CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

CONTENTS

SECTION A. General description of project activity

A.1. Title of the project activity:

Reducing gas leakages within the Moldovagaz distribution network, Republic of Moldova
Version 3
19/12/2011

A.2. Description of the project activity:

Purpose

The proposed CDM project aims to reduce gas leakages from "above ground" components in the natural gas distribution system in the Republic of Moldova. Gate and pressure regulation stations within the distribution network reduce and maintain the gas pressure for delivery to consumers. At these facilities, a small percentage of the natural gas throughput typically leaks from equipment and is released into the atmosphere contributing to the global warming. Thus, the project will lead to reductions of greenhouse gas (GHG) emissions, minimising its contribution to climate change.

The project will be implemented across the distribution network served by 12 gas distribution companies (subsidiaries) of Moldovagaz Joint Stock Company.

Leaks in the distribution system are caused by normal equipment wear, thermal and vibrational stresses and seasonal expansion/contraction cycling from ambient air temperature changes. Methane emissions occur through various sources including, ball/gate/plug valves, flanges, and threaded fittings. Many of these components are not routinely checked under existing safety practices of Moldovagaz. The company operators lack the advanced leak detectors and trained workers to identify chronically leaking components, accurately measure the leak rates and make reliable repairs of the leaks.

Current situation

According to current practice, capital repairs and maintenance activities in the gas distribution network are carried out to ensure reliable and safe transmission of gas to consumers. In other words, the inspection and maintenance of the distribution network is not performed because of either economic losses or environmental impacts caused by actual gas leakage. Moldovagaz does not have economic or administrative incentives to detect and reduce chronic leaks using up-to-date technologies and sealing materials.

Project activity

The project activity will reduce natural gas leakage in the distribution network of the Republic of Moldova through the implementation of advanced leak detection and repairs procedures. The project activities will include inspection and leak measurements, as well as repair works at "above-ground" facilities in the distribution system. In addition, selected staff of Moldovagaz will be trained in advanced leak detection, measurement, and repair techniques.

Contribution to Sustainable Development

Natural gas leaks result in emissions of methane (CH_4) into the atmosphere. The implementation of the project is expected to reduce these emissions by 7,489,030 tCO_{2e} over a ten-year crediting. In addition to reducing greenhouse gas emissions, this project will also contribute to Moldova's sustainable development goals[1] by:

- Improving environmental quality and minimising risks for employees and local communities due to the reduction of harmful pollutants (methane);
- Preserving a finite resource (natural gas). The reduction in gas losses will mean that the same amount of service can be provided to customers of Moldovagaz but with a lesser amount of gas required. Using a finite resource more efficiently, and thus preventing waste of that resource, is an important example of sustainable development;
- Capacity building of the local staff in advanced leak detection, measurements and repair techniques;
- Strengthening human capital in the country through retention and employment of locals to support the project implementation (leak measurement program, repair works, and monitoring).

The Republic of Moldova does not have domestic natural gas resources. Rising fuel costs present a substantial economic challenge for the Moldovan economy. Reducing waste such as leaking natural gas from the distribution system is a critical step in improving resource efficiency and reducing dependence on expensive and volatile foreign sources of energy.

A.3. Project participants:

Name of Party involved (*) (host) indicates a Host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Government of Moldova Republic (Host)	Moldova-Russian Joint Stock Company Moldovagaz	No
Denmark	Danish Carbon Holding ApS	No
Denmark	Nordjysk Elhandel A/S	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		

[1] Republic of Moldova, *National Strategy for Sustainable Development*, 2000: http://www.undp.md/publications/doc/RAPORT_21.pdf

A.4. Technical description of the project activity:

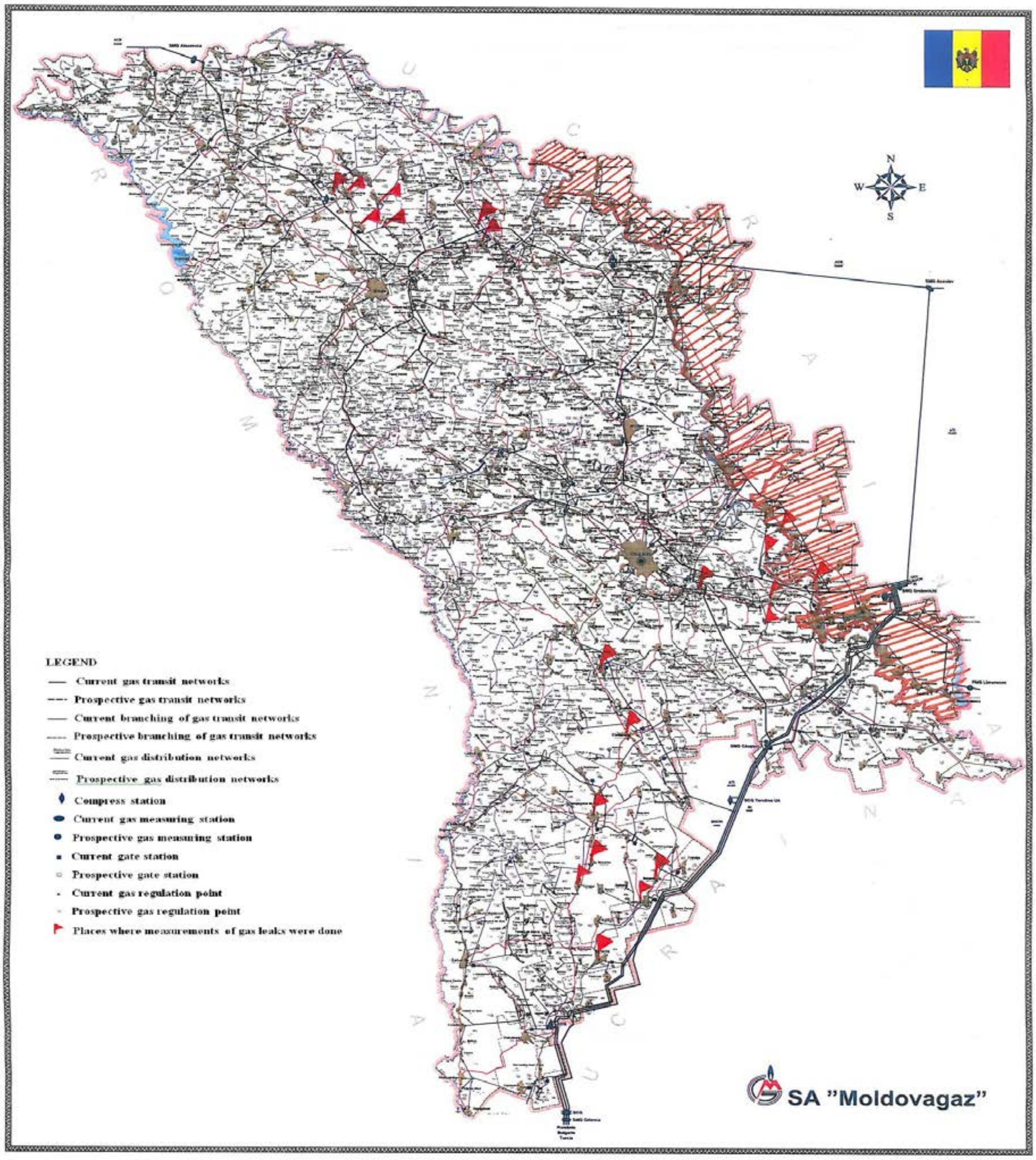
A.4.1. Location of the project activity:

The project is hosted by the Moldova-Russian Joint Stock Company, Moldovagaz. The company's headquarters is based in Chisinau with the coordinates of 47.0107°N, and 28.8687°E [2].

The project will be implemented across the Moldovagaz (MG) distribution network composed of 12 subsidiary gas distribution companies. This network covers all regions of the Republic of Moldova, except Transnistia (Figure 1). Such geographical scope of the project has been decided, as MG manages the whole distribution system in Moldova; consequently, their objective is focused on improving the whole network. Additionally, the feasibility study was conducted on different parts of the system (north, central and south), which illustrated that leakage was prevalent across the network.

[2] Chişinău: http://en.wikipedia.org/wiki/Chi%C5%9Fin%C4%83u

Figure 1 Map of gas network system in Moldova (Transnistria (hatched area) is outside the project boundary). Sites where the baseline survey was performed are marked with red flags.



A.4.1.1.	Host Party(ies):

Republic of Moldova

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

All the regions in the Republic of Moldova, except Transnistia.

Table 1 below provides a list of the Moldovagaz distribution companies included in the project, and the regions they cover.

Table 1 Moldovagaz distribution companies included in the project, and their regional coverage

No	Gas distribution company	Regions
1	Chisinaugaz LLC	Chisinau municipality, Chisinau region
2	Ialovenigaz LLC	Ialoveni region, Anenii Noi region, Criuleni region, Straseni region, Dubasari region
3	Baltigaz LLC	Balti municipium, Balti region, Glodeni region, Riscani region, Singerei region, Falesti region
4	Gagauzgaz LLC	Autonomous Territorial Unit of Gagauzia
5	Edinetgaz LLC	Edinet region, Briceni region, Ocnita region, Dondseni region
6	Florestigaz LLC	Floresti region, Drochia region, Soroca region
7	Orheigaz LLC	Orhei region, Rezina region, Soldanesti region, Telenesti region
8	Stefan-Vodagaz LLC	Stefan-Voda region, Causeni region
9	Cahulgaz LLC	Cahul region, Cantemir region
10	Cimisliagaz LLC	Cimislia region, Basarabeasca region, Leova region
11	Unghenigaz LLC	Ungheni region, Calarasi region, Nisporeni region
12	Taracliagaz LLC	Taraclia region

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

All cities, towns, communities within the indicated regions are included in the project boundaries.

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

The physical location for this project activity includes all of the surface facilities of the gas distribution system of the Republic of Moldova, such as:

- High pressure gas regulation points (GRS) - 774 units;
- Cabinet type gas regulation points (CGRP) (with gas flow volume more than 20 m^3 per hour) - 15,557 units; and
- Stand-alone valves with stem packing - 6,786 units.

The geographical coordinates of Northern, Southern, Western, and Eastern furthest points of Moldovagaz network are as follows:

- North: Naslavcea - 48°28′N; 27°35′E (region - Ocnita)[3]
- South: Giurgiuleti - 45°29′N; 28°12′E (region - Cahul)[4]
- West: Criva - 48°16′N; 26°40′E (region - Briceni)[5]
- East: Olanesti - 46°30′N; 29°55′E (region - Stefan Voda)[6]

The exact locations of all the identified and repaired leaks will be recorded in the monitoring system database.

The project participants have undertaken the baseline leak survey for the preparation of this PDD (Figure 1; red flags denote location of baseline leak survey). The Figures (2-4) present illustrative examples of components/units measured during the survey, and which will form the project activity.

Figure 2 A high pressure gas regulation point

Figure 3 A cabinet type gas regulation point

[3] Reference: http://en.wikipedia.org/wiki/Naslavcea
[4] Reference: http://en.wikipedia.org/wiki/Giurgiule%C5%9Fti
[5] Reference: http://en.wikipedia.org/wiki/Criva,_Briceni
[6] Reference: http://en.wikipedia.org/wiki/Ol%C4%83ne%C5%9Fti

Figure 4 A stand-alone valve

A.4.2. Category(ies) of project activity:

Project Type: “Leak reduction from natural gas pipeline compressor or gate stations” (AM0023 version 03)

Project Category: Sectoral Scope 10 – Fugitive emissions from fuels (solid, oil, gas)

A.4.3. Technology to be employed by the project activity:

The project activity proposes to establish a systematic advanced leak detection and measurement plan and procedure using best available techniques. Table 2 provides a summary of the technologies that are currently used by Moldovagaz and those to be utilised under the project:

Table 2 Overview of technologies for leak detection and measurement, and leak repair, which are currently used and planned to be used by Moldovagaz

Maintenance practice	Technology used before project implementation	Equipment / technology to be implemented under the project
Leak detection and measurement	Leak detector devices: mine interferometers ShI-11, electronic detecting devices - STX 17,6; PGF -2M; TGM 3; STX 5A IG 5; IG 6 Leak measurement devices: None.	▪ GMI Gassurveyor™ (500 Series) ▪ Hi-Flow™ Sampler
Leak repair	Repairs are performed due to emergency/safety requirements, with the use of outdated sealing materials. Currently tape “FUM”, grease “NIKOLYUB”, lubricant “Kranol”, graphite lubricant “Gas”, lithol, flax fiber yarns, lithol, petrol-and-oil resistant rubber and metallic materials are used for valve repair. As such, packing tends to lose containment after pressure variations and changes in weather conditions.	▪ GORE® sealing materials

Baseline leak survey (feasibility study):

The feasibility study was conducted on April 12-28, 2011. The measurements, using 2 methane detectors Gassurveyor™ 3500, were taken in five Moldovagaz branches: Chisinaugaz; Gagauzgaz; Florestigaz; Cimisliagaz; and Taracliagaz. Details on the equipment used are provided below, under the Project Technology heading. All identified leaks (those that screened above 0.5% methane in air) were tagged and numbered. Once leaks were identified, leak rate measurements were made using the Hi-Flow™ sampler. Digital photos of Hi Flow Sampler screen reading were taken for every measured leak. Based on this approach, 140 leaking valves were identified, correlating to over 300,000 m^3 of methane emissions.

Baseline Technology:

Section B.4 discusses in detail the current practice of detecting leaks of natural gas and measures employed to eliminate leaks.

Project Technology:

The project involves state-of-the-art technology to detect, measure (via concentration and flow rate) and repair leaks. Detected and repaired leaks will be tagged, logged manually and electronically, and stored in the database every year. Digital photos of each leaking component shall also help in locating and knowing conditions before and after the repair of leaks have taken place. The section below explains briefly the technical highlights of the advanced equipment to be used in the project.

1. Leak Detection technology:

During the baseline survey, leaks were detected using catalytic oxidation/thermal conductivity detectors; GMI Gassurveyor™ (500 Series) (Figure 5)[7]. The GMI Gassurveyor™ (500 Series) is a highly flexible, portable gas detector designed as per latest standards and is certified for use in hazardous areas. The detector has LCD screen with automatic backlighting, audio, visual and fault alarms and are one of the state-of-the-art gas detectors. During the monitoring phase, all project inspections will be carried out with accuracy not less than that of the GMI Gassurveyor™ (500 Series).

Figure 5 Gassurveyor Model

[7] Technical details of GMI Gassurveyor™ (500 Series):
http://www.heathus.com/_hc/index.cfm/products/gas/gasurveyor-500-series

2. Leak Measurement technology:

For leak measurements, Hi-Flow™ samplers[8] will be applied. Hi-Flow™ samplers (Figure 6) capture all the emissions from a leaking component to accurately quantify leak emissions rates. Leak emissions, plus a large volume sample of the air around the leaking component, are pulled into the instrument through a vacuum sampling hose. A dual-element hydrocarbon detector (catalytic-oxidation/ thermal-conductivity) measures hydrocarbon concentrations in the captured air stream ranging from 0.01 to 100 percent. Sample measurements are corrected for the ambient hydrocarbon concentration, and mass leak rate is calculated by multiplying the flow rate of the measured sample by the difference between the ambient gas concentration and the gas concentration in the measured sample. Hi-Flow™ samplers measure leak rates up to 10.5 cubic feet per minute (equivalent of 0.297 m^3/min), equal to 15.1 thousand cubic feet (428.2 m^3) per day, with the accuracy of calculated leak rate of +/- 5%.

Figure 6 High-flow Sampler

3. Advanced Leak Repair Material:

After the leak is detected, the actual repair works on leaks can vary from replacing seals, fittings, valves and other leaking components or replacing entire equipment sets.

The project activity proposes to use advanced and environmentally safe materials made from expanded polytetrafluoroethylene (PFTE) under license of W.L. Gore & Associates, Inc. Technical features of this material are presented below based on excerpts from the manufacturer:

- GORE® Valve Stem Packing is a pliable, self-lubricating packing that eliminates stem wear and lasts indefinitely (Figure 7). This continuous-length packing installs easily and forms a cohesive cylinder when compressed, eliminating the need to cut and form rings. In most cases, it is not necessary to remove the valve form service, and no disassembly is required. When GORE® valve stem packing is wound around a valve stem, pushed into the stuffing box and compressed by tightening the gland nut, it is compacted into a high-density packing. The result is a perfect, high-precision fit and a packing that fills flaws and irregularities — including those caused by wear. Once installed, a slight turn on the gland nut is all the maintenance that is usually required.

[8] Technical details of a Hi-Flow™ sampler: http://www.heathus.com/_hc/index.cfm/products/gas/hi-flow-sampler

Figure 7 GORE® sealing material

- GORE® Valve Stem Packing offers a high degree of pliability, allowing the packing to conform to worn valve stems and stuffing boxes. GORE® Valve Stem Packing will not deteriorate with age, has a low coefficient of friction, and withstands temperatures from -450°F to +650°F (-268°C to +315°C). This soft, flexible packing is unaffected by all common chemicals and will not contaminate product flow. The softness and self-lubricating nature of GORE® Valve Stem packing practically eliminates stem wear.[9]

Implementation of GORE® sealing material is a significant improvement compared to the current approach of tape, grease, graphite lubrication and other sealing materials. Implementation of this new sealing material that does not dry out is expected to significantly reduce re-emergence of leaks in the system between regular maintenance inspections. Manufacture performance data shows that seal integrity is maintained for up to 10 years, as opposed to 1-3 months for the currently used materials.

A.4.4. Estimated amount of emission reductions over the chosen crediting period:

Years	Annual estimation of emission reductions in tonnes of CO_{2e}
2012	249,634
2013	748,903
2014	748,903
2015	748,903
2016	748,903
2017	748,903
2018	748,903
2019	748,903
2020	748,903
2021	748,903
Total estimated reductions (tonnes of CO_{2e})	**7,489,030**
Total number of crediting years	**10 years**
Annual average over the crediting period of estimated reductions (tonnes of CO_{2e})	**748,903**

[9] GORE® Valve Stem Packing DP: http://www.gore.com/en_xx/products/sealants/packing/gore-tex_valve_stem_packing.html

A.4.5. Public funding of the project activity:

No public funding has been provided.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the project activity:

Approved baseline and monitoring methodology AM0023 Version 03:
"Leak reduction from natural gas pipeline compressor or gate stations"[10].

The methodology above refers also to the "Tool for the demonstration and assessment of additionality" Version 05.2[11].

B.2. Justification of the choice of the methodology and why it is applicable to the project activity:

The rationale behind the choice of the approved methodology AM0023 version 03 is that the project activity meets all its applicability conditions. Table 3 explains the relevancy of the selected methodology to the proposed project activity in the Republic of Moldova.

Table 3 Relevancy of the selected methodology to the proposed project activity

Applicability condition	Relevancy to the project activity
This methodology is applicable to project activities that reduce leaks in natural gas pipeline compressor stations and gate stations in natural gas long-distance transmission systems, as well as to other surface facilities in gas distribution systems including pressure regulation stations by establishing advanced leak detection and repair practices.	The scope of the project activity includes the reduction of gas leaks from surface facilities in the gas distribution systems of the Republic of Moldova, including pressure gas regulation points; and stand-alone valves. Using the Hi-Flow™ sampler and other advanced technologies provided by the project, the project developers have already undertaken an initial study to identify and quantify leak rates. Furthermore, the project activity includes equipping Moldovagaz staff with advanced measurement, detection equipment and repair materials, and training them in the use of these equipment and materials. As a result of the project implementation, advanced leak detection and repair practices will be established, ensuring that repaired leaks do not re-emerge. **Outcome**: The project activity meets the applicability condition.

[10] ACM0023 Leak reduction from natural gas pipeline compressor or gate stations --- Version 3.0: http://cdm.unfccc.int/methodologies/DB/C69JGKFDWWR01DEWATZAYCMFJU35VL
[11] "Tool for the demonstration and assessment of additionality" Version 05.2: http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v5.2.pdf

Applicability condition	Relevancy to the project activity
This methodology is applicable to project activities that reduce leaks (…): ▪ Where natural gas pipeline operators have no current systems in place to systematically identify and repair leaks;	Currently, Moldovagaz has no systematic methodology to identify and repair chronic leaks that are present in the distribution network. According to existing rules (e.g., «Safety Regulations in Gas Service in Moldova») and established practice, leak detection and maintenance works are focused on ensuring reliable and safe transmission of gas to consumers. Existing regular inspection and maintenance (I&M) procedures only detect a fraction of leaks (mainly large leaks presenting an immediate safety hazard) occurring in the system and eliminate them temporarily. Leaks often re-occur between regular inspections because sealing materials of a relatively low quality are used. As a result of the project, a new systematic and rigorous program for leak identification, measurement and repair will be implemented using advanced, technologies, materials and techniques. This program will be designed on top of the existing minimal I&M procedures carried out by Moldovagaz. **Outcome**: The project activity meets the applicability condition.
This methodology is applicable to project activities that reduce leaks (…): ▪ Where leaks can be identified and accurately measured;	The initial baseline survey of leaks in support of this PDD was carried out using, advanced equipment for gas leak detection and measurement; proving that leaks in the Moldovagaz distribution network can be identified and accurately measured (*see* Project Technology in Section A.4.3). This approach is in full accordance with AM0023 v3. During the full scale project implementation and monitoring phases, the same leak detection and measurement technologies, as during the baseline survey, will be used (i.e. Hi-Flow™ samplers). **Outcome**: The project activity meets the applicability condition.
This methodology is applicable to project activities that reduce leaks (…): ▪ Where a monitoring system can be put in place to ensure leaks repaired remain repaired.	The monitoring system to be employed by the project proponents will be in compliance with the monitoring methodology of AM0023. The system, which is described in further sections of this document (*see* B.7.2, Annex 4), will ensure that 100% of previously visited components will be re-visited to make sure that all the repaired leaks stay repaired and no new leaks have emerged.. That ensures that leak repaired remain repaired. **Outcome**: The project activity meets the applicability condition.

B.3. Description of the sources and gases included in the project boundary:

AM0023 requires that the boundary will be the physical gate stations, and other surface facilities in the gas distribution system, including pressure regulation stations.

During baseline feasibility, all types of gas distribution equipment were checked for potential leaks:

- Gas regulation points (GRPs);
- Cabinet type regulation points (with volume more than 50 m^3 per day);
- Cabinet type regulation points (with volume 20-50 m^3 per day);
- Cabinet type regulation points (with volume less than 20 m^3 per day);
- Stand alone valves with stem packing.

In total, approximately, 1.7 percent of all GRPs, 1.4 percent of all cabinet-type regulation points, and 0.3 percent of all valves were inspected. The survey showed that the most of the leaks are at the valves and the threaded connection. Cabinet type regulation points with volume less than 20 m^3 per day showed almost no leaks and, thus have been excluded from the boundary of the proposed project.

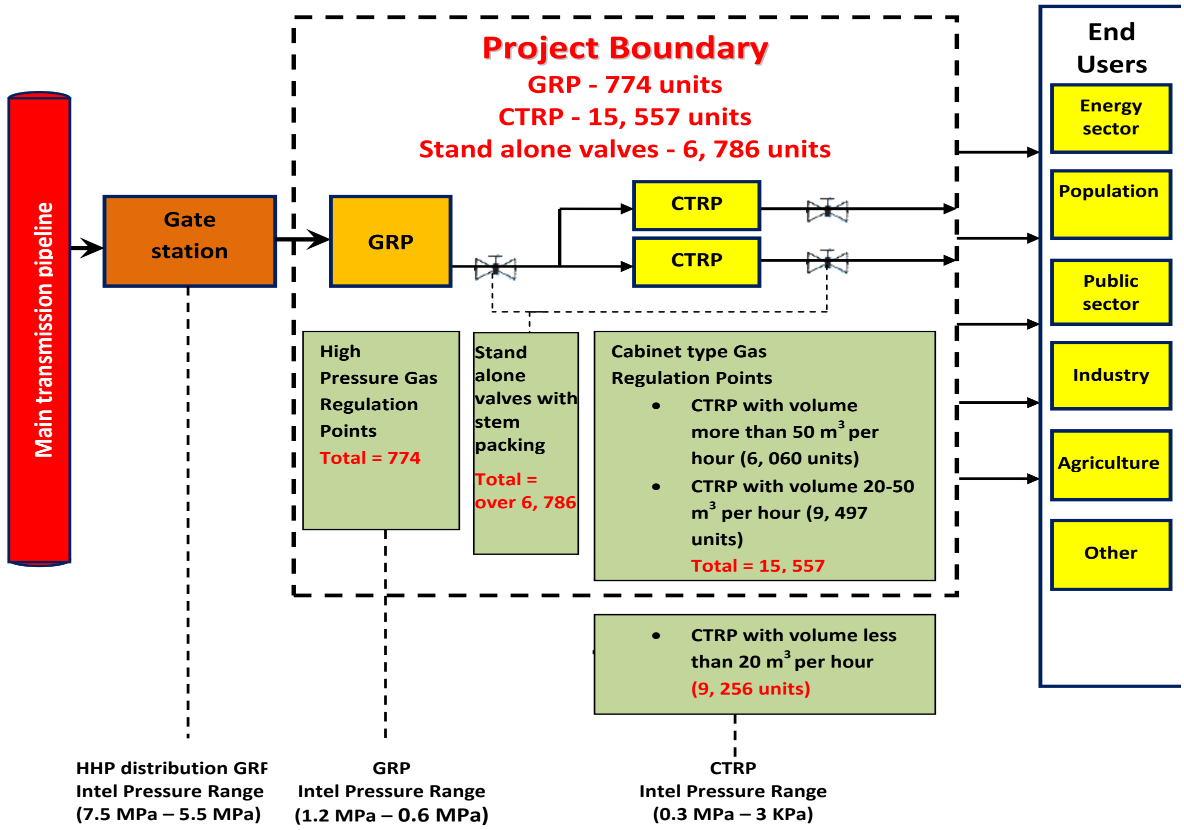
As such, this project boundary has been determined to encompass the following:

1. All valves in high pressure gas regulation points (GRPs) – 774 units.
2. All valves in cabinet type pressure regulating points CTRPs (> 20 m^3 gas flow per hour) – 15,557 units.
3. Stand-alone valves with stem-packing – 6,786 units.

Also, the project boundary will not include new sections in the distribution network, constructed after CDM project baseline definition. Thus the number of components within the project boundary will always remain the same as at the start of project implementation.

Based on this classification, Figure 8 presents the gas distribution network components, and CDM project boundary.

Figure 8 Moldovagaz distribution network components and CDM project boundary



During the full scale implementation of the project each above ground location will be tagged with unique geographical co-ordinates for the purposes of easy identification and monitoring, as required by the methodology.

Table 4 presents sources and gases included in the project boundary.

Table 4 Sources and gases included in the project boundary

Source		Gas	Included?	Justification / Explanation
Baseline	Fugitive emissions	CO_2	No	Not relevant
		CH_4	Yes	This project activity will reduce emissions of methane from gas distribution facilities, which are above ground. This project covers only unintentional fugitive methane emissions, which will be recorded during the full project implementation and monitoring stages.
		N_2O	No	Not relevant
Project Activity	Fugitive emissions	CO_2	No	Not relevant
		CH_4	Yes	The monitoring system prescribed by the methodology is designed to ensure no methane is escaping from identified and repaired leaks. If a repaired leak re-emerges, it is conservatively assumed that that the leak resumed at the same flow rate the day after the last inspection, or in case of the first inspection, the day after the repair has taken place. Thus, leaks where the repair failed are excluded from emission reductions from the day after the last inspection.
		N_2O	No	Not relevant

B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

The approved methodology AM0023 (Version 03) does not directly prescribe what steps should be undertaken to identify the baseline scenario. Therefore, the project proponents have determined plausible alternatives that could yield the same or similar results as proposed CDM activity, and analysed them in detail. This is described below.

Identification of candidate baseline scenarios

The main services provided by Moldovagaz are importing, transmission and delivery of natural gas to consumers at specified pressures and volumes. Given the nature of this type of project, the proposed project activity has only three feasible baseline scenario alternatives:

1. Continuation with existing practices of leak detection and routine maintenance;
2. The proposed project is not implemented as a CDM project; and
3. Similar efforts have been made or are expected to be made to reduce methane leaks from key components, using similarly capable leak detection and measurement technology as described in AM0023.

Scenario 1: Continuation with existing practices of leak detection and routine maintenance

Brief Description of Current Leak Detection and Repair Procedures

Current leak detection and repair practices are limited in scope. Moldovagaz does have a “planned” maintenance schedule where teams within each of its subsidiaries are tasked with checking different parts of the network per according to an established schedule (e.g., gas regulation point (GRP) and cabinet-type regulation points (CTRP) are being inspected twice a week in winter, and once a week in summer). However, there is no rule or specification on what type of maintenance should actually be implemented. There is also no limit on how much a component can leak before it is declared un-safe. In practice, repairs are implemented mainly out of safety concerns, and due to compliance with legal requirements, including:

- «Law on Industrial Safety of Hazardous Production Facilities» N 803-XIV from 11.02.2000.
- «Safety Regulations in Gas Service in Molvoda».
- «Law on gas» N123- XVIII from December 23, 2009.
- «Law on payment for environment pollution» N 1540 from 25.02.1998.

As defined by the law, the main reason to reduce gas leaks is to meet safety requirements. There are no taxes or penalties for distribution gas losses in Moldova.

Moldovagaz operators do not currently possess advanced leak detection and measurement devices, such as the tools prescribed by AM0023, which would enable staff to effectively identify the source and accurately quantify the volume of leakage. Currently, all Moldovagaz subsidiaries have hydrocarbon leak detectors in stock, such as: mine interferometers ShI-11, electronic detecting devices - STX 17,6; PGF - 2M; TGM 3; STX 5A IG 5; IG 6. However, these detection devices are technically old, and their quantities are insufficient for widespread use; consequently, the examination of leaks is primarily undertaken using soap solution.

If repair is required, work is carried out using outdated and ineffective materials. For example, valve stems are repaired using the following material: twisted cord of flax treated with oil. However, according to Moldovagaz staff, these materials lose their sealing ability relatively quickly due to several factors, such as:

- Poor material quality and inadequate sealing;
- Differences in pressure (cyclic load on the seal); and
- Weather changes.

Despite the existence of a procedure for detecting gas leaks and eliminating them, Moldovagaz does not apply systematic tagging and numbering of leaks, and there is no single leak database which would enable thorough analysis of the situation to inform decision making. Furthermore, in many instances, the maintenance teams do not report recurring leaks due to the incorrect perception that management may feel that they are underperforming and not carrying out their jobs properly. Thus current system fails to ensure systematic detection and repair of all the leaks at 100% of components, as was evidenced during the initial baseline survey conducted in support of this PDD. Even though Moldovagaz has procedures in place, during the survey over 150 leaks were found (of which 140 were associated with poor valve packing) at 121 sites; highlighting the inadequacy of existing inspection and maintenance (I&M) methods.

Additionally, Moldovagaz is not able to take necessary actions toward comprehensive leak elimination due to a constant lack of financial resources (see also additionality justification in B.5.), and leak elimination is mainly limited to low-cost measures like valve tightening, re-greasing or sealant replacement, which often fail to provide lasting solutions due to poor quality materials.

The continuation of the current practice described above is the most economically attractive course of action at present.

Scenario 2: The proposed project is not implemented as a CDM project

This scenario is discussed in detail in Section B.5 in relation to the additionality assessment of the proposed project activity. As described above, Moldovagaz staff lacks technical resources to comprehensively and accurately detect, measure and repair leaks in the gas distribution system. There is no systematic detection and repair program employed by Moldovagaz operators, to effectively and comprehensively reduce chronic leaks from above-ground components. In addition, obsolete equipment is being used to perform routine inspections, which are driven by safety and equipment maintenance concerns, rather than leak quantification and minimization.

Moldovagaz recognizes the issue of gas leakage in its distribution system; consequently, it recently developed a draft plan to reduce gas losses from the system. The plan aims to tackle a broad range of objectives including capital repairs on 366 km of old pipelines to improve the operational viability of the gas network; repairs to fences, walls, roofs, and components, such as cathode protection, and anode conductors at 557 GRP and CBRP that are greater than 20 years old; and research into gas leakage, through a planned partnership with the Moldovian Technological University. However, Moldovagaz lacks the necessary funding to implement the majority of these measures. Having recognized the CDM potential of the leak reduction project, Moldovagaz revised the plan to incorporate CDM activities (i.e., Action plan on natural gas leaks reduction on gas distribution networks for 2011-2015).

Therefore, this scenario although plausible is not realistic.

In fact, very few distribution companies in the developing world employ the state-of-the-art technology, as required by the methodology and proposed in the project, without CDM support. A fact illustrated by the CDM pipeline[12], where only a few similar projects are being implemented in developing countries (e.g., Uzbekistan, Georgia).

Scenario 3: Similar efforts have been made or are expected to be made to reduce methane leaks from key components, using similarly capable leak detection and measurement technology as described in AM0023

In the past, Moldovagaz has not considered reducing gas leakages in their distribution system. However, recently, as stated above, a draft leak reduction plan was developed; but, it has remained a declaration of intent, since Moldovgaz lacks the technical and financial resources to implement a leak reduction

[12]Examples: Georgia (Project ID: 2404; Uzbekistan (Projects IDs: 3430; 3339; 3910, 4085); Armenia (http://cdm.unfccc.int/Projects/Validation/DB/AB9O2CQFPCMJS6BUWUCYGCF6G2XT4T/view.html); Serbia http://cdm.unfccc.int/Projects/Validation/DB/TNEDB2TADG2FMTUGZT9KFGGXZCLS00/view.html).

program. This has been confirmed by interviewing Moldovagaz staff. The identified barriers would remain applicable, if CDM revenue was not made available.

Furthermore, it is plausible that equipment currently leaking would be scheduled for replacement, regardless of CDM support. Yet, analyzing the past experience of Moldovagaz, this is unlikely to happen. If components are in a satisfactory condition, regardless of age, they continue to use it. Replacement only occurs if the equipment is worn out and not operational (or a hazard), otherwise it remains in service. For example, despite having a “planned” maintenance schedule, which requires all cabinet-type regulation points being inspected for their technical condition twice a week in winter, and once a week in summer, and having to undergo maintenance once every 6 months, most of the facilities in the Moldovagaz distribution network are between 20 and 45 years old.

In fact, Moldovagaz is constrained by available funding to undertake any major investment in above-ground infrastructure, which makes this scenario unrealistic.[13]

Furthermore, without CDM assistance, the project company would continue using the equipment that is currently leaking. The repairs would continue being done as per the existing practice that allows gas system functioning within requirements, yet not preventing leaks from re-occurrence.
As such, the company has no other alternative than to continue with the existing practices.

Given the above analysis, Scenario 1: *Continuation with existing practices of leak detection and routine maintenance* has been identified as the baseline scenario.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality):

Early CDM consideration:

Although a Certified Emission Reductions Project Investment Agreement was signed between Moldovagaz and Danish Carbon Holding on 22 October 2010, the first major expenditure on the project was the hiring a subcontractor, ICF International on February 10, 2011 to support the project development and implementation. As such, the start date for the project activity is taken as the date of first expenditure (February 10, 2011), which is when Danish Carbon Holding committed to fund and develop the CDM project. Following on from this, a feasibility study was planned and conducted from April 11th through 28th, to evaluate the technical and financial conditions for the project implementation.

As per EB 62, Annex 13: the project proponent needs to demonstrate seriousness of CDM consideration by ensuring that they inform the Host Party/DNA and/or the UNFCCC secretariat in writing, within six months of commencement of the project activity, about their intention to seek CDM status. In line with the above requirement the project proponent first made a presentation to the DNA of the Republic of Moldova in April 11, 2011 to discuss their intent to develop the leak reduction project. Further, the DNA was invited and participated in the stakeholder consultation, which was conducted on June 20, 2011. A

[13] The investment priority for Moldovagaz is the replacement of old underground gas pipelines and the extension of distribution networks to support consumer requirements

prior consideration notice was submitted to the UNFCCC on July 14, 2011. On Aug 9, the UNFCCC confirmed the receipt of the notice, and informed that the project has been uploaded on the UNFCCC CDM website:
https://cdm.unfccc.int/Projects/PriorCDM/notifications/index_html.
Thus, the project activity meets the prior CDM consideration requirement as laid out in EB 41, Annex 46.

The key milestones of the project development process are summarized in Table 5 below.

Table 5 Key milestones of the project development process

Date	Milestone
22 October 2010	Certified Emission Reductions Project Investment Agreement signing between Moldovagaz and Danish Carbon Holdings signing between Moldovagaz and Danish Carbon Holdings
10 February 2011	Subcontractor (ICF International) hired; first major project expenditure
11 April 2011	Project presentation to Moldovan DNA
20 June 2011	Participation of Moldovan DNA in stakeholder consultation

Demonstration of project additionality:

The additionality is determined following the "Tool for the Demonstration and Assessment of Additionality" version 05.2, as required by the AM0023. The additionality demonstration also takes into account considerations added in the AM0023 v.3 itself.

The following paragraphs are complimentary with Section B.4.

Step 1: Identification of alternatives to the project activity consistent with current laws and regulations

Sub-step 1a: Define alternatives to the project activity

In continuation with the discussion on baseline identification in the section B.4., the following three scenarios have been identified as plausible alternatives to the proposed project activity:

1. Continuation with existing practices of leak detection and routine maintenance;
2. The proposed project is not implemented as a CDM project;
3. Similar efforts have been made or are expected to be made to reduce methane leaks from key components, using similarly capable leak detection and measurement technology as described in AM0023

Sub-step 1b: Consistency with mandatory laws and regulations:

Scenario 1:
Continuation of the current leak detection and maintenance practices by Moldovagaz is consistent with the existing laws and regulations in the gas sector of the Republic of Moldova. Moldovagaz meets all its current contractual and legal requirements, including:

- «Law on Industrial Safety of Hazardous Production Facilities» N 803-XIV from 11.02.2000.
- «Safety Regulations in Gas Service in Molvoda».

- «Law on gas» N123- XVIII from December 23, 2009.
- «Law on payment for environment pollution» N 1540 from 25.02.1998.

As defined by these laws, the main reason to reduce gas leaks is to meet safety requirements. There are no taxes or penalties for distribution gas losses in the Republic of Moldova.

Scenario 2 and Scenario 3:
Under existing laws and regulations in the Republic of Moldova, there is no threshold above which leaks are illegal. Furthermore, activities included in the proposed project activity (systematic leak detection and repair program) are neither prohibited nor required by the existing mandatory laws and regulations.

Step 2: Financial incentive

Scenario 1:
Scenario 1 does not entail additional financial costs in order to procure additional monitoring equipment, train staff, implement a leak monitoring system and repair leaks beyond business-as-usual.

Moldovagaz's current leak detection and repair activities are satisfactory from Moldovagaz's operational stand-point, and will continue to be primarily guided by personnel safety and operational maintenance concerns, not by leak reduction for economic and or environmental reasons.

Scenario 2 and Scenario 3:
Theoretically Moldovagaz would benefit from distribution loss reductions, as these could potentially reduce the amount of gas being purchased from the transmission company. However, since Moldovagaz is operating at a loss[14], it does not have the funds to support gas leak reduction projects. Additionally, it does not have the opportunity to attract loans to implement the project.

As per the Tool, the project proponent can decide whether to follow the investment analysis (Step 2) or barrier analysis (Step 3), or use both. Furthermore, if the investment analysis is applied, the methodology specifies that a gas leak reduction project can use simple cost analysis. Simple cost analysis is applicable when the project has no other financial incentive than potential CER revenue to implement the proposed project activity.

In case of this project, Moldovagaz is constrained by available funding, as mentioned above in Section B.4. Thus, the proposed project would have never happened without the potential of CDM credits. That would mean that Moldovagaz would continue its current practices, which does not require any additional investment. However, project proponents face not only financial constraints, but also institutional and technical ones. Therefore, to show the full breadth of barriers and as allowed by the Tool, the project proponent have decided to apply the barrier analysis only to demonstrate the additionality.

[14] Net losses in 2009 and 2010 were 927,870,164 LEI and 401,954,170 LEI, respectively; http://www.moldovagaz.md/menu?id=26&r=4&l=ru

Step 3: Barrier analysis

Sub-step 3a: Identify barriers that would prevent the implementation of the proposed CDM project activity:

The proposed CDM project activity faces numerous barriers which prevent its implementation without the incentive of CER revenues.

Institutional barriers:

Through interviews with Moldovagaz personnel, it is clear that there is a lack of institutional procedures and technical capacity to establish and implement advanced leak detection and repair activities in the distribution network.

The type of leak detection, repair and monitoring activities, that are needed to be put in place in order to have CERs generated, will require a coordinated and well-funded program to train and certify staff in operating advanced measurement technologies and in repairing leaks using state-of-art materials and to implement advanced inspection and repair activities. This entails significant costs and managerial capacity. The fact that no such extensive leak detection and repair program has been undertaken to date demonstrates that the opportunity for CER revenue has raised the awareness and incentivized the project proponent to begin such an intensive effort.

Technical familiarity and technology barriers:

The project activity assumes the use of the advanced technology and materials for leak detection and repair. To date, Moldovagaz operators are not familiar with advanced leak detection and measurement practices as prescribed by AM0023. In fact, their methods/equipment (e.g., soap solution) does not enable leak quantification, only leak identification. Also, materials used to seal the leaks are sourced locally, which, although cheaper than GORE® materials, are much less effective. Despite the fact that current practices have proved ineffective in preventing leaks over the long term, Moldovagaz would continue following them; due to lack of funding needed to procure the equipment/ materials, train staff and implement an advanced system which, in fact, is beyond Moldovagaz current operational needs.

During the baseline leak survey, leak detection at the facilities was conducted using GMI Gassurveyor™ (500 Series). All identified leaks (those that screened above 0.5% methane in air) were tagged and numbered. Once leaks were identified, leak rate measurements were made using the Hi-Flow™ sampler. Based on this approach, 140 leaking valves were identified over the interval of 3 weeks, correlating to over 300,000 m^3 of methane emissions. These leaks were not detected using existing Moldovagaz business-as-usual methods.

As detailed in Section A.4.3, the Hi-Flow sampler provides an intrinsically safe method to accurately quantify component leakages. However, the **main disadvantage** of the Hi-Flow™ sampler is (1) the cost and (2) availability. The device is made only by one company (Bacharach, Inc.) in the US, and has never been used outside the US (with the exception of donor-funded programs in Ukraine, Kyrgyzstan, India, Brazil and other CDM/JI projects). At a cost of $18,800 per unit, for most gas companies – particularly distribution companies where the leaks would be lower than transmission companies – the potential level of leaks would not justify such a cost. This is particularly true if there are cheaper, albeit less accurate, alternatives.

Yet, due to the opportunity posed by registering the project, Danish Carbon Holding ApS, will provide the equipment/repair materials to conduct on-going leak measurements/ repairs, as well as the necessary training and certification for staff in how to use the equipment.

Barriers to financing:

The cost to implement the project will be significant. Based on the monitoring plan (see Annex 4), at least twelve Hi-Flow samplers will need to be purchased, at a cost of US$18,800 per device[15]. Leak detection devices (GMI Gassurveyor (500 series)) will cost on the order of US$3000 per unit[16]; although much cheaper, all monitoring teams will need to be equipped with these advanced equipment. Additionally, the cost of GORE® valve stem packing materials is on the order of €5-15 per meter, depending on the valve diameter. Considering the project sample size and the leak statistics from the initial feasibility survey, a significant number of valves may need repair during project implementation; consequently, several kilometers of GORE® material will be required. Moreover, project implementation assumes significant costs for training, and labour costs for the team of 30 staff to support measurement and repair activities.

Based on interviews with Moldovagaz staff, investment priorities are focused on projects that support the operational viability of the gas network (i.e., replacing damaged underground pipelines), and increasing service to consumers (i.e., extending the pipeline network). Considering significant financial losses reported by Moldovagaz, it was confirmed that they lack the resources/funding to purchase leak detection equipment and implement other systems required to systematically identify and repair leaks. Consequently, these costs would never be financed under the baseline scenario due to budget constraints.

Sub-step 3b: Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity):

Scenario 1, continuation of Moldovagaz’s current practice (Business as Usual) does not lead to additional procurement costs (e.g., materials and/or monitoring equipment, staff training), and thus does not require Moldovagaz to seek additional financing in the local or international markets. Thus the implementation of Scenario 1 is not prevented by the barriers identified in Step 3a. Scenarios 2 and 3 are prevented by the aforementioned barriers.

Step 4: Common practice analysis

Sub-step 4a: Analyze other activities similar to the proposed project activity:

None of the gas companies in CIS has developed or introduced an advanced leak detection, monitoring and repair system within their networks, similar to the one envisaged by the proposed CDM project without carbon finance support. There are in fact, numerous examples of this methodology being exploited in the former Soviet Union countries through JI and CDM.

Furthermore, no Hi-Flow™ sampler has been used in the Republic of Moldova beforehand.

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[15] Quote from Heath Consultants, Inc (15/6/2011)
[16] Quote from Ribble Enviro Ltd.: http://www.ribble-enviro.co.uk/product/gmi-gasurveyor-500-series.htm#

Sub-step 4b: Discuss any similar Options that are occurring:

As per sub-step 4a, the only similar options that are occurring in the region are taking place under JI and CDM. Therefore, the proposed project activity is not a common practice.

Based on the additionality analysis performed above we conclude that the Baseline Scenario is the continuation of the current inspection and maintenance practice. The proposed project is additional to the baseline scenarios and its implementation is only possible within the CDM framework.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Determine if the leak repaired is part of the baseline activity or only is achieved as a result of the CDM Project

The level of emission reductions is determined in several steps:

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

Step 1 and 2 should be undertaken as part of the preparation of the CDM-PDD. Steps 3,4, and 5 are undertaken continuously during the crediting period.

Below we detail Steps 1 and 2.

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

In order to ensure as per the methodology, a clear distinction of leaks that would (“not included” in the project) and would not (“included”) have been identified and repaired under existing practices prior to the project implementation, it is first necessary to assess and describe current leak detection and repair practices in the company. Only those types of leaks that are not detected and repaired under current practices are considered in the calculation of emission reductions.

The following criteria are relevant for classification of leaks in the Moldovagaz system:

Emergency/ safety repairs – Moldovagaz makes some repairs and component replacements in direct response to safety concerns connected to outright emergency situations. According to Moldovan regulations, there is no specification on what exactly counts as a safety concern – this is left to the discretion of the gas company. However, safety concerns for above ground leaks are defined by the Moldovagaz operational staff as being cases where there is significant risk to public health and safety of the gas distribution system (e.g., explosion or inflammation risk, or where a high concentration of gas can accumulate in an enclosed space (risk of suffocation due to lack of oxygen)). However, the majority of the above ground leaks in the Moldovagaz network do not fall into this category (i.e., components are typically located outdoors, in open spaces).

In order to deal with emergencies, there is a separate emergency team within each Moldovagaz subsidiary (with four teams located in Chisinau) that is dedicated 24 hours a day to the implementation of repairs in these more dangerous emergency situations. The emergency services team that deals with these immediate safety concerns will continue to operate completely independently of the CDM project team at Moldovagaz, throughout the course of the project. **None of the leaks identified or repaired by this team will be included in the CDM project.**

Leaks detected by visibility, audibility and/or smell and use of existing leak detection technologies – In line with Moldovan Technical exploitation and repair regulations (NRS 35-04-71:2005), Moldovagaz has a “planned” inspection and maintenance (I&M) schedule for its pressure regulator stations and points. This schedule includes maintenance activities, such as the examination of emergency valves, the lubrication and stuffing of stem packing, and checking the parameters of block valves, to name a few (Section 9.3 of Regulations). Furthermore, Moldovagaz is obliged to implement some repairs on the annual basis. Examples include: disassembling leaking gate valves and repairing faulty elements; cleaning components from dirt and corrosion; and lubrication of friction surfaces (Section 9.3.3. of Regulations). The schedule may also cover capital repairs; in theory, if a component exceeds its operational lifetime or its functions have been severely hindered and impacted proper and safe operations of the whole system. However, during the last 20 years, no GRP and CGRP replacement as a result of components reaching the end of their operational lifetime has been conducted.

Additionally, in theory this I&M procedure could eliminate most of the leaks. However, the teams making the inspections lack many of the basic tools and training required for proper leak identification. They have no access to advanced leak measurement equipment and training to be provided to the CDM detection and repair teams by Danish Carbon Holding ApS, and can only primarily detect leaks that can be seen, heard, smelt, and detected using soap solution. Some leaks can also be detected using leak detection equipment available to Moldovagaz staff; however, these equipment are technical old, and limited in supply. This means that many leaks are missed. This is reflected in the initial leak survey undertaken in preparation of this PDD where numerous leaks were identified using advanced equipment. Technically, these leaks should have been detected during the “planned” maintenance schedule; the fact that they were not detected illustrates the inadequate equipment and approach currently being implemented by Moldovagaz (e.g., 52% and 61% of the valves in Cabinet-type RP (>50 m^3/h) and (20-50 m^3/ h), respectively, were leaking during the initial baseline study).

In addition, even when a leak is identified, there is no requirement that the leak be repaired using appropriate materials. According to interviews with managers of the Moldovagaz team, the repair materials currently available to the repair teams (tape “FUM”, grease “NIKOLYUB”, lubricant “Kranol”, graphite lubricant “Gas”, flax, lithol, petrol-and-oil resistant rubber) are ineffective at repairing leaks and repairs undertaken with these materials continue to have significant leak rates.

Without the Hi-Flow samplers or other similar technology, the Moldovagaz staff has little opportunity to judge the size and importance of the leaks they find, and do not systematically repair all or even most leaks they identify. As a result, the only leaks that can be effectively IDENTIFIED and REPAIRED under existing non-emergency practices are those leaks that can be fixed by tightening connections and tightening thread fittings. These are the only types of leaks that can be both:

a. IDENTIFIED using Moldovagaz’s existing leak detection equipment (smell and soap solution) –

Per the US EPA's *Directed Inspection and Maintenance at Gate Stations and Surface Facilities* Lessons Learned document[17] it states that "Soaping is effective for locating loose fittings and connections, which can be tightened on the spot to fix the leak, and for quickly checking the tightness of a repair". More advanced leak screening techniques are required to identify other types of leaks, such as valve stem packing. Leak detection equipment available to Moldovagaz personnel are technically old, and not in sufficient quantities for widespread use.

b. REPAIRED using the only effective technology typically available to the staff – wrenches to tighten the fittings.

In order to be conservative, **ALL repairs composed of simply tightening loose fittings and connections (e.g., threaded fittings, unions) are excluded from the project as it is plausible that they could be detected and repaired under the current practices.** This type of leak is excluded from the project.

This conservative approach will ensure that leaks which could have been identified and repaired under Moldovan regulations are not included in the project, irrelevant of whether or not the company actually fulfils these requirements (e.g., during the initial feasibility study, approximately 10% of the leaks detected were on threaded fittings; these have been excluded from the CER estimates presented in A.4.4 and B.6.4).

However, all other leaks (e.g., valve steam packing) require more advanced technologies and practices to identify them, and repairs that require new materials, seals, etc. and will therefore continue to leak as long as advanced equipment and materials are not part of the Moldovagaz teams' tool kit.

The key facts documenting this assessment are to be demonstrated to the validator through:

- Interviews with key staff,
- Documentation on the current technologies used to measure leaks, and
- Leak repair material used.

Furthermore, in order to ensure the environmental additionality of the project (i.e., the project delivers emission reductions over and above those in the baseline scenario) the project teams will be separated in space and time from the regular Moldovagaz I&M teams. The project detection and repair (D&R) teams will do their work in a pre-defined interval of time at different Moldovagaz regional subsidiaries. Their work will be done in a fully independent mode so that their operations will not in any way or form overlap or interfere with regular Moldovagaz activities, including regular I&M and capita; repair works.

2. *Documentation of the replacement schedules for components*

With regards to the expected time schedules for replacement of components that may be subject to leaks – there is no existing long-term component replacement schedule at Moldovagaz for above ground components in the regular budget.[18] The replacement of components follows the Technical exploitation

[17] US EPA, *Directed Inspection And Maintenance At Gate Stations And Surface Facilities, Executive Summary*, http://www.epa.gov/gasstar/documents/ll_dimgatestat.pdf

[18] As discussed in Section B.4, Moldovagaz has developed a draft 5 year plan to reduce gas losses in its system, which includes potential capital repairs to specific GRP and CBRP units. However, this is still only a draft plan, and cannot be considered a long term replacement schedule, since Moldovagaz lacks the necessary funding to implement these measures.

and repair regulations (NRS 35-04-71:2005), which require only ad-hoc replacement in case of emergencies, or if there has been significant component deterioration, which is impacting its effective technical operation. Therefore, for most components of the system, no long-term replacement schedule/plan exists.

Due to a lack of resources, the company does not have the option to retire the components in a planned manner and Moldovagaz does not see the need to schedule additional replacements under current practice (e.g., Technical exploitation and repair regulations (NRS 35-04-71:2005)) and Moldovan regulations. Replacements are done solely on an unforeseen emergency basis when the component has completely ceased to function, or if significant wear and tear has been reported. In these situations, Moldovagaz subsidiaries develop annual plans for replacement/repair activities. These plans require approval from the head company, Moldovagaz; who allocate budgets based on system priorities (i.e., emergency repairs will take priority over planned maintenance) and available financial resources. Annual repair and capital projects which are established through this process are detailed in the Moldovagaz's annual repair and capital works program.

It should be noted that just because a component is leaking, this does not mean it is not capable of functioning – this is true in both developing and developed world as leaks abound in all systems, which, in spite of leakage, continue to function safely and properly. As such, the focus of Moldovagaz is repairs, with replacements only made when there is a complete breakdown of the component and it is not functioning. This is best illustrated by the current in-service lifetimes of component included in the project boundary (below). In particular, during the last 20 years, although repairs for maintenance have been undertaken, no GRP and CGRP replacement has been conducted.

The above-ground equipment includes:

- Gas regulation points – 774 units, with an average in-service life of greater than 20 years;
- Gas regulation points of cabinet type – 15,557 units; including:
  - Cabinet-type gas regulation points with gas throughput capacity more than 50 m3/h – 6 060 units, with an in-service life of up to 45 years;
  - Cabinet-type gas regulation points with gas throughput capacity of 20- 50 m 3/h – 9 497 units, with an in-service life of up to 25 years
- Stand alone valves – 6 786 units, which have been in-service up to 45 years; of this total, 3985 units are made of cast iron, have been operational for 20 to 45 years. This cast iron subset of valves were primarily installed during the Soviet Union period, and are subject to significant leaks since cast iron has the highest coefficient of thermal expansion. Thus they are impacted by large changes in Moldova temperature between day and night.

Thus, the majority of Moldovagaz's above ground gas distribution infrastructure has not been replaced since it was first constructed.

The theoretical lifetime of the components is not relevant for Moldovagaz to develop a replacement schedule. Although leaky, the component continues to carry out its core purpose and its current condition is sufficient to allow continued operations of the gas network. This is expected to continue to be the case for a period greater than CDM crediting period. Instead, replacement of components is only done in emergencies, or if the component's technical performance has deteriorated sufficiently to impact gas supply operations. Thus, if components are identified for repair, they are included in annual capital repair budgets and schedules.

Additionally, as previously mentioned in Section B.4, Moldovagaz has developed a draft 5-year plan to reduce gas losses in its system. As part of this plan, objectives include possible capital repairs to 557 GRP and CBRP units that are over 20 years old. Although still a declaration of intent, since Molodvagaz lacks funding to implement it, if this capital repair plan comes to fruition and any components are identified for repair or replacement, they will also be included in the annual capital repair budgets and schedules.

Thus, the two scenarios in which the component would have been replaced under normal practice are, as detailed above:

a. In emergency situations when the component has ceased to function; and
b. Those components in the priority list that can be replaced based on annual budget allocations as they are made known.

Therefore, leaks that are stopped due to replacement of component that has entirely ceased to function will not be included in the CDM project, as it will be assumed that this component would have been replaced under normal practice.

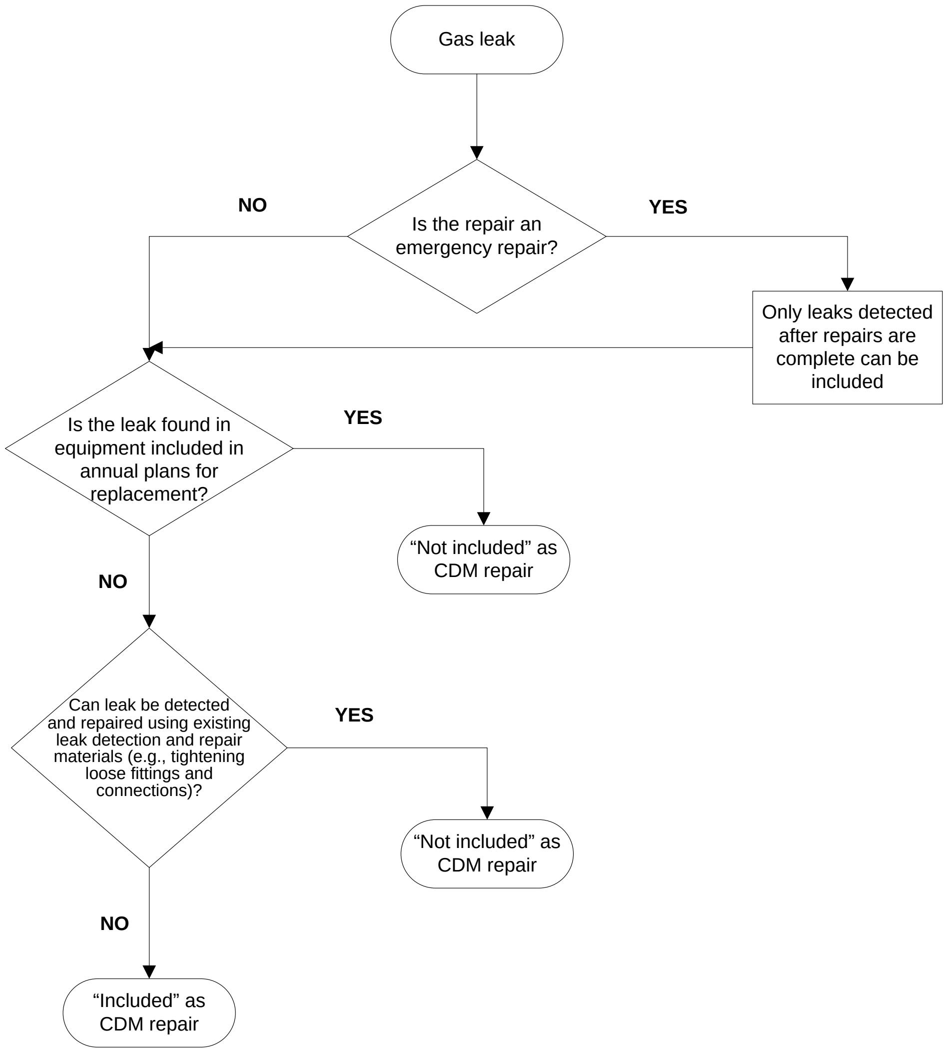
Similarly, annual budget allocations as they are made known each year will be matched with the actual components to be replaced. These lists will be provided to the verifier when they have been compiled by the company on an ongoing basis. The dates the work is done will also be provided to the validator/verifier to ensure that credits are no longer counted for repairs made to component, after the component is replaced using ongoing budget funds.

The project developer will follow the decision tree (Figure 9), which corresponds with the criteria above, for each leak, in order to determine if that particular leak reduction can be counted as additional. To be completely clear the purpose of this decision tree is to ensure that the existing teams, their findings, and their limited repair activities are not included in the project if they are considered part of the baseline.

- The first batch of the decision tree determines if the leak was identified and repaired as part of an emergency event. For the avoidance of doubt, repairs required for the continued operation of the system, such as repairs to correct an excessive drop in pressure that prevents normal system operation, are included as emergency repairs. Repairs made in this category, as mentioned above, are excluded.
- The next query asks that the components being repaired to be cross-referenced with the list of components subject to capital repair/replacement schedule. Leaks from components that are scheduled for replacement are excluded from the project activity.
- The decision tree then concludes with the question “can the leak be detected and repaired effectively with existing technologies, such as tightening loose fittings?” The additional detail provided above should clarify that Moldovgaz currently only has the capacity to identify and repair leaks involving connections and thread fittings that require simple tightening.

Once the leaks have been repaired, each repair case will be entered into the leak database. These records will ensure that there is clarity on which leaks have been repaired as part of the baseline, and which are additional as part of the CDM project.

Figure 9 Decision tree to determine if a particular leak reduction is additional



Baseline emissions are calculated in the following manner:

In general, leaks are detected using a variety of tools, many of which have been made available through CDM, such as the GMI Gassurveyor, other electronic screening tools and soap solution. For each leak identified, the Hi-Flow sampler captures all emissions from a leaking component to accurately quantify leak flow rates. Leak emissions, plus a large volume sample of the air around the leaking component, are pulled into the instrument through a vacuum sampling hose. High volume samplers are equipped with dual hydrocarbon detectors that measure the concentration of hydrocarbon gas in the captured sample, as well as the ambient hydrocarbon gas concentration. Sample measurements are corrected for the ambient hydrocarbon concentration, and the leak rate is calculated by multiplying the flow rate of the measured sample by the difference between the ambient gas concentration and the gas concentration in the measured sample. Methane emissions are estimated by calibrating the hydrocarbon detectors to a range of concentrations of methane-in-air. High volume samplers are equipped with special attachments designed to ensure complete emissions capture and to prevent interference from other nearby emissions sources. The hydrocarbon sensors are used to measure the exit concentration in the air stream of the system. The sampler essentially makes rapid vacuum enclosure measurements. The leak flow rate of methane is calculated as follows:

$$F_{CH4,i} = F_{sample,i} \times \left(C_{sample,i} - C_{back,i} \right) \quad (1)$$

Where:

$F_{CH4,i}$ = The leak flow rate of methane for leak *i* from the leaking component (m³/h)
$F_{sampler,i}$ = The sample flow rate of the sampler for leak *i* (m³/h)
$C_{sample,i}$ = The concentration of methane in the sample flow from leak *i* (volume percent)
$C_{back,i}$ = The concentration of methane in the background near the component (volume percent)

For each leak that is detected and repaired as part of the project activity, project participants will:

- Apply the established criteria in Decision Tree (Figure 9) in order to identify whether the leak would also have been detected and repaired in the absence of the project activity;
- Note the date of leak detection;
- Note the date of leak repair;
- Note the exact location of the leak;
- Measure the leak flow rate (volume per time);
- Note the measurement method in order to determine the uncertainty range of measurement;
- In cases where the repair involves a replacement of any component: note the date when the component would be replaced if the leak would not have been detected, using either the annual replacement schedule by the company or the difference between the average lifetime and the age of the component, whatever is earlier.

All data collected during project implementation would be entered into a database. The database will be continuously updated during the crediting period, including new leaks detected and repaired during the crediting period. The data in the database will also be included in each monitoring report.

Leakage: no leakage emissions are expected from this project.

Emission reductions are calculated as per the following formula:

$$ER_y = ConvFactor \times \sum_i \left[F_{CH4,i} \times T_{i,y} \times \left(1 - UR_i\right) \right] \times GWP_{CH4} \quad (2)$$

Where:

ER_y = The methane emission reductions of the project activity during the period y ($tCO_{2equivalents}$). In the case, the component is replaced due to the project activity at an earlier point in time than in the absence of the project activity, emission reductions from that component should only be accounted until the components would have been replaced in the absence of the project activity.
ConvFactor = The factor to convert m³ CH_4 into tCH_4. At standard temperature and pressure (0 degree Celsius and 101.3 kPa) this factor amounts to 0.0007168tCH_4/m³ CH_4.
i = All leaks eligible towards accounting of emissions reductions, taking into account the guidance described above.
$F_{CH4,i}$ = The leak flow rate of methane for leak i from the leaking component (m³/h)

UR_i	=	The uncertainty range for the measurement method applied to leak i, determined, where possible, at a 95% confidence interval, from guidance provided in chapter 6 of the 2000 IPCC Good Practice Guidance. If leak measurement equipment manufacturers report an uncertainty range without specifying a confidence interval, a confidence interval of 95% may be assumed.
$T_{i,y}$	=	The time (in hours) the relevant component for leak i has been operating during the monitoring period y, taking into account the guidance described above (e.g. regarding deductions for broken leaks).
GWP_{CH4}	=	The global warming potential for methane (tCO_{2e}/tCH_4).

B.6.2. Data and parameters that are available at validation:

Data / Parameter:	**GWP_{CH4}**
Data unit:	tCO_{2e}/tCH_4
Description:	Global warming potential
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	21
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data is well established and used in the first crediting period
Any comment:	In the second crediting period and changes in global warming potential will be incorporated

In accordance with the *Guidelines for Completing the Project Design Document (CDM-PDD)*, data that is not available at the time of validation shall be included in Section B.7.1.

B.6.3. Ex-ante calculation of emission reductions:

The Moldovagaz above ground infrastructure consists of 774 GRPs, 15,557 cabinet-type RPs, and 6,786 stand-alone valves with stem-packing that are not part of these regulation points. Roughly, 1.7 percent of the GRPs, 1.4 percent of the cabinet-type RPs, and 0.3 percent of the valves have been surveyed so far. Results from this initial baseline survey have been extrapolated to the whole Molodovagaz system. Measurement results and extrapolations can be found in the spreadsheet (entitled “Moldova - CER Summary – 2011-11-09”) with Emission Reductions calculations.

Ex-ante **Emission Reductions** were calculated as per the formula (2) above.

1. The first step was to calculate leak flow rate ($F_{CH4,i}$) as per formula (1):
    a. $F_{Sample,i}$ has been determined by multiplying average valve leak rate per site type (litres per minute) and total number of each site type (Table 6):

Table 6 Determination of Fsample,i parameter

Site type	Average valve leak rate per site, lpm	Total number of sites	Covert from l/m to m^3/h ((60)/1000)	$F_{sample,i}$ m^3/h
Gas regulation points	6.58	774	0.06	306
Cabinet type RP (>50 m^3/h)	4.68	6,060	0.06	1,700
Cabinet type RP (20-50 m^3/h)	2.77	9,497	0.06	1,577
Stand alone valves	5.23	6,786	0.06	2,127
			Total =	**5,710**

b. The average valve leak rate has been determined based on sample measurements for each site type, taken during the feasibility study with a High-flow sampler (Table 7)

Table 7 Number of sites surveyed during feasibility study per site type

Site type	Total number of sites
Gas regulation points	13
Cabinet type RP (>50 m^3/h)	73
Cabinet type RP (20-50 m^3/ h)	15
Stand alone valves	20

c. The resulting figure (F_{sample} = 5,710m^3/h) was then refined to only include methane by multiplying it by the percentage of methane in the gas (C_{sample}) minus any background methane (C_{back}). This generated $F_{CH4,i}$ as per the formula (1) (Table 8).

Table 8 Determination of leak flow rate $F_{CH4,i}$

$F_{sample,i}$, m^3/h	Average volume percent methane in sample $C_{sample,i}$	Average volume percent methane in background $C_{back,i}$	Leak flow fate $F_{CH4,i}$ m^3/h
5,710	100%	0%	5,710

2. $F_{CH4,i}$ was then used in the formula (2).
3. Since the High-Flow sampler automatically accounts for standard temperature and pressure in data readings, the conversion factor (ConvFactor) of 0.00071168tCH_4/m^3 CH_4 was used.
4. Since the distribution system is in continuous operation, time (T) was considered to be 8760 for the purpose of this estimate. However, actual emissions will incorporate real operational hours.
5. The uncertainty range (UR_i) was calculated, as per formula 3 below, using guidance of the IPCC "Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories" Chapter 6, page 12, which provides an approach for combining uncertain quantities.
(Please note that "U" and "U_{total}" used in the IPCC document have been replaced by "UR" and "UR_i" respectively to make it consistent with the acronyms used in the AM0023.).

$$UR_i = \frac{\sqrt{(UR_1 * x_1)^2 + (UR_2 * x_2)^2 + ... + (UR_n * x_n)^2}}{x_1 + x_2 + ... + x_n} \qquad (3)$$

Where

UR_i = the percentage uncertainty in the sum of the quantities (half the 95% confidence interval divided by the total (i.e. mean) and expressed as a percentage);

x_n and UR_n = the uncertain quantities and the percentage uncertainties associated with them, respectively.

(Please note that "n" in this case refers to each recorded leak rate of each component surveyed)

Firstly, the "sum of the squares' has been calculated, using the results of the feasibility survey (i.e. each recorded leak rate of each component surveyed, x_n) and multiplying each by 5% (i.e. at 95% confidence interval as per IPCC Guidance, UR_n). Then, the square root of the resulting sum has been derived, and divided by the sum of recorded leak rate of each component surveyed (Table 9).

Table 9 Determination of uncertainty range, UR_i

Sum of $(UR_n*x_n)^2$	Square root of the sum	Sum of x_n	UR_i
A	√A	B	√A/B
11.0574	3.3257	617.8	0.0054

The resulting estimate (UR_i) has been used to estimate the final baseline results. Detailed calculations are provided in the CER calculation data sheet provided to the DOE.

6. Global Warming Potential for CH_4 (GWP_{CH4}) is 21tCO_{2e}/tCH_4, as adopted by COP.
7. Leakage and Project Emissions at this stage are assumed to equal 0, as repairs are made and maintained. However, during project implementation, actual project emissions (including re-emerging leaks) will be reported.

Summary data based on results from the feasibility study is presented below (Table 10):

Table 10 Summary of ex-ante emission reductions calculations

Conversion Factor tCH_4/m^3CH_4	Leak flow fate $F_{CH4,i}$ m^3/h	Time of use (estimated) $T_{i,y}$; h	Uncertainty range UR_i	GWP_{CH4} tCO_{2e}/tCH_4	Total tCO_{2e}
0.0007168	5,710	8,760	0.005	21	748,903

B.6.4 Summary of the ex-ante estimation of emission reductions:

The 2012 estimate of emission reduction is based on the assumption that the project will start generating emission reductions from September 1, 2012. By this time, it has been assumed that the baseline study will be completed and project will be registered (Note: baseline study is assumed to take place simultaneously with processing of the request for registration by the UNFCCC Secretariat and CDM Executive Board.

However, this estimated date is subject to change, depending on the actual date of validation completion, actual date of submission of complete request for registration, actual date of baseline study start and its completion.

Year	Estimation of project activity emissions (tonnes of CO_{2e})	Estimation of baseline emissions (tonnes of CO_{2e})	Estimation of leakage (tonnes of CO_{2e})	Estimation of overall emission reductions (tonnes of CO_{2e})
2012	0	249,634	0	249,634
2013	0	748,903	0	748,903
2014	0	748,903	0	748,903
2015	0	748,903	0	748,903
2016	0	748,903	0	748,903
2017	0	748,903	0	748,903
2018	0	748,903	0	748,903
2019	0	748,903	0	748,903
2020	0	748,903	0	748,903
2021	0	748,903	0	748,903
Total (tonnes of CO_{2e})	**0**	**7,489,030**	**0**	**7,489,030**

B.7. Application of the monitoring methodology and description of the monitoring plan:

B.7.1 Data and parameters monitored:

Data / Parameter:	***i*, Total number of leaks**
Data unit:	Number
Description:	Number of leaks identified, repaired and re-surveyed
Source of data to be used:	Initial feasibility survey
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not used in CER calculation estimate (average leak rate was used in the calculation)
Description of measurement methods and procedures to be applied:	Measured with Hi-Flow sampler and recorded in the project leak database
QA/QC procedures to be applied:	Each leak will be tagged and assigned a unique number which will be recorded in the database for follow-up monitoring to enable unique identification of the detected leak
Any comment:	NA

Data / Parameter:	$\mathbf{T_{i,y}}$
Data unit:	h (hours)
Description:	The time (in hours) the relevant component for leak i has been operating during the monitoring period y,
Source of data to be used:	Moldovagaz operation log
Value of data applied for the purpose of calculating expected emission reductions in section B.5	8760h
Description of measurement methods and procedures to be applied:	Any outages will be recorded. Otherwise the regulators operate on a continuous basis until a scheduled replacement
QA/QC procedures to be applied:	Any outages resulting from system repairs will be documented and logged in the project database.
Any comment:	Hours of operation will end when components concerned is replaced for a non-leak related reason (e.g., it breaks down), or when the date of predicted replacement as identified in the PDD is reached (whatever is earlier).

Data / Parameter:	**Date**
Data unit:	Day/ Month/ Year
Description:	Date of leak detection, repair, follow-up monitoring
Source of data to be used:	Monitoring and repair team logs
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Based on date leak is measured/monitored, and when leak it was repaired
Description of measurement methods and procedures to be applied:	Based on date leak is measured/monitored, and when leak it was repaired
QA/QC procedures to be applied:	Work orders, receipts, etc., in addition to repair logs
Any comment:	In cases of re-emerging leaks, it will be assumed to have occurred the day after the most recent measurement which showed no leak

Data / Parameter:	$F_{CH4,i}$
Data unit:	m^3/h
Description:	Leak flow rates based on Hi-Flow sampler reading
Source of data to be used:	From Hi-Flow sampler readings during initial feasibility survey by Anem Management Ltd
Value of data applied for the purpose of	5,710 m^3/h (total leak rate from feasibility study). Explanation on how this value has been derived is given in B.6.3.

calculating expected emission reductions in section B.5	The measurement accuracy is +/-5%, as per the technical specification of a Hi-Flow sampler.
Description of measurement methods and procedures to be applied:	Measurements with Hi-Flow Sampler are automatically adjusted to the methane content, temperature and pressure and, thus, will directly yield methane leak flow rates. Based on the initial feasibility survey. Approximately, 1.7 percent of the GRPs, 1.4 percent of the cabinet-type RPs, and 0.3 percent of the valves were surveyed. Results have been extrapolated to the whole Molodovagaz system
QA/QC procedures to be applied:	The Hi Flow Sampler automatically takes 2 samples of the leak (at the higher and lower flow rate) within one measurement and automatically provides final leak rate estimation. If the deviation between two samples is greater than 10% of LEL, then another measurement will be performed to ensure accuracy of the measurement results. Prior to measurements, the measuring devices will checked for compliance with calibration requirements as appropriate; if needed, the devices will be re-calibrated in line with manufacturers' recommendations. Each leak will be measured with a Hi Flow Sampler; measurement readings will be recorded in the monitoring report and the device data-logger where appropriate.
Any comment:	Values for individual leaks are included in the CER calculation spreadsheet provided to the DOE.

Data / Parameter:	**UR_i**
Data unit:	Fraction
Description:	Reflects uncertainty in Hi-Flow sampler measurement accuracy
Source of data to be used:	Manufacturer's data for Hi-Flow Sampler
Value of data applied for the purpose of calculating expected emission reductions in section B.5	0.0054 for measurements with Hi-Flow Sampler
Description of measurement methods and procedures to be applied:	The value applied has been calculated using results of the initial feasibility survey (leak rates per component surveyed), and the following assumptions: Given there will be a large number of leak measurements that are uncorrelated variables, the IPCC "Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories" approach to combining uncertain quantities by addition (Rule A from Chapter 6) is used. The UR_i will be calculated using leakage flow rates and the respective UR of the Hi-Flow sampler used for the leak. The uncertainty calculations have been described in B.6.3 and are included in the CER calculations spreadsheet.
QA/QC procedures to be applied:	IPCC best practice guidance on uncertainties estimation will be taken into account.
Any comment:	The leak measurement manufacturer does not specify an uncertainty range. Therefore, as specified in the methodology, a confidence interval of 95% is

	assumed, as per IPCC “Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories”

Data / Parameter:	**Temperature and pressure**
Data unit:	Degree Celsius and bar
Description:	Temperate of gas and ambient air pressure at leak source. The values are needed to calculate the methane density at standard conditions when converting volume into mass.
Source of data to be used:	Measured during leak survey by Hi-Flow sampler
Value of data applied for the purpose of calculating expected emission reductions in section B.5	The Hi-Flow sampler automatically takes these measurements into account in the data it provides/reports.
Description of measurement methods and procedures to be applied:	Hi-Flow Sampler automatically adjusts readings to standard temperature and pressure. Where necessary, temperature of gas and ambient air pressure will be obtained from Moldovagaz, and/or measured during leak measurement surveys.
QA/QC procedures to be applied:	Hi-Flow Sampler will be calibrated as per manufacturers’ requirements. The values (temperature and pressure) will be compared against Moldovagaz process control data, as relevant, to ensure there is no major discrepancy.
Any comment:	NA

B.7.2. Description of the monitoring plan:

Annex 4 presents a detailed overview of the monitoring plan. A summary is provided below.

Staff within Moldovagaz (MG) will implement the Project operations and monitoring activities by performing detection, measurement, repair and documentation of leaks throughout the crediting period. Danish Carbon Holding (DCH) will provide CDM methodological supervision and support to the MG team. As per Annex 4, the project implementation management and execution will be completely separated in time and space from regular inspection & maintenance (I&M) and emergency/capital repairs implemented by MG. Project leak detection and repair crews will be dispatched to facilities at different times from the regular I&M crews. There will be no data sharing between two types of crews to prevent possible bias, which can impact project implementation.

Training Program

A training program will be conducted to train local staff at MG on how to use advanced detection and measurement equipment, how to execute effective repairs, and how to document the leaks found in an effective manner. The training will be conducted by the project manager in collaboration with technical experts with experience in gas leak detection and measurement, and advanced repair materials to be used in the project. These experts will provide detailed instructions and written materials on how to conduct the leak detection, measurements and repairs.

Calibration of equipment
All Hi-Flow samplers will be calibrated to ensure accuracy in their measurements. The MG Technical Teams will be provided with calibration kits and spare part kits. The calibration is done as per the Hi-Flow manual which suggests a 30 day calibration period by certified staff. The calibration is done as per field specifications. The MG Technical Teams will calibrate their detectors at least once a month following the same procedures for each Hi-Flow sampler. The calibration records will be documented each month and maintained by the technical operators together with the Database Management Team.

Leak Measurement
The Technical Teams will survey the components in the project boundary using advanced leak detection instruments, such as the GMI Gassurveyor (500 series). Once identified, the leaks will be tagged, and numbered. The flow rate for each leak will then be quantified using the Hi-Flow sampler. A digital photograph will be taken of the leaking component, tag and Hi-Flow sampler reading. These photographs will be archived by the Database Management Team. In addition, the type of repair expected given the nature of the leak and its location will be categorised for future repair planning.

After leaks have been detected and measured, they will be repaired. Before each repair is made, another Hi-Flow sampler measurement will be taken. In the case there is any discrepancy between the final measurement and the original measurement a third measurement will be taken to confirm the change. The final, confirmed leak rate will be used to determine baseline leakage as per the AM0023 methodology, regardless of whether the leak rate is lower or higher than the original leak measurement. After the repair, a new leak measurement will be carried out to ensure that the leak was properly repaired. If required, additional repairs will be made until no further leak can be detected. If leaks cannot be eliminated remaining leaks will be measured and recorded. The date of the repair (or discovery of remaining leak) will be recorded in the Project Database.

Monitoring Repaired Leaks
All leaks that have been subject to repair will be monitored – using the same leak detection technologies on each leak identified in the baseline – to ensure they are maintained, on an annual basis. Where a leak repair fails, it is conservatively assumed that the leak resumed the day after the last inspection, or in case of the first inspection, the day after the repair has taken place. Emission reductions are counted from the date of subsequent repair of that same leak, and are measured using the same type of equipment as in the initial survey (Hi-Flow sampler). Such leaks will be repaired again followed by new leak measurements. Data collected will be included in the periodic monitoring reports stored in the Database.

Quality Assurance/Quality Control
After data collection and collation by the Technical Teams, the MG database manager will review the data and checks that it has been recorded correctly. Procedures will include: 1) tracing data from individual spreadsheets to the collated spreadsheet; 2) identify outliers and verify the measurement with the responsible technical operator to double check the number; and 3) reviews measurements by each individual Hi-Flow™, to ensure that no one Hi-Flow™ in particular is making measurements that appear to be outliers on a consistent basis. If such discrepancies are found, the Hi-Flow™ will be recalibrated and checked immediately, and any erroneous leaks will be re-measured.

Additionally, to ensure leak tags are not damaged or lost, digital photo are accidently deleted, and/or there are problems with the database, three concurrent ways of tagging leak locations and tracking leak measurements will be implemented: 1) a digital photo of the leak; 2) the physical tag on-site and the leak rate and measurement date are written on the tag; and 3) when the leak measurement and date are entered into the database, the location of the leak is documented on a drawing of the regulator point itself.

The project will utilise an independent third party consulting firm, to provide QA/QC oversight for the project. Their role and responsibilities will include: 1) verify that maintenance and monitoring of leaks is being conducted in accordance with the Monitoring Plan; 2) observe MG database team to ensure that data is being recorded and handled as per the requirements of this Monitoring Plan; and 3) conduct audits of the data to ensure that adequate records are being kept, and that leaks found and leaks repaired have been accurately documented in the database.

See Annex 4 for further details on the Monitoring Plan.

B.8. Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies):

The date of baseline setting: 20/06/2011

The baseline was developed by ICF International (ICF International is not the project participant listed in Annex 1 to the PDD) based on the results of a feasibility study between April 11th and 28th, 2011.

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SECTION C. Duration of the project activity / crediting period

C.1. Duration of the project activity:

C.1.1. Starting date of the project activity:

February 10, 2011 – The first major expenditure on the CDM project was the hiring of ICF International, to support the project development and implementation

C.1.2. Expected operational lifetime of the project activity:

10 years (120) months

C.2. Choice of the crediting period and related information:

C.2.1. Renewable crediting period:

C.2.1.1. Starting date of the first crediting period:

Not applicable

C.2.1.2. Length of the first crediting period:

Not applicable

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

Date of complete request for registration submittal

C.2.2.2. Length:

10 years

SECTION D. Environmental impacts

D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

The project is focused on reducing natural gas losses from the distribution network of the Republic of Moldova. As such, the project does not require any infrastructure or components that would create any local or regional air/water/pollution impacts. In particular, materials and equipment used in this project do not emit harmful substances into the atmosphere, and are not a source of noise, vibration, or any other harmful physical impact. The project activity has no transboundary environmental impacts, and requires no environmental impact assessment (EIA) per Moldovan environmental legislation.

The Moldovan government has committed to integrating the principles of sustainable development in country policies and programs to reverse the loss of natural resources. Since the project supports energy conservation, with the reduction on natural gas emissions to the environment, these overarching principles are supported.

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

Not applicable

SECTION E. Stakeholders' comments

E.1. Brief description how comments by local stakeholders have been invited and compiled:

A public forum was held on June 20, 2011 in conjunction with the requirement for a consultation of local stakeholders in the design for the CDM Project on “Reducing gas leakages within the Moldovagaz distribution network, Republic of Moldova”. The meeting was held at the Central office of “Moldovagaz” company in Chisinau.

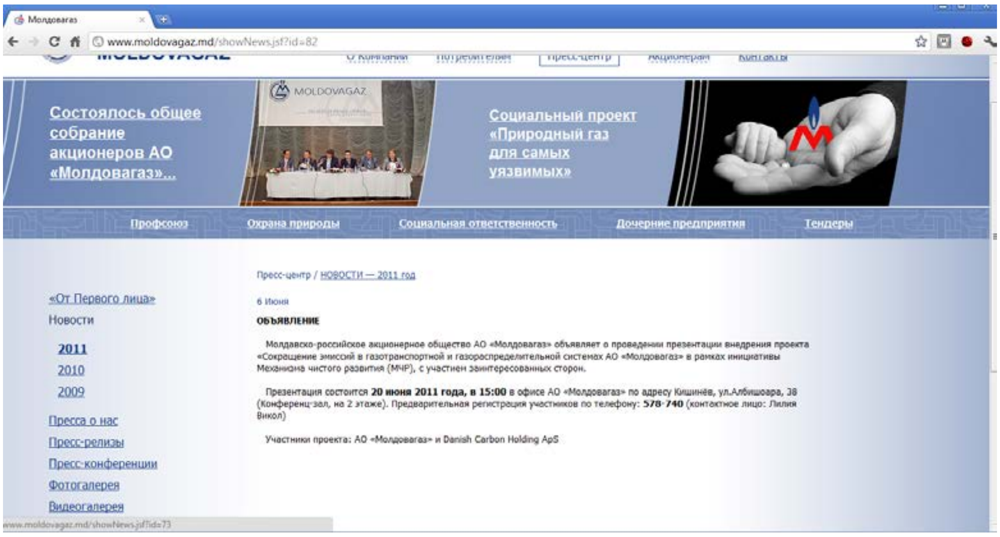
Moldovagaz first identified different stakeholders that would be impacted by the project. These included:

1. Ministry of Economy
2. Ministry of Ecology
3. National Agency Regulation in the Energy sector (NARE)
4. Local residents in the operational regions
5. Academy of Sciences
6. Institute of Ecology
7. Institute of Energy
8. Public corporation, TERMAKOM
9. Moldovan Thermal Power Plants
10. Local gas distribution subsidiaries, including - Floresht'-Gas, Shtefan-Vode-Gas, Orkhey-Gas. Yaloven'-Gas, Taraklia-Gas, Ungen'-Gas, Chimishlia-Gas, Kahul-Gas, etc
11. Moldovatransgas
12. Organization on Ecological movement in Moldova
13. Alliance to Save Energy Regional Office - Moldova

Invitations were sent to these stakeholder groups through a combination of:

1. A bilingual announcement about the meeting that was published in the "Moldavian news", the national newspaper (№60 (1406) d/d June 07, 2011).
2. An announcement that was posted on the website of "Moldovagaz" company (Figure 10):

Figure 10 Announcement on stakeholder consultation, posted on the website of Moldovagaz



3. Letters of invitation that were sent to the listed state and non-governmental institutions

At the meeting, an agenda, project details and other documents (e.g., evaluation forms) were distributed among the participants before the beginning of the meeting. Representatives of SA Moldovagaz, Danish Carbon Holding ApS and ICF International provided detailed data about the project to all participants, including information about its expected economic, ecological and social impacts, the Clean Development Mechanism, and the project development/ implementation.[19]

E.2. Summary of the comments received:

After the presentations the participants of the meeting asked questions regarding the project. The table below (Table 11) summarizes stakeholder comments and associated responses.

Table 11 Summary of comments raised during the stakeholder consultation

Name	Question	Answer by Project Management Team
Mr. Vladimir Brega, Institute of Ecology	▪ There are different devices and mechanisms which have their standard specifications. Any machine has its standardized indicator of emissions. They are all well known. Why do you follow such a principle as first to register emissions and then to measure etc. Probably it would be better to use the existing prices for certified emissions. Practice shows that such quotas of such countries as Ukraine and the Republic of Moldova are bought at a very low price without any reason. ▪ Ms Seu mentioned that they would change the methodology if it is necessary. Don't you understand that we had losses earlier and we have them now? They already show us that we have used the wrong methodology ▪ Please describe and justify your methodology of methane leakage measurements on flanges, etc. ▪ What about the uncertainty	Installation of gas pipelines began in 1960-s and 70-s. Since that time new materials and technologies have become available in the world but they were not used in the Soviet Union and in Eastern Europe. The world is constantly changing and new technologies and new expensive materials appear. The value of this project is that it provides opportunities to get advanced materials for free due to the investment provided. Moldovagaz will have a good support to replace old equipment and to ensure good operation of its pipelines and equipment. As for methodology, the UNFCC defines the methodology and the process to undertake the project activity. Certified emissions reductions depends on market forces, such as oil prices, demand, international situation on emissions and on different obligations many countries undertake. However, these are investment risks of the Danish party. You are correct that estimating methane leakages can be highly uncertain; however, these uncertainties are directly correlated to the method used to estimate the emissions. The typical approach used in most gas companies is to use empirical factors. In this case, there is no knowledge of the leak, and estimates can be generated based on knowledge of the number of components and average emission factors per component type. Alternately, estimates can be estimated using mass balance methods (i.e., input flow - output flow = losses + measurement error).

[19] Further information can be found on the Moldovagaz website: http://www.moldovagaz.md/showNews.jsf?id=83

Name	Question	Answer by Project Management Team
	with the leakage measurements at the present time (without the project activity?) - How will this be reflected?	However, in this project, we will be utilising the Hi-Flow sampler, and advanced leak measurement device. As such, we will first identify each physical leak, and then measure the leakage using the Hi-Flow sampler. Measurements conducted with the Hi-Flow sampler have an accuracy of +/- 5%; consequently, they provide a very good estimate of leakage.
Mr. B. Dobzhansky – Gagauz-Gas, Director	▪ How did you measure the volume of leaks in the Moldovagaz system? ▪ How much does it weigh? ▪ What will be the result of project implementation? ▪ To what extent will green house gases be reduced? ▪ A large share of GHG emissions is from boilers, thermal power plants, etc. Did you make any comparative analyses if this has a greater influence on the environment compared to gas transmission and distribution? ▪ Have you analyzed gas flaring at the industrial enterprises or in houses?	The main objective of our work is to measure gas leaks in particular methane, which has a significant global warming potential. Gas leak measurements were made using advanced technologies, such as the Hi-Flow sampler. Based on initial measurements at a sample of sites, which we extrapolated to the whole MG system, we estimated a preliminary number. It is over 750 000 tons of CO_{2e} per year. The project will aim to reduce these losses. Combustion and consumption of gas by industrial enterprises and dwellers was not the purpose of our project work, so no comparative analyses have been conducted. It is beyond the boundaries of the project. We have examined only GRPs, CGRP and stand-alone gate valves. The estimations of volumes and weight of emissions to be saved, a preliminary number of ca. 750 000 tCO_{2e} per year has been derived.
Mr. Minai Torshu – Deputy Director, Institute of Energy	▪ What type of equipment did you use for measurements and what was the process?	In order to fulfill CDM requirements we had to follow a definite prescribed procedure, as defined by the CDM methodology. Every piece of equipment was tagged and registered by our team. Measurements were made using the Hi-Flow sampler, which quantifies gas leakage.
o Mr. Vladimir Donchenko, Deputy Director on Technologies, SA "Termocom" o Mr. Vasile Petelka, Director, Shtefan-Vode-gas	▪ All three stakeholders commented that the project was positive for the Republic of Moldova. Yet, they also requested additional information on the technical characteristics of the equipment for gas losses detection and materials for gas leak reduction.	Follow-up communications were sent to the three stakeholders, with additional details on the Hi-Flow™ sampler, GMI Gassurveyor™, and GORE® Repair materials

Name	Question	Answer by Project Management Team
o Mr. O. Balmush, Measurements Engineer, Orkhey-GAS		
Mr. Alexander Paul, Engineer, Chimishlia-Gas	▪ In the section "Project Progress" DCH acquires rights for carbon units or certified reduced emissions which would be received as a result of the project implementation. I want to ask, who will have to cover these costs? According to the new calculation methodology of leakages by ANRE many enterprises were put in disadvantageous conditions. Can it happen so that we will have to bear the burden of even higher costs in future and pay for such an “economy"?	A follow-up communication was sent to the stakeholder, with the following response: “You are correct that Danish Carbon Holding (DCH) will obtain the certified emission reductions (CERs) generated through the project; however, this will have no negative financial impact on Moldovagaz (MG). On the contrary, DCH will provide the capital necessary to hire labour and equipment to implement the Project, to pay for leak detection and measurement training for MG staff, and to purchase computers and other relevant software/hardware for the leak database. DCH will coordinate with MG to ensure the Project is compliant with Moldovan regulations, and to set up and manage a special bank account to accept DCH payments for staff, repair work and materials. DCH will also be responsible for ensuring the credibility of the Project, by providing project management assistance, and CDM methodological supervision, to ensure that the Project is implemented in-line with CDM requirements.”
Various stakeholders, including: Mr. Simeon, Academy of Sciences in the Republic of Moldova; Mr. Dobzhansky, “Gagauz-Gas – gas; Ms. Komarova, SA "CET-1"; Ms. Kontsedailova, SA "CET-2" Mr. Pleshko, Moldovatransgaz; Mr. Minai Tyrshu, Institute	No question submitted, but general comment on the positive nature of the project	The various stakeholders provided general comments on the positive impact of the project for the Republic of Moldova and also Moldovagaz. For example, comments included: “Project is of a certain importance. We hope that it will help to reduce losses of SA "Moldovagaz" and lead to stability” - Mr. Simeon, Academy of Sciences in the Republic of Moldova “This project is of a great value but it must have a logical conclusion. We expect that it will benefit sustainable development of the country and reduction of technological leakages and will not have an adverse effect concerning prices” - Mr. Minai Tyrshu, Deputy Director, Institute of Energy “The project is of great importance and it's implementation will favour the good reputation of

Name	Question	Answer by Project Management Team
of Energy; Mr. Tanov, Tarakliya-gaz; Mr. Bordenyuk, Chisinau-gaz; Mr. Streistian, Yaloveni-gaz		SA "Moldovagaz" – Mr. Alexandryanu, director, Edinet-gas “We look forward the successful completion of the project and hope to receive support in reduction of gas emissions in networks” – Mr. Grumeza, Balti-Gaz

E.3. Report on how due account was taken of any comments received:

The way the received comments have been answered is described in the Section E.2**,** under the column “Answer by Project Management Team”. Most of the comments were satisfactorily addressed during the meeting, only few required follow-up action. This included sending emails with requested information or clarification.

Annex 1

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Represented by:	Rene Treumer Andersen
Title:	Head of Climate Centre
Salutation:	Mr.
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public Financing was used for this project.

Annex 3

BASELINE INFORMATION

Baseline leak survey / Feasibility study

The feasibility study to identify and quantify leaks in sections of the Moldovagaz (MG) distribution network was conducted from April 11, 2011 through April 28, 2011. Measurements were conducted in the area of five branches of Moldovagaz (Chisinaugaz; Gagauzgaz; Florestigaz; Cimisliagaz; and Taracliagaz) by Anem Management Ltd, accompanied by ICF International. Methane leaks detected during the study were tagged and measured. Identified sources of leaks included valves, flanges, and threaded fittings. Measurements were performed using the Hi Flow™ Sampler.

The Hi-Flow™ Sampler makes leak rate measurements with the same accuracy as enclosure measurements but at a speed approaching that of leak detection screening instruments (Howard et al., 1994; Lott et al., 1995 Howard, 1995). The Hi-Flow™ Sampler uses a high flow rate of air combined with a rapid enclosure to completely capture the gas leaking from the component. A catalytic oxidation/thermal conductivity sensor is used to measure the sample concentration in the air stream of the high flow system. The Hi Flow™ Sampler methane sensors have been calibrated throughout the project and calibration details have been provided to the validator.

A random sampling of measurements were conducted at 1) gas regulation points; 2) Cabinet type regulation point (RP) (with volume >50 m^3/h); 3) Cabinet type RP (with volume 20-50 m^3/ h); and 4) Stand alone valves were chosen in the Vulcanesti, Causeni and Chisinau regions. A total of 121 individual sites were inspected over the course of the project with a total of 155 separate leak measurements taken. Table 12 presents a summary of the feasibility study results (for valves only), and project CER estimates.

Table 12 Feasibility study measurements and CER estimates per site category

Site type	Number of surveyed sites	Average leak rate per site[a], lpm	Total number of sites	Volume of gas emissions, m^3/year[b]	Estimated CER volume, tCO_{2e}/year[c,d]
Gas regulation points	13	6.58	774	2,678,716	40,105
Cabinet-type regulation points (RP) (>50 m^3/h)	73	4.68	6,060	14,895,965	223,019
Cabinet-type RP (20-50 m^3/ h)	15	2.77	9,497	13,810,158	206,763
Stand alone valves	20	5.23	6,786	18,636,120	279,016

[a]Only valves; all other component leaks (threaded fittings, flanges) excluded

[b]Operational hours per year = 8760h

[c]Uncertainty = 0.5% (estimated per *IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*)

[d]Methane global warming potential (GWP_{CH4})= 21tCO_{2e}/tCH_4 (*2006 IPCC Guidelines for National Greenhouse Gas Inventories*)

Table 13 presents statistical information on each site type surveyed.

Table 13 Statistical information on each site type surveyed

Total number of GRP	13
Average leak per GRP [only valves], lpm	6.58
Median, lpm	6.80
stdev	1.53
Total number of CTGRP	73
Average leak per GRP [only valves], lpm	4.68
median, lpm	4.80
stdev	3.31
Total number of CTGRP 20-50	15
Average leak per GRP [only valves], lpm	2.77
median, lpm	3.10
stdev	2.15
Total number of stand alone valves	20
Average leak per GRP [only valves], lpm	5.23
median, lpm	0.00
stdev	8.96

Feasibility study results and calculations are presented in the attached CER calculations spreadsheet.
A complete feasibility report has been submitted to the DOE for validation of estimated baseline emissions.

Annex 4

MONITORING INFORMATION

The monitoring plan below will be used as an introduction to the periodic monitoring reports, in order to ensure that the monitoring report is in compliance with the monitoring plan.

Management and Operational Systems

In order to ensure successful operation of the Project and the credibility and verifiability of the CERs achieved, the Project will have a well-defined management and operational system, and the Project Participants will work together to implement a comprehensive monitoring program.
Staff within Moldovagaz (MG) will implement the Project operations and monitoring activities by performing detection, measurement, repair and documentation of leaks throughout the crediting period. Danish Carbon Holdings (DCH) will provide CDM methodological supervision and support to the MG team.

MG Project Team

The MG Project Team will be composed of a number of sub-teams, as follows:

Leak Detection, Measurement and Repair Technical Teams
MG is currently comprised of twelve subsidiaries; however, as a result of an internal reorganization of the "Moldovagaz" structure, the 12 affiliated companies, will be transformed in to 4 companies each covering part of the network: Northern, Central, Southern and Kishinev territory. To ensure good coordination between the companies, a centralised approach will be implemented. The Project Team will be independent of the companies and will report directly to senior MG management [Mr. V. Tonu, Head of Gas Deliveries and Realization Department]. This structure will ensure that data is compiled and analysed centrally, and that all decision making occurs with senior management oversight. Additionally, project staff gain experience in all the subsidiary networks and can more easily disseminate knowledge across the organisation.

All project operations and monitoring activities will be overseen by a project manager (PM), who will report directly to senior MG management [Mr. V. Tonu]. The PM will be hired specifically for this role from within MG [Mr. Ivan Garchiu]. He will supervise six leak detection, measurement and repair teams covering the Northern, Central, Southern and Kishinev territories.

There will be six teams, each consisting of 5 people. Each of the teams will have a local project "Leader" whose role will be to train new team members, oversee and support their team's leak detection, measurement and repair activities, coordinate with the Database team, to ensure that the detected and repaired leaks are being accurately entered into the Database, and coordinate with the PM; two certified leak detection/measurement technician, and two repair technicians. These six teams will undertake the initial baseline study at the start of the Project.

The operators will be formally trained and certified by technical experts in leak detection and measurement techniques, and advanced repair techniques. The teams will be equipped with:

- 1 Hi-flow™ sampler
- Digital camera

- 1 GMI Gassurveyor™ (500 Series)
- Soap solution
- Tags
- Ladder (as needed)
- GORE® Repair materials (e.g., GORE® Valve Stem Packing)
- Other materials (Teflon thread tape, valves)

After the baseline study has been completed, and after leak repairs have been made, regular monitoring of the components and repair of any new leaks will be required on an ongoing basis throughout the term of the project. These teams will also be responsible for performing this activity.

Database Management Team
Two database technicians, supervised by the PM, will be responsible for documenting the leak measurement data, and ensuring that it is correctly entered into an Excel database. The data will be entered on a daily basis, during the leak detection, measurement and repair phases of the project. After that it will be entered as and when monitoring and maintenance works are conducted. This team will also be responsible for mapping the gas network system, and instructing the Leak Detection, Measurement, and Repair Technical Teams which facility should be visited on a day to day basis. One of the database technicians will be designated “Leader” with responsibility for checking the data and for managing the collection, storage and archiving of all data records.

Project Manager
The Project Manager (PM) will be responsible for coordinating the overall CDM project. The PM will oversee the Technical Teams and Database Management, and will also be responsible for coordinating all other project logistics, including:

- Working with Danish Carbon Holdings to procure equipment and resources
- Ensuring staffing needs for the Technical and Database Management Teams are met
- Engaging with the community and stakeholders
- Evaluating training needs and carrying out training programs
- Monitoring and reviewing safety and environmental aspects of the CDM operations
- Coordinating with any relevant Moldova government bodies
- Liaising with MG senior management to ensure smooth implementation of the CDM project

The PM will also be the first line of responsibility for implementing project operations on a day-to-day basis and the monitoring plan. Ultimate authority will lie with senior MG management [Mr. V. Tonu], for overall project implementation at MG.

Danish Carbon Holdings Project Team
Danish Carbon Holdings (DCH) will provide the capital necessary to hire labour and equipment to implement the Project, to pay for leak detection and measurement training for MG staff, and to purchase computers and other relevant software/hardware for the leak database. DCH will coordinate with MG to ensure the Project is compliant with Moldovan regulations, and to set up and manage a special bank account to accept DCH payments for staff, repair work and materials.
DCH will also be responsible for ensuring the credibility of the Project, by involving independent third parties on an ongoing basis. Specifically, DCH has hired an independent third party consulting firm, ICF International, to ensure project quality assurance/ control.

DCH will provide project management assistance, and CDM methodological supervision, to ensure that the Project is implemented in-line with CDM requirements.

Training Program

A training program will be conducted to train local staff at MG on how to use advanced detection and measurement equipment, how to execute effective repairs, and how to document the leaks found in an effective manner. The training will be managed by the PM in collaboration with technical experts with significant experience in gas leak detection and measurement, and advanced repair materials to be used in the project. These experts will provide detailed instructions and written materials on how to conduct the leak detection, measurements and repairs. ICF International will provide quality control oversight to ensure CDM project training objectives are met. Specific training and expertise elements to be addressed include:

- **Instrument Training**: The DI&M teams will be trained in the use of advanced leak detection and measurement technologies, with certification provided upon completion of the course. Training will cover the following topics:

  Leak detection approaches
  - Typical leak locations/ sources
  - Methods to conduct leak detection (soap solution, gas surveyor)
  - Reporting requirements (tagging, data collection, digital picture)

  High Flow Sampler operation
  - Basic High Flow Sampler Setup and Operation
  - High Flow Sampler Applications Overview Basic
  - Instrument Calibration
  - Fundamentals and Theory of Operation
  - High Flow Sampler Safety Considerations
  - Setup and Calibration
  - High Flow Sampler Workshops/Field Exercise

- **Repair Training**: The DI&M teams will be trained in the use of the specific repair strategies/approaches, safety requirements, including:

  Repair approaches
  - Understanding valve technology
  - GORE® repair materials
  - Implementing repairs
  - Safety requirements

- **Reporting**: Survey teams will be informed on the procedure for conducting and reporting findings from baseline and subsequent surveys, such as use of a standardized data sheet and procedures for electronic reporting of field data.

The PM will verify that all technical team members have been appropriately trained by monitoring which team members are new, as well as observing the teams out in the field to ensure that all members are appropriately trained.

Calibration of equipment

All Hi-Flow samplers will be calibrated to ensure accuracy in their measurements. The MG Technical Teams will be provided with calibration kits and spare part kits. The calibration is done as per the Hi-Flow manual which suggests a 30 day calibration period by certified staff. The calibration is done as per field specifications. The MG Technical Teams will calibrate their detectors at least once a month following the same procedures for each Hi-Flow sampler. The calibration records will be documented each month and maintained by the technical operators together with the Database Management Team.

Leak Measurement

The Technical Teams will survey the components in the project boundary using advanced leak detection instruments, such as the GMI Gassurveyor 500. Once identified, the leaks will be tagged, and numbered. The flow rate for each leak will then be quantified using the Hi-Flow sampler. A digital photograph will be taken of the leaking component, tag and Hi-Flow sampler reading. These photographs will be archived by the Database Management Team. In addition, the type of repair expected given the nature of the leak and its location will be categorised for future repair planning.

After leaks have been detected and measured, they will be repaired. Before each repair is made, another Hi-Flow sampler measurement will be taken. In the case there is any discrepancy between the final measurement and the original measurement a third measurement will be taken to confirm the change. The final, confirmed leak rate will be used to determine baseline leakage as per the AM0023 methodology, regardless of whether the leak rate is lower or higher than the original leak measurement. After the repair, a new leak measurement will be carried out to ensure that the leak was properly repaired. If required, additional repairs will be made until no further leak can be detected. If leaks cannot be eliminated remaining leaks will be measured and recorded. The date of the repair (or discovery of remaining leak) will be recorded in the Project Database.

Monitoring Repaired Leaks

All leaks that have been subject to repair will be monitored – using the same leak detection technologies on each leak identified in the baseline – to ensure they are maintained, on an annual basis. Where a leak repair fails, it is conservatively assumed that the leak resumed the day after the last inspection, or in case of the first inspection, the day after the repair has taken place. Emission reductions are counted from the date of subsequent repair of that same leak, and are measured using the same type of equipment as in the initial survey (Hi-Flow sampler). Such leaks will be repaired again followed by new leak measurements. Data collected will be included in the periodic monitoring reports stored in the Database.

Quality Assurance and Corrective Action

Involvement of Independent Third Parties

The Project Participants have taken a number of steps to ensure that the Project data is of a high quality. Firstly, independent technical experts, Anem Management Ltd, have conducted a feasibility study of the MG network (April 2011). Secondly, DCH have subcontracted quality assurance/control (QA/QC) responsibilities to an independent third party consulting firm, ICF International. On an ongoing basis, ICF International will be responsible for QA/QC of the project going forward. Their role and responsibilities will be:

- Verify that maintenance and monitoring of leaks is being conducted in accordance with the Monitoring Plan.
- Observe MG database team to ensure that data is being recorded and handled as per the requirements of this Monitoring Plan.
- Conduct audits of the data to ensure that adequate records are being kept, and that leaks found and leaks repaired have been accurately documented in the database.
- Observe MG technical teams to ensure that they are operating equipment and conducting leak detection, monitoring and repair works in the correct manner, and advise on any training needs required.
- Conduct on the ground assessment to verify that project implementation is on schedule and highlight any risks of delay.
- Verify repair/replacement schedule of any regulators that are due to be replaced or repaired for the coming year.
- Provide an independent assessment of what types of materials and equipment MG technical teams should use to most effectively repair leaks.

Additionally, DCH will subcontract a third party to undertake the monitoring report and annual CER verification assessment. Their responsibility will be to:

- Submit a draft monitoring report to DCH and MG for review after each visit.

Any issues or problems detected by the third party will be reported back to MG and DCH who will then conduct corrective actions as detailed below.

Corrective Actions and Emergencies

At the end of each yearly monitoring period, the third party will submit a draft monitoring report (including comments and irregularity checks) for review and approval to MG’s team leader (Mr. V. Tonu), the PM (Mr. Garchiu) and DCH. In the event that such irregularities are observed:

- An analysis of the irregularities and their causes will be carried out immediately.
- The management of MG will make a decision, in consultation with Danish Carbon Holdings, on appropriate corrective actions to eliminate the non-conformity and its causes.

- Corrective actions will be executed under the supervision of the team leader, and any necessary amendments will be made.

Data Flow, Storage and Management

A Microsoft Excel database will be used to track leak and repair data. The data parameters tracked will be as follows:

1. *(i)* Total number of leaks – each leak will be tagged with a number and monitored after repair for any additional leaks.
2. T_i Hours of operation, during which time the leak is venting gas
3. Date of leak repair – Work orders, receipts and other records.
5. Leak Flow Rate $F_{CH4,i}$ (litres per minute) – Leak rates will be measured and double checked before repair – major discrepancies will warrant a third test. In other words, if a Hi-Flow™ sampler is used to measure the rate of a leak, if the results of two tests are far apart, the testing should continue until two measurements have results very close together (to reduce any inaccuracies in the testing process). Should the Hi-Flow™ sampler or other equipment need recalibration or adjustment to ensure their accuracy, the project participants will take the necessary action to do so.
6. Temperature and Pressure – Temperature and pressure are measurements taken into account by the Hi-Flow™ sampler at the time of measurement and are integrated into the results from the Hi-Flow™ sampler device. The hi-flows will be calibrated on a regular basis.
7. Uncertainty factor – The IPCC Good Practice Guidance will be consulted in compiling uncertainty estimates.

In order to ensure complete record keeping and proper identification of leaks, the following data will also be tracked:

- Number and location of the regulator system (street address and building number)
- Region
- Names of lead technical operator
- Leak tag number
- Type of facility surveyed (gate station / cabinet / station within a building etc)
- Component that is leaking
- Digital photo number
- Any other relevant observations

The data will be entered every 1 to 2 days, during the leak detection and measurement phase of the project, and this will continue during the initial repair phase. After that, data will be entered on an annual basis as and when monitoring and maintenance works are conducted. The database will include records of re-emerging leaks and records performed by Verification teams.

Data will be processed as follows:

1. Technical operator will record data while out in the field for each component separately, using handwritten notes and digital photographs

2. At the end of each day on which measurements have been taken, the technical operator will bring their handwritten notes and digital photograph data to the Database Management team at head

office, and they will enter the data collected that day into an excel spreadsheet. This spreadsheet will contain an excel drawing of each component measured that day, and each leak will be tagged on that drawing

3. On a monthly basis, the Database Management team will collate the data from each day into a master spreadsheet, containing data from all operators on all days

Quality Control, Discrepancies, and Data Security
After the monthly data collation, the MG database manager will review the data and check that it has been recorded correctly.

- As leaks can be traced from the individual spreadsheets to the collated spreadsheet, any discrepancies can be easily observed.
- For the individual leaks that appear to be outliers (over 20 litres per minute), the MG database manager will verify the measurement with the responsible technical operator to double check the number, and any discrepancies are simply remeasured.
- In addition, the MG database manager will review measurements by each individual Hi-Flow™, to ensure that no one Hi-Flow™ in particular is making measurements that appear to be outliers on a consistent basis. If such discrepancies are found, the Hi-Flow™ will be recalibrated and checked immediately, and any erroneous leaks will be re-measured.

There are three concurrent ways of tagging leak locations and tracking leak measurements. Each method by itself would satisfy the needs of identification. However, the three methods of identification system that is almost impossible to marginalize:

- Firstly a digital photo of the leak itself is taken and this photograph is then documented on the computer with the actual leakage rate and measurement date
- Second the leak itself is physically tagged on-site and the leak rate and measurement date are written on the tag; and
- Third, when the leak measurement and date are entered into the database, the location of the leak is documented on a drawing of the regulator station itself.

As a result, if due to unforeseen circumstances, a tag is damage or lost, or a digital photo is accidently deleted, or there are problems with the excel database, there are two other sources of information and documentation about the leak as a back up. In addition, this system ensure that leaks can be easily identified and repaired, with the data actually being vital to the repair team to quickly and accurately identify the leak needing repair.

Since the project also relies heavily on electronic data storage, the project managers will employee the following measures to ensure its physical protection.

1. All new data for each week will be stored both on site at MG and will also be sent to the London office of ICF International.
2. In London, all the data will be backed off site in addition to onsite. This will provide two backup locations for all data.

3. Finally, MG will install an external hard drive system to back up all its files. All data will be archived for at least two years after the crediting period.

These measures should ensure beyond a reasonable doubt the continued existence of all the electronic data for the project.

Ex-ante calculation of emission reductions

Please see section B.6.3 above for detail on how the project participants will calculate emission reductions.

Data and parameters monitored

Please see section B.7.1. above for detail on the data and parameters that will be tracked, and information on how they will be monitored.

This monitoring plan is summarised in section B.7.2. of the PDD above.