CLEAN DEVELOPMENT MECHANISM

CDM-MP64-A01

Draft Large-scale Methodology

AM00XX: Recovery and utilization of coke oven gas from coke plants for LNG production

Version 01.0

Sectoral scope(s): 04 and 05

United Nations
Framework Convention on
Climate Change

COVER NOTE

1. Procedural background

1. This draft new methodology is based on the proposed new methodology “NM0372: Recovery of Coke oven gas for production of LNG”.

2. This submission NM0372 was considered by the Methodologies Panel (Meth Panel) at its 63rd and 64th meetings in accordance with the procedure "Development, revision and clarification of baseline and monitoring methodologies and methodological tools", version 01.1 (EB 70, annex 36).

2. Purpose

3. The purpose of the regulatory document is to provide a baseline and monitoring methodology for quantifying emission reductions from project activities those install a new liquefied natural gas (LNG) production plant which will recover the coke oven gas (COG) of existing coke plant to produce LNG.

3. Key issues and proposed solutions

4. Not applicable.

4. Impacts

5. The proposed new methodological standard will be applicable to project activities that install a new LNG production plant to produce LNG by recovering the COG of existing coke plant(s).

5. Subsequent work and timelines

6. The methodology is recommended by the Meth Panel for consideration by the Board at its eighty-first meeting. No further work is envisaged.

6. Recommendations to the Board

7. The Meth Panel recommends that the Board adopt this final draft methodology, to be made effective at the time of the Board’s approval.

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1. Introduction

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

Table 1. Methodology key elements

Typical project(s)	This methodology is applicable to the project activities that install a new LNG production plant which will recover the coke oven gas (COG) of existing coke plant to produce LNG. This methodology is also applicable to the project activities where some other carbon containing waste stream (i.e. exhaust from other chemical plants) is used with COG for LNG production
Type of GHG emissions mitigation action	• Waste energy recovery

2. Scope, applicability, and entry into force

2.1. Scope

2. This methodology applies to project activities that install a new liquefied natural gas (LNG) production plant which will recover the coke oven gas (COG) of existing coke plant to produce LNG.

2.2. Applicability

3. The COG used in the project activity is sourced from existing coke plant(s).

4. The methodology is applicable only when the production activity of the coke plant from which the COG is sourced is not impacted significantly by the proposed project activities, i.e. the production ratio of coke to coal,[1] COG to coal and co-products[2] to coal in the crediting period shall not change by more than +/- 10 per cent compared to the maximum ratio in the last three years of the baseline, respectively. If the ratio changes by more than +/-10 per cent in any crediting period, project participant may choose not to claim the emission reductions for that monitoring period; otherwise, the project proponent shall revise the sections on “Establishment and description of baseline scenario” and “Demonstration of additionality” in the project design document (PDD) and seek approval by the Board before requesting further issuances.

5. The COG generated in the existing coke plant, except the COG used on-site in the production process of coke, would have been flared or vented to atmosphere in the absence of the project activity. This shall be proven by applying one of the following procedures:

[1] This ratio is referred with an assumption that only coal is used in coke oven plant. In case of other fuels are also used project participants may to choose different denominator (e.g. energy supplied) during the validation which cannot be changed during the crediting period.

[2] Main co-products e.g. coal-tar, coal dust etc.

(a) By on-site check at validation facilities such as pipelines or COG liquefaction plants do not exist at the coke plant;

(b) By direct measurements of the amount of COG flared or vented for at least three years prior to the start of the project activity, or by the information from the plant monitoring records, production report or financial report etc.;

(c) Energy balance of the relevant sections of the coke plant to prove that the COG supplied to the project activity is not used as an energy source before the implementation of the project activity. For the energy balance, the representative process parameters are required. The energy balance shall confirm that the COG is not used as an energy source and also provide conservative estimations of the energy content and amount of COG released;

(d) Energy bills (electricity, fossil fuel) to demonstrate that all the energy required for the process (e.g. based on specific energy consumption specified by the manufacturer) has been procured commercially. Project participants are required to demonstrate through the financial documents (e.g. balance sheets, profit and loss statement) that no energy was generated by COG and sold to other facilities and/or the grid.

6. In cases where CO_2 and/or CO could be used as carbon sources along with COG (carbon feeding process), this methodology is only applicable for carbon sources that would have been exhausted/flared or vented from chemical plants in the absence of the project activity. This can be demonstrated through any of the following:

(a) By on-site check facilities such as pipelines or CO_2/CO liquefaction plants do not exist at the chemical plant;

(b) By direct measurements of the amount of carbon sources flared or vented for at least three years prior to the start of the project activity, or as long as the coke plant has been in operation, or by the information from the plant monitoring records, production report or financial report et.al;

(c) Chemical plant manufacturer's commissioning report from the facility could be used as an estimate of the CO_2/CO volumes generated and used for the plant capacity/per unit of product produced.

7. The qualities of LNG from the project activity shall comply with national or industry standards and are of comparable characteristic (for example calorific value, methane content) with the LNG sold in the host country market.

8. In addition, the applicability conditions included in the tools referred to below apply.

9. Finally, the methodology is only applicable if the procedure for the selection of the most plausible baseline scenario results in a baseline scenario as outlined below:

(a) In case I: non-carbon-feeding process:

(i) Continuation of current practices in the coke plant from which the COG is sourced, i.e. flaring and/or venting of the COG;

(b) In case II: carbon-feeding process:

(i) Continuation of current practice in both the coke plant and the chemical plant from which the COG and the additional carbon source is sourced, i.e. flaring and/or venting of the COG and the feeding carbon sources used in the project activity.

2.3. Entry into force

10. The date of entry into force is the date of the publication of the EB 81 meeting report.

3. Normative references

11. This baseline and monitoring methodology is based on proposed new methodology "NM0372: Recovery of Coke oven gas for preparation of LNG" prepared by CNOOC Gas & Power Group, CNOOC Shandong Green Energy Co., Ltd., and SinoCarbon Innovation and Investment Co., Ltd.

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

(a) "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion";

(b) "Tool to calculate baseline, project and/or leakage emissions from electricity consumption";

(c) "Combined tool to identify the baseline scenario and demonstrate additionality";

(d) "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period".

13. For more information regarding the proposed new methodology and the tools as well as their consideration by the Executive Board (hereinafter referred to as the Board) of the clean development mechanism (CDM) please refer to <http://cdm.unfccc.int/methodologies/PAmethodologies/index.html>.

4. Definitions

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

15. For the purpose of this methodology, the following definitions apply:

(a) **COG** - Coke oven gas, obtained as a by-product of the production of coke in coke production plants and rich in hydrogen, methane, carbon dioxide and carbon monoxide;

(b) **Existing coke plant(s)** - a facility that produces coke and that has been in operation for at least three years immediately prior to the start date of the project activity;

(c) **Carbon feeding process** - a process where carbon sources are fed along with COG for LNG production. This process aims to increase the quantity of LNG produced, because additional carbon fed reacts with the excess hydrogen available in COG;

(d) **Existing carbon source(s)** – a facility/chemical plant produces the waste/exhaust/vent stream containing CO_2 and/or CO.

5. Baseline methodology

5.1. Project boundary

16. The spatial extent of the project boundary encompasses:

(a) The site of the existing coke plant;

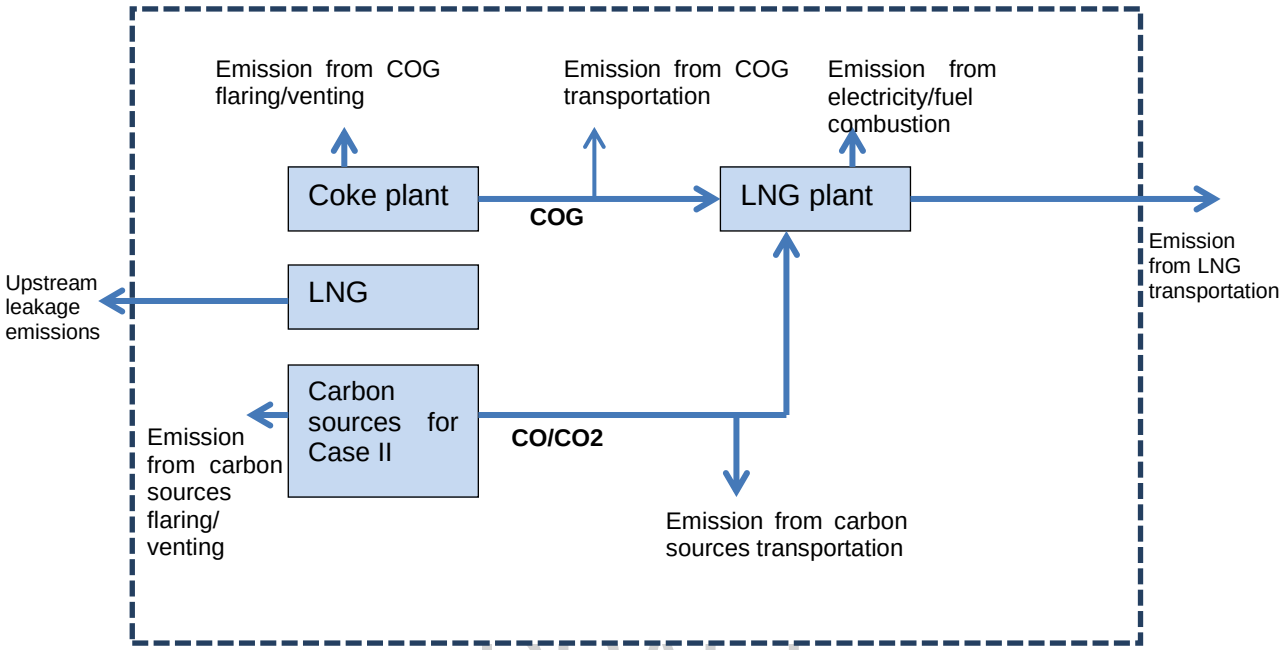
(b) The new LNG production plant;

(c) The site of the carbon sources in case the carbon-feeding process is used in project activity;

(d) All power plants connected physically to the electricity system (grid) that the project plant is connected to.

17. The project boundary is shown in the diagram below:

Figure 1. Project boundary



18. The GHGs included in or excluded from the project boundary are listed in Table 2.

Table 2. Emission sources included in or excluded from the project boundary

Source		Gas	Included	Justification/explanation
Baseline	Emissions from venting and/or flaring from COG	CO_2	Yes	Major emission source in case of flaring
		CH_4	Yes	Conservatively considered as CO_2 emissions in case of venting
		N_2O	No	Minor source
	Emissions from the carbon sources[3]	CO_2	Yes	Main source of emission in baseline
		CH_4	No	Assumed negligible
		N_2O	No	Assumed negligible

[3] In case carbon feeding process (Case II) is used in the project activities.

Source		Gas	Included	Justification/explanation
Project activity	Emissions from electricity consumption during producing LNG by processing COG	CO_2	Yes	Main source of emission in project
		CH_4	No	Assumed negligible
		N_2O	No	Assumed negligible
	Emission from fuel consumption during producing LNG by processing COG	CO_2	Yes	Main source of emission in project
		CH_4	No	Assumed negligible
		N_2O	No	Assumed negligible
	Fugitive emissions resulting from COG transport	CO_2	No	Assumed negligible
		CH_4	Yes	Fugitive CH_4 emissions may occur if COG is transported to the end use facility in the project scenario
		N_2O	No	Assumed negligible

5.2. Selection of the baseline scenario and demonstration of additionality

19. Identify the baseline scenario and demonstrate additionality using the latest version of "Combined tool to identify the baseline scenario and demonstrate additionality" and following the requirements below:

(a) In applying step 1(a); alternative scenarios should be separately determined for the following components:

(i) Usage of COG;

(ii) Usage of carbon sources which will be fed in project activity;[4]

(iii) Production of LNG. However, it can be assumed that the baseline for LNG production is from fossil origin for the purpose of simplification;

(b) The alternative scenarios for usage of COG in the absence of the project activity shall include, but not be limited to:

(i) T1: The project activity not implemented as a CDM project activity;

(ii) T2: Continuation of current practices i.e. flaring or venting of the COG;

(iii) T3: Sell as energy, e.g. urban fuel supply, power generation;

(iv) T4: Combustion of COG for process heating or electricity generation;

(v) T5: Sell as raw material for chemical industry production, e.g. fertilizer, methanol etc.

(c) The alternative scenarios for the usage of carbon sources in the absence of the project activity shall include, but not be limited to:

(i) C1: The project activity not implemented as a CDM project activity;

[4] Only applicable when there is carbon feeding process in the implemented project activity.

(ii) C2: Continuation of current practices i.e. flaring or venting of the feeding carbon sources;

(iii) C3: Using as raw material for chemical industry production by the supplier itself;

(iv) C4: Sell as raw material for chemical industry production, e.g. producing fire extinguisher, soft drink etc.

20. Project proponent is required to use investment analysis for additionality demonstration. In doing so, the price of COG/carbon feeding source should be counted as zero. Therefore, payments made for COG/carbon feeding sources cannot be counted when carrying out a financial analysis. However, costs incurred for recovery, pre-treatment of COG, cleaning and handling/transportation (e.g. cost of pipeline) to make it ready for use by the LNG production plant may be counted.

5.3. Baseline emissions

21. Baseline emissions are occurring due to flaring (and/or venting) of COG and carbon sources, where applicable.

$$BE_y = FC_{LNG,y} \times w_{CH4,y} \times \frac{44}{16}$$ Equation (1)

Where:

BE_y = Baseline emissions in year *y* (t CO_2e)

$FC_{LNG,y}$ = Quantity of LNG that is eligible for crediting in year *y* (tonne)

$w_{CH4,y}$ = The mass fraction of methane in LNG produced by the proposed project (Fraction)

$44/16$ = Conversion factor from methane to CO_2

5.3.1. Determination of the quantity of LNG that is eligible for crediting in year *y* ($FC_{LNG,y}$)

22. The quantity of LNG that is eligible for claiming emissions reductions is calculated as follows:[5]

$$FC_{LNG,y} = \min\left(1, \frac{Q_{COG,BL}}{Q_{COG,y}}\right) \times \min\left(1, \frac{Q_{CO2,BL}}{Q_{CO2,y}}\right) \times FC_{LNG\_actual,y}$$ Equation (2)

[5] The second component in the equation regarding the carbon from carbon feeding process needs to be considered only when Case II is used in the project activity.

Where:

$Q_{COG,BL}$ = The historical annual amount of COG generated in the existing coke production plants and vented/flared before the proposed project (Nm^3)

$Q_{COG,y}$ = The amount of COG generated in the existing coke production plant(s) and used by the proposed project in year *y* (Nm^3)

$Q_{CO2,BL}$ = The historical annual amount of CO_2/CO generated in the carbon sources plant and vented/flared before the proposed project (Nm^3)

$Q_{CO2,y}$ = The amount of CO_2/CO generated in the carbon sources plant and used by the proposed project in year *y* (Nm^3)

$FC_{LNG\_actual,y}$ = The actual quantity of LNG produced by the proposed project in year *y* (tonne)

5.4. Project emissions

23. Project emissions in the project activity occur from following sources:

(a) Project emissions from combustion of fossil fuels within the project boundary (e.g. auxiliary fuel consumption, transportation, COG cleaning etc.);

(b) Project emission from electricity consumption within the project boundary (e.g. LNG processing, COG cleaning, transportation etc.);

(c) Project emissions from COG pipeline leakage within the project boundary (e.g. transport the COG to the project LNG plant).[6]

$$PE_y = PE_{FC,y} + PE_{EC,y} + PE_{CH4\_pipeline,y}$$ Equation (3)

Where:

PE_y = Project emissions in year *y* (t CO_2e)

$PE_{FC,y}$ = Project emissions from combustion of fossil fuels within the project boundary in year *y* (t CO_2e)

$PE_{EC,y}$ = Project emissions from electricity consumption within the project boundary in year *y* (t CO_2e)

$PE_{CH4\_pipeline,y}$ = Project emissions from COG pipeline leakage in year *y* (t CO_2e)

5.4.1. Project emissions from combustion of fossil fuels within the project boundary in year *y* ($PE_{FC,y}$)

24. The project emissions from fossil fuel combustion ($PE_{FC,y}$) shall be calculated using the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion". When applying the tool:

(a) Processes *j* in the tool corresponds to the sources of fossil fuel consumption in the project activity, other than for electricity generation. Consumption sources

[6] Non-CO_2 GHGs contained in carbon feeding sources shall also be accounted, if applicable.

shall include, as relevant, fossil fuels used for auxiliary consumption in process, transportation, COG cleaning etc.

5.4.2. Project emissions from electricity use ($PE_{EC,y}$)

25. The project emissions from electricity consumption ($PE_{EC,y}$) shall be calculated using the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption".

5.4.3. Project emissions from COG pipeline leakage ($PE_{CH4\_pipeline,y}$)

26. Emission factors are taken from the 1995 *Protocol for Equipment Leak Emission Estimates*, published by U.S. EPA.[7] Emissions should be determined for all relevant activities and all equipment (such as valves, pump seals, connectors, flanges, open-ended lines, etc.).The U.S. EPA approach is based on average emission factors for total organic compounds (TOC). Methane emissions are calculated by multiplying the methane fraction in the COG with the appropriate emission factors from Table 3 and then summing across all pieces of equipment, as follows:

$$PE_{CH4\_pipeline\_y} = GWP_{CH4} \times \frac{1}{1000} w_{CH4,pipeline,y} \times \sum_{equipment} \left[EF_{equipment} \times t_{equipment}\right] \quad \text{Equation (4)}$$

Where:

$PE_{CH4\_pipeline}$	=	Fugitive CH_4 emissions from transportation of the COG to the LNG production facility in year *y* (tCO_2e)
GWP_{CH4}	=	Global Warming Potential for methane
$w_{CH4,pipeline,y}$	=	Average mass fraction of methane in the COG in year *y* (t CH_4/t COG)
$EF_{equipment}$	=	The emission factor for the relevant equipment type, taken from Table 3 or the 2006 IPCC Guidelines (kg CH_4/hour/equipment)
$t_{equipment}$	=	The operation time of the equipment (hours)

27. All data for gas volumes in all equations should be converted to common standard temperature and pressure values. The default density of methane at 0 degree Celsius and 1 atm is 0.0007168 t CH_4/m^3.

28. It is recommended to group the equipment according to the different types listed in Table 3.

[7] Please refer to Document reference EPA-453/R-95-017 at <http://www.epa.gov/ttn/chief/efdocs/equiplks.pdf>.

Table 3. Oil and natural gas production average emission factors

Equipment type	Service	Emission factor (kg/hour/equipment item)
Valves	Gas	4.5E-03
Pump seals	Gas	2.4E-03
Others*	Gas	8.8E-03
Connectors	Gas	2.0E-04
Flanges	Gas	3.9E-04
Open-ended lines	Gas	2.0E-03

Source: US EPA-453/R-95-017 Table 2.4, page 2-15

(a) "Other" equipment type was derived from compressors, diaphragms, drains, dump arms, hatches, instruments, meters, pressure relief valves, polished rods, relief valves and vents. This "other" equipment type should be applied for any equipment type other than connectors, flanges, open-ended lines, pumps or valves.

5.5. Leakage

29. Leakage in the project activity is considered as zero.[8]

5.6. Emission reductions

30. Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y$$ Equation (5)

Where:

ER_y = Emission reductions in year *y* (t CO_2e)

BE_y = Baseline emission in year *y* (t CO_2e)

PE_y = Project emissions in year *y* (t CO_2e)

LE_y = Leakage in year *y* (t CO_2e)

5.7. Changes required for methodology implementation in 2nd and 3rd crediting periods

31. Refer to the latest approved version of the tool "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period".

[8] It is conservative, because it is very likely that the negative leakage emissions due to upstream LNG production in the absence of project activity will be larger than the positive leakage emissions from energy use outside the project boundary due to project activity (i.e. primarily transportation of LNG produced beyond the project boundary etc.)

5.8. Data and parameters not monitored

32. In addition to the parameters listed here, the provisions on data and parameters not monitored in the tools referred to in this methodology apply.

Data / Parameter table 1.

Data / Parameter:	**GWP_{CH4}**
Data unit:	t CO_2/t CH_4
Description:	Global warming potential of methane valid for the relevant commitment period
Source of data:	Default value of 25 from IPCC Fourth Assessment Report: Climate Change 2007 (AR4)
Measurement procedures (if any):	-
Monitoring frequency:	Updated to the latest IPCC default in each Kyoto commitment period
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 2.

Data / Parameter:	**$Q_{COG,BL}$**
Data unit:	Nm^3
Description:	The historical annual amount of COG generated in the existing coke production plants and vented/flared before the proposed project
Source of data:	The operation record of the coke production plants
Measurement procedures (if any):	The historical annual utilizable amount of COG in the existing coke production plants should be determined as the historic annual average amount of COG sent to the flares during the last three years before the implementation of the project
Monitoring frequency:	-
QA/QC procedures:	-
Any comment:	International or national standards should be used for measurement. It is also used

Data / Parameter table 3.

Data / Parameter:	**$Q_{CO2,BL}$**
Data unit:	Nm^3
Description:	The historical annual utilizable amount of CO_2/CO generated in the carbon sources plant before the proposed project
Source of data:	The operation record of the carbon source plants
Measurement procedures (if any):	The historical annual utilizable amount of CO_2/CO generated in the carbon sources plant should be determined as the historic annual average amount of CO_2/CO sent to the flares or vent during the last three years before the implementation of the project

Monitoring frequency:	-
QA/QC procedures:	-
Any comment:	International or national standards should be used for measurement

Data / Parameter table 4.

Data / Parameter:	**$EF_{equipment}$**
Data unit:	$kgCH_4$/hour
Description:	Emission factor for each equipment type
Source of data:	Table 3 above or 2006 IPCC guidelines
Measurement procedures (if any):	n/a
Monitoring frequency:	-
QA/QC procedures:	-
Any comment:	-

5 Monitoring methodology

33. All data collected as part of monitoring should be archived electronically and be kept at least for two years after the end of the last crediting period. One hundred per cent of the data should be monitored if not indicated otherwise in the tables below.

34. In the CDM-PDD, project proponents have to provide information concerning the system in place to ensure the quality of the data. It should include the actions to be undertaken to constitute and to maintain the needed measurement equipment to satisfy the requirements concerning the quality of the data:

    (a) The inventory, identification and the description of the measurement equipment used;

    (b) The description of the QA/QC procedures for monitoring;

    (c) The organizational structure and the responsibilities;

    (d) The calibration and verification of the measurement equipment;

    (e) The connecting of standard equipment to data logging devices;

    (f) The process of recording data entries.

35. The monitoring provisions in the tools referred to in this methodology apply.

5.5 Data and parameters monitored

Data / Parameter table 5.

Data / Parameter:	**$FC_{LNG\_actual,y}$**
Data unit:	tonne
Description:	Actual quantity of LNG produced in the project activity in year *y*
Source of data:	Onsite measurements

Measurement procedures (if any):	Measuring equipment as per the national/international standards
Monitoring frequency:	Continuously
QA/QC procedures:	Cross-check of production, marketing and stock change data
Any comment:	-

Data / Parameter table 6.

Data / Parameter:	$w_{CH4,y}$
Data unit:	%
Description:	The mass fraction of methane in LNG produced by the project activity
Source of data:	Onsite measurement
Measurement procedures (if any):	Measuring equipment as per the national/international standards
Monitoring frequency:	Continuous measurements for LNG produced
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 7.

Data / Parameter:	$Q_{COG,y}$
Data unit:	Nm^3
Description:	The amount of COG generated in the existing coke production plants and used by the proposed project in year *y*
Source of data:	Onsite measurements
Measurement procedures (if any):	Measurement as per the national/international standards
Monitoring frequency:	Continuously
QA/QC procedures:	Cross-check measurement results with records for purchased COG
Any comment:	-

Data / Parameter table 8.

Data / Parameter:	$Q_{CO2,y}$
Data unit:	Nm^3
Description:	The amount of CO_2 generated in the carbon sources plant and used by the proposed project in year *y*
Source of data:	Onsite measurements
Measurement procedures (if any):	Measurement as per the national/international standards
Monitoring frequency:	Continuously
QA/QC procedures:	Cross-check measurement results with records for purchased CO_2
Any comment:	-

Data / Parameter table 9.

Data / Parameter:	$w_{CH4,pipeline,y}$
Data unit:	%
Description:	Average mass fraction of methane in the COG in year *y* (t CH4/t COG)
Source of data:	Onsite measurement
Measurement procedures (if any):	Measuring equipment as per the national/international standards
Monitoring frequency:	Continuous measurements
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 10.

Data / Parameter:	$t_{equipment}$
Data unit:	Hours
Description:	Operation time of the pipeline equipment
Source of data:	Actual measurements
Measurement procedures (if any):	Recorded monthly, aggregated annually
Monitoring frequency:	Continuous
QA/QC procedures:	-
Any comment:	-

Data / Parameter table 11.

Data / Parameter:	$R_{Coal:coke,y}$ **and** $R_{COG:coal,y}$ **and** $R_{COG:co-product,y}$
Data unit:	Fraction for (t Coal/t Coke), (t COG/t Coal) and (t COG/t co-product)
Description:	Ratio of coal consumed for production of coke and COG, and the ratio of co-product produced associated with the COG production. Used for demonstrating the compliance to applicability in paragraph 4
Source of data:	Calculated based on the operating data before and after the implementation project activities
Measurement procedures (if any):	N/A
Monitoring frequency:	Recorded monthly, aggregated annually
QA/QC procedures:	Ratio of coal consumed for production of coke and COG, and the ratio of co-product produced associated with the COG production. Used for demonstrating the compliance to applicability in paragraph 4
Any comment:	Calculated based on the operating data before and after the implementation project activities

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Document information

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