PROPOSED NEW BASELINE AND MONITORING METHODOLOGY OR METHODOLOGICAL TOOL FORM FOR EMISSION REDUCTIONS ACTIVITIES
(Version 02.0)

INFORMATION TO BE COMPLETED BY THE SECRETARIAT AND METHODOLOGIES EXPERT PANEL	
Type of standard	Choose an item.
Unique reference number and title of the proposed new methodology or new methodological tool	>>
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[1] Format for footnotes.

SECTION A. Summary and applicability of the baseline and monitoring methodology or methodological tool

A.1. Title, submission date and version

Title: “Leak detection and repair in natural gas transmission and distribution systems”
Submission date: April 22, 2026
Version: Version 1.0

A.2. If this methodology or methodological tool is based on a previous submission or an approved Article 6.4 mechanism methodology or methodological tool, please state the reference numbers here. Explain briefly the main differences and their rationale.

>> This baseline and monitoring methodology is not based on a previous A6.4 submission or approved methodology.

A.3. Summary description of the methodology or methodological tool, including major baseline and monitoring methodological steps.

>> This methodology is designed to quantify the emission reductions associated with the introduction of an Advanced Leak Detection and Repair (LDAR) program designed to identify, measure, and repair leaks of natural gas within transmission and distribution systems. It is an approach based on existing actual emissions, adjusted downwards to ensure alignment with paragraph 33 of the RMP. The baseline case is the business as usual (BAU) case and they are calculated using the same approach based on actual measurements taken of each leak found, taking into account the uncertainty of the measuring equipment.

The project developer undertakes a baseline study of the above ground gas transmission and/or gas distribution infrastructure inspecting components for leakage. For any leaks identified, a volumetric measurement of leak rate is taken along with the GPS and other identifying special coordinates. The leaks are then repaired and another measurement is taken confirming the leak has been eliminated. The project developer then regularly visits each component to confirm the leak remains repaired. All of the results are tracked using redundant data streams and the measurements are adjusted to account for uncertainty.

SECTION B.	Proposed new baseline and monitoring methodology or methodological tool

1. Introduction

1. The following table presents a summary of the key elements of a methodology:

Table 1. Methodology key elements

Type of GHG mitigation measure(s)	☐ Fuel/feedstock switch ☐ Technology switch ☐ GHG destruction ☒ GHG formation avoidance ☐ Engineered carbon dioxide removal ☐ Nature based carbon dioxide removal
Types of mitigation outcomes achieved under this methodology	☒ Emission reductions ☐ Removals
Are the mitigation outcomes under this methodology at risk of reversal?	☐ Yes ☒ No
Typical projects eligible under the methodology	Project developers working with Natural Gas distribution and/or transmission companies that lack advanced LDAR systems and have methane leaking from components found in existing above-ground gas infrastructure can use this methodology to quantify the emission reduction results from eliminating the leakage of methane.

2. Scope and entry into force

2.1. Scope

2. The methodology covers reducing methane emission reductions from Leaks in gas transmission and/or distribution system through the introduction of an advanced Leak Detection and Repair program (LDAR).

2.2. Entry into force

2.3. Applicability of sectoral scopes

3. Designated operational entities validating and verifying Article 6.4 activities that use this methodology shall apply sectoral scope(s):

3. Definitions

4. In addition to the definitions contained in the 'Article 6.4 mechanism Glossary of Terms', the following definitions apply for the purpose of this methodology:

(a) **Term** – Definition;

Component. Above-ground equipment in above ground natural gas transmission or distribution systems, including the following:

- Stand Alone Valves;
- Residential gas regulators, commercial gas regulators, other gas pressure regulation equipment;
- Compressor Stations and Gate Stations;
- Flanges and other connectors;
- Pump seals;
- Compressor seals;
- Pressure relief and safety valves. Pressure relief valves are only accountable under this methodology when the gas pressure is less than the set point to open the valve (i.e. when the relief valve is closed);
- Open-ended lines, and sampling connections. Leaks from open-ended lines and sampling connections occur at the point of the line open to the atmosphere and are usually controlled by using caps, plugs, and flanges. Leaks can also be caused by the incorrect implementation of the block and bleed procedure.
- Others: pressure regulators, diaphragms, drains, dump arms, hatches, instruments, meters, polished rods, and vents.

Leak detection and repair (LDAR) program. A structured program to detect and repair physical leaks from components. If a component is determined to have a physical leak, then the component is tagged and the physical leak repaired within a specified time. In the context of this methodology the following types of LDAR programs are defined:

- **Conventional LDAR program.** This comprises (where applicable) physical leaks detected by worker audio, visual and olfactory responses, area and building monitoring for flammable or toxic gases, worker personal monitors and leak checks performed as part of normal inspection and maintenance activities. The conventional LDAR program shall also comprise any additional leak detection and repair measures required by local regulations. The physical leaks that are detected and repaired within the framework of conventional LDAR cannot be included in the project activity;
- **Advanced LDAR program.** A program that is in addition to the conventional LDAR program.

Maintenance. It is a set of activities that are performed on components in order to correct or to prevent any degradation in their operating conditions. The maintenance carried out at predetermined intervals or according to prescribed criteria and intended to reduce the probability of failure or the degradation of the functioning and the effects limited.

Physical leak. The unintentional and continuous loss of natural gas from a component. The leaking may occur past a seal, mechanical connection or minor flaw on the component at a rate that is in excess of normal tolerances allowed by the manufacturer. Leaks may occur due to normal wear and tear, improper or incomplete assembly of components, inadequate material specification, manufacturing defects, damage during installation or use, corrosion, fouling and demanding service conditions (e.g. vibrations and thermal cycling).

Repair of physical leaks. A repair of a physical leak occurs when the natural gas losses from a physical leak at a component are reduced to within normal manufacturer's tolerances for periods during which the component is in pressurized natural gas. The repair may be achieved by tightening or adjusting the component, applying sealants, replacing packing materials, welding, flanges or seals, repairing or replacing the component.

4. Normative references

5. This proposed baseline and monitoring methodology is based on the following proposed new methodologies and/or approved or consolidated methodologies:

This baseline and monitoring methodology is based on the approved CDM Methodology AM0023 v4 Leak detection and repair in gas production, processing, transmission, storage and distribution systems and in refinery facilities --- Version 4.0.0 that has been identified by the ICVCM as having met the *highest standard of integrity*.

https://cdm.unfccc.int/methodologies/DB/PZN9ZCTGF3KHFH0W21NY0NYL6X5CIR

https://icvcm.org/wp-content/uploads/2024/08/VCS_AM0023_v04_2024.pdf

6. This methodology also refers to the latest approved versions of the following methodological tools:

Article 6.4 Tools and Standards

a) **Sustainable development tool version 01.1 - A6.4-TOOL-AC-001**

https://unfccc.int/sites/default/files/resource/A6.4-TOOL-AC-001.pdf

b) Setting the baseline in mechanism methodologies v01.0 A6.4-STAN-METH-004

https://unfccc.int/sites/default/files/resource/A6.4-STAN-METH-004.pdf

c) Demonstration of additionality in mechanism methodologies v1.2 A6.4-STAN-METH-003

https://unfccc.int/sites/default/files/resource/A6.4-STAN-METH-003.pdf

d) Addressing leakage in mechanism methodologies A6.4-STAN-METH-005

https://unfccc.int/sites/default/files/resource/A6.4-STAN-METH-005.pdf

e) Common Practice Analysis tool A6.4-AMT-001

https://unfccc.int/process-and-meetings/the-paris-agreement/article-6/article-64-pacm/mechanism-process/methodologies/a64-amt-001

f) Investment Analysis Methodology Tool A6.4-AMT-002

https://unfccc.int/process-and-meetings/the-paris-agreement/article-6/article-64-pacm/mechanism-process/methodologies/a64-amt-002

This methodology is based on the following sources of information:

7. Relevant decisions by the CMA.

5. Applicability

8. The methodology is applicable under the following conditions:

(a) Sub-paragraph

This methodology is applicable to project activities that reduce physical leaks in components through the introduction of an advanced LDAR program.

The methodology is applicable only in existing gas transmission and distribution systems under the following conditions:

- During the last three years prior to the implementation of the project activity, no advanced LDAR program was in place to address physical leakage from components that are included in the project boundary (assessed once at validation);
- New physical leaks that are detected at components during the crediting period (e.g. not at the time the project starts) are accountable only if the components where the new leak is detected were included in the project boundary at the first verification of the project activity (assessed at each verification following the first verification);

Note that this methodology is not applicable to:

- Physical leaks that are detected and repaired under an existing conventional LDAR program (assessed at each verification for new leaks) (These are the leaks that could possibly be stopped prior to the end of the project period as the capacity theoretically exists to find and repair for these leaks).;
- In countries or jurisdictions where advanced LDAR practices are mandated by law (assessed at each verification);
- Physical leaks that can be repaired by tightening/re-greasing or by similar measures (assessed at each verification for new leaks);
- Physical leaks that are identified on components where the scheduled replacement was delayed from its normal scheduled time as documented through operational logs, worker logbooks, gas company records, interviews or other similar sources (assessed at each verification for new leaks);
- Physical leaks that are repaired due to a specific legal or regulatory requirement, in accordance with paragraph 76(a) of the baseline standard. This exclusion is not applicable where laws or regulations integrate an Article 6 mechanism as an instrument for implementation or that simply state general aspirational goals without a corresponding policy framework for specific leak reduction activities are not pertinent to this provision).
- Leak identification and repair activities that utilize physical resources and equipment that are already dedicated to addressing leaks elsewhere.
- Reductions in process venting (assessed at each verification for new leaks);
- Physical leaks occurring in new infrastructure, or extension of any existing infrastructure, i.e. transmission & distribution systems not in operation as of the year of the project investment decision by the activity developed (assessed once at validation).;
- Gas extraction or processing facilities (assessed once at validation).

9.

6. Avoidance of double-counting

10. *(a) Double counting due to overlapping claims between different crediting mechanism*

Activities:

The Project Developer will seek to get exclusive rights to the emission reductions resulting from the project. However, in case that is not possible and such overlapping claims are identified by the Project Developer, an agreement between the entities to not double issue credits must be finalized.

(b) Double counting due to overlap with mandatory domestic mitigation schemes: (assessed once at validation). Project Developers will not claim ERs under A6.4 that from emission reductions that overlap with any domestic trading scheme or mitigation scheme.

(c) Double counting due to overlap with other frameworks or environmental market:

Project Developers cannot claim credit for methane emissions in any other relevant environmental markets or accounting frameworks that currently or in the future may come to existence and also claim A6.4 credits for the same outcomes. Project developers will need to certify that they have and will not seek to claim any additional credits.

11.

7. Demonstration of alignment with the policies, options and implementation plans with regard to the NDC and LT-LEDS of the host Party and the long-term temperature goal of the Paris Agreement and long-term goals of the Paris Agreement

12. Activity participants shall provide to the DOE responsible to perform the validation of the Article 6.4 project an assessment, undertaken by the DNA of the host Party, of the activity's consistency with Decision 3/CMA.3 paragraph 40 (c) and paragraph 27 (a) as part of the host Party's approval.

8. Activity Boundary

13. The spatial extent of the project boundary, defined at the activity level, includes the components where the project activity is being implemented which are defined using the GPS coordinates or other easily indefinable spatial determinates. The method of demonstrating the spatial extent of the project boundary should be clearly illustrated.

Moreover, only components on which methane (CH4) emissions from physical leaks can be detected and repaired through the introduction of the advanced LDAR program can be included in the project boundary. The project boundary should be defined by all components included in the project that are, or could be, sources of physical leakage.

For the purpose of defining the project boundary, a database should be used containing unique project identification and location determinants such as GPS coordinates.

Table 2. Emissions sources and sinks included in or excluded from the activity boundary

Source		GHG			Justification / Explanation
BASELINE	Leaks in gas transmission and/or distribution system	CO_2	☐ Included ☒ Not included	☐ Controlled ☐ Related to ☐ Affected by	>> The CO_2 content in natural gas is negligible and not including the emission reductions of CO_2 is conservative.
		CH_4	☒ Included ☐ Not included	☐ Controlled ☐ Related to ☒ Affected by	>> Main source of emissions
		N_2O	☐ Included ☒ Not included	☐ Controlled ☐ Related to ☐ Affected by	>> The N_2O content in natural gas is negligible and not including the emission reductions of N_2O is conservative.

Source		GHG			Justification / Explanation
ACTIVITY	Identification and repair of leaks	CO_2	☐ Included ☒ Not included	☐ Controlled ☐ Related to ☐ Affected by	>> The CO_2 emissions from leak detection and repair operations are negligible.
		CH_4	☒ Included ☐ Not included	☐ Controlled ☐ Related to ☒ Affected by	>> For reappeared leaks that are not immediately re-repaired, the emission will be quantified and subtracted from emission reductions.
		N_2O	☐ Included ☒ Not included	☐ Controlled ☐ Related to ☐ Affected by	>> The N_2O emissions from leak detection and repair operations are negligible.
LEAKAGE	Reappeared leaks that are not immediately re-repaired	CO_2	☐ Included ☒ Not included	☐ Controlled ☐ Related to ☐ Affected by	>> The CO_2 content in natural gas is negligible and not including the emission reductions of CO_2 is conservative.
		CH_4	☐ Included ☒ Not included	☐ Controlled ☐ Related to ☐ Affected by	>> As CH_4 from leaks decreases less gas and associated emissions will be required upstream to meet the current demand and therefore it is conservative to exclude.
		N_2O	☐ Included ☒ Not included	☐ Controlled ☐ Related to ☐ Affected by	>> The N_2O content in natural gas is negligible and not including the emission reductions of N_2O is conservative.

9. Demonstration of additionality

9.1. Regulatory analysis

14. The activity participants shall submit an analysis of regulation in the host country based on credible and current evidence and shall demonstrate and justify that the emission reductions resulting from an Article 6.4 activity would not occur as a result of any law or regulation, unless the law or regulation refers to or formally integrates the mechanism as an instrument for implementation.

15. The respective analysis shall be conducted at each renewal of crediting period.

9.2 Avoidance of locking-in the level of emissions

16. Only existing systems are eligible, i.e. transmission & distribution systems in operation as of the year of the project investment decision. This excludes any activity in systems set up after this time or the expansion of existing systems.

17. The methodology does not cover any extraction or processing facilities where leak reductions might help prolong gas supply.

    Leak repairs simply reduce methane emissions from gas transmission/distribution systems, but they do not prolong the lifetime of the systems themselves and therefore are not incompatible with long term goals of the Paris Agreement, taking into account different national circumstances, approaches and pathways.

9.3 Investment analysis, Barrier analysis and Common practice analysis

The activity participant shall demonstrate additionality at the level of the LDAR implementation, not on a leak-by-leak basis, based on the latest version of the additionality standard A6.4-STAN-METH-003 Demonstration of additionality in mechanism methodologies.

As the applicability conditions of the projects dictate that the methodology only applies to leaks and repairs that could not have been detected and repaired under current activities. Therefore, the additionality analysis will focus on understanding if the advanced LDAR activities themselves would be deemed additional. In practice without the capacity inherent in an advance LDAR program the gas company would not be able to assess the cost-benefit of any proposed repairs as they would struggle to even identify leaks. Without the proper equipment that costs about $50,000 per unit, they would not be able to measure any leaks volumetrically and assess the savings benefit and without access to advanced repair materials they would not be able to make appropriate repairs using advanced materials that will stop the leakage.

OPTION 1: INVESTMENT ANALYSIS AND COMMON PRACTICE ANALYSIS (default option)

The activity participant shall provide an assessment of financial additionality of the activity, presenting an investment analysis. This is the default option.

In order to be additional using this option, the investment analysis shall demonstrate that the activity would not occur without the financial incentive provided by the mechanism. The investment analysis shall take into account the most recent version of the relevant tool(s) published by the Article 6 Supervisory Body.

OPTION 2: DEMOSTRATE PROJECT FINANCES, BARRIER ANALYSIS, AND COMMON PRACTICE

As per paragraph 53 of the additionality s**tandard, the application of the Barrier Analysis may be proposed provided such justification is provided including example of relevant barriers. To that end, there are several common aspects of natural gas distribution and distribution companies that justify the utilization of the barrier analysis. In particular, they often lack the internal and external access to the resources required to implement costly, advanced leak detection and repair programs and in fact, in many cases lack a direct financial incentive to make the repairs as the gas savings generated by the leak reduction does not accrue to the gas company.**

As background, many gas utilities are government owned with rates and payments schedules subject to political pressures that belie the full costs associated with the transport and delivery of natural gas including the ongoing investments in the renewal of the system infrastructure and proper maintenance programs. Furthermore, many of these same state-owned gas companies are providing highly subsidized gas to consumers. They also rely on the state government for funding meaning that the gas company budget is subject to the priorities and decisions of the central government that has many competing needs for investment. This means in practice that gas companies are often set up as entities without sufficient budgets and access to private capital markets needed to make the investment in advanced leak detection a repair programs that could find and repair the leaks identified.

Furthermore, in some cases gas companies are not the direct beneficiary of any gas savings associated with the leak repairs made. Subsidies distort the price of gas so that saving gas may simply reduce the amount of subsidy payments made by the government towards providing gas to consumers. In some cases, companies can simply pass on any economic losses from leakage to the buyer as a technical loss charges which can perversely incentivize the gas companies to not focus on loss reduction as they see no additional revenue. Additionally, some gas distribution companies do not meter customers, instead charging a flat rate. This means that a reduction in gas losses may not be directly correlated to an increase in revenue from sales as the gas may instead go to unmet demand from consumers paying a flat rate.

On top of these issues, the development and organization of an Advanced LDAR system in costly, requiring advanced equipment, training and supplies that are not currently available in the local market.

Therefore, in these cases an investment analysis would not be appropriate to demonstrate the additionality of a particular project because while the repairs of leaks would technical generate a positive financial benefit larger than that could cover the costs of such a program, a gas company could potentially receive neither the financial benefit of those savings, or have access to the resources required to implement the measures to achieve the savings.

The gas distribution companies in Bangladesh are a perfect example of how all these issues work to prohibit the implementation of an Advanced LDAR system in the absence of carbon finance. The vast majority of Bangladeshi natural gas customers are not metered. They are billed instead based on whether they have one or two natural gas cooking burners. So, if gas is saved from leaks, it is not clear that the gas companies will actually see any increase in revenue from that gas not leaking into the atmosphere. It is more likely that either consumers will use the saved gas to meet unmet demand without paying any additional fees, or the Government will simply reduce subsidized purchases by a tiny percentage of the total gas consumption that the savings represent. Furthermore, gas has historically been highly subsidized in Bangladesh. While recently prices have been increased, this was in response to dwindling domestic supply and expensive imported LNG rather than an effort to improve the financial position of gas companies. The gas companies are not substantially profitable and only are able to continue operation with government support for the operations and subsidies. Therefore, while the gas savings theoretically might prove cost-effective, in practice the investment analysis in Bangladesh with the distribution companies would miss the reality that these activities would not happen, and have not happened, but for carbon financing.

Where financially additionality is not feasible or inappropriate, following the procedures provided by the Additionality standard, Option 2 can be used if properly justified. Justifications that may be appropriate include but are not limited to, the existence of:

Institutional barriers (e.g. the Gas Utility not being the beneficiary of cost savings associated with the investment for the activity implementation)

Information barriers; (lack of training, organizational capacity, and familiarity with the practices and technologies needed to enact an advanced LDAR)

Financial barriers (e.g. lack of access to loans from capital markets by Gas Utilities; implementation of the LDAR system requires significant volumes of resources that are not available to the Gas Utilities);

The barrier analysis shall take into account also existing legislation and current practices within the activity sector and geographic area

Activity participants shall justify the selection of the Option 2, describing the barriers that have been identified and why an investment analysis is not suitable for the proposed case providing also supporting evidence.

9.3.1 Investment analysis

The Investment analysis will be undertaken on the implementation of a comprehensive advanced LDAR project since as per the applicability criteria plausible leak reductions made under existing practices will not be included in the project. The investment analysis on implementing an advanced LDAR programs can be used to show the project's additionality. The additionality is demonstrated at LDAR program level, rather than at individual leak, to demonstrate whether the entire program is financially viable with or without the revenues from the carbon credits.

18. Activity participants shall demonstrate additionality of the advance LDAR program by applying a comprehensive investment analysis by selecting either:

(a) A benchmark analysis: Comparison of the financial attractiveness of an Article 6.4 activity with a financial benchmark. This will be used when the gas company has a particular benchmark such an investment would need to surpass in order to be approved. This will take into consideration the potential lack of direct financial benefit received by the gas company from the leak reduction or the potential corresponding decreased in subsidy payments from the government; or in case no such benchmark exists in the gas company

This is appropriate as the gas companies would have to implement and pay for this project activity in the absence of carbon finance and may not receive any direct financial benefit of leak reduction. Using the internal benchmark the gas company utilizes in other investment decisions makes sense while accounting for the lack of direct benefit they would receive.

(b) An investment comparison analysis: Comparison of the financial attractiveness of an Article 6.4 activity with alternative options. This will be used by project proponents when it can be shown that the lack of a direct financial benefit to the gas company from the leak repair activities would implementing the project a less financially attractive option to the gas company than continuing with business as usual including the leaks continuing or doing the project at a later date.

In the case the gas company, as a publicly owned utility, does not have a definitive benchmark hurdle for its investments, it makes sense to use a comparison analysis of the options it has available including continuing with the current leak detection and repair procedures in a business-as-usual case. This analysis would need to take into account the potential that the gas company may not directly benefits or to assess the level of actual financial benefit received by the gas company from undertaking the project.

A simple cost analysis is not suitable for the proposed activity type as implementation of the Advanced LDAR likely generates saving (i.e. from the reduction of the cost of natural gas to be purchased by the utility while supplying the same amount of gas to the consumers) even if the savings are not directed realized by the gas company itself.

By applying the investment analysis, the following guidance and requirements as provided by the most recent version of the methodological tool: Investment analysis published by the Article 6 Supervisory Body shall be considered:

(a) General requirements for conducting the investment analysis;

(b) Requirements applicable to benchmark analysis and investment comparison analysis;

(c) Requirements applicable to benchmark analysis;

(d) Requirements applicable to investment comparison analysis.

While some of the specific leak detection and repair efforts that may be included under an advanced LDAR program in natural gas transmission and distribution systems are potentially cost effective by themselves, many gas distribution utilities do not reap the benefit of the savings or have access to the savings allowing them to finance advanced LDAR activities. The project participant will use an investment analysis to demonstrate the attractiveness (or lack thereof) of the proposed activity for the gas company itself including taking into account the direct beneficiary of any gas savings. The activity developer will take into account all factors that might affect the financial attractiveness of the proposed project for the gas utility or other private sector investors including but not limited to:

1) Subsidies- Many countries subsidize gas to end users. Saving money by reducing leakage may reduce a utility's losses from subsides but it does not afford the utility with the resources or incentive to undertake an advanced LDAR.
2) Pre-determined unaccounted for loss fees- Many natural gas utilities especially gas transportation utilities are paid a set fee for Unaccounted for Losses (UAL) which include leakages. If the UAL are reduced by stopping leaks, the fee simply is reduced leaving the gas utility with no additional revenue required to cover the expense of the advanced LDAR. The gas may not even belong to the utility itself; it is just paid for transporting another party's gas. Therefore, the utility which may theoretically have the ability to undertake such a program does not have the financial incentive.
3) Meters and payments- How gas transportation or distribution costs are metered or calculated and paid. The gas company may the meters needed to quantify, sell and profit from any saved gas such as some gas companies do not have ubiquitous meters and instead charge a flat fee for gas access regardless of the amount used.
4) Any other element that has an impact (either positive or negative) on the financial performance of the activity (e.g. generation of savings, cost of operating the LDAR system, etc.

The activity participants will undertake an investment analysis taking into account these and other relevant circumstances to determine if the project makes financial sense for the gas utility in the absence of the incentives from the mechanism, or if, the project is financially additional. Legal documents, sector studies, attestations from the natural gas utilities, or appropriate government agencies and officials will be gathered by the activity participants as evidence for their findings and assessed by the validator.

19. To ensure conservativeness in the assessment of additionality, the financial analysis shall include a sensitivity analysis in accordance with the Additionality Standard. The sensitivity analysis shall demonstrate that the conclusion of the analysis is robust to reasonable variations in critical parameters and assumptions. At a minimum, sensitivity tests shall be applied to variations in capital expenditures (CAPEX), operating expenditures (OPEX), revenues, and cost savings associated with reduced methane leakage. The range of variation applied shall be justified by project participants based on available market data or historical trends. The additionality conclusion shall only be considered valid if it remains robust across all reasonable sensitivity cases. In order to be additional, the investment analysis shall demonstrate that the activity would not occur without the financial incentive provided by the mechanism. The investment analysis shall take into account the most recent version of the relevant tool(s) published by the Article 6 Supervisory Body.

9.3.2 Barrier analysis

20. The activity developer will undertake a barrier analysis to demonstrate that the barriers prevent the Article 6.4 activity from being implemented without the incentives from the mechanism and that there are no other programs or incentives, such as subsidies, that would incentivize the Article 6.4 activity.

The activity developer should use the analysis to demonstrate that the incentives from the mechanism are the determinant element in overcoming the identified barriers. Even in the case that barrier analysis is justified, still the activity proponent has to provide information on the financial viability of the activity from the perspective of the Gas Utility.

The barriers facing gas utilities vary from country to country and even utility to utility, and are different for privately owned utilities and those under the government control and budgetary process. There are several common barriers that can inhibit the implementation of advanced LDAR projects but the activity developer can propose others as appropriate:

Institutional barriers: After accounting for the cost of gas purchases (i.e., payments to the government, and subsidiaries for purchasing and transmitting the gas, etc.), as well as administrative expenses, and interest payments, many gas companies simply lack the maintenance budget required to implement an advanced LDAR program even if it proved to be cost-effective. In some cases, utilities are state-owned or quasi-state entities that are prescribed budgets and would not see the benefit of any gas savings. In other cases, unaccounted for losses are just added to the transit or sales cost and if leaks are reduced the UAL payment is just reduced as well.

To demonstrate the intransience of this barrier in allowing the project activity to move forward, the activity developer will need to provide and demonstrate the financial flows of the gas utility and explain how the gas utility is not adequately incentivized through the saving by using budgets, annual reports, government reports, attestations from industry experts, utility executives, government officials, or other relevant sources.

Information barriers:

The Natural Gas Utility may lack access to:

Skilled and/or properly trained labor needed to operate and maintain the technology as it is not available in the applicable geographical area, which leads to an unacceptably high risk of equipment disrepair, malfunctioning or other types of underperformances;

Organizational infrastructure for developing and operating an advanced LDAR system; and

The particular technology and/or logistics for maintenance of the technology needed to implement the advanced LDAR as it is not available in the applicable geographical area.

To demonstrate the intransience of this barrier in allowing the project activity to move forward, the activity developer will need to demonstrate that the gas utility lacks the access to the organization and technical know-how required to be able to implement and manage an advanced LDAR project. This can be demarcated by using Gas Utility records and annual reports, industry analysis, government records and reports, attestations from top gas utility managers and government officials, or other relevant sources.

Financial barriers:

Even in cases where enough savings may eventually exist to repay the upfront costs of the activity, the cost of implementation is very high and lack of access to capital markets or other private financing sources may fatally undermine the project activity. Many gas utilities lack access to capital markets and the Host-Country may also lack access to private investment. No private capital is available from domestic or international capital markets due to real or perceived risks associated with investments in the country where the project activity is to be implemented, as demonstrated by the credit rating of the country or other country investment reports of reputed origin.

To demonstrate the intransience of this barrier in allowing the project activity to move forward, the activity developer will need to demonstrate the lack of access of the gas utility to capital markets needed to finance the project activity without mechanism support. These would include financial statements, credit rating analysis for the host country and gas utility, attestation from the gas utility bank or other prominent financial institutions in the Host Country, Government records, or attestations from gas utility and government officials.

21. The activity participants can demonstrate, using these barriers, that in spite potential financial benefits from cost-effective repairs from an advanced LDAR program, the utility would still not be able to develop a program without carbon financing.

9.3.3 Common practice analysis

22. Assess if advanced LDAR systems are common practice for the region where the project activity is Situated.

Activity participants shall apply a common practice analysis following the provisions and steps for Approach B of the most recent version of the Methodological tool: Common practice analysis published by the Article 6 Supervisory Body. As each country has its own unique infrastructure and corporate structure for gas utilities, the Geographic area shall be the entire Host Country.

$$F = P_{sim} / P_{all} \quad \mathbf{1}$$

Where:

P_{sim} will indicate all components technically similar to those types of components (e.g. residential pressure regulators, commercial pressure regulators, gas regulation points, stand-alone valves, gate stations, compressor stations, etc.) included in the proposed project that are included in an Advanced LDAR system in the Host Country during the three-year period prior to the start date of the project.

P_{all} a count-based indicator will be used demonstrating the number of total components similar to those targeted in the proposed project (e.g. residential pressure regulators, commercial pressure regulators, gas regulation points, stand-alone valves, gate stations, compressor stations, etc.) in the entire host country.

The common practice max threshold (F_{max}) for this time-bound approach will be the default value of 10% as per the tool and conservatively falling within the early adopters category of the Rodger's innovation curve.

If F ≥ Fmax, then the proposed activity shall be considered common practice and is therefore not additional. If F < Fmax, then the proposed activity is "not common practice".

Fewer than 10% of the total number of targeted components of a gas transmission or distribution system being covered by an Advanced LDAR program during the three years prior to the start of the project will ensure that Advanced LDAR practices, techniques and technology are not common practice and support an outcome that is highly likely to be additional.

23.

10. Baseline scenario

10.1 Selection of the baseline approaches from paragraph 36 of the rules, modalities and procedures

26. A paragraph

- ☐ Best available technologies that represent an economically feasible and environmentally sound course of action, where appropriate.
- ☐ An ambitious benchmark approach where the baseline is set at least at the average emission level of the best performing comparable activities providing similar outputs and services in a defined scope in similar social, economic, environmental and technological circumstances.
- ☒ An approach based on existing actual or historical emissions, adjusted downwards to ensure alignment with paragraph 33 of the RMP.

27. Existing above ground natural gas transmission and distribution systems that are eligible for inclusion in this methodology are typically vast systems built over time that match the topography and urban infrastructure that they transport gas through. The construction and design of the systems themselves are unique with different materials and technologies employed to transport and deliver gas to the desired location. Furthermore, each system deals with unique geography and climate that significantly influences the prevalence of gas leakage. Therefore, the certainty required to establish a baseline can only be achieved by assessing the actual emissions component by component across the individual system included in the project.

10.2 Application of the selected approach, prior to implementation of a downward adjustment

10.2.1 Procedure for the identification of the baseline scenario

28. The activity developer needs to consider the following pre-determined baseline scenarios:

1. Continuation of the pre-activity scenario with existing BAU practices of leak detection and routine maintenance for each component included in the project boundary up until any relevant planned or ad hoc replacements of the particular component;
2. The proposed project activity undertaken without being registered as a A6.4 project activity
3. The proposed activity is implemented as Art. 6.4 activity at a later point in time.

29. Step1 Ensure the alternative baseline scenarios comply with national regulation and targets

The Activity participants will confirm which of these alternatives complies with national regulations or other relevant national regulatory frameworks and targets officially published by the Host Party. If an option does not comply it will not be considered further.

The identification of the baseline scenario and the quantification of the associated emissions shall take into account all policies and regulatory elements that are applicable to the proposed activity or that are scheduled for implementation over the activity crediting period. In addition, any national or sub-national target applicable to the natural gas leak detection (or scheduled to entry into force) will have to be factored in when identified the baseline scenario. All existing legal requirements, including policies and national/sub-national targets, will have to be assessed and their relevance for the proposed activity shall be evaluated and justified. The results of the assessment shall provide clarity on whether any policy or regulation or target (or combination of these) is applicable to the proposed activity and the impacts on the emissions in the baseline scenario shall be quantified. Policies and specific targets shall be taken into account when associated with a concrete instrument for implementation. General goals or targets that are not supported with an actual implementation instrument may not be considered.

Step 2 If more than one baseline scenario is possible that complies with Step 1, then the plausibility of the remaining scenarios selection could be demonstrated using site-specific historical data (technical, economic, etc.) of the previous three years and, in case of multiple remaining options, selecting the most conservative in terms of emissions.

Where the first option is the most plausible, the BAU scenario will be considered the baseline scenario and baseline emissions will be calculated in the same manner as the BAU baseline emissions (including the replacement schedule, if any). The leaks included in the baseline scenario will be determined using the same approach as the BAU process.

10.2.2 Calculation of baseline emissions prior to downward adjustment

30. *Baseline Emissions*

Baseline Emission reductions are calculated using the exact same process as the BAU baseline Emissions. Since there are no reliable default factors that would provide reasonable estimations for the baseline (nor activity) emissions, then the BAU calculation will be equal to the one for the baseline and no difference can occur.

Baseline emissions Calculations

Baseline emissions are determined based on the quantity of CH4 emitted through physical leaks that are detected prior to being repaired as part of the project activity (i.e., by the advanced LDAR program).

Baseline emissions are calculated as follows:

$$BE_{Act,y} = \{ConvFactor\ x\ \sum_j [F_{CH4,j}\ x\ T_{j,y}\ x\ (1 - UR_j)]\ x\ GWP_{CH4}\} \quad \mathbf{2}$$

Where:

$BE_{Act,y}$	=	Actual Measured Baseline emissions for crediting year *y* (t CO_2e)
ConvFactor	=	Conversion factor to convert Nm^3 CH_4 into t CH_4
j	=	All physical leaks that are included in the project activity for which physical leaks were detected and repaired and which would leak in the baseline scenario during the crediting year *y*
$F_{CH4,j}$	=	Measured flow rate of methane for the physical leak *j* from the leaking component (m^3 CH_4 / h)
UR_j	=	Uncertainty range for the flow rate measurement method applied to physical leak *j*
$T_{j,y}$	=	The time the relevant component, in which physical leak *j* occurred, would leak in the baseline scenario and would be eligible for crediting during the crediting year *y* (hours)
GWP_{CH4}	=	The global warming potential of methane valid for the commitment period (t CO_2e / t CH_4)
y	=	Project year

The uncertainty related to the conversion factor is zero, as this is a well-known chemical unit conversion. In addition, the GWP is a given factor determined by the best science available from the IPCC and also has minimal uncertainty. The uncertainty related to the variable of time is also negligible as the hours of operation are typically well know and tracked. However, the measurements of the flow rate of methane are subject to the uncertainty given the stated accuracy of the equipment itself. This is mitigated by ensuring the equipment remains calibrated within the manufacturer's recommended period prior to measurement. It is addressed as follows to ensure a to a 95% confidence interval that the calculation of the baseline is conservative.

The uncertainty of the measurement is taken into account conservatively by using the flow rate at the lower end of the uncertainty range of the measurement at a 95% confidence interval for baseline emissions from leaks. For example, if the measured flow rate is 1 m^3/h and the uncertainty range of the measurement method is ±10%, emissions reductions shall be calculated based on a flow rate of 0.9 m^3/h. Given the large quantity of measurements potentially involved in the baseline study, calculation methods provided in the 2006 IPCC Guidelines to calculate UR using the combined uncertainties of all measurements can be used.

The following assumption should be made in the calculation of baseline emissions:

For parts of components where no physical leaks were detected at the initial survey and where a leak or leaks were detected during a subsequent survey, baseline emissions shall be added to the database and accounted in the baseline calculation from the moment when the leak was detected and measured;

Baseline emissions from a specific leak j or a specific component r are included in the calculations until whichever of the following occurs first:

The equipment concerned is replaced for a non-leak related reason (i.e. it breaks down); or

The end of the crediting period of the overall project activity.

10.3 Calculation of the downward adjusted baseline

31. **Downward adjustment in the calendar year of the start date of the first crediting period:**

32. Through the following step-wise procedure:

i. Determine the uncertainty at the lower bound of the uncertainty interval relative to the central estimate of the ex-ante quantified unadjusted net baseline emissions and/or removals at 95% confidence level during the first crediting period $UNC_{BE\ act,CP1}$. Given that the combined uncertainty of the leak measurements represented as UR_j already is conservatively included in the calculation of $BE_{Act\ ,y}$, at a 95% level of confidence, unless other uncertainties are identified, $BE_{adj,UNC,y}$ = $BE_{Act\ ,y}$.

ii. Determine the downward adjusted baseline emissions and/or removals based on uncertainty for the calendar year of the start date of the first crediting period $BE_{adj,UNC,y}$as follows:

$$BE_{adj,UNC,y} = BE_{Act\ ,y} * (1 - UNC_{BE\ act,CP1}) \quad 3$$

$BE_{adj,UNC,y}$	=	Downward adjusted baseline emissions and/or removals based on uncertainty in year y
$BE_{Act\ ,y}$	=	Unadjusted existing actual net baseline emissions in year y
$UNC_{BE\ act,CP1}$	=	Uncertainty at the lower bound of the uncertainty interval relative to the central estimate of the ex-ante quantified unadjusted net baseline emissions during the first crediting period (fraction). Does not include measurement uncertainties as these are already conservatively accounted for in the measurement of $BE_{Act\ ,y}$
y	=	Calendar year of the start date of the first crediting period

iii. Determine the minimum downward adjusted baseline emissions and/or removals for the calendar year of the start date of the first crediting period $BE_{adj,min,y}$as follows[2];

$$BE_{adj,min,y} = BE_{Act,y} - (BE_{Act\ ,y} - AE_y) * 0.1 \quad 4$$

$BE_{adj,min,y}$	=	Minimum downward adjusted baseline emissions and/or removals in year y.
$BE_{Act\ ,y}$	=	Unadjusted existing actual net baseline emissions in year y.
AE_y	=	Ex-ante estimated activity emissions in year y (=PE_y)

[2] As $BE_{Act\ ,y}$ includes the measurement uncertainty, this value will be even more conservative than the guidance suggests.

y	=	Calendar year of the start date of the first crediting period

$$BE_{adj,y} = min(BE_{adj,min,y}, BE_{adj,UNC,y}) \quad 5$$

$BE_{adj,y}$	=	Downward adjusted baseline emissions and/or removals in year y
y	=	Calendar year of the start date of the first crediting period

33. Downward adjustment in subsequent years:

34. Downward adjustment shall apply cumulatively in all subsequent calendar years of the crediting period. The downwards adjustment, since the methodology uses actual/historical emissions for the baseline, will be applied from the first year already as mandated by the standard. The starting point for increasing the downward adjustment over time shall be the calendar year of the start date of the crediting period. The downward adjustment in the calendar project year (y) shall be determined as follows:

The downward adjustment shall be set as the higher of the path defined by the NDC and the 2% which is double the annual level prescribed by the standard. With regard to the NDC in Approach 1, only the unconditional component is considered.

Approach 1

In the case the Host Country NDC (or other official policies that are publicly available for the relevant sector target) specifies a relevant methane emission reduction target for the natural gas transmission/distribution sector then:

Approach 1's downward adjustment calculation will be equal to the annual methane emission reduction rate as a percentage of annual reduction sought by the Host Country from the date of submission in the natural gas distribution/transmission sector of the applicable NDC document for the year (other stated public commitment, or net zero target by 2050 or 2060). For example, if the Host Country is seeking a 45% reduction of methane in the natural gas transmission and distribution sector from 2021-2030, it would indicate a downward adjustment of 5% per year for the baseline. If the year of emission reduction overlaps with multiple NDC documents (e.g., the year 2027 appears in both the 2020 and 2035 NDCs), the downward adjustment shall be determined using the most recent NDC that includes a reduction target applicable to that year. The identified target will apply also after the end of the NDC (when activities have a crediting period that goes beyond the current NDC end year) and at renewal of the crediting period, any new target in new NDCs shall be considered.

Approach 2

For countries where there are no applicable NDC provisions or other public policies, or their ambitions are below 2% reductions per year, the downward adjustment of 2% will be adopted.

The rationale is that 2% would allow the Host Country to reach the goal of the Paris Agreement as stated in Article 4 to achieve a balance between anthropogenic emissions by sources and removals by sinks of GHGs in the second half of the century. Thus a 2% annual reduction would contribute to reaching this target in 2075 which is aligned with the "second half of the century". In addition, this is more conservative that the minimum 1% mandated by the standard.

Minimum Downward Adjustment

$$AF_y = 100\% - \max\{(PY * 2\%), [(PY\ x\ (HCR \div TRGY))]\} \quad 6$$

Where:

AF_y	=	Adjustment Factor for the crediting year *y* of the crediting period (%)
HCR	=	Host Country gas transmission/distribution reduction goal as stated in the Host Country NDC or other publicly stated policy (%)
TRGY	=	Total Reduction Goal Year is the number of years the Host Country has delineated to meet its Reduction Goals in its NDC.
PY	=	The numeric year of the project (i.e. 1-10 in a 10-year project period) with the first year beginning with the start date of the first crediting period. A pro-rata approach may be used to determine this value if monitoring periods fall during more than one of the project years.

Baseline emissions are therefore calculated as follows:

$$Baseline\ emissions = (AF_y * BE_{adj,y}) \quad 6.1$$

10.4 Identification of the conservative BAU scenario

35. Activity proponent shall identify a conservative BAU that would occur in absence of the Article 6.4 activity. The following alternative shall be considered for the determination of the BAU scenario:

(a) Continuation of the historical situation (pre-activity scenario);

(b) Establishment of an economically viable technology and/or practice;

(c) A scenario combining (a) for the remaining lifetime of the existing equipment and/or practice, followed afterwards by (b); or

(d) Only when it is justified that the previous alternatives are not suitable, another relevant scenario in line with the applicable principles and requirements set out in the latest version of the baseline standard

36. The methodology is only applicable if the identified BAU scenario is (a) Continuation of the historical situation (pre-activity scenario). If scenario (d) is selected, activity proponents shall indicate how the methodology can be applied to the identified scenario. Proponents shall justify the choice of the selected scenario and also how this is conservative. When multiple options are available, i.e. several BAU scenarios are plausible, the most conservative shall be selected. In the selection of the scenario, all applicable (or scheduled to entry into force) legal requirements, policies and national/sub-national targets shall be considered (as described in Section B5.5.2).

10.4.1 Calculation of the conservative BAU emissions

37. For this purpose, this methodology will apply to BAU scenario (a)scenario and activity proponents shall identify the conservative BAU baseline as follows:

(a) Through the following step-wise procedure:

i. Determine the uncertainty at the lower bound of the uncertainty interval relative to the central estimate of the ex-ante quantified BAU net baseline emissions and/or removals during the first crediting period ($UNC_{BAU,CP1,y}$). The determination of the uncertainty shall consider all causes of uncertainty as per paragraph 13 in Appendix 1 of the baseline standard;

ii. Determine the conservative BAU baseline emissions based on uncertainty for the relevant year or period ($BAU_{cons,UNC,y}$), as follows;

$$BAU_{cons,UNC,y} = BAU_y \times \left(1 - UNC_{BAU,CP1,y}\right) \quad \mathbf{7}$$

Where:

$BAU_{cons,UNC,y}$	=	Uncertainty at the lower bound of the uncertainty interval relative to the central estimate of the ex-ante quantified most likely net BAU baseline emissions and/or removals during the first crediting period year y (fraction)
$UNC_{BAU,CP1,y}$	=	Conservative BAU baseline emissions based on uncertainty in year y
BAU_y	=	Most likely net BAU baseline emissions in year y

iii. Determine the minimum conservative value of the BAU baseline during the first crediting period as follows:

$$BAU_{cons,min,y} = BAU_y \times \left(BAU_y - AE_y\right) \times 0.1 \quad \mathbf{8}$$

Where:

$BAU_{cons,min,y}$	=	Minimum conservative BAU baseline emissions in year y
AE_y	=	Activity emissions in year y

iv. Compare the conservative BAU baseline emissions and/or removals based on uncertainty (BAU_{cons},UNC,y) and the minimum conservative BAU baseline emissions and/or removals ($BAU_{cons,min,y)}$) and select the lower as the conservative BAU baseline emissions;

$$BAU_{cons,,y} = min\left(BAU_{cons,min,y}, BAU_{cons,UNC,y}\right) \quad \mathbf{9}$$

Where:

$BAU_{cons,,y}$	=	Conservative BAU baseline emissions in year y

38. Where BAU emissions are determined based on the quantity of CH4 emitted through physical leaks that are detected prior to being repaired as part of the project activity (i.e., by the advanced LDAR program).

BAU Baseline emissions are calculated as follows:

$$BAU_y = \left\{ConvFactor\ x\ \textstyle\sum_j\left[F_{CH4,j}\ \ x\ T_{j,y}\ x\left(1 - UR_j\right)\right] x\ GWP_{CH4}\right\} \quad \mathbf{10}$$

Where:

BAU_y	=	BAU Baseline emissions for crediting year *y* (t CO_2e)
ConvFactor	=	Conversion factor to convert Nm³ CH_4 into t CH_4

j	=	All physical leaks that are included in the project activity for which physical leaks were detected and repaired and which would leak in the baseline scenario during the crediting year *y*
$F_{CH4,j}$	=	Measured flow rate of methane for the physical leak *j* from the leaking component (m^3 CH_4 / h)
UR_j	=	Uncertainty range for the flow rate measurement method applied to physical leak *j*
$T_{j,y}$	=	The time the relevant component, in which physical leak *j* occurred, would leak in the baseline scenario and would be eligible for crediting during the crediting year *y* (hours)
GWP_{CH4}	=	The global warming potential of methane valid for the commitment period (t CO_2e / t CH_4)
y	=	Project year

The uncertainty related to the conversion factor is zero, as this is a well-known chemical unit conversion. In addition, the GWP is a given factor determined by the best science available from the IPCC and also has minimal uncertainty. The uncertainty related to the variable of time is also negligible as the hours of operation are typically well know and tracked. However, the measurements of the flow rate of methane are subject to the uncertainty given the stated accuracy of the equipment itself. This is mitigated by ensuring the equipment remains calibrated within the manufacturer's recommended period prior to measurement. It is addressed as follows to ensure a to a 95% confidence interval that the calculation of the baseline is conservative.

The uncertainty of the measurement is taken into account conservatively by using the flow rate at the lower end of the uncertainty range of the measurement at a 95% confidence interval for baseline emissions from leaks. For example, if the measured flow rate is 1 m^3/h and the uncertainty range of the measurement method is ±10%, emissions reductions shall be calculated based on a flow rate of 0.9 m^3/h. Given the large quantity of measurements potentially involved in the baseline study, calculation methods provided in the 2006 IPCC Guidelines to calculate UR using the combined uncertainties of all measurements can be used.

The following assumption should be made in the calculation of baseline emissions:

For parts of components where no physical leaks were detected at the initial survey and where a leak or leaks were detected during a subsequent survey, baseline emissions shall be accounted from the moment when the leak was detected and measured;

Baseline emissions from a specific leak j or a specific component r are included in the calculations until whichever of the following occurs first:

- The equipment concerned is replaced for a non-leak related reason (i.e. it breaks down); or
- The end of the crediting period of the overall project activity.

The BAU scenario and quantification of the BAU emissions and/or removals shall be determined:

(a) Ex ante in the PDD at the start of the first crediting period for the same duration as the crediting period of the proposed Article 6.4 activity, specifying the BAU emissions and/or removals for each calendar year within the crediting period; and
(b) Ex post for each calendar year within the crediting period.

The BAU scenario shall be redetermined at each crediting period renewal following the same approach as described above.

10.5 Comparison of the downward adjusted baseline and the conservative business-as-usual baseline

39. Activity participants shall compare, ex-ante in the project design document, the following

(a) The downward adjusted baseline ($BE_{adj,y}$); and

(b) The conservative BAU baseline ($BAU_{cons,,y}$)

Where the ex-ante conservative BAU baseline emissions and/or removals is lower than the ex-ante downward adjusted baseline for any calendar year or cumulatively over the crediting period, then the activity participant shall return the determination of the downward adjusted baseline and revise the quantitative methods and factors to determine the downward adjustment, to ensure that the downward adjusted baseline is lower than the conservative BAU baseline for each calendar year and cumulatively for the crediting period.

40. Activity participants shall compare, ex-post in monitoring reports, for each individual calendar year during the crediting period, the ex-post calculated downward adjusted baseline for the year and the ex-post calculated conservative BAU baseline for the same year and confirm that the downward adjusted baseline is lower than the conservative BAU baseline. If it is not, then the conservative BAU baseline shall be used for that calendar year.

11. Activity scenario

11.1 Calculation of activity emissions

41. Project emissions include emissions from physical leaks that take place on components included in the project boundaries in the following cases:

- If a repair of a physical leak ceases to function and is not immediately repaired, for as long as it is not repaired again; or
- If a new physical leak is detected in a component which was part of the initial survey and for which no physical leak was detected during that survey, as long as that physical leak is not repaired.

Project emissions are calculated as follows:

$$PE_y = ConvFactor \times \sum_z \left[F_{CH4,z} \times T_z \times (1 + UR_z)\right] \times GWP_{CH4} \quad (11)$$

Where:

PE_y	=	Project emissions in crediting year *y* (tCO_2e)
ConvFactor	=	Conversion factor to convert Nm^3 CH_4 into t CH_4
Z	=	All leaks that are accounted for as project emissions during the crediting year *y*
$F_{CH4,z}$	=	The leak flow rate of methane for the physical leak *z* from the leaking component (Nm^3CH_4/h)
UR_z	=	The uncertainty range for the measurement method applied to leak *z*
T_z	=	The time the relevant previously repaired component has continued leaking after monitoring measurement during the crediting year *y* (hours)
GWP_{CH4}	=	Global warming potential of methane valid for the commitment period (t CO_2e / t CH_4)

The uncertainty of the measurement is taken into account conservatively by using the flow rate at the upper end of the uncertainty range of the measurement at a 95% confidence interval for project emissions from leaks. For example, if the measured flow rate is 1 m^3/h and the uncertainty range of a measurement is ±10%, emissions reductions will be calculated at an effective flow rate of 1.1 m^3/h. Given the large quantity of measurements potentially involved, calculation methods provided in the 2006 IPCC Guidelines to calculate UR using the combined uncertainties of all measurements can be used.

The following assumptions should be made in the calculation of project emissions:

If a repair of a physical leak ceases to function, it is conservatively assumed that the leak resumed at the lowest of either:

- At the same flow rate that was measured prior to its repair when using only leak detection equipment;
- At the newly measured leak rate up to the original measured leak rate if the leak is re-measured using leak measurement equipment at the time of monitoring;

For parts of components where no physical leak was detected at the initial survey and where physical leak(s) were detected during subsequent survey, project emissions from these components shall be accounted from the moment when the leak was detected if they are not immediately repaired;

Project emissions from a specific physical leak are included in the calculations until whichever of the following is earlier:

- The date of any repair of the physical leak, as long as the repair does not cease to function; or
- The equipment concerned is replaced (i.e. it breaks down).

42. The data is based on actual measurements using equipment calibrated as per manufacturers specifications for every leak and does not rely on sampling. The data is held and tracked using four redundant data streams which can be cross-checked against any leak repair included in the database calculating. The advanced LDAR approach is based on the best practices promoted by the US Environmental Protection Agency, the Global Methane Initiative[3] and numerous other international bodies seeking to drive methane emission reductions in this sector. The GWP is based on the latest IPCC Guidelines.

12. Leakage

12.1 Identification of leakage emission sources

43. The repair of gas leaks throughout gas transmission and distribution systems has little likelihood of any leakage occurring and any leakage that does occur would most likely result in reduced emissions thereby increasing the emission reductions claimed. So not considering leakage is a conservative choice.

Rationale:

As leaks are repaired on existing equipment and components, there will be no continued use or transfer of equipment beyond the activity boundary.

44. The repair materials and other equipment will be paid for and purchased specifically for this project and there are no competing uses for the repair material and other equipment for the project that would alter emissions outside the project boundary.

Repair of leakage in an existing gas transmission and/or distribution system will in no way lead to leaks relocating outside the system. The leaks are repaired and the system continues to operate as normal.

Reducing gas leakage in the gas transmission and distribution systems allows the same economic output and use of the gas to occur at the end of the pipeline while requiring less gas to be added to the system. However, by reducing the natural gas input needed to provide the end user the same delivered amount of gas could lead to a reduction in overall demand for gas or allow previously suppressed demand to be met. Additionally, the project activity is likely to lead to positive

[3] https://www.globalmethane.org/training/ldar-mod2/story.html

leakages (further emission reductions) as there are numerous emissions and methane leakages that occur in upstream gas extraction and processing. These upstream emissions would have occurred if the leaks in the transmission/distribution system had not been repaired and more gas was required to meet demand. The relatively miniscule amount of potential gas savings from leak reductions in comparison to the total amount delivered by the gas utilities themselves, let alone to regional and global gas markets, makes any price change from leak reduction that could drive additional use implausible. Therefore, not considering leakages in the methodology should be considered conservative. This means there is not likely to be any rebound effect as while the saved gas will be consumed as energy instead of being a direct emission, it will be offset through less gas input into the system needed to achieve the same economic outcome.

12.2 Avoidance or minimization of leakage

45. There is no negative leakage from this project type.

46. The only plausible source of leakage is positive from reduced upstream demand from less methane escaping as leaks.

12.3 Addressing leakage emissions

47. Leakage will conservatively be considered zero.

48.

13. Emission reductions

49. Emission reductions are calculated as follows:

$$ER_y = (AF_y * BE_{adj,y}) - PE_y) \quad \textbf{12}$$

50.

Where:

ER_y	=	Emission reductions for crediting year *y* (tCO_2e)
AF_y	=	Adjustment Factor (%)
$BE_{adj,y}$	=	Baseline emissions for crediting year *y* (tCO_2e)
PE_y	=	Project emissions for crediting year *y* (tCO_2e)

14. Data and parameters not monitored

Data/parameter	**>>** GWP_{CH4}
Description	>> Global warming potential of CH_4
Data unit	>> t CO_{2e} / t CH_4
Equations referred	>> 1, 2, 7
Purpose of data	☒ Baseline emissions / removals ☒ Project emissions / removals ☐ Leakage emissions *Tick the applicable box(es).*
Value(s) applied	>> latest IPCC values shall be used as agreed by the CMA.
Source of data	☐ Measured ☒ Other sources *Tick the applicable box. 'Other sources' include official statistics, expert judgment, proprietary data,* ***IPCC****, commercial and scientific literature, etc.*

Choice of data or measurement methods and procedures	>> Project participants shall update GWPs according to any decisions by the SBM or as per latest report from IPCC going forward
Treatment of uncertainty	>> This is a value provided by the IPCC and is considered to be certain for the purposes of this calculation.
Additional comments	**Decision -/CMA.3** *Clarifies* that the 100-year time-horizon global warming potential values referred to in decision 18/CMA.1, annex, paragraph 37, shall be those listed in table 8.A.1 of the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, excluding the value for fossil methane. Standard: Article 6.4 activity standard for projects (ver2.0, para 13)_13. activity participants shall use the 100-year time-horizon global warming potentials (GWPs) from the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) as contained in Appendix 1, or 100-year time-horizon GWP values from a subsequent IPCC assessment report as agreed upon by the CMA.

Data/parameter	**>>** ConvFactor
Description	>> The factor to convert Nm³ CH4 into t CH4
Data unit	>> t CH_4 / Nm^3 CH_4
Equations referred	>> 1, 2, 7
Purpose of data	☒ Baseline emissions / removals ☒ Project emissions / removals ☐ Leakage emissions *Tick the applicable box(es).*
Value(s) applied	>> 0.0007168
Source of data	☐ Measured ☒ Other sources *Tick the applicable box. 'Other sources' include official statistics, expert judgment, proprietary data,* ***IPCC****, commercial and scientific literature, etc.*
Choice of data or measurement methods and procedures	The leak flow rate (FCH4,j) and conversion factor (ConvFactor) should be reduced to the same reference conditions. At standard temperature and pressure (i.e., 0 degree Celsius and 101.3 kPa) in its leak flow rate (FCH4,j) measurements. As such, a conversion factor (ConvFactor) of 0.0007168 reflects the methane density at 0 degree Celsius and 101.3 kPa, which is derived by dividing the methane density at standard conditions by Avogadro constant (22.414 l/mol). For example, if local industry's "normal conditions" defined as 20 degree Celsius and 101.3 kPa, a value of 0.00067 (IPCC 2006 Vol.2, p. 4.12) is used to convert from Nm³ CH_4 into t CH_4, and the flow rate should be determined for reference conditions of 20 degree Celsius and 101.3 kPa
Treatment of uncertainty	>> This is a standard conversion of units of measurement. There is no uncertainty but an uncertainty factor is applied to the final result based on the combined uncertainty associate with the measurements.

Additional comments	

2. Data and parameters monitored

Data/parameter		**>>** $T_{j,y}$
Description		>> The time the relevant component, in which physical leak *j,* occurred, would leak in the baseline scenario and would be eligible for crediting during the crediting year *y* (hours)
Data unit		>> Hours.
Equations referred		>> 1,2
Purpose of data		☒ Baseline emissions / removals ☐ Project emissions / removals ☐ Leakage emissions *Tick the applicable box(es).*
Measurement and updating frequency		>> ongoing
Measurement methods and procedures		>> Any outages or interruptions in operations will be recorded
Entity/person responsible for the measurement		>> The Gas Utility will track and record any outages that reduce the hours of operation for components within the project boundary.
Measuring instrument(s)	*Type of instrument*	>> *Not specified at methodological level*
	Accuracy class	>> *Not specified at methodological level*
	Calibration requirements	>> *Not specified at methodological level*
	Location	>> *Not specified at methodological level*
QA/QC procedures		>> Any outages resulting from system repairs will be documented and logged in the project database in the form of a reduction in the time of operation. To be clear, if an unrelated activity requires the shut-down of an already repaired piece of equipment, the hours of operation for every piece of affected equipment with be reduced in the database for the entire duration of the shut-down. Any other unscheduled shutdown will also be timed and accounted for through a reduction of operating hours
Treatment of uncertainty		>> The hours of operation of gas systems is a well-known value with little room for error. There is little uncertainty but an uncertainty factor is applied to the final result based on the combined uncertainty associate with the measurements.
Additional comment		>>

Data/parameter	**>>** T_z

Description	>> The time the relevant previously repaired component has continued leaking after monitoring measurement during the crediting year *y* (hours)	
Data unit	>> Hours.	
Equations referred	>> 7	
Purpose of data	☐ Baseline emissions / removals ☒ Project emissions / removals ☐ Leakage emissions *Tick the applicable box(es).*	
Measurement and updating frequency	>> ongoing	
Measurement methods and procedures	>> Any outages or interruptions in operations will be recorded	
Entity/person responsible for the measurement	>> The Gas Utility will track and record any outages that reduce the hours of operation for components within the project boundary.	
Measuring instrument(s)	*Type of instrument*	>> *Not specified at methodological level*
	Accuracy class	>> *Not specified at methodological level*
	Calibration requirements	>> *Not specified at methodological level*
	Location	>> *Not specified at methodological level*
QA/QC procedures	>> Any outages resulting from system repairs will be documented and logged in the project database in the form of a reduction in the time of operation. To be clear, if an unrelated activity requires the shut-down of an already repaired piece of equipment, the hours of operation for every piece of affected equipment with be reduced in the database for the entire duration of the shut-down. Any other unscheduled shutdown will also be timed and accounted for through a reduction of operating hours	
Treatment of uncertainty	>> The hours of operation of gas systems is a well-known value with little room for error. There is little uncertainty but an uncertainty factor is applied to the final result based on the combined uncertainty associate with the measurements.	
Additional comment	>> -	

Data/parameter	**>>** Temperature and pressure of natural gas
Description	>> Temperature and pressure of natural gas
Data unit	>> ºC and kPa
Equations referred	>> *1,2,7 (in case measuring device does not already account for temp and pressure)*
Purpose of data	☒ Baseline emissions / removals ☒ Project emissions / removals ☐ Leakage emissions *Tick the applicable box(es).*

Measurement and updating frequency	>> At the time of each leak measurement	
Measurement methods and procedures	>> *Not specified at methodological level*	
Entity/person responsible for the measurement	>> *The operator taking the leak measurements will take any measurements required.*	
Measuring instrument(s)	*Type of instrument*	>> *Not specified at methodological level*
	Accuracy class	>> *Not specified at methodological level*
	Calibration requirements	>> *Not specified at methodological level*
	Location	>> *Not specified at methodological level*
QA/QC procedures	>> Data measurement equipment will be calibrated and double checked on a regular basis. The manufacturer's recommended calibration procedures shall be applied	
Treatment of uncertainty	>> An uncertainty factor is applied to the final result based on the combined uncertainty associate with the measurements.	
Additional comment	>> The typical volumetric methane flow measurement equipment used to measure leakage provides results already established at standard temperature and pressure (0 degree Celsius and 101.3 kPa) so no separate measurements would be needed in this case.	

Data/parameter	**>>** *UR_j*	
Description	>> The uncertainty range for the measurement method applied to leak j	
Data unit	>> Fraction	
Equations referred	>> 1, 2	
Purpose of data	☒ Baseline emissions / removals ☐ Project emissions / removals ☐ Leakage emissions *Tick the applicable box(es).*	
Measurement and updating frequency	>> *Periodically calculated for each monitoring period using the manufacturer's specified uncertainty range for the volumetric leak flow measurements taken.*	
Measurement methods and procedures	>> Estimated, where possible, at a 95% confidence interval, consulting the 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.	
Entity/person responsible for the measurement	>> *Not specified at methodological level*	
Measuring instrument(s)	*Type of instrument*	>> *Not specified at methodological level*

	Accuracy class	>> *Not specified at methodological level*
	Calibration requirements	>> *Not specified at methodological level*
	Location	>> *Not specified at methodological level*
QA/QC procedures	>> *Not specified at methodological level*	
Treatment of uncertainty	>> This is the calculation of uncertainty factor based on a 95% level of confidence that is applied to the final result based on the combined uncertainty associate with the measurements.	
Additional comment	>>	

Data/parameter	**>>** *UR_z*	
Description	>> The uncertainty range for the measurement method applied to leak z	
Data unit	>> Fraction	
Equations referred	>> 7	
Purpose of data	☐ Baseline emissions / removals ☒ Project emissions / removals ☐ Leakage emissions *Tick the applicable box(es).*	
Measurement and updating frequency	>> *Periodically calculated for each monitoring period using the manufacturer's specified uncertainty range for the volumetric leak flow measurements taken.*	
Measurement methods and procedures	>> Estimated, where possible, at a 95% confidence interval, consulting the 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.	
Entity/person responsible for the measurement	>> *Not specified at methodological level*	
Measuring instrument(s)	*Type of instrument*	>> *Not specified at methodological level*
	Accuracy class	>> *Not specified at methodological level*
	Calibration requirements	>> *Not specified at methodological level*
	Location	>> *Not specified at methodological level*
Measurement intervals	>> *Periodically calculated for each monitoring period using the manufacturer's specified uncertainty range for the volumetric leak flow measurements taken.*	
QA/QC procedures	>> *Not specified at methodological level*	

Treatment of uncertainty	>> This is the calculation of uncertainty factor based on a 95% level of confidence that is applied to the final result based on the combined uncertainty associate with the measurements.
Additional comment	>>

Data/parameter	**>>** $UNC_{BE\ act,CP1}$	
Description	>> Uncertainty that impact the baseline $BE_{Act\ ,y}$ based on the data and calculation methods used not including measurement uncertainties as these are already conservatively accounted for in the measurement of the pre downward adjustment factor baseline.	
Data unit	>> Fraction	
Equations referred	>> 3	
Purpose of data	☒ Baseline emissions / removals ☐ Project emissions / removals ☐ Leakage emissions *Tick the applicable box(es).*	
Measurement and updating frequency	>> *Periodically calculated for each monitoring period using the manufacturer's specified uncertainty range for the volumetric leak flow measurements taken.*	
Measurement methods and procedures	>> Estimated, where possible, at a 95% confidence interval.	
Entity/person responsible for the measurement	>> *Not specified at methodological level*	
Measuring instrument(s)	*Type of instrument*	>> *Not specified at methodological level*
	Accuracy class	>> *Not specified at methodological level*
	Calibration requirements	>> *Not specified at methodological level*
	Location	>> *Not specified at methodological level*
QA/QC procedures	>> *Not specified at methodological level*	
Treatment of uncertainty	>> This is the calculation of uncertainty factor based on a 95% level of confidence that is applied to the final result based on the combined uncertainty associate with the measurements.	
Additional comment	>> It is expected that based on the approach outlined in the methodology, the only uncertainty that will affect the baseline calculation is the uncertainty related to leak measurements. The combined uncertainty UR_j however is already conservatively accounted for in the $BE_{Act\ ,y}$ calculation. In the case another project specific uncertainty is identified by the project developer after assessing all causes of uncertainty as per paragraph 13 of section 4 in Appendix 1, the activity developer will assess that uncertainty and quantify the uncertainty to a 95% level of confidence. The value will be taken at the lower bound of the uncertainty interval relative to the central estimate of the	

	ex-ante quantified unadjusted net baseline emissions during the first crediting period for any other project uncertainty identified.

Data/parameter	**>>** $F_{CH4,\,j}$	
Description	>> *The leak flow rate of methane for leak (j) from the leaking component*	
Data unit	>> m^3CH_4/h	
Equations referred	>> *1, 2, 9,10*	
Purpose of data	☒ Baseline emissions / removals ☐ Project emissions / removals ☐ Leakage emissions *Tick the applicable box(es).*	
Measurement and updating frequency	>> *At least once per monitoring period.*	
Measurement methods and procedures	>> Procedures required by manufactures of the equipment used to measure leak flow rates should be followed	
Entity/person responsible for the measurement	>> *A trained project implementor will take the measurements required.*	
Measuring instrument(s)	*Type of instrument*	>> *Not specified at methodological level but options listed in Section B12.3.*
	Accuracy class	>> *Not specified at methodological level*
	Calibration requirements	>> *The calibration procedures and frequency as recommended by the measurement equipment manufacturer shall be followed.*
	Location	>> *Not specified at methodological level*
QA/QC procedures	>> Two measurements will be taken for every leak and the more conservative of the two (the lower measurement) will be used in the calculations. This will allow the operator to double check the readings and ensure a conservative result.	
Treatment of uncertainty	>> This value is adjusted by an uncertainty factor based on a 95% level of confidence that is applied to the final result based on the combined uncertainty associate with the measurements.	
Additional comment	>> The leak flow rate ($F_{CH4,j}$) and conversion factor (*ConvFactor*) should be corrected to the same reference temperature and pressure conditions. For example if value of 0.00067 (IPCC 2006 Vol.2, p. 4.12) is used to convert from m^3 CH_4 into t CH_4, then the flow rate should corrected to reference conditions of 20 degree Celsius and 101.3 kPa	

Data/parameter	**>>** $F_{CH4,\,z}$
Description	>> *The leak flow rate of methane for leak (z) from the leaking component*
Data unit	>> m^3CH_4/h
Equations referred	>> 7
Purpose of data	☐ Baseline emissions / removals ☒ Project emissions / removals ☐ Leakage emissions *Tick the applicable box(es).*

Measurement and updating frequency	>> *At least once per monitoring period.*	
Measurement methods and procedures	>> Procedures required by manufactures of the equipment used to measure leak flow rates should be followed	
Entity/person responsible for the measurement	>> A trained project implementor will take the measurements required.	
Measuring instrument(s)	*Type of instrument*	>> *Not specified at methodological level but options listed in Section B12.3.*
	Accuracy class	>> *Not specified at methodological level*
	Calibration requirements	>> *The calibration procedures and frequency as recommended by the measurement equipment manufacturer shall be followed.*
	Location	>> *Not specified at methodological level*
QA/QC procedures	>>Two measurements will be taken for every leak and the more conservative of the two (the higher measurement) will be used in the calculations.	
Treatment of uncertainty	>> This value is adjusted by an uncertainty factor based on a 95% level of confidence that is applied to the final result based on the combined uncertainty associate with the measurements.	
Additional comment	>> The leak flow rate ($F_{CH4,j}$) and conversion factor (*ConvFactor*) should be corrected to the same reference temperature and pressure conditions. For example if value of 0.00067 (IPCC 2006 Vol.2, p. 4.12) is used to convert from m³ CH_4 into t CH_4, then the flow rate should corrected to reference conditions of 20 degree Celsius and 101.3 kPa	

Data/parameter	**>>**, $w_{CH4,i,y}$,	
Description	>> Average mass fraction of methane in the natural gas/for crediting year *y*	
Data unit	>> kg CH_4/kg gas	
Equations referred	>> *9,10*	
Purpose of data	☒ Baseline emissions / removals ☒ Project emissions / removals ☐ Leakage emissions *Tick the applicable box(es).*	
Measurement and updating frequency	>> *At least once per monitoring period.*	
Measurement methods and procedures	>> For the purpose of determining average mass fraction of methane, a natural gas sample should be collected and chemical analysis should be made in the laboratory	
Entity/person responsible for the measurement	>> *Gas Utility should provide this information*	
Measuring instrument(s)	*Type of instrument*	>> *Not specified at methodological level*
	Accuracy class	>> *Not specified at methodological level*

	Calibration requirements	>> *Not specified at methodological level*
	Location	>> *Not specified at methodological level*
QA/QC procedures	>> *This value may be realized automatically by the measurement equipment.*	
Treatment of uncertainty	>> This value is adjusted by an uncertainty factor based on a 95% level of confidence that is applied to the final result based on the combined uncertainty associate with the measurements.	
Additional comment	>>	

Data/parameter	**>>** $F_{purge,i}$	
Description	>> The purge flow rate of the clean air or nitrogen at leak *i*	
Data unit	>> m^3/h	
Equations referred	>> *9*	
Purpose of data	☒ Baseline emissions / removals ☒ Project emissions / removals ☐ Leakage emissions *Tick the applicable box(es).*	
Measurement and updating frequency	>> *At least once per monitoring period.*	
Measurement methods and procedures	>> Procedures requires by manufactures of the equipment used to measure leak flow rates should be followed	
Entity/person responsible for the measurement	>> *Not specified at methodological level*	
Measuring instrument(s)	*Type of instrument*	>> *Not specified at methodological level*
	Accuracy class	>> *Not specified at methodological level*
	Calibration requirements	>> *Not specified at methodological level*
	Location	>> *Not specified at methodological level*
QA/QC procedures	>> *Not specified at methodological level*	
Treatment of uncertainty	>> This value is adjusted by an uncertainty factor based on a 95% level of confidence that is applied to the final result based on the combined uncertainty associate with the measurements.	
Additional comment	>> The purge flow rate and leak flow rate should be corrected to the same reference temperature and pressure conditions	

Data/parameter	**>>** $w_{sampleCH4,i}$
Description	>> The concentration of methane in the sample flow from leak *i*

Data unit	>> volume percent	
Equations referred	>> *10*	
Purpose of data	☒ Baseline emissions / removals ☒ Project emissions / removals ☐ Leakage emissions *Tick the applicable box(es).*	
Measurement and updating frequency	>> *At least once per monitoring period.*	
Measurement methods and procedures	>> For the purpose of determining average mass fraction of methane, a natural gas or refinery gas sample should be collected and chemical analysis should be made in the laboratory	
Entity/person responsible for the measurement	>> *Gas Utility should provide this information*	
Measuring instrument(s)	*Type of instrument*	>> *Not specified at methodological level*
	Accuracy class	>> *Not specified at methodological level*
	Calibration requirements	>> *Not specified at methodological level*
	Location	>> *Not specified at methodological level*
QA/QC procedures	>>	
Treatment of uncertainty	>> This value is adjusted by an uncertainty factor based on a 95% level of confidence that is applied to the final result based on the combined uncertainty associate with the measurements.	
Additional comment	>>	

Data/parameter	**>>** V_{bag}	
Description	>> Volume of calibrated bag used for measurement	
Data unit	>> m^3	
Equations referred	>> *10*	
Purpose of data	☒ Baseline emissions / removals ☒ Project emissions / removals ☐ Leakage emissions *Tick the applicable box(es).*	
Measurement and updating frequency	>> *At least once per monitoring period.*	
Measurement methods and procedures	>> *Provided by the manufacturer*	
Entity/person responsible for the measurement	>> *manufacturer*	
Measuring instrument(s)	*Type of instrument*	>> *Not specified at methodological level*

	Accuracy class	>> *Not specified at methodological level*
	Calibration requirements	>> *Not specified at methodological level*
	Location	>> *Not specified at methodological level*
QA/QC procedures	>>	
Treatment of uncertainty	>> This value is adjusted by an uncertainty factor based on a 95% level of confidence that is applied to the final result based on the combined uncertainty associate with the measurements.	
Additional comment	>>	

Data/parameter	**>>** $t_{aver,i}$	
Description	>> Average bag fill time for leak *i*	
Data unit	>> seconds	
Equations referred	>> *10*	
Purpose of data	☒ Baseline emissions / removals ☒ Project emissions / removals ☐ Leakage emissions *Tick the applicable box(es).*	
Measurement and updating frequency	>> *At least once per monitoring period.*	
Measurement methods and procedures	>> Procedures required by manufactures of the equipment used to measure leak flow rates should be followed	
Entity/person responsible for the measurement	>> *Not specified at methodological level*	
Measuring instrument(s)	*Type of instrument*	>> *Not specified at methodological level*
	Accuracy class	>> *Not specified at methodological level*
	Calibration requirements	>> *Not specified at methodological level*
	Location	>> *Not specified at methodological level*
QA/QC procedures	>>	
Treatment of uncertainty	>> This value is adjusted by an uncertainty factor based on a 95% level of confidence that is applied to the final result based on the combined uncertainty associated with the measurements.	
Additional comment	>>	

Data/parameter	**>>** AF_y
Description	>> Downward adjustment factor applied to the baseline in a given project year y

Data unit	>> percentage	
Equations referred	>> *6*	
Purpose of data	☒ Baseline emissions / removals ☐ Project emissions / removals ☐ Leakage emissions *Tick the applicable box(es).*	
Measurement and updating frequency	>> *At least once per monitoring period.*	
Measurement methods and procedures	>> calculated as per B5.5.5	
Entity/person responsible for the measurement	>> *Not specified at methodological level*	
Measuring instrument(s)	*Type of instrument*	>> *Not specified at methodological level*
	Accuracy class	>> *Not specified at methodological level*
	Calibration requirements	>> *Not specified at methodological level*
	Location	>> *Not specified at methodological level*
QA/QC procedures	>>	
Treatment of uncertainty	>> This value is used to adjust the actual results downward to get a more conservative result and will be considered as certain in the application of the methodology.	
Additional comment	>>	

Data/parameter	**>>** PY	
Description	>> The numeric year of the project	
Data unit	>> project year number	
Equations referred	>> 6	
Purpose of data	☒ Baseline emissions / removals ☐ Project emissions / removals ☐ Leakage emissions *Tick the applicable box(es).*	
Measurement and updating frequency	>> *Not specified at methodological level*	
Measurement methods and procedures	>> *Not specified at methodological level*	
Entity/person responsible for the measurement	>> *Not specified at methodological level*	
Measuring instrument(s)	*Type of instrument*	>> *Not specified at methodological level*

	Accuracy class	>> *Not specified at methodological level*
	Calibration requirements	>> *Not specified at methodological level*
	Location	>> *Not specified at methodological level*
QA/QC procedures	>>	
Treatment of uncertainty	>> There is no uncertainty with the number of project year.	
Additional comment	>> The numeric year of the project (ie 1-10 in a 10 year project period) with the first year beginning with the start date of the first crediting period. A pro-rata approach may be used to determine this value if monitoring periods fall during more than one of the project years.	

Data/parameter	**>>** HCR	
Description	>> Host Country gas transmission/distribution reduction goal as stated in the Host Country NDC	
Data unit	>> percentage reduction (%)	
Equations referred	>> *6*	
Purpose of data	☒ Baseline emissions / removals ☐ Project emissions / removals ☐ Leakage emissions *Tick the applicable box(es).*	
Measurement and updating frequency	>> *Not specified at methodological level*	
Measurement methods and procedures	>> *Not specified at methodological level*	
Entity/person responsible for the measurement	>> *Not specified at methodological level*	
Measuring instrument(s)	*Type of instrument*	>> *Not specified at methodological level*
	Accuracy class	>> *Not specified at methodological level*
	Calibration requirements	>> *Not specified at methodological level*
	Location	>> *Not specified at methodological level*
QA/QC procedures	>>	
Treatment of uncertainty	>> There is no uncertainty with the value stated in the NDC.	
Additional comment	>>	

Data/parameter	**>>** TRGY
Description	>> Total Reduction Goal Year is the number of years the Host Country has delineated to meet its Reduction Goals in its NDC.

Data unit	>> number of years	
Equations referred	>> *6*	
Purpose of data	☒ Baseline emissions / removals ☐ Project emissions / removals ☐ Leakage emissions *Tick the applicable box(es).*	
Measurement and updating frequency	>> *Not specified at methodological level*	
Measurement methods and procedures	>> *Not specified at methodological level*	
Entity/person responsible for the measurement	>> *Not specified at methodological level*	
Measuring instrument(s)	*Type of instrument*	>> *Not specified at methodological level*
	Accuracy class	>> *Not specified at methodological level*
	Calibration requirements	>> *Not specified at methodological level*
	Location	>> *Not specified at methodological level*
QA/QC procedures	>>	
Treatment of uncertainty	>> There is no uncertainty with the value stated in the NDC of period to reach goals.	
Additional comment	>>	

15.1 Frequency of submission of monitoring reports

51. There is no risk of reversals and this is not a removal activity. For activities involving removals and for emission reduction activities with risks of reversals there is no prescribed period.

16. Methodologies principles

16.1 Encouraging ambition over time

52. The activity supports practices that would not otherwise be implemented in the host country, thereby leading to higher emissions,

Advanced LDAR programs need to continue operations during the entire life span of the gas distribution/transportation system to maximize the leak reduction benefits. Ongoing visits by the project team to components inside the project boundary throughout the project period will encourage the identification and repair of additional leaks throughout the project period.

In addition, the project activity should demonstrate how it is leveraging its investment in training, local capacity building, and sharing of mitigation benefits, to facilitate the continuation of the advanced LDAR activity beyond the conclusion of the project period.

This methodology includes a downward adjustment to the baseline emission that increases ambition over time. Countries can increase ambition also through more stringent NDCs targets that increase the downward adjustment.

The methodology does not lead to any perverse incentive, i.e. the quantity of gas sold by the Gas Utility operating the system will not change due to the leak detection and repair. The demand for natural gas is not determined by the operator, but rather by customers and it is not affected by the LDAR implementation. Identifying and repairing the leaks in the system would only result in a reduction of the quantity of natural gas that is needed to satisfy the same demand from customers.

16.2 Contributing to the equitable sharing of mitigation benefits between participating Parties

53. It is noted that the repairs made to the gas transmission/distribution systems will continue to provide emission reduction benefits long after the crediting period for A 6.4. Therefore, the Host Country will benefit from the project long after the end of the Article 6.4 activity´s crediting period.

It is mandatory to use the Sustainable development Tool in the activity design and implementation phase in order to demonstrate that the Article 6.4 mitigation activity supports the achievement of the host country´s sustainable development objectives and negative environmental or social impacts are avoided.

Furthermore, activity participants shall check if the Host Country´s Designated National Authority (DNA) has specified conditions for the equitable sharing of mitigation benefits between the project Parties and will ensure that the host party benefits have been retained.

16.3 Encouraging broad participation

54. By allowing each gas utility to develop a baseline based on actual measurements of their own systems, any gas utility is able to utilize the methodology. The proposed methodology by being accurate, simple, clear, and avoiding complexity, allows a wide range of activity participants and Host Parties to adhere to the methodology requirements irrespective of a Party's scientific infrastructure, or its financial and national circumstances. In addition, the methodology is also applicable to any activity regardless of the size/scale. Also, there is no limitation to the Host countries that could host activities, as long as eligibility criteria are met.

16.4 Attributability of emission reductions or net removals to the Article 6.4 activity

55. The project involves the direct measurement of leaks and the immediate repair of those leaks followed by another measurement to ensure the leak is fully repaired. There is no potential of other exogenous factors playing any role in the emission reductions claimed by projects using this methodology.

16.5 Potential perverse incentives

56. The methodology does not lead to any perverse incentive, i.e. the quantity of gas sold by the Gas Utility operating the system will not change due to the leak detection and repair as it is driven by the customers demand for heating, cooking, etc. which are completely divorced from the advanced LDAR activity.

16.6 Rebound effects

57. Typically, the demand for natural gas is not determined by the operator, but rather by customers and it is not affected by the LDAR implementation. Identifying and repairing the leaks in the system would only result in a reduction of the quantity of natural gas that is needed to satisfy the same demand from customers. Even when considering some sort of plausible rebound effect (i.e. saved gas from repaired leaks is injected into the distribution system and consumed by existing or new customers), customers would utilize for energy purposes the gas that would be otherwise be vented in the atmosphere in absence of the activity. However, this results in a reduction of the climate impacts, as the gas would now be burned for productive uses instead of being emitted as methane. No additional gas would be burned as less gas, equal to the amount that was previously leaking, would need to enter into the gas system to have the exact same economic benefit. The only difference would be the reduction in fugitive emissions.

Lack of rebound effects holds true for non-energy-constrained jurisdictions (gas supply meets or exceeds demand) where it negligible. The proponent will provide evidence on the existence or lack thereof of energy-constraints (i.e. through national statistics, statements from the utility, etc.). For energy-constrained jurisdictions, pursuant to Section 7 of Appendix 1 to the baseline standard, a conservative rebound deduction shall be applied. The proponent shall assume that 100% of gas saved through LDAR activities would be consumed by end-users and shall calculate the corresponding downstream combustion emissions (applying the applicable emission factor for natural gas combustion in $kgCO_2e/m^3$) as a deduction from claimed emission reductions. Alternatively, the proponent may submit documented evidence demonstrating that saved gas would be used to displace a more emissions-intensive fuel/practices, in which case no rebound effect is accounted for and for conservativeness no additional emission reductions are claimed for the fuel switch.

Appendix 1. Monitoring Procedures

1. Establishment of a database

The data is held and tracked using four redundant data streams which can be cross-checked against any leak repair included in the database calculating.

2. Data collection during project implementation

The implementation of the project involves an initial survey and regular subsequent surveys of each component within the project boundary. Increasing the frequency at which physical leak surveys are conducted will tend to increase the level of physical leak control achieved.

3. Monitoring equipment

Project participants may use the following tools to detect the presence of a leak, but not to quantify physical leaks in components:

- **Electronic gas detectors** using small hand-held gas detectors or "sniffing" devices to detect accessible physical leaks. Electronic gas detectors are equipped with catalytic oxidation and thermal conductivity sensors designed to detect the presence of specific gases. Electronic gas detectors can be used on larger openings that cannot be screened by soaping;
- **Organic Vapor Analyzers (OVAs)** and **Toxic Vapor Analyzers (TVAs)** are portable hydrocarbon detectors that can also be used to identify physical leaks. An OVA is a flame ionization detector (FID), which measures the concentration of organic vapors over a range of 0.5 to 50,000 parts per million (ppm). TVAs and OVAs measure the concentration of methane in the area around a physical leak;
- **Acoustic leak detection** using portable acoustic screening devices designed to detect the acoustic signal that results when pressurized gas escapes through an orifice. As gas moves from a high-pressure to a low-pressure environment across a physical leak opening, the turbulent flow produces an acoustic signal, which is detected by a hand-held sensor or probe, and read as intensity increments on a meter. Although acoustic detectors do not measure physical leak rates, they provide a relative indication of leak size – a high intensity or "loud" signal corresponds to a greater leak rate.
- **Optical Gas Imaging Instruments.** There are two general classes of such instruments, active and passive instruments. The active type uses a laser beam that is reflected by the background. The attenuation of the beam passing through a hydrocarbon cloud provides the optical image. The passive type uses ambient illumination to detect the difference in heat radiance of the hydrocarbon cloud. Optical gas imaging instruments do not measure leak rates, but allows faster screening of components than FID detectors.
- **Remote leak sensing devices.** For key pieces of equipment or zones especially on gas transmission systems, remote leak detection devices can monitor real-time for reappeared leakage.

4. One of the following technologies shall be used to measure leak flow rates:

- **Bagging techniques** are commonly used to measure flow rates of physical leaks. The leaking component or leak opening is enclosed in a "bag" or tent. An inert carrier gas such as nitrogen is conveyed through the bag at a known flow rate. Once the carrier gas attains equilibrium, a gas sample is collected from the bag and the methane concentration of the sample is measured. The flow rate of the physical leak from the component is calculated from the purge flow rate through the enclosure and the concentration of methane in the outlet stream as follows:

$$F_{CH4,i} = F_{purge,i} \times w_{CH4,i} \tag{13}$$

Where:

$F_{CH4,i}$	=	The leak flow rate of methane for leak *i* from the leaking component (m^3CH_4/h)
$F_{purge,i}$	=	The purge flow rate of the clean air or nitrogen at leak *i* (m^3/h)
$w_{CH4,i}$	=	The measured mass fraction of methane in the natural gas during the crediting year *y* (kg CH_4 / kg gas)

- **High volume- Leak Measurement Devices or Hi-Flow Samplers™** capture all emissions from a leaking component to 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 obtained by calibrating the hydrocarbon detectors to a range of concentrations of methane-in-air. High volume samplers are equipped with special attachments designed to promote complete emissions capture and to prevent interference from other nearby emissions sources.[4] 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;
- **Calibrated bag** measurements use anti-static bags of known volume (e.g. 0.085 m^3 or 0.227 m^3) with a neck shaped for easy sealing around the vent. Measurement is made by timing the bag expansion to full capacity while also employing a technique to completely capture the leak while the inflation is being timed. The measurement is repeated on the same leak source numerous times (at least 7, typically 7 to 10 times) to ensure a representative average for the fill times (outliers or problem times should be omitted and the tests rerun until a representative average rate is established). The temperature of the gas is measured to allow correction of volume to standard conditions. Additionally, the gas composition is measured to verify the proportion of methane in the vented gas, since in some cases air may also be vented, resulting in a mixture of natural gas and air. Calibrated bags allow for reliable measurement of leak flow rates of more than 250m^3/h. The leak flow rate of methane is calculated as follows:

$$F_{CH4,i} = V_{bag} \times w_{sampleCH4,i} \times 3600 / t_{aver,i} \qquad \textbf{14}$$

Where:

$F_{CH4,i}$	=	The leak flow rate of methane for leak *i* from the leaking component (m^3/h)
V_{bag}	=	Volume of calibrated bag used for measurement (m^3)
$w_{sampleCH4,i}$	=	The concentration of methane in the sample flow from leak *i* (volume percent)
$t_{aver,i}$	=	Average bag fill time for leak *i* (seconds)

5. Monitoring requirements

For each component where a physical leak has occurred, the following information should be collected during regular monitoring checks:

- Date of monitoring;
- An assessment whether the relevant component has been replaced after the repair of the leak;
- The number of hours during which the component is in pressurized natural gas service;
- An assessment whether the repair of the leak functions appropriately.

All information should be added to the database and be included in monitoring reports.

[4] The background concentration must be subtracted from the main sample concentration because it may be elevated due to other leaks in the vicinity of the leak being measured. Variables such as wind speed and wind direction may cause the background concentration to fluctuate, so the background is measured simultaneously with the sample concentration.

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Document information

Version	*Date*	*Description*
0.2.0	19 August 2025	Revision to incorporate new sections and sub-sections in line with current standards; provide completion instructions, realign their sequence, and allow inclusion of explanatory notes.
01.0	18 December 2024	Initial publication of form template.

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