GTU,y}$ - reduced GHG emission factor for natural gas transportation to end consumers (t CO_2/ths m^3). $[GTU]$ - leaks from gas fuel combustion in gas turbine units during the transportation of gas to end consumers; $[y]$ - monitoring period; $[NG]$ - natural gas; $[i]$ - consumer; $[I]$ - total number of consumers.

D.1.4. Formulae for calculation of GHG emission reductions:

Total emission reductions are the difference between the baseline and project emissions.

Formula 13 – Quantity of Emission Reduction Units (ERU)	
	$ER_y = BE_y - PE_y - LE_y$
	BE_y - total GHG emissions due to fossil fuel combustion caused by the use of the old energy supply system by consumers, in period "y" of the baseline scenario (t CO_2e); PE_y - GHG emissions due to natural gas combustion caused by the use of new energy carrier supply system by consumers, in period "y" of the project scenario (t CO_2e); LE_y - GHG leaks due to the use of new energy carrier supply system by consumers , in period "y" of the project scenario (t CO_2e); $[y]$ - monitoring period.

D.2. Results of the GHG emission reductions monitoring

D.2.1. GHG emissions in the project scenario

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

Monitoring period:	**Total project emissions,t CO_2e**
01/01/2012 – 31/12/2012	434 720
Total project emissions during monitoring period 01/01/2012 - 31/12/2012 (t CO_2e)	**434 720**

D.2.2. GHG emissions in the baseline scenario

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

Monitoring period:	**Total baseline emissions, t CO_2e**
01/01/2012 – 31/12/2012	882 205
Total baseline emissions during monitoring period 01/01/2012 - 31/12/2012 (t CO_2e)	**882 205**

D.2.3. Leakages:

As a result of project implementation during the reporting period, the following GHG emissions occurred:

Monitoring period:	**Leakage, t CO_2e**
01/01/2012 – 31/12/2012	46 239
Total leakage emissions during monitoring period 01/01/2012 - 31/12/2012 (t CO_2e)	**46 239**

D.2.4. Emissions reduction due to the project implementation in the monitoring period:

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

Monitoring period:	**Emission reductions, t CO_2e**
01/01/2012 – 31/12/2012	401 246
Total emissions reductions during monitoring period 01/01/2012 - 31/12/2012 (t CO_2e)	**401 246**

Annex 1: Monitoring Parameters for the period of 01/01/2012 - 31/12/2012

Parameter		Period
		01/01/2012 - 31/12/2012
		2012
$\sum_{1}^{i} FC_{NG,i,y}$ ths m^3	**Total natural gas consumption in monitoring period "*y*"**	230 614
ths m^3	Total natural gas consumption by individuals	205 123
ths m^3	Total natural gas consumption by public utilities	25 490
$L_{PJ,y}$, ths km	**Length of gas distribution systems built under the project**	0,0528705
$NCV_{NG,y}$, GJ/ths m^3	**Net calorific value of natural gas**	34,06[32]
$NCV_{FF,y}$, GJ/т	**Net calorific value of coal**	21,69
$NCV_{FF,y}$, GJ/т	**Net calorific value of fuel oil**	40,47[32]
$EF_{C,NG,y}$, t C/TJ	**Carbon emission factor for natural gas combustion**	15,17[32]
$OXID_{NG,y}$, relative units	**Carbon oxidation factor for natural gas combustion**	0,995[32]
$EF_{C,FF,y}$, t C/TJ	**Carbon emission factor for coal combustion**	27,36[32]
$OXID_{FF,y}$, relative units	**Carbon oxidation factor for coal combustion**	0,98[32]
$EF_{C,FF,y}$, t C/TJ	**Carbon emission factor for fuel oil combustion**	21,1[32]
$OXID_{FF,y}$, relative units	**Carbon oxidation factor for fuel oil combustion**	0,99[32]
$EF_{CH_4,los2,y}$, t CH_4/PJ	**Default methane emission factor at technological gas equipment at end consumer's place**	192[33]
$EF_{CH_4,los1,y}$, t CH_4/ths km	**Default methane emission factor for natural gas transportation and distribution**	710[33]
$EF_{CO_2,GTU,y}$, t CO_2e/ths m^3	**Reduced GHG emission factor for natural gas transportation to end consumers**	0.059759[34]

[32] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2013-nir-15apr.zip

[33] http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/ukr-2013-nir-15apr.zip

[34] Додаток 3.1-3.3. Розрахунок скорочень викидів ПГ за проектом «Скорочення викидів парникових газів шляхом газифікації Закарпатської області»