Monitoring report of JI project «Reduction of methane emissions on the gas equipment of gas-distributing points and on the gas armature of gas-distributing networks of PJSC «Mariupolgaz »»

Monitoring period: 01/09/2011-29/02/2012

Version: 02 as of 05/03/2012

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Appendix A.[1] Calculation of greenhouse gases emission reductions at gas equipment of gas-distributing points (cabinet-type gas-distributing points), on gas armature of gas-distributing networks of PJSC «Mariupolgaz » for 6 month (from September 01, 2011 to February 29, 2012).

[1] Appendix A is given in electronic form

Section A. General project activity and monitoring information

A.1. Title of the project

Reduction of methane emissions on the gas equipment of gas-distributing points and on the gas armature of gas-distributing networks of PJSC «Mariupolgaz ».

A.2. Status of JI project

JI project "Reduction of methane emissions on the gas equipment of gas-distributing points and on the gas armature of gas-distributing networks of PJSC «Mariupolgaz »" was determined by Bureau Veritas Certification, Determination report No. UKRAINE-det/0311/2011 as of 25/07/2011. The project was approved by State Environmental Investment Agency of Ukraine (Letter of Approval No. 2402/23/7 as of 05/09/2011) and Federal Office for Environment (FOEN) of Switzerland (Letter of Approval No. J294-0485 as of 25/07/2011).

A.3. Short description of the project activity

As a result of unscheduled rehabilitation of gas-distributing points (GDP), cabinet-type gas-distributing points (CGDP) and gas armature of gas-distributing networks carried out by PJSC «Mariupolgaz » the following greenhouse gases (GHG) emission reductions were achieved in accordance with this project for the monitoring period from September 01, 2011 to February 29, 2012[2]:

Table.1. GHG emissions reduction

	01/09/2011-31/12/2012	01/01/2012-29/02/2012
Methane emissions reduction for the period, m^3	8 229 346	3 979 765
GHG emissions reduction for the period, tCO_2e.	123 875	59 907
Total methane emissions reduction for the period of monitoring, m^3	12 209 111	
Total GHG emissions reduction for the period of monitoring, tCO_2e.	183 782	

A.4. Monitoring period

Starting date: 01/09/2011
Closing date: 29/02/2012

[2] The presented values of GHG emission reductions are approximated to integers.

A.5. Methodology applied to the project activity

A.5.1. Baseline determination methodology

The Specific Approach has been applied that based on the Methodology AM0023 version 3.0 of 30/10/2009 «Leak reduction from natural gas pipeline compressor or gate stations»[3] approved by Clean Development Mechanism Executive Board with clarification related to the method of leakage volume measurement and stated in section B.1 of the determined PDD version 05.

A.5.2. Monitoring methodology

For quantitative estimation and preparation of the report on emission reduction on the ground of baseline and project activity the Specific Approach on the base of approved monitoring methodology AM0023, version 3.0, specifying the methods of leakage measurement was used (section B.1 of PDD version 05).
The uncertainty of the method of measurement was taken into account in the course of GHG emission reduction calculation (see section D of PDD, version 05).

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

In accordance with PDD, version 05, the project boundaries include the places of methane leakages due to nonhermeticity of gas equipment GDP (CGDP), gas armature, flanged and threaded joints of gas-distributing networks of PJSC «Mariupolgaz ». In total the project's boundaries include equipment of 244 GDP (CGDP) and 6481 units of gas armature. During the period from starting date of the project implementation (2005) to September 1 (2011), 244 GDP (CGDP) and 6 481 units of gas armature were repaired (replaced) within the project boundaries. Quantity of repaired (replaced) equipment of GDP (CGDP) and gas armature of gas-distributing networks of PJSC «Mariupolgaz » by periods is given in Table 2:

[3] http://cdm.unfccc.int/UserManagement/FileStorage/JY2L0XEKMB3HD18T7RPO6ZSFCQINGA

Table 2. Quantity of repaired GDP (CGDP) and repaired (replaced) gas armature of gas pipelines by periods

Period	Quantity of GDP (CGDP), where in the gas equipment was repaired (replaced)	Quantity of repaired (replaced) gas armature of gas-distributing networks
2005	49	1 300
2006	97	2 590
2007	87	2 407
2008	-	28
2009	-	28
2010	5	68
January – August 2011	6	60
September 2011 – February 2012	-	-
Total	**244**	**6 481**

Project measures for current monitoring period (September 01, 2011 – February 29, 2012) also involved subsequent Purposeful Examination and Technical Maintenance (PETM) of the whole gas equipment of GDP (CGDP) and gas armature, which were repaired (replaced) out of schedule for the whole period of JI project.

The gas equipment of GDP (CGDP) and gas armature of gas pipelines repaired (replaced) during previous periods of project activity is inspected regularly, as component part of standard monitoring activity, to ascertain, that they do not become the source of emissions again.

Current repair of gas equipment according to the Monitoring Plan, given in PDD, version 05, is carried out once per year, and maintenance is performed once per half-year.

Measurements of volume of methane leakages of repaired (replaced) gas equipment of GDP (CGDP) and gas armature of gas pipelines of PJSC «Mariupolgaz » don’t exceed the volume of leakages measured after the first repair of equipment.

Samples of repaired CGDP with replacement of the equipment are shown in Pic. 1-2.

Pic. 1. Repaired CGDP in Mariupol city, Kulibina str., register № 7. Year of CGDP commissioning is 1976.

Pic. 2. Repaired CGDP in Kremenivka village, Chapaeva str., register № 80. Year of CGDP commissioning is 1982.

Photo of gas equipment that PJSC "Mariupolgaz" was purchased for the reporting period and which will be install on gas pipelines and in the GDP (CGDP) during 2012 is shown on Pic. 3-5.

Pic. 3. Ball valve flange connections production of Hungary.

Pic. 4. Ball valve for underground installation production of Hungary.

Pic. 5. Pressure regulators and filters made in Italy (Pietro Fiorentiti)

A.7. Possible deviations and revisions to the registered PDD

There are no significant deviations from the registered version of PDD.

The estimated calculated values of volumes of GHG emission reductions listed in the determined PDD, version 05 are lower than actually received reductions for the current monitoring period by 1.3%.

The reason of such deviation is that fact that estimations of emission reductions given in the determined PDD version 03 are preliminary and are based on theoretical calculations, statistical estimates, as well as on the basis of initial measurements performed at facilities of PJSC "Mariupolgaz" gas distribution infrastructure before the beginning of the project implementation.

According to the chosen Specific Approach GHG emission reductions within the framework of this project are calculated ex post.

A.8. Possible deviations or revisions to the registered monitoring plan

There are no deviations to the registered monitoring plan.

A.9. Persons responsible for preparation and submission of monitoring report

Leader of Working Group, chief engineer of PJSC «Mariupolgaz » Grudolov M.A., is responsible for monitoring report on behalf of PJSC «Mariupolgaz » and Director Fabian Knodel is responsible for report on behalf of VEMA S.A.

Section B. Key monitoring activities

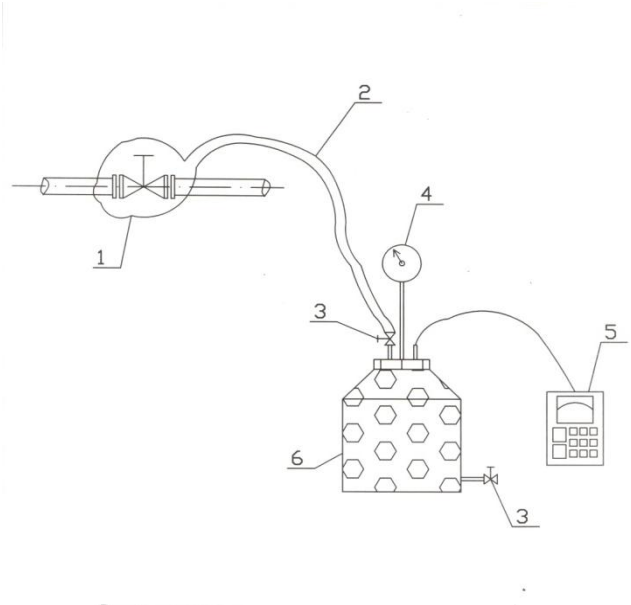
B.1.1. Applied equipment

Control and monitoring system is divided into three parts:
1) measurement of the amount of methane leakages before repair (replacement) of gas equipment;
2) measurement of the amount of methane leakages after the repair (replacement) of gas equipment;
3) archiving and processing of obtained results.

The measurement of natural gas leakages volumes are made on the basis of technology of the "calibrated bag" that is described in the approved CDM methodology AM0023, version 3.0 «Leak reduction from natural gas pipeline compressor or gate stations». One of the problems of the use of this methodology is difficulty of armature volume calculation used for measuring, and also the initial volume of air, at determination of gas volume that entered the "bag".
To solve these problems a special setting was made on the base of plastic tank of the known volume (0,11 m^3), a package, plastic hose and manometer (see Pic.6). All connections was executed hermetically.

Pic. 6. Photo of quantitative measuring of methane emissions device.

Scheme of device is given on Picture 7.



Pic.7. Scheme of device for quantitative measuring of methane leakages

Legend:
1. Hermetic bag.
2. Hose.
3. Tap.
4. Manometer.
5. Gas analyzer EX-TEC® HS 680.
6. Hermetic tank.

Gas analyzer EX - TEC® HS 680. For determination of methane concentration in this case a high-fidelity gas-analyzer of EX - TEC® HS 680 (Pic.8) is used.

Pic. 8. Photo to the gas-analyzer EX-TEC® HS 680.

The gas-analyzer has protection from an explosion (CENELEC).
Application to the gas analyzers and ranges of measuring are given in Table 3.

Table 3. Application and ranges of measuring of the gas analyzer EX - TEC® HS 680

Application	Range of measuring
Above-ground check-up	From 0 ppm to 10 volume percent (%) CH_4
Measuring in deepening of trenches of underground pipelines	from 0,0 to 100 volume percent (%) of CH_4 from 0 to 30 volume percent (%) of CO_2
Verification is in the closed spaces	From 0 ppm to 10 volume percent (%) of CH_4
Verification in apartments	From 0 ppm to 10 volume percent (%) of CH_4
Notification about the presence of explosive gases	From 0 ppm to 10 volume percent (%) of CH_4
Measuring of amount of mixtures in gases	From 0,0 to 100 volume percent (%) of CH_4
Analysis of ethane	CH, CH_4, C_2H_6, C_3H_8 (additionally)

A relative error amounts in 10% that corresponds to the standard EN 50054/57[4]

After an exposure and emission measuring repair or replacement of gas equipment GDP (CGDP) and gas armature of gas pipelines is executed with the use of modern materials of sealers (GOST 7338-90[5], GOST 5152-84[6] or GOST 10330-76[7]) and complete replacement of worn out equipment by new and modern one of European manufacturers or their analogues of domestic production.

B.1.2. Calibration procedure

The devicei applied in the process of methane leakage monitoring are:

- gas analyzer EX-TEC® HS 680 (Serial Number 06401000778), inter-checking interval is 1 year;
- manometer "Д-59Н-100-1.0 6 kPa", inter-checking interval is 1 year;
- thermometer type TL-4, inter-checking interval is 2 years.

The certificates conforming technical serviceableness of devices will be issued as a result of check-up (calibration).

[4] Electrical apparatus for the detection and measurement of combustible gases) General requirements and test methods.
[5] «Rubber and rubber-fabric plates»
[6] «Stuffing»
[7] «Scutched flax fibre. Technical conditions»

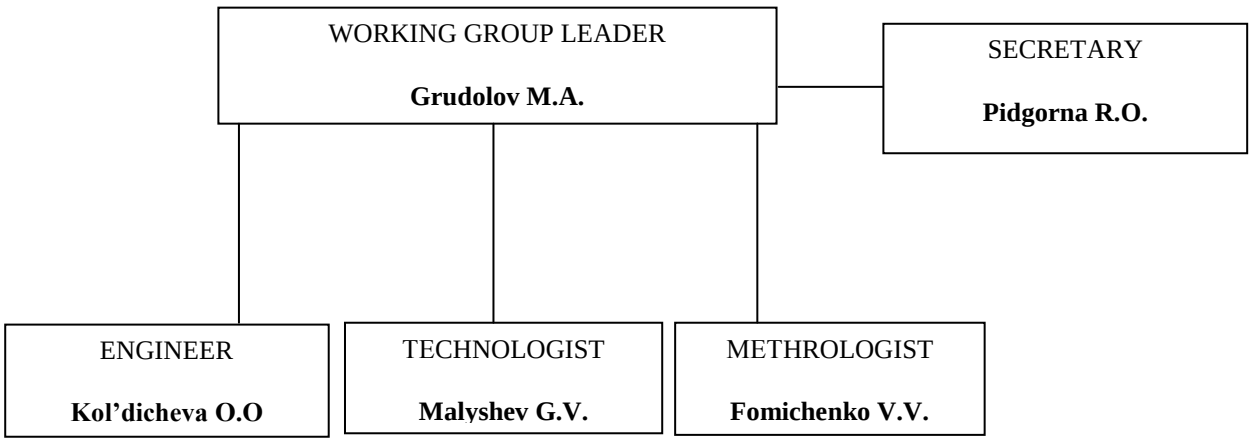
B.1.3. Involvement of Third Parties

SE «Kharkivstandardmetrology».
State Enterprise «Kharkivstandardmetrology» is the enterprise which has low powers to spend checking and calibration of gas analyzers.
«Kharkivstandardmetrology» performance of such kinds works for enterpise "Analitgaz-Service" which has operating contract with PJSC "Mariupolgaz" for repair and technical service of all gas analyzers of PJSC "Mariupolgaz".
This contract also provides that "Analitgazs-Service" on the instructions of "Mariupolgaz" carries out services in checking and calibration of gas analyzers in State Standard organisations.

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

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

Co-ordination of work of all departments and services of PJSC "Mariupolgaz" is carried out in relation to introduction of JI project by the Working group created by Order of Chairman of Board of PJSC "Mariupolgaz" № 243 of 30/12/2004. The update structure of the Working group was approved by Order of General director of PJSC "Mariupolgaz" №132a of 26/05/2011 and is presented on Pic. 9.



Pic.9. Structure of the Working group.

Responsible for collection of all information foreseen by the monitoring plan, and also implementation of all necessary calculations is Kol'dicheva O.O. Responsible for storage and archiving of all obtained information as a result of the conducted measuring and calculations is Pidgorna R.O. On the basis of the received information the leader of the working group Grudolov M.A. determines

the plan of measures on Project and the volume of necessary resources. Malyshev G.V. is responsible for organization of monitoring measurement of leakages and their removal. Fomichenko V.V. provides availability of trusted measuring equipment and maintenance.

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

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

Table. 4. Parameters used in the course of GHG emissions calculation

Identification number	Data variable	Source of data	Data unit measurement	Form of representation of obtained data	Comments
1. i	The sequence number GDP (CGDP), bolt, tap, valve, where methane emissions are found , removed and then checked	Leakage measurement activities	Dimensionless	Electronic	Corresponding number is appropriated to leakage found at device. List of gas equipment GDP (CGDP), shut-off devices (bolts, taps, valves), flanged and threaded joints is given in Accompanying document 1 to the PDD version 05. Inspection is carried out after repair.
2. Ti	Time	Records of investigation results	The amount of hours of exploitation of equipment on which leakages were found during a year	Electronic	Quantity of hours of exploitation during a year from the moment of its repair (replacement)
3. Data	Date	Data on repair (replacement) and monitoring (register)	Date of repair (replacement) and monitoring	Electronic	Date of rehabilitation used together with the quantity of hours of equipment exploitation to determine the total number of hours of operation. In the case of repeated leakages the date is the date of last inspection, which showed no leakages
4. GWP_{CH4}	Global Warming Potential for methane	IPCC	tCO_2e/ tCH_4	Electronic	Project developer will conduct monitoring of any changes in Global Warming Potential for methane published by IPCC and approved by COP
5. $F_{CH4,i}$	Leakage speed for each found leakage	Leakage measurement activity	m^3CH_4/h	Electronic	It is calculated by using the largest deviation of device error (10% for gas analyzer)

Identification number	Data variable	Source of data	Data unit measurement	Form of representation of obtained data	Comments
6. t	Gas temperature	Data of measurements of glass mercury thermometer TL-4	^{0}C	Electronic	It is measured for determination of CH_4 density.
7. P	Gas pressure	Data of measurements of manometer "Д-59Н-100-1.0 6 kPa"	MPa	Electronic	It is measured for determination of CH_4 density.
8. URi	Vagueness factor of emission measuring equipment	Information given by manufacturer and/or IPCC	%	Electronic	If possible, 95% confidence interval is measured, advice of Good Practice Guidelines presented in section 6 2000 IPCC. If the manufacturer of leakage measurement equipment states uncertainty interval without specifying the confidence interval, it can be considered as 95%.
9. *Vbag*	Tank capacity	Data of measurements of flow meter	m^3	Electronic	Tank is filled with water. Quantity of water measured by flow meter shall be a tank capacity. Measurement showed that the volume capacity is 0.11 m^3.
10. $w_{sampleCH4,i}$	Methane concentration in a sample	Data of measurements of gas analyzer EX-TEC® HS 680	%	Electronic	The concentration of methane in the sample (in tank) of leakage *i* is the difference between the concentration of methane in the sample at the beginning and end of measurement. Concentration is measured by gas analyzer EX-TEC ® HS 680.
11. τ_i	Time when methane concentration in tank reaches a certain level	Data of measurements of second meter «SOS pr-2b-2»	seconds	Electronic	Time during which the concentration of methane in tank reaches a certain level is determined by the second meter. Measurement begins with the opening tap on the tank lid and ends in 180 seconds.

B.2.3. Data concerning leakages

There are no leakages during the project implementation (JI Specific Approach on the basis of the approved Methodology AM0023, version 3.0 also as well as Methodology AM0023, version 3.0 doesn't provide for leakages).

B.3. Data processing and archiving

All data will be processed and archived in electronic and/or paper form and kept till 31/12/2019.

B.4. Extraordinary situations and disturbances

There were no extraordinary situations for 6 month of monitoring period (from 01/09/2011 to 29/02/2012) at gas-distribution networks of PJSC "Mariupolgaz".

B.5. Procedures for detection and elimination of failures at gas-distributing points and gas-distribution networks of PJSC "Mariupolgaz".

Detection, elimination and registration of failures and extraordinary situations at shut-off stations of PJSC "Mariupolgaz" is carried out according to the Gas Supply Safety Rules of Ukraine.

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

Such external data are using for monitoring:

Data/Parameter	GWP_{CH4},
Unit	tCO_2e/tCH_4
Description	Global Warming Potential for methane
Periodicity of measuring/ of monitoring	Constantly
Source of data that was (will be) applied	IPCC
The value of data (for ex - ante calculations/ determinations)	21
Confirmation of data choice or description of method and measuring procedures that were (will be) applied	-
Procedures of management of quality / providing of quality of	The responsible for monitoring person checks the data annually.

measuring that were (will be) applied	
Comments	The project developer monitors any changes in global warming potential for methane published IPCC (IPCC Second Assessment Report: Climate Change 1995 (SAR)) and accepted COP. The value of GWP for methane is provided on the UNFCCC web-site: http://unfccc.int/ghg_data/items/3825.php

Data/Parameter	URi
Unit	%
Description	Factor of vagueness of equipment of emissions measuring
Periodicity of measuring/ of monitoring	Annually
Source of data that was (will be) applied	IPCC
The value of data (for ex - ante calculations/ determinations)	95
Confirmation of data choice or description of method and measuring procedures that were (will be) applied	Methodology of AM0023, version 3.0
Procedures of management of quality / providing of quality of measuring that were (will be) applied	The responsible for monitoring person checks the data annually
Comments	Estimated where possible, 95% confidence interval, advice of IPCC presented in division 6 of *IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories, 2000*[8]. If the producer of equipment of emissions measuring declares the area of vagueness without clarification of confidence interval, it can be accepted 95%

[8] IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories, 2000: http://www.ipcc-nggip.iges.or.jp/public/gp/english/6_Uncertainty.pdf

B.7. Level of measuring equipment error

Relative error of gas analyzer EX-TEC® HS 680 is 10%, corresponding to standard EN 50054/57. The device is calibrated annually.

Section C. Quality assurance and quality control measures

C.1. Documented procedures and management plan

C.1.1. Roles and responsibilities

Chief engineer of PJSC "Mariupolgaz", Grudolov M.A., manages the project. He manages and coordinates the activity of all departments. Specially organized Working Group is responsible for collection and processing of parameters.
Structure of data collection and Project management is given in Section B.2 of this Monitoring Report.

C.1.2. Trainings

Special training for work with new equipment is not needed. All trainings concerning the project were held by the equipment suppliers and their cost is included into the cost of equipment.

C.2. Internal audits and control measures

Under the guidance of a specially established working group PJSC "Mariupolgaz" formed a group for measurement of all necessary parameters provided for by the methane leakage monitoring plan.
Monitoring measurements are performed by specifically trained personnel according to the Methods of measurements. Data on Monitoring measurements are recorded in paper form directly in the course of measurements. Then, on the basis of paper data the single electronic database of leakage monitoring measurements is formed.

Current repair of gas equipment GDP (CGDP) and gas armature of gas-distribution networks is carried out once per year, and maintenance is performed once per half-year.

Repaired gas equipment is inspected regularly as component part of standard monitoring activity, to ascertain, that it doesn’t become the source of emissions again.

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

As a result of project implementation the quality of gas supply of the region population will be improved.
Also there will be will reduction of natural gas losses, reduction of GHG emissions which cause greenhouse effect and climate change. The level of safety of gas pipelines’ operation will be increased.

Section D. Calculation of greenhouse gases emission reductions

D.1. Project emissions

Using the method of leakage volume by means of airtight container the volume of project methane leakage of one device *i* may be calculated by the formula:

$F_{CH4,iP} = V_{bag} * w_{sampleCH4,i} * 3600 / \tau_i$ where (1)

$F_{CH4,P}$ - methane leakage through leakages *i* from untight element after reconstruction (m³/h);
V_{bag} - capacity of airtight tank for measurement (m³);
$w_{sampleCH4,i}$ - methane concentration in leakage sample *i*, which is the difference of the concentration at the beginning and at the end of measurement (%);
τ_i - average duration of tank filling for leakage *i* after reconstruction (seconds).

Annual methane leakages shall be calculated by the formula:

$Q_{yP} = ConvFactor * \Sigma[F_{CH4P} * T_{i,y} * UR_i)] * GWP_{CH4} * 0.9,$ where (2)

Q_{yP} - methane emissions for certain period for reconstructed device (tCO_2e).
ConvFactor - coefficient of m^3CH_4 conversion into tCH_4 subject to the normal temperature and pressure (0°C and 101.3 kPa); it is 0.0007168 tCH_4/m^3CH_4
UR_i - coefficient of uncertainty of measurement methods (95%);
$T_{i,y}$ - time in hours for corresponding component *i* and during which it was functioning (period of monitoring) *y*;
GWP_{CH4} - Global Warming Potential for methane (21 tCO_2e/tCH_4);
0.9 - coefficient taking into account equipment error.

Estimated project emissions are given in Table 5[9].

Table 5. Project emissions tCO_2e

	01/09/2011-31/12/2011	01/01/2012-29/02/2012
Volumes of project GHG emissions for the period, tCO_2e.	15 363	7 430
Total volumes of project GHG emissions for the monitoring period, tCO_2e.	**22 793**	

[9] The presented values of project GHG emission are approximated to integers.

D.2. Baseline emissions

Using the method of leakage volume by means of airtight container the volume of baseline methane leakage of one device *i* may be calculated by the formula:

$F_{CH4,iB} = V_{bag} * w_{sampleCH4,i} * 3600 / \tau_i$ where (3)

$F_{CH4,P}$ - methane leakage through leakages *i* from untight element before reconstruction (m³/h);
V_{bag} - capacity of airtight tank for measurement (m³);
$w_{sampleCH4,i}$ - methane concentration in leakage sample *i*, which is the difference of the concentration at the beginning and at the end of measurement (%);
τ_i - average duration of tank filling for leakage *i* after reconstruction (seconds).

Annual methane leakages shall be calculated by the formula:

$Q_{yB} = ConvFactor * \Sigma[F_{CH4Y} * Ti,y * (1 - UR_i)] * GWP_{CH4} * 0.9$ where (4)

Q_{yP} - methane emissions for certain period for device before reconstruction (tCO_2e).
ConvFactor - coefficient of m^3CH_4 conversion into tCH4 subject to the normal temperature and pressure (0°C and 101.3 kPa); it is 0.0007168 tCH_4/m^3CH_4;
URi - coefficient of uncertainty of measurement method;
$T_{i,y}$ - Time in hours for corresponding component *i* and during which it was functioning (period of monitoring) *y*;
GWP_{CH4} - Global Warming Potential for methane (21 tCO_2e/tCH_4);
0.9 - coefficient taking into account equipment error.

Emissions that will take place in case of absence of rehabilitation measures are given in Table 6[10].

Table 6. Baseline emissions tCO_2e

	01/09/2011-31/12/2011	01/01/2012-29/02/2012
Volumes of baseline GHG emissions for the period, tCO_2e.	139 238	67 337
Total volumes of baseline GHG emissions for the monitoring period, tCO_2e.	**206 575**	

[10] The presented values of baseline GHG emission are approximated to integers.

D.3. Leakages

No leakages within the project implementation are observed (using Specific Approach, based on the approved Methodology AM0023, version 3.0 such as the methodology AM0023, version 3.0, leakages are not foreseen).

D.4 Emissions reduction as a result of project implementation JI project for 6 months (September 2011 - February 2012).

Emissions reduction as a result of project implementation is calculated as difference between baseline and project emissions.

Quantity of Emission Reduction Units (ERUs) in t CO_2e is calculated under the formula:

$ERU = \sum[Q_{yB} - Q_{yP}]$, where (7)

ERU– Emission Reduction Units, tCO_2e;
Q_{yP} – project emissions, tCO_2e;
Q_{yB} – baseline emissions, tCO_2e.

In the Table 7 provided to reduce emissions by 6 months of monitoring (September 2011 - February 2012) as a result of project implementation[11].

Table 7. Emission reductions tCO_2e

	01/09/2011-31/12/2011	01/01/2012-29/02/2012
Quantity of GHG emission reduction for the period, tCO_2e.	123 875	59 907
Total quantity of GHG emission reduction for the monitoring period, tCO_2e.	**183 782**	

[11] The presented values of GHG emission reductions are approximated to integers.