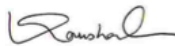




**Validation report form for renewal of crediting period for  
CDM project activities  
(Version 03.0)**

*Complete this form in accordance with the instructions attached at the end of this form.*

**BASIC INFORMATION**

<b>Title and UNFCCC reference number of the project activity</b>	Uberlândia landfills I and II Project reference number 7110
<b>Number and duration of the next crediting period</b>	2 <sup>nd</sup> crediting period – length: 7 years
<b>Version number of the validation report</b>	02
<b>Completion date of the validation report</b>	21/07/2019
<b>Version number of PDD to which this report applies</b>	04
<b>Project participants</b>	Energás Geração de Energia Ltda. (Brazilian Private Entity) Limpebrás Resíduos Ltda. (Brazilian Private Entity) Asja Brasil Serviços para o Meio Ambiente Ltda. (Brazilian Private Entity)
<b>Host Party</b>	Brazil
<b>Applied methodologies and standardized baselines</b>	ACM0001: Flaring or use of landfill gas, version 18.1
<b>Mandatory sectoral scopes</b>	Sectoral Scope: 13 (waste handling and disposal)
<b>Conditional sectoral scopes, if applicable</b>	Sectoral Scope: 1 (Energy industries – renewable / non-renewable sources)
<b>Estimated amount of annual average GHG emission reductions or GHG removals by sinks in the next crediting period</b>	141,878 tCO <sub>2</sub> e
<b>Name and UNFCCC reference number of the DOE</b>	Name: KBS Certification Services Pvt. Ltd. UNFCCC reference number: E-0051
<b>Name, position and signature of the approver of the validation report</b>	  Kaushal Goyal Managing Director

## **SECTION A. Executive summary**

### **Purpose and general description**

The objective of the project activity “Uberlândia landfills I and II in Brazil” is to capture landfill gas (LFG) generated through the decomposition of the organic matter of municipal solid waste disposed at the Uberlândia landfills I and II site and to utilise the LFG for electricity generation.

The Landfill I started operating in July of 1995 and stopped receiving waste in September 2010. During the 15 years of lifetime, Landfill I received around 2,100,000 tonnes of domestic waste.

The Landfill II started operating in October 2010 being able to receive till 4,500,000 m<sup>3</sup> of solid waste for an approximately 18 years of lifetime.

Verified during the site visit the improvement of landfill gas collection and flaring, through the installation of an active recovery system composed by:

- a collection system;
- a transmission pipeline network;
- a gas station, composed by condensate separators, pipe bundle heat exchanger, chiller, blowers and flaring system; and
- a dry filter (moisture and contaminant removal) and a power plant.

As a result, the project results in reductions of CO<sub>2</sub> and CH<sub>4</sub> emissions that are real, measurable and give long - term benefits to the mitigation of climate change.

The total emission reductions from the project are estimated to be on the average 141,878 tCO<sub>2</sub>e per year over the selected 7 year for the 2<sup>nd</sup> crediting period. The emission reduction forecast has been checked, and it is deemed likely that the stated amount is achieved given that the underlying assumptions do not change.

### **Scope of validation**

The purpose of a validation is to have an independent third party assessment of the updated project design document to confirm that the original project baseline is still valid or has been updated taking in account of new data where applicable. In particular, the project's baseline, monitoring plan, and the project's compliance with relevant UNFCCC criteria are validated in order to confirm the correctness of the application of the approved baseline methodologies for the determination of the continued validity of the baseline or its update, and estimation of the emission reductions for the applicable crediting period.

The validation scope is defined as an independent and objective review of the updated project design document (PDD). The updated PDD is reviewed against Kyoto Protocol requirements, UNFCCC rules and the relevant decisions by the CDM Executive Board, including the approved baseline and monitoring methodology ACM0001 (18.1).

### **Validation process**

This report summarizes the findings from the validation of the updated PDD of the project, performed on the basis of UNFCCC criteria for CDM, as well as criteria given by the CDM Validation and Verification Standard for project activities, CDM Project Cycle Procedure for project activities and CDM Project Standard for project activities and included an assessment of: (a) The impact of new relevant national and/or sectoral policies and circumstances on the baseline taking into account relevant guidance from the Board with regard to renewal of the crediting period at the time of requesting renewal of crediting period; (b) The correctness of the application of an approved baseline methodology for the determination of the continued validity of the baseline or its update, and the estimation of emission reductions from the applicable crediting period. This validation opinion is also to be seen in conjunction with the validation report at the time of requesting registration for the first crediting period. The Validation Opinion is not meant to provide any consultancy towards the project participants. However, stated requests for clarifications and/or corrective actions may have provided input for improvement of the project design.

### **Conclusion**

Asja has commissioned KBS Certification Services Pvt. Ltd. to perform the validation for renewal of the crediting period of the registered project activity “Uberlândia landfills I and II” in Brazil (hereafter called “the project”). In conclusion, it is KBS's opinion that the project meets all the relevant requirements for the renewal of the crediting period.

**SECTION B. Validation team, technical reviewer and approver****B.1. Validation team member**

No.	Role	Type of resource	Last name	First name	Affiliation (e.g. name of central or other office of DOE or outsourced entity)	Involvement in			
						Desk/document review	On-site inspection	Interview(s)	Validation findings
1.	Team Leader/ Technical Expert (1.2, 13.1)/ Local Expert		Leiroz	Andrea	Central Office	✓	✓	✓	✓

**B.2. Technical reviewer and approver of the validation report for RCP**

No.	Role	Type of resource	Last name	First name	Affiliation (e.g. name of central or other office of DOE or outsourced entity)
1.	Technical Reviewer (TA 1.2, 13.1)	IR	Badaya	Rohit	Central office
2.	Manager Technical & Certification	IR	Sharma	Chetan Swaroop	Central office
3.	Authorizer	IR	Goyal	Kaushal	Central office

**SECTION C. Means of validation****C.1. Desk/document review**

The report is based on the assessment of the project design document version 01 and subsequent versions 02, 03 and 04 /2/, application of standard auditing techniques including but not limited to desk review, follow up actions (e.g., on site visit, electronic (telephone or e-mail) interviews) and also the review of the applicable approved methodological and relevant tools, guidance and CDM decisions.

All the documents used for arriving validation conclusion are listed in Appendix 03 and referenced accordingly in validation report.

**C.2. On-site inspection**

Duration of on-site inspection: 25/04/2019 to 26/04/2019				
No.	Activity performed on-site	Site location	Date	Team member
1.	<ul style="list-style-type: none"> <li>Technology/ measure employed in the project activity</li> <li>Baseline identification</li> <li>Emission reductions calculations</li> <li>Monitoring plan</li> <li>Applicability of applied version of the methodology</li> </ul>	Uberlândia, Minas Gerais, Brazil	25/04/2019	Andrea Leiroz
2.	<ul style="list-style-type: none"> <li>Local laws and regulations in host country applicable to the project activity.</li> </ul>	Uberlândia, Minas Gerais, Brazil	26/04/2019	Andrea Leiroz

**C.3. Interviews**

No.	Interviewee			Date	Subject	Team member
	Last name	First name	Affiliation			
1.	Uchida	Melina	Director, Asja Brasil	25-26/04/2019	<ul style="list-style-type: none"> <li>Project description</li> <li>Baseline</li> <li>Emission reduction calculation</li> <li>Monitoring plan</li> </ul>	Andrea Leiroz
2.	Sprovieri	João	Consultor, Beng	25-26/04/2019	<ul style="list-style-type: none"> <li>Project description</li> <li>Baseline</li> <li>Emission reduction calculation</li> <li>Monitoring plan</li> <li>Applicability of applied version of the methodology</li> </ul>	Andrea Leiroz
3.	Ribeiro	Kennedy	Project manager, Energas	25-26/04/2019	<ul style="list-style-type: none"> <li>Project description</li> <li>Emission reduction calculation</li> <li>Monitoring plan</li> </ul>	Andrea Leiroz
4.	Frazão	Alana	Environmental resources analyst, Energas	25-26/04/2019	<ul style="list-style-type: none"> <li>Monitoring plan</li> <li>Environmental licenses</li> </ul>	Andrea Leiroz

**C.4. Sampling approach**

Not applicable for this project activity.

### C.5. Clarification requests (CLs), corrective action requests (CARs) and forward action requests (FARs) raised

Area of validation findings	No. of CL	No. of CAR	No. of FAR
Compliance with PDD form	-	02	-
Application and selection of methodologies and standardized baselines	-	02	-
Validity of original baseline or its update	-	01	-
Estimated emission reductions or net anthropogenic removals	03	05	-
Validity of monitoring plan	02	05	-
Crediting period	-	-	-
Project participants	-	-	-
Post-registration changes	-	-	-
Others (please specify)	-	-	-
<b>Total</b>	<b>05</b>	<b>15</b>	<b>-</b>

## SECTION D. Validation findings

### D.1. Compliance with PDD form

<b>Means of validation</b>	PDD applies the applicable CDM-PDD-FORM: Project design document form version 11.0 /20/. KBS verified that the renewal crediting period, information transferred to the later valid version of the PDD form is materially the same as that in the registered PDD /1/.
<b>Findings</b>	CAR-01 and CAR-02 were raised and successfully closed. The findings are discussed in Appendix 04 of the validation report.
<b>Conclusion</b>	Validation team confirms that final PDD is completed using the valid version of the applicable CDM-PDD-FORM: Project design document form version 11.0 /20/.

### D.2. Application and selection of methodologies and standardized baselines

<b>Means of validation</b>	<p>The project was originally registered based on version 12.0.0 of ACM0001 – “Flaring or use of landfill gas” /22/. For the renewal of crediting period, the submitted revised CDM-PDD (version 04 dated 19/07/2019) /2/ correctly applies the latest version of the methodology, i.e. version 18.1 – “Flaring or use of landfill gas” /21/. Therefore, the project was validated against ACM0001 version 18.1 /21/ requirements, as described in the following sections.</p> <p><b>Application of selected baseline and monitoring methodology</b></p> <p>The purpose of the project activity is the implementation of a landfill gas collection system to flare and utilize LFG for producing electricity at the Uberlândia landfills I and II. As described in the PDD /2/, the Uberlândia landfill I was implemented in July 1995 and closed in September 2010. Uberlândia landfill II started its operations in October 2010 and has an operational lifetime of 18 years /5/ /12/. During the operation of the landfill there was no other LFG capture and flaring system. KBS confirmed that the project is currently capturing the LFG and sending it to an enclosed flare and for electricity production.</p> <p>The methodology ACM0001 (version 18.1) /21/ is applicable to the project as this project consists of the implementation of a landfill gas collection system to flare and utilize LFG for producing electricity at the Uberlândia landfills I and II. The applied baseline methodology is justified as it has been demonstrated that the project activity ensures that:</p> <ul style="list-style-type: none"> <li>(a) A new LFG capture system was installed in an existing SWDS;</li> <li>(b) An investment was made into an existing LFG capture system to increase the recovery rate or change the use of the captured LFG, provided that: <ul style="list-style-type: none"> <li>(i) The captured LFG was vented or flared and not used prior to the implementation of the project activity; and</li> <li>(ii) In the case of an existing active LFG capture system for which the amount of LFG cannot be collected separately from the project</li> </ul> </li> </ul>
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system after the implementation of the project activity and its efficiency is not impacted on by the project system: historical data on the amount of LFG capture and flared is available.

No investment was made to increase the recovery rate since the project was a Greenfield capture and flaring project.

- (c) Flare the LFG and/or use the captured LFG in any (combination) of the following ways:
- (i) Generating electricity;
  - (ii) Generating heat in a boiler, air heater or kiln (brick firing only) or glass melting furnace; and/or
  - (iii) Supplying the LFG to consumers through a natural gas distribution network;
  - (iv) Supplying compressed/liquefied LFG to consumers using trucks;
  - (v) Supplying the LFG to consumers through a dedicated pipeline;

LFG is flared and used to generate electricity as confirmed during the site visit and follow-up interview. The project activity was confirmed through the contract between Limpebrás Resíduos Ltda and Asja Brasil Serviços para o Meio Ambiente Ltda (contract for the creation of Energás Geração de Energia Ltda where it is clearly described the project activity) /7/ and the Project permit /11/.

- (d) Do not reduce the amount of organic waste that would be recycled in the absence of the project activity.

PP provided a declaration /13/ confirming that there is no recycle center for the organic material in the landfill. In addition, recycling of organic waste is not part of the operational procedures of the landfill. Thus, the amount of organic waste that would be recycled in the absence of the project activity will not be reduced.

The methodology is only applicable if the application of the procedure to identify the baseline scenario confirms that the most plausible baseline scenario is:

- (a) Atmospheric release of the LFG or capture of LFG and destruction through flaring to comply with regulations or contractual requirements, to address safety and odour concerns, or for other reasons; and
- (b) In the case that the LFG is used in the project activity for generating electricity and/or generating heat in a boiler, air heater, glass melting furnace or kiln:
  - (i) For electricity generation: that electricity would be generated in the grid or in captive fossil fuel fired power plants; and or
  - (ii) For heat generation: that heat would be generated using fossil fuels in equipment located within the project boundary;
- (c) In the case of LFG supplied to the end-user(s) through natural gas distribution network, trucks or the dedicated pipeline, the baseline scenario is assumed to be displacement of natural gas.
- (d) In the case of LFG from a Greenfield SWDS, the identified baseline scenario is atmospheric release of the LFG or capture of LFG in a managed SWDS and destruction through flaring to comply with regulations or contractual requirements, to address safety and odour concerns, or for other reasons.

The baseline scenario is released the LFG to atmosphere from the SWDS, and the electricity would be generated in the grid connected power plants. For more details, please refer to step 1 of Section D.3 where KBS confirmed that the atmospheric release of the LFG is still the current practice for landfills in Brazil. It is not mandatory to flare the landfill gas in Brazil, according to the Brazilian National Policy on Solid Waste /35/, which is the only law that regulates the solid waste management and final destination. There are no policies or regulations in Brazil that require landfill gas capture or destruction other than for technical safety issues /35/. Regarding electricity generation in existing and/or new grid-connected power plants, there are no new rules or legislations in Brazil that go against the previous established baseline i.e. electricity could continue to be generated by the plants feeding the grid.

	<p>The methodology ACM0001 (version 18.1) /21/ is applicable since:</p> <ul style="list-style-type: none"> <li>(a) The proposed project activity does not apply any other CDM approved methodology. ACM0001 is not used to claim emission reductions for the displacement of fossil fuels in a kiln or glass melting furnace, where the purpose of the CDM project activity is to implement energy efficiency measures at a kiln or glass melting furnace /2/;</li> <li>(b) The management of the SWDS in the project activity is not changed to meet a technical or regulatory requirement during the crediting in order to increase methane generation compared to the situation prior to the implementation of the project activity.</li> </ul> <p>The “Tool to calculate the emission factor for an electricity system” version 07.0 /28/ is used since the project will supply electricity to the local grid and will consume electricity from the grid for internal use. The tool “Emissions from solid waste disposal sites” version 08.0 /25/ is used in order to calculate project’s baseline emissions for <i>ex-ante</i> estimations purposes. The actual baseline emissions will be monitored. The “Tool to calculate project or leakage CO<sub>2</sub> emissions from fossil fuel combustion” version 03.0 /24/ will not be used since there will be no consumption of fossil fuel in project case as KBS could verify by reviewing the project permit /11/. The tool “Project emissions from flaring” version 03.0 /27/ is used in order to establish the calculations of the methane destruction efficiency of the enclosed flare and the “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” version 03.0 /29/ is used in order to establish the monitoring procedures and calculations of the methane flows sent to flaring and electricity generation. The “Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation” version 03.0 /26/ is used for calculating project emissions when electricity from the grid is being consumed.</p> <p>The tool “Determining the baseline efficiency of thermal or electric energy generation systems” (Version 02.0) /30/ will not be used since there is no thermal energy or electricity generation units in the baseline scenario. The “Tool to determine the remaining lifetime of equipment” (Version 01) /31/ will not be used since the project activity does not involve the replacement of existing equipment with new equipment or which retrofit existing equipment as part of energy efficiency improvement activities. The tool “Project and leakage emissions from transportation of freight” (Version 01.1.0) /33/ will not be used since the project activity does not involve freight transportation by road.</p> <p>The tool “Combined tool to identify the baseline scenario and demonstrate additionality” (Version 07.0) /23/ will not be used to identify the baseline scenario since the project is renewing the crediting period and thus, the tool “Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period” (Version 03.0.1) /32/ is used in order to assess the continued validity of the baseline and to update the baseline at the renewal of a crediting period, as required by paragraph 49 (a) of the modalities and procedures of the clean development mechanism.</p>
<b>Findings</b>	CAR-03 and CAR-04 were raised and successfully closed. The findings are discussed in Appendix 04 of the validation report.
<b>Conclusion</b>	<p>The compliance of those applicability conditions was confirmed during the site visit. The assessment of the project’s compliance with the applicability criteria of ACM0001 (version 18.1) are documented in detail above.</p> <p>Hence use of the selected methodology is appropriate for this project activity.</p>

### D.3. Validity of original baseline or its update

<b>Means of validation</b>	<p>The following steps from the “Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period” /32/ as per CDM-EB “Validation and Verification Standard for project activities” (version 02.0) /17/ were applied:</p> <p><b>Step 1: Assess the validity of the current baseline for the next crediting period</b></p> <p>The “CDM Project Standard for project activities” /18/ requires assessing the impact of new relevant national and/or sectoral policies and circumstances on the baseline. The validity of the current baseline is assessed using the following Sub-steps:</p>
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**Step 1.1: Assess compliance of the current baseline with relevant mandatory national and/or sectoral policies**

KBS has confirmed that no relevant mandatory national and/or sectoral policies applicable to the project activity came into effect after the submission of the project activity for validation.

For the baseline scenario LFG2: Atmospheric release of the LFG or capture of LFG in a managed SWDS and destruction through flaring to comply with regulations or contractual requirements, to address safety and odour concerns, or for other reasons.

It is not mandatory to flare the landfill gas in Brazil, according to the Brazilian National Policy on Solid Waste /35/, which is the only law that regulates the solid waste management and final destination.

There are no policies or regulations in Brazil that require landfill gas capture or destruction other than for technical safety issues /35/. The environmental permit granted by the environmental agency SEMAD (Minas Gerais State Secretary of Environment and Sustainable Development) /8/ to the landfill does not mention landfill gas capture and/or destruction among the mandatory applicability conditions.

For the baseline scenario E3: Electricity generation in existing and/or new grid-connected power plants. There are no new rules or legislations in Brazil that go against the previous established baseline i.e. electricity could continue to be generated by the plants feeding the grid.

The electricity generation through renewable sources by independent producers is regulated by the National Electric Agency (ANEEL) and hence, the alternative is in compliance with the national laws on energy production with LFG. This has been verified by KBS with the authorization for electricity generation issued by ANEEL to Energias Geração de Energia Ltda. /16/.

The project participant has stated in PDD that there was no use of any fossil fuel before implementation of the project activity and the electricity is provided by the national grid. KBS was able to verify the validity of this information through the registered PDD /1/ and validation report /4/.

For the second crediting period, the project complies with national requirements: The National Electric System Operator (ONS from the Portuguese Operador Nacional do Sistema Elétrico) /42/; The Electricity Regulatory Agency ("ANEEL" from the Portuguese Agência Nacional de Energia Elétrica) /45/; The Mines and Energy Ministry ("MME" from the Portuguese Ministério de Minas e Energia) /43/; The Chamber of Electrical Energy Commercialization ("CCEE" from the Portuguese Câmara de Comercialização de Energia Elétrica) /44/.

Thus, it is concluded that no relevant national and/or sectoral policies affected the validity of the project activity baseline.

**Step 1.2: Assess the impact of circumstances**

There are no new national/sectoral policies/legislation/circumstances that could affect the baseline scenario during the renewal of the crediting period. KBS confirmed that the atmospheric release of the LFG is still the current practice for landfills in Brazil.

**Step 1.3: Assess whether the continuation of the use of current baseline equipment(s) or an investment is the most likely scenario for the crediting period for which renewal is requested**

The continuation of atmospheric release of the LFG and only destroying a small percentage to address safety and odour concerns is technically possible, since it is a simple management system that requires minor maintenance.

For the electricity generation, in the absence of the project activity, the electricity would be generated by the grid connected power plants.

Thus, this sub-step should not be applied since the baseline scenario identified at the validation of the project activity would be a more financial attractive scenario than the project activity without CDM.

**Step 1.4: Assessment of the validity of the data and parameters**

The following parameters needed to be updated based in ACM0001 version 18.1 /21/ requirements and tools /23/ - /33/:  $OX_{top\_layer}$ ,  $BE_{CH4,SWDS,y}$ , net calorific value of methane at reference conditions, efficiency of the LFG captured system that will be installed in the project activity,  $\phi$ ,  $OX$ ,  $F$ ,  $DOC_{f,default}$ ,  $MCF$ ,  $DOC_j$ ,  $k_j$ ,  $f$ ,  $W_x$ ,  $R_u$ ,  $MM_i$ ,  $SPEC_{flare}$ . These parameters are properly described in the following section D.5.



	<p><b>Conclusion on step 1</b> KBS confirms that the current baseline is still valid as per methodology ACM0001 (version 18.1) /21/ for the second crediting period.</p> <p><b>Step 2: Update the current baseline and the data and parameters</b></p> <p><b>Step 2.1: Update the current baseline</b> The baseline emissions for the second crediting period have been updated, without reassessing the baseline scenario, based on the latest approved version of methodology ACM0001 /21/.</p> <p><b>Step 2.2: Update the data and parameters</b> The parameters described under step 1.4 were properly updated considering the latest versions of ACM0001 /21/ and tools /23/ - /33/.</p>
<b>Findings</b>	CAR-05 was raised and successfully closed. The finding is discussed in Appendix 04 of the validation report.
<b>Conclusion</b>	Validity of the baseline has been correctly assessed and the parameters are updated as per the Methodology Tool "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period" /32/ in the PDD submitted for the renewal of crediting period.

#### D.4. Estimated emission reductions or net anthropogenic removals

<b>Means of validation</b>	<p><b>Algorithms and/or formulae used to determine emission reductions</b> The various algorithm/formulae for calculating baseline and project emissions have been transparently documented in line with the requirements of ACM0001 version 18.1 /21/.</p> <p><u>Baseline emissions:</u> Baseline emissions are estimated as the amount of methane that would have been destroyed/combusted during the year in project scenario (<math>BE_{CH_4,y}</math>) and the net quantity of electricity produced using LFG times <math>CO_2</math> emissions intensity of the baseline source of electricity displaced (<math>BE_{EC,y}</math>). No thermal energy is produced and no LFG is supplied to natural gas network as can be verified during the on-site visit and in the documentation sent for operation license request of the electricity generation /8/ /9/.</p> <p>The methane from the Uberlândia landfills I and II (<math>BE_{CH_4,y}</math>) baseline emissions is given by the formula:</p> $BE_{CH_4,y} = (1 - OX_{top-layer}) * (F_{CH_4,PJ,y} - F_{CH_4,BL,y}) * GWP_{CH_4}$ <p>The fraction of methane that would be oxidized in the top layer of the SWDS in the baseline (<math>OX_{top-layer}</math>) of 0.1 is according to the ACM0001 recommendations /21/.</p> <p>As stated in the PDD /2/, there are no regulatory requirements on LFG capture and flaring. Since a LFG capture system (passive venting wells in order to drain the LFG for safety and odour concerns /4/ /35/) existed at Uberlândia landfills I and II, the amount of methane in the LFG that would be flared in the baseline in year y (<math>F_{CH_4,BL,R,y}</math>) is 1.76% (fraction of LFG that is required to be flared due to a requirement in year y - value adopted for the first crediting period) /37/ of the amount of methane in the LFG which is flared and/or used in the project activity in year y (<math>F_{CH_4,PJ,y}</math>) as resulted in the application of Case 4 in Step A.2 of the methodology ACM0001 version 18.1 /21/.</p> <p>For the <i>ex-ante</i> estimation, the amount of methane in the LFG which is flared and/or used in the project activity in year y (<math>F_{CH_4,PJ,y}</math>) was estimated annually according the "Emissions from solid waste disposal sites" version 08.0 /25/. The <math>BE_{CH_4,SWDS,y}</math> (amount of methane in the LFG that is generated from the SWDS in the baseline scenario in the year y) is calculated as per the Application A of the tool considering the daily amount of waste dumped and future entrances /5/ and the waste composition /6/ and is according to the tool "Emissions from solid waste disposal sites" version 08.0 /25/. The efficiency of the LFG capture system that will be installed in the project activity (<math>\eta_{PJ}</math>) is estimated to be 85% according to a public technical document /37/. KBS has verified the calculation of <math>BE_{CH_4,SWDS,y}</math> and assumptions and evidences are correctly applied.</p> <p>For the <i>ex-post</i> determination, the amount of methane in the LFG which is flared and/or used in the project activity in year y (<math>F_{CH_4,PJ,y}</math>) is determined by monitoring the quantity of methane actually flared and gas used to generate electricity. No thermal energy is produced and no methane is sent to the pipeline for feeding to the natural gas distribution network.</p>
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The amount of methane in the LFG which is destroyed by flaring in year  $y$  ( $F_{CH4,flared,y}$ ) is determined based on quantity of landfill gas sent to the flare ( $F_{CH4,sent\_flare,y}$ ) and the project emissions from flaring of the residual gas stream ( $PE_{flare,y}$ ), calculated according to the "Project emissions from flaring", version 03.0 /27/. The amount of methane in the LFG which is sent to the flare in year  $y$  ( $F_{CH4,sent\_flare,y}$ ) is determined using the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream", version 03.0 /29/. As described in the PDD, Option A (volume flow and volumetric fraction measured in dry basis) is selected for the calculation. However, during the project operational monitoring, if not demonstrated that the temperature of the gaseous stream ( $T_t$ ) is less than 60°C (dry basis), then the flow measurement should be assumed to be on a wet basis and the option B should be applied instead. The flare efficiency of the enclosed flare is 90% as per Option A of the "Project emissions from flaring", version 03.0 /27/.

The baseline emissions associated with the electricity generation in year  $y$  ( $BE_{EC,y}$ ) is calculated as per the tool "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" version 03.0 /26/. Project participant choose Scenario A (Electricity consumption from the grid), Option A.1 where the combined margin emission factor of the applicable electricity system is determined using the procedures in the "Tool to calculate the emission factor for an electricity system" version 07.0 /28/.

The net amount of electricity generated using LFG in year  $y$  ( $EC_{BL,k,y}$ ) was calculated according to the total installed power of 2.80 MW and the total generators working hours (8 100 hours). The net quantity of electricity is the total electricity generated and delivered to the grid since the project internal consumption will continue to use electricity from the grid.

The emission factor for electricity generation for source  $k$  in year  $y$  ( $EF_{EL,k,y}$ ) was calculated according to "Tool to calculate the emission factor for an electricity system" /28/. For the *ex-ante* estimation of emissions reduction, the electricity generated is estimated to be 7 911 MWh in the first year up to 23 734 MWh in the six subsequent years and 15 823 MWh in the last year of the second crediting period, according to the spreadsheet /3/. KBS is able to confirm that the most recent information available by the Brazilian DNA (2018) /39/ was used to determine the baseline emission factor of 0.2375 tCO<sub>2e</sub>/MWh since the PDD was submitted on 21 January 2019 for starting the validation.

The dispatch data analysis was the option selected for the calculation of the operating margin (OM). The build margin (BM) emission factor will be determined applying Option 2. However, for the second crediting period, the build margin factor should be calculated *ex-ante* based on the most recent information available at the time of submission of the request for renewal of the crediting period to the DOE. According to the monitoring procedures established by the "Tool to calculate the emission factor for an electricity system" /28/, the emission factor will be determined for the year in which the project displaces the grid electricity. If data to calculate the emission factor is not available, the emission factor from the previous year ( $y-1$ ) may be used. If data available is older than 18 months, than the emission factor to be used will be for year  $y-2$ . Monitoring procedures are correctly applied by the project participant.

Based on 2018 data available at the time of submission of the request for renewal of the crediting period, OM emission factor was estimated to be 0.5390 tCO<sub>2e</sub>/MWh and the BM was determined to be 0.1370 tCO<sub>2e</sub>/MWh /28/ /39/. As a result, the combined margin (CM) emission factor used for estimating purposes of the emission reductions in the PDD is 0.2375 tCO<sub>2e</sub>/MWh, based on 0.25:0.75 weighting between OM and BM emission factor fixed for the second crediting period /28/.

#### Project emissions:

Project emissions are estimated as the sum of emissions from consumption of electricity from the grid due to the project activity in year  $y$  ( $PE_{EC,y}$ ) and emissions from consumption of fossil fuels for purpose other than electricity generation in year  $y$  ( $PE_{FC,y}$ ). Emissions from consumption of electricity ( $PE_{EC,y}$ ) are calculated following the "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" version 03.0 /26/ while emissions from fossil fuel combustion are not considered since the project will not

consume fossil fuel for its operation.

The emissions from electricity consumption are estimated based on the amount of electricity consumed by the project activity  $EC_{PJ,y}$  times the emission factor for electricity generation and transmission and distribution losses. A default value for  $TDL_y$  of 20% is considered as per the "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" version 03.0 /26/. The parameter will be monitored annually according to the same tool. The amount of electricity consumed by the project activity is estimated to be 514 MWh in the first year up to 1,541 MWh in the six subsequent years and 1,027 MWh in the last year of the second crediting period, based on the electricity demand of main components (engines, blower, chillers, leachate pump, air-conditioner of equipment house) and operation offices /14/. KBS has assessed the values and cross checked with the equipment specified in the project LFG system and found to be correct.

No leakage effects need to be accounted under the methodology used.

However, experiences with other landfills have shown that the methane generation and collection efficiency of the landfills projected by the first order decay model has an inherent uncertainty of almost 50% and hence the amount of CERs, which will be monitored *ex-post*, might vary from the projected amount. No other project emission or leakage sources contributing more than 1% and not mentioned by the methodology have been found.

Based on the calculations and results presented in the sections above the implementation of the project activity will result in an average *ex-ante* estimation of emission reduction calculated to be 141,878 tCO<sub>2</sub>e per year for the selected crediting period.

#### Estimation of GHG emissions

Emission reductions are directly monitored and calculated *ex-post*, using the approach indicated in the methodology ACM0001 version 18.1 /21/.

##### Baseline emissions:

As explained above, baseline emissions are estimated as the amount of methane that would have been destroyed/combusted during the year in project scenario ( $BE_{CH_4,y}$ ) and the net quantity of electricity produced using LFG times CO<sub>2</sub> emissions intensity of the baseline source of electricity displaced ( $BE_{EC,y}$ ).

For the *ex-ante* estimation, the amount of methane in the LFG which is flared and/or used in the project activity in year  $y$  ( $F_{CH_4,PJ,y}$ ) is estimated to be:

Year	$F_{CH_4,PJ,y}$ (tCH <sub>4</sub> /yr)
From 09/2019	1.755
2020	5.486
2021	5.717
2022	5.958
2023	6.208
2024	6.468
2025	6.740
Until 09/2026	4.681

The annual estimation results are presented in the spreadsheet /3/. The  $BE_{CH_4,SWDS,y}$  (amount of methane in the LFG that is generated from the SWDS in the baseline scenario in the year  $y$ ) is calculated as:

Year	$BE_{CH_4,SWDS,y}$ (tCO <sub>2</sub> /yr)
From 09/2019	154,847
2020	161,361
2021	168,151
2022	175,222

2023	182,585
2024	190,249
2025	198,225
Until 09/2026	206,527

KBS has verified the calculation of  $BE_{CH_4,SWDS,y}$  and assumptions and evidences are correctly applied /3/.

For the *ex-ante* estimation, the amount of methane in the LFG that would be flared in the baseline in year  $y$  ( $F_{CH_4,BL,y}$ ) is estimated to be:

Year	$F_{CH_4,BL,y}$ (tCH <sub>4</sub> /yr)
From 09/2019	31
2020	97
2021	101
2022	105
2023	109
2024	114
2025	119
Until 09/2026	82

The amount of methane in the LFG which is destroyed by flaring in year  $y$  ( $F_{CH_4,flared,y}$ ) is determined based on quantity of landfill gas sent to the flare ( $F_{CH_4,sent\_flare,y}$ ) and the project emissions from flaring of the residual gas stream ( $PE_{flare,y}$ ), calculated according to the "Project emissions from flaring", version 03.0 /27/. The amount of methane in the LFG which is sent to the flare in year  $y$  ( $F_{CH_4,sent\_flare,y}$ ) is determined using the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" version 03.0 /29/. As described in the PDD, Option A (volume flow and volumetric fraction measured in dry basis) is selected for the calculation. The burning efficiency in the enclosed flare of 90% is considered as per Option A of the "Project emissions from flaring", version 03.0 /27/.

Thus, baseline emissions of methane from the SWDS are estimated as:

Year	$BE_{CH_4,y}$ (tCO <sub>2</sub> /year)
From 09/2019	38,714
2020	121,027
2021	126,120
2022	131,424
2023	136,946
2024	142,694
2025	148,677
Until 09/2026	103,269

For the *ex-ante* estimation, the net amount of electricity generated using LFG in year  $y$  ( $EC_{BL,k,y}$ ) is estimated to be:

Year	Electricity generated in the plant (MWh)
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From 09/2019	7,911
2020	23,734
2021	23,734
2022	23,734
2023	23,734
2024	23,734
2025	23,734
Until 09/2026	15,823

Based on 2018 data available at the time of submission of the request for renewal of the crediting period, OM emission factor was estimated to be 0.5390 tCO<sub>2</sub>e/MWh and the BM was determined to be 0.1370 tCO<sub>2</sub>e/MWh /39/. As a result, the combined margin (CM) emission factor used for estimating purposes of the emission reductions in the PDD is 0.2375 tCO<sub>2</sub>e/MWh.

The baseline emissions associated with electricity generation was estimated as:

Year	BE <sub>EC,y</sub> (tCO <sub>2</sub> /yr)
From 09/2019	2,255
2020	6,765
2021	6,765
2022	6,765
2023	6,765
2024	6,765
2025	6,765
Until 09/2026	4,510

Thus, the total baseline emissions are estimated in:

Year	BE <sub>y</sub> (tCO <sub>2</sub> /yr)
From 09/2019	40,969
2020	127,792
2021	132,884
2022	138,188
2023	143,711
2024	149,459
2025	155,441
Until 09/2026	107,779

Project emissions:

Project emissions are estimated as the sum of emissions from consumption of electricity from the grid due to the project activity in year y (PE<sub>EC,y</sub>) and emissions from consumption of fossil fuels for purpose other than electricity generation in year y (PE<sub>FC,y</sub>).

The emissions from electricity consumption are estimated based on the amount of electricity consumed by the project activity (EC<sub>PJ,i,y</sub>) times the grid emission factor and transmission and distribution losses. A value for EF<sub>EL,i,y</sub> of 0.2375 tCO<sub>2</sub>/MWh and for TD<sub>L,y</sub> of 20% is considered as per the "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" version 03.0 /26/. The amount of electricity consumed by the project activity is estimated to be 514 MWh in the first year up to 1,541 MWh in the six subsequent years and 1,027 MWh in the last year of the second crediting period, based on the

	<p>electricity demand of main components (engines, blower, chillers, leachate pump, air-conditioner of equipment house) and operation offices /14/.</p> <p>There is no consumption of fossil fuels for purpose other than electricity generation in year y, therefore <math>PE_{FC,y} = 0</math>.</p> <p>Thus, the total project emissions are estimated in:</p> <table border="1"> <thead> <tr> <th>Year</th><th><math>PE_y</math> (tCO<sub>2</sub>/yr)</th></tr> </thead> <tbody> <tr> <td>From 09/2019</td><td>147</td></tr> <tr> <td>2020</td><td>440</td></tr> <tr> <td>2021</td><td>440</td></tr> <tr> <td>2022</td><td>440</td></tr> <tr> <td>2023</td><td>440</td></tr> <tr> <td>2024</td><td>440</td></tr> <tr> <td>2025</td><td>440</td></tr> <tr> <td>Until 09/2026</td><td>293</td></tr> </tbody> </table> <p>The project activity is estimated to result in 141,878 tCO<sub>2</sub>e tCO<sub>2</sub>e per year of emission reductions annually throughout the 7 year renewable crediting period.</p>	Year	$PE_y$ (tCO <sub>2</sub> /yr)	From 09/2019	147	2020	440	2021	440	2022	440	2023	440	2024	440	2025	440	Until 09/2026	293
Year	$PE_y$ (tCO <sub>2</sub> /yr)																		
From 09/2019	147																		
2020	440																		
2021	440																		
2022	440																		
2023	440																		
2024	440																		
2025	440																		
Until 09/2026	293																		
<b>Findings</b>	CL-01, CL-02, CL-03, CAR-06, CAR-07, CAR-08, CAR-09 and CAR-10 were raised and successfully closed. The finding is discussed in Appendix 04 of the validation report.																		
<b>Conclusion</b>	<p>The assessment team confirms that:</p> <ul style="list-style-type: none"> <li>• All assumptions and data used by the project participants are listed in the PDD and/or supporting documents, including their references and sources;</li> <li>• All documentation used by the project participants as the basis for assumptions and source of data is correctly quoted and interpreted in the PDD;</li> <li>• All values used in the PDD are considered reasonable in the context of the proposed CDM project activity;</li> <li>• The baseline methodology has been applied correctly to calculate project emissions, baseline emissions, leakage and emission reductions;</li> <li>• All estimates of the baseline, project and leakage emissions can be replicated using the data and parameter values provided in the PDD.</li> </ul>																		

#### D.5. Validity of monitoring plan

<b>Means of validation</b>	<p>The project applies the approved monitoring methodology ACM0001 (version 18.1) –Flaring or use of landfill gas /21/.</p> <p>The original monitoring plan was updated based on ACM0001 (version 18.1) /21/ latest requirements.</p> <p>The project monitoring plan is in compliance with the monitoring methodology ACM0001 (version 18.1) /21/.</p> <p>Parameters determined ex-ante</p> <p>The following parameters are made available <i>ex-ante</i>:</p> <p>According to ACM0001 version 18.1 /21/:</p> <ul style="list-style-type: none"> <li>- The fraction of methane that would be oxidized in the top layer of the SWDS in the baseline (<math>OX_{top\_layer}</math>) of 0.1 is according to the ACM0001 /21/;</li> <li>- The <math>GWP_{CH_4}</math> (global warming potential - GWP) of 25 for the methane gas is correctly applied according to IPCC2006 values /34/ /38/;</li> <li>- The efficiency of the LFG captured system that will be installed in the project activity of 85% is correctly applied according to ACM0001 version 18.1 /21/.</li> </ul> <p>According “Emissions from solid waste disposal sites” version 08.0 /25/:</p> <ul style="list-style-type: none"> <li>- The <math>\phi</math> (model correction factor to account for model uncertainties), the value correctly applied 0.75 for the SWDS located in humidity/wet climate</li> </ul>
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according mean annual temperature (22.8°C) and mean annual precipitation (1,283 mm). The mean annual temperature and precipitation are extracted from the Integrated Agrometeorological Information Center (CIIAGRO) web site based on long-term averages from 26 years data /36/. Value chosen is according to the “Emissions from solid waste disposal sites” version 08.0 /25/ and was confirmed by KBS;

- OX (oxidation factor), value correctly applied 0.1 for solid waste disposal sites that are covered with oxidizing material such as soil or other material, KBS has verified during the site visit that it is covered with soil;
- F (fraction of methane in the SWDS gas), the value correctly applied 0.5 according to “Emissions from solid waste disposal sites” version 08.0 /25/;
- $DOC_{f,default}$  (fraction of degradable organic carbon (DOC) that can decompose), the value correctly applied 0.5 according to the “Emissions from solid waste disposal sites” version 08.0 /25/;
- $MCF_{default}$  (methane correction factor), value correctly applied 1.0 is used for anaerobic managed solid waste disposal sites that have controlled placement of waste as verified by KBS during the site visit;
- $DOC_j$  (fraction of degradable organic carbon (by weight) in the waste type  $j$ ), values correctly applied for wet waste according to the “Emissions from solid waste disposal sites” version 08.0 /25/. The values applied are:

Waste type $j$	$DOC_j$ (% wet waste)
Wood and wood products	43
Pulp, paper and cardboard	40
Food, food waste, beverages and tobacco	15
Textiles	24
Garden, yard and park waste	20
Glass, plastic, metal, other inert waste	0

- $k_j$  (decay rate for the waste type  $j$ ): values applied according mean annual temperature (22.8°C) and mean annual precipitation (1,283 mm) – wet climate. Climate data was confirmed by KBS /36/. The values used are:

Waste type $j$	$k_j$
Slowly degrading	Pulp, paper, cardboard (other than sludge), textiles
	0.07
	Wood, wood products and straw
	0.035
Moderately degrading	Other (non-food) organic putrescible garden and park waste
	0.17
Rapidly degrading	Food, food waste, sewage sludge, beverages and tobacco.
	0.4

- $f$ : Fraction of methane captured at the SWDS and flared, combusted or used in another manner. Value 0 is correctly applied as per recommendations of ACM0001 version 18.1 /21/;
- Waste composition: The fraction of waste type is according to the landfill internal studies provided by the project participant /6/. The values were verified by KBS and are:

Composition of waste	
A) Wood and wood products	0.46%
B) Pulp, paper and cardboard (other than sludge)	6.12%
C) Food, food waste, beverages and tobacco (other than sludge)	50.05%
D) Textiles	3.72%

E) Garden, yard and park waste	13.83%
F) Glass, plastic, metal, other inert waste	25.82%
<b>TOTAL</b>	<b>100.00%</b>

According to the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" version 03.0 /29/:

- $R_u$ : The universal ideal gases constant used is 8,314 Pa.m<sup>3</sup>/kmol.K is according to the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" /29/;
- $MM_i$ : The molecular mass of greenhouse gas methane is 16.04 kg/kmol is according to the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" /29/ application criteria as the methane is the greenhouse gas considered and the remaining gases are pure nitrogen for simplification.
- $MM_k$ : The molecular mass of greenhouse gas nitrogen is 28.01 kg/kmol is according to the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" /29/ application criteria as the methane is the greenhouse gas considered and the remaining gases are pure nitrogen for simplification.
- $MM_{H_2O}$ : The molecular mass of water is 18.0152 kg/kmol is according to the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream" /29/ application criteria as the methane is the greenhouse gas considered and the remaining gases are pure nitrogen for simplification.

According to the "Project emissions from flaring" version 03.0 /27/:

- $SPEC_{flare}$ : The manufacturer's flare specifications for temperature is 1 200°C (maximum), for flow rate is from 2,500 Nm<sup>3</sup>/h (maximum) and for maintenance schedule is 7 days as per internal procedures /40/.

According to the "Tool to calculate the emission factor for an electricity system" version 07.0 /28/:

- $EF_{grid,BM,y}$  (build margin emission factor) the value correctly applied 0.1370 tCO<sub>2</sub>e/MWh based on the most recent information available at Brazilian DNA /39/ at the time of submission of the request for renewal of the crediting period.

Parameters monitored ex-post:

The monitoring plan allows for collection and archiving of the following key parameters related to the determination of emission reductions resulting from the project activity:

According to ACM0001 version 18.1 /21/:

- Management of SWDS will be monitored annually;
- $O_{pj,h}$ : Operation of the equipment that consumes the LFG: Operation of the flare will be measured every minute by flame detector. No value is expected for the purpose of *ex-ante* emission reduction calculations. The calibration is not applicable since it is a device integrated with the operational software at the landfill gas plant;
- $EG_{PJ,y} = EC_{BL,k,y}$ : Amount of electricity generated using LFG by the project activity in year y will be measured continuously by an electricity meter. The electricity meter will be calibrated according to manufacturer's specification. The values applied for the purpose of calculating *ex-ante* emission reduction were verified by KBS and are correct. The electricity generation readings will be double checked by the electricity distribution company.

Following the options and procedures of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream", version 03.0 /29/ and the methodology ACM0001 version 18.1 /21/, project participants had opted for assuming that the



gaseous stream will be methane and the remaining gas is pure nitrogen. In order to check if the assumptions are fulfilled during the monitoring, the temperature of the gas near the flow meter will be continuously measured in order to guarantee that the temperature will be below 60°C. Therefore, the parameters to be monitored, in order to calculate the amount of methane in the LFG which is sent to the flare, are:

- $V_{t,db}$ : Volumetric flow of the gaseous stream in time interval  $t$  on a dry basis ( $m^3/h$ ). The flow will be measured with a mass flow meter capable to convert instantly the gas to normal conditions (temperature of 0°C and pressure of 1 atm). There will be a flow meter installed for each component of the project i.e., for each flare line and each electricity generators line. The flow will be measured continuously and data will be hourly aggregated. The flow meter's will be calibrated according to manufacturer's recommendations. No values are expected for *ex-ante* estimation of the emission reduction since the parameter is not used for *ex-ante* calculations;
- $V_{t,wb}$ : Volumetric flow of the gaseous stream in time interval  $t$  on a wet basis ( $m^3/h$ ). The flow will be measured with a mass flow meter capable to convert instantly the gas to normal conditions (temperature of 0°C and pressure of 1 atm). There will be a flow meter installed for each component of the project i.e., for each flare line and each electricity generators line. The flow will be measured continuously and data will be hourly aggregated. The flow meter's will be calibrated according to manufacturer's recommendations. No values are expected for *ex-ante* estimation of the emission reduction since the parameter is not used for *ex-ante* calculations;
- $v_{i,t,db}$ : Volumetric fraction of greenhouse gas  $i$  in a time interval  $t$  in a dry basis the value correctly applied 50% according to the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream", version 03.0 /29/. The methane gas fraction will be measured continuously by an on-site gas analyser /15/ and data will be hourly aggregated. The equipment will be calibrated according to manufacture's recommendations. The calibration involves a zero check with an inert gas (nitrogen) and verification with a bottled standard gas;
- $v_{i,t,wb}$ : Volumetric fraction of greenhouse gas  $i$  in a time interval  $t$  in a wet basis the value correctly applied 50% according to the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream", version 03.0 /29/. The methane gas fraction will be measured continuously by an on-site gas analyser /15/ and data will be hourly aggregated. The equipment will be calibrated according to manufacture's recommendations. The calibration involves a zero check with an inert gas (nitrogen) and verification with a bottled standard gas. No values are expected for *ex-ante* estimation of the emission reduction since the parameter is not used for *ex-ante* calculations;
- $T_i$ : temperature of the gaseous stream in time interval  $t$ . The temperature of the landfill gas will be measured by a thermoresistance in order to guarantee that gas temperature at the point of flow measurement is not above 60°C, as per the conditions to adopt dry basis calculations. KBS was able to verify that the LFG capturing and electricity generation system will only operate when temperature is under 60°C for safety issues of the electricity generators stable conditions. Nonetheless, temperature will be monitored continuously. The equipment will be calibrated according to manufacturer's recommendations.
- $P_i$ : Pressure of the gaseous stream in time interval  $t$ . The pressure of the gaseous stream will not be monitored separately. According to the monitoring plan contained in the PDD, normal conditions will be used. As per the ACM0001 /21/ and "Tool to determine the mass flow of a greenhouse gas in a gaseous stream", version 03.0 /29/, it is not necessary to monitor the parameter separately since the flow meter normalizes instantly the volumetric flow rate of the LFG. Project participant has applied the normal conditions (temperature 0°C and pressure 1 atm) for *ex-ante* estimation of emission reduction purposes, as specified in ACM0001. No values are expected for *ex-ante* estimation of the emission reduction since the parameter is not used for *ex-ante* calculations.
- Status of biogas destruction device: Operational status of biogas

destruction devices. Continuous monitoring and documenting may be undertaken by recording the energy production from methane captured or the operation of the flare by means of a flame detector to demonstrate the actual destruction of methane.

- $P_{H_2O,t,Sat}$ : Saturation pressure of  $H_2O$  at temperature  $T_t$  in time interval  $t$ . This parameter is solely a function of the gaseous stream temperature  $T_t$  and can be found at reference [1] of the "Tool to determine the mass flow of a greenhouse gas in a gaseous stream", version 03.0 /29/ for a total pressure equal to 101,325 Pa.

According to the "Project emissions from flaring", version 03.0 /27/:

- $T_{EG,m}$ : Temperature in the exhaust gas of the enclosed flare in minute  $m$  will be measured once per minute by thermocouple type N, as per the tool recommendations /27/. No value is expected for the purpose of *ex-ante* emission reduction calculations. The thermocouple will be calibrated once a year.
- $Flame_m$ : Flame detection of flare in the minute  $m$  will be measured once per minute by an ultra violet flame detector. No value is expected for the purpose of *ex-ante* emission reduction calculations. The optical flame detector will be calibrated as per manufacturer's specification.
- $Maintenance_y$ : Maintenance events completed in year  $y$  will be measured annually and kept in a maintenance log for two year beyond the life of the flare. No value is expected for the purpose of *ex-ante* emission reduction calculations. The dates should be compared to the maintenance schedule to check that maintenance events were completed within the minimum time between maintenance events specified by the manufacturer.

A 90% value for the flare efficiency is considered for the *ex-ante* estimations of emission reductions as per the tool "Project emissions from flaring", version 03.0 /27/.

According to "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation", version 03.0 /26/:

- $TDL_{j,y}$ : Average technical transmission and distribution losses for providing electricity to source  $j$  in year  $y$ . A default value of 20% is chosen as per the "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" /26/. The parameter will be monitored annually according to the same tool.
- $EG_{EC,y} = EC_{PJ,j,y}$ : Quantity of electricity consumed from the grid by the project activity during the year  $y$  will be measured continuously by an electricity meter. The parameter will be measured by an electricity meter owned by the local grid administration and electricity distribution company. The data will be obtained with the electricity bills with monthly aggregated values. The electricity meter will be calibrated by the local electricity distributor company, according to the local regulations, since the meters are tamper- proof. The equipment maintenance will be of responsibility of the electricity distribution company, since the project participant has no access to manipulate the equipment. The values applied for the purpose of calculating *ex-ante* emission reduction were verified by KBS and are correct.

According to "Tool to calculate the emission factor for an electricity system" version 07.0 /28/:

- $EF_{grid,CM,y}$ : The combined margin emission factor will be determined *ex-post* based on the most recent information available at Brazilian DNA; the detailed calculations of the combined margin emission factor are described in section D.4.
- $EF_{grid,OM,y}$ : The operating margin emission factor will be determined *ex-post* based on the most recent information available at Brazilian DNA; the detailed calculations of the combined margin emission factor are described in section D.4.

	Management system and quality assurance Detailed monitoring procedures, including responsibilities for project management, procedures for QA/QC of monitoring reports and calibration are defined in the PDD. The monitoring plan contains all necessary parameters described in accordance with the monitoring methodology. The monitoring plan, including data management and QA/QC procedures, will give opportunity for real measurements of achieved emission reductions, which can hence be reported <i>ex-post</i> and verified. The application of the monitoring methodology is transparent and KBS considers that the project participants are able to implement the monitoring plan.
<b>Findings</b>	CL-04, CL-05, CAR-11, CAR-12, CAR-13, CAR-14 and CAR-15 were raised and successfully closed. The finding is discussed in Appendix 04 of the validation report.
<b>Conclusion</b>	It is KBS's opinion, that the project participants are able to implement the monitoring plan.

#### D.6. Crediting period

<b>Means of validation</b>	The second crediting period starts on 04/09/2019, in line with the end of the first crediting period.
<b>Findings</b>	N/A
<b>Conclusion</b>	KBS confirmed that the second crediting period of the registered CDM project activity commences on the day immediately after the expiration of the current crediting period.

#### D.7. Project participants

<b>Means of validation</b>	The involved party is Brazil as the host Party. There is no Annex I Party identified yet. The project participants are Energás Geração de Energia Ltda, ASJA Brasil Serviços para o Meio Ambiente Ltda and Limpebrás Resíduos Ltda of Brazil. The Project participants are listed in section A.4 of the PDD and the information is consistent with the contact details in Appendix 1 of the PDD.
<b>Findings</b>	N/A
<b>Conclusion</b>	KBS verified that the project participants included in the updated PDD are consistent with the names of the project participants in the project view page and are the same as 1 <sup>st</sup> crediting period.

#### D.8. Post-registration changes

Type of post-registration changes (PRCs)	Confirmation (Y/N)	Validation report for PRCs	
		Version	Completion date
Temporary deviations from the registered monitoring plan, applied methodologies, standardized baselines or other methodological regulatory documents <sup>1</sup>	N	NA	NA
Corrections	N	NA	NA
Change to the start date of the crediting period	N	NA	NA
Inclusion of a monitoring plan	N	NA	NA
Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other methodological regulatory documents	N	NA	NA
Changes to the project design	N	NA	NA
Changes specific to afforestation and reforestation project activities	NA	NA	NA

### SECTION E. Internal quality control

Following the completion of the assessment process and a recommendation by the assessment team, the validation opinion prepared by Team Leader is independently reviewed by internal Technical Reviewer. TR reviews if all the KBS procedures have been followed and all conclusions are justified in accordance with

<sup>1</sup> Other standards, methodologies, methodological tools and guidelines (to be) applied in accordance with the applied(selected) methodologies are collectively referred to as the other (applied) methodological regulatory documents).

applicable standards, procedures, guidance and CDM decisions. The TR either is qualified for the technical area within the CDM sectoral scope(s) applicable to project activity or is supported by qualified independent technical expert at this stage.

The Technical Reviewer will either accept or reject the recommendation made by the assessment team. The findings can be raised at this stage and PP must resolve them within agreed timeline.

The opinion recommended by Technical Reviewer will be confirmed by Manager Technical & Certification and finally authorized by the Managing Director on behalf of KBS as final validation opinion. The Technical Reviewer and Manager T&C maybe be same person.

## **SECTION F. Validation opinion**

KBS Certification Services Pvt. Ltd. has been contracted by 'Asja Brasil Serviços para o Meio Ambiente Ltda' to perform a validation of the CDM registered project 'Uberlândia landfills I and II (UNFCCC Ref #7110) in Brazil for renewal of crediting period.

The validation was performed in accordance with the UNFCCC criteria for the Clean Development Mechanism, latest version of Validation and Verification Standard for project activities and related Standards/Guidance and host country criteria, as well as criteria given to provide for consistent project operations, monitoring and reporting.

The CDM project activity will result in reductions of greenhouse gas (GHG) emissions that are real, measurable and give long-term benefits to the mitigation of climate change. In our opinion, the project meets all relevant UNFCCC, CDM criteria and all relevant host country criteria.

The review of the project design documentation and the subsequent follow-up interviews have provided validation team with sufficient evidence to determine the validity of the original baseline and/or its update through an assessment. The project design document (dated 19/07/2019) correctly applies large scale methodology ACM0001 version 18.1. It is demonstrated that the project baseline scenario is not changed and also all necessary parameters are updated correctly for the 2<sup>nd</sup> crediting period.

The total emission reductions from the project are estimated to be 993,143 tCO<sub>2</sub>e for the 2<sup>nd</sup> crediting period during 04/09/2019 to 03/09/2026, averaging 141,878 tCO<sub>2</sub>e annually. The emission reduction forecast has been checked and it is deemed likely that the stated amount is achievable given the underlying assumptions do not change.

The monitoring plan provides for the monitoring of the project's emission reductions. The monitoring arrangements described in the monitoring plan are feasible within the project design, and it is validation team's opinion that the project participants are able to implement the monitoring plan.

In summary, it is validation team's opinion that the CDM project activity "Uberlândia landfills I and II" (UNFCCC Ref #7110) in Brazil meets all relevant UNFCCC requirements for the renewal of the crediting period. Hence KBS requests the renewal of the crediting period of the project.

## Appendix 1. Abbreviations

Abbreviations	Full texts
ANEEL	National Electric Agency
BE	Baseline Emissions
BM	Build Margin
CAR	Corrective Action Request
CCEE	The Chamber of Electrical Energy Commercialization
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CH <sub>4</sub>	Methane
CIIAGRO	Integrated Agrometeorological Information Center
CL	Clarification request
CM	Combined Margin
CO <sub>2</sub>	Carbon dioxide
DNA	Designated National Authority
DOE	Designated Operational Entity
EF	Emission Factor
ER	Emission Reduction
FAR	Forward Action Request
GHG	Greenhouse gas(es)
GWP	Global Warming Potential
KBS	KBS Certification Services Pvt. Ltd.
LFG	Landfill Gas
MME	The Mines and Energy Ministry
OM	Operating Margin
ONS	National Electric System Operator
PDD	Project Design Document
PE	Project Emissions
PP	Project Participant
PRC	Post registration change
PS	Project Standard
PCP	Project Cycle Procedure
RCP	Renewal of Crediting period
SEMAD	Minas Gerais State Secretary of Environment and Sustainable Development
SWDS	Solid Waste Disposal Site
QA/QC	Quality Assurance/Quality Control
tCO <sub>2e</sub>	Tonnes of CO <sub>2</sub> equivalents
T&C	Technical & Certification
UNFCCC	United Nations Framework Convention on Climate Change
VVS	Validation & Verification Standard

## Appendix 2. Competence of team members and technical reviewers

Personnel Name:		Andrea Leiroz	
Qualified to work as:			
Team Leader	<input checked="" type="checkbox"/>	Technical Expert	<input checked="" type="checkbox"/>
Validator/Verifier	<input checked="" type="checkbox"/>	Financial Expert	<input type="checkbox"/>

Technical Reviewer	<input type="checkbox"/>	Local Expert (India)	<input checked="" type="checkbox"/>
<b>Area(s) of Technical Expertise</b>			
<b>Sectoral Scope</b>	<b>Technical Area</b>		
Energy industries (renewable/non-renewable sources)	TA 1.1: Thermal energy generation from fossil fuels and biomass including thermal electricity from solar		
	TA 1.2: Energy generation from renewable energy sources		
Waste handling and disposal	TA 13.1. Solid waste and wastewater TA 13.2. Manure		
Approved by (Manager C & T)	Sanjay Kandari		
Approval date:	17/12/2018		

<b>Personnel Name:</b>	Rohit Badaya		
<b>Qualified to work as:</b>			
Team Leader	<input checked="" type="checkbox"/>	Technical Expert	<input checked="" type="checkbox"/>
Validator/Verifier	<input checked="" type="checkbox"/>	Financial Expert	<input checked="" type="checkbox"/>
Technical Reviewer	<input checked="" type="checkbox"/>	Local Expert (India)	<input checked="" type="checkbox"/>
<b>Area(s) of Technical Expertise</b>			
<b>Sectoral Scope</b>	<b>Technical Area</b>		
Energy industries (renewable/non-renewable sources)	TA 1.1: Thermal energy generation from fossil fuels and biomass including thermal electricity from solar		
	TA 1.2: Energy generation from renewable energy sources		
Energy demand	TA 3.1. Energy Demand		
Waste Handling and Disposal	TA 13.1 Solid waste and wastewater TA 13.2 Manure		
Approved By	Manager Competency & Training		
Approval date:	16/10/2017		

### Appendix 3. Documents reviewed or referenced

No.	Author	Title	References to the document	Provider
/1/	Energás Geração de Energia Ltda	CDM-PDD for Project activity "Uberlândia landfills I and II" in Brazil for the first crediting period.	Version 03 of 21/10/2014	UNFCCC Website
/2/	Energás Geração de Energia Ltda	CDM-PDD for Project activity "Uberlândia landfills I and II" in Brazil for the second crediting period.	Version 01 of 21/01/2019 Version 02 of 15/05/2019 Version 03 of 12/06/2019 Version 04 of 19/07/2019	Project participant
/3/	Energás Geração de Energia Ltda	Emission reduction spreadsheet for the project activity "Uberlândia landfills I and II" in Brazil: Uberlandia 2nd CP CER Spreadsheet	Version 1 of 30/11/2018 Version 2 of 15/05/2019 Version 3 of 11/06/2019 Version 4 of	Project participant

			19/07/2019	
/4/	DNV KEMA Energy & Sustainability Accredited Climate Change Services	Validation report for Project activity "Uberlândia landfills I and II" in Brazil for the first crediting period.	Version 01a of 28/08/2012	Other
/5/	Energás Geração de Energia Ltda	Waste quantities in landfills I and II: "Total de resíduos Aterros I e II Resíduos aterrados".	15/05/2019	Project participant
/6/	Limpebrás Resíduos Ltda	Waste composition in landfills I and II: "Gravimetria 2016.pdf".	2016	Project participant
/7/	Energás Geração de Energia Ltda	Contract for the creation of Energás Geração de Energia Ltda – 5ª substitution – "5 ALTERAÇÃO ENERGAS.pdf".	05/02/2019	Project participant
/8/	Minas Gerais State Secretary of Environment and Sustainable Development	Landfill operation and gas capture environmental permit #083/2015.	11/08/2015	Project participant
/9/	Minas Gerais State Secretary of Environment and Sustainable Development	Electricity plant environmental license #899/2018.	08/12/2018	Project participant
/10/	Energás Geração de Energia Ltda	Landfill gas combustion plant – Management Manual.	Version 2 of 29/06/2012	Project participant
/11/	Energás Geração de Energia Ltda	Energy plant environment and operation permit.	19/01/2012	Project participant
/12/	Energás Geração de Energia Ltda	Concession contract for landfill operation and biogas use between the Municipality of Uberlândia and Limpebrás Engenharia Ambiental Ltda.	31/03/2008	Project participant
/13/	Limpebrás Resíduos Ltda	Declaration confirming that there is no recycle center for the organic material in the landfill and that recycling of organic waste is not part of the operational procedures.	30/04/2019	Project participant
/14/	Energás Geração de Energia Ltda	Project electricity consumption. Spreadsheet with consumption for each equipment: QC_ENERGµS_Rev1.xls.	-	Project participant
/15/	Siemens	Gas analyzer model Ultramat 23 – Manual instructions.	09/2008	Project participant
/16/	National Electric Agency (ANEEL)	Authorization for electricity generation to Energás Geração de Energia Ltda. for the first phase of 2.852 MW dated 25 September 2012. Available at: <a href="http://www2.aneel.gov.br/cedoc/ofc2012841scg.pdf">http://www2.aneel.gov.br/cedoc/ofc2012841scg.pdf</a> .	25/09/2012	Other
/17/	CDM Executive Board	Clean Development Mechanism Validation and Verification Standard for project activities.	Version 02.0	Other
/18/	CDM Executive Board	Clean Development Mechanism Project Standard for project activities.	Version 02.0	Other
/19/	CDM Executive Board	Clean Development Mechanism Project Cycle Procedure for project activities.	Version 02.0	Other
/20/	CDM Executive Board	CDM-PDD-FORM: Project design document form.	Version 11.0	Other

/21/	CDM Executive Board	Large-scale Consolidated Methodology ACM0001: Flaring or use of landfill gas.	Version 18.1	Other
/22/	CDM Executive Board	Large-scale Consolidated Methodology ACM0001: Flaring or use of landfill gas.	Version 12.0.0	Other
/23/	CDM Executive Board	TOOL02: Methodological tool: Combined tool to identify the baseline scenario and demonstrate additionality.	Version 07.0	Other
/24/	CDM Executive Board	TOOL03: Methodological tool: Tool to calculate project or leakage CO <sub>2</sub> emissions from fossil fuel combustion.	Version 03.0	Other
/25/	CDM Executive Board	TOOL04: Methodological tool: Emissions from solid waste disposal sites.	Version 08.0	Other
/26/	CDM Executive Board	TOOL05: Methodological tool: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation.	Version 03.0	Other
/27/	CDM Executive Board	TOOL06: Methodological tool: Project emissions from flaring.	Version 03.0	Other
/28/	CDM Executive Board	TOOL07: Methodological tool: Tool to calculate the emission factor for an electricity system.	Version 07.0	Other
/29/	CDM Executive Board	TOOL08: Methodological tool: Tool to determine the mass flow of a greenhouse gas in a gaseous stream.	Version 03.0	Other
/30/	CDM Executive Board	TOOL09: Methodological tool: Determining the baseline efficiency of thermal or electric energy generation systems.	Version 02.0	Other
/31/	CDM Executive Board	TOOL10: Methodological tool: Tool to determine the remaining lifetime of equipment.	Version 01	Other
/32/	CDM Executive Board	TOOL11: Methodological tool: Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period.	Version 03.0.1	Other
/33/	CDM Executive Board	TOOL12: Methodological tool: Project and leakage emissions from transportation of freight.	Version 01.1.0	Other
/34/	CDM Executive Board	Standard for application of the global warming potentials to clean development mechanism project activities and programmes of activities for the second commitment period of the Kyoto protocol.	Version 01.0, EB69, annex 3	Other
/35/	Republic Federative of Brazil	National Policy on Solid Waste. Law #12305. Available at: <a href="http://www.planalto.gov.br/ccivil_03/ato2007-2010/2010/lei/12305.htm">http://www.planalto.gov.br/ccivil_03/ato2007-2010/2010/lei/12305.htm</a> .	02/08/2010	Other
/36/	Integrated Agrometeorological Information Center (CIIAGRO)	Mean annual temperature and precipitation for Uberlândia city. Available at: <a href="http://www.ciiagro.sp.gov.br/ciiagro">http://www.ciiagro.sp.gov.br/ciiagro</a>	-	Project participant



		<a href="http://www.ciiagro.sp.gov.br/ciiagro/online/Quadros/QTmedPeriodo.asp">online/Quadros/QTmedPeriodo.asp</a> <a href="http://www.ciiagro.sp.gov.br/ciiagro/online/Quadros/QChuvaPeriodo.asp">http://www.ciiagro.sp.gov.br/ciiagro/online/Quadros/QChuvaPeriodo.asp</a>		
/37/	Environmental State Agency of São Paulo (Cetesb)	Reducing the uncertainty of methane recovered (R) in greenhouse gas inventories from waste sector and of adjustment factor (AF) in landfill gas projects under the clean development mechanism.	2010	Project participant
/38/	Intergovernmental Panel on Climate Change (IPCC)	Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Available at: <a href="http://www.ipcc.ch">http://www.ipcc.ch</a> .	-	Other
/39/	Interministerial Commission in Global Climate Change (DNA of Brazil)	Carbon Emission Factor for the National Grid. Available at: <a href="https://www.mctic.gov.br/mctic/operacional/ciencia/SEPED/clima/textogeral/emissao_despacho.html">https://www.mctic.gov.br/mctic/operacional/ciencia/SEPED/clima/textogeral/emissao_despacho.html</a> .	-	Other
/40/	Asja	Flare instructions manual: "Manual Flare_ver 01.pdf".	12/2011	Project participant
/41/	United States Environmental Protection Agency - USEPA	A Landfill Gas-to-Energy Project Development Handbook: "Collection efficiency 0.85 & Load Factor 0.95 – USEPA 1996 Handbook EPA-LFG.pdf".	09/1996	Project participant
/42/	National Electric System Operator (ONS)	<a href="http://www.ons.org.br">http://www.ons.org.br</a>	-	Other
/43/	The Mines and Energy Ministry (MME)	<a href="http://www.mme.gov.br">http://www.mme.gov.br</a>	-	Other
/44/	The Chamber of Electrical Energy Commercialization (CCEE)	Operator of Brazilian electric energy market. Available at: <a href="https://www.ccee.org.br/">https://www.ccee.org.br/</a>	-	Other
/45/	Electricity Regulatory Agency (ANEEL)	<a href="http://www.aneel.gov.br">http://www.aneel.gov.br</a>	-	Other

## Appendix 4. Clarification requests, corrective action requests and forward action requests

Table 1. CL from this validation

CL ID	01	Section no.	D.4	Date: 02/05/2019
<b>Description of CL</b>				
PDD – Section B.6.1: In section B.6.1 of the PDD, further clarification should be provided regarding the use of LFG for heat generation in year y.				
<b>Project participant response</b>				Date: 15/05/2019
There is no use of LFG for heat generation, therefore section has been amended accordingly.				
<b>Documentation provided by project participant</b>				
-				
<b>DOE assessment</b>				Date: 15/05/2019

KBS verified that section B.6.1 of the PDD was revised according to project description. Thus, this CL is closed.

<b>CL ID</b>	02	<b>Section no.</b>	D.4	<b>Date:</b> 02/05/2019
<b>Description of CL</b>				
PDD – Section B.6.1: Evidence provided for determining the fraction of LFG that is required to be flared due to a requirement in year y is not valid.				
<b>Project participant response</b>				<b>Date:</b> 15/05/2019
<i>Evidence “Reducing the uncertainty of methane recovered (R) in GHG inventories from waste sector and of adjustment factor (AF) in landfill gas projects under CDM”, pages 165 to 176 have been made available to the DOE during the site visit.</i>				
<b>Documentation provided by project participant</b>				
-				
<b>DOE assessment</b>				<b>Date:</b> 15/05/2019
KBS verified that section B.6.1 of the PDD was revised and the wrong link for the evidence was removed. Thus, this CL is closed.				

<b>CL ID</b>	03	<b>Section no.</b>	D.4	<b>Date:</b> 02/05/2019
<b>Description of CL</b>				
PDD – Section B.6.1: It is not clearly described in the PDD which option of the "Methodological tool: Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" is applied to determine the baseline emissions associated with electricity generation in year y ( $BE_{EC,y}$ ).				
<b>Project participant response</b>				<b>Date:</b> 15/05/2019
<i>Option A chosen and PDD amended accordingly.</i>				
<b>Documentation provided by project participant</b>				
-				
<b>DOE assessment</b>				<b>Date:</b> 15/05/2019
KBS verified that section B.6.1 of the PDD was revised and PP described which option under item 6.2.1.1 of the tool was applied. Thus, this CL is closed.				

<b>CL ID</b>	04	<b>Section no.</b>	D.5	<b>Date:</b> 02/05/2019
<b>Description of CL</b>				
PDD – Section B.6.2: According to “Emissions from solid waste disposal sites” version 08.0: <ul style="list-style-type: none"> <li><math>k_j</math> (decay rate for the waste type j). The value applied is for wet climate however, the PDD does not address how the local climate was defined.</li> </ul>				
<b>Project participant response</b>				<b>Date:</b> 15/05/2019
<i>Local climate data properly defined and included in the PDD.</i>				
<b>Documentation provided by project participant</b>				
-				
<b>DOE assessment</b>				<b>Date:</b> 15/05/2019
KBS verified that section B.6.2 of the PDD was revised and PP described how the local climate was defined. Thus, this CL is closed.				

<b>CL ID</b>	05	<b>Section no.</b>	D.5	<b>Date:</b> 02/05/2019
<b>Description of CL</b>				
PDD – Section B.7.1: According to “Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation” version 03.0: <ul style="list-style-type: none"> <li><math>TDL_y</math> (Average technical transmission and distribution losses for providing electricity to source j in year y). The value applied is based on the most recent data available in Brazil. Further clarification should be provided to explain why a different value from the registered PDD was applied. In addition, the description of the parameter is not properly addressed as per the tool.</li> </ul>				
<b>Project participant response</b>				<b>Date:</b> 15/05/2019
<i>Technical transmission and distribution losses (<math>TDL_{j,y}</math>) value has been assumed to be 20%, according to Option 2: default value from TOOL05 - Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation. CERs spreadsheet and PDD have been amended accordingly.</i>				
<b>Documentation provided by project participant</b>				

-	
<b>DOE assessment</b>	<b>Date:</b> 15/05/2019
KBS verified that section B.7.1 of the PDD was correctly updated. A default value of 20% is chosen for the TDL <sub>y</sub> , as per the “Tool to calculate baseline, project and/or leakage emissions from electricity consumption”. The description of the parameter was revised according to the same tool. Thus, this CL is closed.	

**Table 2. CAR from this validation**

<b>CAR ID</b>	01	<b>Section no.</b>	D.1	<b>Date:</b> 02/05/2019
<b>Description of CAR</b>				
PDD – Front Page, Section B.1 and Appendix 5: Some instructions for fill out the PDD form were not correctly applied as per recommendations of the "Specific instructions" of the Instructions for completing the PDD form version 10.1:				
<ul style="list-style-type: none"> <li>In the front page of the PDD, the title of the sector scope 1 is not as per UNFCCC description.</li> <li>Section B.1 of the PDD does not refer to UNFCCC CDM website for the exact reference of approved methodology, tools and standardized baseline.</li> <li>The numbering sequence of the figures and tables are not correct.</li> <li>In Appendix 5, the PDD refers to an equation numbered in Section B.6.1. However, the equations in the PDD are not numbered.</li> <li>In Appendix 7, the PDD does not provide the history of all post-registration changes to the project activity that have been approved by the Board after its registration.</li> </ul>				
<b>Project participant response</b>				<b>Date:</b> 15/05/2019
<ol style="list-style-type: none"> <li>1. Amended accordingly;</li> <li>2. Amended accordingly;</li> <li>3. Amended accordingly;</li> <li>4. Amended accordingly;</li> <li>5. Included accordingly;</li> </ol>				
<b>Documentation provided by project participant</b>				
-				
<b>DOE assessment</b>				<b>Date:</b> 15/05/2019
KBS verified the revised PDD and found the following:				
<ul style="list-style-type: none"> <li>In the front page of the PDD, the title of the sector scope 1 was correctly updated as per UNFCCC description. This issue is closed.</li> <li>Section B.1 of the PDD refers to UNFCCC CDM website for the exact reference of approved methodology and tools. This issue is closed.</li> <li>The numbering sequence of the figures and tables are now ok. However, in the text of Appendix 5, it was not updated the figures number. CAR is open.</li> <li>In Appendix 5, PP modified the reference to an equation in Section B.6.1. Now it is ok. This issue is closed.</li> <li>In Appendix 7, PP included the history of all post-registration changes to the project activity that have been approved by the Board after its registration. This issue is closed.</li> </ul>				
<b>Project participant response</b>				<b>Date:</b> 12/06/2019
Appendix 5 updated the figures number				
<b>Documentation provided by project participant</b>				
-				
<b>DOE assessment</b>				<b>Date:</b> 12/06/2019
KBS verified that Appendix 5 of the PDD was correctly updated. Thus, this CAR is closed.				
<b>CAR ID</b>	02	<b>Section no.</b>	D.1	<b>Date:</b> 02/05/2019
<b>Description of CAR</b>				
PDD –Section B.3: The project boundary described under Section B.3 of the PDD is not correct considering the description of the project activity provided in Section A.3. In addition, the emission sources described in the table are not in accordance with the applied methodology ACM0001 version 18.1.				
<b>Project participant response</b>				<b>Date:</b> 15/05/2019
Amended accordingly				
<b>Documentation provided by project participant</b>				
-				
<b>DOE assessment</b>				<b>Date:</b> 15/05/2019
KBS verified that section B.3 of the PDD was correctly updated according to ACM0001 and project activity description. Thus, this CAR is closed.				

<b>CAR ID</b>	03	<b>Section no.</b>	D.2	<b>Date:</b> 02/05/2019
<b>Description of CAR</b>				
PDD – Section B.2: The PDD does not assess all the applicability criteria established in the applied methodology ACM0001 version 18.1. PP is requested to justify each applicability criteria of the applied methodology in the PDD and provide evidence in order to confirm each one.				
<b>Project participant response</b>				<b>Date:</b> 15/05/2019
<i>Amended accordingly. Evidences of each criteria have been presented to the DOE during the site visit.</i>				
<b>Documentation provided by project participant</b>				
-				
<b>DOE assessment</b>				<b>Date:</b> 15/05/2019
The PDD does not assess all the applicability criteria established in the applied methodology ACM0001 version 18.1. Some applicability criteria of the applied methodology were not justified in the PDD. CAR is open. Evidences were provided. This issue is closed.				
<b>Project participant response</b>				<b>Date:</b> 12/06/2019
Amended according to ACM0001.				
<b>Documentation provided by project participant</b>				
-				
<b>DOE assessment</b>				<b>Date:</b> 12/06/2019
KBS verified that section B.2 of the PDD was correctly updated according to ACM0001 and all applicability criteria established in the applied methodology were justified. Thus, this CAR is closed.				

<b>CAR ID</b>	04	<b>Section no.</b>	D.2	<b>Date:</b> 02/05/2019
<b>Description of CAR</b>				
PDD – Section B.2: The PDD does not assess all tools established in the applied methodology ACM0001 version 18.1.				
<b>Project participant response</b>				<b>Date:</b> 15/05/2019
<i>Amended accordingly</i>				
<b>Documentation provided by project participant</b>				
-				
<b>DOE assessment</b>				<b>Date:</b> 15/05/2019
KBS verified the revised PDD and confirmed that all tools established in the applied methodology ACM0001 were assessed. However, the methodological tool “Determining the baseline efficiency of thermal or electric energy generation systems was included twice in this section of the PDD. CAR is open.				
<b>Project participant response</b>				<b>Date:</b> 12/06/2019
Removed accordingly				
<b>Documentation provided by project participant</b>				
-				
<b>DOE assessment</b>				<b>Date:</b> 12/06/2019
KBS verified that section B.2 of the PDD was correctly updated. The methodological tool “Determining the baseline efficiency of thermal or electric energy generation systems was no more included twice in this section of the PDD. Thus, this CAR is closed.				

<b>CAR ID</b>	05	<b>Section no.</b>	D.3	<b>Date:</b> 02/05/2019
<b>Description of CAR</b>				
PDD – Section B.4: The updated PDD does not describe the relevant mandatory national and/or sectoral policies applicable to the project activity came into effect after the submission of the project activity for validation and provide evidences in order to confirm that no relevant mandatory national and/or sectoral policies applicable to the project activity came into effect after the submission of the project activity for validation. Evidences should be provided.				
<b>Project participant response</b>				<b>Date:</b> 15/05/2019
<i>Included in Step 1.1: Assess compliance of the current baseline with relevant mandatory national and/or sectorial policies.</i>				
<b>Documentation provided by project participant</b>				
-				

<b>DOE assessment</b>	<b>Date:</b> 15/05/2019
KBS confirmed that updated PDD describe the relevant mandatory national policies applicable to the project activity and PP provided evidences in order to confirm that no relevant mandatory national policies applicable to the project activity came into effect after the submission of the project activity for validation. Thus, this CAR is closed.	

<b>CAR ID</b>	06	<b>Section no.</b>	D.4	<b>Date:</b> 02/05/2019
<b>Description of CAR</b>				
PDD – Sections B.6.1 and B.6.3: For the <i>ex-ante</i> estimation, it is not clearly described in sections B.6.1 and B.6.3 of the PDD how the net amount of electricity generated using LFG in year $y$ ( $EC_{BL,k,y}$ ) is estimated. In addition, it was verified during the site visit that the amount of electricity consumed by the project activity is not zero as stated in the PDD.				
<b>Project participant response</b>				<b>Date:</b> 15/05/2019
<i>Amount of electricity generated using LFG has been correctly described and estimated in sections B.6.1 and B.6.3.</i> <i>Amount of electricity consumed by the project activity has been amended considering electrical demand from the plant equipment setup described in the spreadsheet “QC_ENERGÁS_Rev1.xls” sent to DOE.</i>				
<b>Documentation provided by project participant</b>				
QC_ENERGÁS_Rev1.xls				
<b>DOE assessment</b>				<b>Date:</b> 15/05/2019
Section B.6.1 of the updated PDD does not provide any information about how the net amount of electricity generated using LFG in year $y$ ( $EC_{BL,k,y}$ ) is estimated. However, the information was included in section B.6.3 of the PDD. This issue is closed. The amount of electricity consumed by the project activity was determined based on each equipment consumption. KBS verified the spreadsheet provided by PP. Nevertheless, no evidences were provided in order to confirm the values applied. CAR is open.				
<b>Project participant response</b>				<b>Date:</b> 12/06/2019
Evidences sent to DOE according to email dated 22/05/19 15:36h				
<b>Documentation provided by project participant</b>				
-				
<b>DOE assessment</b>				<b>Date:</b> 12/06/2019
The amount of electricity consumed by the project activity was determined based on each equipment consumption. KBS verified the spreadsheet provided by PP, cross-checked the values against evidences and confirmed that the value applied is correct. Thus, this CAR is closed.				

<b>CAR ID</b>	07	<b>Section no.</b>	D.4	<b>Date:</b> 02/05/2019
<b>Description of CAR</b>				
PDD – Section B.6.1: It is stated under Step 6: Calculate the combined margin emissions factor that: “The operating and build margin CO <sub>2</sub> emission factors will be ex-post”. However, the calculation of the build margin CO <sub>2</sub> emission factor is not following the recommendations of the “Tool to calculate the emission factor for an electricity system”.				
<b>Project participant response</b>				<b>Date:</b> 15/05/2019
<i>Amended and in accordance with the relevant tool:</i> <i>“The build margin CO<sub>2</sub> emission factors will be ex-ante.</i> <i>The operating margin CO<sub>2</sub> emission factors will be ex-post.</i> <i>Therefore, the combined margin CO<sub>2</sub> emission factor will be ex-post.”</i>				
<b>Documentation provided by project participant</b>				
-				
<b>DOE assessment</b>				<b>Date:</b> 15/05/2019
KBS verified the revised PDD and confirmed that the calculation of the build margin CO <sub>2</sub> emission factor is according to the “Tool to calculate the emission factor for an electricity system”. Thus, this CAR is closed.				

<b>CAR ID</b>	08	<b>Section no.</b>	D.4	<b>Date:</b> 02/05/2019
<b>Description of CAR</b>				
PDD – Sections B.6.1 and B.6.3: Project emissions are not clearly described in sections B.6.1 and B.6.3 of the PDD. For project emission from consumption of electricity, it is stated that emissions will be from two sources. However, just one source (electricity consumption from the grid) is used in the calculation. In addition, the description of the emissions from consumption of fossil fuels due to the project activity for purpose other than electricity generation is not correct.				

<b>Project participant response</b>	<b>Date:</b> 15/05/2019
<i>Amended considering only project emissions from electricity consumption from the grid.</i>	
<b>Documentation provided by project participant</b>	
-	
<b>DOE assessment</b>	<b>Date:</b> 15/05/2019
For project emission from consumption of electricity, it is now correctly stated that emissions will be from one source (electricity consumption from the grid). Moreover, the description of the emissions from consumption of fossil fuels due to the project activity for purpose other than electricity generation is correct. Thus, this CAR is closed.	

<b>CAR ID</b>	09	<b>Section no.</b>	D.4	<b>Date:</b> 02/05/2019
<b>Description of CAR</b>				
PDD – Section B.6.3: The second crediting period dates considered in the emission reduction calculation are not according to the project's crediting period renewal.				
<b>Project participant response</b>				<b>Date:</b> 15/05/2019
<i>Amended.</i>				
<b>Documentation provided by project participant</b>				
-				
<b>DOE assessment</b>				<b>Date:</b> 15/05/2019
No change was observed in the revised PDD and revised ER spreadsheet. The second period starts on 04/09/2019 and should be end on 03/09/2026. The spreadsheet considered 3 months in 2019 and 9 months in 2026. Section B.6.3 and consequently section B.7.1 should be revised. CAR is open.				
<b>Project participant response</b>				<b>Date:</b> 12/06/2019
Amended considering 4 months in 2019 and 8 months in 2026				
<b>Documentation provided by project participant</b>				
-				
<b>DOE assessment</b>				<b>Date:</b> 12/06/2019
KBS verified the updated PDD and ER spreadsheet and confirmed that the period applied is correct. Thus, this CAR is closed.				

<b>CAR ID</b>	10	<b>Section no.</b>	D.4	<b>Date:</b> 02/05/2019
<b>Description of CAR</b>				
PDD – Sections B.6.1, B.6.2, B.6.3 and ER spreadsheet: The emission reduction spreadsheet should be updated. The CERs calculation only considered the waste disposal from 2010 to 2028. The waste disposal for Landfill I was not considered in the calculation.				
<b>Project participant response</b>				<b>Date:</b> 15/05/2019
Amended accordingly. Evidence on waste disposal in "Total de residuos Aterros I e II_Resíduos aterrados.xlsx"				
<b>Documentation provided by project participant</b>				
Total de residuos Aterros I e II_Resíduos aterrados.xlsx				
<b>DOE assessment</b>				<b>Date:</b> 15/05/2019
The emission reduction spreadsheet was correctly revised and the information for landfill I was included. The amount of waste dumped and future entrances considered in the calculation was cross-checked by KBS through the evidence provided by PP. Thus, this CAR is closed.				

<b>CAR ID</b>	11	<b>Section no.</b>	D.5	<b>Date:</b> 02/05/2019
<b>Description of CAR</b>				
PDD – Section B.6.2: According to the tool " <i>Emissions from solid waste disposal sites</i> " Version 8.0:				
<ul style="list-style-type: none"> <li>f<sub>y</sub>: Fraction of methane captured at the SWDS and flared, combusted or used in another manner that prevents the emissions of methane to the atmosphere in year y. For landfill gas projects this parameter is only used for <i>ex-ante</i> estimation purposes. The parameter is not properly considered in the PDD.</li> </ul>				
<b>Project participant response</b>				<b>Date:</b> 15/05/2019
<i>Parameter properly included in section B.6.2.</i>				
<b>Documentation provided by project participant</b>				
-				
<b>DOE assessment</b>				<b>Date:</b> 15/05/2019
The parameter was included in section B.6.2 of the revised PDD accordingly to the tool and methodology ACM0001. Thus, this CAR is closed.				

<b>CAR ID</b>	12	<b>Section no.</b>	D.5	<b>Date:</b> 02/05/2019
<b>Description of CAR</b>				
PDD – Section B.6.2: According to the tool “Project emissions from flaring” version 02.0.0:				
<ul style="list-style-type: none"> <li>• Pref: atmospheric pressure at reference conditions. The parameter is not properly considered in Section B.6.2 of the PDD since option A is applied to calculate flare efficiency.</li> <li>• T<sub>ref</sub>: temperature at reference conditions. The parameter is not properly considered in Section B.6.2 of the PDD since option A is applied to calculate flare efficiency.</li> </ul>				
<b>Project participant response</b>				<b>Date:</b> 15/05/2019
<ul style="list-style-type: none"> <li>• Pref parameter is not presented as “Data and parameters fixed ex ante” according to “Project emissions from flaring”, thus it should not be considered in Section B.6.2 of the PDD. Alternatively, it has been mentioned in Table 1 – Parameters used in the Tool “Project emissions from flaring” in the PDD;</li> <li>• Tref parameter is not presented as “Data and parameters fixed ex ante” according to “Project emissions from flaring”, thus it should not be considered in Section B.6.2 of the PDD. Alternatively, it has been mentioned in Table 1 – Parameters used in the Tool “Project emissions from flaring” in the PDD;</li> </ul>				
<b>Documentation provided by project participant</b>				
-				
<b>DOE assessment</b>				<b>Date:</b> 15/05/2019
KBS verified that both parameters were properly removed from section B.6.2 of the revised PDD since option A (default value) is applied to determine flare efficiency and both parameters are not used. Thus, this CAR is closed.				

<b>CAR ID</b>	13	<b>Section no.</b>	D.5	<b>Date:</b> 02/05/2019
<b>Description of CAR</b>				
PDD – Section B.7.1: According to ACM0001 version 18.1:				
<ul style="list-style-type: none"> <li>• <math>EG_{PJ,y} = EC_{BL,k,y}</math>: Amount of electricity generated using LFG by the project activity in year y. The period adopted for the estimative of electricity generated is not according to the project's crediting period renewal. In addition, no information was provided in section B.7.1 of the PDD.</li> </ul>				
<b>Project participant response</b>				<b>Date:</b> 15/05/2019
<i>Amended accordingly.</i>				
<b>Documentation provided by project participant</b>				
-				
<b>DOE assessment</b>				<b>Date:</b> 15/05/2019
Information about amount of electricity generated using LFG by the project activity in year y was included in section B.7.1 of the revised PDD. Nonetheless, the period is not correct (See CAR 9). This CAR is open.				
<b>Project participant response</b>				<b>Date:</b> 12/06/2019
Amended considering 4 months in 2019 and 8 months in 2026				
<b>Documentation provided by project participant</b>				
-				
<b>DOE assessment</b>				<b>Date:</b> 12/06/2019
KBS verified the updated PDD and confirmed that the period applied is correct. Thus, this CAR is closed.				

<b>CAR ID</b>	14	<b>Section no.</b>	D.5	<b>Date:</b> 02/05/2019
<b>Description of CAR</b>				
PDD – Section B.7.1: According to “Tool to determine the mass flow of a greenhouse gas in a gaseous stream” version 03.0:				
<ul style="list-style-type: none"> <li>• <math>V_{i,t,db}</math>: Volumetric fraction of the greenhouse gas i in a time interval t on a dry basis (<math>m^3</math> gas i/ <math>m^3</math> dry gas ). Information provided in “Additional comment” is not properly addressed as per tool.</li> <li>• <math>V_{i,t,wb}</math>: Volumetric fraction of the greenhouse gas i in a time interval t on a wet basis (<math>m^3</math> gas i/ <math>m^3</math> wet gas ). Information provided in “Additional comment” is not properly addressed as per tool.</li> </ul>				
<b>Project participant response</b>				<b>Date:</b> 15/05/2019
<i>Amended accordingly.</i>				
<b>Documentation provided by project participant</b>				
-				

<b>DOE assessment</b>	<b>Date:</b> 15/05/2019
<ul style="list-style-type: none"> <li><math>V_{i,t,db}</math>: Volumetric fraction of the greenhouse gas <math>i</math> in a time interval <math>t</math> on a dry basis (<math>m^3</math> gas <math>i</math> / <math>m^3</math> dry gas ). Information provided in "Additional comment" is now properly addressed as per tool. This issue is closed.</li> <li><math>V_{i,t,wb}</math>: Volumetric fraction of the greenhouse gas <math>i</math> in a time interval <math>t</math> on a wet basis (<math>m^3</math> gas <math>i</math> / <math>m^3</math> wet gas ). Information provided in "Additional comment" is not properly addressed as per tool. The options mentioned are not correct. CAR is open.</li> </ul>	
<b>Project participant response</b>	<b>Date:</b> 12/06/2019
Amended according to the Tool.	
<b>Documentation provided by project participant</b>	
-	
<b>DOE assessment</b>	<b>Date:</b> 12/06/2019
KBS verified section B.7.1 of the updated PDD and confirmed that information provided in "Additional comment" for the parameter $V_{i,t,wb}$ : Volumetric fraction of the greenhouse gas $i$ in a time interval $t$ on a wet basis ( $m^3$ gas $i$ / $m^3$ wet gas ) is now properly addressed as per tool. Thus, this CAR is closed.	

<b>CAR ID</b>	15	<b>Section no.</b>	D.5	<b>Date:</b> 02/05/2019
<b>Description of CAR</b>				
PDD – Section B.7.1: According to "Baseline, project and/or leakage emissions from electricity consumption and monitoring of electricity generation" version 03.0: <ul style="list-style-type: none"> <li><math>EG_{EC,y} = EC_{PJ,j,y}</math>: Quantity of electricity consumed from the grid by the project activity during the year <math>y</math>. The values adopted are not correct. The period adopted for the estimative of electricity generated is not according to the project's crediting period renewal.</li> </ul>				
<b>Project participant response</b>				<b>Date:</b> 15/05/2019
Amended accordingly.				
<b>Documentation provided by project participant</b>				
<b>DOE assessment</b>				<b>Date:</b> 15/05/2019
Information about quantity of electricity consumed from the grid by the project activity in year $y$ was correctly included in section B.7.1 of the revised PDD. Nonetheless, the period is not correct (See CAR 9). This CAR is open.				
<b>Project participant response</b>				<b>Date:</b> 12/06/2019
Amended considering 4 months in 2019 and 8 months in 2026				
<b>Documentation provided by project participant</b>				
-				
<b>DOE assessment</b>				<b>Date:</b> 12/06/2019
KBS verified the updated PDD and confirmed that the period applied is correct. Thus, this CAR is closed.				

Table 3. FAR from this validation

No FAR raise during this validation

<b>FAR ID</b>	xx	<b>Section no.</b>		<b>Date:</b> DD/MM/YYYY
<b>Description of FAR</b>				
<b>Project participant response</b>				<b>Date:</b> DD/MM/YYYY
<b>Documentation provided by project participant</b>				
<b>DOE assessment</b>				<b>Date:</b> DD/MM/YYYY



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**Document information**

<i>Version</i>	<i>Date</i>	<i>Description</i>
03.0	31 May 2019	Revision to: <ul style="list-style-type: none"> <li>• Ensure consistency with version 02.0 of the “CDM validation and verification standard for project activities” (CDM-EB93-A05-STAN) and version 02.0 of the “CDM project cycle procedure for project activities” (CDM-EB93-A06-PROC);</li> <li>• Make editorial improvements.</li> </ul>
02.0	31 October 2017	Revision to align with the requirements of the “CDM validation and verification standard for project activities” (version 01.0).
01.0	23 March 2015	Initial publication.
Decision Class: Regulatory Document Type: Form Business Function: Renewal of crediting period Keywords: crediting period, project activities, validation report		