CLEAN DEVELOPMENT MECHANISM

CDM-MP95-A01

Draft Small-scale Methodology

SSC-NM109: Nitrogen as a Fuel Gas Replacement for Pneumatic Devices

Version 01.0

Sectoral scope(s): 10

United Nations
Framework Convention on
Climate Change

COVER NOTE

1. Procedural background

1. This draft new methodology is based on the proposed new small-scale methodology SSC-NM109 "Nitrogen as a Fuel Gas Replacement for Pneumatic Devices", prepared by Jacqueline Peterson. The draft methodology was submitted by a project participant on 23 August 2023 and deemed qualified on 18 September 2023.

2. This submission SSC-NM109 was considered by the Methodologies Panel (MP) in accordance with the procedure "Development, revision and clarification of baseline and monitoring methodologies and methodological tools", version 02.1 (EB 89, Annex 7).

2. Purpose

3. The purpose of this document is to present a new methodology in the oil and gas sector using nitrogen as a replacement instrument gas at upstream oil and gas wellsites.

3. Key issues and proposed solutions

3.1. Applicability

4. The draft methodology is applicable to project activities developed at both on-shore and off-shore upstream oil and gas production facilities. This methodology is not applicable to mid-stream or downstream facilities including refineries and pipelines.

5. This draft methodology is applicable to both Low-Bleed and High-Bleed pneumatic devices at existing upstream oil and gas production facilities that are legally permitted to use fuel gas-driven pneumatic devices, yet voluntarily elect to replace fuel gas with nitrogen which is a non-GHG power gas alternative. The baseline estimates shall not exceed the volume of vent gas that is legally permitted. This methodology is not applicable to oil and gas facilities where pneumatic devices are legally required to be non-emitting at the time of project activities. In jurisdictions with low-bleed controller requirements, sites with high-bleed pneumatic controllers in operations will not be eligible under this methodology.

6. This methodology is not applicable to project activities where flaring of fuel gas is the baseline. The fuel gas previously used as an instrument gas source is turned off and not used once the nitrogen-based pneumatic devices are installed.

3.2. Baseline scenario, baseline emissions and project emissions.

7. The baseline scenario is the use of fuel gas as an instrument gas to actuate pneumatic devices. Following actuation, the fuel gas is vented to the atmosphere. The primary component of fuel gas is methane.

8. The draft methodology proposes to estimate baseline emissions based on the amount of vent gas that would have been emitted in the absence of the project activity. Baseline vent gas is calculated for each wellsite based on the amount of nitrogen consumed and the natural gas composition at the wellsite location. Baseline emissions are only determined

by the quantity of nitrogen used to actuate pneumatic devices and are not impacted by the quantity of nitrogen stored in liquid form at the wellsite. Additionally, nitrogen is not retained in the pneumatic devices following actuation. All nitrogen used directly represent an equivalent volume of fuel gas that otherwise would have been vented.

9. The draft methodology proposes to estimate project emissions due to the production of nitrogen based on the electricity and fuels consumed for heat generation in the process to produce nitrogen. There are no project activity emissions that occur at the wellsite during project activities.

4. Impacts

10. The proposed new methodology will broaden the portfolio of methodological standards in the area of upstream oil and gas production.

5. Subsequent work and timelines

11. The methodology is recommended by the MP for consideration by the Board at its 123rd meeting. No further work is envisaged.

6. Recommendations to the Board

12. The MP recommends the Board to approve the new methodology, to be made effective at the time of the Board's approval.

TABLE OF CONTENTS **Page**

1. Introduction

1. The following table describes the key elements of the methodology:

Table 1. Methodology key elements

Typical project(s)	Activities that involve the replacement of methane by nitrogen in the operation of pneumatic devices at upstream oil and gas wellsites
Type of greenhouse gas (GHG) emissions mitigation action	Fugitive emissions from fuels Replacing High-bleed pneumatic controllers with Low-bleed alternatives

2. Scope, applicability, and entry into force

2.1. Scope

2. Pneumatic devices are used in upstream oil and gas operations to control flows and liquid levels. Natural gas produced onsite is commonly used as an instrument gas to actuate pneumatic pumps and controllers, with methane released every time a device is actuated. Examples of pneumatic devices used in oil and gas include pneumatic valves, actuators, pumps and controllers.

3. Typical measures implemented to reduce GHG emissions from pneumatic devices include replacing High-bleed pneumatic controllers with Low-bleed alternatives. Low-bleed pneumatic controllers can still result in significant aggregated emissions as they do not eliminate the practice of methane venting.

4. One method of eliminating methane venting from upstream wellsites involves electrifying the site and installing a compressed air system. These systems can be complex, require maintenance and parts replacements, and rely on an external power source, making them vulnerable to system failure in remote locations and uneconomic for small, low-vent wellsites. Nitrogen systems that rely on thermodynamic principles present a simple solution for wellsites of all sizes and locations, including those that may be serviced by compressed air. This methodology only applies to use of nitrogen as a replacement against using fuel gas for operating pneumatic devices.

5. Project activities will result in greenhouse gas emission reduction by using nitrogen as a replacement instrument gas at upstream oil and gas wellsites, eliminating the practice of routine methane venting from pneumatics. In gaseous form, nitrogen can perform the same function as fuel gas to drive pneumatic devices. Instead of venting natural gas containing methane, nitrogen is emitted from the pneumatic devices.

6. The process to replace natural gas with nitrogen as a power gas for pneumatics is simple and efficient. Liquid nitrogen (LIN) is stored on site in a specialized cryogenic tank that keeps the nitrogen in liquid state at-196 ^{o}C; this tank connected to existing pneumatic systems through a single header. Nitrogen is released as gas at the pressure and quantities needed to operate the pneumatic devices. There is no change to existing devices or operations; the existing line to use methane as instrument gas is turned off,

and the nitrogen-based system turned on. Once the nitrogen depletes over the course of normal operations, the cryogenic tanks are refilled by nitrogen.

7. By applying a gas equivalence ratio (GER) to the amount of nitrogen consumed, it is possible to accurately calculate baseline emissions (the amount of methane that would have been vented absent the project activity).

2.2. Applicability

8. This methodology is only applicable to project activities developed at wellsites where upstream oil and gas production occurs. This methodology is applicable to both on-shore and off-shore upstream oil and gas production facilities. This methodology is not applicable to mid-stream or downstream facilities including refineries and pipelines.

9. This methodology is applicable to both Low-Bleed and High-Bleed pneumatic devices at existing upstream oil and gas production facilities that are currently using and is legally permitted to use fuel gas-driven pneumatic devices, yet voluntarily elect to replace fuel gas with nitrogen which is a non-GHG power gas alternative.

10. Project activities shall involve emission reductions from pneumatic devices at well sites. The number of wellsites and number of devices shall be defined in the PDD and shall not change over the course of the crediting period.

11. It should be ensured throughout the project activity that the fuel gas is not vented.

12. Emission reductions can be claimed until the permanent removal of the nitrogen-based system at the wellsite facility, the closure of the wellsite facility, or the end of the lifetime of the pneumatic devices or the removal of all pneumatic devices at the facility, whichever occurs first. Nitrogen-based systems may be replaced or swapped over the course of the project's lifetime and must be included in the monitoring plan.

13. Nitrogen system shall be a closed loop system, using nitrogen generated and transported from air separation units (ASUs) to wellsite locations. Nitrogen consumption is measured by level sensors within the tank on a continuous basis. Nitrogen is stored cryogenically, and tanks are equipped with engineering controls to prevent instances of physical leakage.

14. This methodology is not applicable to the following cases:

    (a) Greenfield oil and gas facilities or new wellsites;

    (b) Oil and gas facilities where fuel gas is flared in the baseline (as opposed to vented);

    (c) Oil and gas facilities where pneumatic devices are legally required to be non-emitting at the time of start date of project activity. In jurisdictions with requirement to install low-bleed controller, sites with high-bleed pneumatic controllers in operations will not be eligible under this methodology;

    (d) Oil and gas facilities with wellsites that are electrified or are currently utilizing compressed air as instrument gas.

2.3. Entry into force

15. The date of entry into force is the date of the publication of the EB ## meeting report on DD Month YYYY.

2.4. Applicability of sectoral scopes

16. For validation and verification of CDM projects and programme of activities by a designated operational entity (DOE) using this methodology, application of sectoral scope 10 is mandatory.

3. Normative references

17. This methodology is based on the proposed small-scale methodology "SSC-NM109: Nitrogen as a Fuel Gas Replacement for Pneumatic Devices" submitted by Kathairos Solutions Inc.

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

(a) "TOOL03: Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" (hereinafter referred to as TOOL03);

(b) "TOOL05: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" (hereinafter referred to as TOOL05);

(c) "TOOL12: Project and leakage emissions from transportation of freight" (hereinafter referred as TOOL12); and

(d) "TOOL21: Tool for demonstration of additionality of small-scale project activities" (hereinafter referred as TOO21).

4. Definitions

19. The definitions contained in the Glossary of CDM terms shall apply.

20. For this methodology the following definitions applies:

(a) **Choked Flow** - In pneumatic devices, flow can be choked or non-choked as fuel gas and nitrogen are considered compressible fluids. Flow in a duct or passage such that the flow upstream of a certain critical section cannot be increased by a reduction of downstream pressure is defined as choked. Choked conditions will be applied for this Methodology as these conditions represent a conservative approach in estimating nitrogen volumes;

(b) **Gas Equivalency Ratio** [1] - The flow of different density gases through an orifice predominantly related to the square root of the ratio of a gas' specific gravities. The GER is a fixed value and does not change depending on instrument or device type used within the project activity. The capacity of a device to flow air or gas is expressed as flow coefficient which measures the impact on flow from factors to a device such as:

(i) Orifice size (diameter of the piping or opening through the valve);

[1] Refer to Instrument Society of America (ISA) ANSI/ISA-75.02-1996 Control Valve Capacity Test to determine equivalence between nitrogen and natural gas (equivalent to IEC 60534). The expanded formula can be found in L.R. Driskell's: Approach to Control Valve Sizing (Instrument Society of America. 1983).

(ii) Length of piping or opening through the valve;

(iii) Turbulence caused by bends or turns in the piping;

(iv) Restrictions that reduce orifice size, shape of the orifice or the flow path.

(c) **High-Bleed Devices** - A pneumatic device with a flow rate volume greater than or equal to 0.17m3/hr;

(d) **Low-Bleed Devices** - A pneumatic device with a flow rate volume of less than 0.17m3/hr;

(e) **Non-Emitting Devices** - Pneumatic devices at a wellsite that do not emit hydrocarbons;

(f) **Oil and Gas Facility** - A facility used as part of an oil and gas activity including: an oil or gas well, a well pad and all related equipment used for oil or gas exploration or production;

(g) **Pneumatic Controller** - A type of device that regulates the supply of pressure to an actuator or control loop, which opens, closes or positions a valve to regulate the flow of oil, gas or any other production/process fluid. An actuator can be coupled with other mechanical devices in a control loop;

(h) **Pneumatic Devices** - A tool or instrument that utilizes compressed air or gas as a power source;

(i) **Pneumatic Pump** - A type of device that injects chemicals into oil and gas pipelines, vessels, and wells to prevent corrosion and freezing of entrained fluids. Various chemicals may be used that must be injected at a pressure equal to or greater than the operating pressure;

(j) **Wellsite** - The location of a well or multiple wells that have been drilled for the purpose of extracting naturally occurring gas and/or oil.

5. Baseline methodology

5.1. Project boundary

21. The project boundary includes:

(a) One or multiple facilities where nitrogen is produced and stored (also known as ASU); Project Activity Emissions include nitrogen produced at an ASU;

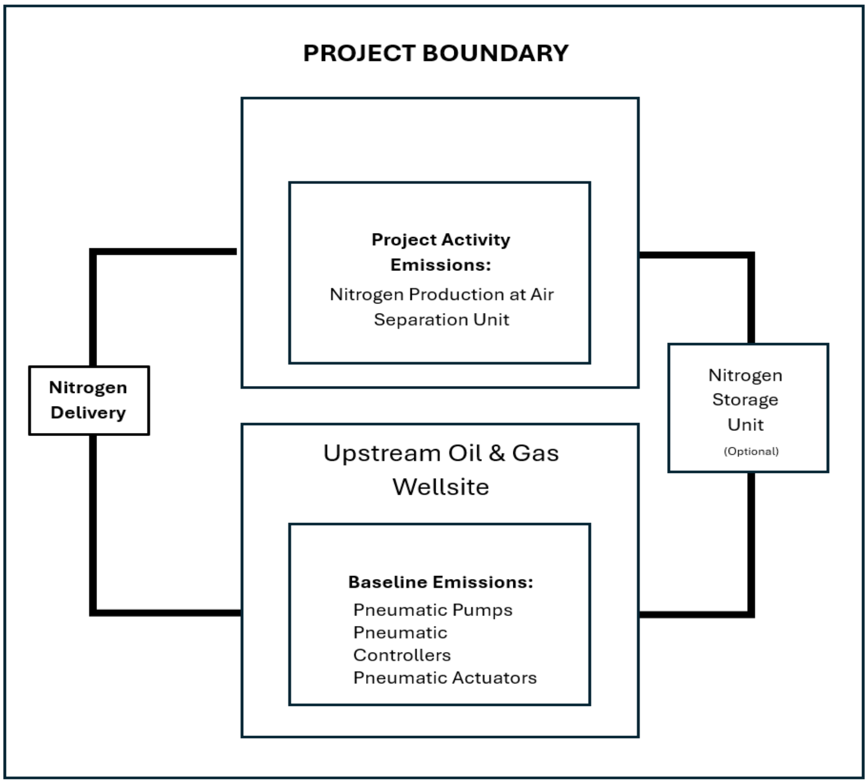
(b) The site(s) where the nitrogen is used to power pneumatic pumps, controllers and actuators, replacing the use of natural gas.

22. No interventions are required at the wellsite to adapt for the use of nitrogen. Existing pneumatic systems will remain in place.

23. Nitrogen is transported from ASUs to wellsite locations. Acquisition of new nitrogen storage and transport units may occur to perform project activities on an as-needed basis. Emissions resulting from the transportation of nitrogen will be reported as project emissions.

24. The following graphic provides a depiction of the project boundary and the activity and baseline emissions associated:

Figure 1. Project boundary



5.2. Baseline

25. In the baseline scenario, fuel gas is used as an instrument gas to actuate pneumatic devices. Following actuation, the fuel gas is vented to the atmosphere. The primary component of fuel gas is methane. As all fuel gas used by pneumatic devices in the baseline condition is vented, the GER estimates the total quantity of natural gas vented within the project baseline by measuring the volume of nitrogen consumed.

26. Routine fuel gas venting from pneumatics is standard industry practice at existing upstream wellsites in all regions, since fuel gas is the most affordable, reliable, and familiar power gas available to oil and gas producers. The vast majority of existing wellsites use fuel gas as a power source for pneumatic devices.

27. While it is recognized that there are alternative methods to eliminate methane venting from upstream wellsites, such as site electrification and installation of compressed air systems, these are not considered baseline scenarios, given the significant additional costs involved. The industry standard practice (and baseline scenario) remains instrument fuel gas.

28. Baseline vent gas is calculated for each wellsite based on the amount of nitrogen consumed and the natural gas composition at the wellsite location. Measuring the amount of nitrogen consumed is the most accurate and conservative way to calculate the baseline

emissions. Given the closed loop nature of the nitrogen system, every volume of nitrogen used is directly correlated to an equivalent volume of fuel gas that otherwise would have been emitted. Measuring nitrogen consumption to determine baseline emissions is more conservative than calculations based on manufacturer specifications, which may overestimate baseline emissions by assuming devices operate at maximum capacity, instead of actual vented volumes. The calculations based on manufacturer specifications are not included in this methodology.

5.3. Additionality

29. Project participants shall apply the “General guidelines for SSC CDM methodologies” and the TOOL21.

30. The project activity is deemed additional if it is determined that the emission reductions due to the project activity would not have taken place in the baseline. Investment barrier may be claimed if the cost of installing and operating a nitrogen-based system is higher than the value of the fuel gas conserved as a result of the installation. There may be barriers due to prevailing practice and technological barriers since fuel gas as an instrument gas has historically been used to power pneumatic devices at wellsite facilities.

5.4. Baseline Emissions

31. Baseline emissions are determined by the quantity of nitrogen used to actuate pneumatic devices and are not impacted by the quantity of nitrogen stored in liquid form at the wellsite. Additionally, nitrogen is not retained in the pneumatic devices following actuation. All nitrogen used directly represent an equivalent volume of fuel gas that otherwise would have been vented.

32. The baseline is determined by the amount of fuel gas that would have been emitted in the absence of the project activity based on the equation below.

$$BE_y = \sum_i \left[\left(Q_{N2,i,y} \times GER_{N2} \right) \times \%_{CH4,i} \times \left(\frac{\rho_{CH4}}{1000} \right) \right] \times GWP_{CH4}$$ Equation (1)

Where:

BE_y	=	Baseline emissions in year *y* (tCO_2e)
$Q_{N2,i,y}$	=	Nitrogen used by the gas or oil facility *i* in year *y* (m3)
GER_{N2},	=	Gas Equivalency Ratio of Nitrogen to Methane
$\%_{CH4,\mathrm{i}}$	=	Methane composition in vent gas (% CH4) of the gas or oil facility *i*
ρ_{CH4}	=	Density of Methane (kg/m3)
GWP_{CH4}	=	Global warming potential of methane (tCO_2e/tCH_4)
i	=	Gas or oil facility(ies) included in the project activity

33. Baseline vent gas is calculated for each subproject based on the amount of nitrogen consumed and the natural gas composition at the subproject location.

34. Gas composition differs at each wellsite, with varying percentages of the greenhouse gases methane and CO_2. Because these gases have different Global Warming Potentials

(GWP), a gas composition analysis must be performed at each wellsite to determine the amount of methane that the nitrogen is displacing.

35. The gas equivalence ratio of nitrogen to methane (GER^{2}_{N2}) is determined based on inserting the requisite values for methane (main component of fuel gas), nitrogen and air in the following equation, assuming choked flow and reference conditions of 15ºc and 1atm:

$$GER_{N2} = Q_{N2,i,y} \times \frac{1}{\sqrt{\frac{1}{G_{N2}}}} \times \frac{1}{Y_{N2}} \times Y_{CH4} \times \sqrt{\frac{1}{G_{CH4}}}$$ Equation (2)

$$Y = 1 - \frac{1}{3 \times F_k} \; ; \; F_k = \frac{k}{1.4}$$ Equation (3)

Where:

GER_{N2}	=	The gas equivalency ratio of nitrogen to methane
G	=	Gas specific gravity (the density of the gas divided by the density of air at the same condition) (N_2 gas density = 1.1851 Kg/m^3; CH_4 gas density = 0.6785 Kg/m^3; Air density = 1.225 Kg/m^3)
$Q_{N2,i,y}$	=	Nitrogen used by the gas or oil facility *i* in year *y* (m3)
Y	=	Expansion factor
F_k	=	Ratio of specific heats
k	=	Ratio of specific heats for given gas (N_2 = 1.4; CH_4 = 1.31)

$$GER_{N2} = \frac{1}{\sqrt{\frac{1}{(\frac{1.1851}{1.225})}}} \times \frac{1}{Y_{N2}} \times Y_{CH4} \times \sqrt{\frac{1}{(\frac{0.6785}{1.225})}}$$ Equation (4)

$$Y_{N2} = 1 - \frac{1}{3 \times 1} \; ; \; F_k = \frac{1.4}{1.4}$$ Equation (5)

$$Y_{CH4} = 1 - \frac{1}{3 \times 0.9357} \; ; \; F_k = \frac{1.31}{1.4}$$ Equation (6)

[2] Refer to Instrument Society of America (ISA) ANSI/ISA-75.02-1996 Control Valve Capacity Test to determine equivalence between nitrogen and natural gas (equivalent to IEC 60534). The expanded formula can be found in L.R. Driskell's: Approach to Control Valve Sizing (Instrument Society of America. 1983).

$$GER_{N2} = 1.276 \quad \text{Equation (7)}$$

36. The parameters used to calculate GER_{N2} are fixed and do not need to be updated at the renewal of a crediting period.

37. Gas composition and nitrogen usage are measured parameters. Nitrogen usage is measured by level sensors within the liquid nitrogen tank.

38. The density of methane, GER and the global warming potential of methane are fixed parameters. The density of methane is a physical property and does not need to be updated at the renewal of a crediting period.

39. The baseline vent gas is capped based on the type and number of pneumatic devices in operation at each wellsite facility. Total baseline vent gas for a subproject facility shall not exceed the sum of the default emission factors for all devices in operation based on the following emission factors provided in Table 2.[3]

Table 2. Default emission factors

Device Type	Default Emission Factor[4]
Continuous low bleed pneumatic devices	6.8 scf/hr/unit
Continuous high bleed pneumatic device	21 scf/hr/unit
Intermittent bleed pneumatic devices	8.8 scf/hr/unit
Pneumatic pumps	13.3/scf/hr/unit

5.5. Project emissions

40. Nitrogen production at an ASU is included in the project boundary and is considered a project activity emission.

41. Project emissions from the production of nitrogen are determined based on the electricity and fuels consumed for heat generation in the process to produce nitrogen as follows:

$$PE_{N2,Production,y} = PE_{N2,Production,electricity,y} + PE_{N2,Production,fuel,y} \quad \text{Equation (8)}$$

Where:

$PE_{N2Production}$	=	Emissions from nitrogen production (Tonnes of CO_2e)
$PE_{N2,Production,electricity,y}$	=	Project emissions due to the consumption of electricity in year *y* (tCO_2). Determined by applying the provisions of the TOOL05

[3] As documented in the United States Environmental Protection Agency's (EPA) 40 CFR Part 98 Greenhouse Gas Reporting Rule: Revisions and Confidentiality Determinations for Petroleum and Natural Gas Systems (2024, Table W-1 to Subpart W of Part 98 – Default Whole Gas Population Emission Factors)

[4] These values should be updated every crediting period or every 3 years in case a new update is published; whichever is earlier.

$PE_{N2,Production,fuel,y}$	=	Project emissions due to the consumption of fossil fuels for heat generation in year *y* (tCO_2). Determined by applying the provisions of the TOOL03

42. Project emissions due to physical leakage may occur if the connections between the tank and pneumatic devices are not fitted properly or if a system component malfunctions. In such a scenario, an excessive amount of nitrogen would be consumed and vented into the atmosphere. There are no GHG emissions that would occur during such a scenario; however, there is the potential such a leak would lead to over-estimation of emission reductions (baseline vent gas) and must be accounted for accordingly. It is possible to identify instances of leaks by tracking nitrogen consumption levels on a continuous basis and identifying unexplained or anomalous nitrogen consumption data. It is typical for nitrogen consumption to fluctuate daily due to variation in regular operational or process conditions. However, if the nitrogen consumption rate doubles within a 24-hour period without a corresponding operational process change, it is assumed there is a leak in the system unless determined otherwise. If a leak is identified, a field technician is dispatched to inspect devices and remedy the problem.

43. To ensure conservativeness, the project proponent shall omit all nitrogen consumption data generated over the period in which the physical leak occurred from baseline emission calculations. This will apply only to the specific subproject location in which the leak occurred.

44. When nitrogen is used as a replacement gas for pneumatic devices, project emission occurs during the transport of nitrogen, as well as during the manufacture and delivery of the nitrogen tanks and storage units.

45. The project emissions that occurs during the transport of nitrogen is ongoing and occurs outside of the project boundary.

46. The project emissions due to the transportation of nitrogen is calculated by applying TOOL12.

5.6. Leakage

47. Conserved methane gas that is not vented to the atmosphere during project activities may be directed to an alternate end use, including combustion, resulting in project boundary leakage. A discount factor of 5% to the baseline emission shall be applied to account for leakage and ensure conservativeness, i.e. $LE_y = BE_y$ x 0.05.

48. Emissions occurring outside of the project boundary as a result of project activities are estimated under Leakage.

49. The leakage that occurs during the initial manufacture and delivery of the nitrogen tanks and storage units is not accounted for given the one-time nature of the emission source and the long lifecycle of a cryogenic tank (over 25 years).

5.7. Emission reductions

50. Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y \quad \text{Equation (9)}$$

Where:

ER_y	=	Emission reductions in year *y* (t CO_2)
BE_y	=	Baseline Emissions in year *y* (t CO_2)
PE_y	=	Project emissions in year *y* (t CO_2)
LE_y	=	Leakage emissions in year *y* (t CO_2), $LE_y = BE_y$ x 0.05

6. Monitoring methodology

6.1. Data and parameters monitored

Data / Parameter table 1.

Data / Parameter:	***Concentration of Methane (% CH_4)***
Data unit:	%
Description:	Percent methane in vent gas
Source of data:	Gas Composition Analysis
Measurement procedures (if any):	Laboratory analysis of fuel gas samples taken by certified technicians from each wellsite within the project boundary
Monitoring frequency:	Gas composition samples are collected on an annual basis
QA/QC procedures:	Third-party technicians have appropriate certifications. Equipment is subject to routine testing
Any comment:	-

Data / Parameter table 2.

Data / Parameter:	***N2 Consumed ($Q_{N2,i,y}$)***
Data unit:	Standard cubic meters (m3)
Description:	Amount of nitrogen consumed
Source of data:	Level sensors and telemetry units
Measurement procedures (if any):	Nitrogen usage is measured by sensors within the nitrogen tank and hourly readings are transmitted through on-site telemetry to a central portal
Monitoring frequency:	Continuous monitoring occurs. Hourly readings are provided every 12 hours for every subproject location
QA/QC procedures:	Solid state sensors are calibrated by manufacturer. Nitrogen quantities are cross-referenced with nitrogen delivery tickets to ensure consistency
Any comment:	Nitrogen readings can be exported in Excel or CSV format

6.2. Data and parameters not monitored

Data / Parameter table 3.

Data / Parameter:	***Density of Methane ρCH4***
Data unit:	kg/m^3
Description:	The density of methane in a gaseous state

Source of data:	CDM UNFCCC - Methane Density, Gautam Dutt, MGM International, 2003
Measurement procedures (if any):	This metric is a fixed parameter. Value corresponding to conditions at which volumes are reported
Monitoring frequency:	N/A
QA/QC procedures:	N/A
Any comment:	N/A

Data / Parameter table 4.

Data / Parameter:	***GWP_{CH4}***
Data unit:	N/A
Description:	The Global Warming Potential of Methane
Source of data:	CDM UNFCCC – Reference: Global warming potential values under the temporary measures
Measurement procedures (if any):	The CDM Executive Board agrees to inform project participants and coordinating/managing entities that, in converting emission reductions achieved on or after 1 January 2021 to carbon dioxide equivalents in project and programme design documents or in preparing monitoring reports for emission reductions achieved on or after 1 January 2021, they shall apply as global warming potential (GWP) values, the lowest value from the Intergovernmental Panel on Climate Change (IPCC) assessment reports for each greenhouse gas (GHG) for a 100-year time horizon
Monitoring frequency:	N/A
QA/QC procedures:	N/A
Any comment:	N/A

Data / Parameter table 5 .

Data / Parameter:	***Gas Specific Gravity (G)***
Data unit:	kg/m^3
Description:	The density of nitrogen gas divided by the density of air at the same condition, typically @ 15 ^{o}C. (N2 gas density = 1.1851 Kg/m^3; CH4 gas density = 0.678 Kg/m^3; Air density = 1.225 Kg/m^3)
Source of data:	Refer to the International Standard Atmosphere (ISA) Model: ISO 2533:1975 for fixed values
Measurement procedures (if any):	This metric is a fixed parameter. Value corresponding to conditions at which volumes are reported
Monitoring frequency:	N/A
QA/QC procedures:	N/A
Any comment:	N/A

Data / Parameter table 6 .

Data / Parameter:	***Ratio of specific heats for given gas (k) (N_2 = 1.4; CH_4 =1.31)***
Data unit:	Ratio
Description:	The ratio of specific heats for a given gas (1.4 is the ratio specific heat for air, 1.3 for methane). The heat capacity ratio or adiabatic index or ratio of specific heats, is the ratio of the heat capacity at constant pressure to heat capacity at constant volume
Source of data:	ANSI/ISA-75.02-1996 Control Valve Capacity Test Procedures and National Institute of Standards and Technology (NIST), Properties for nitrogen
Measurement procedures (if any):	ANSI/ISA-75.02-1996 Control Valve Capacity Test Procedures and National Institute of Standards and Technology (NIST), Properties for nitrogen
Monitoring frequency:	N/A
QA/QC procedures:	N/A
Any comment:	N/A

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Document information

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