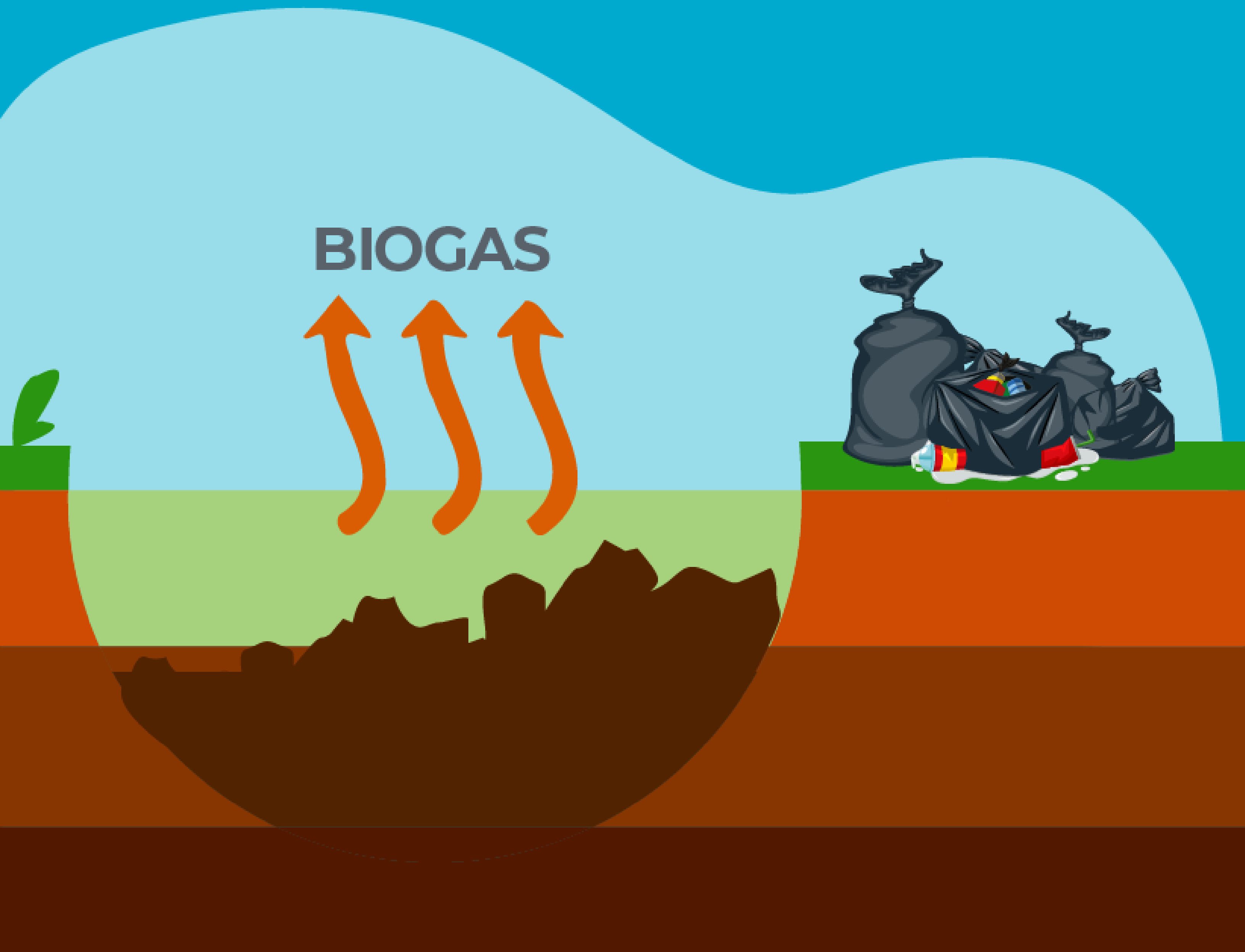
CERCARBONO
Certified Carbon Standard

Methodology M/LFM-DE_RE01

For Projects for the Destruction and Utilisation of Biogas from Landfill Sites



Methodology M/MLF-DE_RE01 For Projects for the Destruction and Utilisation of Biogas from Landfill Sites

Version 2.1

Contents

Index of tables

Acronyms and abbreviations

CDM	Clean Development Mechanism
GHG	Greenhouse Gases
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change o
ISO	International Standardization Organization
LFG	Landfill Gas
MRV	Measuring/Monitoring, Reporting and Verification
NIZ	Non-Interconnected Zone
PDD	Project Description Document
PMCC	Climate Change Mitigation Programme or Project
SDGs	Sustainable Development Goals
UNFCCC	United Nations Framework Convention on Climate Change
VVB	Validation and Verification Body

Terms and definitions

The terms and definitions providing guidance for thorough understanding of this methodology are included in the ***Terms and Definitions of the Voluntary Certification Programme of Cercarbono*** document, available at www.cercarbono.com, section: Documentation.

Summary

This methodology has been developed to allow for carbon credits generation through Climate Change Mitigation Programmes or Projects (CCMP) focused destruction or use as energy sources, of landfill biogas to reduce the amount released to the atmosphere. The CCMP start date is established in the current version of ***Cercarbono's Protocol for Voluntary Carbon Certification*** (hereinafter Cercarbono's Protocol, available at www.cercarbono.com, section: Documentation), section: **CCMP start date**. Principles described in this document shall also be followed.

To be eligible, CCMPs must abide with herein proposed and described principles and requirements, as well as with those included in the current version of Cercarbono's Protocol. In addition, such CCMPs shall chemically oxidate the methane contained in the biogas either without or with an energy use (in this case displacing a fossil fuel for energy production or electric power generated by using fossil fuel sources), provided it is demonstrated that in CCMP's absence, such biogas would be released to the atmosphere without any treatment. Projects may be new, existing, retrofits, rehabilitations or replacements involving landfill capture or combustion or use as an energy source in landfills.

This methodology provides required guidelines and means for estimation of such emissions reduction, as well as general guidelines associated to CCMP data / documentation management and monitoring.

Foreword

Cercarbono, as a voluntary carbon certification programme, supported and financed the development of this methodology, carried out by an external consulting company and internal staff, backed by its Board of Directors and the Chief Executive Officer.

Developers	
Author	Cercarbono. Alex Saer – CEO.
Collaborators	Icontec.
	Red Tree SAS[1].
Developing technical team	
Jorge Plauchú	Expert technical consultant - Cercarbono.
Miguel Freyermuth	Expert technical consultant - Cercarbono.
William Rodríguez Delgado	Red Tree SAS / Icontec Consultant.
Support and review	
Álvaro Vallejo Rendón	Programme director - Cercarbono.
Catalina Romero Vargas	Technical director - Cercarbono.
Graphic design	
Santiago Arboleda	Graphic designer - Cercarbono.
Review and style correction	
Claudia Valdés Pérez	Contents coordinator and technical reviewer - Cercarbono.
Natalia Forero	Contents assistant - Cercarbono.

This methodology shall be updated when required, as set out in the ***Procedures of Cercarbono's Certification Programme***.

[1] Consulting company appointed by Cercarbono.

1 Introduction

Climate change is one of the main challenges human society faces. Changes associated to this global issue can disrupt life in Earth, at least as we know it. Use of fossil fuels for power generation is one of the main causes for this problem, as it is responsible for about half of the global GHG emissions generation in our planet, according to reported data from the Intergovernmental Panel on Climate Change (IPCC).

Methane (CH_4) is the second most important Greenhouse Gas (GHG) in terms of generated emissions and is present in the atmosphere with a 19,5 % mean weighted average of the world's anthropogenic emissions quantified as carbon dioxide equivalent (CO_2e), which adjusted as per the change in Global Warming Potential (GWP) represents in reality 19,2 % (IPCC, 2022[2]). Anaerobic decay of solid waste in landfills is one of the main methane-related emission sources, and adequate management of such facilities would in turn result in significant reductions of such emissions.

Considering this issue and the need to advance their solution, some actions tending to reduce environmental impact through climate change mitigation and adaptation processes have been implemented, among others, through CCMPs oriented to carbon markets aiming to minimize GHG emissions by destroying or giving an energetic use to landfill produced biogas.

Aiming to dynamize carbon trade, some companies joining or advising CCMP development from its formulation and implementation to certification have been created. Cercarbono, with its voluntary certification programme, promotes methodological tool creation and use for the development of capital projects, to facilitate companies and individuals that can contribute to reducing GHG emissions causing the climate crisis, with the ultimate objective of generating and backing carbon certificates which guarantee the quality of each achieved reduction unit.

This methodology for the development of CCMPs focused on GHG emissions reduction through controlled destruction or use of landfill-produced biogas, intends to present an alternative for those projects to gain access to the carbon market, while considering all required principles applicable to this type of actions.

The methodology is applicable to controlled destruction of biogas through combustion, use of biogas for thermal / electric energy production, and the use of biogas with the ultimate purpose of injecting it to a natural gas / biogas / biofuel distribution network or transporting it by means of tank trucks[3].

[2] Available at: https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_Full_Report.pdf.
[3] This transport form is also referred to as "virtual gas pipeline".

2 Principles

The principles establish the foundations for justification and explanations required in this document. CCMP's using this methodology shall comply and refer the relevant principles and how they are applied according to current version of Cercarbono's Protocol, and guidance as per in ISO 14064-2:2019 Standard.

3 Objective and application field

This methodology is specific and applicable to Cercarbono's certification programme. It can be used by any natural or legal person, both public or private, aiming to develop CCMPs related to destruction or use a source of energy, of the biogas contained in landfill gas (LFG) produced. CCMPs shall comply with all applicable regulations and shall have considered opting for result-based payments or similar compensations connected with performance of climate change mitigation actions generating GHG emission reductions.

The methodology outlines basic recommendations based on referred principles for the design and implementation of CCMPs (including GHG destruction or renewable energy generation) focused on destruction and use of landfill-produced biogas in the waste management sector.

Types of CCMP comprised within conditions and guidelines in this methodology include new or existing facilities, system retrofit, rehabilitation or replacement for:

- Controlled destruction of landfill biogas (in flares, internal combustion engines, burners, among others), through combustion, which in absence of the CCMP would be released to the atmosphere.
- Electric power generation using landfill-produced biogas.
- Thermal energy generation through combustion of landfill-produced biogas.
- Biofuel production by means of capturing landfill-produced biogas for injection to natural gas distribution networks, partially displacing such fuel.
- Landfill-produced biogas (either raw or treated) capture and use for distribution through dedicated pipeline networks, displacing the use of other fossil fuels.
- Landfill-produced biogas (either raw or treated) capture and use for distribution by means of car trucks to users, which in absence of the CCMP would use fossil fuels instead.

Other CCMPs not listed above may use this methodology, provided they comply with all applicable criteria. A combination of above listed types of actions could also be implemented, as applicable, according with the programme or project conditions.

For this methodology to be applied by a CCMP, it shall comply with following conditions:

- Prior to CCMP implementation, there is no biogas collection system or, if any in operation, it shall be demonstrated such system was not designed for biogas destruction or use, or such system has been optimised or upgraded to enable required capture conditions.
- CCMP implementation shall not impact the amount of recycled organic waste that would be processed in absence of such CCMP.
- The amount of methane produced in the landfill from the mass and characteristics of the solid waste shall not deliberately being increased through the implementation of new operation strategies, as compared with identified baseline conditions[4].

[4] I.e., total methane baseline emissions during accreditation period shall be limited to those originally estimated based on first-order decay model representing landfill baseline conditions.

- Baseline scenario for the CCMP shall enable concluding that in absence of the activity, the biogas: (i) would have been released to the atmosphere, (ii) would have been destroyed to avoid odours or for safety reasons, (iii) generated electric or thermal energy would have been exclusively produced based on the use of fossil fuels, or (iv) biogas users would have used fossil fuels for the same purpose.

CCMPs shall comply with the requirements of the Measuring/Monitoring, Reporting, and Verification (MRV), or similar, systems in force in the jurisdiction governing its operation, in addition to all relevant requirements and criteria of the ***Cercarbono's Protocol***, the ***Procedures of Cercarbono's Certification Programme*** document, and the related and relevant complementary methodological tools used, in their current versions, available at www.cercarbono.com, section: Documentation.

Considerations to establish CCMP's operation start date are included in current version of Cercarbono's Protocol, section: **CCMP start date**.

4 Inclusion / exclusion requirements

This methodology has been developed for use by CCMPs focused on GHG emissions reduction (including GHG destruction or renewable energy generation) through biogas destruction or use in landfills in the waste management sector, aimed to carbon credits' generation, whose equipment for biogas destruction or use have entered in operation according to provisions in current version of Cercarbono's Protocol, section: **CCMP start date**. The CCMP shall comply with following criteria:

- Landfill-produced biogas shall be captured using a collection and conduction system that reduces or minimises leaks from gases, such as methane.
- Combusting methane contained in captured biogas or implementing a methane use strategy, including some of the considered measures as per in this methodology, either biogas-based electric or thermal energy production, biogas injection into natural gas networks, biogas distribution through dedicated pipeline networks, distribution by means of tank trucks or any combination of them.
- Implemented in any kind of landfills featuring: (i) new or existing facilities for biogas destruction or use, or (ii) existing facilities for biogas destruction or use increasing their capacity or efficiency.
- Being related and complemented by all guidelines as described in current version of Cercarbono's Protocol.

4.1 Additionality

Additionality in this methodology shall be demonstrated by applying the current version of ***Cercarbono's Tool to Demonstrate Additionality of Climate Change Mitigation Initiatives***, available at: www.cercarbono.com, section: Documentation.

4.2 Ownership

The owner of the CCMP must obtain and show express records authorizing project implementation must be provided, including those from the owner(s), holder(s) or right holder(s), as applicable, for development of the project or programme (including those associated to the land and capture, destruction and usage infrastructure).

Evidence of property rights over CCMP facilities must be provided, in addition to all applicable licenses / environmental permits, as applicable.

Ownership rights over GHG emissions reduction must be demonstrated by involved party(ies), i.e., a document signed by all involved parties defining participation, claims or rights transfer regarding GHG emissions reduction must be presented.

4.3 CCMP stakeholders' participation

The CCMP shall guarantee and demonstrate a stakeholders' participation (especially those for which its implementation might pose an environmental, social, or economic impact for their development or way of life). Such evidence may be documented in the granting of environmental and other kind of permits' issuance, complying with applicable regulations in the country the CCMP is implemented. The CCMP must have in place a participation protocol including:

- Mapping of actors, i.e., an institutional map for all governance structures or institutions and leaders associated to CCMP-related decision-making in the territory.
- Consensus decisions with local governance structures.
- Consensus processes traceability.
- Request, grievances, complaints and asking management and traceability thereof.
- A framework time schedule for CCMP-related decision making.
- A conflict management protocol.

On top of the above referred items, the CCMP shall comply with effective participation guidance and with the no net harm principle, as described in the current version of Cercarbono's Protocol.

Results of consultations with owners and participants in the CCMP shall be described in the Project Description Document (PDD).

4.4 General objective of the CCMP

The CCMP objective shall describe the expected positive impact from its implementation and the expected mitigation potential.

It shall also include, as a minimum, the main activity, geographical location for implementation of the project activity(ies), involved actors and the operation period for project activities.

5 CCMP boundaries

5.1 Spatial limits

CCMP spatial limits refer to the physical and geographical site for biogas capture, destruction, or use, as applicable. The spatial extent of the CCMP includes biogas capture systems, biogas conduction to the spot its destruction or treatment required for using it are performed and, as applicable, facilities required for biogas use, injection into networks or tank truck delivery.

The site where the CCMP central or unit is installed must be specified in terms of the country and second level (state, department, province or similar), and third level (municipality or similar) political subdivisions, including geographical coordinates using the official reference system for the country where the CCMP is located. Location by means of a file in shp (ESRI Shapefile) or kml (Keyhole Markup Language) format must also be included.

On top of the above referred requirements, the CCMP shall follow Cercarbono's guidelines on CCMP limits as per the current version of Cercarbono's Protocol.

5.2 Temporary limits

Project duration: is the period (in years) from the start (day.month.year) to the final (day.month.year) date of CCMP mitigation actions.

Accreditation period: accreditation period is defined according to relevant provisions in current version of Cercarbono's Protocol.

Installed technology useful life or lifetime, which must be demonstrated when the requested accreditation period is greater than the default remaining life as per in the current version of CDM's Methodological Tool 10[5], corresponds to the period during which the main power generation system, and the biogas gathering, treatment, compression or destruction systems can comply with its function under adequate operational cost-efficiency and safety.

[5] *TOOL10: Tool to determine the remaining lifetime of equipment.*

6 Baseline scenario

Possible baseline scenarios associated to landfill-generated biogas management can be the following:

A. Prior to CCMP development, landfill-produced biogas, or a major portion thereof, is released directly to the atmosphere. In this case, project alternatives might lead to following situations in project scenario (thus requiring related information to build the baseline scenario):

- Biogas is captured and destroyed in a controlled way by flaring.
- Biogas is captured and used for electric power generation.
- Biogas is captured and used for thermal energy generation.
- Biogas is captured and used through injection into a natural gas network.
- Biogas is captured and used through distribution using biogas dedicated networks of by means of tank trucks.

B. Prior to CCMP development, landfill-produced biogas, or a portion thereof, is captured and through combustion in a flare, without any use. In this case, project alternatives might lead to following situations in project scenario (thus requiring related information to build the baseline scenario)[6]:

- Captured biogas is used for electric power generation or efficiency associated to such process is improved.
- Captured biogas is used for thermal energy generation or efficiency associated to such process is improved.
- Captured biogas is used by injecting it to a natural gas distribution network or efficiency associated to such process is improved.
- Captured biogas is used by injecting it to a natural gas distribution network using biogas dedicated networks of by means of tank trucks or efficiency associated to such process is improved.

Whatever the situation of the CCMP, related methodological guidance shall be considered, discarding, or not considering those not applicable to the type of project implemented.

In case there are other biogas management systems in the landfill, such as aeration treatment (*in-situ* or passive), oxidation layers, biogas-based hydrogen production, among others, biogas that may be included in this methodology is limited exclusively to excess, non-processed biogas from such treatments.

[6] When referring to captured biogas use, it can be either in the condition it is recovered (raw), or after undergoing purification treatments in different degrees to enable its transport technically/economically and/or further use in compliance with applicable regulations and specifications in each case.

The CCMP developer shall specifically describe in the PDD, baseline scenario conditions and project status justifying specific data recording.

6.1 GHG emission sources in baseline scenario

GHG emission sources to be considered in CCMP baseline scenario are described in ***Table 1***.

Table 1. GHG emission sources considered in baseline scenario.

Source	GHG	Included	Explanation
Biogas generation in landfill.	CO_2	No	Organic solid waste decay in landfills generates biogas with these three types of GHG. CO_2 is not included due to its biogenic origin, whereas produced amounts of N_2O is considered as negligible. Biogas capture may be present or not in baseline scenario.
	CH_4	Yes	
	N_2O	No	
Fossil fuel consumption for electric power generation.	CO_2	Yes	All fossil fuels used for electric power generation produce these three types of GHGs when combusted. Neither CH_4 nor N_2O are considered as the produced amounts of these GHGs are negligible.
	CH_4	No	
	N_2O	No	
Fossil fuel consumption for thermal energy generation.	CO_2	Yes	All fossil fuels used for thermal energy generation produce these three types of GHGs when combusted. Neither CH_4 nor N_2O are considered as the produced amounts of these GHGs are negligible.
	CH_4	No	
	N_2O	No	
Use of natural gas from distribution networks (or gas pipelines).	CO_2	Yes	Natural gas produces these three types of GHGs when combusted. Neither CH_4 nor N_2O are considered as the produced amounts of these GHGs are negligible.
	CH_4	No	
	N_2O	No	
Use of fossil fuel displaced by using methane obtained from biogas dedicated networks or biogas distributed by tank trucks.	CO_2	Yes	Any fossil fuel displaced by biogas produces these three types of biogas, when combusted. Neither CH_4 nor N_2O are considered as the produced amounts of these GHGs are negligible.
	CH_4	No	
	N_2O	No	

If the CCMP responsible identifies in the baseline scenario a GHG source different from those described above, it may be included, provided such inclusion, and associated results obtained are justified.

The CCMP must ensure the identification of GHGs, and emission sources related to the CCMP it is developing.

In addition to the guidelines described above, in any case, all other guidelines described in the current version of the Cercarbono's Protocol must be followed.

6.2 Baseline scenario GHG emissions calculation

Calculation of baseline GHG emissions is related with management alternatives for the methane contained in landfill-captured biogas. Accordingly, emissions in baseline scenario are estimated as per in ***Equation 1***.

$$\boldsymbol{BLE_t = LBBLE_t + PGBLE_t + TEBLE_t + NPBLE_t + BTBLE_t} \qquad \textbf{\textit{Equation 1}}$$

Variable	Units	Description
$\boldsymbol{BLE_t}$	tCO_2e	Baseline GHG emissions during period ***t*** of baseline scenario.
$\boldsymbol{LBBLE_t}$	tCO_2e	GHG emissions from landfill-produced biogas in the baseline scenario in period ***t***, expected to be captured for its destruction or use.
$\boldsymbol{PGBLE_t}$	tCO_2e	GHG emissions from fossil fuel-based electric power generation in the baseline scenario in period ***t***, expected to be displaced by the project.
$\boldsymbol{TEBLE_t}$	tCO_2e	GHG emissions from fossil fuel-based thermal energy generation in the baseline scenario in period ***t***, expected to be displaced by the project.
$\boldsymbol{NPBLE_t}$	tCO_2e	GHG emissions from natural gas consumption in the baseline scenario in period ***t***, expected to be displaced due to the use of biogas through injection into natural gas pipelines by the project.
$\boldsymbol{BTBLE_t}$	tCO_2e	GHG emissions from fossil fuel consumption in the baseline scenario in period ***t***, expected to be displaced due to the use of biogas through injection into dedicated biogas pipelines or through biogas distribution using tank trucks by the project.

6.2.1 Landfill-generated biogas captured for its destruction or use

Biogas generation at landfill is calculated using this equation:

$$\boldsymbol{LBBLE_t = \left(\left(MLGP_t \times (1 - OX_t)\right) - MFUBL_t\right) \times GWP_{CH4}} \qquad \textbf{\textit{Equation 2}}$$

Variable	Units	Description
$\boldsymbol{LBBLE_t}$	tCO_2e	GHG emissions from landfill-produced biogas in the baseline scenario in period ***t***, expected to be captured for its destruction or use.
$\boldsymbol{MLGP_t}$	tCH_4	Methane in landfill-produced biogas in project scenario, flared or used by the CCMP in period ***t***.

Variable	Units	Description
OX_t	NA	Oxidated methane fraction in period ***t***.
$MFUBL_t$	tCH_4	Methane in landfill-produced biogas, flared or used in baseline scenario in period t. This value is applicable if methane destruction was carried out prior to project development. Otherwise $MPLB_t = 0$. For determination of mass flow from volume flow data, the use of CDM's Methodological Tool 08 is recommended.
GWP_{CH4}	tCO_2e/tCH_4	Methane Global Warming Potential.

Disaggregation level for period ***t*** can be determined by the CCMP, but in general, annual values are used. The period the baseline scenario is calculated for shall be consistent with the useful life of the technology employed in the project, without surpassing such timespan as a maximum for sakes of comparing periods.

$MFUBL_t$ value corresponds to the amount of methane destroyed through flaring prior to project development, expected to continue being destroyed during project operation, therefore it is applicable to cases where biogas flaring was carried out in the baseline scenario, whereas in the project scenario all or part of the biogas is used otherwise. In case no methane destruction was carried out prior to CCMP development, then $MFUBL_t$ value would be zero. $MFUBL_t$ and $MLGP_t$ shall pertain to the same period.

OX_t value corresponds to oxidation factor in period t, which reflects the amount of methane from the landfill that is oxidated before being released to the atmosphere due to different site-specific factors. In the oxidation report, an analysis on oxidated and non-oxidated contents escaping through cracks and fissures or by lateral diffusion is to be included to avoid overestimation of the oxidation processes (IPCC, 2019). An oxidation value of "0" may be employed for landfills featuring a total covering using membranes as they prevent oxidation and maximise methane capture, while in the remaining cases using a value of 0,1 is recommended. In case the facility must report to the designated authority the OX_t value supported with studies, such value for the applicable period shall be used in establishing the baseline scenario. The information on OX_t selection shall be documented in the PDD.

The $MLGP_t$ value corresponds to the amount of methane contained in the captured biogas for purposes of being employed in the project scenario, either to be destroyed or totally/partially used. To obtain such value two scenarios may be present, first is $MLGP_t$ estimation after the project development (*ex-post* scenario), and second is $MLGP_t$ determination before project development (*ex-ante* scenario).

a. In the *ex-post* scenario, it is calculated by means of following equation:

$$MLGP_t = MDFP_t + MPGP_t + MTEP_t + MGNP_t + MIDP_t \qquad \textit{Equation 3}$$

Variable	Units	Description
$MLGP_t$	tCH_4	Methane in landfill-produced biogas in project scenario, flared or used by the CCMP in period ***t***.

Variable	Units	Description
$MDFP_t$	tCH_4	Methane in biogas destroyed by flaring in the project in period ***t***.[7]
$MPGP_t$	tCH_4	Methane in biogas used for electric power generation in period ***t***.[8]
$MTEP_t$	tCH_4	Methane in biogas used for thermal energy generation in period ***t***.[9]
$MGNP_t$	tCH_4	Methane in biogas used for injection in natural gas systems in the project in period ***t***.[10]
$MIDP_t$	tCH_4	Methane in biogas injected in biofuel-dedicated systems or distributed by means of tank trucks in period ***t***.[11]

b. In the *ex-ante* scenario, it is calculated by means of following equation:

$$MLGP_t = MLGB_t \times \eta SC \qquad \textit{Equation 4}$$

Variable	Units	Description
$MLGP_t$	tCH_4	Methane in landfill-produced biogas in project scenario, flared or used by the CCMP in period ***t***.
$MLGB_t$[12]	tCH_4	Methane in biogas expected to be generated in the landfill in baseline scenario in period ***t***.
ηCS	NA	Biogas capture system efficiency (or that of the system to be installed in the landfill).

$MLGB_t$ is calculated using ***Equation 5*** which is based in the method described by IPCC (2019).

$$MLGB_t = DCBL_t \times MVF \times 16/12 \qquad \textit{Equation 5}$$

Variable	Units	Description
$MLGB_t$	tCH_4	Methane in biogas expected to be generated in the landfill in baseline scenario in period ***t***.
$DCBL_t$	tC	Degradable organic carbon available in degraded solid waste in baseline scenario in period ***t***.

[7] Corresponds to the integration of all valid measurements for parameter ***$MDFP_{m,t}$*** (Equation 18), obtained in period ***t***.
[8] Estimation of this value shall be performed using CDM's Methodological Tool 08 (*Tool to determine the mass flow of a greenhouse gas in a gaseous stream*).
[9] See footnote 8.
[10] See footnote 8.
[11] See footnote 8.
[12] For this variable, the last version of the waste model developed by IPCC may be used, preferably using country specific developed values.

Variable	Units	Description
MVF	*NA*	Methane volume fraction in landfill gas.
16/12	*NA*	Molecular mass ratio CH_4/C.

To calculate ***MVF*** (methane volume fraction in landfill gas) either a directly measured or calculated value shall be used by the CCMP responsible, or in case a default value is used, as propose by the IPCC (2019), the adequateness of such use shall be justified, and conservative assumptions shall be made regarding reported uncertainty in that case.

Default values: according to IPCC (2019), most of the waste in a landfill generate a gas containing approximately 50 % methane. Only materials with significant contents of fat and oil may generate a gas containing significantly higher than 50 % methane fractions. Thus, in the absence of measured or calculated values, the use of the default value for methane content in landfill gas as per in IPCC is recommended (0,5), conservatively considering the effect of reported uncertainty for such value (±5 %).

Measured value: methane fraction in landfill gas should not be confused with measured methane as emitted in landfills. In a landfill, CO_2 is absorbed in infiltrated water and the neutral condition in the landfill transforms a significant part of absorbed CO_2 in bicarbonate. It is a good practice to adjust CO_2 absorption in infiltrated water, if methane fraction in the landfill gas is based on methane concentrations measured in the landfill gas emitted by the landfill. (IPCC, 2019; Bergman, 1995; Kämpfer and Weissenfels, 2001; IPCC, 1997). Measured values and their representativeness shall be supported in the PDD.

$DCBL_t$ is calculated with ***Equation 6*** (IPCC, 2019).

$$DCBL_t = BCBL_{t-1} \times \left(1 - e^{-k}\right) \qquad \textit{Equation 6}$$

Variable	Units	Description
$DCBL_t$	*tC*	Degradable organic carbon available in degraded solid waste in baseline scenario in period ***t***.
$BCBL_{t-1}$	*tC*	Biodegradable organic carbon mass accumulated in solid waste in the baseline scenario at the end of ***t-1*** period.
k	$year^{-1}$	Reaction constant for ***t-1*** period.

$$k = ln(2)/LML \qquad \textit{Equation 7}$$

Variable	Units	Description
k	$year^{-1}$	Reaction constant for ***t-1*** period.
LML	*year*	Landfill mean lifetime.

LML value shall be justified in the PDD.

Accordingly, $BCBL_t$ is calculated with ***Equation 8*** (IPCC, 2019).

$$BCBL_t = \mathbf{TCBL}_t + \left(\mathbf{BCBL}_{t-1} \times e^{-k}\right) \qquad \textbf{Equation 8}$$

Variable	Units	Description
$BCBL_t$	*tC*	Biodegradable organic carbon mass accumulated in solid waste in the baseline scenario at the end of period ***t***.
$TCBL_t$	*tC*	Total mass of biodegradable organic carbon available in solid waste expected to be received in the landfill in baseline scenario at the end of period ***t***.
$BCBL_{t-1}$	*tC*	Biodegradable organic carbon mass accumulated in solid waste in the baseline scenario at the end of ***t-1*** period.
k	*year* $^{-1}$	Reaction constant for ***t-1*** period.

The total mass of biodegradable organic carbon available in solid waste sent to the landfill is calculated using ***Equation 9*** (IPCC, 2019).

$$TCBL_t = WBL_t \times DOCF_t \times DOCFA_t \times MCF \qquad \textbf{Equation 9}$$

Variable	Units	Description
$TCBL_t$	*tC*	Total mass of biodegradable organic carbon available in solid waste expected to be received in the landfill in baseline scenario at the end of period ***t***.
WBL_t	*t*	Amount of waste expected to be received in the landfill in the baseline scenario in period ***t***.
$DOCF_t$	*tC/ t waste*	Degradable organic carbon fraction in waste expected to be sent to the landfill in period ***t***.
$DOCFA_t$	*NA*	Degradable organic carbon fraction decomposed in anaerobic conditions in period ***t***.
MCF	*NA*	Methane correction factor for anaerobic degradation in year it is deposited.

MCF has been determined by IPCC (2019) for default values in landfills with / without active aeration considering diverse management hypotheses. For both types of landfills a significant reduction of the ***DOCF$_t$*** fraction is presented, due to aerobic degradation processes, which justifies the estimation of more precise correction factors. Aeration processes have an impact mainly on microbial activity, resulting in high fluctuations in methane emissions, so the use of in-situ measurements is recommended to monitor this effect and obtaining a more precise measurement (IPCC, 2019). IPCC (2019) publishes ***MCF*** average values in accordance with described conditions, which are recommended to be used in cases where no associated measurements are performed, justifying its use, conservatively considering reported uncertainty values in this same source.

Accordingly, ***DOCF$_t$*** is calculated using ***Equation 10***.

$$DOCF_t = \sum_{r=1}^{R} \left(DOCF_{r,t} \times F_{r,t} \right) \qquad \textbf{Equation 10}$$

Variable	Units	Description
$DOCF_t$	*tC/t waste*	Degradable organic carbon fraction in waste expected to be sent to the landfill in period ***t***.
$DOCF_{r,t}$	*tC/t waste*	Degradable organic carbon fraction decomposing in anaerobic conditions for ***r*** waste types in period ***t*** of baseline scenario.
$F_{r,t}$	*NA*	Proportion of ***r*** waste type as compared to the total ***r*** waste in period ***t***.
r	*NA*	Waste type index.
R	*NA*	Total count of considered waste types.

For values included in the equation, as well as for those employed in its calculation (coefficients, factors or heating values used in methodology), the IPCC Good Practice Guidance shall be used, conservatively considering the uncertainty for such values (IPCC, 2019).

For $DOCF_{r,t}$ existent values relevant to the activity, site, country, or region shall be used and in absence of them, default values as per in IPCC (2019) can be employed for the different types of waste having a different biodegradation degree, justifying the lack of existing values. If there is no such information for a landfill, then the default value for $DOCF_{r,t}$ will be 0,5 or that encountered in country specific values from national, authorized, sources, including conservative consideration of uncertainty factor according to IPCC (2019). Moreover, the remaining guidelines of IPCC (2019) methodology shall be followed for selection of such value.

All values used in previous equations, and adopted decisions regarding baseline scenario periods, shall be supported by the CCMP in compliance with principles outlined in current version of Cercarbono's Protocol.

Further to above-described guidelines, in any case guidelines described in current version of Cercarbono's Protocol shall be considered for GHG emissions in the baseline scenario.

6.2.2 Fossil fuel-based electric power generation

Baseline scenario for fossil fuel-based electric power generation depends on if such fuels are used (or not) in an interconnected grid. Accordingly, two alternative baseline scenario construction alternatives are described below for each condition. The project developer shall employ that suited to the specific conditions.

6.2.3 Electric power generation in an interconnected grid

In cases where it is demonstrated that in CCMP absence, electricity would have been supplied by an interconnected electric grid, where electricity is generated under the electric mix in the influence zone, projects' baseline scenario shall be related to GHG emissions that would had been generated for an equivalent electricity block to that produced by the project, supplied by the interconnected grid with its associated emissions, during the time periods a comparison is required. Baseline scenario calculations are performed using ***Equation 11***.

$$PGBLE_t = \sum_{j=1}^{J} ECBL_{j,t} \times EFIG_t \times (1 + TDTL_{j,t}) \qquad \textbf{Equation 11}$$

Variable	Units	Description
$PGBLE_t$	tCO_2e	GHG emissions from fossil fuel-based electric power generation in the baseline scenario in period ***t***, expected to be displaced by the project.
$ECBL_{j,t}$	*MWh*	Electricity that would be consumed by user ***j*** in the baseline scenario in period ***t***, expected to be displaced by the project.
$EFIG_t$	tCO_2e/MWh	CO_2 emission factor of interconnected grid for period ***t***.
$TDTL_{j,t}$	*%*	Average technical losses for electricity transmission and distribution to grid user ***j*** in period ***t***.
j	*NA*	Index for electricity user to be supplied in project scenario.
J	*NA*	Total user count.

Data disaggregation level can be determined by CCMP owner, but in general at least annual data within period ***t*** shall be included when monitoring frequency is not indicated in ***Table 3*** in CCMP monitoring section.

$EFIG_t$ is calculated by electric grid managers and its last available value can be used in determining baseline GHG emissions by the CCMP, provided it has been calculated in accordance with CDM's developed Methodological Tool 07[13], in which case the calculation-associated values are not required to be supported, but their origin and reliability of referred sources. It may also be calculated and supported directly by the CCMP in which case the selected values shall be supported. For calculation of an interconnected grid emission factor, as required, the specific tool developed by the CDM shall be used.

All values used in previous equation, as well as adopted decisions regarding baseline scenario periods, shall be supported by the CCMP, in compliance with principles as per in current version of Cercarbono's Protocol.

6.2.4 Electric power generation in a Non-Interconnected Zone (NIZ)

In cases where CCMPs supply electricity to a NIZ, there are two alternatives to develop the baseline scenario: (i) the zone in which electricity is supplied has already a fossil fuel-based electricity supply or is more GHG intensive than CCMP GHG emissions and (ii) the ZNI does not have electricity supply prior to CCMP implementation.

[13] Use current version of CDM's: *Methodological tool to calculate the emission factor for an electricity system.*

If the interconnected zone already had a supply, and it came from two or more captive, fossil fuel-based power generation plants, then baseline scenario GHG emissions shall be determined by using following equation:

$$PGBLE_t = \sum_{k=1}^{K} ECBL_{j,t} \times EFNZ_{k,t} \times \left(1 + TDTL_{j,t}\right) \qquad \textit{Equation 12}$$

Variable	Units	Description
$PGBLE_t$	tCO_2e	GHG emissions from fossil fuel-based electric power generation in the baseline scenario in period ***t***, expected to be displaced by the project.
$ECBL_{j,t}$	*MWh*	Electricity that would be consumed by user ***j*** in the baseline scenario in period ***t***, expected to be displaced by the project.
$EFNZ_{k,t}$	tCO_2e/MWh	CO_2 emission factor of captive electricity generation plant ***k*** in the non-interconnected zone in period ***t***.
$TDTL_{j,t}$	*%*	Average technical losses for electricity transmission and distribution to grid user ***j*** in period ***t***.
j	*NA*	Index for electricity user to be supplied in project scenario.
k	*NA*	Index for captive plant index.
K	*NA*	Total captive plant count.

In previous equation, the emission factor for captive plant(s) ***k*** supplying electricity in tha baseline scenario would be:

$$EFNZ_t = \frac{\sum_{k=1}^{K}\sum_{c=1}^{C} FFNZ_{k,c,t} \times FFHV_{c,t} \times EFFF_{c,t}}{\sum_{k=1}^{K} PGNZ_{k,t}} \qquad \textit{Equation 13}$$

Variable	Units	Description
$EFNZ_t$	tCO_2e/MWh	CO_2 emission factor of captive electricity generation plant ***k*** in the non-interconnected zone in period ***t***.
$FFNZ_{k,c,t}$	*Volume or mass units*	Type ***c*** fossil fuel used by captive plant ***k*** in period ***t***.
$FFHV_{c,t}$	*MJ/volume or mass unit*	Average low heating value of type ***c*** fossil fuel used in period ***t***.
$EFFF_{c,t}$	tCO_2e/MJ	Average emission factor for type ***c*** fossil fuel used in period ***t***.
$PGNZ_{k,t}$	*MWh*	Electric power generated by captive plant ***k*** in period ***t*** in baseline scenario.
k	*NA*	Index for captive plant index.
K	*NA*	Total captive plant count.
c	*NA*	Index of fossil fuel type.
C	*NA*	Total count of fossil fuels used by a captive plant.

For $\boldsymbol{EFFF_{c,t}}$ it is recommended to use official emission factors for the country in which the CCMP is implemented. In absence of such values, IPCC (2019) recommended values can be used, provided a justification for its use is documented.

In cases where electricity to be displaced comes from both an interconnected grid and from captive plants in a non-interconnected zone, or when electricity in a non-interconnected zone is supplied by a power generation facility operating a cogeneration cycle, or cases where any combination of such power generating schemes is in place, then criteria as per in current version of CDM's Methodological Tool 05[14] shall be applied.

Total period for which baseline scenario is calculated shall directly correspond with the useful life of the GHG project technology, without surpassing a maximum twenty-year comparison period.

If useful life of the technology employed for electricity supply in a NIZ associated to the baseline scenario is shorter than that used in the CCMP, baseline emissions for the remaining years after current NIZ technology obsolescence shall be estimated by identifying the option most closely related to the potential situation in the absence of the CCMP, i.e., sustaining if presumably such NIZ could become a part of the interconnected grid (in which case ***Equation 11*** shall be used to estimate the project baseline scenario), or if continued supply from the NIZ could be expected, in which case ***Equation 12*** shall be used provided pertinent changes are performed to consider projected situation. In no case the baseline scenario shall be projected for a timespan longer than that of technology used.

All values used in previous equation, as well as adopted decisions regarding baseline scenario periods, shall be supported by the CCMP, in compliance with principles as per in current version of Cercarbono's Protocol.

When the NIZ had no electricity supply prior to the CCMP start, the CCMP responsible can use one of the two previously described equations (***Equation 11*** or ***Equation 12***), demonstrating the selected option is the one more closely related to what presumably would occur in the non-interconnected zone in absence of the CCMP (either connecting to the interconnected grid or supplying electricity in a non-interconnected fashion). For any of these options, developed project additionality shall be demonstrated, choosing the most conservative option.

Further to above-described guidelines, in any case guidelines described in current version of Cercarbono's Protocol shall be considered for GHG emissions in the baseline scenario.

6.2.5 Fossil fuel-based thermal energy generation

In cases where biogas is used to displace fossil fuel consumption for thermal energy generation, the baseline scenario shall be determined by means of following equation:

[14] Use current version of *TOOL 05: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation*.

$$TEBLE_t = MHV \times \sum_{l=1}^{L}(MDFP_{l,t} \times EFFBL_l \times \frac{\eta TP_l}{\eta TBL_l}) \quad \textit{Equation 14}$$

Variable	Units	Description
$TEBLE_t$	tCO_2e	GHG emissions from fossil fuel-based thermal energy generation in the baseline scenario in period ***t***, expected to be displaced by the project.
MHV	MJ/tCH_4	Methane lower heating value at reference conditions.
$MDFP_{l,t}$	tCH_4	Methane contained in biogas, expected to be used to displace fossil fuel used in device ***l*** in period t of project scenario.
$EFFBL_l$	tCO_2e/MJ	CO_2 emission factor for fossil fuel used in device ***l*** in baseline scenario, to be displaced by project captured biogas.
ηTP_l	*NA*	Thermal efficiency of device ***l*** used in project scenario.
ηTBL_l	*NA*	Thermal efficiency of device ***l*** used in baseline scenario.
l	*N/A*	Index for device using fossil fuel.
L	*N/A*	Total count of devices using fossil fuel.

Data disaggregation level can be determined by CCMP owner, but in general at least annual data within period ***t*** shall be included when monitoring frequency is not indicated in ***Table 3*** in CCMP monitoring section.

For ***EFFBL***, it is recommended to use official emission factors for the country the CCMP is implemented in or reported mean values as per in (2019) for a specific fossil fuel.

Correspondence shall exist between total time for baseline scenario and useful life of the technology employed in the project, without surpassing twenty years as the maximum comparison period.

In case equipment used for thermal energy generation are different or experience modifications between the baseline and project scenarios, baseline emissions shall be impacted multiplying them by the ratio of project equipment efficiency to baseline equipment efficiency, using a sound and reliable source-referenced methodology for such determination.

As for thermal efficiency ratio, the lower value between 1 and such ratio value shall be used.

All values used in previous equation, as well as related decisions adopted regarding periods and conditions in which the baseline scenario is proposed, shall be supported by the CCMP, complying with the principles outlined in current version of Cercarbono's Protocol.

Further to above-described guidelines, in any case guidelines described in current version of Cercarbono's Protocol shall be considered for GHG emissions in the baseline scenario.

6.2.6 Biogas injection in natural gas distribution systems

In cases where biogas is used for injection[15] into natural gas distribution networks, displacing the use of such fuel, baseline scenario shall be determined using ***Equation 15***.

$$NPBLE_t = (MDGP_t \times MHV \times EFNBL) \qquad \textbf{Equation 15}$$

Variable	Units	Description
$NPBLE_t$	tCO_2e	GHG emissions from natural gas consumption in the baseline scenario in period ***t***, expected to be displaced due to the use of biogas through injection into natural gas pipelines by the project.
$MDGP_t$	tCH_4	Methane contained in biogas, expected to be used to displace natural gas in period ***t*** of project scenario.
MHV	MJ/tCH_4	Methane lower heating value at reference conditions.
$EFNBL$	tCO_2e/MJ	CO_2 emission factor for natural gas used in baseline scenario, which will be displaced by methane contained in biogas to be used for injection into a natural gas pipeline.

Data disaggregation level can be determined by CCMP owner, but in general at least annual data within period ***t*** shall be included when monitoring frequency is not indicated in ***Table 3*** in CCMP monitoring section.

For ***EFNBL***, it is recommended to use official emission factors for the country the CCMP is implemented in or mean reported values as per in IPCC (2019) for such fossil fuel.

Correspondence shall exist between total time for baseline scenario and useful life of the technology employed in the project, without surpassing twenty years as the maximum comparison period.

All values used in previous equation, as well as related decisions adopted regarding periods and conditions in which the baseline scenario is proposed, shall be supported by the CCMP, complying with the principles outlined in current version of Cercarbono's Protocol.

Further to above-described guidelines, in any case guidelines described in current version of Cercarbono's Protocol shall be considered for GHG emissions in the baseline scenario.

6.2.7 Biogas distribution in dedicated networks or using tank-trucks

In cases where biogas is used to be injected in dedicated (biogas or biofuel) distribution networks or for commercialization by means of tank-trucks, displacing fossil fuel consumption, the baseline scenario shall be determined using following equation:

[15] Usually this is only possible after biogas treatment and purification.

$$BTBLE_t = \left(MDLBL_t \times MHV \times \sum_{c=1}^{C} EFCBL_c \right)$$ **Equation 16**

Variable	Units	Description
$BTBLE_t$	*tCO_2e*	GHG emissions from fossil fuel consumption in the baseline scenario in period ***t***, expected to be displaced due to the use of biogas through injection into dedicated biogas pipelines or through biogas distribution using tank trucks by the project.
$MDLBL_t$	*tCH_4*	Methane in landfill biogas expected to be used to displace fossil fuel that would be used in absence of distribution through dedicated pipeline networks or tank-trucks in period ***t*** of baseline scenario.
MHV	*MJ/tCH_4*	Methane lower heating value at reference conditions.
$EFCBL_c$	*tCO_2e/MJ*	CO_2 emission factor for fossil fuel ***c*** in baseline scenario to be displaced by project captured biogas.
c	*N/A*	Index of fossil fuel type.
C	*N/A*	Total count of fossil fuels considered.

Data disaggregation level can be determined by CCMP owner, but in general at least annual data within period ***t*** shall be included when monitoring frequency is not indicated in ***Table 3*** in CCMP monitoring section.

For ***$EFCBL_c$*** it is recommended to use official emission factors for the country the CCMP is implemented in or mean reported values as per in IPCC (2019) for such fossil fuel.

Correspondence shall exist between total time for baseline scenario and useful life of the technology employed in the project, without surpassing twenty years as the maximum comparison period.

All values used in previous equation, as well as related decisions adopted regarding periods and conditions in which the baseline scenario is proposed, shall be supported by the CCMP, complying with the principles outlined in current version of Cercarbono's Protocol.

Further to above-described guidelines, in any case guidelines described in current version of Cercarbono's Protocol shall be considered for GHG emissions in the baseline scenario.

7 Project scenario

7.1 Project scenario GHG emission sources

GHG emissions to be considered in project scenario are described below, in ***Table 2***.

Table 2. GHG emission sources considered in project scenario.

Source	GHG	Included	Explanation
Destruction of methane from landfill biogas in a flare.	CO_2	No	Flaring of methane contained in landfill biogas generates emissions associated to the flare destruction efficiency. Considering combustion-generated CO_2 is biogenic, it is not accounted for. N_2O not considered, as produced amount is negligible.
	CH_4	Yes	
	N_2O	No	
Fossil fuel consumption for ancillary processes (electric or thermal power generation).	CO_2	Yes	Fossil fuel combustion for electricity generation and thermal systems operation. Fossil fuel combustions in tank-trucks used for distribution of methane contained in landfill biogas.
	CH_4	No	
	N_2O	No	
Electricity consumption in control and ancillary systems.	CO_2	Yes	Imported energy consumption (either from an interconnected grid or a third party) of systems controlling the project's electricity generation.
	CH_4	No	
	N_2O	No	
Methane emissions from distribution in pipeline networks or through tank-trucks.	CO_2	No	Physical losses of methane contained in captured landfill biogas and distributed through pipeline networks or tank-trucks.
	CH_4	Yes	
	N_2O	No	

7.2 Leakage

Leakage is not considered in projects using methane contained in landfill biogas. GHG emissions due to actions such as those resulting from power plant construction activities, soil preparation, upstream emissions due to fossil fuels used for transportation, extraction or processing of the technology employed in the CCMP are deemed negligible.

7.3 Project scenario GHG emissions calculation

Project scenario GHG emissions ($\boldsymbol{PE_t}$) can be calculated using ***Equation 17***.

$$\boldsymbol{PE_t = LMDPE_t + FFCPE_t + ECAPE_t + MLPPE_t + MLTPE_t} \qquad \textit{Equation 17}$$

Variable	Units	Description
$\boldsymbol{PE_t}$	*tCO₂e*	Project scenario GHG emissions during period ***t***.
$\boldsymbol{LMDPE_t}$	*tCO₂e*	GHG emissions from methane contained in landfill biogas destruction in flares in period ***t*** of project scenario.

Variable	Units	Description
$FFCPE_t$	tCO_2e	GHG emissions from fossil fuel use in ancillary processes (biogas treatment and purification systems, ancillary electricity generation, thermal equipment start-up, tank-truck distribution of methane contained in biogas, among others), in period ***t*** of project scenario.
$ECAPE_t$	tCO_2e	GHG emissions from electricity consumption in ancillary and control systems in period ***t*** in the project scenario, including biogas treatment and purification systems.
$MLPPE_t$	tCO_2e	GHG emissions from methane losses in pipeline distribution networks and systems in period ***t*** of project scenario.
$MLTPE_t$	tCO_2e	GHG emissions from methane transport and losses in tank-truck distribution systems in period ***t*** of project scenario.

Data disaggregation level can be determined by CCMP owner, but in general at least annual data within period ***t*** shall be included when monitoring frequency is not indicated in ***Table 3*** in CCMP monitoring section. Correspondence shall exist between used values for ***t*** in project scenario with those used for baseline scenario estimation.

GHG emissions generation period in the project scenario is determined by the useful life of the main technology used for biogas capture or use. Such value shall be defined and justified by the CCMP and shall not be greater than the technology useful life.

CCMP shall identify and calculate any other GHG emission source that may be applicable to project scenario. Selection of methodologies for calculation of GHG emissions in the project scenario corresponds to the project responsible. They shall be recognized and be based in IPCC's guidelines for GHG emissions calculation, and they shall comply with all principles outlined in current version of Cercarbono's Protocol.

All values used in the equation, and results obtained thereof, shall be supported by the CCMP.

Further to above-described guidelines, in any case guidelines described in current version of Cercarbono's Protocol shall be considered for GHG emissions in the project scenario.

7.3.1 Project scenario GHG emissions from destruction of methane contained in landfill biogas

In cases where methane in landfill-captured biogas is flared, this part of project scenario GHG emissions shall be determined using following equation:

$$LMDPE_t = \sum_{m=1}^{MT} \left(MBFP_{m,t} \times \left(1 - \eta MDP_{m,t}\right) \times GWP_{CH4}\right) \qquad \textit{Equation 18}$$

Variable	Units	Description
$LMDPE_t$	tCO_2e	GHG emissions from methane contained in landfill biogas destruction in flares in period ***t*** of project scenario.
$MBFP_{m,t}$	tCH_4	Methane in biogas flared during minute ***m*** in period ***t*** in project scenario.
$\eta MDP_{m,t}$	%	Flare methane destruction efficiency in minute ***m*** in period ***t*** in project scenario.
GWP_{CH4}	tCO_2e/tCH_4	Methane Global Warming Potential.
m	*NA*	Index of the minute where flared methane is monitored.
MT	*NA*	Total minute count in period ***t***.

$\eta MDP_{m,t}$ is defined by the CDM (Methodological Tool 06), as one minus the ratio of methane mass flow in the flare exhaust to the methane mass flow in the landfill biogas sent to flare.

Flare methane destruction efficiency depends on its combustion efficiency and the time t the flare is in operation. CCMP shall determine efficiency of enclosed flares using monitored data or use a default value instead. Flare operation time shall be quantified by the minute and is determined using a flame detector. For enclosed flares, it is also required their compliance with the control requirements as per the manufacturer's specifications for the operation conditions.

Temporal data disaggregation level for $MBFP_{m,t}$ and $\eta MDP_{m,t}$, monitoring shall be recorded minute-by-minute, and monitoring frequency can be determined by CCMP owner, but in general at least annual data within period ***t*** shall be included when monitoring frequency is not indicated in the monitored parameters table. Correspondence shall exist between used values for ***t*** in project scenario with those used for baseline scenario estimation.

GHG emissions generation period in the project scenario is determined by the useful life of the main technology used for biogas capture of use. This value shall be defined and justified by the CCMP and shall not be greater than the landfill's useful life.

All values and results used in the equation shall be supported by the CCMP.

Further to above-described guidelines, in any case guidelines described in current version of Cercarbono's Protocol shall be considered for GHG emissions in the project scenario.

7.3.2 Project scenario GHG emissions due to fossil fuel consumption in ancillary processes

In cases where in the context of the project scenario fossil fuel is used to carry out ancillary activities such as: biogas treatment and purification, electric power generation, thermal systems operation, tank-truck transportation of recovered methane, among others, this fraction of the project scenario GHG emissions shall be determined using ***Equation 19***.

$$FFCPE_t = \sum_{c=1}^{C} \left(FCP_{c,t} \times EFFDP_c \right) \qquad \textbf{Equation 19}$$

Variable	Units	Description
$FFCPE_t$	tCO_2e	GHG emissions from fossil fuel use in ancillary processes (biogas treatment and purification systems, ancillary electricity generation, thermal equipment start-up, tank-truck distribution of methane contained in biogas, among others), in period ***t*** of project scenario.
$FCP_{c,t}$	*Fuel volume or mass unit*	Type ***c*** fossil fuel consumed in period ***t*** in project scenario.
$EFFDP_c$	tCO_2e/ *fuel volume or mass unit*	CO_2 emission factor for type **c** fossil fuel, displaced by captured biogas in project scenario.
c	*NA*	Index of fossil fuel type.
C	*NA*	Total count of fossil fuels used in project scenario.

Data disaggregation level can be determined by CCMP owner, but in general at least annual data within period ***t*** shall be included when monitoring frequency is not indicated in ***Table 3*** in CCMP monitoring section. Correspondence shall exist between used values for ***t*** in project scenario with those used for baseline scenario estimation.

GHG emissions generation period in the project scenario is determined by the useful life of the main technology used for biogas capture of use. This value shall be defined and justified by the CCMP and shall not be greater than the landfill's useful life.

For ***EFFDP*** it is recommended to use official country emission factors according to CCMP implementation site location. Otherwise, values from reliable references may be used, which shall be justified regarding its representativeness and applicability in the CCMP context.

All values and results used in the equation shall be supported by the CCMP.

Further to above-described guidelines, in any case guidelines described in current version of Cercarbono's Protocol shall be considered for GHG emissions in the project scenario.

7.3.3 Project scenario GHG emissions due to imported electricity consumption

In cases where imported electricity purchased from an external grid is used for methane contained in the biogas-capture, destruction or use systems, this fraction of the project scenario GHG emissions shall be determined as per in following equation:

$$ECAPE_t = IECP_t \times EFGSP_t \times (1 + TDTP_t)$$ ***Equation 20***

Variable	Units	Description
$ECAPE_t$	tCO_2e	GHG emissions from electricity consumption in ancillary and control systems in period ***t*** in the project scenario, including biogas treatment and purification systems.

Variable	Units	Description
$IECP_t$	MWh	Imported electricity consumption in period ***t*** of project scenario.
$EFGSP_t$	tCO_2e/MWh	CO_2 emission factor for the electric grid or electricity supplier in period ***t*** in project scenario.
$TDTP_t$	%	Average technical transmission and distribution losses for electricity supply from the electric grid or an electricity supplier in period ***t***.

Data disaggregation level can be determined by CCMP owner, but in general at least annual data within period ***t*** shall be included when monitoring frequency is not indicated in ***Table 3*** in CCMP monitoring section. Correspondence shall exist between used values for ***t*** in project scenario with those used for baseline scenario estimation.

GHG emissions generation period in the project scenario is determined by the useful life of the main technology used for biogas capture of use. This value shall be defined and justified by the CCMP and shall not be greater than the landfill's useful life.

All values and results used in the equation shall be supported by the CCMP.

Further to above-described guidelines, in any case guidelines described in current version of Cercarbono's Protocol shall be considered for GHG emissions in the project scenario.

7.3.4 Project scenario GHG emissions for losses of methane contained in landfill biogas in pipeline distribution systems

In cases where methane obtained from landfill gas is distributed through pipelines (either biogas dedicated or mixed with natural gas), this fraction of the project emissions shall be calculated using ***Equation 21***.

$$MLPPE_t = MDPP_t \times LDNP_t \times GWP_{CH4}$$ ***Equation 21***

Variable	Units	Description
$MLPPE_t$	tCO_2e	GHG emissions from methane losses in pipeline distribution networks and systems in period ***t*** of project scenario.
$MDPP_t$	tCH_4	Methane in biogas distributed through pipeline networks in period ***t*** in project scenario.
$LDNP_t$	%	Biogas (or natural gas, as applicable) percentage losses in distribution network in period ***t*** in project scenario.
GWP_{CH4}	tCO_2e/tCH_4	Methane Global Warming Potential.

Data disaggregation level can be determined by CCMP owner, but in general at least annual data within period ***t*** shall be included when monitoring frequency is not indicated in ***Table***

3 in CCMP monitoring section. Correspondence shall exist between used values for ***t*** in project scenario with those used for baseline scenario estimation.

GHG emissions generation period in the project scenario is determined by the useful life of the main technology used for biogas capture of use. This value shall be defined and justified by the CCMP and shall not be greater than the landfill's useful life.

All values and results used in the equation shall be supported by the CCMP. It is assumed in distribution networks where a combination with natural gas is present, losses are equivalent to the relative percentage for both combined fuels.

Further to above-described guidelines, in any case guidelines described in current version of Cercarbono's Protocol shall be considered for GHG emissions in the project scenario.

7.3.5 Project scenario GHG emissions for losses of methane contained in landfill biogas in tank-truck distribution systems

In cases where methane obtained from landfill biogas is distributed using tank-trucks, project scenario shall be determined using following equation:

$$\boldsymbol{MLTPE_t = ETDP_t + ETLP_t} \quad \textbf{Equation 22}$$

Variable	Units	Description
$\boldsymbol{MLTPE_t}$	tCO_2e	GHG emissions from methane transport and losses in tank-truck distribution systems in period ***t*** of project scenario.
$\boldsymbol{ETDP_t}$	tCO_2e	GHG emissions from biogas tank-truck distribution systems in period ***t*** in project scenario.
$\boldsymbol{ETLP_t}$	tCO_2e	GHG emissions from methane losses in biogas tank-truck distribution systems in period ***t*** in project scenario.

If access to complete data regarding fuel consumption due to biogas transportation in tank-truck transport systems in period t of project scenario is available, then $\boldsymbol{ETDP_t}$ shall be calculated using CDM's Methodological Tool 03: *Tool to calculate project or leakage CO_2 emissions from fossil fuel* combustion.

Otherwise, ***Equation 23***, where a method utilizing distances and transported payload is described, can be used.

$$\boldsymbol{ETDP_t = \sum_{f=1}^{F} DP_{f,t} + TTPP_{f,t} \times EFTP_f} \quad \textbf{Equation 23}$$

Variable	Units	Description
$ETDP_t$	tCO_2e	GHG emissions from biogas tank-truck distribution systems in period ***t*** in project scenario.
$DP_{f,t}$	*km*	Distance (return) between origin and destiny for ***f*** transport activity in period ***t*** in project scenario.
$TTPP_{f,t}$	*t*	Total transported payload for ***f*** transport activity in period ***t*** in project scenario.
$EFTP_f$	$tCO_2e/t\text{-}km$	Emission factor for ***f*** transport activity in project scenario.
f	*N/A*	Index for transport activity.
F	*N/A*	Total transport activity count in period t in project scenario.

$$ETLP_t = (MLTP_t - MUTP_t) \times GWP_{CH4} \qquad \textbf{Equation 24}$$

Variable	Units	Description
$ETLP_t$	tCO_2e	GHG emissions from methane losses in biogas tank-truck distribution systems in period ***t*** in project scenario.
$MLTP_t$	tCH_4	Methane in captured landfill biogas loaded into tank-trucks in period ***t*** in project scenario.
$MUTP_t$	tCH_4	Methane in landfill biogas unloaded from tank- trucks in period ***t*** in project scenario.
GWP_{CH4}	tCO_2e/tCH_4	Methane Global Warming Potential.

Data disaggregation level can be determined by CCMP owner, but in general at least annual data within period ***t*** shall be included when monitoring frequency is not indicated in ***Table 3*** in CCMP monitoring section. Correspondence shall exist between used values for ***t*** in project scenario with those used for baseline scenario estimation.

GHG emissions generation period in the project scenario is determined by the useful life of the main technology used for biogas capture or use. This value shall be defined and justified by the CCMP and shall not be greater than the landfill's useful life.

All values and results used in the equation shall be supported by the CCMP.

Further to above-described guidelines, in any case guidelines described in current version of Cercarbono's Protocol shall be considered for GHG emissions in the project scenario.

8 GHG emissions reduction

GHG emissions reduction from the CCMP is obtained by subtracting project scenario GHG emissions from baseline scenario GHG emissions, according to following equation:

$$ER_t = BLE_t - PE_t$$ ***Equation 25***

Variable	Units	Description
ER_t	tCO_2e	Ex-ante emissions reduction during period ***t***.
BLE_t	tCO_2e	Baseline GHG emissions during period ***t*** of baseline scenario.
PE_t	tCO_2e	CCMP project scenario GHG emissions during period ***t***.

9 Stakeholders' consultation

The stakeholders' consultation as per in this methodology shall be performed according to guidelines as per in section: **Public consultation of CCMPs** of the Cercarbono's Protocol, and as per in applicable reference documents.

All records and results of the public consultation process are kept and managed by Cercarbono.

10 Safeguards

The CCMP must check that it does not produce net harm in accordance with the ***Safeguarding Principles and Procedures of Cercarbono's Certification Programme,*** available at www.cercarbono.com, section: Documentation.

11 Uncertainty

An uncertainty assessment shall be performed by the CCMP during planning and implementation phase, in accordance with Annexes A.3.5, A.3.6, and A.3.8 of ISO 14064-2:2019 Standard. The owner of the CCMP shall pursue minimizing the uncertainty of the initiative-related information and data.

12 Contributions to UN's Sustainable Development Goals

In the framework of Cercarbono programme, CCMPs shall report their contributions to SDGs by means of ***Cercarbono's Tool to Report Contributions from Climate Change Mitigation Initiatives to the Sustainable Development Goals***, available at www.cercarbono.com, section: Documentation. Assessment of application of such tool will be part of the verification process. The rubric of the SDG tool shall be duly signed by the VVB in charge of the verification event.

CCMPs adequately implementing Cercarbono's SDGs tool shall be awarded a differentiation seal, shown on the retirement certificate and in EcoRegistry platform.

13 Grouped projects

Grouped projects are composed by instances such as electric power generation centrals, plants, or facilities which for a given MRV process are unified to achieve an environmental impact mitigation through a single CCMP. It shall be demonstrated that each of these instances comply with all established criteria in the host country regulations, as well as those in Cercarbono's Protocol and in this methodology, to be eligible for such unified treatment and, given the case, to generate marketable emissions reduction credits.

For several emissions reduction instances to become unified in a single CCMP, the subject renewable energy source must be the same for all of them and additionality must be tested individually for each instance.

Th PDD shall include a clear and separate description for each of the grouped instances, the CCMP responsible(s), either natural or legal person(s), the spatial and temporary extent, as well as that of the grouped project as a whole. In addition, achieved and projected GHG emissions reduction through the accreditation period shall be disaggregated by individual instance, and the cumulative sum of them shall also be reported.

Monitoring requirements associated to these initiatives shall be followed by each one of the grouped instances.

On top of above-described guidelines, the requirements regarding grouped projects as per in current version of Cercarbono's Protocol must be considered in any case.

14 CCMP monitoring

All information and data related to the CCMP shall be subject for validation and verification, under the guidelines of ISO 14064-3:2019 and Cercarbono's Protocol. Additionally, all collected information as per by the monitoring plan shall be electronically filed and stored to allow for future consultation for at least four years past the end date of the accreditation period.

14.1 Description of the monitoring plan

The CCMP owner shall possess al required information to demonstrate the results and statements related to the project comply with all principles and are in line with the methodological requirements of this document, those in Cercarbono's Protocol and in Annexes A.3.5, A.3.6, and A.3.8 of ISO 14064-2:2019 Standard.

Required measurements for variable monitoring requiring it, either direct variable specific measurements or indirect measurements to allow for monitored variable calculation, shall be performed using calibrated equipment and instrumentation according to relevant industry standards, to methodological documents relevant to CCMP implementation, or according to vendor/manufacturer recommendations, as applicable.

Calibration frequency shall be dictated by manufacturer recommendations or applicable regulation standards. The minimum calibration frequency in the absence of such references shall be yearly.

For measurements derived from lab analysis or reported by suppliers, it shall be assumed involved meters comply with this, provided such companies or organizations have a valid certified product quality system in place.

The CCMP responsible shall develop and implement a monitoring plan, in compliance with conditions as per in Cercarbono's Protocol (section: ***CCMP monitoring***) and item 6.10 of ISO 14064-2:2019 Standard.

14.2 Monitored data or parameters

Data and parameters requiring monitoring are presented in ***Table 3*** below.

Table 3. Variables requiring monitoring.

Variable/parameter/data		Units	Data source / measurement method	Periodicity
$FCP_{c,t}$	Type ***c*** fossil fuel consumed in period ***t*** in project scenario.	*Fuel volume or mass unit*	Estimated from volume or mass flowmeters, or from scale readings, according to fuel type.	The same as defined for GHG quantification in project scenario (PE_t). Monthly records, as a minimum.
$IECP_t$	Imported electricity consumption in period ***t*** of project scenario.	*MWh*	Totalizing meters located at the project's local energy consumption point.	The same as defined for GHG quantification in project scenario (PE_t). Monthly records, as a minimum.

Variable/parameter/data		Units	Data source / measurement method	Periodicity
$DOCF_t$	Degradable organic carbon fraction in waste expected to be sent to the landfill in period ***t***.	*tC/t waste*	***$DOCF_t$*** fraction is estimated as the average for waste or material classes in the landfill. For the total estimation it is important to be accurate when considering inert or not degradable contents in landfill waste. This calculation shall be backed step-by-step and specific values obtained from secondary information shall be correctly referenced. (IPCC, 2019).	The same as defined for GHG quantification in project scenario (***BLE_t***).
$DP_{f,t}$	Distance (return) between origin and destiny for ***f*** transport activity in period ***t*** in project scenario.	*km*	Tank truck biogas transporter logbooks or estimated based on delivery data.	A record shall be produced for each transport event, to be utilized in applicable monitoring period.
$ECBL_{j,t}$	Electricity that would be consumed by user ***j*** in the baseline scenario in period t, expected to be displaced by the project.	MWh	Totalizing meters located at power receiving spot of interconnected grid or non-interconnected zone.	The same as defined for GHG quantification in project scenario (***PE_t***). Monthly records, as a minimum.
$EFFDP_c$	CO_2 emission factor for type **c** fossil fuel, displaced by captured biogas in project scenario.	tCO_2e/ fuel volume or mass unit	Values shall be the same as that reported in the national GHG inventory.	Not applicable.
$EFGSP_t$	CO_2 emission factor for the electric grid or electricity supplier in period ***t*** in project scenario.	*tCO_2e/MWh*	Calculated from relevant data or as reported by electric power supplier.	Each monitoring period or annually, according to customary reporting.
$EFIG_t$	CO_2 emission factor of interconnected grid for period ***t***.	*tCO_2e/MWh*	a) Data for each supplied unit's generated GHG emissions can be used, provided they are supplied by the interconnected grid manager, or the corresponding energy authority. b) Current version of CDM's Methodological Tool 07 (*Tool to calculate the emission factor for an electricity system*) can be used to calculate emission factors for electric grids, or it can be calculated from fossil fuel consumption GHG	This calculation result is usually published on an annual basis, but if a higher frequency is used, this shall be used. In case calculations are performed, this shall be done for each calendar year and using it in a consistent way with reporting periods.

Variable/parameter/data		Units	Data source / measurement method	Periodicity
			emissions and total electricity produced, using CDM's Methodological Tool 07 for Combined Margin Factor calculation.	
EFNBL	CO_2 emission factor for natural gas used in baseline scenario, which will be displaced by methane contained in biogas to be used for injection into a natural gas pipeline.	tCO_2e/MJ	Values shall be the same as that reported in the national GHG inventory.	Not applicable.
$\boldsymbol{EFNZ_{k,t}}$	CO_2 emission factor of captive electricity generation plant ***k*** in the non-interconnected zone in period ***t***.	*tCO_2/MWh*	Calculation performed using relevant data or using captive plant ***k*** reports.	Annually.
$\boldsymbol{EFTP_f}$	Emission factor for ***f*** transport activity in project scenario.	tCO_2 /t-km	Default values according to CDM's Methodological Tool 12: *Project and leakage emissions from transportation of freight*, V.01.1.0: • Light trucks: 245 x 10^{-6} tCO_2/t-km. Heavy trucks: 129 x 10^{-6} tCO_2/t-km.	This shall be reviewed when a new version of the data source document is published. (CDM's Methodological Tool 12).
$\boldsymbol{FFNZ_{k.c,t}}$	Type ***c*** fossil fuel used by captive plant ***k*** in period ***t*** in baseline scenario***.*** (If fuel is in gaseous phase, volume shall be normalized).	Volume or mass units	Estimated using volume or mass flowmeters. In case it is supplied through small day tanks, an indirect determination can be made using manual or sensor aided readings of the level scale. Normally, this shall be reported by the organization in charge of the non-interconnected grid management or the relevant energy authority for the non- interconnected zone.	Continuous for flowmeters. In case graduated level scales are used, according to readings frequency, each 24 hours as a minimum.
$\boldsymbol{GWP_{CH4}}$	Methane Global Warming Potential.	*tCO_2e/tCH_4*	IPCC or value defined for mandatory use by regulatory authority.	According to Cercarbono's related communications and documentation, applicable to the corresponding monitoring period timespan in line with IPCC guidelines or as

Variable/parameter/data		Units	Data source / measurement method	Periodicity
				dictated by applicable specific regulation.
$LDNP_t$	Biogas (or natural gas, as applicable) percentage losses in distribution network in period ***t*** in project scenario.	%	Value as reported by gas pipeline network operator.	Annually. Use corresponding year value.
LML	Landfill mean lifetime.	year	IPCC. 2019. *Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories*. Volume 5: Waste. Chapter 3: Solid Waste Disposal. *Table 3.4 Recommended default half-life ($t_{1/2}$) values (yr) under tier 1*.	In case landfill's design parameters are changed.
$MBFP_{m,t}$	Methane in biogas flared during minute ***m*** in period ***t*** in project scenario.	tCH_4	Estimated based on measurements from volumetric gas flowmeters. To determine mass flow departing from volumetric flow data, use current version of CDM's Methodological Tool 08: *Tool to determine the mass flow of a greenhouse gas in a gaseous stream*.	The same as defined for GHG quantification in baseline scenario (***BLE_t***). Daily records, as a minimum.
MCF	Methane correction factor for anaerobic degradation in year it is deposited.	*NA*	IPCC. 2019. *Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories*. Volume 5: Waste. Chapter 3: Solid Waste Disposal. Table 3.1 (Updated) SWDS classification and methane correction factors (MCF).	The same as defined for GHG quantification in baseline scenario (***BLE_t***).
$MDFP_{l,t}$	Methane contained in biogas, expected to be used to displace fossil fuel used in device ***l*** in period t of project scenario.	tCH_4	Estimated based on measurements from volumetric gas flowmeters. To determine mass flow departing from volumetric flow data, use current version of CDM's Methodological Tool 08: *Tool to determine the mass flow of a greenhouse gas in a gaseous stream*.	Continuous, with daily integration as a minimum.
$MDLBL_t$	Methane in landfill biogas expected to be used to displace fossil fuel that would be used in absence of	tCH_4	Estimated based on measurements from volumetric gas flowmeters. To determine mass flow departing from volumetric flow data, use current version of CDM's Methodological Tool 08: *Tool to determine*	The same as defined for GHG quantification in baseline scenario (***BLE_t***). Daily records, as a minimum.

Variable/parameter/data		Units	Data source / measurement method	Periodicity
	distribution through dedicated pipeline networks or tank-trucks in period ***t*** of baseline scenario.		*the mass flow of a greenhouse gas in a gaseous stream*.	
$MDPP_t$	Methane in biogas distributed through pipeline networks in period ***t*** in project scenario.	*tCH_4*	Estimated based on measurements from volumetric gas flowmeters. To determine mass flow departing from volumetric flow data, use current version of CDM's Methodological Tool 08: *Tool to determine the mass flow of a greenhouse gas in a gaseous stream*.	Continuous, with daily integration as a minimum.
$MFUBL_t$	Methane in landfill-produced biogas in baseline scenario in period t.	*tCH_4*	Estimated from measurement data for ***$MBPP_t$***, using volumetric flowmeters. This value is applicable if methane destruction was carried out prior to project development. Otherwise ***$MPLB_t$*** *= 0.* For determination of mass flow from volume flow data, the use of CDM's Methodological Tool 08 is recommended.	According with referred CDM's Methodological Tool 08.
$MGLP_t$	Methane in landfill-produced biogas in project scenario, flared or used by the CCMP in period ***t***.	*tCH_4*	Estimated based on measurements from volumetric gas flowmeters. To determine mass flow departing from volumetric flow data, use current version of CDM's Methodological Tool 08: *Tool to determine the mass flow of a greenhouse gas in a gaseous stream*.	The same as defined for GHG quantification in baseline scenario (***BLE_t***). Daily records, as a minimum.
MHV	Methane lower heating value at reference conditions.	*MJ/tCH4*	Default value as per in IPCC or from official government sources.	Not applicable.
$MLTP_t$	Methane in captured landfill biogas loaded into tank-trucks in period ***t*** in project scenario.	*tCH_4*	Estimated from volumetric flowmeter data or gas payload. Estimado a partir de datos de medidores volumétricos o peso neto de gas cargado. To determine mass flow departing from volumetric flow data, use current version of CDM's Methodological Tool 08: *Tool to determine the mass flow of*	A record shall be produced for each transport event, to be utilized in applicable monitoring period.

Variable/parameter/data		Units	Data source / measurement method	Periodicity
			a greenhouse gas in a gaseous stream.	
$MUTP_t$	Methane in landfill biogas unloaded from tank- trucks in period ***t*** in project scenario.	tCH_4	Transporteer records (logbooks and truck scale records) or user invoices.	A record shall be produced for each transport operation.
MVF	Methane volume fraction in landfill gas.	NA	Default value: IPCC. 2019. Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Volume 5: Waste. Chapter 3: Solid Waste Disposal. Measured value: Estimated value by CCMP responsible.	Minimum possible frequency to be applied, according to ability of the landfill to obtain this value. Monthly, as a minimum.
OX_t	Oxidated methane fraction in period ***t***.	*NA*	IPCC. 2019. *Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories*. Volume 5: Waste. Chapter 3: Solid Waste Disposal. Table 3.2 Oxidation factor (OX) for SWDS.	The same as defined for GHG quantification in baseline scenario (BLE_t).
$PGNZ_{k,t}$	Electric power generated by captive plant ***k*** in period ***t*** in baseline scenario.	*MWh*	Totalizing meters located at energy receiving spot of captive plant (s) ***k***.	The same as defined for GHG quantification in project scenario (PE_t). Monthly records, as a minimum.
$TDTL_{,t}$	Average technical losses for electricity transmission and distribution to grid user ***j*** in period ***t***.	%	Grid or system administrator reported value. Use the most specific value available.	Annually. Use corresponding year value.
$TDTP_t$	Average technical transmission and distribution losses for electricity supply from the electric grid or an electricity supplier in period ***t***.	%	Grid or system administrator reported value. Use the most specific value available.	Annually. Use corresponding year value.
$TTPP_{f,t}$	Total transported payload for ***f*** transport activity in period ***t*** in project scenario.	*t*	Tank truck biogas transporter logbooks or estimated based on delivery data.	Data shall be recorded and used for applicable monitoring period.

Variable/parameter/data		Units	Data source / measurement method	Periodicity
WBL_t	Amount of waste expected to be received in the landfill in the baseline scenario in period t.	*t*	As per data from landfill's receiving scales.	The same as defined for GHG quantification in baseline scenario (BLE_t).
ηCS	Biogas capture system efficiency (or that of the system to be installed in the landfill).	NA	Technical specifications of the biogas capture system to be installed (if available) or use a default value of 50 %.	Not applicable.
$\eta MDP_{m,t}$	Flare methane destruction efficiency in minute ***m*** in period ***t*** in project scenario.	%	For open flares, flare efficiency if flame is detected in minute ***m*** is 50 %, otherwise, it is 0 %. For closed flares, a 90 % default flare efficiency may be used (provided two conditions are met: i) flare temperature and residual gas flow are within flare manufacturer's specified ranges in minute ***m*** , and ii) flame is detected in minute ***m***). It can also be determined by measurement according to guidelines in section 6.2.2.2 of current version of CDM's Methodological Tool 06: *Project emissions from flaring*.	The same as defined for GHG quantification in project scenario (PE_t). Recordings each minute, as per in UNFCCC's recommendation.

14.3 Monitoring contributions to the Sustainable Development Goals

The monitoring of contributions to the Sustainable Development Goals is carried out according to the ***Cercarbono's Tool to Report Contributions from Climate Change Mitigation Initiatives to the Sustainable Development Goals,*** available atwww.cercarbono.com, section: Documentation**.**

15 Regulatory compliance

In the framework of this methodology, CCMP owner shall demonstrate the facilities where the CCMP is implemented comply with required licenses, permits and environmental management plans, as well as all applicable regulations according to the technology employed in the subject jurisdiction before the start of any validation / verification activity.

The VVB performing CCMP's validation and/or verification under this methodology, shall also comply with accreditation requirements as per dictated in the host country for the CCMP, shall possess demonstrable technical knowledge about the relevant technology the initiative is aiming to obtain a validation / verification for.

GHG emissions reduction achieved by the CCMP, as applicable, shall be entered in the national registry of a given country (provided they correspond to GHG emissions reduction commitments assumed by such country), in line with international efforts on Measurement/Monitoring, Report and Verification of climate change initiatives.

16 Information management

The owner of the CCMP shall establish and apply quality management procedures according to the principles in this methodology for data, databases and documentation retrieving, management and control, including uncertainty assessment as applicable for baseline and project scenarios and monitoring activities[16].

The owner of the CCMP should reduce, as far as possible, uncertainties associated with GHG emissions reduction quantification. Thus, errors or omissions detected shall be identified and processed, and related documentary evidence shall be generated and kept.

The owner of the CCMP shall apply follow-up criteria and procedures, through which consistent assessments and audits to ensure accuracy of GHG emissions reduction quantification are performed, according to the monitoring plan.

When measurement and monitoring equipment is used, the owner of the CCMP must make sure calibrated measurement and monitoring equipment is used and maintained as appropriate.

All data and information related with CCMP's follow-up must be recorded and documented.

[16] The owner of the CCMP may apply principles as per in ISO 9001 and ISO 14033 Standards for data quality management.

17 CCMP documentation

It is required to keep all documentation and generated records in demonstrating CCMP's activity has been implemented in accordance with its design. Any deviation in implementing it as compared with the original design is to be technically justified. Compliance with this methodology's guidelines, conditions, and procedures shall be demonstrated.

The CCMP owner shall have the documentation proving conformity of the GHG project with the requirements in this document. Such documentation must be consistent with the validation and verification requirements as per in Cercarbono programme.

18 Transition regime for the use of other methodologies

Once this methodology is published in Cercarbono's website, CCMP owners shall use it to generate carbon credits for GHG emissions reduction achieved.

Given Cercarbono's certification programme allow the use of available methodologies from other carbon programmes or standards, it shall be considered a transition regime from the initially used methodology or guideline to the present methodology. To that purpose, CCMP advancement according to Cercarbono's definition of project cycle shall be considered. Such cycle comprises five stages (as per in current version of Cercarbono's Protocol). According to the stage the CCMP is in, the following shall be applied:

- If the CCMP is at Stages 1 or 2 (formulation and public comments), the CCMP shall integrate the methodology in full.
- If the CCMP is at Stages 3, 4 or 5 (validation, verification, certification), the CCMP may implement the methodology originally selected from a programme other than Cercarbono. Otherwise, it shall use this methodology. If the CCMP is at Stage 5, credits will be issued based on originally selected methodology (from a programme other than Cercarbono), provided such methodology is in force and authorized by Cercarbono.

19 CCMP validation and verification

Validation and verification requirements, additional to technical guidance in this methodology are described in current version of Cercarbono's Protocol.

20 References

Cercarbono. (2022a). *Cercarbono's Tool to Demonstrate Additionality of Climate Change Mitigation Initiatives*. Version 2.0.1. Available at: www.cercarbono.com.

Cercarbono. (2022b). *Cercarbono's Tool to Report Contributions from Climate Change Mitigation Initiatives to the Sustainable Development Goals*. Version 1.3. Available at: www.cercarbono.com.

Cercarbono. (2022c). *Terms and Definitions of the Voluntary Certification Programme of Cercarbono*. Version 3.0. Available at: www.cercarbono.com.

Cercarbono. (2023a). *Cercarbono's Protocol for Voluntary Carbon Certification*. Version 4.2. Available at: www.cercarbono.com.

Cercarbono. (2023b). *Procedures of Cercarbono's Certification Programme*. Version 2.0. Available at: www.cercarbono.com.

Intergovernmental Panel on Climate Change (IPCC). (2000). *IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*. Available at: kutt.it/eJmhqr.

Intergovernmental Panel on Climate Change (IPCC). (2006). *2006 IPCC Guidelines for National Greenhouse Gas Inventories*. Available at: kutt.it/kZeqse.

Intergovernmental Panel on Climate Change (IPCC). (2019). *2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories*. Available at: kutt.it/y4Ef1V.

Intergovernmental Panel on Climate Change (IPCC). (2021). *Climate Change 2022: Mitigation of Climate Change*. Available at: kutt.it/At53Z5.

ISO 14064-2:2019. *Greenhouse gases - Part 2: Specification with guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements*.

ISO 14064-3:2019. *Greenhouse gases - Part 3: Specification with guidance for the verification and validation of greenhouse gas statements*.

Kämpfer, P. y Weissenfels, W. (Eds.) (2001). *Biologische Behandlung organischer Abfälle*. Available at: kutt.it/QrNGt2.

United Nations Framework Convention on Climate Change (UNFCCC). *Tool 03 Tool to calculate project or leakage CO2 emissions from fossil fuel combustion.* Clean Development Mechanism. Available at: kutt.it/mcfLIF.

United Nations Framework Convention on Climate Change (UNFCCC). *Tool 05 Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation.* Clean Development Mechanism. Available at: kutt.it/rsVIPt.

United Nations Framework Convention on Climate Change (UNFCCC). *Tool 06 Project emissions from flaring.* Clean Development Mechanism. Available at: kutt.it/PfYeBP.

United Nations Framework Convention on Climate Change (UNFCCC). *Tool 07 Tool to calculate the emission factor for an electricity system.* Clean Development Mechanism. Available at: kutt.it/TsejM6.

United Nations Framework Convention on Climate Change (UNFCCC). *Tool 08 Tool to determine the mass flow of a greenhouse gas in a gaseous stream.* Clean Development Mechanism. Available at: kutt.it/IJI5QP.

United Nations Framework Convention on Climate Change (UNFCCC). *Tool 10 Tool to determine the remaining lifetime of equipment*. Clean Development Mechanism. Available at: kutt.it/C6kDjN.

United Nations Framework Convention on Climate Change (UNFCCC). *Tool 12 Project and leakage emissions from transportation of freight.* Clean Development Mechanism. Available at: kutt.it/wHpQxQ.

21 Document history

Version	Date	Comments/changes
1.0	26.10.2020	Initial document version for public consultation from 26.10.2020 to 19.11.2020.
1.1	20.01.2021	Final version incorporating public consultation comments and missing additional elements.
2.0	17.01.2023	Version adapted to international context and applicability and requirements as of Cercarbono's Protocol Version, submitted for public consultation from 17.01.2023 to 16.02.2023.
2.1	27.06.2023	Updated version with modified content in some sections and equations, submitted for independent, third-party assessment.