# JOINT IMPLEMENTATION PROJECT

## «Reduction of methane leaks on the gas equipment of the gas distribution points and on the gas armature, flanged, threaded joints of the gas distribution pipelines of PJSC «Krivorijgaz»

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

**Director of CEP Carbon Emissions Partners S.A.**

| (date) | (signature) | **Fabian Knodel** |
|---|---|---|
| | PS | (name and patronymic, last name) |

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

**Chairman of the Management Board of PJSC «Krivorijgas»**

| (date) | (signature) | **Vakulenko Ivan Evhenovych** |
|---|---|---|
| | PS | (surname, name and patronymic of the person) |

Kryvyi Rih 2012

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

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## Annexes

## LIST OF ABBREVIATIONS PRESENTED IN PDD

GDN – Gas distribution network
CLS – Conditional leakproof state
SPLNG – Standard physical leak of natural gas
APLNG – Above-standard physical leak of natural gas
PETM – Purposeful Examination and Technical Maintenance
NGLF – Natural gas leak factor
NG – Natural gas
UGSSR – Ukrainian Gas Supply System Safety Rules
GDP – Gas distribution point
CGDP - Cabinet-type gas distribution point
CDM - Clean Development Mechanism
NERC – National Electricity Regulatory Commission
PJSC - Public Joint Stock Company
PDD – Project Design Document
JI – Joint Implementation

## SECTION A. General description of the project

### A.1. Title of the project:

Reduction of methane leaks on the gas equipment of the gas distribution points and on the gas armature, flanged, threaded joints of the gas distribution pipelines of PJSC "Krivorijgaz"

Sectoral scope 10. Fugitive emissions from fuels (solid, oil and gas)

Version of Project Design Document: 02

Date: September 18, 2012.

### A.2. Description of the project:

The purpose of the project "Reduction of methane leaks on the gas equipment of the gas distribution points and on the gas armature, flanged, threaded joints of the gas distribution pipelines of PJSC "Krivorijgaz" is reduction of the methane leaks at gas transportation and gas distribution infrastructure of PJSC "Krivorijgaz". These leaks are the result of leaking gas equipment and gas fittings. The basic sources of leaks, included into the project boundary are:

- gas equipment (pressure relief valves, gate valves, filters, breakers, etc.) located at gas distribution points (GDPs) and cabinet-type gas distribution points (CGDPs) of PJSC "Krivorijgaz";
- gas fittings (faucets, slide valve, screw valves, etc.) located at gas pipelines of PJSC "Krivorijgaz".

The project boundary encompasses 116 GDPs, 60 CGDPs and 1125 gas fitting units at gas pipelines.

The main cause of methane leaks is failure of sealing elements of equipment caused by temperature fluctuations and moisture. Basic component of natural gas is methane (92 - 95%), which is greenhouse gas. Repair of methane leaks will result in a reduction of greenhouse gas emissions. Hereinafter, for determination of natural gas leaks the term "methane leaks" is also used, since leak measurements refer to methane.

**Situation existing prior to the start of the project**

PJSC "Krivorijgaz" is an enterprise that provides transportation and supply of liquefied and natural gas in the city of Kryvyi Rih and Kryvyi Rih district. Today PJSC "Krivorijgaz"secures the supply of natural and liquefied gas to industrial enterprises (181), public-service facilities (1 767), consumers and population (287 290 apartments).

*The main activities of the company are:*
- Transportation of natural gas and oil gas by distribution pipelines;
- Supply of natural gas at regulated tariffs;
- Installation of domestic gas meters;
- Design, installation of gas supply systems;
- Maintenance, repair works.

The structure of existing tariffs for gas transportation regulated by the state does not take into account the amortization and investment needs of gas distribution enterprises. This leads to a lack of financing for repair works and modernization of gas networks, purchase of proper technological equipment and components, and, as a result, contributes to the increase of methane leaks at PJSC "Krivorijgaz" facilities.

**Baseline scenario**

Prior to the start of the Project (2005) PJSC "Krivorijgaz" carried out only the detection of methane leaks at gas fittings of gas distribution networks by organoleptic means and the detection of methane leaks at GDP CGDP equipment by gas detectors by gas detectors in accordance with Ukrainian Gas Supply System Safety Rules[1]. The company detected methane leaks with the purpose of avoidance of emergency and explosive situations. Measurings of methane leak volumes, their registration and accounting were not conducted, and the proper measuring devices were absent. Repair of leaks detected by by organoleptic means and gas detectors usually consisted in the current repair of GDP and CGDP equipment and the gas fittings with gaskets made of cotton fibers with fatty treatment and asbestic and graphite filler. This technology of repairs provided only for short-term sealing of equipment and gas fittings and ensured avoidance of explosive situations. However, theoretical calculations of methane leak volumes as a result of leakiness of GDP and CGDP gas equipment, gas fittings of PJSC "Krivorijgaz" gas pipelines showed that methane leak volumes amounted to about 8.3 million $m^3$ per year.

**Project scenario**

Project activities consist in the reduction of methane leaks that occur as a result of faulty sealing of GDN components of PJSC “Krivorijgaz” (gas equipment of GDPs (CGDPs) and gas fittings of gas pipelines).

Within the framework of the JI project in order to repair methane leaks at gas equipment and gas fittings two types of repairs are applied:

1. Complete replacement of old gas equipment and gas fittings with new units.
2. Replacement of sealing elements with the use of modern sealing materials, changing the common practice of maintenance and repair on the basis of paronite packing and gaskets made of cotton fibers with fatty treatment and asbestic and graphite filler.

The existing practice of maintenance and repair on the basis of paronite packing and gaskets made of cotton fibers with fatty treatment and asbestic and graphite filler does not give a long-lasting effect of methane leak reduction.

As a result of JI project activities, in addition to methane leak reductions, technical losses of natural gas will decrease, a contribution will be made to the improvement of environmental situation, and the risk of accidents and explosions will be reduced.

Project activities will include:

- Implementation of Purposeful Examination and Technical Maintenance (PETM) of GDN components (gas equipment of GDPs (CGDPs) and gas fittings). This is a modern and the most economically effective practice, which provides possibilities of detection of leak points, determination of leak volume (i.e., potential gas leak reductions) and evaluation of quality of conducted repairs. This key information is required for substantiation of efficiency of repair works and priority choice of its objects, which is important under short financing for repair of all leaks. PETM program will include such organizational measures as: creation of a working team of the project, training of employees, introduction of procedures on monitoring of all GDP and CGDP gas equipment units and fittings, creation of conducted repairs and methane leak data collection and storage system, implementation of internal audit and quality assurance of methane leak repair system;
- Detection of methane leaks: leak monitoring system at all GDN components (gas equipment of GDPs (CGDPs), gas fittings) that are included in the project boundary and including repaired methane leaks (elements of GDN repaired as part of the project activity). Monitoring will be carried out on a regular basis by specially trained staff. Detected leak points will be duly tagged with individual numbers and registered in the database;

[1]The Order of The State Committee of Ukraine on supervision of labor safety No. 254 dated 01/10/1997, registered at the Ministry of Justice of Ukraine No. 318/2758 dated 15/05/1998.

- Repair of all leaks detected: repair of leaking GDN components within the project boundary will vary from replacement of sealing elements by using new and modern materials to replacement of gas equipment units and gas fittings with new and modern ones. The repaired GDP (CGDP) equipment and gas pipeline fittings will be inspected regularly, as a part of standard monitoring activity, to make sure that they did not become the source of leaks again.

The project was initiated in January 2005:

In January 2005 an inspection of all GDN components of PJSC "Krivorijgaz" (GDP (CGDP) gas equipment and gas fittings, flanged and threaded joints of gas pipelines) took place, the results of this inspection made the basis for the Registry of leak spots of the project.

12/01/2005 – PJSC "Krivorijgaz" approved the PDD (version 01), which included the programme of emission monitoring.

February 15, 2005 – the starting date of the project, when PJSC "Krivorijgaz" started inspection and repair works at GDP (CGDP) gas equipment and gas fittings, flanged and threaded joints of PJSC "Krivorijgaz" gas distribution networks in the framework of the JI Project.

September 21, 2012 – a JI Project Working Team was created at PJSC "Krivorijgaz", whose main objective is to ensure the implementation of the JI Project monitoring plan.

July 20, 2012 – an Emissions Reduction Purchase Agreement conserning the JI Project was executed between CEP Carbon Emissions Partners S.A. and PJSC "Krivorijgaz".

September 12, 2012 – a Letter of Endorsement № 2553/23/7 was issued by the State Environmental Investment Agency of Ukraine.

## A.3. Project participants:

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

PJSC "Krivorijgaz" is the oranisation which implements the project (Applicant). Its enterprise code is 03341397. The name of the type of economic activity according to the standard industrial classification of economic activities is 40.22.0 Gas distribution and supply. It is responcible for project, construction and installation works, that are carried out by efforts of internal service personnel or with the help of subcontractors. The enterprise funds the project and doesn't get profit.

CEP Carbon Emissions Partners S.A. is a research and engineering organization. It is responsible for development of project design document of the joint implementation project. In addition it will also take part in determination and verification processes, as well as create monitoring reports.

## A.4. Technical description of the project:

### A.4.1. Location of the project:

The Project is located in the territory of the city of Kryvyi Rih (Dnipropetrovsk region) and the surrounding territories, Ukraine. (Figure 1).


*Figure 1. The map of Ukraine with indication of the city of Kryvyi Rih*

#### A.4.1.1. Host Party(-ies):

The Project is located in the territory of 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 Annex 1 and meets the requirements of participation in Joint Implementation projects.

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

The Project is located in the territory of the city of Kryvyi Rih (Dnipropetrovsk region) and the surrounding territories, Ukraine.

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

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

The city of Kryvyi Rih (Dnipropetrovsk region) and the surrounding territories.

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

Geographic coordinates of the city of Kryvyi Rih:
Latitude: N 47°54′37″
Longitude: E 33°23′30″
Time zone: GMT +2:00

Kryvyi Rih is a city in Dnipropetrovsk region; it is the largest Ukrainian city which is not an administrative capital of a region. The area is 410 square kilometers. The population is 661 000 people.

Kryvyi Rih is located within the steppe zone of Ukraine, near the confluence of the rivers Inhulets and Saksahan, which belong to the Dnieper river basin. Altitude is 84 m above sea level. Climate is steppe, Atlantic/continental. Average temperature is +20.4 °C in summer and -3.4 °C in winter. Average annual precipitation is 483 mm.

A complete list and addresses of gas distribution points (116 units), cabinet-type gas distribution points (60 units) and gas fittings (1125 units), that are included in the project boundary, is provided in Supporting Document 1 - "Registry of gas distribution points and gas fittings of the Joint Implementation Project "Reduction of methane leaks on the gas equipment of the gas distribution points and on the gas armature, flanged, threaded joints of the gas distribution pipelines of PJSC "Krivorijgaz"[3].

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

**1. Development and introduction of methane leak measuring method**

To calculate the volume of methane leaks a JI specific approach was used. The JI specific approach was developed in accordance with "Methodology for calculation of greenhouse gas emission reductions achieved by above-standard natural gas leak repair at the gas distribution networks" (registration number UkrNTI 0112U00A816 dated 2012) that was developed by the Institute of Gas of the National Academy of Sciences of Ukraine (hereinafter - the Methodology). According to the Methodology the project participants chose calculation method as the one that satisfies the project requirements to accuracy and transparency of detecting and repairing methane leaks and to the conservative approach to the calculations. In addition, taking into account the limited funding and lack of long-term development plan for the industry, we can state that it is impossible to apply measurement method of calculations in the conditions described above at PJSC "Krivorijgaz".

Description of the main activities and technologies under the project is provided below. More detailed information about all implemented activities aimed at detection and repair of leaks at the GDN components of PJSC "Krivorijgaz" will be presented at the monitoring stage of the JI project:

**Gas detector Dozor S-P.** To determine whether methane leak is present in a sample or not, the gas leak detector and Dozor S-P is used. It is shown in Figure 2.

[3]Supporting document 1 "Registry of gas distribution points and gas armature within the boundaries of the JI Project "Reduction of methane leaks on the gas equipment of the gas distribution points and on the gas armature, flanged, threaded joints of the gas distribution pipelines of PJSC "Krivorijgaz"" is executed in an electronic form and submitted to the State Environmental Investment Agency of Ukraine and Bureau Veritas Certification Holding SAS – a company that verifies the project.

*Figure 2. Gas detector Dozor S-P.*

Technical characteristics of gas detector Dozor S-P are provided in Talbe 1.

*Table 1. Technical characteristics of gas detector Dozor S-P*

| Parameter | Value |
|---|---|
| Measurement range, % LFL | From 0 to 50 |
| Threshold alarm value, % LFL | Single impulses: at 2%, Continuous signal: at 30% |
| Threshold alarm value for deleterious substances control | Threshold 1: 1 MPC, Threshold 2: 3 or 5 MPC |
| Threshold sensitivity, % vol., not more than | 0.1 |
| Absolute limit of basic error | ±5 |
| Operating temperature range,˚C | From -10 to +50˚C |
| Explosion safety marking | 1ExibsIIBT4X |
| Continuous work time without recharge, not less than | 12 h |
| Number of charge cycles of rechargeable battery, not less than | 500 |
| Outside dimensions, not more than | 190x90x60 mm |
| Weight, not more than | 0.48 kg |

After leak detection, repair or replacement at relevant GDN component (GDP (CGDP) gas equipment and gas fittings of gas pipelines) is carried out with the use of modern sealing materials (GOST 7338-90[4], GOST 5152-84[5] or GOST 10330-76[6]).

Detailed information on the measuring methods used in leak monitoring is provided in the Annex 3.

**2. Introduction of modern sealants for leak repair.**

[4] "Rubber and Rubber-fabric Planes"
[5] "Sealing Gland"
[6] "Dishevelled flax. Specifications"

**Sealants (sealing agents) GOST 7338-90** are oil-and-petrol-resistant plates used for making rubber and technical wares, that serve for the compression of immobile connections, prevention from friction between metallic surfaces, single shock load accommodation; the sealants are also used for making gaskets, flooring and other sealing wares.

The project activities provides for greasing of locking devices and compression of the threaded connections with flax fibres GOST 10330-76 and Plitol-M oil (TU U 25404313.004-2201)

**Sealing gland GOST 5152-84.** Asbestic braided sealing gland is used for the compression of sealing armature chambers, centrifugal and piston pumps, and also different devices at working temperatures from - 70 to 300˚C.

Braided sealing gland is the most widespread type of sealing materials, used to fill sealing armature chambers, centrifugal and piston pumps, different devices. This sealing gland is used to complete more than 80% of armature. They differentiate both in materials they are made of and methods of making (by structure). Both factors substantially influence operating properties of sealing gland. The important components of sealing gland are different types of treatment and fillers that give necessary properties to sealing gland.

**3. Replacement of shut-off and control valves.**

**Shut-off and control valves.** Within the framework of the Project it is also planned to replace old GDP (CGDP) gas equipment as well as shut-off and control valves of the USSR production with the equipment and shut-off and control valves of European producers and their analogues of national production.

In the process of the Project implementation manufacturer of gas equipment used to prevent methane leaks can be subject to change depending on introduction of more modern and sophisticated technologies and equipment in the market.

**4. Installation of centralized methane leak accounting system.**

The choice of equipment and materials will depend on the size, source of leaks and operating schedule of system component where this leak was detected in the process of PETM of gas distribution networks implementation, including:

- studying of baseline conditions – when using measuring devices described above;
- registration of the results and determination of priority in repair of leaks, which ensures the highest efficiency of this work on condition of limited means for repair.
- data analysis and evaluation of natural gas loss reduction and emission reductions.
- development of plan of future inspections, and further monitoring of GDN components included in the project boundary, as well as monitoring of elements where leaks have already been repaired in the framework of the project.

Implementation of the PETM program aimed at leak detection and repair, further maintaining of leakproofness of GDN components of PJSC “Krivorijgaz” is not time limited. Even after the end of the crediting period, the Project will generate methane emission reductions.

**Implementation Schedule**

1. Drawing of the primary registry of GDPs and gas fittings included in the project boundary (GDP (CGDP) gas equipment, threaded and flanged connections of gas pipelines). Inspection of GDP (CGDP) gas equipment, gas fittings, threaded and flanged connections of gas pipelines and

primary monitoring measurements. The start of development of the monitoring Plan, the PDD of the project, version 01. (January 2005).

2. Introduction and implementation of the PETM programme, repair (replacement) of gas equipment at 18 GDPs (CGDPs) and 113 gas fittings (January - December 2005).
3. Implementation of the PETM programme, repair (replacement) of gas equipment at 35 GDPs (CGDPs) and 225 gas fittings (January - December 2006)
4. Implementation of the PETM programme, repair (replacement) of gas equipment at 53 GDPs (CGDPs) and 337 gas fittings (January - December 2007).
5. Implementation of the PETM programme, repair (replacement) of gas equipment at 26 GDPs (CGDPs) and 169 gas fittings (January - December 2008).
6. Implementation of the PETM programme, repair (replacement) of gas equipment at 44 GDPs (CGDPs) and 281 gas fittings (January - December 2009). Continuation of implementation of the PETM programme, implementation of regular monitoring inspections and measurements at already repaired gas equipment of GDPs (CGDPs) and fittings of gas pipelines, leak repair at already repaired equipment, if such leaks take place (January 2010 - December 2017).

On condition of proper maintenance no replacement of equipment implemented in the framework of the project is expected during the project period, since it meets all criteria of the existing modern common practice. Training of employees and specialists of PJSC "Krivorijgaz" will take place in accordance with practice that existed prior to the project, and in case of necessity, such as lack of skills for working with equipment that is implemented in the framework of the project activities, equipment manufacturers will conduct briefings and training, as stipulated in contracts for the purchase of equipment.

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

The project activity includes:
- repair (replacement) of GDP (CGDP) gas equipment, gas fittings of PJSC "Krivorijgaz" gas pipelines with the use of modern sealing materials and modern equipment of European producers and their analogues of national production;
- monitoring of methane leaks aimed at the detection of methane leaks caused by sealing failures;
- further renewal of leakproofness at GDN components of PJSC "Krivorijgaz".

Reduction of natural gas leaks will result in reduction of emissions of methane that is a greenhouse gas.

Absence of the Project activity means that all equipment, including old units, that are still capable of operating, and equipment characterized by worse leak-proofness than the one planned in the project activity, will be operated for a long time in the ordinary mode. This makes it impossible to reduce methane emissions.

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

The following emission reductions will be achieved during the Project implementation at each stage of the Project:

*Table 2. Estimated amount of emission reductions in the period before the first commitment period (2005-2007)*

| | Years |
|---|---|
| Length of the crediting period | 3 |

| Year | Estimate of annual emission reductions in tonnes of $CO_2$ equivalent |
|---|---|
| 2005 | 12 203 |
| 2006 | 42 711 |
| 2007 | 73 218 |
| Total estimated emission reductions over the crediting period (tonnes of $CO_2$ equivalent) | **128 132** |
| Annual average of estimated emission reductions over the crediting period (tonnes of $CO_2$ equivalent) | **43 931** |

*Table 3. Estimated amount of emission reductions in 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 | 91 523 |
| 2009 | 122 031 |
| 2010 | 122 031 |
| 2011 | 122 031 |
| 2012 | 122 031 |
| Total estimated emission reductions over the crediting period (tonnes of $CO_2$ equivalent) | **579 647** |
| Annual average of estimated emission reductions over the crediting period (tonnes of $CO_2$ equivalent) | **115 929** |

*Table 4. Estimated amount of emission reductions in the period after the first commitment period (2013-2017)*

| | Years |
|---|---|
| Length during the crediting period | 5 |
| Years | Estimate of annual emission reductions in tonnes of $CO_2$ equivalent |
| 2013 | 122 031 |
| 2014 | 122 031 |
| 2015 | 122 031 |
| 2016 | 122 031 |
| 2017 | 122 031 |
| Total estimated emission reductions over the crediting period (tonnes of $CO_2$ equivalent) | **610 155** |
| Annual average of estimated emission reductions over the crediting period (tonnes of $CO_2$ equivalent) | **122 031** |

More detailed information is provided in Supporting document 2[7].

A description of formula used for calculation of emission reductions is provided in Section D.1.4.

## A.5. Project approval by the Parties involved:

The Project has been already supported by the Government of Ukraine, namely by the State Environmental Investment Agency of Ukraine, which issued a Letter of Endorsement for the JI Project (No. 2553/23/7 dated 12/09/2012).
Therefore, organizational risk for the JI Project is minimized.

Upon the receipt of the Determination Report from the Accredited Independent Entity the Project Design Document and Determination Report will be submitted to the State Environmental Investment Agency of Ukraine and the authorized body of the country where another project participant is registered to receive the Letters of Approval.

[7]Supporting document 2 "Calculation of GHG emission reductions of the Joint Implementation Project "Reduction of methane leaks on the gas equipment of the gas distribution points and on the gas armature, flanged, threaded joints of the gas distribution pipelines of PJSC "Krivorijgaz" is executed in an electronic form and submitted to the State Environmental Investment Agency of Ukraine and Bureau Veritas Certification Holding SAS – a company that verifies the project.

## SECTION B. Baseline

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

**Baseline** is the scenario that represents the anthropogenic emissions by sources of GHGs that would occur in the absence of the proposed project. The baseline was chosen in accordance with the requirements of the "Guidance on criteria for baseline setting and monitoring", Version 03[8]. In line with the "Guidelines for users of the joint implementation project design document form", Version 04, a stepwise approach is used for baseline description and justification:

**Step 1. Identification and description of the selected approach for the baseline setting.**
The proposed project applies a JI 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 03 and the "Methodology for calculation of greenhouse gas emission reductions achieved by above-standard natural gas leak repair at the gas distribution networks" (registration number UkrNTI 0112U00A816 dated 2012) that was developed by the Institute of Gas of the National Academy of Sciences of Ukraine to set the baseline (measurement and calculation of methane leaks). Project participants selected the calculation method for estimation of GHG emission reductions.

The Methodology is based on approved Clean Development Mechanism methodology AM0023 version 4.0 "Leak detection and repair in gas production, processing, transmission, storage and distribution systems and in refinery facilities"[9] and takes into account the specifics of methane leak detection and repair activity in Ukraine.

This Methodology is designed for development of the projects aimed at methane leak reduction at technological equipment of gas distribution networks and is applicable to project activities that reduce methane leaks by implementing investment activities, which would not be implemented under the existing company practice, i.e. methane leaks would not be repaired.

This Methodology is applicable to project activities that repair above-standard methane physical leaks in gas distribution network components by establishing advanced leak detection and repair practices, being the supplement to conventional Leak Detection and Repair Program, provided in the UGSSR, referred to as PETM in this project design document.
Ordinary program on Leak Detection and Repair that existed at PJSC "Krivorijgaz" prior to the start of the Project was based on Ukrainian Gas Supply System Safety Rules (UGSSSR) and included only detection and repair of leaks with the purpose of avoidance of emergency and explosive situations. Ordinary activity within the UGSSR neither provides for mandatory replacement of worn-out equipment still capable of operation nor requires application of new modern although more expensive sealing materials to repair leaks. This practice does not lead to major reduction of methane leaks in GDN components during its transportation.
In the course of the Project implementation PETM program of GDN components of PJSC "Krivorijgaz", as described in paragraph "Project scenario" in section A.2 of the PDD, is in its essence the implementation of advanced Leak Detection and Repair Program than the one which existed at PJSC "Krivorijgaz" prior to the Project.

To use the proposed JI Specific Approach for baseline setting the following three conditions shall be satisfied:

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

[9] http://cdm.unfccc.int/UserManagement/FileStorage/LV8NU1GYWTK06COJPDIXQ35FR2MA47

1. Natural gas pipeline operators have no current LDaR program in place to systematically identify and repair leaks;
2. Methane losses (leaks) can be identified and accurately measured;
3. A monitoring system can be put in place to ensure leaks repaired remain repaired.

The Project fully complies with the second and the third conditions; it also complies with the first condition but there are some remarks relating to this condition. They are stated below.

Information relating to the *first condition*: before the beginning of the project PJSC "Krivorijgaz" provided only the detection of leaks by means of gas detectors in accordance with Ukrainian Gas Supply System Safety Rules in order to avoid emergency and explosive situations. The measurements of the volumes of leaks, their registration and accounting were not carried out, and appropriate measuring devices were absent. The theoretical calculations of leak volumes, that were made on the basis of the initial measurements made, amount to about 8.3 million $m^3$ per year.

But aforementioned measures do not give understanding of the real volumes of leaks caused mainly by the use of old equipment and worn out sealing materials. The Project does not provide for more frequent checks of gas equipment, but it is planned to use modern sealing material, replace old gas equipment with the new, modern equipment of European production or their analogues of national production and implement the monitoring measuring of methane leak volumes.

According to international experience and data received from the regions, it can be concluded that at companies where new sealing materials and gas equipment were used, volumes of methane leaks reduced considerably.

In addition, due to the fact that the national legislation doesn't provide any mechanisms for encouragement of operators to reduce methane leaks, effective program for detection and repair of methane leaks could not be applied without the project activities. The operators which were mainly motivated by the safety conditions could only detect a leak, but could not measure its volume.

In other words, we want to emphasize that the practice that existed at PJSC "Krivorijgaz" before the beginning of the Project implementation didn't repair the leaks included into this Project.

Information relating to *the second condition:* The purchase of modern equipment on detection and measurement of methane leak volumes and direct measurements of leak volumes at GDP (CGDP) gas equipment and gas fittings demonstrated that when applying modern practices and gas equipment not only the leaks may be detected and repaired but also they can be exactly measured.

Information relating to the *third condition:* Introduction of step-by-step procedures, creation of the comprehensive database and application of a system approach will allow the company to conduct reliable monitoring of the repaired GDP (CGDP) gas equipment and gas fittings of gas pipelines and detect leaks that occurred again after being repaired, if any (see Annex 3). The training of personnel at sites and introduction of quality control at all stages of the project activity will allow the company to implement the Monitoring Plan.

**Step 2. Application of the approach chosen**

**Initial conditions**

Only two options of baseline conditions can be considered as possible and reliable alternatives to the Project:

*Alternative 11.:* Continuation of the current system of leak detection and repair;
*Alternative 1.2.:* Implementation of this Project without the application of JI mechanism.

Detailed analysis of each alternative is provided below.

*Alternative 1.1*: Continuation of the current system of leak detection and repair is the most plausible and realistic alternative to the Project implementation because it requires no additional costs for PJSC "Krivorijgaz". Methane leaks are a component of natural gas transportation process, i.e. continuation of the current situation is a common practice that suits the financial and organizational situation of the enterprise. According to this alternative only routine repairs are provided; this allows of keeping methane leaks at a stable level, that is reduction of leaks in this case is impossible.

*Alternative 1.2*: Implementation of this Project without the application of JI mechanism. This alternative questions the use of new technologies aimed at repair of methane leaks in the process of natural gas transportation as it requires considerable resources and organizational programs (staff training). PJSC "Krivorijgaz" is not obliged and motivated to conduct modernization of the equipment that will reduce greenhouse gas leaks, as improvement of ecological situation in the region is not an economically viable business without the JI mechanism.

Arguments that are presented in this PDD (see Section B.2) prove that continuation of the existing practice of leak detection and repair is the most plausible scenario on condition of the absence of the Project.

Therefore, this scenario can be viewed as the Baseline.

**Emission Reductions**

Calculation method of the "Methodology for calculation of greenhouse gas emission reductions achieved by above-standard natural gas leak repair at the gas distribution networks" (registration number UkrNTI 0112U00A816 dated 2012) consists in determining the presence of above-standard physical leaks of methane at GDN components, and after their repair, that is, after reducing them to conditional leakproof state (CLS), determining the volume of leaks with the help of leak factors that were obtained on the basis of statistical processing of results of actual measurements of methane leaks in gas distribution networks in Ukraine before and after measures aimed at leak repair.

In accordance with the Methodology, the level of emission reductions is determined in the following order:

1. The current practice of leak detection and repair activities is assessed and described.
2. Clear and transparent criteria are established to identify whether the detection and repair of methane leaks would also have occurred in the absence of the project activity.
3. The time schedules for replacement of equipment in the absence of the project activity are determined.
4. Data on leaks are collected during the project implementation.
5. The effectiveness of leak repair is checked during monitoring.
6. Emission reductions are calculated ex-post based on data collected in the previous steps.

The steps for this Project are described below.

**1. Assessment and description of the current leak detection and repair practices**

The Methodology stipulates that for the calculation of emission reductions only those emissions, which are not detected and repaired in accordance with the current practice, are taken into account. The project applies a JI specific approach based on the "Methodology for calculation of greenhouse gas emission reductions achieved by above-standard natural gas leak repair at the gas distribution networks"

(registration number UkrNTI 0112U00A816 dated 2012) that was developed by the Institute of Gas of the National Academy of Sciences of Ukraine; the Methodology accounts specific nature of Ukrainian GDN operation and maintenance.

Before the beginning of the Project PJSC "Krivorijgaz" provided only the detection of leaks in accordance with Ukrainian Gas Supply System Safety Rules in order to avoid emergency and explosive situations. The measurements of the volumes of leaks, their registration and accounting were not carried out

Before the Project implementation PJSC "Krivorijgaz" didn't take any measures on purposeful examination and maintenance beyond the scope of requirements established by the safety rules. Traditional material used in the course of repair works ensured only temporary repair of methane leaks, while approach provided by the Project ensures reliable long-term repair of methane leaks.

Gas equipment of GDPs (CGDPs), gas fittings of gas pipelines included in the project boundary will be examined, repaired or replaced, despite the fact that they are regularly inspected and repaired in the framework of the existing maintenance system. Repair and replacement under the Project will be performed with the use of modern equipment of the European production, their analogues of national production, and new sealing materials, without regard to whether the leak has been detected or not, in order to prevent leaks in the future.

**2. Replacement schedules for equipment**

Since February 2005, when methane leaks are detected repair or replacement of GDP (CGDP) gas equipment, gas fittings of gas pipelines have been carried out with the use of modern equipment and materials, in accordance with the project activity.

Inclusion into calculation of methane emission reductions of any similar cases of replacement of components with application of materials and equipment that were used before the project practice is not appropriate, since they would not cause any substantial influence on the result of the Project, i.e. on the level of methane emission reductions.

It is also important to indicate that under this Project all GDN components (gas equipment of GDPs (CGDPs), gas fittings of gas pipelines) included in the project boundary will be repaired or replaced, even if leaks are detected only at some quantity of GDN components.

**3. Data collection during project implementation**

Full details on all GDN components (gas equipment of GDPs (CGDPs), gas fittings of gas pipelines) included in the project boundary are listed in the Registry of gas distribution points and gas fittings included in the project boundary of the JI project "Reduction of methane leaks on the gas equipment of the gas distribution points and on the gas armature, flanged, threaded joints of the gas distribution pipelines of PJSC "Krivorijgaz" (Supporting Document 1). The presence of above-standard physical leaks of methane is determined with the help of individual indicators of leaks, that operate on the principle of registration of change in resistance of the semiconductor sensor that occurs in contact with gas. Repair work (replacement of equipment) is carried out after methane leaks were detected at a GDN component. Data to calculate emission volumes of methane (which is a component of natural gas) are collected in the process of repairs (replacement) of GDN components included in the project boundary. The calculations are carried out according to the Methodology by using calculation method to estimate methane leak reductions. The basis of the methodology is the use of natural gas leak factors (NGLF) for each type of GDN component, which were obtained based on statistical analysis of the results of actual measurements of methane leaks before and after they were repaired at the gas distribution networks in

Ukraine. The project provides for collection of data relating to the presence of pressure in GDN components, since if it is absence, leaks at a corresponding GDN component are also absent.

After repair (replacements) of gas equipment the new measuring is carried out, to make sure that methane leaks are repaired.
The data collected are included into the reports on fulfillment of the monitoring plan. All data are kept in a database. Every report on fulfillment of the monitoring plan will include complete information from such database (Annex 3).

**4. Monitoring requirements**

In the process of the Project implementation monitoring of the facilities of the Project is carried out to verify whether methane leaks repaired remain repaired. The Monitoring Plan for this Project covers all repaired (replaced) gas equipment of GDPs (CGDPs), gas fittings of gas pipelines. Frequency of leak detection and measuring activity at sites where leaks were already repaired, is specified in the Monitoring Plan.

For GDN component that was repaired (replaced) in a previous monitoring period and where above-standard physical leak wasn't detected in a current monitoring period, methane leaks will be deemed to be equal to the volume of leaks, measured after the first repair (replacement) for the entire period since the last inspection/monitoring.

If APLNG was detected again at an equipment unit, such equipment unit will be excluded from the calculations of reduction of methane emissions for corresponding monitoring period. It will be considered that at this equipment unit there was no reduction of methane emissions during the period from the date of the last monitoring measurement of methane emissions. Such equipment unit will be repaired (or replaced) repeatedly. Then measuring of methane leaks will be carried out once again.

The collected data will be included into the regular reports on fulfillment of the monitoring plan. All data are kept in a database. Each report on fulfillment of the monitoring plan will include complete information from a corresponding database (Annex 3 to this PDD).

**5. Calculation of methane emission reductions**

Reduction of methane leaks at GDN components occurs only after removal of above-standard physical leaks at such component (which is connected with the replacement and / or replacement of sealing element) and only for a period of time when GDN component was under pressure. It is defined as the difference between the factors that correspond to volume of APLNG and SPLNG in $m^3$ per hour.

Description of the baseline and justification of its choice are presented in the section B.2. below.

Key information for determination of the baseline is presented below.
Description of formulae for calculation of GHG emissions in the baseline scenario is shown below:

Greenhouse gas emissions in the baseline scenario according to a JI specific approach (which is calculated by using the tabular method of the Methodology) are calculated according to the formula:

$$BE_y = GWP_{CH_4} \cdot ConvFactor \cdot W_y \cdot B_y \quad \text{(B1)}$$

Where:

$BE_y$ – greenhouse gas emissions in period «y», in the baseline scenario (t $CO_2$e);

$GWP_{CH_4}$ – global warming potential of methane (t$CO_2$e/t$CH_4$);

$W_y$ – Average mass fraction of methane in the natural gas in period «y», in the project scenario (%);

$B_y$ – volume of natural gas leaks into the atmosphere in period «y», in the baseline scenario ($m^3$ of natural gas);
$ConvFactor$ – Conversion factor to convert methane leaks from volume units to weight units (t $CH_4$/ $m^3$ $CH_4$). Under normal conditions defined as 0 degree Celsius and 0.1013 MPa, $ConvFactor$ = 0.0007168 t/$m^3$.
[$y$] – index that corresponds to monitoring period;
[$CH_4$] – index that corresponds to methane.

Emissions of natural gas (92-5% of which is methane) in the atmosphere caused by leaks from gas transportation networks are calculated according to the formula:

$$B_y = \sum_{h \in H_i} \left( \sum_{i' \in I'} K^g_{i',h} \cdot H^g_{i',h,y} + \sum_{i'' \in I''} K^n_{i''} \cdot H^n_{i'',h,y} \right); \quad \text{(B2)}$$

Where:
$K^g_{i',h}$ – natural gas leak factor for GDN component $i'$ that is in CLS (i.e. corresponds to SPLNG), in the baseline scenario ($m^3$/h);
$K^n_{i''}$ – natural gas leak factor that corresponds to APLNG for GDN component $i''$, in the baseline scenario ($m^3$/h);
$H^g_{i',h,y}$ – Time of operation of GDN component in CLS under pressure in period «y», in the baseline scenario (h);
$H^n_{i'',h,y}$ – Time of operation of GDN component from the moment when project activities (repair / replacement) that resulted in the repair of APLNG were implemented to the end of monitoring period «y» (h);
[$y$] – index that corresponds to monitoring period;
[$i'$] – index that corresponds to a number of GDN component, which is in a set of elements $I'$ ($(I' + I'') = I$, where I is a set that includes all GDN components that are in the project boundary) where the project activities did not result in any emission reductions (there was no replacement / repair of components) in the reporting monitoring period;
[$i''$] – index that corresponds to a number of GDN component, which is in a set of elements $I''$ ($(I' + I'') = I$, where I is a set that includes all GDN components that are in the project boundary) where the project activities resulted in emission reductions (there was replacement / repair of components) in the reporting monitoring period;
[$h$] – index that corresponds to a number of activity under the project at GDN component, if more than one activity was carried out at reporting component in the monitoring period (where H is a set, which includes all activities in the project scenario at GDN component in the monitoring period);
[$g$] – index that corresponds to SPLNG;
[$n$] – index that corresponds to APLNG.

| **Data/Parameter** | i |
|---|---|
| Data unit | Dimensionless |
| Description | Sequence number of GDN component (GDP (CGDP), gas fittings of gas pipeline) included in the project boundary |
| Time of determination/monitoring | Once at the beginning of Project |
| Source of data (to be) used | Activity on leak measurements |
| 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 | "Methodology for calculation of greenhouse gas emission reductions achieved by above-standard natural gas leak repair at the gas distribution networks" (registration number UkrNTI 0112U00A816 dated 2012) that was developed by the Institute of Gas of the National Academy of Sciences of Ukraine |
| QA/QC procedures (to be) applied | Personnel will have corresponding qualification for fixing of results. |
| Any comment | List of GDN component (GDP (CGDP) gas equipment, gas fittings of gas pipeline) included in the project boundary is presented in the Supporting document 1 |

| **Data/Parameter** | $GWP_{CH4}$, |
|---|---|
| Data unit | $tCO_2e$ / $tCH_4$ |
| Description | Global Warming Potential of methane |
| Time of determination/monitoring | During the whole crediting period |
| Source of data (to be) used | IPCC Second Assessment Report: Climate Change 1995(SAR) and approved by the COP. GWP value for methane is provided on the site of the UNFCCC[10] |
| 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 | N/A |
| QA/QC procedures (to be) applied | The project developer will monitor any changes in GWP for methane published by the IPCC and approved by the COP |
| Any comment | Data that allow of greenhouse gas emission calculation; information will be archived in paper and electronic form. |

| **Data/Parameter** | *h* |
|---|---|
| Data unit | Dimensionless |
| Description | Number of activity (replacement/repair) at GDN component after the presence of APLNG was determined at such component |
| Time of determination/monitoring | Every time after activity was carried out at corresponding GDN component |
| Source of data (to be) used | Activity on leak measurements |
| 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 | "Methodology for calculation of greenhouse gas emission reductions achieved by above-standard natural gas leak repair at the gas distribution networks" (registration number UkrNTI 0112U00A816 dated 2012) that was developed by the Institute of Gas of the National Academy of Sciences of Ukraine |
| QA/QC procedures (to be) applied | According to the procedures of operation data on all work at GDN components of PJSC "Krivorijgaz" are entered in |

[10] http://unfccc.int/ghg_data/items/3825.phphttp://unfccc.int/ghg_data/items/3825.php

| | |
|---|---|
| | equipment repair logs. Personnel will have corresponding qualification for fixing of results. |
| Any comment | Data that allow of greenhouse gas emission calculation; information will be archived in paper and electronic form. |

| **Data/Parameter** | $W_y$ |
|---|---|
| Data unit | % |
| Description | Average mass fraction of methane in the natural gas in period "y" in the project scenario |
| Time of determination/monitoring | Annually |
| Source of data (to be) used | Calculation |
| 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 data on the basis of company's official data in monitoring period are used |
| QA/QC procedures (to be) applied | Equipment for measuring calorific value of natural gas transported by GDNs of PJSC "Krivorijgaz" calibrated and verified in accordance with the procedures for quality control |
| Any comment | Data that allow of greenhouse gas emission calculation; information will be archived in paper and electronic form. |

| **Data/Parameter** | $K^{g}_{i,h}$ |
|---|---|
| Data unit | $m^3/h$ |
| Description | Natural gas leak factor from GDN component $i'$ in CLS |
| Time of determination/monitoring | Every time after activity was carried out at GDN component |
| Source of data (to be) used | Standard values or data from "Methodology for calculation of greenhouse gas emission reductions achieved by above-standard natural gas leak repair at the gas distribution networks" (registration number UkrNTI 0112U00A816 dated 2012) that was developed by the Institute of Gas of the National Academy of Sciences of Ukraine |
| 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 | Standard values or data from Table A.1 in Annex A to "Methodology for calculation of greenhouse gas emission reductions achieved by above-standard natural gas leak repair at the gas distribution networks" (registration number UkrNTI 0112U00A816 dated 2012) that was developed by the Institute of Gas of the National Academy of Sciences of Ukraine are used |
| QA/QC procedures (to be) applied | N/A |
| Any comment | Data that allow of greenhouse gas emission calculation; information will be archived in paper and electronic form. |

| **Data/Parameter** | $K_{i"}^{n}$ |
|---|---|
| Data unit | $m^3/h$ |
| Description | Natural gas leak factor that corresponds to APLNG for GDN component $i"$ |
| Time of determination/monitoring | Once at the beginning of the project for each type of component |
| Source of data (to be) used | "Methodology for calculation of greenhouse gas emission reductions achieved by above-standard natural gas leak repair at the gas distribution networks" (registration number UkrNTI 0112U00A816 dated 2012) that was developed by the Institute of Gas of the National Academy of Sciences of Ukraine |
| 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 | Standard values or data from Table A.1 in Annex A to "Methodology for calculation of greenhouse gas emission reductions achieved by above-standard natural gas leak repair at the gas distribution networks" (registration number UkrNTI 0112U00A816 dated 2012) that was developed by the Institute of Gas of the National Academy of Sciences of Ukraine |
| QA/QC procedures (to be) applied | N/A |
| Any comment | Data that allow of greenhouse gas emission calculation; information will be archived in paper and electronic form. |

| **Data/Parameter** | $H_{i',h,y}^{g}$ |
|---|---|
| Data unit | h |
| Description | Time of operation of GDN component under pressure from the beginning of monitoring period "y" to implementation of project activities (repair / replacement) that resulted in the repair of APLNG at such component |
| Time of determination/monitoring | Annualy |
| Source of data (to be) used | Data of the company received during GDN operation and activities aimed at leak repair |
| 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 | N/A |
| QA/QC procedures (to be) applied | Company's official data that are entered in GDN component operation logs are used |
| Any comment | Data that allow of greenhouse gas emission calculation; information will be archived in paper and electronic form. |

| **Data/Parameter** | $H_{i",h,y}^{n}$ |
|---|---|
| Data unit | h |

| | |
|---|---|
| Description | Time of operation of GDN component under pressure from the moment of implementation of project activities (repair / replacement) that resulted in the repair of APLNG at such component to the end of the monitoring period "y" |
| Time of determination/monitoring | Annually |
| Source of data (to be) used | Data of the company received during GDN operation and activities aimed at leak repair |
| 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 | N/A |
| QA/QC procedures (to be) applied | Company's official data that are entered in GDN component operation logs are used |
| Any comment | Data that allow of greenhouse gas emission calculation; information will be archived in paper and electronic form. |

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

**1. Approach to demonstration of the fact that the Project generates reduction of emissions by sources which are additional to those that would have occurred in the absence of the JI project**

"Methodology for calculation of greenhouse gas emission reductions achieved by above-standard natural gas leak repair at the gas distribution networks" (registration number UkrNTI 0112U00A816 dated 2012) that was developed by the Institute of Gas of the National Academy of Sciences of Ukraine and the latest version of the "Tool for the demonstration and assessment of additionality" ver. 06.0.0[11], approved by the CDM Executive Board, were used to justify the additionality of this Project.

This approach can be applied to this Project on methane leak reduction, because it was developed exactly for the projects of such type. The consideration of local conditions and legislation will allow of assessment of its additionality objectively.

**2. Application of the selected approach. Proofs of the Project additionality**

*Step 1 - Identification of alternatives to the Project implementation consistent with current Ukrainian laws and regulations.*

*Sub-Step 1a: Identification of alternatives to the Project implementation:*

Only two baseline alternatives can be considered as acceptable for the Project:

*Alternative 1.1*: The continuation of the existing system of leak detection and repair;

*Alternative 1.2*: Implementation of this project without the use of JI mechanism.

[11] "Tool for the demonstration and assessment of additionality" (Version 06.0.0):http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v6.0.0.pdf

*Alternative 1.1*: Continuation of the current practive of natural gas (and thus methane) leak detection and repair is the most plausible alternative to the Project implementation, because it does not require any additional investment from PJSC "Krivorijgaz".

In Ukraine tariffs for natural gas are regulated by the state. The existing tariff calculation methodologies do not provide for any financial benefits in case of methane leak reductions. The existing Ukrainian system of natural gas tariff formation stipulates the change of tariff on natural gas in case of reduction of its losses. The payment that is now set for the methane leaks within the fixed limits is difficult or impossible to charge because of the absence of measuring technologies and big amount of insignificant emissions spread in large territory.

*Alternative 1.2*: According to Methodology to determine the plausible baseline alternative it is necessary to determine if measures aimed at reduction of methane leaks from equipment have been implemented or are expected to be implemented, by using leak detection and measurement technology similar to the technology described in this methodology.

Before the beginning of the Project implementation PJSC "Krivorijgaz" did not carry out any measures aimed at purposeful examination and technical maintenance that would go beyond the scope of the requirements set forth by safe practice regulations.

The type and volumes of technological losses in the Ukrainian gas distribution networks were mainly unknown to the moment of the first purposeful examination and prophylactic overviews, carried out for the evaluation of possibilities of project implementation within the framework of the mechanisms set by article 6 of the Kyoto protocol to the UN Framework Convention on Climate Change. Estimations of net volume of gas consumption and its losses were approximate, because most end-consumers (60 % of households) have no gas-meters, and the invoicing is executed on the basis of normative standards.

In case of the absence of the support of the Project by the mechanisms set by article 6 of the Kyoto protocol to the UN Framework Convention on Climate Change PJSC "Krivorijgaz" had neither incentives nor resources for implementation of the measures planned in the framework of the Project,. The Project stipulates additional costs on measuring devices, new gas equipment of European producers and their analogues of national production, modern sealing materials and personnel training.

PJSC "Krivorijgaz" has no financial incentives to cover such costs on the implementation of the Project measures or measures similar to the project measures, but for possible income, that can be obtained within the framework of the mechanism set by article 6 of the Kyoto protocol to the UN Framework Convention on Climate Change.

Outcome of Step 1a: One plausible alternative was identified. It's *Alternative 1.1.*

*Sub-Step 1b: Consistency with mandatory Ukrainian laws and regulations*
*Alternative 1.1*: The current practice of natural gas loss (and accordingly, methane emissions) detection and repair conforms to the current legislation of Ukraine, namely:
1. Law of Ukraine "On the basis of the natural gas market functioning"[12]
2. Law of Ukraine "On Pipeline Transport"[13]
3. Order of the Ministry of Fuel and Energy Industry of Ukraine "On approval of methods for detection of specific losses, technological and production losses of natural gas during gas transportation in gas distribution networks[14].

[12] http://search.ligazakon.ua/l_doc2.nsf/link1/JD33S02A.html

[13] http://zakon2.rada.gov.ua/laws/show/192/96-вр/ed20120408

[14] http://zakon1.rada.gov.ua/laws/show/z0570-03

The legislation admits and doesn't forbid natural gas losses, and, accordingly, methane emissions in the process of natural gas transportation. The regulations set periodicity of equipment verifications to be carried out by gas distribution organizations with the aim of natural gas loss detection. Practice of natural gas loss detection at PJSC "Krivorijgaz" corresponds to the indicated standards. Control over compliance with standards is performed by implementation of annual revisions by authorized bodies.

The Project also conforms to the existing legislative requirements in Ukraine relating to detection of natural gas losses and methane leaks at gas distribution facilities, and to any other current applicable legislative regulations.

The program of PJSC "Krivorijgaz" for regular detection of natural gas losses will be implemented together with application of more up-to-date methods of detection and measurement of natural gas losses, and therefore, methane emissions, as well as the activities for long-term natural gas leak, and therefore, methane emission, repair planned under the Project.

**Outcome of Sub-Step 1b**: The selected plausible, credible and conservative alternative (*Alternative 1.1*) fully correspondents to mandatory requirements and standards of the Ukrainian legislation. *Alternative 1.2* also doesn't contradict national legislation of Ukraine.

*Step 2 – Investment Analysis*

Since the "Tool for the demonstration and assessment of additionality" version 06.0.0 provides the choice to carry out either investment analysis or barrier analysis, the barrier analysis was chosen to demonstrate additionality.

*Step 3 – Barrier Analysis*

*Sub-step 3a – Identification of barriers that would prevent the implementation of the proposed JI Project activity:*

The Project is the first project of such type for PJSC "Krivorijgaz", and in this connection a few types of barriers arose at the beginning of the Project implementation. PJSC "Krivorijgaz" faced financial barriers and the problem of insufficient experience in the use of new approaches and measuring devices for gas leak detection and repair at its facilities, including:

- Organizational barrier.

Insufficient potential of labor and technical resources of PJSC "Krivorijgaz" for implementation and carrying out of purposeful examination and technical maintenance of gas equipment. It is connected with the absence of qualified personnel: the company has faced significant outflow of qualified personnel in the last several years, and newly recruited employees do not have enough experience and knowledge.

- Absence of special technical knowledge.

At the begining of the Project qualified personnel employed by the company at that time did not have any experience in operation and repair of more modern equipment planned under the project. Therefore, the Project implementation requires time to gain practical experience in installation, commissioning and further operation of equipment included in the project boundary.

- Financial barrier.

Additional costs on the Project implementation include the costs on:

- purchase and use of modern measuring devices for methane emission detection (detectors of "VARTA-5-03", FP 11,2, k., "Poisk-02 MD type or gas analyzers of Variotec type);
- purchase of modern and more expensive sealing materials of different types;
- replacement of old types of GDN components with new gas equipment of European producers;
- personnel training, realization of direct prophylactic overview and technical maintenance;
- systematic collection of data and data management;
- systematic and long-term control of efficiency of detected methane leak repairs.

During the project implementation modern sealing material is used. In accordance with the previous results of research, the sealing materials that comply with GOST 7338-90, GOST 10330-76 and GOST 5152-84 are far more effective, but at the same time more expensive than sealing materials that are used in the current practice. In the current practice PJSC "Krivorijgaz" does not gain any additional benefits in case of reduction of methane leaks. Thus, there are no incentives for PJSC "Krivorijgaz" to purchase and use more expensive sealing material.

At the beginning of the Project old GDP (CGDP) gas equipment and shut-off and control valves of the USSR production were mostly used at networks of PJSC "Krivorijgaz". They are much worse than the new gas equipment and shut-off and control valves of European producers in terms of leak-proofness. But at the same time they are considerably cheaper. Thus, installation of new gas equipment of European producers and their analogues of national production at the gas pipelines could not prevail because of the shortage of funds.

Application of the JI mechanisms to this Project makes these measures economically attractive and is the only way of their introduction.

**Outcome of Sub-Step 3a**: We may conclude, that this Project is economically not attractive without registration of the Project as a JI Project. This proves additionality of this Project.

*Sub-step 3b: Demonstrate that the identified barriers would not prevent the implementation of at least one of the alternatives (but for the proposed Project activity):*

Financial barriers are also connected with the structure of the existing tariffs for gas transportation and distribution. The tariffs are regulated by the state and do not take into account the depreciation and investment needs of gas distribution enterprises. Such situation results in the constant shortage of money and impossibility of timely implementation of major repairs, ensurance of equipment operation, investing in modernization and development of gas distribution infrastructure.

PJSC "Krivorijgaz" will get no direct economic benefits from reduction of methane emissions that will be achieved during the Project implementation but for revenues from the sale of emission reduction units, as lower gas losses will lead to tariff reduction for consumers under the existing tariff system.

Also, it should be taken into account that in Ukraine methane is not included in the list of ecologically harmful gases and emitting methane is not punished by means of ecological fines. Thus, no sanctions are imposed on PJSC "Krivorijgaz" in connection with methane leaks at gas pipelines and PJSC "Krivorijgaz" gets no financial benefits for reduction of methane leaks.

**Outcome of Sub-Step 3b***:* As reduction of methane emissions does not bring any economic benefits to PJSC "Krivorijgaz"and implementation of this Project does not bring any economic benefits to other Project participants, including the applicant of the Project, but for the benefits within the framework of JI Project, we may conclude that implementation of the Project without the receipt of revenues within the framework of the JI Project, faces the investment barrier.

At the same time, based on the barrier analysis provided above, we may conclude that the barriers listed above would not prevent the implementation of only one of two alternatives, namely - *Alternative 1.1*: The continuation of the existing system of leak detection and repair.

*Step 4: Common practice analysis*
*Sub-step 4a: Analysis of other activities similar to the proposed Project activity:*

The absence of financial incentives described in Step 3 are typical not only for PJSC "Krivorijgaz", but also for other companies operating mean and low pressure gas distribution networks in Ukraine. Therefore existing practice for detection and repair of methane emissions represented in the baseline scenario selected for this Project is the common one for Ukraine.

In general, the gas distribution companies in Ukraine use the same methods of natural gas loss detection as the ones used at gas pipelines of PJSC "Krivorijgaz" before the beginning of the Project. Sealing materials that are used for reduction of losses are also very similar in the regions of Ukraine. Programs of natural gas loss detection and repair that are used in Ukraine, in most cases are aimed at meeting safety requirements and prevention of accidents.

*Sub-step 4b: Discussion of any similar Options that are occurring:*

But for this Project and other projects, implemented within the framework of the mechanism set by article 6 of the Kyoto protocol to the UNFCCC (United Nations Framework Convention on Climate Change), no programs of direct detection and repair of natural gas losses at gas distribution networks are implemented in Ukraine. The Project provides for the use of modern technologies and methodologies for methane leak detection and calculation.

The prospects of obtaining financing for the Project within the framework of the mechanism set by article 6 of the Kyoto protocol to the UNFCCC allowed its developer to prepare this Project. Thus, it can be concluded that any actions, similar to those which are planned under this Project, are developed and implemented in Ukraine, expecting the receipt of benefits in accordance with the mechanisms set by article 6 of the Kyoto protocol to the UNFCCC.

**Outcome**: Activities similar to the project activities, can be currently implemented only on condition of receipt of revenue from realization of the mechanism set by article 6 of the Kyoto protocol to the UNFCCC. Thus, this Project is considered to satisfy the criteria of additionality.

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

PJSC "Krivorijgaz" is the legal user of all gas distribution facilities where GDN components included in the JI project boundary are located on the basis of Agreement on the use of state property that is not subject to privatization № 04/01-825 dated 28/12/2001.

There are three types of methane emission sources in the JI Project:
(i) Emissions that are under the control of the project participants, such as: technological natural gas leaks during scheduled repair of gas pipelines;
(ii) Emissions that are reasonably attributable to the project, such as: methane leaks at gas fittings of house distribution networks;
(iii) Significant leaks:
- Leaks at gas equipment (pressure relief valves, gate valves, filters, etc.) of gas distribution points (cabinet-type gas distribution points);
- methane leaks at gas fittings (faucets, slide valve, etc.), , located at gas distribution networks of PJSC "Krivorijgaz".

Only methane leaks of type (iii) are included in the JI Project boundary:
- Leaks at gas equipment (reducers, valves, filters, etc.) of gas distribution points (cabinet-type gas distribution points);
- leaks at gas armature (faucets, valves, etc.), threaded and flanged joints, located in gas distribution networks of PJSC "Krivorijgaz".

Complete list of gas distribution points (116 units), cabinet-type gas distribution points (60 units) and gas fittings (1125 units), that are including into the JI Project boundary, is provided in the Supporting document 1.

Sources of leaks of type (i) - technological natural gas leaks during repair of gas pipelines - are not included in the project boundary as PJSC "Krivorijgaz" does not apply the technologies which allow the company to avoid such leaks.
Sources of leaks of type (ii) – natural gas leaks at house distribution networks - are not included in the JI Project boundary because, volumes of such leaks are much lower, than volumes of leaks of type (iii), and sources of these leaks, as a rule, are in private houses (apartments).

The JI Project boundary for the baseline and project scenarios is outlined by the dotted line in Figure 3.

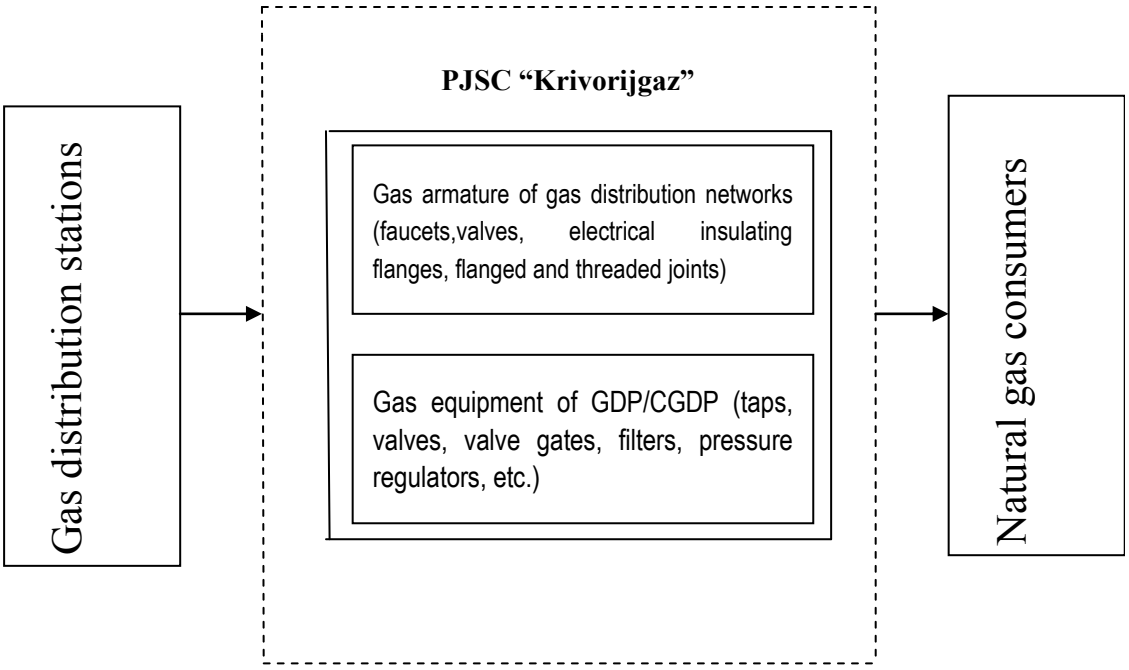


*Figure 3. Project boundary*

Geographically GDPs (CGDPs) and gas pipelines of PJSC "Krivorijgaz" are located in the city of Kryvyi Rih and the surrounding territories, Ukraine.

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

Date of baseline setting: 3/02/2005
Baseline was determined by CEP Carbon Emissions Partners S.A. (Switzerland) and PJSC "Krivorijgaz" (Ukraine)

CEP Carbon Emissions Partners S.A.
Route de Thonon 52

Geneva, Switzerland
Fabian Knodel
Director
Telephone: +41 (76) 346 11 57
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e-mail:0709bp@gmail.com
CEP Carbon Emissions Partners S.A. is the participant of the Project (stated in Annex 1)

PJSC "Krivorijgaz"
Address: 1 Metalurhiv Str., Kryvyi Rih, Dnipropetrovsk region, Ukraine.
Telephone: +380 (05642) 405 40 00
Fax: +380 (05642) 405 40 00
E-mail: vakulenko@krgaz.dp.ua
www: http://www.krgaz.dp.ua/
Contact person: Vakulenko Ivan Evhenovych
PJSC "Krivorijgaz" is the Project participant (stated in Annex 1).

## SECTION C. Duration of the project / crediting period

### C.1. Starting date of the project:

Starting date of the Project is 15/02/2005 – the date when PJSC "Krivorijgaz" started inspection and repair works at GDP (CGDP) gas equipment and gas fittings, flanged and threaded joints of OJSC "Krivorijgaz" gas distribution networks in the framework of the JI Project.

### C.2. Expected operational lifetime of the project:

Functioning of the system of leak detection and repair, and also further maintaining of leakproofness of gas equipment that was created within the framework of the Project, are not limited in time, as periodic repair (replacement) of GDP (CGDP) gas equipment and gas fittings of gas pipelines will be performed constantly.
Expected operational lifetime of the Project in years and months is 12 years and 11 months, or 155 months, from 15/02/2005 to 31/12/2017.

### C.3. Length of the crediting period:

The JI Project refers to the first commitment period and makes 5 years/60 months (January 1, 2008 – December 31, 2012).

The starting date of the crediting period is the date when the first project measures at gas pipelines of PJSC "Krivorijgaz" were carried out and when the first GHG emission reductions are expected to be generated, namely 15/02/2005. The end of the crediting period is December 31, 2012. The crediting period lasts for 7 years and 11 months or 95 months.

If after the first commitment period according to the Kyoto Protocol it will be prolonged, the crediting period of the Project will be prolonged till December 31, 2017. The prolongation of the crediting periof after 2012 is subject to the Host party's approval. The total crediting period (before the crediting period, the crediting period and after the crediting period) will last for 12 years and 11 months or 155 months.

## SECTION D. Monitoring plan

### D.1. Description of monitoring plan chosen:

The proposed project uses the specific approach to JI projects based on "Guidance on criteria for baseline setting and monitoring" (Version 03) of the Joint Implementation Supervisory Committee - JISC[15]
The Monitoring plan was developed for correct and clear calculation of greenhouse gas emissions and preparation of reports on methane emission reductions on the basis of the baseline and project activities. JI specific approach was developed in accordance with "Methodology for calculation of greenhouse gas emission reductions achieved by above-standard natural gas leak repair at the gas distribution networks" (registration number UkrNTI 0112U00A816 dated 2012) that was developed by the Institute of Gas of the National Academy of Sciences of Ukraine (hereinafter – the Methodology).

The Methodology provides for the possibility to use two equal and independent of each other methods of calculating methane emissions at gas distribution networks, namely:

- Calculation method that is based on the use of data on natural gas leaks from GDN components that are formed from the standard values of methane emissions for each GDN component and data obtained through statistical processing of results of actual measurements of methane leaks before and after activities aimed at leak repair.
- Measurement method that is based on actual measurements of methane leaks from each GDN component before and after the repair or replacement.

Because of a large number of components that can potentially leak at gas distribution networks, the difficulty in accessing some part of them for conducting actual methane leak measurements, as well as lack of necessary measuring equipment at the beginning of the project, PJSC "Krivorijgaz" uses the calculation method to estimate emission reductions achieved by implementation of the advanced leak reduction and repair program.

When using the calculation method according to the Methodology to determine the Above-standard Physical Leak of Natural Gas (APLNG) from GDN component the values of natural gas leak factor (NGLF) are taken from Table. A.1 in Annex A to the Methodology, which is included in a package of supporting documents; to determine the Standard Physical Leak of Natural Gas (SPLNG) - standard values or in case of their absence, NGLF obtained on the basis of statistical processing of results of actual measurements of methane leaks before and after the activities aimed at leak repair, provided in Table A.1 in Annex A to the Methodology are used. The NGLF values listed in Annex A to the Methodology, derived from the statistical treatment of results of actual measurements of methane leaks before and after the activities aimed at leak repair [16][17].

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[15] http://ji.unfccc.int/Ref/Documents/Baseline_setting_and_monitoring.pdf
[16] Report on the scientific and technical work "Development of methodological fundamentals of reducing greenhouse gas emissions by repairing above-standard leaks of natural gas at gas distribution networks," Gas Institute of NAS of Ukraine, 2012
[17] Report on the scientific and technical work "Assessment of methane leaks at gas distribution networks of Ukraine", Institute of General Energy of National Academy of Sciences of Ukraine, 2011

Assessment of whether the state of GDN component is conditionally leakproof or not, shall be conducted by using audio, visual and olfactory response system and by detection with the help of individual dosimeters during the check of the presence of leaks in the process of conducting the project activities.
Each GDN component is characterized by NGLF that can be standard, i.e., the one for a conditional leakproof state of equipment, or above-standard when an equipment unit is not in a conditional leakproof state, i.e., actual physical leak of natural gas exceeds the limit, which is set for standard operational condition of GDN component. Equipment unit for which APLNG was detected but wasn't repaired in a corresponding monitoring period is considered conditionally leakproof, i.e., emissions from such a unit are taken as equal to SPLNG in a corresponding monitoring period. Reduction of methane leak at GDN component *i* in a monitoring period occurs only after the component above-standard leak is repaired (by replacement of component *i* and / or replacement sealants of component *i*). It is defined as the difference between NGLFs for APLNG and SPLNG for hours when the unit was under pressure.
Dates of leak repair and gas pressure relief at a corresponding GDN component are the dates preceding the day when a component was actually replaced and / or the sealant of such element was replaced and the date of natural gas pressure feed at GDN component is the date following the day when the activity was carried out. Gas equipment, where repeat methane leak is detected should be excluded from calculations of greenhouse gas reductions in a respective monitoring period. That is, it will be deemed that no reduction of methane leaks at a respective GDN component took place during the period from the date of the last monitoring measurement of methane leak to the date when repeat leak was detected and repaired. Such equipment must be repaired (or replaced) again, and only after this activity reduction of methane leaks into the atmosphere can be calculated for a respective GDN component. Thus, application of the calculation method of the Methodology for calculating methane leak reductions in gas distribution networks in fact leads to underestimation of the reductions due to the implementation of the above mechanisms of calculation; this confirms the conservativeness of the approach.

According to the Methodology the Working team of PJSC "Krivorijgaz" made / will make the following registries:
1. Registry of gas distribution points and gas fittings of the JI project "Reduction of methane leaks on the gas equipment of the gas distribution points and on the gas armature, flanged, threaded joints of the gas distribution pipelines of PJSC "Krivorijgaz" (refer to Supporting document 1), which includes detailed information about all GDPs (CGDPs), shut-off and control valves, flanges and threaded connections that are included in the project boundary.
2. Registry to APLNG repaired at GDN components (refer to Supporting document 2).
3. Registry of monitoring of GDN component operating modes - under pressure or under pressureless condition, that is when NGLF is equal to zero.
4. Registry of monitoring of operating state of GDN component where APLNG were repaired (refer to Supporting document 4).

All relevant data associated with calculation of methane emission reductions are stored in an electronic database. Each Monitoring Report will contain all necessary information from this database.
Project data and documents in paper and/or electronic form shall be stored till 31/12/2019 pursuant to Order No. 821 dated 21/09/2012 issued by the management board of PJSC "Krivorijgaz".

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

| Parameter reference | Name to the parameter | Data unit |
|---|---|---|
| i | Sequence number of GDN component (GDP (CGDP), gas fittings of gas pipeline) included in the project boundary | Dimensionless |

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

Data and parameters monitored during the whole crediting period:

| Parameter reference | Name to the parameter | Data unit |
|---|---|---|
| $h$ | Number of activity (replacement/repair) at GDN component after the presence of APLNG was determined at such component | Dimensionless |
| $W_y$ | Average mass fraction of methane in the natural gas | % |
| $K^g_{i,h}$ | Natural gas leak factor from GDN component $i'$ in CLS | $m^3/h$ |
| $K^n_{i''}$ | Natural gas leak factor that corresponds to APLNG for GDN component $i''$ | $m^3/h$ |
| $H^g_{i',h,y}$ | Time of operation of GDN component under pressure from the beginning of monitoring period "y" to implementation of project activities (repair / replacement) that resulted in the repair of APLNG at such component | h |
| $H^n_{i'',h,y}$ | Time of operation of GDN component under pressure from the moment of implementation of project activities (repair / replacement) that resulted in the repair of APLNG at such component to the end of the monitoring period "y" | h |
| $GWP_{CH4}$ | Global Warming Potential of methane | $tCO_2e / tCH_4$ |

[*y*] – index that corresponds to monitoring period;
[*i'*] – index that corresponds to a number of GDN component, which is in a set of elements *I' ((I' + I'') = I*, where I is a set that includes all GDN components that are in the project boundary) where the project activities did not result in any emission reductions (there was no replacement / repair of components) in the reporting monitoring period;
[*i''*] – index that corresponds to a number of GDN component, which is in a set of elements *I'' ((I' + I'') = I*, where I is a set that includes all GDN components that are in the project boundary) where the project activities resulted in emission reductions (there was replacement / repair of components) in the reporting monitoring period;
[*h*] – index that corresponds to a number of activity under the project at GDN component, if more than one activity was carried out at reporting component in the monitoring period (where H is a set, which includes all activities in the project scenario at GDN component in the monitoring period);
[*g*] – index that corresponds to SPLNG;

[*n*] – index that corresponds to APLNG.

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

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

| 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 |
|---|---|---|---|---|---|---|---|---|
| 1. *i* | Sequence number of GDN component (GDP (CGDP), gas fittings of gas pipeline) included in the project boundary | Activity on leak measurements | Dimensionless | m | Once at the beginning of Project | 100% | Electronic and hard copy | All GDPs, CGDPs and gas fittings included in the project boundary are listed in the Registry and tagged correspondingly |
| 2. $GWP_{CH_4}$ | Global Warming Potential of methane | IPCC Second Assessment Report: Climate Change 1995(SAR) and approved by the COP. GWP value for methane is provided on the site of the UNFCCC [18] | $tCO_2e$ / $tCH_4$ | e | During the whole crediting period | 100% | Electronic and hard copy | The project developer will monitor any changes in GWP for methane published by the IPCC and approved by the COP |

[18] http://unfccc.int/ghg_data/items/3825.phphttp://unfccc.int/ghg_data/items/3825.php

| 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 |
|---|---|---|---|---|---|---|---|---|
| 3. $h$ | Number of activity (replacement/repair) at GDN component after the presence of APLNG was determined at such component | Activity on leak measurements | Dimensionless | m | Every time after activity was carried out at corresponding GDN component | 100% | Electronic and hard copy | Each activity carried out at GDN component that is included in the project boundary is tagged with an individual number |
| *4.* $W_y$ | Average mass fraction of methane in the natural gas in period "y" in the project scenario | Information on the basis of company's official data in monitoring period is used | % | c | Annually | 100% | Electronic and hard copy | Company's data |

| 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 |
|---|---|---|---|---|---|---|---|---|
| 5. $K^{g}_{i'h}$ | Natural gas leak factor from GDN component $i'$ in CLS | Standard values or data from «Methodology for calculation of greenhouse gas emission reductions achieved by above-standard natural gas leak repair at the gas distribution networks" (registration number UkrNTI 0112U00A816 dated 2012) | $m^3/h$ | e | Every time after activity was carried out at GDN component | 100% | Electronic and hard copy | Company's data or calculations on the basis of company's data |
| 6. $K^{g}_{i''h}$ | Natural gas leak factor that corresponds to APLNG for GDN component $i''$ | «Methodology for calculation of greenhouse gas emission reductions achieved by above-standard natural gas leak repair at the gas distribution networks" | $m^3/h$ | e | Once at the beginning of the project for each type of component | 100% | Electronic and hard copy | Calculations on the basis of company's data |

| 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 |
|---|---|---|---|---|---|---|---|---|
| 7. $H^{g}_{i',h,y}$ | Time of operation of GDN component under pressure from the beginning of monitoring period "y" to implementation of project activities (repair / replacement) that resulted in the repair of APLNG at such component | Data of the company received during GDN operation and activities aimed at leak repair | h | c | Annualy | 100% | Electronic and hard copy | Company's data. Calculations for each GDN component for each monitoring period |
| 8. $H^{n}_{i'',h,y}$ | Time of operation of GDN component under pressure from the moment of implementation of project activities (repair / replacement) that resulted in the repair of APLNG at such component to the end of the monitoring period "y" | Data of the company received during GDN operation and activities aimed at leak repair | h | c | Annualy | 100% | Electronic and hard copy | Company's data. Calculations for each GDN component where activities on leak repair was carried out; for each monitoring period |

According to the current legislation, all measuring equipment in Ukraine must satisfy the set requirements and corresponding standards and undergo periodic verification.

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

Greenhouse gas emissions in the project scenario according to a specific approach to Joint Implementation projects (calculations by using the tabular method of the Methodology) are calculated according to the formula:

$$PE_y = GWP_{CH_4} \cdot ConvFactor \cdot W_y \cdot P_y \quad (1)$$

where:

$PE_y$ – greenhouse gas emissions in period «y», in the project scenario (t $CO_2$eq);

$GWP_{CH_4}$ – global warming potential of methane (t$CO_2$eq/t$CH_4$);

$W_y$ – Average mass fraction of methane in the natural gas in period «y», in the project scenario (%);

$P_y$ – volume of natural gas leaks into the atmosphere in period «y», in the project scenario ($m^3$ natural gas);

$ConvFactor$ – Conversion factor to convert methane leaks from volume units to weight units (t $CH_4$/ $m^3$ $CH_4$).
Under normal conditions defined as 0 degree Celsius and 0.1013 MPa, $ConvFactor$ = 0.0007168 (t/ $m^3$).
[$y$] – index that corresponds to monitoring period;
[$CH_4$] – index that corresponds to methane.

Emissions of natural gas (92-95% of which is methane) in the atmosphere caused by leaks from gas transportation networks are calculated according to the formula:

$$P_y = \sum_{h \in H_{i'}} \sum_{i' \in I'} K^g_{i'h} \cdot H^g_{i'hy} + \sum_{h \in H_{i''}} \sum_{i'' \in I''} K^g_{i''h} \cdot H^n_{i''hy} \quad (2)$$

$K^g_{i'h}$ – natural gas leak factor for GDN component $i'$ in CLS (i.e. corresponds to SPLNG), in the project scenario ($m^3$/h) ;

$K^g_{i''h}$ – natural gas leak factor that corresponds to APLNG for GDN component $i''$, in the project scenario ($m^3$/h);

$H^g_{i'hy}$ – Time of operation of GDN component under pressure from the beginning of monitoring period “y” to implementation of project activities (repair / replacement) that resulted in the repair of APLNG at such component (h);

$H^{n}_{i"hy}$ – Time of operation of GDN component under pressure from the moment of implementation of project activities (repair / replacement) that resulted in the repair of APLNG at such component to the end of the monitoring period "y" (h);
[*y*] – index that corresponds to monitoring period;
[*i'*] – index that corresponds to a number of GDN component, which is in a set of elements *I' ((I' + I'') = I*, where I is a set that includes all GDN components that are in the project boundary) where the project activities did not result in any emission reductions (there was no replacement / repair of components) in the reporting monitoring period;
[*i''*] – index that corresponds to a number of GDN component, which is in a set of elements *I'' ((I' + I'') = I*, where I is a set that includes all GDN components that are in the project boundary) where the project activities resulted in emission reductions (there was replacement / repair of components) in the reporting monitoring period;
[*h*] – index that corresponds to a number of activity under the project at GDN component, if more than one activity was carried out at reporting component in the monitoring period (where H is a set, which includes all activities in the project scenario at GDN component in the monitoring period);
[*g*] – index that corresponds to SPLNG;
[*n*] – index that corresponds to APLNG.

**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:**

| 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 |
|---|---|---|---|---|---|---|---|---|
| 1. *i* | Sequence number of GDN component (GDP (CGDP), gas fittings of gas pipeline) included in the project boundary | Activity on leak measurements | Dimensionless | m | Once at the beginning of Project | 100% | Electronic and hard copy | All GDPs, CGDPs and gas fittings included in the project boundary are listed in the Registry and tagged correspondingly |

| 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 |
|---|---|---|---|---|---|---|---|---|
| 2. $GWP_{CH_4}$ | Global Warming Potential of methane | IPCC Second Assessment Report: Climate Change 1995(SAR) and approved by the COP. GWP value for methane is provided on the site of the UNFCCC [19] | $tCO_2e$ / $tCH_4$ | e | During the whole crediting period | 100% | Electronic and hard copy | The project developer will monitor any changes in GWP for methane published by the IPCC and approved by the COP |
| 3. $h$ | Number of activity (replacement/repair) at GDN component after the presence of APLNG was determined at such component | Activity on leak measurements | Dimensionless | m | Every time after activity was carried out at corresponding GDN component | 100% | Electronic and hard copy | Each activity carried out at GDN component that is included in the project boundary is tagged with an individual number |
| 4. $W_y$ | Average mass fraction of methane in the natural gas in period "y" in the project scenario | Information on the basis of company's official data in monitoring period is used | % | c | Annually | 100% | Electronic and hard copy | Company's data |

[19] http://unfccc.int/ghg_data/items/3825.phphttp://unfccc.int/ghg_data/items/3825.php

| 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 |
|---|---|---|---|---|---|---|---|---|
| 5. $K^{g}_{i,h}$ | Natural gas leak factor from GDN component $i'$ in CLS | Standard values or data from «Methodology for calculation of greenhouse gas emission reductions achieved by above-standard natural gas leak repair at the gas distribution networks" (registration number UkrNTI 0112U00A816 dated 2012) | $m^3/h$ | e | Every time after activity was carried out at GDN component | 100% | Electronic and hard copy | Company's data or calculations on the basis of company's data |

| 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 |
|---|---|---|---|---|---|---|---|---|
| 6. $K_{i"}^{n}$ | Natural gas leak factor that corresponds to APLNG for GDN component $i"$ | «Methodology for calculation of greenhouse gas emission reductions achieved by above-standard natural gas leak repair at the gas distribution networks" (registration number UkrNTI 0112U00A816 dated 2012) | $m^3/h$ | e | Once at the beginning of the project for each type of component | 100% | Electronic and hard copy | Calculations on the basis of company's data |
| 7. $H_{i',h,y}^{g}$ | Time of operation of GDN component under pressure from the beginning of monitoring period "y" to implementation of project activities (repair / replacement) that resulted in the repair of APLNG at such component | Data of the company received during GDN operation and activities aimed at leak repair | h | c | Annualy | 100% | Electronic and hard copy | Company's data. Calculations for each GDN component for each monitoring period |

| 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 |
|---|---|---|---|---|---|---|---|---|
| 8. $H^{n}_{i",h,}$ | Time of operation of GDN component under pressure from the moment of implementation of project activities (repair / replacement) that resulted in the repair of APLNG at such component to the end of the monitoring period "y" | Data of the company received during GDN operation and activities aimed at leak repair | h | c | Annualy | 100% | Electronic and hard copy | Company's data. Calculations for each GDN component where activities on leak repair was carried out; for each monitoring period |

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

Greenhouse gas emissions in the baseline scenario according to a JI specific approach (which is calculated by using the tabular method of the Methodology) are calculated according to the formula:

$$BE_y = GWP_{CH_4} \cdot ConvFactor \cdot W_y \cdot B_y \quad (3)$$

Where:

$BE_y$ – greenhouse gas emissions in period «y», in the baseline scenario (t $CO_2$eq);

$GWP_{CH_4}$ – global warming potential of methane (t$CO_2$eq/t$CH_4$);

$W_y$ – Average mass fraction of methane in the natural gas in period «y», in the project scenario (%);

$B_y$ – volume of natural gas leaks into the atmosphere in period «y», in the baseline scenario ($m^3$ natural gas);

$ConvFactor$ – Conversion factor to convert methane leaks from volume units to weight units (t $CH_4$/ $m^3$ $CH_4$).

Under normal conditions defined as 0 degree Celsius and 0.1013 MPa, $ConvFactor$ = 0.0007168 t / $m^3$.
[$y$] – index that corresponds to monitoring period;
[$CH_4$] – index that corresponds to methane.

Emissions of natural gas (92-95% of which is methane) in the atmosphere caused by leaks from gas transportation networks are calculated according to the formula:

$$B_y = \sum_{h \in H_i} \left( \sum_{i' \in I'} K^g_{i'h} \cdot H^g_{i'hy} + \sum_{i'' \in I''} K^n_{i''} \cdot H^n_{i''hy} \right) \quad (4)$$

Where:
$K^g_{i',h}$– natural gas leak factor for GDN component $i'$ that is in CLS (i.e. corresponds to SPLNG), in the baseline scenario ($m^3$/h);

$K^n_{i''}$ – natural gas leak factor that corresponds to APLNG for GDN component $i''$, in the baseline scenario ($m^3$/h);

$H^g_{i'hy}$ – Time of operation of GDN component in CLS under pressure in period «y», in the baseline scenario (h);

$H^n_{i''hy}$ – Time of operation of GDN component from the moment when project activities (repair / replacement) that resulted in the repair of APLNG were implemented to the end of monitoring period «y» (h);
[$y$] – index that corresponds to monitoring period;
[$i'$] – index that corresponds to a number of GDN component, which is in a set of elements $I'$ ($(I' + I'') = I$, where I is a set that includes all GDN components that are in the project boundary) where the project activities did not result in any emission reductions (there was no replacement / repair of components) in the reporting monitoring period;
[$i''$] – index that corresponds to a number of GDN component, which is in a set of elements $I''$ ($(I' + I'') = I$, where I is a set that includes all GDN components that are in the project boundary) where the project activities resulted in emission reductions (there was replacement / repair of components) in the reporting monitoring period;
[$h$] – index that corresponds to a number of activity under the project at GDN component, if more than one activity was carried out at reporting component in the monitoring period (where H is a set, which includes all activities in the project scenario at GDN component in the monitoring period);
[$g$] – index that corresponds to SPLNG;
[$n$] – index that corresponds to APLNG.

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

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

Direct monitoring of emission reductions is not used.

**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):**

Direct monitoring of emission reductions is not used.

**D.1.3. Determination of leakage in the monitoring plan:**

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

According to a JI 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 03[20],, the "Methodology for calculation of greenhouse gas emission reductions achieved by above-standard natural gas leak repair at the gas distribution networks" (registration number UkrNTI 0112U00A816 dated 2012) that was developed by the Institute of Gas of the National Academy of Sciences of Ukraine and on the basis of elements of approved CDM methodology AM0023 version 4.0 no leakage is expected.

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

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

No leakage is expected.

**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):**

GHG Emission Reductions are calculated in accordance with the formula:

$$ER_y = BE_y - PE_y; \quad (5)$$

where:

$ER_y$ – reduction of GHG emission into the atmosphere in period «y» (t $CO_2$e);

$BE_y$ – GHG emission in period «y» in the baseline scenario (t $CO_2$e);

$PE_y$ – GHG emission in period «y» in the project scenario (t $CO_2$e);

[$y$] – index corresponding to monitoring period.

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

Implementation of this Project does not provide for any negative environmental impact (Refer to section F below). Therefore data collection on environmental impacts of the Project is not required. There are no laws or regulations in Ukraine requiring collection of such information.

| **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. |
| 1. | Low | Each GDN component included into the project boundary shall be listed in Supporting document 1 – "Registry of gas distribution points, cabinet-type gas distribution points and gas fittings of gas distribution networks of the Joint Implementation Project "Reduction of methane leaks on the gas equipment of the gas distribution points and on the gas armature, flanged, threaded joints of the gas distribution pipelines of PJSC "Krivorijgaz" and tagged with an individual number |

| | | |
|---|---|---|
| 2. | Med/Low | IPCC Second Assessment Report: Climate Change 1995(SAR) and approved by the COP. GWP value for methane is provided on the site of the UNFCCC [21]<br>The project developer will monitor any changes in GWP for methane published by the IPCC and approved by the COP |
| 3. | Low | According to the procedures of GDN operation and activity on leak measurement each implementation (replacement / repair) at GDN component should be entered in the repair logs and the electronic database provided by the project. |
| 4. | Low | According to the procedures of GDN operation the company determines the average mass fraction of methane in the natural gas, which appears in the official reports of the enterprise and influences the price of gas transportation by GDN. |
| 5. | Low | Standard values for each GDN component or in case of their absence factors provided in Table A.1 in Annex A to «Methodology for calculation of greenhouse gas emission reductions achieved by above-standard natural gas leak repair at the gas distribution networks" that was developed by the Institute of Gas of the National Academy of Sciences of Ukraine are used |
| 6. | Low | Factors provided in Table A.1 in Annex A to «Methodology for calculation of greenhouse gas emission reductions achieved by above-standard natural gas leak repair at the gas distribution networks that was developed by the Institute of Gas of the National Academy of Sciences of Ukraine are used |
| 7. | Low | Company's official data that are entered in GDN component operation logs and duplicated in electronic database are used |
| 8. | Low | Company's official data that are entered in GDN component operation logs and duplicated in electronic database are used |

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

Coordination of activities of all departments and services of PJSC "Krivorijgaz" relating to the JI project implementation is carried out by the Working Team created pursuant to Order No.821 of PJSC "Krivorijgaz" management board as of 21/09/2012. The structure of the Working Team is shown in Figure 4.

[21] http://unfccc.int/ghg_data/items/3825.phphttp://unfccc.int/ghg_data/items/3825.php

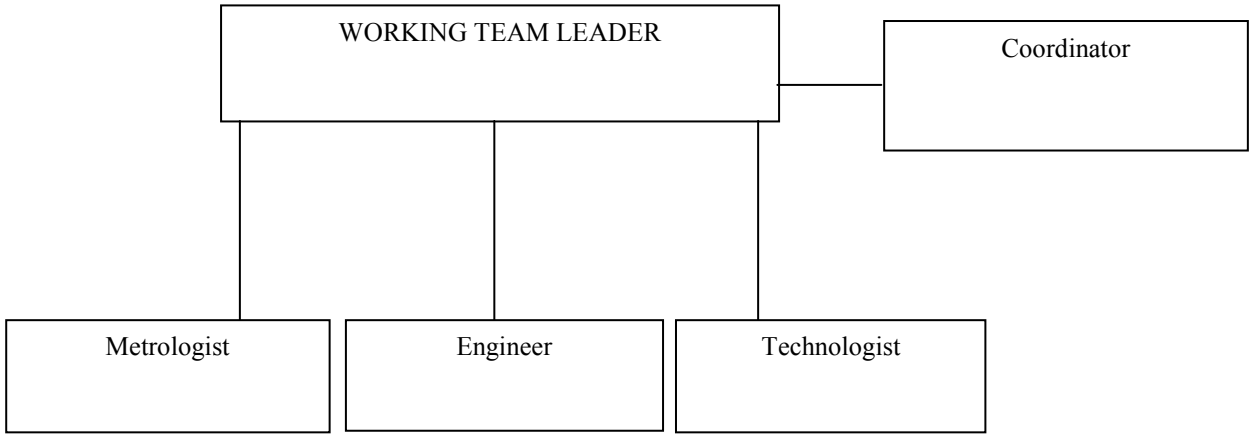


*Figure 4. Structure of the Working team*

The technologist is responsible for collection of all information under the monitoring plan and conduction of all necessary calculations. The engineer is responsible for organization of monitoring measurements of leaks and their repair. On the basis of the information received, Head of the Working Team shall determine the plan of project activities and the amount of resources required. The metrologist shall ensure the availability of verified metering devices and technical support. The coordinator is responsible for storage, archiving and backuping of project information.

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

CEP Carbon Emissions Partners S.A.
Route de Thonon 52
Geneva, Switzerland
Fabian Knodel
Director
Telephone: +41 (76) 346 11 57
Fax: +41 (76) 346 11 57
e-mail:0709bp@gmail.com
CEP Carbon Emissions Partners S.A. is the participant of the Project (stated in Annex 1)

PJSC “Krivorijgaz”
Address: 1 Metalurhiv Str., Kryvyi Rih, Dnipropetrovsk region, Ukraine.
Telephone: +380 (05642) 405 40 00
Fax: +380 (05642) 405 40 00
E-mail: vakulenko@krgaz.dp.ua
www: http://www.krgaz.dp.ua/
Contact person: Vakulenko Ivan Evhenovych
PJSC “Krivorijgaz” is the Project participant (stated in Annex 1).

## SECTION E. Estimation of greenhouse gas emission reductions

### E.1. Estimated project emissions:

The estimation of project emissions was performed on the basis of the data received according to the monitoring plan presented in Section D.1.1.2 and Annex 3. The results of measurements and calculations done by CEP Carbon Emissions Partners S.A. (refer to Supporting document 2) [22] are provided in Table 5.

*Table 5. Estimated Project Emissions*

| Year | Estimated project emissions (tons $CO_2$ equivalent) |
|---|---|
| 2005 | 28 036 |
| 2006 | 28 036 |
| 2007 | 28 036 |
| Total 2006 - 2007 | **84 108** |
| 2008 | 28 036 |
| 2009 | 28 036 |
| 2010 | 28 036 |
| 2011 | 28 036 |
| 2012 | 28 036 |
| Total 2008 - 2012 | **140 180** |
| 2013 | 28 036 |
| 2014 | 28 036 |
| 2015 | 28 036 |
| 2016 | 28 036 |
| 2017 | 28 036 |
| Total 2013 - 2017 | **140 180** |
| Total (tons of $CO_2$ equivalent) | **364 468** |

### E.2. Estimated leakage:

No leakage is expected.

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

As there is no leakage, the sum of E.1. and E.2. will be equal to E.1. (refer to Table 5)

### E.4. Estimated baseline emissions:

[22] Supporting document 2 "Reduction of methane leaks on the gas equipment of the gas distribution points and on the gas armature, flanged, threaded joints of the gas distribution pipelines of PJSC "Krivorijgaz" is executed in an electronic form and submitted to the State Environmental Investment Agency of Ukraine and Bureau Veritas Certification Holding SAS – a company that verifies the project.

Baseline emissions provided in the Table 6 were estimated by using the formulae provided in Section D.1.1.4.

*Table 6. Estimated baseline emissions*

| Year | Estimated baseline emissions (tons of $CO_2$ equivalent) |
|---|---|
| 2005 | 40 239 |
| 2006 | 70 747 |
| 2007 | 101 254 |
| Total 2005 - 2007 | **212 240** |
| 2008 | 119 559 |
| 2009 | 150 067 |
| 2010 | 150 067 |
| 2011 | 150 067 |
| 2012 | 150 067 |
| Total 2008 - 2012 | **719 827** |
| 2013 | 150 067 |
| 2014 | 150 067 |
| 2015 | 150 067 |
| 2016 | 150 067 |
| 2017 | 150 067 |
| Total 2013 - 2017 | **750 335** |
| Total (tons of $CO_2$ equivalent) | **1 682 402** |

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

Estimated annual reduction of greenhouse gas emissions in the project is calculated according to the formula:

Estimated emission reductions = Baseline emissions – Project emissions

All results of estimation of emission reductions in the project are provided in the Table 7 below.

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

*Table 7. Estimated emission reductions under the Project*

| Year | Estimated project emissions (tons of $CO_2$ equivalent) | Estimated leakage (tones of $CO_2$ equivalent) | Estimated baseline emissions (tons of $CO_2$ equivalent) | Estimated emission reductions (tons of $CO_2$ equivalent) |
|---|---|---|---|---|
| 2005 | 28 036 | 0 | 40 239 | 12 203 |
| 2006 | 28 036 | 0 | 70 747 | 42 711 |

| | | | | |
|---|---|---|---|---|
| 2007 | 28 036 | 0 | 101 254 | 73 218 |
| Total 2005 – 2007 (tons of $CO_2$ equivalent) | **84 108** | **0** | **212 240** | **128 132** |
| 2008 | 28 036 | 0 | 119 559 | 91 523 |
| 2009 | 28 036 | 0 | 150 067 | 122 031 |
| 2010 | 28 036 | 0 | 150 067 | 122 031 |
| 2011 | 28 036 | 0 | 150 067 | 122 031 |
| 2012 | 28 036 | 0 | 150 067 | 122 031 |
| Total 2008 – 2012 (tons of $CO_2$ equivalent) | **140 180** | **0** | **719 827** | **579 647** |
| 2013 | 28 036 | 0 | 150 067 | 122 031 |
| 2014 | 28 036 | 0 | 150 067 | 122 031 |
| 2015 | 28 036 | 0 | 150 067 | 122 031 |
| 2016 | 28 036 | 0 | 150 067 | 122 031 |
| 2017 | 28 036 | 0 | 150 067 | 122 031 |
| Total 2013 – 2017 (tons of $CO_2$ equivalent) | **140 180** | **0** | **750 335** | **610 155** |
| Total (tons of $CO_2$ equivalent) | **364 468** | **0** | **1 682 402** | **1 317 934** |

## 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 environmental standards of Ukraine, natural gas emissions into the air are not considered polluting. (The Decree of the Cabinet of Ministers of Ukraine №1598 dated 29/11/2001 "On approval of the list of the most widespread and dangerous polluting substances emissions of which are subject to regulation"[23]). Therefore no environmental permissions are required for natural gas transportation and supply. The only environmental impact is reduction of natural gas emissions into the atmosphere.

Implementation of this project will increase the safety of operation of gas distribution networks, which, in turn, will reduce the probability of explosions or fires.

No transboundary impacts of the project activity, according to their definition in the text of the "Convention on long-range tansboundary pollution"[24] ratified by Ukraine, will take place.

The Project implementation does not cause any harmful impacts on the environment.

**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:**

The Project implementation does not provide for any harmful impacts on the environment.

[23] http://search.ligazakon.ua/l_doc2.nsf/link1/ed_2001_11_29/an/16/KP011598.html

[24] http://zakon1.rada.gov.ua/laws/show/995_223

## SECTION G. Stakeholders' comments

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

Consultations were conducted with the specialists of the Institute of General Energy of NAS of Ukraine. No comments from Stakeholders were received. The project activity provides for neither negative impact on the environment nor negative social effect.

Annex1

## CONTACT INFORMATION ON PROJECT PARTICIPANTS

**Project owner:**

| | |
|---|---|
| Organisation: | PJSC "Krivorijgaz" |
| Street/P.O.Box: | Metalurhiv |
| Building: | 1 |
| City: | Kryvyi Rih |
| State/Region: | Dnipropetrovsk region |
| Postal code: | 50051 |
| Country: | Ukraine |
| Phone: | +380 (05642) 405 40 00 |
| Fax: | +380 (05642) 405 40 00 |
| E-mail: | vakulenko@krgaz.dp.ua |
| URL: | - |
| Represented by: | - |
| Title: | The Head of the Board |
| Salutation: | - |
| Last name: | Vakulenko |
| Middle name: | Evhenovych |
| First name: | Ivan |
| Department: | - |
| Phone (direct): | +380 (05642) 405 40 00 |
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| Mobile: | - |
| Personal e-mail: | vakulenko@krgaz.dp.ua |

**Project participant and ERU buyer:**

| | |
|---|---|
| Organisation: | CEP Carbon Emissions Partners S.A. |
| Street/P.O.Box: | Route de Thonon |
| Building: | 52 |
| City: | Geneva |
| State/Region: | - |
| Postal code: | Case postale 170 CH-1222 Vesenaz |
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| Represented by: | - |
| Title: | Director |
| Salutation: | |
| Last name: | Knodel |
| Middle name: | - |
| First name: | Fabian |
| Department: | - |
| Phone (direct): | +41 (76) 3461157 |
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| Mobile: | |
| Personal e-mail: | 0709BP@GMAIL.COM |

Annex 2

## BASELINE INFORMATION

**To determine the baseline the following parameters are used:**

| № | Parameter reference | Name to the parameter | Data unit |
|---|---|---|---|
| 1. | i | Sequence number of GDN component (GDP (CGDP), gas fittings) included in the project boundary | Dimensionless |
| 2. | $GWP_{CH4}$ | Global Warming Potential of methane | $tCO_2e$ / $tCH_4$ |
| 3. | $h$ | Number of activity (replacement/repair) at GDN component after the presence of APLNG was determined at such component | Dimensionless |
| 4. | $W_y$ | Average mass fraction of methane in the natural gas, in period "y", in the project scenario | % |
| 5. | $K^g_{i,h}$ | Natural gas leak factor from GDN component $i'$ in CLS | $m^3/h$ |
| 6 | $K^n_{i''}$ | Natural gas leak factor that corresponds to APLNG for GDN component $i''$ | $m^3/h$ |
| 7 | $H^g_{i',h,y}$ | Time of operation of GDN component under pressure from the beginning of monitoring period "y" to implementation of project activities (repair / replacement) that resulted in the repair of APLNG at such component | h |
| 8. | $H^n_{i'',h,y}$ | Time of operation of GDN component under pressure from the moment of implementation of project activities (repair / replacement) that resulted in the repair of APLNG at such component to the end of the monitoring period "y" | h |

The detailed description of parameters for determination of the baseline is presented in tables of section B.1.
Calculation of the baseline is performed as per formulae (3) and (4) (Section of D.1.1.4).

Annex 3

# MONITORING PLAN

The monitoring plan includes the following sections:

1. The program of the initial monitoring measurements of methane leaks at the gas equipment of GDPs (CGDPs), gas fittings of PJSC "Krivorijgaz" gas distribution networks.
2. Monitoring map of methane leaks at the gas equipment of GDPs (CGDPs), gas fittings of PJSC "Krivorijgaz" gas distribution networks.
3. Methodology of methane leak detection.
4. Guidance on monitoring measurement data collection and storage.

## I. PROGRAM

### of the initial monitoring measurements of methane leaks at the gas equipment of GDPs (CGDPs), gas fittings of PJSC "Krivorijgaz" gas distribution networks.

The aim of the initial monitoring measurements of methane leaks is:

1. Receipt of a more reliable estimation of methane leak volumes from the gas transportation system (exept for the leaks, related to operation, technical maintenance or emergency situations).
2. Methane ERUs estimate during the JI Project implementation.
3. Determination of the potential income of the project and amount of repair work / replacement which is necessary under condition of an attractive payback period for investment.
4. Determination of priorities in relation to works that must be executed at gas equipment.
5. Obtaining of initial experience in JI project implementation, identification of questions, that must be solved or improved (such as additional measuring equipment, accuracy class of devices, necessity of training of corresponding workers) before the beginning of the project, to provide for the proper implementation.

The JI Project has the following stages:

- determination of the list of facilities where methane leaks occur;
- repair of methane leaks by replacement of sealing materials with more modern and reliable ones or complete replacement of equipment;
- calculation of methane leaks at facilities;
- monitoring of leaks at equipment that was already repaired (replaced).

Certain issues have to be determined systematically during preliminary measurements:

- where leaks take place and calculation of their volumes (at the initial stages an approximate calculation is possible to have an understanding of the size of leak volumes);
- where leaks are relatively small;
- where there are possibilities for repair or/and replacements of equipment, that require small funds;
- where significant leaks are detected and their repair will not require significant financing.

Quality information (for example, difficulties in measuring at certain components because of the limited access to them etc) also must be recorded, where possible to facilitate planning and implementation of the Project.
The system of the name/ numeration of gas equipment units must be agreed upon before the beginning of measurements.
The table, provided below must has explanatory and actual, not directing and normative character.

**Table 1MP. Information about facilities located at GDPs (CGDPs)**

A logger of technical verification of gas equipment of GDPs (CGDPs) is maintained (a maintenance log that is kept by inspectors) - one time per four days, it is performed by the corresponding authorized worker. Leaks are specified in the logger of reports (Table 1MP). Availability of APLNG is determined by using gas detector and / or by organoleptic method.

Current repair is conducted one time per year, technical maintenance - one time per half-year.
Table 1MP. Information on GDP (CGDP) facility

| Name of GDP (CGDP) (code according to the Register)/ Name of GDP (CGDP) component | Gas pressure at entrance /exit, (MPa) | Average volume of the transported gas, $m^3/h$. | % $CH_4$ | Availability of above-standard leak, yes/no |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

Date of measurement: _____

**Table 2MP. Information on facilities at gas distribution pipelines**

A logger of technical verification of gas fittings is maintained (a maintenance log that is kept by inspectors) - one time per month, it is performed by the corresponding authorized worker. Leaks are specified in the logger of reports (Table 2MP). Availability of APLNG is determined by using gas detector and / or by organoleptic method.

Current repair is conducted one time per year, technical maintenance - one time per half-year.

Table 2MP. Information on GDP (CGDP) facility

| No. (code according to the registry)/name of type of gas fittings | Gas pressure, (MPa) | Average volume of the transported gas, $m^3/h$. | % $CH_4$ | Availability of above-standard leak, yes/no |
|---|---|---|---|---|
| 1 | 2 | 4 | 5 | 6 |

Date of measurement: _____

## II. MONITORING MAP

**of methane leaks at the GDN components (gas equipment of GDPs (CGDPs), gas fittings of PJSC "Krivorijgaz" gas distribution networks) included in the project boundary**

The monitoring map determines the general procedure for realization of the annual measurement of methane leaks at GDP (CGDP) gas equipment, gas fittings of PJSC "Krivorijgaz" gas distribution networks, that are included in the JI project boundary.

In accordance with the Project activity (Section A.2 of the PDD), each project activity at GDP (CGDP) gas equipment unit and gas fittings of PJSC "Krivorijgaz" gas distribution networks must be tagged with an individual number.
With the aim of tagging of each project activity at PJSC "Krivorijgaz" GDN component included in the project boundary a Registry "Repair of APLNG at GDN components" of the project is drawn. In this Registry each activity at GDN component is tagged with individual number.

Since the beginning of the project activity, inspections aimed at determination of methane leaks are held at GDP (CGDP) gas equipment once every four days, and at gas fittings - once a month, so that one could make sure that gas equipment didn't become the source of methane leaks again. Inspections are recorded in the report of the service of gas pipelines and GDPs (CGDPs) operation and Registries planned under the project.

Methane leak detection at gas equipment during the first repair (replacements) of equipment in accordance with Project Implementation schedule is conducted twice: the first time -before repair (replacement) of equipment, the second time - after repair (replacement).
Current repair is conducted one time per year, technical maintenance - one time per half-year.

Technical maintenance of gas equipment that is in the Registry is conducted not rarer than one time per half of a year.
Current repair of gas equipment that is in the Registry is conducted one time per year.

If APLNG is identified during the reporting monitoring period at GDN component that was repaired (replaced) in the previous monitoring period, this GDN component is excluded from the calculation of leak reduction in the reporting monitoring period and the GDN component shall be repaired (replaced) on a priority basis.

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

Table 3MP. Data and parameters not monitored throughout the whole crediting period, but determined only once, which are available at the stage of PDD development.

| No | Parameter reference | Name to the parameter | Data unit |
|---|---|---|---|
| 1. | i | Sequence number of GDN component (GDP (CGDP), gas fittings of gas pipeline) included in the project boundary | Dimensionless |

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

Data and parameters monitored during the whole crediting period are provided in table 4 MP:
Table 4 MP. Data and parameters monitored during the whole crediting period.

| No | Parameter reference | Name to the parameter | Data unit |
|---|---|---|---|
| 1. | $h$ | Number of activity (replacement/repair) at GDN component after the presence of APLNG was determined at such component | Dimensionless |
| 2. | $W_y$ | Average mass fraction of methane in the natural gas | % |
| 3. | $K^g_{i,h}$ | Natural gas leak factor from GDN component $i'$ in CLS | $m^3/h$ |
| 4. | $K^n_{i"}$ | Natural gas leak factor that corresponds to APLNG for GDN component $i"$ | $m^3/h$ |
| 5. | $H^g_{i',h,y}$ | Time of operation of GDN component under pressure from the beginning of monitoring period "y" to implementation of project activities (repair / replacement) that resulted in the repair of APLNG at such component | h |
| 6. | $H^n_{i",h,y}$ | Time of operation of GDN component under pressure from the moment of implementation of project activities (repair / replacement) that resulted in the repair of APLNG at such component to the end of the monitoring period "y" | h |
| 7. | $GWP_{CH4}$ | Global Warming Potential of methane | $tCO_2e / tCH_4$ |

[*y*] – index that corresponds to monitoring period;
[*i'*] – index that corresponds to a number of GDN component;
[*i'*] – index that corresponds to a number of GDN component, which is in a set of elements *I' ((I' + I") = I*, where I is a set that includes all GDN components that are in the project boundary) where the project activities did not result in any emission reductions (there was no replacement / repair of components) in the reporting monitoring period;
[*i''*] – index that corresponds to a number of GDN component, which is in a set of elements *I" ((I' + I") = I*, where I is a set that includes all GDN components that are in the project boundary) where the project activities resulted in emission reductions (there was replacement / repair of components) in the reporting monitoring period;
[*h*] – index that corresponds to a number of activity under the project at GDN component, if more than one activity was carried out at reporting component in the monitoring period (where H is a set, which includes all activities in the project scenario at GDN component in the monitoring period);
[*g*] – index that corresponds to SPLNG;
[*n*] – index that corresponds to APLNG.

## III. METHODOLOGY OF METHANE LEAK DETECTION

Composition of team for conduction of measuring:
Master of service exploitation of street gas pipelines and court introductions (SESG and CI);
A locksmith on exploitation and repair of gas equipment of GDP - 1 man;
A locksmith of SESG and CI - 1 man.

Necessary materials, instruments and devices:
1) Keys, instruments;
2) Thermochemical detector STH-17-80 or leak detector Dozor S-P - 1 unit;
3) Fire-extinguisher.

Procedure for detection of methane leaks at the gas equipment of GDPs (CGDPs) and gas fittings of gas pipelines:
1. To check where GDP (CGDP, well) where gas equipment and gas fittings, where measuring will be conducted, are located and whether they are gas contaminated or not. To conduct measuring of gas contamination of GDP (CGDP, well) with the detector STH-17-80 or leak detector Dozor S-P.

Data recorded during measuring of methane leak in protocol of measuring:
1. Name and code of GDP (CGDP) gas equipment or gas fittings, where methane leak measurements are conducted.
2. Address of location of GDP GDP (CGDP) or gas fittings, where methane leak measurements are conducted.
3. Determining whether the leak is present or not
4. The last names, name and patronymic of persons that conducted measuring.

## IV. GUIDANCE
## on monitoring measurement data collection and storage

Realization of JI Project provides for:

1. Initial and further regular monitoring inspections of each GDN component that is included in the project boundary and measurement that determine whether APLNG is present at GDN component or not.
2. Repair (replacement) of old gas equipment.

All data, collected in the process of realization of the JI project, must be collected and entered in one database. The database must be constantly updated during the JI Project lifetime. Data about the new leaks detected and repaired during the project lifetime must also be included. The data from a database must be included in monitoring reports on the JI Project.

It is recommended to create a Working team on the JI Project at the enterprise, and to define responsibility for collection of all information on the JI Project, storage and archiving of documents on the JI Project between the members of the Working team.

Basic information sources for the calculation of methane emission reduction units are documents, the qualities of which are given in Table 5MP below:

**Table 5MP. List of documents executed during JI Project implementation**

| № | The name of document | Document data source | Document format | Person who draws the document | Document is formed for the purpose | Place of document storage |
|---|---|---|---|---|---|---|
| 1 | Logsof reports on leak detection | Reports of operation service of gas pipelines and GDPs (CGDPs) | Filled paper forms with data on leaks detected during inspections carried out once per four days | Masters of operation service of pipelines and GDPs (CGDPs) | To form Monitoring reports, calculate leak reduction volumes, Schedule of unscheduled repairs | At departments of operation service of pipelines and GDP (CGDP) |
| 2 | Logs of unscheduled repair work at GDN components (replacement of GDN components) | Schedule of unscheduled repairs | Filled paper form | Masters of repair teams | To form the Registry of repaired APLNG at GDN components | The coordinator of JI Project Working team |
| 3 | Registry of repaired APLNG at GDN components | Logss of unscheduled repair work at GDN components (replacement of GDN components) | Electronic table | Authorized member of the Working team | To form Monitoring reports, calculate leak reduction volumes, | The coordinator of JI Project Working team |

| № | The name of document | Document data source | Document format | Person who draws the document | Document is formed for the purpose | Place of document storage |
|---|---|---|---|---|---|---|
| 4 | Registry "Monitoring of the state of component under pressure" | Logs of operation services of GDN components | Electronic table | Authorized member of the Working team | To form Monitoring reports, calculate leak reduction volumes, | The coordinator of JI Project Working team |
| 5 | Calculation of methane leak volume | Registry of repaired APLNG, Registry "Monitoring of the state of component under pressure", "Methodology for calculation of greenhouse gas emission reductions achieved by above-standard natural gas leak repair at the gas distribution networks" (registration number UkrNTI 0112U00A816 dated 2012) | Electronic table | Authorized member of the Working team | To form Monitoring reports | The coordinator of JI Project Working team |