



**Component project activity design document form for
CDM component project activities**

(Version 04.0)

Complete this form in accordance with the Attachment "Instructions for filling out the component project activity design document form for CDM component project activities" at the end of this form.

COMPONENT PROJECT DESIGN DOCUMENT (CPA-DD)

Title of the CPA	CPA-1: Landfill gas recovery, energy generation and biogas distribution from CTR Santa Rosa
Version number of the CPA-DD	Version 7.5
Completion date of the CPA-DD	11/09/2015
Title of the PoA to which the CPA is included	Caixa Econômica Federal Solid Waste Management and Carbon Finance Project
Host Party	Brazil
Estimated amount of annual average GHG emission reductions	794,672

SECTION A. General description of CPA**A.1. Title of the proposed or registered PoA**

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Caixa Econômica Federal Solid Waste Management and Carbon Finance Project

A.2. Title of the CPA

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CPA-1: Landfill gas recovery, energy generation and biogas distribution from CTR Santa Rosa

A.3. Description of the CPA

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The present CPA is to be implemented as part of the CDM PoA: *Caixa Econômica Federal Solid Waste Management and Carbon Finance Project*. It aims at avoiding methane emissions from municipal waste treated CTR Santa Rosa landfill in Brazil.

The privately operated landfill of CTR Santa Rosa is located in Rio de Janeiro state, in Seropédica municipality, close to Rio de Janeiro city, the second most populous Brazilian city. CTR Santa Rosa covers an area of 1,699,512.97 m² and started receiving waste in March 2011, having received all necessary environmental licenses for operation. The landfill will initially receive an expected 6,000 tons per day for the first year of domestic solid waste from Rio de Janeiro, Seropédica and Itaguaí municipalities.

In the CTR Santa Rosa CPA, the baseline scenario consists in the complete release of the LFG to the atmosphere, since there are no laws, nor regulatory incentives to enforce the capture or flaring of methane on landfill sites apart from rare cases where rudimentary and inefficient systems are installed so as to reduce the risk of explosion. Without the additional financial incentive of the emissions reductions revenues, the high cost of modern methane capture and flaring technology preclude their implementation in Brazilian landfills.

The objective of the CPA-1 CTR Santa Rosa landfill is to capture and burn/use the methane generated by the decay of organic waste from the CTR Santa Rosa Sanitary Landfill. The project also intends to generate electricity from the combustion of methane and upgrade the LFG and distribute it via a natural gas grid.

The CPA can be summarized as follows:

- ✓ Implementation of an LFG collection system at the CTR Santa Rosa Landfill site ;
- ✓ Use the captured biogas as fuel to generate electricity. The generated electricity can be used for use on-site or sold to the national grid;
- ✓ Use of the captured biogas for distribution to consumers on a natural gas distribution grid; and
- ✓ Flare the excess captured LFG to destroy any methane emissions.

Contributions to sustainable development

In this CPA, the baseline scenario consists in the release of huge amounts of GHG emissions to the atmosphere, further contributing to global warming and its harmful consequences. The technology implemented by the CPA under Caixa PoA completely changes this scenario locally, reducing the GHG emissions to the atmosphere by almost 50%. Additionally, the Santa Rosa CPA foresees the generation of renewable energy from methane collected, displacing electricity that would have otherwise been produced by fossil fuel sources connected to the Brazilian National Electricity Grid (SIN). Santa Rosa CPA will contribute to sustainable development through the following activities:

Capacity building and job creation: Landfill gas capture projects are not common in Brazil, so there are not enough qualified people on the market. As part of Caixa PoA, Santa Rosa CPA proponents will invest in training activities in order to get a properly skilled staff (engineers, technicians, operators, etc) able to conduct the implementation and management of this CPA.

Renewable energy generation: the renewable energy generated by this CPA will contribute the country efforts to increase the participation of renewable energy in the Brazilian energy generation profile, helping the country to achieve the goals outlined in the National Climate Change Plan.

A.4. Entity/individual responsible for the operation of CPA

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SERB – SANEAMENTO E ENERGIA RENOVÁVEL DO BRASIL S.A./CICLUS Ambiental is the entity responsible for the Santa Rosa CPA-1

A.5. Technical description of the CPA

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CPA-1 CTR Santa Rosa covers a combination of scenarios #2 and #3 as described in the Caixa PoA-DD. The LFG collected will be used to generate electricity, some of it will also be upgraded and distributed via a natural gas distribution network, and the excess produced will be flared, to avoid any methane emissions going into the atmosphere.

The CPA-1 CTR Santa Rosa contains the following components:

Landfill gas collection system

State-of-the-art gas collection technology to be included in this CPA includes the items listed below.

- Vertical wells used to extract gas and leachate.
- Horizontal wells used to extract gas.
- Optimal well spacing for maximum gas collection while minimizing costs.
- Wellheads designed for gas measurements.
- Condensate extraction and storage systems designed at strategic low points throughout the gas system.



Figure 1 Example of LFG collecting system. The image above refers to the system implemented on CTR Nova Iguaçu, operated by Haztec Tecnologia e Planejamento Ambiental S.A. (HAZTEC).

Landfill gas pre-treatment station

All LFG collected will be pre-treated to remove moisture and other impurities in order to prevent the corrosion of the subsequent systems (flare system, electricity generators and LFG upgrading station).



Figure 2 Example of LFG pre-treatment system. The image above refers to the system implemented on Bandeirantes Landfill – located in São Paulo state, and operated by BIOGAS

Landfill gas flaring system

CPA-1 CTR Santa Rosa will have a flaring system in place, in order to flare any excess gas being produced and not used by the other systems, and also for those periods of maintenance when the engine may not be operational. The LFG flare system includes the items provided below:

- One enclosed flare system with controlled combustion.
- Blower system used to cause negative pressure in the pipeline (before blower) and positive pressure (after blower) to direct gas for flare.
- Monitoring equipment for continuous monitoring of gas composition (methane, oxygen, dioxide of carbon and balance), flow and burn temperature.
- Security restart system, in the case of a system shut down.



Figure 3 Example of flaring system to be installed. The image above refers to the flaring system implemented on CTR Nova Iguaçu, also operated by Haztec.

Electricity Generation Equipment

A modular engine facility will be installed. Small modular engine generator units make it possible to adapt the equipment to the site specific gas volumes. As the gas volumes increase or decrease over time, the modules can be added or relocated to the other sites. The installation of the different modular engines will go as per the planned stages identified in the investment analysis made for the project.

The installed unit will be comprised of the degassing installations and the powerhouse. This unit facility includes blowers, heat exchangers and chillers. In case of a system maintenance or shutdown, all LFG will be redirected to the flaring system, in order to properly destroy the methane that would not be used to for energy generation.



Figure 4 Example of modular electricity generation facility to be implemented in this project. The image above was obtained from Monterrey Landfill, Mexico.

LFG upgrading station

As part of this CPA the LFG will go through further treatment and will be compressed for injection in the natural gas distribution network in order to displace natural gas sold to consumers. In some cases it will be necessary to remove CO₂ present in the LFG. In the case of a system maintenance or shutdown, all LFG previously directed for the upgrading station will be redirected to the flaring system, in order to properly destroy the methane not being upgraded. Therefore the system will include the following elements:

- Landfill Gas Pre-Purification System
- Pressure Swing Adsorption System
- Dehydration System
- Carbon Dioxide Purification System
- Inlet Landfill Gas Booster Compressor
- Inlet Feed Gas Compressor
- CO₂ Purification Unit Feed Compressor
- Refrigeration Compressor
- Cooling Tower with Circulating Pumps
- Instrument Air System
- Motor Control Center in Powerhouse Building
- DCS in Control Room Building



**Figure 5 Example image of the upgrading station to be implemented in CTR Santa Rosa.
Image from Linde brochure.**

LFG pipelines connecting to gas distribution network

This component covers the pipeline system used to connect the LFG extracted and treated to a gas distribution network, where the LFG collected will reach its end user.

Monitoring system

CPA-1 CTR Santa Rosa will have state-of-the-art monitoring equipment that will be calibrated as per the applied approved monitoring methodology. All staff involved will be trained to properly operate the monitoring equipment. Detailed description of the monitoring plan and equipment is in section D.7 of this CPA-DD.

The data of the operational and monitoring parameters will be collected by each site operator and forwarded to Caixa. Data will be recorded electronically (kept for two years after the end of the crediting period) and written separately. The monitoring data will be printed periodically as a backup procedure.

Facilities, systems and equipment in the baseline scenario

The above mentioned systems and equipment are installed to collect and use the landfill gas, as opposed to the baseline scenario, that would entail the partial or total atmospheric release of the landfill gas. None of these equipment and systems would be installed under the baseline scenario.

A.6. Party(ies)

Name of Party involved (host) indicates host Party	Private and/or public entity(ies) CPA implementer(s) (as applicable)	Indicate if the Party involved wishes to be considered as CPA implementer (Yes/No)
Brazil (host)	Caixa Econômica Federal SERB – SANEAMENTO E ENERGIA RENOVÁVEL DO BRASIL S.A./CICLUS Ambiental	No Yes
Spain	International Bank for Reconstruction and Development acting as the Trustee of the Carbon Partnership Facility	No

A.7. Geographic reference or other means of identification

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Name/contact details of the entity responsible for the CPA: SERB – SANEAMENTO E ENERGIA RENOVÁVEL DO BRASIL S.A./CICLUS Ambiental is Priscila Zidan, project manager. CTR Santa Rosa is located in Rio de Janeiro state, between Seropédica and Itaguaí municipality (22°47'44.53"S and 43°45'38.01" W). Latitude:-22.795703, Longitude:-43.760558).



Figure 6 - Exact location of CTR Santa Rosa, located between Seropédica and Itaguaí municipalities.

A.8. Duration of the CPA

A.8.1. Start date of the CPA

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31/12/2011, when the implementation of the gas collection and flare system is expected to begin, with the signature of the contract with the supplier of the flare

A.8.2. Expected operational lifetime of the CPA

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21 years 0 months

A.9. Choice of the crediting period and related information

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Renewable

A.9.1. Start date of the crediting period

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01/07/2012, when the project is expected to be operational, or upon inclusion under the PoA, whichever is later

A.9.2. Length of the crediting period

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7 years, renewable, with up to two renewal periods.

A.10. Estimated amount of GHG emission reductions

Emission reductions during the crediting period	
Years	Annual GHG emission reductions (in tonnes of CO₂e) for each year
01/07/2012-31/12/2012	151,674
2013	509,774
2014	675,508
2015	801,742
2016	882,923
2017	971,331
2018	1,026,205
01/01/2019-30/06/2019	543,550
Total number of crediting years	7
Annual average GHG emission reductions over the crediting period	794,672
Total estimated reductions (tonnes of CO₂e)	5,562,707

A.11. Public funding of the CPA

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There is no public funding available for this CPA

A.12. Confirmation for CPA

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It has been confirmed by the Coordinating/Managing entity (CME), Caixa, that with the available information on the UNFCCC website and the information on Brazilian DNA website, that the project activity under CPA-1: CTR Santa Rosa, is not registered as an individual CDM project activity nor is a part of another PoA. This has also been confirmed by the project implementer SERB – SANEAMENTO E ENERGIA RENOVÁVEL DO BRASIL S.A./CICLUS Ambiental.

A.13. Contact information of responsible persons/ entities for completing the CDM-CPA-DD-FORM

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Caixa Econômica Federal (Project Participant)
 Diretoria Executiva de Infraestrutura e Saneamento
 Setor Bancário Sul Quadra 4 lotes 3/ 4 - 12º Andar
 Edifício Matriz
 Brasília DF 70092-900
 Brazil

SECTION B. Environmental analysis**B.1. Analysis of the environmental impacts**

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As described in PoA-DD, the environmental analysis is undertaken at the CPA level. Brazilian national as well as state laws and regulations require that an environmental analysis should be performed for any kind of landfill. So the analysis will be done at the CPA level as most of the impacts are confined to each CPA landfill site

Overall, by collecting and combusting landfill gas, the CPA will reduce both global and local environmental effects of uncontrolled GHG releases. The major components of landfill gas, methane and carbon dioxide, are colorless and odorless. Although the majority of landfill gas emissions are quickly diluted in the atmosphere, in confined spaces there is a risk of asphyxiation and/or toxic effects if landfill gas is present in high concentrations. Landfill gas also contains over 150 trace components that can cause other negative local and global environment effects such as odor nuisances, stratospheric ozone layer depletion, and ground level ozone creation. The CPA will contribute to reduce the LFG risks of toxic effects on the local community and local environment.

B.2. Environmental impact assessment

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All environmental impacts were raised at the Environmental Study Assessment prepared to the Landfill Process of Environmental Licensing, and submitted to INEA – Instituto Estadual do Ambiente (Rio de Janeiro State's environmental authority). According with the study, no transboundary impacts for the gas project are expected and the impacts raised are positive, once the project involves activities that will improve the baseline scenario and the environmental quality of the CTR Santa Rosa, including the LFG collection system, leachate treatment improvement, final closure and capping of the landfill and monitoring of environmental parameters (groundwater quality leachate treatment facility monitoring).

The operation of the activities of CTR Santa Rosa was licensed by the INEA as Operation License no. No. IN016380 issued April 19, 2011.

SECTION C. Local stakeholder consultation**C.1. Solicitation of comments from local stakeholders**

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As required by the Interministerial Commission on Global Climate Change (CIMGC), the Brazilian DNA – Designated National Authority, invitations must be sent for comments to local stakeholders as part of the procedures for analyzing CDM projects.. This procedure was followed by PP, present its GHG mitigation initiative to the public. Letters and the Executive Summary of the project were sent to the following local stakeholders:

- Brazil DNA, Secretaria Executiva da Comissão Interministerial de Mudança Global do Clima
- Prefeitura Municipal de Seropédica - RJ / Municipal Administration of Seropédica – RJ.
- Secretaria Municipal de Meio Ambiente de Seropédica - RJ / Municipal Secretariat of Environment of Seropédica – RJ.
- Câmara dos Vereadores de Seropédica - RJ / Municipal Legislation Chamber of Seropédica – RJ.
- INEA – Instituto Estadual do Ambiente – Rio de Janeiro / Rio de Janeiro Environmental Institute.
- Ministério Público do Estado do Rio de Janeiro / Public Ministry of Rio de Janeiro State.
- Fórum Brasileiro de ONG's e Movimentos Sociais para o meio Ambiente e Desenvolvimento (FBMOS) / Brazilian NGO Fórum.
- ABES – Rio – Associação Brasileira de Engenharia Sanitária e Ambiental / Brazilian Association of Sanitary and Environment Engineering.
- Ministério Público Federal no Rio de Janeiro / Federal Public Ministry of Rio de Janeiro.

Also, the Resolution #9 of the CIMGC was followed and the CPA is available at the following website until registration: www.ciclusambiental.com.br

C.2. Summary of comments received

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Most of the letters were sent on the 10th of August 2010, and the last one was sent on the 23rd of August 2010. On the letters there was an invitation to see the PDD for the CPA and to send any comments or questions to the project entity. Confirmation of the reception of the letters was obtained and no comments were received on this period that was open for consultations.

C.3. Report on consideration of comments received

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As mentioned on the section above, no comments were received on this first stage of stakeholder consultation.

SECTION D. Eligibility of CPA and estimation of emissions reductions

D.1. Reference of methodology(ies) and standardized baseline(s)

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The Caixa PoA applies one methodology and its tools:

Version 11 of ACM0001: “Consolidated baseline and monitoring methodology for landfill gas project activities”;

Version 01 – “Tool to determine project emissions from flaring gases containing methane”

Version 01 – “Tool to calculate baseline, project and/or leakage emissions from electricity consumption”

Version 02.2.1 – “Tool to calculate the emission factor for an electricity system”.

Version 02 – “Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion”

Version 05.1.0 – “Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site”

Version 05.2.1 – “Tool for the demonstration and assessment of additionality”

The above are found on the UNFCCC CDM website at:

<http://cdm.unfccc.int/methodologies/DB/EYUD9R1ZAUZ2XNZXD3HQB18OK3VWIV>

D.2. Applicability of methodology(ies) and standardized baseline(s)

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ACM0001 – “Consolidated baseline methodology for landfill gas project activities – Version 11” is applicable to landfill gas capture project activities, where the baseline scenarios are the partial or total atmospheric release of the gas and the project activities include situations such as:

- a) The captured gas is flared; and/or
- b) The captured gas is used to produce energy (e.g. electricity)
- c) The captured gas is used to supply consumers through natural gas distribution network (scenario 3 of the PoA). No emissions reductions will be claimed for displacing natural gas.

The ACM0001 methodology is applicable to the Caixa PoA because the baseline scenario in each CPA is the partial or total atmospheric release of the gas and the project activity comprises the scenarios outlined above. Since emission reductions are not intended to be claimed for displacing natural gas, AM0053 will not be used.

Methodology ACM0001 (version 11) is, therefore, applicable to the CPAs.

“Tool for determining methane emissions avoided from disposal of waste at a solid waste disposal site” – Version 05.1.0

The tool is applicable in cases where the solid waste disposal site where the waste would be dumped can be clearly identified. The disposed site where the waste is deposited is clearly identified thus the tool is applicable to the project.

“Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion” – Version 02

This tool provides procedures to calculate project and/or leakage CO₂ emissions from the combustion of fossil fuels. It can be used in cases where CO₂ emissions from fossil fuel combustion are calculated based on the quantity of fuel combusted and its properties. Therefore the tool is applicable to the CPAs which may use fossil fuel for the operation of the project activity.

“Tool to determine project emissions from flaring gases containing methane” – EB28, Annex 13

The tool is applicable to projects where the residual gas stream to be flared contains no other combustible gases than methane, carbon monoxide and hydrogen, and residual gas stream to be flared shall be obtained from decomposition of organic material (through landfills, bio-digesters or anaerobic lagoons, among others). The project activities include burning of the residual landfill gas which is obtained from decomposition of municipal organic waste and produced by the microbiological decomposition of land-filled garbage where most of the residual gas is methane (about 50-55%) and carbon dioxide (about 40-45%) ; thus the tool is applicable to all CPAs.

The “Tool to calculate baseline, project and/or leakage emissions from electricity consumption” Version 01 is applied to situations where electricity is consumed in the project, thus this tool is applicable to the CPAs that may use electricity from the grid to power equipment such as blowers or pumps.

The “Tool to calculate the emission factor for an electricity system” Version 02.2.1 is used to estimate the potential emission reductions generated by displacing fossil fuel based electricity generation from the grid when emission reduction revenues are claimed. Thus the tool is applicable to all CPAs that may claim ERs from renewable energy generation.

D.3. Sources and GHGs

According to ACM0001, the following sources and gases are included in the project boundary:

Source		GHGs	Included?	Justification/Explanation
Baseline scenario	Emissions from decomposition of waste at the landfill site	CH ₄	Yes	The major source of emissions in the baseline
		N ₂ O	No	N ₂ O emissions are small compared to CH ₄ emissions from landfills. Exclusion of this gas is conservative.
		CO ₂	No	CO ₂ emissions from the decomposition of organic waste are not accounted
	Emissions from electricity consumption	CO ₂	No	Electricity consumption in the baseline is only attributable to that consumed in the administrative building, which would be sourced from the grid. To be conservative, these have not been included.
		CH ₄	No	Excluded for simplification. This is conservative.
		N ₂ O	No	Excluded for simplification. This is conservative.
	Emissions from thermal energy generation	CO ₂	No	Since thermal energy generation is not included in the project activity, these are excluded.
		CH ₄	No	Excluded for simplification. This is conservative.
		N ₂ O	No	Excluded for simplification. This is conservative.
	Project scenario	On-site fossil fuel consumption due to the project activity other than for electricity generation	CO ₂	Yes
CH ₄			No	Excluded for simplification. This emission source is assumed to be very small.
N ₂ O			No	Excluded for simplification. This emission source is assumed to be very small.
Emissions from on-site electricity use		CO ₂	Yes	May be an important emission source
		CH ₄	No	Excluded for simplification. This emission source is assumed to be very small.
		CH ₄	Yes	The major source of emissions in the baseline
		O	No	Excluded for simplification. This emission source is assumed to be very small.

As per the PoA and as per methodology ACM0001, the project boundary is the site of the project activity where the gas is captured and destroyed/used.

Given that the electricity for project activity is sourced from grid, and electricity generated by the LFG captured would have been generated by power generation sources connected to the grid, the project boundary shall include all the power generation sources connected to the grid to which the project activity is connected.

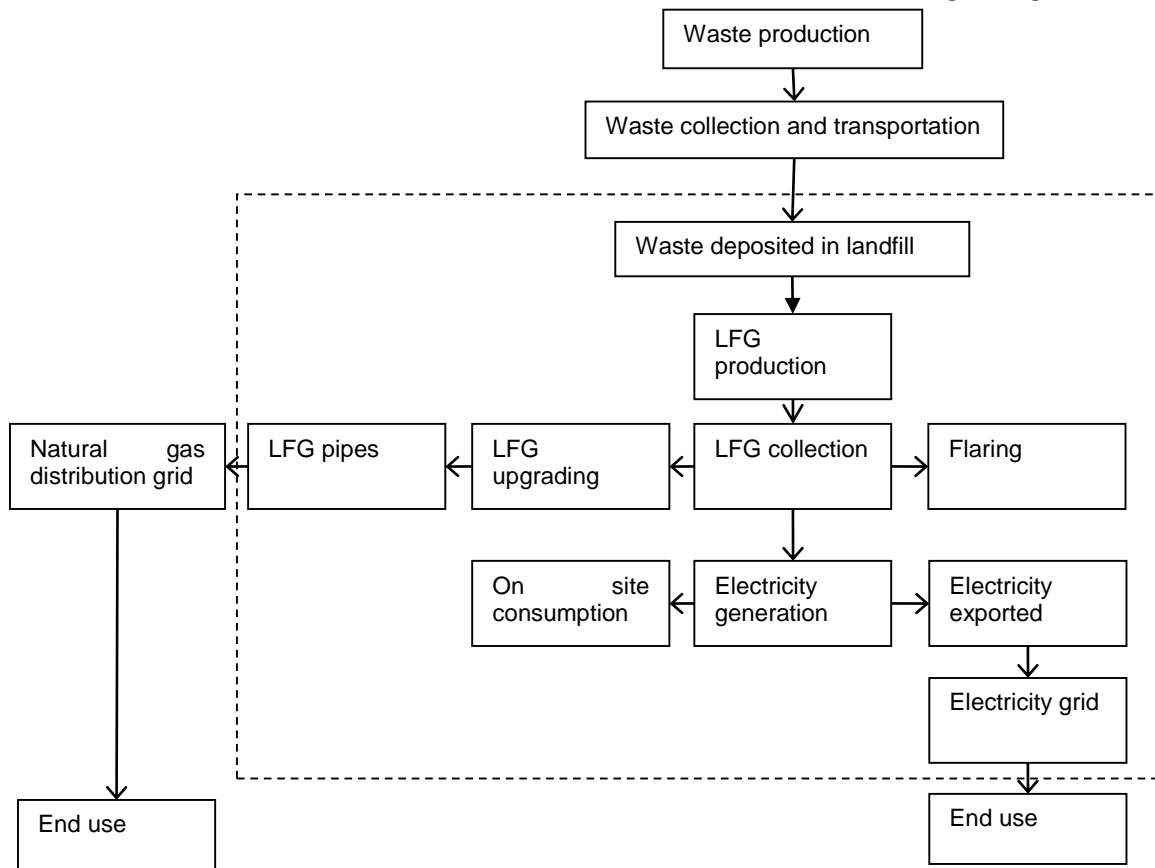


Figure 7 Simplified schematic representation of the CPA project boundary

D.4. Description of the baseline scenario

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For project activities that either flare the landfill gas, and/or generate electricity, and/or have a component where consumers will be supplied with gas through a natural gas distribution grid, given that for the latter case emissions reductions are not going to be claimed for displacing natural gas, baseline scenario assessment and description is performed according to approved baseline methodology **ACM0001**.

Baseline scenario assessment

ACM0001: According to approved methodology ACM0001 version 11, the baseline scenario to the project activity is assessed through the following steps:

Step 1: Identification of alternative scenarios consistent with current laws and regulations

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

As described in section I of the PoA-DD, the alternative scenarios for this specific CPA are:

- LFG1: The project activity undertaken without being registered as a CDM project activity
- LFG2: Atmospheric release of the LFG
- P1: Power generated from landfill gas undertaken without being registered as CDM project activity
- P6: Existing and/or new grid-connected power plants

Outcome of Step 1a: The most plausible and credible alternatives to the project activity are: LFG1 and P1, LFG2 and P6.

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

As explained above, all alternatives are consistent with Brazilian laws and regulations. For this CPA, the state of Rio de Janeiro, does not have any regulation requiring landfills to have gas collection systems.

Outcome of Step 1b: LFG1 and P1 along with LFG2 and P6 continue to be considered plausible baseline scenarios consistent with country implementation of laws and regulations.

As per methodology ACM0001, we continue with step 2

Step 2: Identify the fuel for the baseline choice of energy source taking into account the national and/or sectoral policies as applicable

ACM0001 states that the CPA-DD must demonstrate that the identified baseline fuel is available in abundance in the host country and there is no supply constraint.

Step 2 is not applicable to the proposed project activity, as the baseline energy source is the electricity provided by the national grid.

As per methodology ACM0001, we continue with step 3

Step 3: Step 2 and/or Step 3 of the approved version 05.2.1 of the “Tool for demonstration and assessment of additionality” shall be used to assess which of these alternatives should be excluded from further consideration (e.g. alternatives facing prohibitive barriers or those clearly economically unattractive).

Sub-step 2a. Determine appropriate analysis method

Since the CPA involves flaring, electricity generation and supply of gas to consumers through natural gas distribution grid, then as indicated by the PoA the appropriate analysis method is the benchmark analysis, and so this analysis has been followed.

Sub-step 2b. – Option III. Apply benchmark analysis

Please see section D.5 below for complete analysis

Sub-step 2c. Calculation and comparison of financial indicators

Please see section D.5 below for complete analysis

Sub-step 2d. Sensitivity analysis

Please see section D.5 below for complete analysis

Outcome of Step 2 of the Tool: If after the analysis it is concluded that: (1) the proposed CPA CDM project activity is unlikely to be the most financially/economically attractive (as per Step 2c para 10a of the tool) or is unlikely to be financially/economically attractive (as per Step 2c para 10b of the tool), therefore we proceed to Step 4 of the tool (Common practice analysis).

Step 4 of the Tool: Common practice analysis

Please see section D.5 below for complete analysis, as per the *Guidelines on Common Practice (EB63 Annex 12)*.

Outcome of Step 4 of the Tool: as per the section below, the outcome of the stepwise approach is that the CPAs under the PoA are not the common practice for landfill sites in Brazil.

As per methodology ACM0001, we continue with step 4

Step 4: Where more than one credible and plausible alternative remains, project participants shall, as a conservative assumption, use the alternative baseline scenario that results in the lowest baseline emissions as the most likely scenario. The least emission alternative will be

identified for each component of the baseline scenario. In assessing these scenarios, any regulatory or contractual requirements should be taken into consideration.

As demonstrated in section D.5 below, the outcome of the analysis for CPAs that are to be included under this PoA is that the most plausible baseline scenario for these project activities will be LFG2 “*Atmospheric release of the landfill gas*” and P6 “*Existing and/or new grid-connected power plants*”, and therefore Step 4 of the methodology does not need to be applied because there is only one credible and plausible alternative remaining.

Outcome of the Baseline scenario assessment and description for all CPAs: the most plausible baseline scenario for these project activities will be LFG2 “*Atmospheric release of the landfill gas*” and P6 “*Existing and/or new grid-connected power plants*”.

D.5. Demonstration of eligibility for a CPA

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The CPA is eligible to be included in the Caixa PoA because:

- SERB – SANEAMENTO E ENERGIA RENOVÁVEL DO BRASIL S.A./CICLUS Ambiental has confirmed with the letter of intent (LoI) their voluntary participation to the proposed PoA coordinated by Caixa, and that the CTR Santa Rosa is neither registered as an individual CDM project activity nor included as part of another registered PoA
- The CTR Santa Rosa is a Regional sanitary landfill project, receiving municipal solid waste from Rio de Janeiro, Seropédica and Itaguaí municipalities.
- The baseline scenario consists of the total or partial release of LFG to the atmosphere;
- The project activity intends to collect LFG to be flared, used for energy generation and used to supply consumers through a natural gas distribution network.
- The solid waste disposal site where the waste would be dumped can be clearly identified;
- Only municipal solid waste will be received at the site as per the technical specifications of the concession; additionally hazardous wastes are not allowed to be disposed at the site, therefore the site is eligible under this PoA,
- SERB – SANEAMENTO E ENERGIA RENOVÁVEL DO BRASIL S.A./CICLUS Ambiental has agreed to conduct the stakeholder consultation as required by Brazil’s DNA, and as outlined in Section C of this document,
- SERB – SANEAMENTO E ENERGIA RENOVÁVEL DO BRASIL S.A./CICLUS Ambiental will take responsibility for operating and monitoring the CPA-1 CTR Santa Rosa as per the CDM rules and guidelines provided by Caixa;
- Additionality analysis is performed at the CPA level, following a financial analysis and demonstrating that the project is not viable unless it is registered as a CDM project;
- SERB – SANEAMENTO E ENERGIA RENOVÁVEL DO BRASIL S.A./CICLUS Ambiental has confirmation from Caixa, where future carbon revenues have been presented for the loan evaluation and are a partial guarantee to repay the loan.

The CPA-1 CTR Santa Rosa is additional, meeting the eligibility criteria listed above and justified as follows:

- **There should not be any existing operating LFG collection system** – *CTR Santa Rosa landfill is still being constructed and there are no plans to implement a LFG collection system without CDM registry.*
- **The costs for installation of the LFG collection and use systems should be prohibitive without CDM revenues.** *Estimated costs necessary to implement the LFG capture system, flaring system, electricity generators and LFG upgrading and distribution station exceeds R\$ 90 million, making this project not viable without CDM revenues. This is demonstrated below.*

As stated by the PoA, additionality assessment is performed according to the “Tool for demonstration and assessment of additionality”, version 05.2.1 as explained below:

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

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

As described in section I of the PoA-DD, alternative scenarios for the CPA are:

- LFG1: The project activity undertaken without being registered as a CDM project activity
- LFG2: Atmospheric release of the LFG
- P1: Power generated from landfill gas undertaken without being registered as CDM project activity
- P6: Existing and/or new grid-connected power plants

Outcome of Step 1a, as per the PoA-DD: The most plausible and credible alternatives to the project activity are: LFG1 and P1, LFG2 and P6.

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

As explained on the PoA-DD all alternatives are consistent with Brazilian laws and regulations. For this CPA, the state of Rio de Janeiro does not have any regulation requiring landfills to have gas collection systems.

Outcome of Step 1b, as per the PoA-DD: LFG1 and P1 along with LFG2, P6 continue to be considered plausible baseline scenarios consistent with country implementation of laws and regulations.

Step 2: Identify the fuel for the baseline choice of energy source taking into account the national and/or sectoral policies as applicable

The step 2 is not applicable to the proposed CPA, as the baseline energy source is the electricity provided by the national grid.

Step 3: Step 2 of the Tool for demonstration and assessment of additionality shall be used to assess which of these alternatives should be excluded from further consideration.

Sub-step 2a. Determine appropriate analysis method

Since the CPA involves flaring, electricity generation and supply of gas to consumers through natural gas distribution grid, then as indicated by the PoA the appropriate analysis method is the benchmark analysis, and so this analysis has been followed.

Sub-step 2b. – Option III. Apply benchmark analysis

As per the PoA, CPAs with electricity generation and/or supply of gas to consumers through natural gas distribution network (scenario 2 and 3), the project shall apply benchmark analysis. As also described in the PoA, when benchmark analysis is to be used in assessing the additionality of a CPA, the benchmark used will be derived from government bond rates, increased by a suitable risk premium to reflect private investment and/or the project type, as substantiated by an independent (financial) expert or documented by official publicly available financial data

In order to conduct the benchmark analysis, an evaluation of the project's cash-flow and its internal rate of return (IRR) (without CDM financial incentives) is undertaken through a 21 years period¹. The benchmark analysis is undertaken by comparing the project IRR against Brazil Federal Treasury Bonds.

As per the PoA, the benchmark has been determined by the Brazilian Federal Treasury Bonds, a low-risk long-term investment indicator from the Brazilian Federal Treasury, where the average of July's 2010 NTNFB 010117, governmental bond with 12.09% rate, was used for comparison².

Since the Financial Analysis is in real terms and the bond is in nominal terms, it has to be converted the benchmark into real terms discounting the inflation rate, which the government targetted for the same period for 4.5%³. Therefore the Benchmark IRR for the CPA in Brazil in real terms has been established at 12.09% in nominal terms, which is equivalent to 7.26% in real terms⁴

All values of financial parameters used in the benchmark analysis are reported below:

- Investment analysis is conducted over a period of **21 years** (until **2031**) based on the expected lifetime of the project^{5,6}
- Sales taxes⁷:
 - ICMS: 18%
 - PIS (Profit Participation Contribution): 1.65%
 - COFINS (Social Security Financing Contribution): 7.60%
- Exchange rate used for the investment analysis: 1.80 R\$/US\$ and 2.2 R\$/Euro⁸.
- Generation capacity: maximum generation capacity is 25.47 MW. The engines for power generation will be installed in packages of 3 units⁹. Units in service will be the following:
 - 2013-2014: 3 units X 1.06 MW, total 4.245 MW
 - 2015-2016: 6 units X 1.06 MW, total 8.490 MW
 - 2017-2018: 9 units X 1.06 MW, total 12.735 MW
 - 2019-2020: 12 units X 1.06 MW, total 16.980 MW
 - 2021-2022: 15 units X 1.06 MW, total 21.225 MW
 - 2023-2027: 18 units X 1.06 MW, total 25.470 MW
- Revenues from electricity are calculated using the latest available Renewable Energy Auction (small hydro, bagasse and wind) in Brazil (August 28, 2010): 148.39 R\$/MWh¹⁰ (82.4 US\$/MWh).

¹ The detailed cash-flow was based on a 21-years period without CERs revenues, The spreadsheet has been made available to the DOE

² Source: Brazilian Treasury. http://www.tesouro.fazenda.gov.br/tesouro_direto/download/historico/2010/historicontnf_2010.xls

³ Source: Central Bank of Brazil. <http://www.bcb.gov.br/Pec/metas/TabelaMetaseResultados.pdf>

⁴ Source: Central Bank of Brazil. <http://www.bcb.gov.br>

⁵ Project defined as biogas capture, generation of electricity, supply of gas to customers through gas distribution grid and/or gas flaring.

⁶ lifetime of equipment, Source: Estudo de Viabilidade do Projeto Biogás Seropédica (Feasibility Study of the Seropedica Biogas Project)

⁷ Source: PIS 1,65% e COFINS 7,6%.pdf. Brazilian Tax office (*Ministerio da Fazenda*) [http://www.receita.fazenda.gov.br/PessoaJuridica/PisPasepCofins/IncidenciaExportServico.htm#Base de cálculo](http://www.receita.fazenda.gov.br/PessoaJuridica/PisPasepCofins/IncidenciaExportServico.htm#Base%20de%20c%C3%A1lculo)

⁸ Source: Central Bank of Brazil, June 30, 2010, <http://www.bcb.gov.br>.

⁹ GE ENERGY JENBACHER - HAZTEC - Proposta Comercial.pdf

¹⁰ The reference price for the electricity is based on the second auction for renewable energy sources (August 28, 2010). For conservativeness purposes, it has been selected the highest price of the auction: 148.39 R\$/MWh. Available on CCEE website: http://www.ccee.org.br/cceeinterdsm/v/index.jsp?contentType=RESULTADO_LEILAO&vgnnextoid=ed7c645eb56ba210VgnVCM1000005e01010aRCRD&qryRESULTADO-LEILAO-CD-RESULTADO-LEILAO=0101645eb56ba210VgnVCM1000005e01010a____&x=10&y=8

- Revenues from selling LFG to the distribution network are calculated using a value of 0.5877 R\$/m³¹¹ (0.3265 US\$/m³)
- Investment:
 - LFG collection system¹² (Drilling + Pipeline network + vertical wells + Leachate Pumps + Welding and Assembly): R\$ 26,496,727 (US\$ 14,720,404), with a planning completion of 20% in 2011 and 4% for the following years until 2031.
 - LFG Flaring System¹³ (Flare and Blower system): R\$ 3,339,000 (US\$ 1,855,000)
 - Group motor including engines, construction of the plant, connection, etc: R\$ 13,683,462 (US\$ 7,601,923.47)
 - LFG Processing Plant¹⁴ (incl Import levies¹⁵): R\$ 40,132,011 (US\$ 22,295,562)
- Operation and Maintenance:
 - O&M electricity system¹⁶: 576,000 R\$/y (320,000US\$/y) (fixed) and 36 R\$/MWh (20US\$/MWh).
 - O&M LFG collection System and Flare costs¹⁷: 480,000 R\$/y (266,667US\$/y) with an annual increase rate of 4% until 2031
 - O&M LFG Processing Plant¹⁸: 1,929,280 R\$/y (1,071,822US\$/y)
 - Administrative costs¹⁹: 420,000 R\$/y (233,333 US\$/y).
 - Insurance costs²⁰: 0.177% of investment/y.
- Overhaul for the first group motor (including 3 engines) is estimated at: R\$ 400,400 (US\$ 667,333) (necessary after 60,000 hours of operation)²¹.
- Fair values for the group motors installed in 2017 and 2019 are included. The different groups of engines are considered for a lifetime of 15 years. The fair value has been calculated using depreciation rate of 10%²².

Sub-step 2c. Calculation and comparison of financial indicators:

Using the assumptions listed in the previous section, the calculated project IRR for alternative LFG1/P1 is **5.09%** which is below the benchmark of **7.26%**.

Sub-step 2d. Sensitivity analysis

The purpose of the sensitivity analysis is to examine whether the conclusion regarding the financial viability of the proposed CPA is sound and tenable with those reasonable variations in the assumptions. The investment analysis provides a valid argument in favour of additionality only if it shows that the project is unlikely to be financially attractive.

¹¹ CEG communication

¹² Source: Estudo de Viabilidade do Projeto Conceitual - Santa Rosa (Feasibility Study of the Seropedica Biogas Project).

¹³ Source: Seropedica LANDTEC.pdf

¹⁴ Source: Linde proposal.doc

¹⁵ Source: Import_levies_BiogasPlant.pdf

¹⁶ Source: O&M - HAZTEC - Proposta Técnica e Comercial Rev 3.pdf

¹⁷ Source: Estudo de Viabilidade do Projeto Conceitual - Santa Rosa (Feasibility Study of the Seropedica Biogas Project)

¹⁸ Source: Linde_Haztec letter.pdf

¹⁹ Source: Estudo de Viabilidade do Projeto Conceitual - Santa Rosa (Feasibility Study of the Seropedica Biogas Project)

²⁰ Source: Haztec Insurance.pdf

²¹ Source: Overhauill Motores JMS 420.pdf

²² Source: Depreciation rates (Taxas de depreciacao.pdf). Norm SRF number 162, December 31, 1998 (Instrução Normativa SRF nº 162, de 31 de dezembro de 1998), <http://www.receita.fazenda.gov.br/legislacao/ins/ant2001/1998/in16298.htm>

As a first part of the sensitivity analysis, the financial viability of the CPA has been examined considering only the electricity generation (without considering LFG Processing Plant for selling biogas to distribution network) and only considering the biogas distribution (without considering the electricity generation). The summary of the results obtained in this first part of the sensibility analysis carried out for the project activity are:

Table 2

Variation	IRR
Electricity generation only (without selling biogas)	3.40%
Biogas distribution only (without electricity generation)	0.13%

As shown in the above table, without the CDM revenue, the IRRs of the project variations considering electricity generation only or biogas distribution only are lower than the benchmark rate of 7.26%. Thus the proposed project variations are not financially attractive to the investors.

As a second part of the sensitivity analysis of the CPA, the following hypotheses were adopted, as they are the most significant costs involved in the project activity:

- Variation in the price of the LFG sold in + 10%;
- Variation in the price of the electricity sold in +10%
- Variation of the Gas Upgrading System CAPEX in - 10%;
- Variation of the Power Generation OPEX in - 10%;

The following table summarizes the IRRs resulting from the application of the different hypotheses:

Table 3: Sensitivity analysis

Variations	Initial value	Variation value	Units	IRR
Variation in the price of the LFG sold in + 10%	0.5877	0.6465	R\$/m3	6.66%
Variation in the price of the electricity sold in +10%	148.39	163.23	R\$/MWh	7.02%
Variation of the Gas Upgrading System CAPEX in - 10%	40,132,011	36,118,810	R\$	6.30%
Variation of the Power Generation OPEX in - 10%	137,126,880	123,414,192	R\$	6.47%

As shown in the Table above the project IRR remains below the benchmark when the above financial indicators fluctuated within the range of -10% to +10%. According to the sensitivity analysis, even with ± 10% variations of the financial key parameters, the project IRR is still much lower than the benchmark of 7.26%.

Thus without CDM revenues, the proposed CPA is not financially attractive.

As recommended by the Tool for demonstration and assessment of additionality, the analysis showed that the CPA is unlikely to be financially/economically attractive.

Outcome of Step 2 of the tool, as per the PoA-DD: Given that after the financial analysis it is concluded that the proposed CPA CDM project activity is unlikely to be financially/economically attractive (as per Step 2c para 10b of the tool), then proceed to Step 4 of the tool (Common practice analysis).

Step 4. Common practice analysis

As has been demonstrated in the PoA, and following the *Guidelines on Common Practice (EB63 Annex 12)* the outcome of the stepwise approach is that the CPAs under the PoA are not the common practice for landfill sites in Brazil.

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

As demonstrated in the PoA there are no similar activities happening in Brazil outside the CDM²³ as there are no regulatory incentives and the sale of electricity alone does not cover the additional costs of a biogas capture, flaring, and electricity generation system. Those that are implemented have been installed due to incentives of the CDM.

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

As demonstrated in the PoA, in Brazil, the only situation where the LFG generated in Landfills is actively collected and destroyed by flaring or used to generate electricity occurs under the CDM registry.

Therefore, the CPA-1 Santa Rosa meets all criteria described in the PoA. Costs are definitely prohibitive without the benefits of CDM registry, and current practices in Brazil (baseline scenario in the host country) are the total release of LFG to the atmosphere.

Therefore as per the PoA, the proposed CPA is additional, and as the project activity is unlikely to be financially/economically attractive, the most plausible baseline scenario is confirmed to be LFG2 "Atmospheric release of the landfill gas" and P6 "Existing and/or new grid-connected power plants".

D.6. Estimation of emission reductions**D.6.1. Explanation of methodological choices**

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As mentioned in section D.1 and D.2 above, this CPA applies approved methodology ACM0001 "Consolidated baseline methodology for landfill gas project activities" and its tools. The methods for calculating baseline emissions, project emissions, leakage emissions and emission reductions are explained below:

Baseline emissions

Baseline emissions are calculated with the following equation:

$$BE_y = (MD_{project,y} - MD_{BL,y}) * GWP_{CH4} + EL_{LFG,y} \cdot CEF_{elec,BL,y} + ET_{LFG,y} * CEF_{ther,BL,y} \quad (1)$$

Where:

- BE_y = Baseline emissions in year y (tCO₂e)
- $MD_{project,y}$ = The amount of methane that would have been destroyed/combusted during the year, in tonnes of methane (tCH₄) in project scenario
- $MD_{BL,y}$ = The amount of methane that would have been destroyed/combusted during the year in the absence of the project due to regulatory and/or contractual requirement, in tonnes of methane (tCH₄)
- GWP_{CH4} = Global Warming Potential value for methane for the first commitment period is 21 tCO₂e/tCH₄
- $EL_{LFG,y}$ = Net quantity of electricity produced using LFG, which in the absence of the project activity would have been produced by power plants connected to the

²³ As indicated in the *Brazil Country profile* by Methane to Markets, published in 2009 Page 1: "Despite this figure (number of landfill gas projects in Brazil), there is only one project generating electricity and another evaporating leachate. All other projects are only destroying or, in other words, collecting cleaning and burning (with a complex system of monitoring and certification) the methane contained in biogas without use the available energy" available at http://www.globalmethane.org/documents/landfills_cap_brazil.pdf

- grid or by an on-site/off-site fossil fuel based captive power generation, during year y , in megawatt hours (MWh)
- $CEF_{elec,BL,y}$ = CO₂ emissions intensity of the baseline source of electricity displaced, in tCO₂e/MWh This is estimated as per the section Determination of CEF_{elec,BL,y} below
- $ET_{LFG,y}$ = The quantity of thermal energy produced utilizing the landfill gas, which in the absence of the project activity would have been produced from onsite/offsite fossil fuel fired boiler/air heater, during the year y in TJ
- $CEF_{ther,BL,y}$ = CO₂ emissions intensity of the fuel used by boiler/air heater to generate thermal energy which is displaced by LFG based thermal energy generation, in tCO₂e/TJ.

The methane that would be destroyed in the baseline is calculated as follows.

$$MD_{BL,y} = MD_{project,y} * AF \tag{2}$$

• *Guidance on estimating AF:*

ACM0001 provides the guidance on how to estimate AF. AF should be considered in cases where a specific system for collection and destruction of methane is mandated by regulatory or contractual requirements or is undertaken for other reasons, the ratio of the destruction efficiency of the baseline system to the destruction efficiency of the system used in the CPA shall be used. Since the Brazilian legislation establishes that each state is responsible for the environmental license process for landfills, each state then defines the laws, minimum standards, technologies, restrictions and environmental requirements for the landfills. Therefore under the current PoA, each CPA will determine its AF depending on its geographical location and state regulations which it is subject to. This will be reviewed accordingly by each CPA if there is a change, with the renewal of its crediting period.

Therefore, since there is no thermal energy generation as part of this PoA, equation 1 is reduced to the following equation, which will be used for all CPAs under the PoA:

$$BE_y = (MD_{project,y} - MD_{BL,y}) * GWP_{CH4} + EL_{LFG,y} * CEF_{elec,BL,y} \tag{3}$$

Ex-Ante Baseline emissions

Ex ante methane emissions that are generated in the landfill ($MD_{project,y}$) are calculated following methodology ACM0001, and based on parameter $BE_{CH4,SWDS,y}$ calculated as per the approved “*Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site*” where the following guidance from the methodology should be taken into account:

- In the tool, x will refer to the year since the landfill started receiving wastes [x runs from the first year of landfill operation ($x=1$) to the year for which emissions are calculated ($x=y$)];
- Sampling to determine the different waste types is not necessary. The waste composition can be obtained from previous studies.
- The efficiency of the degassing system which will be installed in the project activity should be taken into account while estimating the *ex ante* estimation.

These will be calculated considering the following equation:

$$MD_{project,y} = BE_{CH4,SWDS,y} / GWP_{CH4} \tag{4}$$

Where:

$BE_{CH_4,SWDS,y}$ = Methane generation from the landfill in the absence of the project activity at year y (tCO_{2e}), calculated as per the “*Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site*”. The tool estimates methane generation adjusted for, using adjustment factor (f) any landfill gas in the baseline that would have been captured and destroyed to comply with relevant regulations or contractual requirements, or to address safety and odor concerns. As this is already accounted for in equation 2, “ f ” in the tool shall be assigned a value 0

$$BE_{CH_4,SWDS,y} = \varphi \cdot (1-f) \cdot GWP_{CH_4} \cdot (1-OX) \cdot \frac{16}{12} \cdot F \cdot DOC_f \cdot MCF \cdot \sum_{x=1}^y \sum_j W_{j,x} \cdot DOC_j \cdot e^{-k_j \cdot (y-x)} \cdot (1 - e^{-k_j}) \quad (5)$$

Where:

- $BE_{CH_4,SWDS,y}$ = Methane emissions avoided during the year y from preventing disposal at the solid waste disposal site (SWDS) during the period from the start of the project activity to the end of the year y (tCO_{2e})
- φ = Model correction factor to account for model uncertainties (0.9)
- f = Fraction of methane captured at the SWDS and flared, combusted or used in another manner
- GWP_{CH_4} = Global Warming Potential (GWP) of methane, valid for the relevant commitment period
- OX = Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)
- F = Fraction of methane in the SWDS gas (volume fraction) (0.5)
- DOC_f = Fraction of degradable organic carbon (DOC) that can decompose
- MCF = Methane correction factor
- $W_{j,x}$ = Amount of organic waste type j prevented from disposal in the SWDS in the year x (tonnes)
- DOC_j = Fraction of degradable organic carbon (by weight) in the waste type j
- k_j = Decay rate for the waste type j
- j = Waste type category (index)
- x = Year during the crediting period: x runs from the first year of the crediting period ($x = 1$) to the year y for which avoided emissions are calculated ($x = y$)
- y = Year for which methane emissions are calculated

The amount of different waste types ($W_{j,x}$) were calculated through waste data based on a recent study. However, if sampling is needed, $W_{j,x}$ will be calculated as follows:

$$W_{j,x} = W_x \cdot \frac{\sum_{n=1}^Z P_{n,j,x}}{Z} \quad (6)$$

Where,

- $W_{j,x}$ = Amount of organic waste type j prevented from disposal in the SWDS in the year x (tons)
- W_x = Total amount of organic waste prevented from disposal in year x (tons)
- $P_{n,j,x}$ = Weight fraction of the waste type j in the sample n collected during the year x
- Z = Number of samples collected during the year x

The second part of the baseline equation represents the baseline emissions produced by the amount of expected energy that would have been produced by the grid, and will be replaced by the electricity produced by the project activities in the CPAs. This is calculated by multiplying $EL_{LFG,y}$ times $CEF_{elec,BL,y}$

Determination of CEF_{elec,BL,y}

The “Tool to Calculate the Emission Factor for an Electricity System” (version 02.2.1) is applied to calculate the combined margin emission factor for the Brazilian grid, using the supplied information provided by the Brazilian DNA. This will be done per CPA, reported in the CPA-DD and will be monitored ex-post by each project activity.

Ex-Post Baseline emissions

$MD_{project,y}$ will be determined *ex post* by metering the actual quantity of methane captured and destroyed once the project activity is operational.

The methane destroyed by the project activity ($MD_{project,y}$) during a year is determined by monitoring the quantity of methane actually flared and gas used to generate electricity and/or produce thermal energy and/or supply to end users via natural gas distribution grid, if applicable, and the total quantity of methane captured.

The sum of the quantities fed to the flare(s), to the power plant(s), and to the natural gas distribution grid (estimated using equation 3) must be compared annually with the total quantity of methane generated. The lowest value of the two must be adopted as $MD_{project,y}$.

The following procedure applies when the total quantity of methane generated is the highest. The working hours of the energy plant(s) should be monitored and no emission reduction could be claimed for methane destruction in the energy plant during non-operational hours. As per the methodology we have that:

$$MD_{project,y} = MD_{flared,y} + MD_{electricity,y} + MD_{thermal,y} + MD_{PL,y} \tag{7}$$

Where:

- $MD_{flared,y}$ = Quantity of methane destroyed by flaring (tCH₄)
- $MD_{electricity,y}$ = Quantity of methane destroyed by generation of electricity (tCH₄)
- $MD_{thermal,y}$ = Quantity of methane destroyed for the generation of thermal energy (tCH₄)
- $MD_{PL,y}$ = Quantity of methane sent to the pipeline for feeding to the natural gas distribution network (tCH₄)

Right hand side of equation (7) is the sum over all the points of captured methane use in case the methane is flared in more than one flare, and/or used in more than one energy generation source. The supply to each point of methane destruction, through flaring or use for energy generation, shall be measured separately. Since there is no thermal energy generation contemplated in this PoA, the third term, $MD_{thermal,y}$ is always assumed as zero. As for the first term, we have that:

$$MD_{flared,y} = \{LFG_{flare,y} * w_{CH4,y} * D_{CH4}\} - (PE_{flare,y} / GWP_{CH4}) \tag{8}$$

Where:

- $LFG_{flare,y}$ = Quantity of landfill gas fed to the flare(s) during the year measured in cubic meters (m³)
- $w_{CH4,y}$ = Average methane fraction of the landfill gas as measured²⁴ during the year and expressed as a fraction (in m³ CH₄/m³ LFG)

²⁴ Methane fraction of the landfill gas and LFG flow have to be measured on same basis (either wet or dry). In case the “Tool to determine project emissions from flaring gases containing methane” is used, follow the standard approaches to convert the flow on wet basis to dry basis. For example, refer to the procedures provided in the book “Fundamentals of Classical Thermodynamics”; Gordon J. Van Wylen, Richard E. Sonntag and Claus Borgnakke; 4^o Edition, 1994, John Wiley & Sons, Inc.

- D_{CH4} = Methane density expressed in tonnes of methane per cubic meter of methane (tCH_4/m^3CH_4)²⁵
- $PE_{flare,y}$ = Project emissions from flaring of the residual gas stream in year y (tCO₂e) determined following the procedure described in the “*Tool to determine project emissions from flaring gases containing methane*”. If methane is flared through more than one flare on a CPA, the $PE_{flare,y}$ shall be determined for each flare²⁶

Since the CPAs under this PoA will implemented enclosed flares, then as per the tool, the temperature in the exhaust gas of the flare will be measured to determine whether the flare is operating or not.

For enclosed flares, either of the following two options can be used to determine the flare efficiency:

- (a) To use a 90% default value. Continuous monitoring of compliance with manufacturer’s specification of flare (temperature, flow rate of residual gas at the inlet of the flare) must be performed. If in a specific hour any of the parameters are out of the limit of manufacturer’s specifications, a 50% default value for the flare efficiency should be used for the calculations for this specific hour.
- (b) Continuous monitoring of the methane destruction efficiency of the flare (flare efficiency).

In case of the continuous monitoring system is unavailable for maintenance, or failure, the following methods will be used:

- 0% if the temperature in the exhaust gas of the flare (T_{flare}) is below 500 °C for more than 20 minutes during the hour h .
- 50%, if the temperature in the exhaust gas of the flare (T_{flare}) is above 500 °C for more than 40 minutes during the hour h , but the manufacturer’s specifications on proper operation of the flare are not met at any point in time during the hour h .
- 90%, if the temperature in the exhaust gas of the flare (T_{flare}) is above 500 °C for more than 40 minutes during the hour h and the manufacturer’s specifications on proper operation of the flare are met continuously during the hour h .

In both cases for all CPAs, if there is no record of the temperature of the exhaust gas of the flare or if the recorded temperature is less than 500 °C for any particular hour, it shall be assumed that during that hour the flare efficiency is zero.

Project implementers will document in the CPA-DD, which option is taken to determine the flare efficiency. In case of use of the default value for the methane destruction efficiency, the manufacturer’s specifications for the operation of the flare and the required data and procedures to monitor these specifications will be documented in the CPA-DD.

For the second term of equation (7) we have that:

$$MD_{electricity,y} = LFG_{electricity,y} * w_{CH4,y} * D_{CH4} \tag{9}$$

Where:

- $MD_{electricity,y}$ = Quantity of methane destroyed by generation of electricity
- $LFG_{electricity,y}$ = Quantity of landfill gas fed into electricity generator

And for the fourth term of equation (7) we have that:

²⁵ At standard temperature and pressure (0 degree Celsius and 1,013 bar) the density of methane is 0.0007168 tCH₄/m³CH₄.

²⁶ Also, following the “Tool to determine project emissions from flaring gases containing methane” CPA implementers may choose to follow the simplified approach to monitor the volumetric fraction of methane and consider the difference to 100% as being Nitrogen (N₂).

$$MD_{PL,y} = LFG_{PL,y} * W_{CH4,y} * D_{CH4} \quad (10)$$

Where $LFG_{PL,y}$ is the quantity of landfill gas sent to pipeline for feeding to the natural gas distribution grid.

At the renewal of the crediting period of the PoA, the following data should be updated according to default values suggested in the most recent version of the tool:

- Oxidation factor (OX);
- Fraction of methane in the SWDS gas (F);
- Fraction of degradable organic carbon (DOC) that can decompose (DOC_f);
- Methane correction factor (MCF);
- Fraction of degradable organic carbon (by weight) in each waste type j (DOC_j);
- Decay rate for the waste type j (k_j).
- Global Warming Potential (GWP)

Project Emissions:

According to the methodology, project emissions are determined by the following:

$$PE_y = PE_{EC,y} + PE_{FC,j,y} \quad (11)$$

Where:

- $PE_{EC,y}$ = Emissions from consumption of electricity in the project case.
- $PE_{FC,j,y}$ = Project emissions from fossil fuel combustion

Project emissions from electricity consumption ($PE_{EC,y}$) are calculated following version 01 of “*Tool to calculate baseline, project and/or leakage emissions from electricity consumption*”; from it, scenario A “Electricity consumption from the grid” will be applied for all CPAs, where $PE_{EC,y}$ is calculated as follows:

$$PE_{EC,y} = \sum_j EC_{PJ,j,y} \times EF_{EL,j,y} \times (1 + TDL_{j,y}) \quad (12)$$

Where:

- $EC_{PJ,j,y}$ Quantity of electricity consumed by the project activity during the year MWh
- $EF_{EL,j,y}$ Brazilian grid emission factor tCO₂/MWh (same as $CEF_{elec,BL,y}$ mentioned above)
- $TDL_{j,y}$ Average technical transmission and distribution losses in the grid in year y for the voltage level at which electricity is obtained from the grid at the project site.

Project emissions from fossil fuel combustion ($PE_{FC,j,y}$) are calculated following the latest version of “*Tool to calculate project or leakage CO2 emissions from fossil fuel combustion*”. These emissions are calculated as follows:

$$PE_{FC,j,y} = FC_{i,j,y} * COEF_{j,y} \quad (13)$$

Where

- $FC_{i,j,y}$ is the fossil fuel combusted of type i, in the process j, for the year y
- $COEF_{j,y}$ is the CO₂ emission coefficient of the fossil fuel i

Where

$COEF_{j,y}$ is calculated by following option B of the tool:

$$COEF_{j,y} = NCV_{i,y} * EF_{CO2y} \quad (14)$$

Where

- $NCV_{i,y}$ Is the weighted average net calorific value of the fuel type i
- EF_{CO2y} Is the weighted average CO₂ emission factor of fuel type j

Project emissions from flaring have not been shown in this section since they are already taken into account in the MD_{project} parameter.

Leakage

No leakage effects need to be accounted under this methodology.

Emission Reductions

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y \tag{15}$$

Where:

- ER_y = Emission reductions in year y (tCO₂e/yr)
- BE_y = Baseline emissions in year y (tCO₂e/yr)
- PE_y = Project emissions in year y (tCO₂/yr)

D.6.2. Data and parameters fixed ex-ante

Data / Parameter	Regulatory requirements relating to landfill gas
Unit	Norms
Description	Regulatory requirements relating to landfill gas from ABNT NBR (<i>Associação Brasileira de Normas Técnicas / Brazilian Association of Technical Norms</i>) and (<i>Norma Brasileira / Brazilian Norm</i>), including: ABNT NBR 8419:1992 Versão Corrigida: 1996. <i>Apresentação de projetos de aterros sanitários de resíduos sólidos urbanos / Introduction of Projects for Sanitary Landfills of Municipal Solid Waste.</i>
Source of data	Publicly available information
Value(s) applied	Will be reflected in the AF, as explained in section D.6.3 below.
Choice of data or Measurement methods and procedures	The information will be recorded, to use it for changes in the adjustment factor (AF) or directly to MD _{BL, y} at the renewal of the crediting period.
Purpose of data	
Additional comment	N/A

Data / Parameter	GWP _{CH4}
Unit	tCO ₂ / tCH ₄
Description	Global Warming Potential of CH ₄
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories and IPCC Fourth Assessment Report: Climate Change 2007
Value(s) applied	21 or 25
Choice of data or Measurement methods and procedures	21 for the first commitment period. 25 for the second commitment period. Shall be updated according to any future COP/MOP decisions.
Purpose of data	Calculation of baseline emissions.
Additional comment	N/A

Data / Parameter	D_{CH₄}
Unit	t CH ₄ / m ³ CH ₄
Description	Methane density
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value(s) applied	0.0007168
Choice of data or Measurement methods and procedures	At standard T and P (0° C and 1,013 bar) the density of methane is 0.0007168 t CH ₄ / m ³ CH ₄
Purpose of data	Calculation of baseline emissions.
Additional comment	N/A

Data / Parameter	BE_{CH₄,SWDS,y}
Unit	tCO ₂ e
Description	Methane generation from the landfill in the absence of the project activity at year y
Source of data	Calculated as per the “Tool for determining methane emissions avoided from disposal of waste at a solid waste disposal site” – Version 05.1.0
Value(s) applied	To be defined for each CPA
Choice of data or Measurement methods and procedures	As per the “Tool for determining methane emissions avoided from disposal of waste at a solid waste disposal site” – Version 05.1.0
Purpose of data	Used for ex-ante estimation of the amount of methane that would have been destroyed/combusted during the year
Additional comment	

Data / Parameter	φ
Unit	-
Description	Model correction factor to account for model uncertainties
Source of data	Assumed as per the “Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site”
Value(s) applied	0.9
Choice of data or Measurement methods and procedures	Onk et al. (1994) have validated several landfill gas models based on 17 realized landfill gas projects. The mean relative error of multi-phase models was assessed to be 18%. Given the uncertainties associated with the model and in order to estimate emission reductions in a conservative manner, a discount of 10% is applied to the model results.
Purpose of data	
Additional comment	

Data / Parameter	OX
Unit	-
Description	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)

Source of data	Assumed as per the “Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site” version 05.1.0
Value(s) applied	Use 0.1 for managed solid waste disposal sites that are covered with oxidizing material such as soil or compost. Use 0 for other types of solid waste disposal sites.
Choice of data or Measurement methods and procedures	As per the “Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site” version 05.1.0
Purpose of data	Used for ex ante estimation of the amount of methane generated
Additional comment	

Data / Parameter	F
Unit	-
Description	Fraction of methane in the SWDS gas (volume fraction)
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value(s) applied	0.5
Choice of data or Measurement methods and procedures	As per the “Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site” version 05.1.0
Purpose of data	Used for ex ante estimation of the amount of methane generated.
Additional comment	This factor reflects the fact that some degradable organic carbon does not degrade, or degrades very slowly, under anaerobic conditions in the SWDS. A default value of 0.5 is recommended by IPCC.

Data / Parameter	DOC_r
Unit	-
Description	Fraction of degradable organic carbon (DOC) that can decompose
Source of data	Assumed as per the “Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site” version 05.1.0
Value(s) applied	0.5
Choice of data or Measurement methods and procedures	As per the “Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site” version 05.1.0
Purpose of data	Used for ex ante estimation of the amount of methane generated.
Additional comment	

Data / Parameter	MCF
Unit	-
Description	Methane Correction factor
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value(s) applied	1

Choice of data or Measurement methods and procedures	As the CTR Santa Rosa will be a managed landfill, the value 1.0 has been applied as per the options within the “Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site” version 05.1.0: <table border="1"> <thead> <tr> <th>SWDS condition</th> <th>MCF Value</th> </tr> </thead> <tbody> <tr> <td>anaerobic managed</td> <td>1.0</td> </tr> <tr> <td>semi-aerobic</td> <td>0.5</td> </tr> <tr> <td>unmanaged (deep > 5m)</td> <td>0.8</td> </tr> <tr> <td>unmanaged-shallow (deep < 5m)</td> <td>0.4</td> </tr> </tbody> </table>	SWDS condition	MCF Value	anaerobic managed	1.0	semi-aerobic	0.5	unmanaged (deep > 5m)	0.8	unmanaged-shallow (deep < 5m)	0.4
SWDS condition	MCF Value										
anaerobic managed	1.0										
semi-aerobic	0.5										
unmanaged (deep > 5m)	0.8										
unmanaged-shallow (deep < 5m)	0.4										
Purpose of data	Used for ex ante estimation of the amount of methane generated.										
Additional comment	The methane correction factor (MCF) accounts for the fact that unmanaged SWDS produce less methane from a given amount of waste than managed SWDS, because a larger fraction of waste decomposes aerobically in the top layers of unmanaged SWDS.										

Data / Parameter	DOC_j																					
Unit	-																					
Description	Fraction of degradable organic carbon (by weight) in the waste type j																					
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories (Volume 5, Tables 2.4 and 2.5)																					
Value(s) applied	<table border="1"> <thead> <tr> <th>Waste type j</th> <th>DOC_j (% wet waste)</th> <th>DOC_j (% dry waste)</th> </tr> </thead> <tbody> <tr> <td>Wood and wood products</td> <td>43</td> <td>50</td> </tr> <tr> <td>Pulp, paper and cardboard (other than sludge)</td> <td>40</td> <td>44</td> </tr> <tr> <td>Food, food waste, beverages and tobacco (other than sludge)</td> <td>15</td> <td>38</td> </tr> <tr> <td>Textiles</td> <td>24</td> <td>30</td> </tr> <tr> <td>Garden, yard and park waste</td> <td>20</td> <td>49</td> </tr> <tr> <td>Glass, plastic, metal, other inert waste</td> <td>0</td> <td>0</td> </tr> </tbody> </table>	Waste type j	DOC _j (% wet waste)	DOC _j (% dry waste)	Wood and wood products	43	50	Pulp, paper and cardboard (other than sludge)	40	44	Food, food waste, beverages and tobacco (other than sludge)	15	38	Textiles	24	30	Garden, yard and park waste	20	49	Glass, plastic, metal, other inert waste	0	0
Waste type j	DOC _j (% wet waste)	DOC _j (% dry waste)																				
Wood and wood products	43	50																				
Pulp, paper and cardboard (other than sludge)	40	44																				
Food, food waste, beverages and tobacco (other than sludge)	15	38																				
Textiles	24	30																				
Garden, yard and park waste	20	49																				
Glass, plastic, metal, other inert waste	0	0																				
Choice of data or Measurement methods and procedures	As per the “Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site” version 05.1.0																					
Purpose of data	Used for ex ante estimation of the amount of methane generated.																					
Additional comment																						

Data / Parameter	k_j
Unit	-
Description	Decay rate for the waste type j
Source of data	IPCC 2006 Guidelines for National Greenhouse Gas Inventories (Volume 5, Tables 2.4 and 2.5)

Value(s) applied		
	Waste type	k_j
	Pulp, paper, cardboard and textiles	0.070
	Wood, wood products and straw	0.035
	Other (non-food) organic putrescible garden and park waste	0.170
	Food, food waste, sewage sludge, beverages and tobacco	0.400
Choice of data or Measurement methods and procedures	As per the “ <i>Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site</i> ” version 05.1.0 and per climatic conditions in Brazil	
Purpose of data	Used for ex ante estimation of the amount of methane generated.	
Additional comment	The values applied are for tropical ($MAT > 20^{\circ}C$) and wet ($MAP > 1000m$) conditions. Source: INMET 2007. Refer to Appendix 4 for details.	

Data / Parameter	E_{DS}
Unit	%
Description	Efficiency of the degassing system which will be installed in the CPAs
Source of data	USEPA
Value(s) applied	50%
Choice of data or Measurement methods and procedures	Conservative value. This value will be applied to all CPAs under this PoA
Purpose of data	Used for ex ante estimation of the amount of methane collected.
Additional comment	

Data / Parameter	$P_{n,j,x}$
Unit	%
Description	Weight fraction of the waste type j in the sample n collected during the year x
Source of data	Sample measurements by Rio authorities (Caracterização gravimétrica e microbiológica dos resíduos sólidos domiciliares – 2009) also found online at http://comlurb.rio.rj.gov.br/download/caracteriza%C3%A7%C3%A3o%202009.pdf
Value(s) applied	See section D.6.3 for the values applied
Choice of data or Measurement methods and procedures	Based on waste characterization by Rio authorities, since CTR Santa Rosa will be receiving only MSW from households from Rio
Purpose of data	Used for ex ante estimation of the amount of methane generated.
Additional comment	

Data / Parameter	η_{ugf}
Unit	-
Description	Nameplate efficiency of the upgrading facility

Source of data	Provided by the manufacturer
Value(s) applied	To be defined for each CPA
Choice of data or Measurement methods and procedures	As per the manufacturer guidelines
Purpose of data	Used to estimate the ex-ante estimate of upgraded biogas, as a product of plant efficiency and estimated amount of vented or flared gas.
Additional comment	

Data / Parameter	TDL_y
Unit	%
Description	Average technical transmission and distribution losses in the grid in year y for the voltage level at which electricity is obtained from the grid at the project site.
Source of data	Default value according to the “ <i>Tool to calculate baseline, project and/or leakage emissions from electricity consumption</i> ” version 01
Value(s) applied	20%
Choice of data or Measurement methods and procedures	As per the tool, under scenario A (electricity consumption from the grid) and scenario C (Electricity consumption from the grid and (a) fossil fuel fired captive power plant(s)) , cases C.I and C.III : second option, case (a): “project or leakage electricity consumption sources;” To be applied annually
Purpose of data	Required to calculate project emissions from electricity consumption
Additional comment	

D.6.3. Ex-ante calculation of emission reductions

>>

Below are the ex-ante calculations, as explained in section D.6.1 above, for this CPA.

Baseline emissions

Baseline emissions are calculated with the following equation:

$$BE_y = (MD_{project,y} - MD_{BL,y}) * GWP_{CH4} + EL_{LFG,y} \cdot CEF_{elec,BL,y} + ET_{LFG,y} * CEF_{ther,BL,y} \tag{1}$$

Where:

- BE_y = Baseline emissions in year y (tCO₂e)
- $MD_{project,y}$ = The amount of methane that would have been destroyed/combusted during the year, in tonnes of methane (tCH₄) in project scenario
- $MD_{BL,y}$ = The amount of methane that would have been destroyed/combusted during the year in the absence of the project due to regulatory and/or contractual requirement, in tonnes of methane (tCH₄)
- GWP_{CH4} = Global Warming Potential value for methane for the first commitment period is 21 tCO₂e/tCH₄
- $EL_{LFG,y}$ = Net quantity of electricity produced using LFG, which in the absence of the project activity would have been produced by power plants connected to the grid or by an on-site/off-site fossil fuel based captive power generation, during year y, in megawatt hours (MWh)

- $CEF_{elec,BL,y}$ = CO₂ emissions intensity of the baseline source of electricity displaced, in tCO₂e/MWh This is estimated as explained in the PoA-DD and Appendix 4 of this CPA-DD
- $ET_{LFG,y}$ = The quantity of thermal energy produced utilizing the landfill gas, which in the absence of the project activity would have been produced from onsite/offsite fossil fuel fired boiler/air heater, during the year y in TJ
- $CEF_{ther,BL,y}$ = CO₂ emissions intensity of the fuel used by boiler/air heater to generate thermal energy which is displaced by LFG based thermal energy generation, in tCO₂e/TJ.

The methane that would be destroyed in the baseline is calculated as follows.

$$MD_{BL,y} = MD_{project,y} * AF \quad (2)$$

- *Guidance on estimating the Adjustment Factor, AF:*

ACM0001 provides the guidance on how to estimate AF. AF should be considered in cases where a specific system for collection and destruction of methane is mandated by regulatory or contractual requirements or is undertaken for other reasons, the ratio of the destruction efficiency of the baseline system to the destruction efficiency of the system used in the CPA shall be used. Since the Brazilian legislation establishes that each state is responsible for the environmental license process for landfills, each state then defines the laws, minimum standards, technologies, restrictions and environmental requirements for the landfills. For the case of the CTR Santa Rosa landfill site, which is located in the state of Rio de Janeiro, the environmental agency of the state does not require the landfill to install any landfill gas collection and flare system, including passive flaring. This is the common practice in the state of Rio de Janeiro.

As a result the term AF is equal to zero, and hence $MD_{BL,y}$ is equal to zero. Therefore equation (1) is reduced to:

$$BE_y = MD_{project,y} * GWP_{CH_4} + EL_{LFG,y} \cdot CEF_{elec,BL,y} \quad (3)$$

Ex-Ante Baseline emissions

Ex-ante methane emissions that are generated in the landfill ($MD_{project,y}$) are calculated following methodology ACM0001, and based on parameter $BE_{CH_4,SWDS,y}$ calculated as per the approved “*Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site*” where the following guidance from the methodology should be taken into account:

- In the tool, x will refer to the year since the landfill started receiving wastes [x runs from the first year of landfill operation ($x=1$) to the year for which emissions are calculated ($x=y$)];
- Sampling to determine the different waste types is not necessary. The waste composition can be obtained from previous studies.
- The efficiency of the degassing system which will be installed in the project activity should be taken into account while estimating the *ex ante* estimation.

These will be calculated considering the following equation

$$MD_{project,y} = \frac{BE_{CH_4,SWDS,y}}{GWP_{CH_4}} \quad (4)$$

where:

$$BE_{CH_4,SWDS,y} = \varphi \cdot (1-f) \cdot GWP_{CH_4} \cdot (1-OX) \cdot \frac{16}{12} \cdot F \cdot DOC_f \cdot MCF \cdot \sum_{x=1}^y \sum_j W_{j,x} \cdot DOC_j \cdot e^{-k_j \cdot (y-x)} \cdot (1 - e^{-k_j}) \quad (5)$$

Where:

$BE_{CH_4,SWDS,y}$	=	Methane emissions generated during the year y from disposal at the solid waste disposal site (SWDS) during the period from the start of the project activity to the end of the year y (tCO ₂ e)
ϕ	=	Model correction factor to account for model uncertainties (0.9)
f	=	Fraction of methane captured at the SWDS and flared, combusted or used in another manner
GWP_{CH_4}	=	Global Warming Potential (GWP) of methane, valid for the relevant commitment period (21)
OX	=	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)
F	=	Fraction of methane in the SWDS gas (volume fraction) (0.5)
DOC_f	=	Fraction of degradable organic carbon (DOC) that can decompose
MCF	=	Methane correction factor
$W_{j,x}$	=	Amount of organic waste type j prevented from disposal in the SWDS in the year x (tonnes)
DOC_j	=	Fraction of degradable organic carbon (by weight) in the waste type j
k_j	=	Decay rate for the waste type j
j	=	Waste type category (index)
x	=	Year during the crediting period: x runs from the first year of the crediting period (x = 1) to the year y for which avoided emissions are calculated (x = y)
y	=	Year for which methane emissions are calculated

The project implementer for CPA-1 CTR Santa Rosa, foresees that the project will be undertaken in three phases; the first one will encompass the installation of the LFG collection system and flare. The second phase will be one where the energy generation system is put in place, and the third one will be the implementation of the gas treatment plant which will upgrade landfill gas to be distributed via a natural gas distribution network.

The estimated amount of waste to be received is based on the technical details of the concession of the site²⁷ and the waste collection data available for the municipalities that will deposit MSW to CTR Santa Rosa, increased yearly by the coefficient of population vegetative growth²⁸. The characterization of the municipal solid waste is based on the waste characterization done by the prefecture of the city of Rio²⁹.

²⁷ Annex A of the Concession bidding documents, items 20.1 e 20.2.

²⁸ Ibid.

²⁹ Waste characterization by Rio Municipality, (Caracterização gravimétrica e microbiológica dos resíduos sólidos domiciliares – 2009) also found online at <http://comlurb.rio.rj.gov.br/download/caracteriza%C3%A7%C3%A3o%202009.pdf>

Table 4 Waste composition data used in the ex ante estimation of emissions reductions for this CPA

Waste type	(%) wet basis	Classification as per theTool
Paper/Paperboard	16.08%	Pulp, paper and cardboard
Plastics	20.31%	Glass, plastic, metal, other inert
Glass	2.84%	Glass, plastic, metal, other inert
Organic Matter	53.63%	Food, food waste, beverages and tobacco
Metal	1.74%	Glass, plastic, metal, other inert
Other Inert	1.09%	Glass, plastic, metal, other inert
Leaf	1.26%	Garden, yard and park waste
Wood	0.34%	Wood and wood products
Rubber	0.23%	Wood and wood products
Textiles	1.75%	Textiles
Leather	0.18%	Wood and wood products
Bone	0.01%	Wood and wood products
Coconut	0.40%	Wood and wood products
Paraffin	0.01%	Food, food waste, beverages and tobacco
Electronics	0.13%	Electrical and Electronics

Ex-Post Baseline emissions

$MD_{project,y}$ will be determined *ex post* by metering the actual quantity of methane captured and destroyed once the project activity is operational.

The methane destroyed by the project activity ($MD_{project,y}$) during a year is determined by monitoring the quantity of methane actually flared and gas used to generate electricity and/or supply to end users via natural gas distribution grid, when applicable, and the total quantity of methane captured.

The sum of the quantities fed to the flare(s), to the power plant(s), and to the natural gas distribution grid (estimated using equation 3) must be compared annually with the total quantity of methane generated. The lowest value of the two must be adopted as $MD_{project,y}$.

The following procedure applies when the total quantity of methane generated is the highest. The working hours of the energy plant(s) should be monitored and no emission reduction could be claimed for methane destruction in the energy plant during non-operational hours. As per the methodology we have that:

$$MD_{project,y} = MD_{flared,y} + MD_{electricity,y} + MD_{thermal,y} + MD_{PL,y} \quad (6)$$

Where:

- $MD_{flared,y}$ = Quantity of methane destroyed by flaring (tCH₄)
- $MD_{electricity,y}$ = Quantity of methane destroyed by generation of electricity (tCH₄)
- $MD_{thermal,y}$ = Quantity of methane destroyed for the generation of thermal energy (tCH₄)
- $MD_{PL,y}$ = Quantity of methane sent to the pipeline for feeding to the natural gas distribution network (tCH₄)

Right hand side of equation (6) is the sum over all the points of captured methane use in case the methane is flared in more than one flare, and/or used in more than one energy generation source. The supply to each point of methane destruction, through flaring or use for energy generation, shall be measured separately. Since there is no thermal energy generation contemplated in this CPA, the third term, $MD_{thermal,y}$ is assumed as zero. As for the first term, we have that:

$$MD_{\text{flared},y} = \{LFG_{\text{flare},y} * w_{\text{CH}_4,y} * D_{\text{CH}_4}\} - (PE_{\text{flare},y} / GWP_{\text{CH}_4}) \quad (7)$$

Where:

- $LFG_{\text{flare},y}$ = Quantity of landfill gas fed to the flare(s) during the year measured in cubic meters (m^3)
- $w_{\text{CH}_4,y}$ = Average methane fraction of the landfill gas as measured³⁰ during the year and expressed as a fraction (in $m^3 \text{CH}_4/m^3 \text{LFG}$)
- D_{CH_4} = Methane density expressed in tonnes of methane per cubic meter of methane ($t\text{CH}_4/m^3\text{CH}_4$)³¹
- $PE_{\text{flare},y}$ = Project emissions from flaring of the residual gas stream in year y ($t\text{CO}_2e$) determined following the procedure described in the “*Tool to determine project emissions from flaring gases containing methane*”.

Since this CPA will implement one enclosed flare system, then as per the tool, the temperature in the exhaust gas of the flare will be measured to determine whether the flare is operating or not. The project implementer will monitor the flare efficiency as per the flare type as described below:

(A) Enclosed flare, and use of a default value

For **enclosed flares**, and no continuous monitoring of the flare efficiency, the project implementer may monitor the temperature in the exhaust gas of the flare to determine whether the flare is operating or not, and use the **default value** for the flare efficiency. Hence the flare efficiency in the hour h ($\eta_{\text{flare},h}$) is:

- 0% if the temperature in the exhaust gas of the flare (T_{flare}) is below 500 °C for more than 20 minutes during the hour h .
- 50%, if the temperature in the exhaust gas of the flare (T_{flare}) is above 500 °C for more than 40 minutes during the hour h , but the manufacturer’s specifications on proper operation of the flare are not met at any point in time during the hour h .
- 90%, if the temperature in the exhaust gas of the flare (T_{flare}) is above 500 °C for more than 40 minutes during the hour h and the manufacturer’s specifications on proper operation of the flare are met continuously during the hour h .

(B) Enclosed flare, with continuous monitoring of the flare efficiency

For **enclosed flares**, with **continuous monitoring** of the flare efficiency, the flare efficiency in the hour h ($\eta_{\text{flare},h}$) is:

- 0% if the temperature of the exhaust gas of the flare (T_{flare}) is below 500°C during more than 20 minutes during the hour h .
- determined as per step 6 below in cases where the temperature of the exhaust gas of the flare (T_{flare}) is above 500°C for more than 40 minutes during the hour h :

However, in case of the continuous monitoring system is unavailable for maintenance, or failure, the following methods will be used:

- 0% if the temperature in the exhaust gas of the flare (T_{flare}) is below 500 °C for more than 20 minutes during the hour h .

³⁰ Methane fraction of the landfill gas and LFG flow have to be measured on same basis (either wet or dry). In case the “Tool to determine project emissions from flaring gases containing methane” is used, follow the standard approaches to convert the flow on wet basis to dry basis. For example, refer to the procedures provided in the book “Fundamentals of Classical Thermodynamics”; Gordon J. Van Wylen, Richard E. Sonntag and Claus Borgnakke; 4^o Edition, 1994, John Wiley & Sons, Inc.

³¹ At standard temperature and pressure (0 degree Celsius and 1,013 bar) the density of methane is $0.0007168 \text{ tCH}_4/m^3\text{CH}_4$.

- 50%, if the temperature in the exhaust gas of the flare (T_{flare}) is above 500 °C for more than 40 minutes during the hour h , but the manufacturer’s specifications on proper operation of the flare are not met at any point in time during the hour h .
- 90%, if the temperature in the exhaust gas of the flare (T_{flare}) is above 500 °C for more than 40 minutes during the hour h and the manufacturer’s specifications on proper operation of the flare are met continuously during the hour h .

For the current CPA option B has been selected.

For the second term of equation (6) we have that:

$$MD_{electricity,y} = LFG_{electricity,y} * w_{CH4,y} * D_{CH4} \tag{8}$$

Where:

- $MD_{electricity,y}$ = Quantity of methane destroyed by generation of electricity (tCH₄)
- $LFG_{electricity,y}$ = Quantity of landfill gas fed into electricity generator (m³)

And for the fourth term of equation (6) we have that:

$$MD_{PL,y} = LFG_{PL,y} * w_{CH4,y} * D_{CH4} \tag{9}$$

Where $LFG_{PL,y}$ is the quantity of landfill gas sent to pipeline for feeding to the natural gas distribution grid.

Therefore, following the projects planned implementation schedule, and as per the estimated availability of landfill gas, the ex-ante estimations for baseline emissions are:

Table 5 Yearly amount of methane destroyed by flaring in the project activity

Year	MD flared (tCH4)
01/07/2012-31/12/2012	7,227
2013	17,978
2014	11,742
2015	11,446
2016	15,312
2017	13,215
2018	15,828
01/01/2019-30/06/2019	6,372
Total	99,120

Table 6 Yearly amount of methane used to generate electricity and the amount of electricity generated and displaced from the grid

Year	MD electricity (tCH4)	Electricity displaced from the grid	
		MWh	tCO2e
01/07/2012-31/12/2012	0	0	0
2013		33,960	10,512

CDM-CPA-DD-FORM

2013	5,806	2014	33,960	10,512
2014	5,806	2015	67,920	21,024
2015	11,612	2016	67,920	21,024
2016	11,612	2017	101,880	31,535
2017	17,418	2018	101,880	31,535
2018	17,418	01/01/2019-30/06/2019	67,362	20,851
01/01/2019-30/06/2019	11,517	Total	474,882	146,992
Total	81,189			

Table 7 Amount of methane injected yearly in the natural gas distribution network

Year	MD pl (tCH4)
01/07/2012-31/12/2012	0
2013	0
2014	14,128
2015	14,128
2016	14,128
2017	14,128
2018	14,128
01/01/2019-30/06/2019	7,006
Total	77,646

By adding these, total baseline emissions are:

Table 8 Ex-ante estimation of baseline emissions (adjusted for CO2e) in this CPA

Year	MD project * GWP CH4 (tCO2e)	Grid displacement (tCO2e)	BE,y (tCO2e)
01/07/2012-31/12/2012	151,775	0	151,775
2013	499,463	10,512	509,975
2014	665,197	10,512	675,708
2015	780,919	21,024	801,943
2016	862,100	21,024	883,123
2017	939,997	31,535	971,532
2018	994,871	31,535	1,026,406
01/01/2019-30/06/2019	522,798	20,851	543,649
Total	5,417,121	146,992	5,564,112

Project emissions

According to the methodology, project emissions are determined by the following:

$$PE_y = PE_{EC,y} + PE_{FC,j,y} \quad (10)$$

PE_{EC,y} consists in the consumption of electricity from the grid in the project scenario For CTR Santa Rosa we have that option **A1** has been selected, i.e., the combined margin emission factor will be calculated, using the procedures of the Tool to calculate the emission factor for an electricity system ($EF_{EL,j/k/l,y} = EF_{grid,CM,y}$).

The generic approach has been selected for this project activity:

$$PE_{EC,y} = \sum_j EC_{PJ,j,y} \times EF_{EL,j,y} \times (1 + TDL_{j,y}) \tag{11}$$

Where:

- EC_{PJ,y} Quantity of electricity consumed by the project activity during the year MWh
- EF_{EL,j,y} Brazilian grid emission factor tCO₂/MWh (same as CEF_{elec,BL,y} mentioned above)
- TDL_y Average technical transmission and distribution losses in the grid in year y for the voltage level at which electricity is obtained from the grid at the project site.

For the first term of the above equation, for the ex-ante calculation of project emissions, the most conservative estimate has been made where 100% of all electricity consumed by the project activity has been assumed to come from the national grid.

The second term of equation (11) has been calculated following version 02.2.1 of “Tool to calculate the emission factor for an electricity system”. For complete details please refer to Appendix 4 to this document. The emission factor for the Brazilian electricity grid is 0.3095 tCO₂e/MWh. As per data availability when the project started validation and as per the options outlined in the tool, TDL_y for this CPA is 20%. Therefore the project emissions are:

Table 9 Project emissions due to electricity consumed on site

Year	PE _{EC,y} (tCO ₂)
01/07/2012-31/12/2012	101
2013	201
2014	201
2015	201
2016	201
2017	201
2018	201
01/01/2019-30/06/2019	100
Total	1,406

Project emissions from fossil fuel combustion (PE_{FC,j,y}) are calculated following the latest version of “Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion”. These emissions are calculated as follows:

$$PE_{FC,j,y} = FC_{i,j,y} * COEF_{i,y} \tag{12}$$

Where

- FC_{i,j,y} is the fossil fuel combusted of type i, in the process j, for the year y
- COEF_{i,y} is the CO₂ emission coefficient of the fossil fuel i

Where

COEF_{i,y} is calculated by following option B of the tool:

$$COEF_{i,y} = NCV_{i,y} * EF_{CO2i,y} \tag{13}$$

Where

- NCV_{i,y} Is the weighted average net calorific value of the fuel type i
- EF_{CO2i,y} Is the weighted average CO₂ emission factor of fuel type i

Based on monitored values of similar project, 0.00000206829 m3/year of LPG for the parameter $FC_{i,j,y}$ has been used³². Considering a value for $NCV_{i,y}$ of 0.1059 GJ/m3 and $EF_{CO_2i,y}$ of 0.0656 tCO2/GJ, the project emissions due to fuel consumption are:

Table 10 Project emissions due to fuel consumed on site

Year	PE _{FC,y} (tCO2)
01/07/2012-31/12/2012	0.0000000072
2013	0.0000000144
2014	0.0000000144
2015	0.0000000144
2016	0.0000000144
2017	0.0000000144
2018	0.0000000144
01/01/2019-30/06/2019	0.0000000071
Total	0.000000101

Leakage

No leakage effects need to be accounted under this methodology.

Emission Reductions

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y \tag{14}$$

Where:

- ER_y = Emission reductions in year y (tCO₂e/yr)
- BE_y = Baseline emissions in year y (tCO₂e/yr)
- PE_y = Project emissions in year y (tCO₂/yr)

Table 11 Estimation of Emission Reductions

Year	Estimation of project activity emissions (tonnes of CO2e)	Estimation of baseline emissions (tonnes of CO2e)	Estimation of overall emission reductions (tonnes of CO2e)
01/07/2012-31/12/2012	101	151,775	151,674
2013	201	509,975	509,774
2014	201	675,708	675,508
2015	201	801,943	801,742
2016	201	883,123	882,923
2017	201	971,532	971,331
2018	201	1,026,406	1,026,205
01/01/2019-30/06/2019	100	543,649	543,550

³² Value from Project Developer, based on monitored consumption on similar equipment installed at a project site run by the same project developer: CDM project reference Number 0008, Brazil NovaGerar Landfill Gas to Energy Project, 2008 verified Monitoring Report.

Total (tonnes of CO ₂ e)	1,406	5,564,112	5,562,707
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D.6.4. Summary of the ex-ante estimates of emission reductions

Year	Baseline emissions (t CO ₂ e)	Project emissions (t CO ₂ e)	Leakage (t CO ₂ e)	Emission reductions (t CO ₂ e)
01/07/2012-31/12/2012	151,775	101	-	151,674
2013	509,975	201	-	509,774
2014	675,708	201	-	675,508
2015	801,943	201	-	801,742
2016	883,123	201	-	882,923
2017	971,532	201	-	971,331
2018	1,026,406	201	-	1,026,205
01/01/2019-30/06/2019	543,649	100	-	543,550
Total	5,564,112	1,406	-	5,562,707
Total number of crediting years	7			
Annual average over the crediting period	794,873	201	-	794,672

D.7. Application of the monitoring methodology and description of the monitoring plan

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D.7.1. Data and parameters to be monitored

Data / Parameter	LFG_{total,y}
Unit	Nm ³
Description	Total amount of landfill gas captured at normal temperature and pressure
Source of data	From project implementer, measured on site
Value(s) applied	The average value for the first crediting period has been considered to be 107,211,280 Nm ³ /year.
Measurement methods and procedures	Measured continuously (average value in a time interval not greater than an hour) by flow meter continuously; data to be aggregated monthly and yearly.
Monitoring frequency	Monitored continuously.
QA/QC procedures	Flow meters shall be subject to a regular maintenance and testing regime, based on the manufacturer's recommended schedule and procedures, to ensure accuracy
Purpose of data	Calculation of baseline emissions.

Additional comment	Data will be kept for 2 years after end of crediting period
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Data / Parameter	LFG_{flare,y}
Unit	m ³
Description	Flow of LFG to the flare. Amount of landfill gas flared at normal temperature and pressure
Source of data	Measured on site
Value(s) applied	The average value for the first crediting period has been considered to be 43,899,609 Nm ³ /year.
Measurement methods and procedures	Measured continuously with a flow meter (average value in a time interval not greater than an hour), data to be aggregated monthly and yearly per flare
Monitoring frequency	Monitored continuously.
QA/QC procedures	Flow meters shall be subject to a regular maintenance and testing regime, based on the manufacturer's recommended schedule and procedures, to ensure accuracy
Purpose of data	Calculation of baseline emissions.
Additional comment	LFG _{flare,y} is considered to be equivalent to the variable FV _{RG,h} (volumetric flow rate of the residual gas) as described in the " <i>Tool to determine Project emissions from flaring gases containing methane</i> " used to determine project emissions from flaring. Data will be kept for 2 years after end of crediting period

Parameter to be reported once electricity generation phase is implemented:

Data / Parameter	LFG_{electricity,y}
Unit	m ³
Description	Amount of LFG sent to power plant at Normal Temperature and Pressure
Source of data	Measured on site
Value(s) applied	The average value for the first crediting period has been considered to be 32,361,957 Nm ³ /year
Measurement methods and procedures	Measured with a flow meter and monitored continuously by the Project Developer. The flow meter will be maintained and calibrated regularly in line with the manufacturer's requirements. Data to be aggregated monthly and yearly.
Monitoring frequency	Monitored continuously.
QA/QC procedures	Flow meters will be subject to a regular maintenance and testing regime to ensure accuracy.
Purpose of data	Calculation of baseline emissions.
Additional comment	Data will be kept for 2 years after end of crediting period

Data / Parameter	W_{CH₄,y}
Unit	m ³ CH ₄ /m ³ LFG
Description	Methane fraction in the landfill gas
Source of data	Measured by continuous gas quality analyzer.
Value(s) applied	The average value for the first crediting period has been considered to be 50%.

Measurement methods and procedures	Measured continuously (average value in a time interval not greater than an hour) with a gas analyzer by the Project Implementer; data to be aggregated monthly and yearly
Monitoring frequency	Monitored continuously
QA/QC procedures	The gas analyzer shall be subjected to regular maintenance and calibration, based on the manufacturer's recommended schedule and procedures, to ensure accuracy
Purpose of data	Calculation of baseline emissions.
Additional comment	$W_{CH_4, y}$ is considered to be equivalent to the variable $f_{V_{CH_4, h}}$ (volumetric fraction of the component CH_4 in the landfill gas in the hour h) as described in the "Tool to determine Project emissions from flaring gases containing methane". Data will be kept for 2 years after end of crediting period

Data / Parameter	T
Unit	°C
Description	Temperature of the landfill gas
Source of data	Project implementer
Value(s) applied	N/A
Measurement methods and procedures	Measured continuously to determine the density of methane D_{CH_4} . No separate monitoring is necessary when using flow meters that automatically measure the temperature and pressure, expressing LFG volumes in normalized cubic meters
Monitoring frequency	Monitored continuously
QA/QC procedures	Measuring instruments shall be subject to a regular maintenance and testing regime, based on the manufacturer's recommendations
Purpose of data	Calculation of baseline emissions.
Additional comment	Data will be kept for 2 years after end of crediting period

Data / Parameter	P
Unit	Pa
Description	Pressure of the landfill gas
Source of data	Project implementer
Value(s) applied	N/A
Measurement methods and procedures	Measured continuously to determine the density of methane D_{CH_4} . No separate monitoring is necessary when using flow meters that automatically measure the temperature and pressure, expressing LFG volumes in normalized cubic meters
Monitoring frequency	Monitored continuously.
QA/QC procedures	Measuring instruments shall be subject to a regular maintenance and testing regime, based on the manufacturer's recommendations
Purpose of data	Calculation of baseline emissions.
Additional comment	Data will be kept for 2 years after end of crediting period

Parameter to be reported once electricity generation phase is implemented:

Data / Parameter	EL_{LFG}
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Unit	MWh
Description	Net amount of electricity generated using LFG.
Source of data	Project Implementer
Value(s) applied	The total value for the first crediting period has been considered to be 474,882 MWh.
Measurement methods and procedures	Electricity will be measured continuously using an electricity meter.
Monitoring frequency	Monitored continuously.
QA/QC procedures	Electricity meter will be subject to regular maintenance and testing in accordance with supplier recommendations to ensure accuracy.
Purpose of data	Calculation of baseline emissions.
Additional comment	

Data / Parameter	$EF_{grid, CM, y}$
Unit	tCO ₂ /MWh
Description	Combined Margin CO ₂ emission factor for the project electricity system in year y
Source of data	Calculated using the <i>Tool to calculate the emission factor for an electricity system</i> , based on published data from the Brazilian Ministry of Science and Technology (Brazil DNA)
Value(s) applied	0.3095 tCO ₂ /MWh
Measurement methods and procedures	Calculated as per the “ <i>Tool to calculate the emission factor for an electricity system</i> ” version 02.2.1.
Monitoring frequency	Monitored yearly.
QA/QC procedures	This value will be updated yearly as per the monitored data $EF_{grid, BM, y}$ and $EF_{grid, OM, y}$ using the latest published data from Brazil’s DNA
Purpose of data	Calculation of project emissions.
Additional comment	$EF_{grid, CM, y} = CE_{elect, BL, y} = EF_{EL, j, y}$ This value will be reported within each CPA, and will be monitored ex-post. Data will be kept for two years after end of crediting period

Data / Parameter	$EF_{grid, BM, y}$
Unit	tCO ₂ /MWh
Description	Build margin CO ₂ emission factor for the project electricity system in year y
Source of data	Based on yearly published data from the Brazilian Ministry of Science and Technology (Brazilian DNA)
Value(s) applied	$EF_{grid, BM, y}$ for year 2010 is 0.1404 tCO ₂ /MWh
Measurement methods and procedures	Monitored yearly using published data from the Brazilian Ministry of Science and Technology (Brazil DNA)
Monitoring frequency	Monitored yearly.
QA/QC procedures	This value will be updated and monitored as per the latest published data from Brazil’s DNA.

Purpose of data	Calculation of project emissions.
Additional comment	This value will be reported within each CPA, and will be monitored ex-post. Data will be kept for two years after end of crediting period

Data / Parameter	EF_{grid,OM,y}
Unit	tCO ₂ /MWh
Description	Operating margin CO ₂ emission factor for the project electricity system in year y
Source of data	Based on yearly published data from the Brazilian Ministry of Science and Technology (Brazilian DNA)
Value(s) applied	EF _{grid,OM,y} for year 2010 is 0.4787 tCO ₂ /MWh
Measurement methods and procedures	Monitored yearly using published data from the Brazilian Ministry of Science and Technology (Brazil DNA). The dispatch data analysis is used, option (C) of the “ <i>Tool to calculate the emission factor for an electricity system</i> ”.
Monitoring frequency	Monitored yearly.
QA/QC procedures	This value will be updated and monitored as per the latest published data from Brazil’s DNA.
Purpose of data	Calculation of project emissions.
Additional comment	This value will be reported within each CPA, and will be monitored ex-post. Data will be kept for two years after end of crediting period

Parameter to be reported once electricity generation phase is implemented:

Data / Parameter	Operation of the energy plant
Unit	Hours
Description	Operation of the energy plant(s) in a year y
Source of data	Project participants
Value(s) applied	The energy plant has been considered to be operational 8,000 h/year
Measurement methods and procedures	Data will be recorded annually by the Project Implementer to ensure methane destruction is claimed for methane used in electricity plant when it is operational.
Monitoring frequency	Monitored continuously.
QA/QC procedures	Equipment will be maintained in line with manufacturer’s recommendations
Purpose of data	Calculation of baseline emissions.
Additional comment	Data will be kept for at least two years after the end of the crediting period

Data / Parameter	MG_{PR,y}
Unit	tCH ₄
Description	Amount of methane generated during year y of the project activity
Source of data	Project implementers
Value(s) applied	Estimated using the actual amount of waste disposed in the landfill as per the latest version of the “ <i>Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site</i> ” version 05.1.0

Measurement methods and procedures	Annually
Monitoring frequency	Annually
QA/QC procedures	As per the latest version of the “ <i>Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site</i> ”
Purpose of data	Calculation of baseline emissions.
Additional comment	This will be monitored only by CPAs where a specific system for collection and destruction of methane is mandated by regulatory or contractual requirements or is undertaken for other reasons

Data / Parameter	T_{flare}
Unit	°C
Description	Temperature in the exhaust gas of the flare
Source of data	Project Implementer
Value(s) applied	N/A
Measurement methods and procedures	The temperature in the exhaust gas will be measured continuously with a thermocouple and continuously monitored.
Monitoring frequency	Monitored continuously.
QA/QC procedures	Measuring instruments will be subject to regular maintenance and testing regime, based on the manufacturer’s recommendations
Purpose of data	Calculation of baseline emissions.
Additional comment	Required to determine adequate operation and operating hours of the flare. Data will be kept for at least two years after the end of the crediting period

Data / Parameter	$t_{O_2,h}$
Unit	--
Description	Volumetric fraction of O ₂ in the exhaust gas of the flare in the hour <i>h</i>
Source of data	Project Implementer
Value(s) applied	No value of data has been applied for the calculation since 90% of flare efficiency has been considered for ex-ante calculations of emission reductions.
Measurement methods and procedures	Monitored continuously as per the “ <i>Tool to determine project emissions from flaring gases containing methane</i> ”. EB 28 Annex 13. A gas analyzer will be adopted. The gas analyzer will: 1) sample and analyze the methane, carbon dioxide and oxygen content of LFG, 2) provide continuous monitoring of the parameter and 3) transfer data to monitoring system for storage of the information
Monitoring frequency	Monitored continuously.
QA/QC procedures	Analyzers will be calibrated according to the manufacturer’s recommendation. A zero check and a typical value check will be performed by comparison with a standard certified gas.
Purpose of data	Calculation of baseline emissions.
Additional comment	Monitoring of this parameter is due to continuous monitoring of the flare efficiency. Data will be kept for two years after end of crediting period.

Data / Parameter	$fv_{CH_4,h}$
Unit	--
Description	Volumetric fraction of methane in the residual gas in the hour h
Source of data	Project implementer
Value(s) applied	No value of data has been applied for the calculation since 90% of flare efficiency has been considered for ex-ante calculations of emission reductions.
Measurement methods and procedures	Monitored continuously as per the “ <i>Tool to determine project emissions from flaring gases containing methane</i> ”. EB 28 Annex 13. Ensure that the same basis (dry or wet) is considered for this measurement and the measurement of the volumetric flow rate of the residual gas ($FV_{RG,h}$) when the residual gas temperature exceeds 60 °C
Monitoring frequency	Monitored continuously.
QA/QC procedures	Analyzers will be periodically calibrated according to the manufacturer’s recommendation. A zero check and a typical value check will be performed by comparison with a standard certified gas.
Purpose of data	Calculation of baseline emissions.
Additional comment	$fv_{CH_4,h}$ is considered to be equivalent to the variable $w_{CH_4,y}$ (methane fraction in the landfill gas on a wet basis). Data will be kept for two years after end of crediting period

Data / Parameter	$FV_{RG,h}$
Unit	m ³ /h
Description	Volumetric flow rate of the residual gas in wet basis at normal (NTP) conditions in the hour h
Source of data	Project implementer
Value(s) applied	No value of data has been applied for the calculation since 90% of flare efficiency has been considered for ex-ante calculations of emission reductions.
Measurement methods and procedures	Monitored continuously as per the “ <i>Tool to determine project emissions from flaring gases containing methane</i> ”. EB 28 Annex 13. Ensure that the same basis (dry or wet) is considered for this measurement and the measurement of the volumetric fraction of methane in the residual gas ($fv_{CH_4,h}$) when the residual gas temperature exceeds 60 °C.
Monitoring frequency	Monitored continuously.
QA/QC procedures	Flow meters are to be periodically calibrated according to the manufacturer’s recommendations.
Purpose of data	Calculation of baseline emissions.
Additional comment	$FV_{RG,h}$ is considered the equivalent of the variable LFGflared,y (Amount of landfill gas flared at normal temperature and pressure). Monitoring of this parameter is due to continuous monitoring of the flare efficiency. Data will be kept for two years after end of crediting period

Data / Parameter	$fv_{CH_4,FG,h}$
Unit	Mg/m ³

Description	Concentration of methane in the exhaust gas of the flare in dry basis at normal conditions in the hour h
Source of data	Project implementer
Value(s) applied	No value of data has been applied for the calculation since 90% of flare efficiency has been considered for ex-ante calculations of emission reductions.
Measurement methods and procedures	Monitored as per the " <i>Tool to determine project emissions from flaring gases containing methane</i> ". EB 28 Annex 13. Continuously measured. Values to be averaged hourly or at a shorter time interval.
Monitoring frequency	Monitored continuously
QA/QC procedures	Analysers will be periodically calibrated according to manufacturer's recommendation. Zero check and typical value check will be performed by comparison with a standard gas.
Purpose of data	Calculation of baseline emissions.
Additional comment	Monitoring of this parameter is due to continuous monitoring of the flare efficiency. Data will be kept for two years after end of crediting period

Data / Parameter	$FC_{i,j,y}$
Unit	Mass or volume unit per year (e.g. ton / yr or m ³ / yr)
Description	Quantity of fuel type i combusted in process j during the year y
Source of data	On-site measurements
Value(s) applied	0.00000206829 m ³ /year was used considering monitored data for similar project
Measurement methods and procedures	Data will be monitored monthly and aggregated yearly, and the specific CPA will indicate the equipment used for measurement. As per the the "Tool to calculate project or leakage CO ₂ emissions from fossil fuel combustion" version 02, the following options may be used: <ul style="list-style-type: none"> • Use either mass or volume meters. In cases where fuel is supplied from small daily tanks, rulers can be used to determine mass or volume of the fuel consumed, with the following conditions: The ruler gauge must be part of the daily tank and calibrated at least once a year and have a book of control for recording the measurements (on a daily basis or per shift); • Accessories such as transducers, sonar and piezoelectronic devices are accepted if they are properly calibrated with the ruler gauge and receiving a reasonable maintenance; • In case of daily tanks with pre-heaters for heavy oil, the calibration will be made with the system at typical operational conditions.
Monitoring frequency	Monitored monthly
QA/QC procedures	Equipment will be maintained in line with manufacturer's recommendations, and the consistency of metered fuel consumption quantities will be cross-checked with available purchase invoices from the financial records.
Purpose of data	Required to calculate project emissions from fossil fuel combustion.
Additional comment	Data will be kept for at least two years after the end of the crediting period

Data / Parameter	NCV_{i,y}
Unit	GJ/m ³
Description	Weighted average net calorific value of fuel type <i>i</i> in year <i>y</i>
Source of data	Values from the fuel supplier will be used.
Value(s) applied	0.1059
Measurement methods and procedures	Values provided by the fuel supplier. Undertaken in line with national or international fuel standards. The NCV will be obtained for each fuel delivery, from which weighted average annual values should be calculated.
Monitoring frequency	Monitored at each fuel delivery, from which weighted average annual values should be calculated.
QA/QC procedures	Values will be verified to check that they are within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines. If the values fall below this range collect additional information from the testing laboratory to justify the outcome or conduct additional measurements.
Purpose of data	Required to calculate project emissions from fossil fuel combustion.
Additional comment	Data will be kept for at least two years after the end of the crediting period

Data / Parameter	EF_{CO₂,i,y}
Unit	tCO ₂ /GJ
Description	Weighted average CO ₂ emission factor of fuel type <i>i</i> in year <i>y</i>
Source of data	If available, values provided by fuel supplier, but if not available then IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of chapter 1 of Vol 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value(s) applied	0.0656
Measurement methods and procedures	As per the "Tool to calculate project or leakage CO ₂ emissions from fossil fuel combustion" version 2.
Monitoring frequency	Monitored annually
QA/QC procedures	Will be checked against any future revision of IPCC Guidelines
Purpose of data	Calculation of project emissions.
Additional comment	

Data / Parameter	W_x
Unit	Tons
Description	Total amount of organic waste prevented from disposal in year <i>x</i> (tons)
Source of data	Project Implementers
Value(s) applied	See Appendix 4 for the values applied
Measurement methods and procedures	Amounts of waste being deposited will be monitored continuously, and aggregated annually

Monitoring frequency	Monitored continuously
QA/QC procedures	As per the “ <i>Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site</i> ” Version 0.5.1.0
Purpose of data	This will be monitored only by CPAs where the variable $MG_{PR,y}$ needs to be monitored.
Additional comment	Data will be kept for at least two years after the end of the crediting period

Data / Parameter	Z
Unit	-
Description	Number of samples collected during the year x
Source of data	Sample measurements done by Project Implementers, or obtained from relevant studies applicable to the site.
Value(s) applied	N/A
Measurement methods and procedures	The parameter will be measured by the project participant. Amounts of waste being deposited will be sampled, when needed, to confirm the composition of the waste. As per the “ <i>Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site</i> ” version 05.1.0, this parameter only needs to be monitored for those CPAs where the waste prevented from disposal includes several waste categories j , as categorized in the tables for DOC_j and k_j . The waste composition may also be obtained from studies applicable to the site.
Monitoring frequency	Monitored annually
QA/QC procedures	-
Purpose of data	Calculation of baseline emissions.
Additional comment	Data will be kept for at least two years after the end of the crediting period

Data / Parameter	$EC_{PJ,y}$
Unit	MWh
Description	Quantity of electricity consumed by the project activity during the year y
Source of data	Project Implementer
Value(s) applied	The average value for the first crediting period has been considered to be 540.6 MWh/year
Measurement methods and procedures	Electricity will be measured continuously using an electricity meter. Data will be aggregated at least annually as stated in the “ <i>Tool to calculate Project emissions from electricity consumption</i> ” version 01.
Monitoring frequency	Monitored continuously
QA/QC procedures	Electricity meter will be subject to regular maintenance and testing in accordance with meter supplier recommendations
Purpose of data	Required to calculate project emissions.
Additional comment	Data will be kept for two years after end of crediting period

Parameter to be reported once purification of LFG and distribution through a natural gas pipeline system phase is implemented:

Data / Parameter	$LFG_{PL,y}$
Unit	m^3

Description	Amount of LFG sent to Pipe Line at Normal Temperature and Pressure
Source of data	Project Implementer
Value(s) applied	The average value for the first crediting period has been considered to be 30,949,714Nm ³ /year
Measurement methods and procedures	Data will be measured with a flow meter and monitored continuously by the Project Developer. The flow meter will be maintained and calibrated regularly in line with the manufacturer's requirements. Data to be aggregated monthly and yearly.
Monitoring frequency	Monitored continuously.
QA/QC procedures	Flow meters will be subject to a regular maintenance and testing regime to ensure accuracy.
Purpose of data	Calculation of baseline emissions
Additional comment	Data will be kept for 2 years after end of crediting period

Parameter to be reported once purification of LFG and distribution through a natural gas pipeline system phase is implemented:

Data / Parameter	Operation of the upgrading gas plant
Unit	Hours
Description	Operation of the upgrading plant(s) in a year y
Source of data	Project participants
Value(s) applied	The upgrading gas plant has been considered to be operational 7,884 h/year
Measurement methods and procedures	Data will be recorded annually by the Project Implementer to ensure methane destruction is claimed for methane used in electricity plant when it is operational.
Monitoring frequency	Monitored annually.
QA/QC procedures	Equipment will be maintained in line with manufacturer's recommendations
Purpose of data	To ensure methane destruction is claimed for methane used in electricity plant when it is operational.
Additional comment	Data will be kept for at least two years after the end of the crediting period

Data / Parameter	Other flare operation parameters: T_{flare} and LFG_{flare,y}
Unit	-
Description	The range of operating conditions is defined according to the methodology and the manufacturer's specifications based on the flow of LFG to the flare and the temperature of the exhaust gas.
Source of data	Thermocouple and flow meter measurements
Value(s) applied	NA

Measurement methods and procedures	Data will be continuously measured to ensure that the flare/s operate within the range specified by the methodology and the manufacturer in terms of the temperature of the exhaust gas and the LFG flow rate, as follows: Minimum temperature: 500°C Maximum temperature: 1200°C Minimum flow rate: 500 Nm ³ /h Maximum flow rate: 2500 Nm ³ /h for the first flare 5000 Nm ³ /h for the second flare The thermocouple and the flow meter will also follow the measurement methods and procedures described for T _{flare} and LFG _{flare,y}
Monitoring frequency	Monitored continuously.
QA/QC procedures	As previously defined for T _{flare} and LFG _{flare,y}
Purpose of data	Calculation of baseline emissions.
Additional comment	Only applicable in case of use of a default value

D.7.2. Description of the monitoring plan

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CPA-1 Santa Rosa will develop an operational plan that defines a standard against which the project performance will be measured in terms of its emission reductions and compliance with all standards and criteria under the PoA. Monitoring will be the responsibility of SERB – SANEAMENTO E ENERGIA RENOVÁVEL DO BRASIL S.A./CICLUS Ambiental staff operating the landfill. The monitoring plan has the following purposes:

- Establish and maintain a reliable and accurate monitoring system
- Provide guidance for the participants on the implementation of necessary measurement and record management procedures;
- Provide guidance for properly transmit monitoring reports to Caixa;
- Guidance for meeting or exceeding CDM requirements for verification and certification purposes

The monitoring plan covers:

- 1) Monitoring team members’ duties and routine reminders;
- 2) Monitoring schedules;
- 3) QA/QC procedures;
- 4) Service forms for data reporting;
- 5) Corrective action and maintenance plans;

The monitoring methodology is based on direct measurement of the amount of landfill gas captured and destroyed at the flare platforms, the natural gas pipelines and the electricity generating units to determine the amount of LFG destroyed. The monitoring plan provides for continuous measurement of the quantity of LFG used and quality of LFG flared.

Flow meters and gas analyzers will be recording continuously the amount of LFG destroyed/used in the CPA-1 CTR Santa Rosa. This equipment is very sensitive, so rigid QA/QC procedures for equipment maintenance and calibration will be developed and performed by SERB – SANEAMENTO

E ENERGIA RENOVÁVEL DO BRASIL S.A./CICLUS Ambiental staff³³, who also will ensure that proper monitoring procedures are performed and monitoring information is sent on a regular basis to Caixa.

All landfill facilities will have all monitoring devices on-site.

Devices and Methods for Data Collection:

Electricity consumption: Standard electricity meters will be used for monitoring electric consumption.

Biogas measurements: Flow meters, gas analyzers, thermocouples, and pressure meters will be used to determine the amount of methane that is flared/used at CPA-1 CTR Santa Rosa. Meters shall be subject to regular maintenance, testing and calibration.

Monitored Data:

SERB – SANEAMENTO E ENERGIA RENOVÁVEL DO BRASIL S.A./CICLUS Ambiental staff has operational and data collection obligations to fulfill, in order to maximize the GHG emissions reductions, ensuring that sufficient information is available to calculate ERs in a transparent and verifiable manner, allowing a fast and successful verification of these ERs.

Caixa will take responsibility for the collection of monitored data in CPA-1 CTR Santa Rosa, the emission reduction estimates, producing the monitoring reports and reporting to the DOE. Caixa will also maintain all necessary data to undertake the PoA monitoring plan, such as a list of all projects under review for inclusion in the PoA and the performing data and parameters for each registered CPA.

All data provided by CPA-1 operators will be checked for completeness and quality and placed on a central database owned by Caixa. All data recording of the monitored data will include paper and electronic versions, backup systems and periodic checking for data entry mistakes. All records will be kept for at least 2 years.

SECTION E. Approval and authorization

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The letters of approval from Parties for the project activity were available at the time of submitting the CPA to the DOE for validation.

³³ Regular calibration of the monitoring devices will be undertaken by those responsible for the measurements, as per manufacturer specifications. Archiving of calibration report will be done both in hard copies and in soft copies.

Appendix 1. Contact information of CPA implementer(s) and responsible person(s)/ entity(ies) for completing the CDM-CPA-DD-FORM

CPA implementer and/or responsible person/ entity	<input type="checkbox"/> CPA implementer(s) <input checked="" type="checkbox"/> Responsible person/ entity for completing the CDM-CPA-DD-FORM
Organization	Caixa Econômica Federal
Street/P.O. Box	Setor Bancário Sul Quadra 4 lotes 3/ 4 - 12º Andar
Building	Edifício Matriz
City	Brasília
State/Region	DF
Postcode	70092-900
Country	Brazil
Telephone	+55(61) 3206-9404
Fax	+55(61) 3206-9391
E-mail	gesan@caixa.gov.br,
Website	www.caixa.gov.br
Contact person	Denise Maria Lara de Souza Seabra
Title	Manager
Salutation	Mr
Last name	Ferreira Trindade
Middle name	
First name	Adailton
Department	Gerência Nacional de Produtos de Financiamento, Saneamento e Infraestrutura
Mobile	+55(61)9965.2284
Direct fax	
Direct tel.	
Personal e-mail	

CPA implementer and/or responsible person/ entity	<input checked="" type="checkbox"/> CPA implementer(s) <input checked="" type="checkbox"/> Responsible person/ entity for completing the CDM-CPA-DD-FORM
Organization	SERB – SANEAMENTO E ENERGIA RENOVÁVEL DO BRASIL S.A./CICLUS Ambiental
Street/P.O. Box	Rua Sao Jose, 70; 4º andar; Centro
Building	Sao Jose
City	Rio de Janeiro
State/Region	Rio de Janeiro
Postcode	20010-020
Country	Brazil
Telephone	+55-21-3575-5700
Fax	+55-21-35755724
E-mail	priscila.zidan@ciclusambiental.com.br
Website	www.ciclusambiental.com.br
Contact person	Priscila Zidan
Title	Project Manager
Salutation	Ms

Last name	Zidan
Middle name	
First name	Priscila
Department	
Mobile	+55-21-7229-7055
Direct fax	+55-21-3575-5724
Direct tel.	+55-21-3575-5700
Personal e-mail	

CPA implementer and/or responsible person/ entity	<input type="checkbox"/> CPA implementer(s) <input type="checkbox"/> Responsible person/ entity for completing the CDM-CPA-DD-FORM
Organization	International Bank for Reconstruction and Development acting as the Trustee of the Carbon Partnership Facility
Street/P.O. Box	1818H St
Building	HQ Building
City	Washington, DC
State/Region	District of Columbia
Postcode	20433
Country	USA
Telephone	202-458-1873
Fax	202-522-7432
E-mail	IBRD-carbonfinance@worldbank.org
Website	www.carbonfinance.org
Contact person	Mr. Jose Andreu
Title	
Salutation	Mr.
Last name	Andreu
Middle name	
First name	Jose
Department	Global Climate and Carbon Finance Unit
Mobile	
Direct fax	
Direct tel.	
Personal e-mail	

Appendix 2. Affirmation regarding public funding

There is no public funding involved in this project activity

Appendix 3. Applicability of methodology(ies) and standardized baseline(s)

Please refer to section D.2.

Appendix 4. Further background information on ex ante calculation of emission reductions

BASELINE INFORMATION

Table 12 Baseline determination information

DATA	VALUE	UNIT	SOURCE
Year of opening	2011		
Year of closure	2025		
Waste composition			Waste characterization by Rio Municipality, (Caracterização gravimétrica e microbiológica dos resíduos sólidos domiciliares – 2009) also found online at http://comlurb.rio.rj.gov.br/download/caracteriza%C3%A7%C3%A3o%202009.pdf
Wood and wood products	0.3%	Percentage of total waste	
Pulp, paper and cardboard	16.1%		
Food waste	53.6%		
Textiles	1.9%		
Garden waste	1.3%		
Inert waste	26.8%		
MCF	1.0		IPCC 2006
K (decay rate)			
Wood and wood products	0.035	-	IPCC 2006 For tropical wet climate
Pulp, paper and cardboard	0.07		
Food waste	0.40		
Textiles	0.07		
Garden waste	0.17		
Inert waste	0		
DOCf	0.5		IPCC 2006
DOCj			
Wood and wood products	43	%	IPCC 2006 Wet Waste
Pulp, paper and cardboard	40		
Food waste	15		
Textiles	24		
Garden, Yard and Park Waste	20		
Inert waste	0		

Table 13 Domestic waste to be deposited annually in CTR Santa Rosa.³⁴

Year	Domestic waste load (tons)
2011	1,043,500
2012	3,019,122
2013	3,352,313
2014	3,385,836
2015	3,419,695
2016	3,453,892
2017	3,488,431
2018	3,523,315
2019	3,558,548
2020	3,594,134
2021	3,630,075
2022	3,666,376
2023	3,703,039
2024	3,740,070
2025	3,777,470
2026	3,815,245
2027	3,853,398
2028	3,891,932
2029	3,930,851
2030	3,970,159
2031	4,009,861
2032	4,049,960

Table 14 Mean annual meteorological values for the Rio de Janeiro state: temperature and rainfall.

Month	Mean temperature (Celsius)	Mean precipitation (mm)
Jan	26	114
Feb	27	104
Mar	26	104
Apr	24	137
May	23	86
Jun	22	81
Jul	21	56
Aug	22	51
Sep	22	86
Oct	23	89
Nov	24	97
Dec	25	170
Mean annual	24	1175

³⁴ Source: "Edital de concorrência da Comlurb"

Project emissions due to electricity consumed on site

As per de PoA, project emissions reductions due to electricity displaced from the grid were estimated through the “Tool to calculate the emission factor for an electricity system” – Version 02.2.1. The official data is published by the Brazilian DNA (Inter-ministerial Commission on Climate Change) is used.

Brazilian Grid Emission Factor, $EF_{grid,CM,y}$

According to the “*Tool to calculate the emission factor for an electricity system*” version 02.2.1 the following steps have been followed:

- STEP 1. Identify the relevant electricity systems.
- STEP 2. Choose whether to include off-grid power plants in the project electricity system (optional).
- STEP 3. Select a method to determine the operating margin (OM).
- STEP 4. Calculate the operating margin emission factor according to the selected method.
- STEP 5. Calculate the build margin emission factor.
- STEP 6. Calculate the combined margin (CM) emissions factor.

Step 1: Identify the relevant electricity systems

For determining the electricity emission factors, identify the relevant **project electricity system**. If the DNA of the host country has published a delineation of the project electricity system and connected electricity systems, these delineations should be used.

In the meeting of the April 29, 2008 the Brazilian DNA decided, by the information note (http://www.mct.gov.br/upd_blob/0024/24562.pdf), to use a unique national system (SIN) for entire Brazilian grid. Hence the relevant electricity system is that of the entire Brazilian grid.

Step 2: Choose whether to include off-grid power plants in the project electricity system (optional)

Off-grid power plants have not been included in the project electricity system.

Step 3: Select a method to determine the operating margin (OM)

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods, which are described under Step 4:

- (a) Simple OM; or
- (b) Simple adjusted OM; or
- (c) Dispatch data analysis OM; or
- (d) Average OM.

The official calculation was developed by the Brazilian DNA (Inter-ministerial Commission on Climate Change), using the dispatch data analysis and used by this CPA.

Step 4: Calculate the operating margin emission factor according to the selected method

For both Operating and Build margins, the Brazilian DNA has decided to suppress the informational barrier by making the calculations available on a daily and monthly basis.

For the calculation of the Operation Margin, $EF_{grid,OM,y}$, the dispatch data analysis was used, option (C) of the “*Tool to calculate the emission factor for an electricity system*”. According to the tool we have that:

$$EF_{grid,OM-DD,y} = \frac{\sum_h EG_{PJ,h} \cdot EF_{EL,DD,h}}{EG_{PJ,y}}$$

Where:

- $EF_{grid,OM-DD,y}$ = Dispatch data analysis operating margin CO₂ emission factor in year y (tCO₂/MWh)
- $EG_{PJ,h}$ = Electricity displaced by the project activity in hour h of year y (MWh)
- $EF_{EL,DD,h}$ = CO₂ emission factor for grid power units in the top of the dispatch order in hour h in year y (tCO₂/MWh)
- $EG_{PJ,y}$ = Total electricity displaced by the project activity in year y (MWh)
- h = Hours in year y in which the project activity is displacing grid electricity
- y = Year in which the project activity is displacing grid electricity

The hourly emissions factor is calculated based on the energy efficiency of the power unit and the fuel type used, as follows:

$$EF_{EL,DD,h} = \frac{\sum_n EG_{n,h} \cdot EF_{EL,ny}}{\sum_n EG_{n,h}}$$

Where:

- $EF_{EL,n,y}$ = CO₂ emission factor of power unit n in year y (tCO₂/MWh);
- $EG_{n,h}$ = Net quantity of electricity generated and delivered to the grid by power unit n in hour h (MWh);
- n = Power units in the top of the dispatch.

For the *ex-ante* calculation of the Operation Margin (OM) Emission Factor, the arithmetic average of the OM Emission Factor published by the DNA was used (latest available data at the time the project was submitted for validation). (<http://www.mct.gov.br/index.php/content/view/307492.html>)

OPERATING MARGIN											
Emission Factor (tCO ₂ /MWh) - Monthly											
2010											
January	February	March	April	May	June	July	August	September	October	November	December
0.2111	0.2798	0.2428	0.2379	0.3405	0.4809	0.4347	0.6848	0.7306	0.7320	0.7341	0.6348
										Mean	0.4787

Thus, $EF_{grid,OM-DD,y} = 0.4787$

Step 5: Calculate the build margin (BM) emission factor

For the calculation of the Build Margin, the latest published information by the Brazilian DNA is that for the year 2010; thus we have that:

BUILDING MARGIN	
Emission Factor (tCO ₂ /MWh) - Annual	
2010	
0.1404	

$EF_{grid,BM,y} = 0.1404$

We are using the values divulged for 2010.

Step 6 : Calculate the combined margin emissions factor

The calculation of the combined margin (CM) emission factor ($EF_{grid,CM,y}$) is based on one of the following methods:

- (a) Weighted average CM; or
- (b) Simplified CM.

The weighted average CM method (option A) has been used as the preferred option.

The combined margin (CM) emission factor is thus calculated as the weighted average of the operating margin emission factor and the build margin emission factor and is expressed in tCO₂/MWh.

$$EF_{grid,CM,y} = w_{OM} \cdot EF_{grid,OM,y} + w_{BM} \cdot EF_{grid,BM,y}$$

Where

$EF_{grid,OM,y}$ = Operating margin CO₂ emission factor in year y (tCO₂/MWh)

$EF_{grid,BM,y}$ = Build margin CO₂ emission factor in year y (tCO₂/MWh)

w_{OM} = Weighting for operating margin emission factor (%)

w_{BM} = Weighting for build margin emission factor (%)

In this case, for weighting these two factors, the default value of 50% will be considered for both the operating margin and the build margin emission factors (i.e., $w_{OM} = w_{BM} = 0.5$).

Finally, using the formula for the combined grid emission factor we have that:

$$EF_{grid,CM,y} = 0.5 \times 0.1404 + 0.5 \times 0.4787 = 0.3095 \text{ tCO}_2/\text{MWh}$$

Appendix 5. Further background information on monitoring plan

The relevant monitoring information is provided in section D.7.

Appendix 6. Summary of post registration changes

Corrections in this version (7.5):

- Volumetric flow rate of the residual gas $FV_{RG,h}$, defined as measured in wet basis. This is in line with information from the manufacturer. This correction is also in line with methodology requirements, as the basis for w_{CH4} (and $fV_{CH4,h}$) was already defined in the CPA-DD as wet, and data for both $FV_{RG,h}$ and w_{CH4} should be used in the same basis for the calculations.

Approved Corrections in version 7.2:

- Minor Correction: Reference to one enclosed flare system, instead of one enclosed flare.

Approved Permanent changes from registered monitoring plan in version 7.1:

- In case the continuous monitoring system of the flare efficiency is unavailable, default values as per “Tool to determine project emissions from flaring gases containing methane” will be applied.
- Transference of parameter TDLY (average technical transmission and distribution losses in the grid in year y for the voltage level at which electricity is obtained from the grid at the project site) from the section of monitored parameters to the section of fixed parameters.
- Inclusion of the monitored parameter identified as “Other flare operation parameters” that is intended to comprehend all manufacturer’s specifications for the operation of the flare and the required data and procedures to monitor these specifications.

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Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
04.0	9 March 2015	Revisions to: <ul style="list-style-type: none"> • Include provisions related to statement on erroneous inclusion of a CPA; • Include provisions related to delayed submission of a monitoring plan; • Provisions related to local stakeholder consultation; • Provisions related to the Host Party; • Editorial improvement.
03.0	25 June 2014	Revisions to: <ul style="list-style-type: none"> • Include the Attachment: Instructions for filling out the component project activity design document form for CDM component project activities (these instructions supersede the "Guidelines for completing the component project activity design document form" (Version 01.0)); • Include provisions related to standardized baselines; • Add contact information on a CPA implementer and/or responsible person/ entity for completing the CDM-CPA-DD-FORM in A.13. and Error! Reference source not found.; • Add general instructions on post-registration changes in paragraph 4 and 5 of general instructions and Error! Reference source not found.; • Change the reference number from <i>F-CDM-CPA-DD</i> to <i>CDM-CPA-DD-FORM</i>; • Editorial improvement.
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the component project activity design document form" (EB 66, Annex 16).
01.0	27 July 2007	EB33, Annex42 Initial adoption.

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