CLEAN DEVELOPMENT MECHANISM
PROGRAMME OF ACTIVITIES DESIGN DOCUMENT FORM
(CDM-PoA-DD) Version 01

CONTENTS

Annexes

NOTE:

This form is for the submission of a CDM PoA whose CPAs apply a large scale approved methodology.

At the time of requesting registration this form must be accompanied by a CDM-CPA-DD form that has been specified for the proposed PoA, as well as by one completed CDM-CPA-DD (using a real case).

SECTION A. General description of programme of activities (PoA)

A.1 Title of the programme of activities:

Caixa Econômica Federal Solid Waste Management and Carbon Finance Project
Version 6
18/01/2012

A.2. Description of the programme of activities:

1. General operating and implementing framework of PoA

Created in 1861, Caixa Econômica Federal (Caixa) is the main agent of public policy for the Brazilian federal government and the second largest public bank in Latin America[1]. Its network, the largest in Brazil, covers all 5,561 Brazilian municipalities with more than 17,000 service points.

Besides being focused on large commercial operations, Caixa has a strong social orientation, since it is centralizing operations as FGTS Fund (Time Guarantee of Service), PIS (Social Integration Program) and Public Housing (PAR - Program Residential Lease, the Letter of Credit, FGTS, among others)[2]. It is also the paying agent of the *Bolsa Familia*, a program of supplementary income from the Federal Government and the Unemployment Insurance. It is also involved in financing public infrastructure construction, mainly focused on sanitation, allocating resources to states and municipalities. Caixa also makes the brokering of federal government funding for the public sector.

In order to undertake a voluntary, coordinated action for the construction of landfill gas (LFG) collection and use systems (by means of flaring and/or electricity generation and/or LFG upgrade and distribution through a natural gas network), Caixa will act as a financial and technical intermediary in the Programme of Activities (PoA), providing assistance for the installation of LFG collection systems, taking the role of the coordinating and managing entity (CME) in charge of validation and verification activities under the CDM.

In this PoA, the landfill gas collected can be flared, used for electricity generation and/or used to supply consumers through a natural gas distribution network. The CDM activities (CPAs) will be implemented and directly managed by site owners and operators that meet the criteria set by Caixa and outlined in this PoA.

2. Policy/measure or stated goal of the PoA

According to the first National GHG Emissions inventory conducted by the Ministry of Science and Technology[3], Brazil has over 6,000 waste depositing sites, receiving over 60,000 tons of waste per day. Of this amount, 76% of the total waste was deposed in dumpsites with no management, gas collection or water treatment and usually without any license or under no control by the environmental agencies concerned. According to the same study, 84% of Brazil's methane emissions come from the deposition of

[1] Information from Caixa, publicly available at http://www1.caixa.gov.br/idiomas/ingles/presentation.asp
[2] Information available at http://www.caixa.gov.br/acaixa/relatorios/demonstrativo.asp
[3] Ministry of Science and Technology, First Brazilian Inventory of Anthropogenic Greenhouse Gas emissions, "Methane Emissions from waste treatment and disposal", 2002, page 15. Available at: http://www.bvsde.paho.org/bvsacd/cd25/methane.pdf

waste in uncontrolled dumpsites. The remaining 24% of waste is deposed in "controlled" landfills where GHG emissions are mostly vented into the atmosphere. In the few cases where gases are collected, this is done for safety reasons (to avoid explosions), and it is often the case that the amounts effectively collected are very low, due to clogs (which are often not drained or treated) blocking the drainage pipes. This situation remains to be almost the same to this day, as according to a study conducted in 2009 by the International Solid Waste Association, ISWA[4], on the current situation of Sanitary Landfills in Brazil, they indicated that 63.6% of Brazilian counties continue to use open dumps, while estimates for controlled landfills have been reduced to 13.8%, and even though policy has tried to move towards sanitary landfills, these have not yet reached 20% of the counties.

Brazil's National Energy Plan 2030[5], states that solid urban wastes are an important source of renewable energy generation and therefore Brazil's solid waste policy should target its use as a source for energy. In this sense the Brazilian Government has worked to design a program that promotes sustainable energy recovery from Municipal Solid Wastes (MSW), bringing together the actions of various governmental entities involved: the Civil House, MME, MMA, MCidades, MCT; MDIC, MTE and MS. This program shall be in line with the established National Sanitation Policy, the guidelines for the management of municipal solid waste and will take into account the opportunities arising from the Law of Public Consortia.

Since current practice of uncontrolled GHG emissions in landfills is largely prevalent today, the PoA will contribute to achieve the goals outlined in both the National Sanitation Policy and Brazil's National Energy Plan. Furthermore, the PoA will help to promote the implementation of LFG capture and combustion/energy generation/distribution systems through the CDM to mitigate the GHG emissions that would have otherwise been completely vented to the atmosphere.

3. Confirmation that the proposed PoA is a voluntary action by the coordinating/managing entity.

Caixa's main priorities and mandate as a bank do not include carbon oriented projects. The implementation of this PoA is part of a voluntary initiative undertaken by Caixa to encourage and provide access to finance for low carbon technologies to be implemented in the waste sector in Brazil. Caixa will therefore voluntarily take on the role as a coordinating/managing entity for the mentioned Programme of Activities as described in this design document.

[4] Waste Management Research, International Solid Waste Association ISWA, "*Report: The current situation of sanitary landfills in Brazil and the importance of the application of economic models*" by R. Oliveira, C. Petter, 2009

[5] Information on the National Energy Plan, PNE3,0 is available at the following site: http://www.epe.gov.br/PNE/Forms/Empreendimento.aspx

A.3. Coordinating/managing entity and participants of POA:

Caixa Econômica Federal will be the Coordinating/managing entity of the PoA, entity which communicates with the Board. Project participants are listed in Table 1 below.

Table 1: Project Participants

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity (ies) project participant (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Brazil (host)	Caixa Econômica Federal	No
Kingdom of Spain	International Bank for Reconstruction and Development acting as the Trustee of the Carbon Partnership Facility	Yes
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party (ies) involved is required.		

A.4. Technical description of the programme of activities:

A.4.1. Location of the programme of activities:

The PoA is located in Brazil

A.4.1.1. Host Party(ies):

The host party is Brazil

A.4.1.2. Physical/ Geographical boundary:

The geographical boundary for the PoA is Brazil. All the CDM programme activities (CPAs) included in the PoA will be implemented in Brazil taking into consideration all applicable national and/or sectoral policies and regulations. (Figure 1Figure 1).

Figure 1 Map of Brazil

A.4.2. Description of a typical CDM programme activity (CPA):

A typical CDM Programme Activity (CPA) consists of the capture of LFG, flaring and/or use for electricity production at a specific landfill site identified in the CPA-DD.

A typical CPA can be summarized as follows:

- ✓ Capture of LFG at eligible landfills in Brazil[6];
  - o Flare of the captured LFG to eliminate the landfill methane emissions; and/or

[6] See section A.4.2.2. Eligibility criteria

- Use the captured biogas as a fuel to generate electricity. The electricity generated can be used for own usage of the city/operator or sold to the national grid. In both cases, it will substitute electricity from the national grid; and/or
- The captured gas may be used to supply consumers through a natural gas distribution network.

Considering the envisioned activities, a typical CPA is confined to the physical boundary of the targeted landfill.
In case of export of the generated electricity to the grid, the national electricity grid will also be included in the CPA's boundary. Likewise in the case of export of gas to a natural gas distribution network, the gas network will also be included in the CPA's boundary.

A.4.2.1. Technology or measures to be employed by the CPA:

A typical CPA under this PoA will involve the installation of the landfill gas collection and flaring/use system to an existing or new landfill. The determination of the proportions of the landfill gas to be destined in the different uses will be determined by the availability of gas, and therefore will be described in more detail at the CPA level. A monitoring plan and data recording and archiving system will be implemented, where Caixa will keep all records for the elaboration of the monitoring reports.

Therefore, in this PoA, a typical CPA can consist of up to 3 scenarios or a combination of them:

a) **Scenario 1 – LFG flaring only**: This CPA will not have an electricity generation system or LFG distribution system, and all LFG generated will be flared. It consists of a LFG collecting system and an enclosed flare. The landfill gas will be collected and directed to an enclosed flare through transportation pipes. The technical parameters of the installed systems will be provided in each specific CPA-DD.

Figure 2 Scenario 1: LFG flaring only

b) **Scenario 2 – Energy generation**: consists of a LFG collecting system, pre-treatment system, electricity generation system, and flaring of any additional gas. First, the landfill gas will be collected, and then through transportation pipes, the landfill gas will reach pre-treatment system, in which the moisture and impurity of landfill gas will be removed. After increasing pressure of the landfill gas, it will be fed into an electricity generation system; the electricity generated will be connected to a local grid through transformer substation system, or be used on-site. The system will also have a flare that will be used to combust LFG when the power generation system is down (maintenance) or the quantity of gas collected exceeds the capacity of the power generation system. The technical parameters of the installed systems will be provided in each specific CPA-DD.

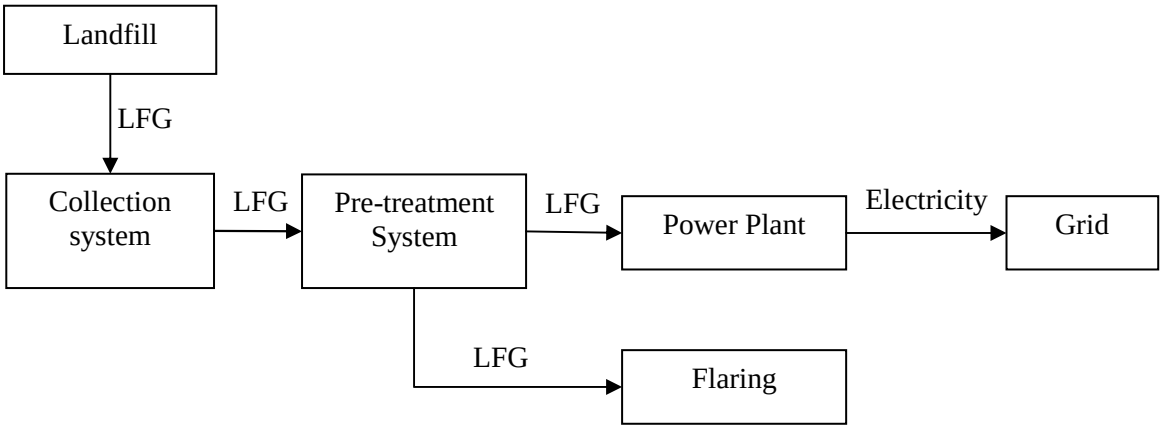

Figure 3 Scenario 2: Energy generation

c) **Scenario 3 – LFG distribution**: consists of a LFG collecting system, pre-treatment system and a pipe system to transport the LFG to a natural gas distribution network. First, the landfill gas will be collected, and then through transportation pipes, the landfill gas will reach pre-treatment system, in which the moisture and impurity of landfill gas will be removed. After that, the LFG will be fed into the LFG Upgrade system, and then distributed to the gas distribution network. The system will also have a flare that will be used to combust LFG when any problems or maintenance occur with the transportation pipes or the LFG collected exceeds the capacity of gas distribution network. The technical parameters of the installed systems will be provided in each specific CPA-DD. The emissions reductions are not intended to be claimed for displacing natural gas hence the CPAs will not use the approved methodology AM0053.

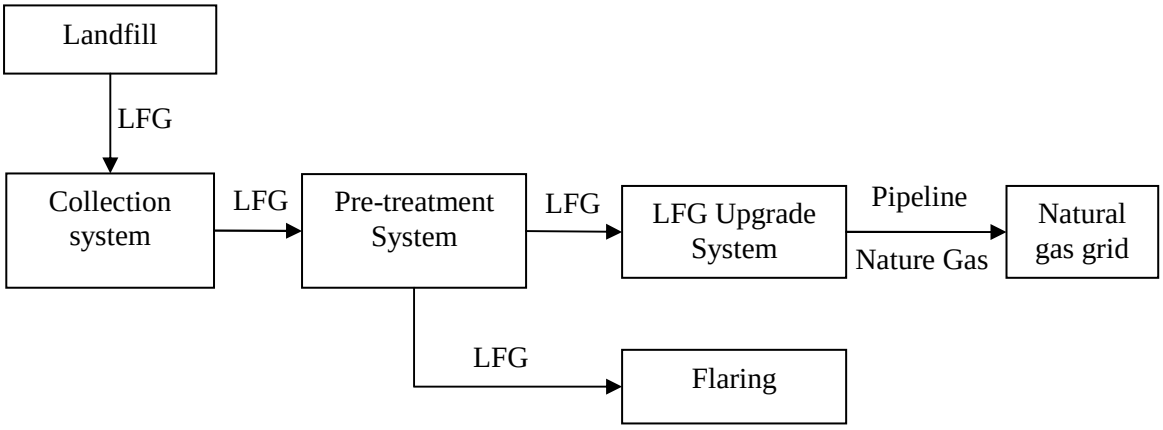

Figure 4 Scenario 3: LFG upgrading and distribution

Basic components of a typical CPA

The components used in these scenarios are briefly described below.

Landfill gas collection system (all scenarios):

State-of-the-art gas collection technology includes the items listed below. Each CPA will have its LFG collection system described in a more detailed fashion.

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

Landfill gas pre-treatment station (all scenarios)

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

Landfill gas flaring system (all scenarios):

Despite the final use of the LFG gas, all CPAs must have a flaring system to destroy the LFG collected in case any problem occurs. The LFG flare system includes the items provided below.

- Flare with controlled combustion system.
- Blower system used to cause negative pressure in the pipeline (before blower) and positive pressure (after blower) to direct gas for flare.
- Continuously monitored gas composition (methane, oxygen, carbon dioxide and balance), flow and burn temperature.
- Security restart system, in case the system shuts down.
- Flare efficiency monitoring. (thermocouple)

Electricity Generation Equipment (scenario 2):

A modular engine facility will be installed. Small modular engine generator units make it possible to adapt the equipment to the site specific gas volumes. As the gas volumes increase or decrease over time, the modules can be added or relocated to the other sites. The unit will consist of degassing installations and the powerhouse. This unit facility includes blowers, heat exchangers, chillers, and the flares that will destroy the methane not used to generate electricity.

LFG upgrading station (scenario 3)

In this system the LFG will suffer further treatment and will be compressed for injection in the natural gas distribution network in order to reach its final consumers. In some cases will be necessary to remove the CO_2 present in the LFG.

LFG pipelines connecting to gas distribution network (scenario 3)

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

Monitoring system (all scenarios)

Each CPA will have state-of-the-art monitoring equipment that will be calibrated as per the applied approved monitoring methodology. Staff involved will be trained to properly operate the monitoring system. Detailed description of the monitoring system is provided in each CPA-DD.

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

A.4.2.2. Eligibility criteria for inclusion of a CPA in the PoA:

To be part of this PoA, each CPA must meet the following criteria:

- Signature by the project implementer of the CPA of a letter of intent (LoI) to confirm both their voluntary participation to the proposed PoA coordinated by Caixa, and that the project under the CPA is neither registered as an individual CDM project activity nor included as part of another registered PoA
- The CPA must be a Municipal or Regional sanitary landfill.
- The baseline scenario consists of the total or partial release of LFG to the atmosphere;
- LFG can be flared, used for energy generation and/or used to supply consumers through a natural gas distribution network.
- The solid waste disposal site where the waste would be dumped can be clearly identified;
- Only those sites that receive municipal solid waste will be eligible under this PoA, therefore, at the project site there should be no hazardous wastes;
- The project implementer has agreed to follow stakeholder consultation requirements as per Brazils DNA, and as outlined in Section D of this document,
- The CPA proponent shall take responsibility for operating and monitoring the CPA as per the CDM rules and guidelines provided by Caixa;
- Additionality analyses is performed at the CPA level, following a financial analysis and demonstrating that the project is not viable unless it is registered as a CDM project;
- In the case the implementation of the CPA requires a loan, the CPA proponent must have confirmation from the financial institution providing the loan for the project activity, where future carbon revenues have been presented for the loan evaluation and are a partial guarantee to repay the loan.

A.4.3. Description of how the anthropogenic emissions of GHG by sources are reduced by a CPA below those that would have occurred in the absence of the registered PoA (assessment and demonstration of additionality):

The additionality of the proposed PoA is justified by the following arguments:

i) The proposed PoA is a voluntary coordinated action;

Caixa has taken the voluntary initiative for the development of this programme of activities. The objective is to enable municipalities to implement a better solid waste management practice by helping them overcome the existing barriers and leverage financial resources that would have otherwise not be available, in the absence of the PoA. The PoA is therefore a voluntary coordinated action initiated by Caixa, where the participation of CPA implementers in the program is also done also on a voluntary basis;

ii) If the PoA is implementing a voluntary coordinated action, it would not be implemented in the absence of the PoA

As mentioned before, according to the first National GHG Emissions inventory conducted by the Ministry of Science and Technology[7], the general barrier in the solid waste sector in Brazil is that of its current practice, where the country has over 6,000 waste depositing sites, and, 76% of the total waste was deposed in dumpsites with no management, gas collection or water treatment and usually without any license or under no control by the environmental agencies concerned. This situation remains to be the same to date, as according to the study conducted in 2009 by the International Solid Waste Association, ISWA[8], on the current situation of Sanitary Landfills in Brazil, it indicates that 63.6% of Brazilian municipalities continue to use open dumps, while estimates for controlled landfills have been reduced to 13.8%, and even though policy has tried to move towards sanitary landfills, these have not yet reached 20% of the municipalities.

According to the 2007 report from the National system of Information on Sanitation in Brazil[9], the great majority of the country (82%) is comprised of small municipalities with less than 30,000 inhabitants, whereas municipalities with more than 1 million inhabitants account for less than 1% of the total; this is important, given that as per Brazilian regulations on solid waste management (SWM), article 30 of the constitution as well as the recent National Solid Waste Policy[10], stipulates that urban cleaning and SWM services are the responsibility of municipal governments. Yet, financial resources are generally inadequate and municipalities spend a small proportion of their budgets on SWM. The 2000 IBGE study

[7] Ministry of Science and Technology, First Brazilian Inventory of Anthropogenic Greenhouse Gas emissions, "Methane Emissions from waste treatment and disposal", 2002, page 15. Available at: http://www.bvsde.paho.org/bvsacd/cd25/methane.pdf

[8] Waste Management Research, International Solid Waste Association ISWA, "*Report: The current situation of sanitary landfills in Brazil and the importance of the application of economic models*" by R. Oliveira, C. Petter, 2009

[9] "Urban Solid waste Management Diagnostic, 2007", published by the Cities Ministry, national Secretary of Environmental Sanitation. Also found online at http://www.snis.gov.br/PaginaCarrega.php?EWRErterterTERTer=16

[10] Law 12.305, August 2, 2010, National Solid Waste Policy (*LEI No 12.305, DE 2 DE AGOSTO DE 2010, Política Nacional de Resíduos Sólidos*);

also found that, of municipalities with waste collection and sweeping services, 15.9%, spent between 5 and 10% of their budgets on such services and 79.2% spent 5% or less.

The situation of waste management for municipal solid waste within Brazil is therefore run in the majority of cases by the public administration, where most of these dumpsites are small receiving an average amount of waste below 500 tons per day (tpd)[11]. The same situation holds true in the 2008 report, published by the end of 2010, where furthermore, in chapter 5 of the report under the title: "Financial performance of the entities in charge of urban solid waste management" it says: "Overall, the recipe has proved insufficient for maintaining the activities of solid waste management, as pointed out by the I005 indicator - Self-sufficiency of city hall with municipal solid waste management.". The report points out municipalities are not ready to assign resources to waste management, they have limited investment capacity and access to credit for SWM services, and as the cities' needs compete for scarce resources, when coupled with the lack of technological know-how waste management is often left at the end of the priority list.

As for the private sector, there are little incentives for project implementers to invest in gas collection and flare/use systems, because of high upfront investment costs and technical as well as common practice barriers that discourage project operators. As documented by the Methane to Markets country profile for Brazil[12]: "Only in the last 10 years the private sector has started landfill management, by concession. Such companies usually run the largest sites and, as of 2006, 14% of collected MSW is placed in landfills operated by them". Up to now there are 35 CDM landfill gas projects in the pipeline[13] (between registered and projects at validation stage) and only 11 of these have the component to generate electricity; most of these sites are the few that are being run by private entities, which is not the common practice in the country. This can also be corroborated by analyzing the gathered data for the "Diagnostic for the urban Solid Waste Management" document (*Diagnóstico do Manejo de Resíduos Sólidos Urbanos*) elaborated by the Brazilian Ministry of the Cities in 2007[14]. According to the data and spreadsheets available for this report[15], which was taken for a sample of the major municipalities of the country, only 6.4% of the sample indicated to have gas utilization and out of those 70% (12 sites) were identified to be CDM projects. Therefore, demand for financing LFG collection systems and LFG to energy projects, without CDM registry are virtually non-existent.

The government has tried to tackle solid waste policies and regulations both at the federal and state level, but coordination, enforcement and identification of the right incentives is still under development. At the federal level, responsibility for SWM services is shared among three Ministries (Health, Environment, and Cities) and at the state level, the situation varies considerably: only 8 states currently have specific solid waste legislation (Ceara, Goias, Mato Grosso do Sul, Pernambuco, Parana, Rio Grande do Sul, Bahia and Mato Grosso), 14 are in the process of preparing such legislation, and 7 have yet to begin.
Recently, in August 2 2010, after a widely consulted debate, the National Solid Waste Policy/Law was introduced; this new law obliges public authorities to implement waste management programs with the objective of improving waste practices in the country through action on different fronts. Under the new law, municipalities have two years to prepare a solid waste plan, where targets will be set to eradicate dump sites and strategies will need to be set along with other municipalities to join forces in order to

[11] "Urban Solid waste Management Diagnostic, 2007", 6.10 page 120, published by the Cities Ministry, national Secretary of Env. Sanitation. Online at http://www.snis.gov.br/PaginaCarrega.php?EWRErterterTERTer=16
[12] Methane to Makets Counrty profile
[13] UNEP Risø CDM pipeline, last accessed 01/03/11.
[14] Sistema Nacional de Informações sobre Saneamento: diagnóstico do manejo de resíduos sólidos urbanos – 2007. Brasília: MCIDADES.SNSA, 2009. Available at http://www.snis.gov.br/
[15] Ibid. Spreadsheets available at http://www.snis.gov.br/PaginaCarrega.php?EWRErterterTERTer=80

develop solutions. In addition this law mandates the formal participation of waste pickers in organized cooperatives, leading to increased income generation and social inclusion for the group.

There are high expectations derived from the new National Waste Management Law, but given that for a long time there was no regulation for mandatory action from landfill/dumpsite operators, municipalities are facing difficult choices in order to be able to comply with the regulators expectations.

It is under this scenario that Caxia's role takes importance as they are in a unique position to facilitate the adoption of the National Waste Management Law, under the adoption of this PoA. As mentioned in section A.2. Caixa Economica Federal (Caixa) is the main agent of public policy for the Brazilian federal government with the largest network in Brazil, covering all 5,561 Brazilian municipalities with more than 17,000 service points. Caixa's mission is to "promote the continued improvement of the quality of life of the Brazilian population, intermediating funds and financial businesses, acting towards the harnessing of urban development and on the sectors of housing, sanitation and infrastructure, and on the management of funds, programs and services of social character"[16]. As an integrated public bank and as per its mission, Caixa is a strategic partner of the state and municipal governments, administering a Federal Guarantee Fund dedicated to private sector investments in municipal sanitation and solid waste projects. Caixa's records show that even though the fund has been well-utilized for sanitation, disbursements for solid waste projects have been low[17]. In an effort to increase the participation for solid waste projects, and in light of the potential of blending carbon finance in order to leverage additional resources that will make the projects viable, Caixa has taken the voluntary initiative for the development of this programme of activities.

As one of the leading development banks in Brazil, Caixa has experience working with a range of public and private entities, and even though Caixa is primarily a banking institution, it has developed the capacity to provide technical advice to its borrowers. Most of the municipalities have very limited capacity to prepare concession processes, deal with issues related to waste pickers, process environmental licensing, and conduct concession processes. The Program through Caixa intends to support this processes by providing Technical Assistance to interested municipalities. This combination of financial and technical support is critical for Caixa to effectively engage with its borrowers. To encourage projects developers, of different levels of credit worthiness and technical capacity to join the PoA, Caixa considered various financing options. These included using the CER revenue to reduce the interest rates; using CER revenues as partial guarantee for the loans.

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The experience up to now has demonstrated that without CDM revenues and technical assistance like the ones that could be provided by the carbon facility by Caixa, project operators wouldn't take the initiative to invest in LFG capture and flaring/energy generation systems in order to mitigate GHG emissions. The alternatives for the project implementers to the participation in the proposed CDM PoA is either develop a CDM project by their own means or not capture the LFG, continuing the current common practice of uncontrolled biogas emissions into the atmosphere.

Therefore the intention of the proposed PoA is twofold: to provide the necessary means for the municipalities in the country to be able to comply with the National Solid Waste Law through an additional stream of revenues leveraged by carbon finance, while scaling up the use of landfill gas

[16] Also found online at the banks webpage http://www1.caixa.gov.br/idiomas/ingles/mission.asp

[17]The cumulative loan amount between 2002-2011 has been 0.36%. Source: "DEMONSTRATIVO OPERACOES CONTRATADAS.pdf"

collection systems and renewable energy generation technologies in order to mitigate methane emissions. Through this PoA, Caixa will support municipalities through the process and will look to harness more interest from the private sector on solid waste management. Not only will Caixa, as a financial entity be able to provide blended sources of financing for the implementation of the projects, allowing the use of future carbon revenues as partial guarantees of the loans, but they will also provide technical assistance to the municipalities to structure the SWM operation with renewable energy generation and to ensure CDM requirements are being met.

The CPAs additionality can also be justified by the following additional arguments:

- ✓ Waste projects limited access to public-sector financing: waste management in Brazil, which falls under sanitation, has a high level of institutional complexity and low private-sector involvement. The historical financing and funding sources for waste projects, most of which has come from the public sector, indicates a lack of sufficient directed resources[18].
- ✓ Technology barrier: most of the landfills operators don't have the experience and technological know-how for the electricity and use operations[19];
- ✓ LFG collection and use systems, like the ones in the CPAs of this PoA are not economically attractive without CDM revenues[20].

In summary the current and expected practice of solid waste management by municipalities in Brazil is that of open dumps, and some landfill sites, very few of which have gas collection systems, much less renewable energy generation technologies. Without technical and financial assistance, acceptance of future CER revenues as partial guarantees for the loan agreements, and guidance from a solid institution to lead the way in the CDM process, municipalities will continue to operate the landfill sites as they always have.

The objective of this PoA is therefore to provide solid support to municipalities with a strong coordinating/managing entity able to lead the process, providing financial assistance along with technological training for the concession process with private operators, and technical training for the realization of the CER revenues, so that the above mentioned barriers can be overcome. In essence, the voluntary coordinated action that will be implemented through this PoA, would not, and has not, been implemented in the absence of the PoA.

(iii) If the PoA is implementing a mandatory policy/regulation, this would/is not enforced;

As mentioned above, the PoA is supporting the implementation of the newly introduced National Solid Waste Policy.

(iv) If mandatory a policy/regulation is enforced, the PoA will lead to a greater level of enforcement of the existing mandatory policy/regulation.

[18] As mentioned in the Brazil Low-carbon Country Case Study, by the World Bank, May 31 2010, pg 183

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

[20] Additionality will be demonstrated for each CPA by an investment analysis. Details can be found in section E.5.1 of the PoA-DD.

As mentioned above, the expectation is that the PoA will lead to the enforcement of the existing National Solid Waste Policy.

A.4.4. Operational, management and monitoring plan for the programme of activities:

A.4.4.1. Operational and management plan:

Caixa, the coordinating/managing entity of this PoA, has established the operational and management plan which includes the following:

a) **Letter of Intent and provisions to ensure that those operating the CPA are aware and have agreed that their activity is being subscribed to the PoA**: If a landfill site operator is interested in joining this PoA, it shall submit a letter of intent (LoI) to participate in Caixa's PoA. The LoI will indicate their voluntary participation within the PoA, their authorization to give the financial information relevant for the projects evaluation, and confirmation that they are not part of any other registered CDM project or PoA. Then the CPA proponent will be briefed by Caixa about the criteria for inclusion under the PoA.

b) **System/procedure to avoid double accounting e.g. to avoid the case of including a new CPA that has been already registered either as CDM project activity or as a CPA of another PoA:** After receiving the LoI, Caixa will proceed to confirm that the project is not part of another Program, or contained as another registered CDM project, by double checking the projects geographical coordinates with the Brazilian DNA and with published information from the UNFCCC website. At this point, a unique number will be assigned to the CPA, which will serve for reference within Caixa's database which will contain the projects location (GPS coordinates) and private operator's name, among other details.

c) **Eligibility assessment**: Caixa will collect the necessary information to conduct an analysis of the project design as per the eligibility criteria established in Section A.4.2.2 of the POA-DD.

d) **Memorandum of agreement**: if the CPA proponent qualifies, a Memorandum of Agreement (MOA) shall be negotiated and signed. The MOA will outline responsibilities for the development of the project to meet basic technical and financial criteria, as well as the criteria and documentation requirements under the CPA. This will include the role Caixa and the CPA operator in the PoA.

e) **Data gathering and documentation:** After the MOA is signed, the detailed project information necessary to elaborate the CPA-DD will be collected. This includes the project additional technical and financial information on the CPA, feasibility study, evidences etc. Caixa will make itself available to the landfill site operator to provide this service.

f) **CPA-DD preparation**: After the necessary information and documentation requirements have been incorporated in the CPA-DD and Caixa has approved the final version of the document, Caixa as CME will submit the information to the DOE for inclusion as per the rules and procedures of inclusions of CPAs under registered PoAs.

g) **Inclusion of CPA in the PoA:** After the DOE confirms that the CPA is eligible for inclusion under the PoA, Caixa will finalize the financing arrangements for carbon finance and the monitoring arrangements for the specific CPA-DD. During project activity operation, the monitoring plan (as outlined in Sections A.4.4.2 and E.7.2 of this PoA) will be strictly followed by Caixa and the CPA project implementer. Training of the CPA project implementer staff will also be provided at this time to ensure that data monitoring and recording, reporting, internal quality control, operation, calibration, and maintenance are followed by the CPA Project Implementer.

h) **A record keeping system for each CPA under the PoA.** Caixa will maintain the monitoring reports for each of the CPA included in the PoA, including a list of all projects that are under review for inclusion in the PoA and approved for inclusion in the PoA and the status of verification. A database will be developed to contain the major project features important for identifying the CPA and quantifying the emission reductions. This documentation will ensure no double counting occurs in the claiming of emission reductions since each CPA will list the location (GPS coordinates), ownership and a copy of the letter of confirmation from the CPA proponent that the CPA is not a component of another CDM programme or project activity. Monitored data will be kept by project implementers. Recorded data will be kept for two years after the end of the crediting period.

A.4.4.2. Monitoring plan:

All relevant parameters included in the monitoring plan shall be recorded and monitored for each CPA under this PoA, being the responsibility of each CPA proponent with guidance set by Caixa. With this data recorded, Caixa will prepare a separate monitoring report for each CPA with verification and CER issuance purposes. Caixa will maintain a database for all CPAs and data will be kept for at least 2 years after the end of the crediting period.

Under this PoA, 100% of the CPAs will be monitored and verified, where the project implementers will be responsible for collecting and recording all the information and Monitoring Reports will be sent to Caixa. The monitoring reports will be made available to the DOE for verification, as Caixa will be the main interlocutor with the DOE, taking responsibility of quality assurance of monitored data and making Monitoring Reports available to the DOE.

Data Collection: The CPA proponents are required to submit a monthly Monitoring Report to Caixa through their local lending centers. The data will be checked for completeness and quality and placed in a central database located at the Caixa Head Quarters – Environmental Program and Management Department (EPMD) that includes all projects under the PoA. Hardcopies of the monthly reports will also be kept on file.

Field visits: Caixa will undertake bi-annual field visits, or as necessary depending on CPA evaluated needs. This will serve as an additional quality check of the monthly monitoring report, to view the operation of the installed monitoring devices to ensure they are working properly and a means of following up on any questions on the data and any monitoring issues.

Calculation of emission reductions: Caixa will use the aggregated data to calculate the emission reductions achieved based on the formulas for ex-post emission reduction calculations outlined in ACM0001 version 11. This database will be updated monthly based on the reports received.

Database for CPAs to prevent double counting and status of verification: In order to have control over the individual calculations for emission reductions in each CPA, the database will always refer to the uniquely assigned reference number for each project, associated with its geographical location and private operator's name. For each project, the database will also contain information on the status of verification and issuance of CERs, as well as project information, to provide transparent and verifiable means of preventing double counting.

Training: Caixa will provide technical support/training to assist the landfill site operators establishing their system of monitoring and reporting with the proper quality controls, troubleshooting on monitoring issues, and in undertaking calibration by identifying service providers.

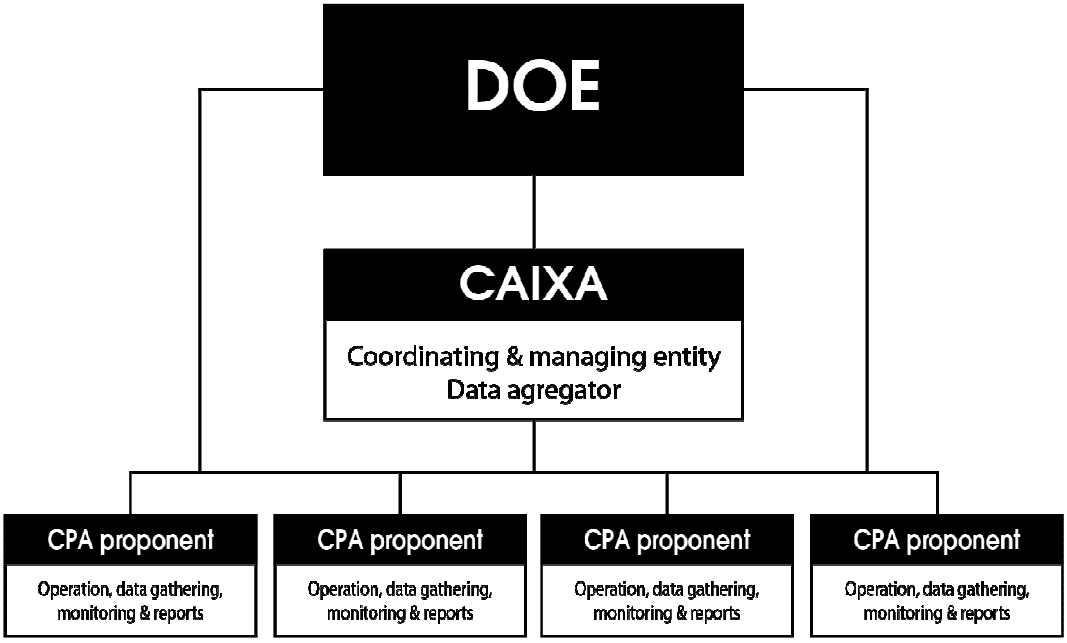

Figure 1 Schematic representation of the monitoring plan

Each CPA will be in charge of their record keeping system for monitored raw data, while Caixa will keep records of the monitoring reports for each CPA; for quality assurance monitoring reports will be crossed checked with raw data upon site visits conducted by Caixa.

A.4.5. Public funding of the programme of activities:

There is no public funding from Annex I Parties of UNFCCC for Caixa Econômica Federal Solid Waste Management PoA.

SECTION B. Duration of the programme of activities

B.1. Starting date of the programme of activities:

22/09/2010, this was the date the PoA started the validation process.

B.2. Length of the programme of activities:

28 years

SEÇÃO C. Análise ambiental

C.1. Please indicate the level at which environmental analysis as per requirements of the CDM modalities and procedures is undertaken. Justify the choice of level at which the environmental analysis is undertaken:

1. Environmental Analysis is done at PoA level ☐
2. Environmental Analysis is done at CPA level ✔

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

C.2. Documentation on the analysis of the environmental impacts, including transboundary impacts:

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

This PoA is not expected any negative transboundary impacts in Brazil.

C.3. Please state whether in accordance with the host Party laws/regulations, an environmental impact assessment is required for a typical CPA, included in the programme of activities (PoA),:

Brazilian regulations require that an environmental analysis must be made for each landfill (CPA) to operate in the country. This documentation is going to be provided in each individual CPA-DD.

In Brazil the "Estudo de Impacto Ambiental – EIA[21]" and its "Relatório de Impacto Ambiental – RIMA[22]" are two different documents, which serve as a tool for "Avaliação de Impacto Ambiental - AIA"[23] which is part of the licensing process. In the EIA is presented detailed information of all the technical surveys and in the RIMA is presented the study's conclusion, in accessible language to facilitate review by the public. This requirement was based on the Federal Law No. 6.938/81, which established the National Environment Policy, regulated by Federal Decree No. 99.274/90, becoming a requirement in the Brazilian environmental agencies from the CONAMA Resolution No. 001, 23/01/86.

The EIA is linked to the Preliminary License, since this is a preliminary study of the impacts that might occur, with installation and/or operation of a given enterprise. The requirement of the EIA / RIMA is defined through the integration of parameters: type, size and location of the project.

[21] Environmental Impact Study
[22] Environmental Impact Report
[23] Environmental Impact Assessment

SECTION D. Stakeholders' comments

The stakeholders consultations will be held, recorded and included into CPA documents as described in the following sections

D.1. Please indicate the level at which local stakeholder comments are invited. Justify the choice:

1. Local stakeholder consultation is done at PoA level ☐
2. Local stakeholder consultation is done at CPA level ✔

Due to the wide range of CPAs geographical positions, local consultation will be done at CPA level to ensure full participation and consultation of local stakeholders of the landfill sites participating in the PoA. A local stakeholder consultation will be conducted for every CPA.

D.2. Brief description how comments by local stakeholders have been invited and compiled:

To be done at CPA level. As required by the Interministerial Commission on Global Climate Change (CIMGC), the Designated Authority (DNA) for Brazil, letters must be sent for comments to local stakeholders as part of the procedures for analyzing CDM projects with at least two weeks in advance from the start of validation process, in order to obtain the letter of approval LoA.

D.3. Summary of the comments received:

To be done at CPA level. All comments received will be included in the specific CPA-DD.

D.4. Report on how due account was taken of any comments received:

To be done at CPA level. All clarifications requested by local attending stakeholders will be addressed during the meetings and recorded on each specific CPA-DD.

SECTION E. Application of a baseline and monitoring methodology

E.1. Title and reference of the approved baseline and monitoring methodology applied to each CPA included in the PoA:

The Caixa PoA applies one methodology and its tools:

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

Version 01 – "*Tool to determine project emissions from flaring gases containing methane*"

Version 01 – "*Tool to calculate baseline, project and/or leakage emissions from electricity consumption*"
Version 02.2.1 – "*Tool to calculate the emission factor for an electricity system*".
Version 02 – "*Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion*"
Version 05.1.0 – "*Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site*"
Version 05.2.1 – "*Tool for the demonstration and assessment of additionality*"

E.2. Justification of the choice of the methodology and why it is applicable to each CPA:

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

a) The captured gas is flared; and/or
b) The captured gas is used to produce energy (e.g. electricity)
c) The captured gas is used to supply consumers through natural gas distribution network (scenario 3 in section A.4.2.1). If emissions reductions are claimed for displacing natural gas, as per ACM0001, project activities may use approved methodology AM0053.

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

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

"Tool for determining methane emissions avoided from disposal of waste at a solid waste disposal site" – Version 05.1.0
The tool is applicable in cases where the solid waste disposal site where the waste would be dumped can be clearly identified. The disposed site where the waste is deposited is clearly identified thus the tool is applicable to the project.

"Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" – Version 02
This tool provides procedures to calculate project and/or leakage CO_2 emissions from the combustion of fossil fuels. It can be used in cases where CO_2 emissions from fossil fuel combustion are calculated based on the quantity of fuel combusted and its properties. Therefore the tool is applicable to the CPAs which may use fossil fuel for the operation of the project activity.

"Tool to determine project emissions from flaring gases containing methane" – EB28, Annex 13
The tool is applicable to projects where the residual gas stream to be flared contains no other combustible gases than methane, carbon monoxide and hydrogen, and residual gas stream to be flared shall be obtained from decomposition of organic material (through landfills, bio-digesters or anaerobic lagoons, among others). The project activities include burning of the residual landfill gas which is obtained from decomposition of municipal organic waste and produced by the microbiological decomposition of land-filled garbage where most of the residual gas is methane (about 50-55%) and carbon dioxide (about 40-45%)[24]; thus the tool is applicable to all CPAs.

[24] "Facts about Landfill Gas", US EPA, found online at http://www.dem.ri.gov/programs/benviron/waste/central/lfgfact.pdf

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

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

E.3. Description of the sources and gases included in the CPA boundary

According to ACM0001, the project boundary is the site of the project activity where the gas is captured and destroyed/used.

If the electricity for project activity is sourced from grid or electricity generated by the LFG captured would have been generated by power generation sources connected to the grid, the project boundary shall include all the power generation sources connected to the grid to which the project activity is connected.
If the electricity for project activity is from a captive generation source or electricity generated by the captured LFG would have been generated by a captive power plant, the captive power plant shall be included in the project boundary. Likewise is the captured gas is sent through a natural gas distributed network, the network will be included in the project boundary.

Table 2 Description of the sources and gases included in the CPA (ACM0001)

	Source	Gas	Included?	Justification / Explanation
Baseline	Emissions from decomposition of waste at the landfill site	**CH_4**	**Yes**	The major source of emissions in the baseline
		N_2O	No	N_2O emissions are small compared to CH_4 emissions from landfills. Exclusion of this gas is conservative.
		CO_2	No	CO_2 emissions from the decomposition of organic waste are not accounted
	Emissions from electricity consumption	CO_2	Yes	Electricity may be consumed from the grid or generated onsite/offsite in the baseline scenario
		CH_4	No	Excluded for simplification. This is conservative.
		N_2O	No	Excluded for simplification. This is conservative.
	Emissions from thermal energy generation	CO_2	No	Since thermal energy generation is not included in the project activity, these are excluded.
		CH_4	No	Excluded for simplification. This is conservative.
		N_2O	No	Excluded for simplification. This is conservative.
Project Activity	On-site fossil fuel consumption due to the project activity other than for electricity generation	**CO_2**	**Yes**	May be an important emission source
		CH_4	No	Excluded for simplification. This emission source is assumed to be very small.
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small.
	Emissions from on-site electricity use	**CO_2**	**Yes**	May be an important emission source
		CH_4	No	Excluded for simplification. This emission source is assumed to be very small.
		N_2O	No	Excluded for simplification. This emission source is assumed to be very small.

E.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

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

Baseline scenario assessment and description for all CPAs

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

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

Using Step 1 of version 05.2.1 of the "*Tool for the demonstration and assessment of additionality*", alternatives to the baseline i.e. the scenario relevant for estimating baseline methane emissions, to be analyzed should include, *inter alia*:

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

Alternatives for the disposal/treatment of the waste in the absence of the project activity, i.e. the scenario relevant for estimating baseline methane emissions, to be analysed should include, *inter alia*:

LFG1: The project activity (i.e. capture of LFG and its flaring and/or its use) undertaken without being registered as a CDM project activity;

LFG2: Atmospheric release of the LFG or partial capture of landfill gas and destruction to comply with regulations or contractual requirements, or to address safety and odor concerns.

Since the PoA may also consider CPAs where LFG is used for generation of electricity to the grid, realistic and credible alternatives should also be separately determined for power generation.

As per the methodology, the realistic and credible alternative(s) for energy generation may include, *inter alia*:

P1: Power generated from landfill gas undertaken without being registered as CDM project activity;
P2: Existing or construction of a new on-site or off-site fossil fuel fired cogeneration plant;
P3: Existing or construction of a new on-site or off-site renewable based cogeneration plant;
P4: Existing or construction of a new on-site or off-site fossil fuel fired captive power plant;
P5: Existing or construction of a new on-site or off-site renewable based captive power plant;
P6: Existing and/or new grid-connected power plants.

As heat energy is not one of the options within this PoA, scenarios P2, P3 and H1-H7 were not considered as an alternative by the project participants. The alternatives P4 and P5 were not considered realistic as there is no need for a power plant at any landfill site in the baseline scenario. In all cases it would be more reasonable to consume energy from the Brazilian grid. Therefore for all CPAs the alternatives for the CPAs are LFG1, LFG2, P1 and P6.

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

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

All scenarios described earlier are consistent with Brazilian laws and regulations, as there are no laws or regulations mandating capture and flaring or use of landfill gas, nor due to safety issues or to promote the productive use of LFG. The Brazilian legislation establishes that each state is responsible for the environmental license process for landfills. Thus, each state defines the laws, minimum standards, technologies, restrictions and environmental requirements for the landfills. Furthermore, the Ministry of Cities has indicated that the priority for investments should consider the (i) reduction of open dumps by 50% within 5 years; (ii) unification and coordination of existing financing lines and programs; (iii) capacity building with a focus on the elaboration of integrated solid waste management plans for municipalities and states, as well as on research and support to NGOs and other technical assistance programs; and (iv) promotion of programs with socioeconomic objectives linked to waste collection, such as creation and enhancement of solid waste collection cooperatives. That may be done through concessions to private entities either to build and operate sanitary landfills or to be responsible for the whole municipality's waste management. In all cases, however, active collection and flaring of the landfill gas has never been required, thus regulations concerning solid waste disposal do not foresee an obligation on LFG flaring and destruction, or other gainful use.

In order to incentivize the use of renewable sources to generate electricity, in 2002 the Brazilian government created the program with name: *PROINFA – Programa de Incentivo a Fontes Alternativas*. The goal of the program was to generate 3,300 MW of renewable energy from wind-energy (1,100 MW), SHPs (1,100 MW) and renewable biomass (1,100 MW, including bagasse, wood, solid waste, etc). Although the program achieved its goals, no landfill-gas-to-energy project was implemented due to the low price paid for the MWh produced.

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

As per methodology ACM0001, we continue with step 2
Step 2: Identify the fuel for the baseline choice of energy source taking into account the national and/or sectoral policies as applicable

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

Step 2 is not applicable to the proposed project activity, since the baseline is the continuation of open dumps where there is no fossil fuel consumption.

As per methodology ACM0001, we continue with step 3
Step 3: Step 2 and/or Step 3 of the approved version 05.2.1 of the "*Tool for demonstration and assessment of additionality*" shall be used to assess which of these alternatives should be excluded from further consideration (e.g. alternatives facing prohibitive barriers or those clearly economically unattractive).

For this PoA, and all CPAs that are to be included under the PoA, Step 2 of the tool: "*Investment Analysis*" will be followed, and step 3 of the tool will be skipped; please refer to section E.5 below for all details on how the assessment will be done. The outcome of this analysis per CPA will depend upon the

economic comparison between the identified benchmark value for the CPA and the project IRR/NPV value of the project activity without CDM revenue.

> ***Outcome of Step 2 of the Tool*:** If after the analysis it is concluded that: (1) the proposed CPA CDM project activity is unlikely to be the most financially/economically attractive (as per Step 2c para 10a of the tool) or is unlikely to be financially/economically attractive (as per Step 2c para 10b of the tool), then proceed to Step 4 of the tool (Common practice analysis).
>
> ***Step 4 of the Tool: Common practice analysis***
> Please see section E.5 below for complete analysis, as per the *Guidelines on Common Practice (EB63 Annex 12)*.
>
> ***Outcome of Step 4 of the Tool*:** as per the section below, the outcome of the stepwise approach is that the CPAs under the PoA are not the common practice for landfill sites in Brazil.

As per methodology ACM0001, we continue with step 4
Step 4: Where more than one credible and plausible alternative remains, project participants shall, as a conservative assumption, use the alternative baseline scenario that results in the lowest baseline emissions as the most likely scenario. The least emission alternative will be identified for each component of the baseline scenario. In assessing these scenarios, any regulatory or contractual requirements should be taken into consideration.

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

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

E.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the CPA being included as registered PoA (assessment and demonstration of additionality of CPA):

E.5.1. Assessment and demonstration of additionality for a typical CPA:

The following steps from the *Tool for the demonstration and assessment of additionality* are taken to demonstrate the additionality of the CPA, as per requirements of methodology ACM0001:

Assessment and demonstration of additionality

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

Sub-step 1a. Define alternatives to the CPA:
All realistic and credible alternatives to the project activity were described in section **E.4**.

Sub-step 1b. Consistency with mandatory laws and regulations:
As mentioned in the previous section, all scenarios described earlier are consistent with Brazilian laws and regulations

According to methodology ACM0001 Step 2 and/or Step 3 of the latest approved version of the "*Tool for demonstration and assessment of additionality*" shall be used to assess which of these alternatives should be excluded from further consideration (e.g. alternatives facing prohibitive barriers or those clearly economically unattractive). Therefore, for all CPAs under this PoA step 2 of the "*Tool for demonstration and assessment of additionality*" is followed, Investment Analysis.

Step 2. Investment Analysis

Sub-step 2a. Determine appropriate analysis method
In addition to CDM related income, some CPAs under the Caixa Landfill Gas Project will generate electricity, and/or will produce revenues from supplying consumers through a natural gas distribution grid, bringing additional revenues to the project activity. However, the investment required to implement such a system and the related operation and maintenance expenses may outweigh any potential revenues. Therefore this step of the additionality tool will be applied to every CPA under the PoA.

If a CPA will only implement a landfill gas collection and flaring system, the CDM project activity and alternatives generate no financial income other than CDM revenues, then Option I of the alternative investment methods will be applied, meaning simple cost analysis. Otherwise an investment comparison analysis or a benchmark analysis will be applied. Therefore:

Outcome of step 2a:
Scenario 1: CPAs with LFG flaring only.
Sub-step 2b*: Option I. Apply simple cost analysis*

Scenario2: CPAs with electricity generation and/or supply of gas to consumers through natural gas distribution grid.
Sub-step 2b. *– Option II. Apply investment comparison analysis*
Sub-step 2b*. – Option III. Apply benchmark analysis*

IRR or NPV will be used in each CPA in order to perform investment comparison analysis, and when a project has all components: flaring, energy generation, and supply of gas to consumers, the project shall apply benchmark analysis.

When benchmark analysis is to be used in assessing the additionality of a CPA, the benchmark used will be derived from government bond rates, increased by a suitable risk premium to reflect private investment and/or the project type, as substantiated by an independent (financial) expert or documented by official publicly available financial data.

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

Step 4. Common Practice Analysis

The common practice in Brazil as demonstrated in the section below, outside of projects already under the CDM, is the baseline scenario: atmospheric release of LFG

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

Following the stepwise approach from the *Guidelines on Common Practice (EB63 Annex 12)*, we have that:

Step 1: Calculate applicable output (goods or services) range

As mentioned above, the expected service of all CPAs under this PoA is the implementation of sanitary landfills in Brazil where municipal solid waste can be safely deposited.

Outcome of step 1: The applicable service of any CPA is that of a controlled site where municipal solid waste can be safely deposited.

Step 2: In the applicable geographical area, identify all plants that deliver the same output or capacity. Note their number N_{all}.

The applicable geographical area is Brazil.

According to the report by Brazil's Pesquisa Nacional de Saneamento Básico 2000 (PNSB 2000), the main official source of information regarding solid urban waste in the country, in Brazil 228,413 tons of solid waste are produced daily, averaging 1.35 kg daily per capita. This situation is a bit alarming, since a significant fraction of the waste produced in the country is disposed in open dumps, which do not have any sort of infrastructure to avoid environmental hazards.

As mentioned in section A.2 according to the first National GHG Emissions inventory conducted by the Ministry of Science and Technology[25], Brazil has over 6,000 waste depositing sites, receiving over 60,000 tons of waste per day.

The most recent statistic on municipal solid waste (MSW) is published by Associação Brasileira de Empresas de Limpeza Pública e Resíduos Especiais (ABRELPE). According to their most recent annual report (Panorama dos Resíduos Sólidos no Brasil – 2007), final disposal of MSW data obtained from 220 cities in Brazil (population >200,000) showed that only 38.6% of the cities sampled uses sanitary landfills as the final destination of their MSW. Overall, 61.4% of Brazilian cities do not dispose their MSW in a proper facility (Figure 2).

[25] Ministry of Science and Technology, First Brazilian Inventory of Anthropogenic Greenhouse Gas emissions, "Methane Emissions from waste treatment and disposal", 2002, page 15. Available at: http://www.bvsde.paho.org/bvsacd/cd25/methane.pdf

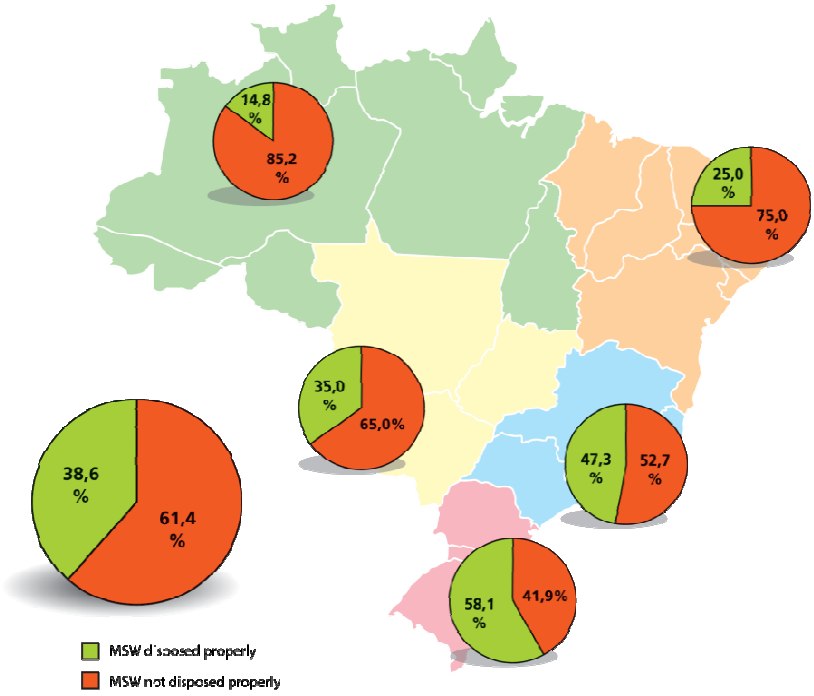

Figure 2 Final disposal of MSW in Brazil, according to projections made by ABRELPE.

As for the percentage of cities that do use sanitary landfills, as per the Brazil Country Profile published by Methane to Markets, very few have gas recovery systems, much less energy generation or distribution to consumers through a natural gas distribution network; the ones that do have gas recovery and energy generation are projects under the CDM. This can also be corroborated by analyzing the *Diagnóstico do Manejo de Resíduos Sólidos Urbanos* elaborated by the Brazilian Ministry of the Cities in 2007[26].

According to this report, which considers a sample of the major municipalities of the country, we have that:
- Only 37.1% (corresponding to 99 landfill sites) of the final waste disposal units in the sample corresponded to sanitary landfills, (Diagnóstico do Manejo de Resíduos Sólidos Urbanos, table 6.14, page 130).

Following the *Guidelines on Common Practice (EB63 Annex 12)*, we have that from the representative sample included in the above mentioned report, and disregarding those sites that within this sample indicated to use the gas and are already CDM projects (adding up to 10), there are 89 sites that deliver the same service: sanitary landfills where municipal solid waste can be safely deposited.

Outcome of step 2: N_{all} is equal to 89; all sites produce the same service: sanitary landfill sites where municipal solid waste is safely deposited.

Step 3: Within plants identified in Step 2, identify those that apply technologies different than the technology applied in the proposed project activity. Note their number N_{diff}.

[26] Sistema Nacional de Informações sobre Saneamento: diagnóstico do manejo de resíduos sólidos urbanos – 2007. Brasília: MCIDADES.SNSA, 2009. Available at http://www.snis.gov.br/

As per the definition of "different technologies" in the Guidelines, we have that:

Different technologies are technologies that deliver the same output (goods or services) and differ by at least one of the following:
(i) Energy source/fuel;
(ii) Feed stock;
(iii) Size of installation: Micro, Small or Large;
(iv) Investment climate in the date of the investment decision
(v) Other features, inter alia: Unit cost of output (unit costs are considered different if they differ by at least 20 %)

As has been explained above, for all CPAs under this PoA, projects are considered "different technologies" due to the added feature of the gas collection system and gas alternative use. The gas collection and use system, as explained under point (v) "other features" is an added cost to the project activity that generates the same service as any other landfill project that simply vents gas into the atmosphere. As demonstrated by the evidence provided out of those 89 sites there are only 7 (2 of which are withdrawn CDM projects[27]) which say do have some use of the gas. Hence the number of sites with "different technologies" adds up to 82.

Outcome of step 3: N_{diff} = 82.

Step 4: Calculate factor $F=1-N_{diff}/N_{all}$ representing the share of plants using technology similar to the technology used in the proposed project activity in all plants that deliver the same output or capacity as the proposed project activity

In this case F=1-(82/89) = 0.0786, meaning there are only 7 sites with such service and gas collection system among 89 facilities.

As per the guidance, none of the proposed CPAs under the PoA are the common practice within the waste sector in Brazil because under the first condition the factor F is smaller than 0.2.

Therefore the outcome of the stepwise approach is that the CPAs under the PoA are not the common practice for landfill sites in Brazil.

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

There are no similar activities happening in Brazil outside the CDM[28] as there are no regulatory incentives and the sale of electricity alone does not cover the additional costs of a biogas capture, flaring, and electricity generation system. Those that are implemented have been installed due to incentives of the CDM.

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

Hence this type of technology for gas collection and use is not widely spread in the host country and the landfills that operate this way represent only a very small portion of the total existing landfills (5 out of over 6,000 estimated waste depositing sites).

Moreover, the installation of a LFG capture and flaring system/or electricity generation, /or for supply to consumers, are very costly for the landfill operator and bring no financial compensation. Therefore, this kind of project is only possible with CDM revenues and is not to be considered as a business as usual activity.

E.5.2. Key criteria and data for assessing additionality of a CPA:

CPAs must demonstrate additionality based on the analysis contained in the previous section and should meet the following criteria:

- **There should not be any existing operating LFG collection system** – this must be documented in CPA with all relevant support documentation (photos, system design documents, etc);

- **The costs for installation of the LFG collection and use systems should be prohibitive without CDM revenues** – all costs and revenues obtained in all scenarios should be documented in each CPA, with price quotes from established vendors supporting the financial analysis.

    - In the case of flaring only (without electricity and/or use envisioned at any time), the simple cost analysis will be used. The additional investment cost of the CPA will thus justify the CPA additionality.
    - In the case of electricity generation and/or supply to consumers through a natural gas distribution network, as stated in paragraph E.5.1 above, the investment comparison or IRR based benchmark analysis will be used for assessing the CPAs' additionality.

E.6. Estimation of Emission reductions of a CPA:

E.6.1. Explanation of methodological choices, provided in the approved baseline and monitoring methodology applied, selected for a typical CPA:

In this PoA, emissions reductions achieved by each CPA will be calculated according the procedures described in the version 11 of approved methodology ACM0001 "Consolidated baseline methodology for landfill gas project activities" and its tools:

- "Tool for the demonstration and assessment of additionality" – Version 05.2.1;
- "Tool for determining methane emissions avoided from disposal of waste at a solid waste disposal site" – Version 05.1.0;
- "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" – Version 01;
- "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" – Version 02;
- "Tool to determine project emissions from flaring gases containing methane" – *EB28, Annex 13*.
- "Tool to calculate the emission factor for an electricity system" – Version 02.2.1

This methodology is applicable to landfill gas capture project activities, where the baseline scenario is the partial or total atmospheric release of the gas and the project activities include situations such as:

(a) The captured gas is flared (scenario #1); and/or

(b) The captured gas is used to produce energy (e.g. electricity). (scenario #2) Emission reductions can be claimed for thermal energy generation, only if the LFG displaces use of fóssil fuel either in a boiler or in an air heater. For claiming emission reductions for other thermal energy equipment (e.g. kiln), project proponents may submit a revision to this methodology;

(c) The captured gas is used to supply consumers through natural gas distribution grid (scenario #3).

If a CPA covers scenario #3 – No emissions reductions will be claimed for displacing natural gas, hence project activities will not use approved methodology AM0053.

E.6.2. Equations, including fixed parametric values, to be used for calculation of emission reductions of a CPA:

In this PoA, emissions reductions are calculated according to version 11 of approved methodology ACM0001 and its recommended tools.

Baseline emissions

Baseline emissions are calculated with the following equation:

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

Where:

BE_y = Baseline emissions in year y (tCO_2e)

$MD_{project,y}$ = The amount of methane that would have been destroyed/combusted during the year, in tonnes of methane (tCH_4) in project scenario

$MD_{BL,y}$ = The amount of methane that would have been destroyed/combusted during the year in the absence of the project due to regulatory and/or contractual requirement, in tonnes of methane (tCH_4)

GWP_{CH4} = Global Warming Potential value for methane for the first commitment period is 21 tCO_2e/tCH_4

$EL_{LFG,y}$ = Net quantity of electricity produced using LFG, which in the absence of the project activity would have been produced by power plants connected to the grid or by an on-site/off-site fossil fuel based captive power generation, during year *y*, in megawatt hours (MWh)

$CEF_{elecy,BL,y}$ = CO_2 emissions intensity of the baseline source of electricity displaced, in tCO_2e/MWh This is estimated as per the section *Determination of* $CEF_{elec,BL,y}$ below

$ET_{LFG,y}$ = The quantity of thermal energy produced utilizing the landfill gas, which in the absence of the project activity would have been produced from onsite/offsite fossil fuel fired boiler/air heater, during the year *y* in TJ

$CEF_{ther,BL,y}$ = CO_2 emissions intensity of the fuel used by boiler/air heater to generate thermal energy which is displaced by LFG based thermal energy generation, in tCO_2e/TJ.

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

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

- *Guidance on estimating AF:*

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

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

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

Ex-Ante Baseline emissions

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

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

These will be calculated considering the following equation:

$$MD_{project,y} = BE_{CH4,SWDS,y}/GWP_{CH4} \quad \textbf{(4)}$$

Where:

$BE_{CH4,SWDS,y}$ = Methane generation from the landfill in the absence of the project activity at year *y* (tCO_2e), calculated as per the "*Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site*". The tool estimates methane generation adjusted for, using adjustment factor (f) any landfill gas in the baseline that would have been captured and destroyed to comply with relevant regulations or contractual requirements, or to address safety and odor concerns. As this is already accounted for

in equation 2, "f" in the tool shall be assigned a value 0

$$BE_{CH4,SWDS,y} = \varphi \cdot (1-f) \cdot GWP_{CH4} \cdot (1-OX) \cdot \frac{16}{12} \cdot F \cdot DOC_f \cdot MCF \cdot \sum_{x=1}^{y} \sum_{j} W_{j,x} \cdot DOC_j \cdot e^{-k_j \cdot (y-x)} \cdot \left(1-e^{-k_j}\right)($$

5)

Where:

$BE_{CH4,SWDS,y}$	=	Methane emissions avoided during the year y from preventing disposal at the solid waste disposal site (SWDS) during the period from the start of the project activity to the end of the year y (tCO_2e)
φ	=	Model correction factor to account for model uncertainties (0.9)
f	=	Fraction of methane captured at the SWDS and flared, combusted or used in another manner
GWP_{CH4}	=	Global Warming Potential (GWP) of methane, valid for the relevant commitment period
OX	=	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)
F	=	Fraction of methane in the SWDS gas (volume fraction) (0.5)
DOC_f	=	Fraction of degradable organic carbon (DOC) that can decompose
MCF	=	Methane correction factor
$W_{j,x}$	=	Amount of organic waste type j prevented from disposal in the SWDS in the year x (tonnes)
DOC_j	=	Fraction of degradable organic carbon (by weight) in the waste type j
k_j	=	Decay rate for the waste type j
j	=	Waste type category (index)
x	=	Year during the crediting period: x runs from the first year of the crediting period (x = 1) to the year y for which avoided emissions are calculated (x = y)
y	=	Year for which methane emissions are calculated

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

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

Where,

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

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

Determination of $CEF_{elec,BL,y}$

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

Ex-Post Baseline emissions

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

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

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

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

$$MD_{project,y} = MD_{flared,y} + MD_{electricity,y} + MD_{thermal,y} + MD_{PL,y} \quad \textbf{(7)}$$

Where:

$MD_{flared,y}$ = Quantity of methane destroyed by flaring (tCH_4)
$MD_{electricity,y}$ = Quantity of methane destroyed by generation of electricity (tCH_4)
$MD_{thermal,y}$ = Quantity of methane destroyed for the generation of thermal energy (tCH_4)
$MD_{PL,y}$ = Quantity of methane sent to the pipeline for feeding to the natural gas distribution network (tCH_4)

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

$$MD_{flared,y} = \{LFG_{flare,y} * w_{CH4,y} * D_{CH4}) - (PE_{flare,y} / \mathrm{GWP}_{CH4}) \quad \textbf{(8)}$$

Where:

$LFG_{flare,y}$ = Quantity of landfill gas fed to the flare(s) during the year measured in cubic meters (m^3)
$w_{CH4,y}$ = Average methane fraction of the landfill gas as measured[29] during the year and expressed as a fraction (in m^3 CH_4/m^3 LFG)

[29] Methane fraction of the landfill gas and LFG flow have to be measured on same basis (either wet or dry). In case the "Tool to determine project emissions from flaring gases containing methane" is used, follow the standard

D_{CH4} = Methane density expressed in tonnes of methane per cubic meter of methane (tCH_4/m^3CH_4)[30]

$PE_{flare,y}$ = Project emissions from flaring of the residual gas stream in year y (tCO2e) determined following the procedure described in the "*Tool to determine project emissions from flaring gases containing methane*". If methane is flared through more than one flare on a CPA, the $PE_{flare,y}$ shall be determined for each flare

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

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

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

(b) Continuous monitoring of the methane destruction efficiency of the flare (flare efficiency).

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

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

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

$$MD_{electricity,y} = LFG_{electricity,y} * w_{CH4,y} * D_{CH4} \quad \textbf{(9)}$$

Where:

$MD_{electricity,y}$ = Quantity of methane destroyed by generation of electricity

$LFG_{electricity,y}$ = Quantity of landfill gas fed into electricity generator

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

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

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

approaches to convert the flow on wet basis to dry basis. For example, refer to the procedures provided in the book "Fundamentals of Classical Thermodynamics"; Gordon J. Van Wylen, Richard E. Sonntag and Claus Borgnakke; 4º Edition, 1994, John Wiley & Sons, Inc.

[30] At standard temperature and pressure (0 degree Celsius and 1,013 bar) the density of methane is 0.0007168 tCH_4/m^3CH_4.

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

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

Project Emissions:

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

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

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

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

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

Where:
$EC_{PJ,j,y}$ Quantity of electricity consumed by the project activity during the year MWh
$EF_{EL,j,y}$ Brazilian grid emission factor tCO_2/MWh (same as $CEF_{elecy,BL,y}$ mentioned above)
$TDL_{j,y}$ Average technical transmission and distribution losses in the grid in year y for the voltage level at which electricity is obtained from the grid at the project site.

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

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

Where
$FC_{i,j,y}$ is the fossil fuel combusted of type i, in the process j, for the year y
$COEF_{j,y}$ is the CO_2 emission coefficient of the fossil fuel i

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

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

Where

$NCV_{i,y}$ Is the weighted average net calorific value of the fuel type i
EF_{CO2y} ` Is the weighted average CO_2 emission factor of fuel type j

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

Leakage

No leakage effects need to be accounted under this methodology.

Emission Reductions

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y \quad \textbf{(15)}$$

Where:
ER_y = Emission reductions in year *y* (tCO_2e/yr)
BE_y = Baseline emissions in year *y* (tCO2e/yr)
PE_y = Project emissions in year *y* (tCO_2/yr)

E.6.3. Data and parameters that are to be reported in CDM-CPA-DD form:

Data / Parameter:	**Regulatory requirements relating to landfill gas**
Data unit:	Norms
Description:	Regulatory requirements relating to landfill gas from ABNT NBR (*Associação Brasileira de Normas Tecnicas* / Brazilian Association of Technical Norms) and (*Norma Brasileira* / Brazilian Norm), including: ABNT NBR 8419:1992 Versão Corrigida: 1996. *Apresentação de projetos de aterros sanitários de resíduos sólidos urbanos* / Introduction of Projects for Sanitary Landfills of Municipal Solid Waste.
Source of data used:	Publicly available information
Value applied:	Will be reflected in the AF, as explained in section E.6.2. above
Justification of the choice of data or description of measurement methods and procedures actually applied :	The information will be recorded, to use it for changes in the adjustment factor (AF) or directly to $MD_{BL,y}$ for all CPAs at the renewal of the credit period.
Any comment:	N/A

Data / Parameter:	**GWP_{CH4}**
Data unit:	t CO_2 / t CH_4
Description:	Global Warming Potential of CH_4
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	21
Justification of the choice of data or description of measurement methods and procedures actually applied :	21 for the first commitment period. Shall be updated according to any future COP/MOP decisions.
Any comment:	N/A

Data / Parameter:	**D_{CH4}**
Data unit:	t CH_4 / m^3 CH_4
Description:	Methane density
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	0.0007168
Justification of the choice of data or description of measurement methods and procedures actually applied :	At standard T and P (0° C and 1,013 bar) the density of methane is 0.0007168 t CH_4 / m^3 CH_4
Any comment:	N/A

Data / Parameter:	**$BE_{CH4,SWDS,y}$**
Data unit:	tCO_2e

Description:	Methane generation from the landfill in the absence of the project activity at year y
Source of data used:	Calculated as per the "Tool for determining methane emissions avoided from disposal of waste at a solid waste disposal site" – Version 05.1.0
Value applied	To be defined for each CPA
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the "Tool for determining methane emissions avoided from disposal of waste at a solid waste disposal site" – Version 05.1.0
Any comment:	Used for ex-ante estimation of the amount of methane that would have been destroyed/combusted during the year

Data / Parameter:	MD_{Hist}
Data unit:	tCH_4
Description:	Amount of methane destroyed historically for the previous year before the start of project activity.
Source of data used:	Project Implementer
Value applied	To be defined for each CPA
Justification of the choice of data or description of measurement methods and procedures actually applied :	To be explained for each CPA
Any comment:	This parameter will be used for the estimation of AF for those CPAs that need its estimate

Data / Parameter:	MG_{Hist}
Data unit:	tCH_4
Description:	Amount of methane generated historically for the previous year before the start of project activity
Source of data used:	Project Implementer
Value applied	To be defined for each CPA
Justification of the choice of data or description of measurement methods and procedures actually applied :	To be explained for each CPA, and calculated as per the "Tool for determining methane emissions avoided from disposal of waste at a solid waste disposal site" – Version 05.1.0
Any comment:	This parameter will be used for the estimation of AF for those CPAs that need its estimate

Data / Parameter:	**φ**
Data unit:	-
Description:	Model correction factor to account for model uncertainties
Source of data used:	Assumed as per the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site"

Value applied:	0.9
Justification of the choice of data or description of measurement methods and procedures actually applied :	Oonk et al. (1994) have validated several landfill gas models based on 17 realized landfill gas projects. The mean relative error of multi-phase models was assessed to be 18%. Given the uncertainties associated with the model and in order to estimate emission reductions in a conservative manner, a discount of 10% is applied to the model results.
Any comment:	N/A

Data / Parameter:	**OX**
Data unit:	-
Description:	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)
Source of data used:	Assumed as per the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" version 05.1.0
Value applied:	Use 0.1 for managed solid waste disposal sites that are covered with oxidizing material such as soil or compost. Use 0 for other types of solid waste disposal sites.
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" version 05.1.0
Any comment:	Used for ex ante estimation of the amount of methane generated

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

Data / Parameter:	**DOC_f**
Data unit:	-
Description:	Fraction of degradable organic carbon (DOC) that can decompose
Source of data used:	Assumed as per the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" version 05.1.0
Value applied:	0.5
Justification of the	As per the "Tool to determine methane emissions avoided from disposal of

choice of data or description of measurement methods and procedures actually applied :	waste at a solid waste disposal site" version 05.1.0
Any comment:	Used for ex ante estimation of the amount of methane generated

Data / Parameter:	**MCF**
Data unit:	-
Description:	Methane Correction factor
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
Value applied:	To be defined for each CPA
Justification of the choice of data or description of measurement methods and procedures actually applied :	Determined for each CPA according to the following values for MCF, as per the "*Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site*" version 05.1.0:
Any comment:	The methane correction factor (MCF) accounts for the fact that unmanaged SWDS produce less methane from a given amount of waste than managed SWDS, because a larger fraction of waste decomposes aerobically in the top layers of unmanaged SWDS. Used for ex ante estimation of the amount of methane generated

SWDS condition	**MCF Value**
anaerobic managed	1,0
semi-aerobic	0,5
unmanaged (deep > 5m)	0,8
unmanaged-shallow (deep < 5m)	0,4

Data / Parameter:	**DOC_j**
Data unit:	-
Description:	Fraction of degradable organic carbon (by weight) in the waste type j
Source of data used:	IPCC 2006 Guidelines for National Greenhouse Gas Inventories (Volume 5, Tables 2.4 and 2.5)
Value applied:	
Justification of the choice of data or description of measurement methods	As per the "*Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site*" version 05.1.0

Waste type j	**DOC_j (% wet waste)**	**DOC_j (% dry waste)**
Wood and wood products	43	50
Pulp, paper and cardboard (other than sludge)	40	44
Food, food waste, beverages and tobacco (other than sludge)	15	38
Textiles	24	30
Garden, yard and park waste	20	49
Glass, plastic, metal, other inert waste	0	0

and procedures actually applied :	
Any comment:	N/A

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

Waste type	k_j
Pulp, paper, cardboard and textiles	0,070
Wood, wood products and straw	0,035
Other (non-food) organic putrescible garden and park waste	0,170
Food, food waste, sewage sludge, beverages and tobacco	0,400

Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the "*Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site*" version 05.1.0 and per climatic conditions in Brazil
Any comment:	The values applied are for tropical (MAT> 20°C) and wet (MAP > 1000m) conditions. Source: INMET 2007.

Data / Parameter:	E_{DS}
Data unit:	%
Description:	Efficiency of the degassing system which will be installed in the CPAs
Source of data used:	USEPA
Value applied:	50%
Justification of the choice of data or description of measurement methods and procedures actually applied :	Conservative value. This value will be applied to all CPAs under this PoA
Any comment:	Used for ex-ante estimation of the amount of methane collected

Data / Parameter:	$P_{n,j,x}$
Data unit:	%
Description:	Weight fraction of the waste type *j* in the sample *n* collected during the year *x*
Source of data used:	Sample measurements by project developer, or obtained from previous studies.
Value applied:	To be defined for each CPA

Justification of the choice of data or description of measurement methods and procedures actually applied :	Based on specific waste composition study for the site of the CPA
Any comment:	Used to estimate the ex-ante estimate of methane generated

Parameters to be reported in case CPA applies scenario 3:

Data / Parameter:	η_{ugf}
Data unit:	-
Description:	Nameplate efficiency of the upgrading facility
Source of data used:	Provided by the manufacturer
Value applied:	To be defined for each CPA
Justification of the choice of data or description of measurement methods and procedures actually applied :	As per the manufacturer guidelines
Any comment:	Used to estimate the ex-ante estimate of upgraded biogas, as a product of plant efficiency and estimated amount of vented or flared gas.

E.7. Application of the monitoring methodology and description of the monitoring plan:

E.7.1. Data and parameters to be monitored by each CPA:

The following parameters will be monitored by each CPA and used for calculated emissions reductions. Values applied will be dependent on the individual CPA.

Data / Parameter:	$LFG_{total,y}$
Data unit:	Nm^3
Description:	Total amount of landfill gas captured at normal temperature and pressure
Source of data to be used:	From project implementer, measured on site
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be defined for each CPA
Description of measurement methods and procedures to be applied:	Measured continuously (average value in a time interval not greater than an hour) by flow meter continuously; data to be aggregated monthly and yearly.
QA/QC procedures to be applied:	Flow meters shall be subject to a regular maintenance and testing regime, based on the manufacturer's recommended schedule and procedures, to ensure accuracy
Any comment:	Data will be kept for 2 years after end of crediting period

Data / Parameter:	$LFG_{flare,y}$
Data unit:	m^3
Description:	Flow of LFG to the flare. Amount of landfill gas flared at normal temperature and pressure
Source of data to be used:	Measured on site
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be defined for each CPA
Description of measurement methods and procedures to be applied:	Measured continuously with a flow meter (average value in a time interval not greater than an hour), data to be aggregated monthly and yearly per flare
QA/QC procedures to be applied:	Flow meters shall be subject to a regular maintenance and testing regime, based on the manufacturer's recommended schedule and procedures, to ensure accuracy
Any comment:	$LFG_{flare,y}$ is considered to be equivalent to the variable $FV_{RG,h}$ (volumetric flow rate of the residual gas) as described in the "*Tool to determine Project emissions from flaring gases containing methane*" used to determine project emissions from flaring. Data will be kept for 2 years after end of crediting period

Data / Parameter:	$LFG_{electricity,y}$
Data unit:	m^3
Description:	Amount of LFG sent to power plant at Normal Temperature and Pressure
Source of data:	Measured on site
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be defined for each CPA
Description of Measurement methods and procedures to be applied:	Measured with a flow meter and monitored continuously by the Project Developer. The flow meter will be maintained and calibrated regularly in line with the manufacturer's requirements. Data to be aggregated monthly and yearly.
QA/QC procedures:	Flow meters will be subject to a regular maintenance and testing regime to ensure accuracy.
Any comment:	Data will be kept for 2 years after end of crediting period

Data / Parameter:	$PE_{flare,y}$
Data unit:	t CO_2e
Description:	Project emissions from flaring of the residual gas stream in year y
Source of data to be used:	Calculated as per the "Tool to determine project emissions from flaring gases containing Methane"
Value of data applied	To be defined for each CPA

for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Calculated as per the "*Tool to determine Project emissions from flaring gases containing Methane*".
QA/QC procedures to be applied:	As per the "*Tool to determine Project emissions from flaring gases containing Methane*"
Any comment:	Data will be kept for 2 years after end of crediting period

Data / Parameter:	$w_{CH4,y}$
Data unit:	m^3 CH_4 / m^3 LFG
Description:	Methane fraction in the landfill gas
Source of data to be used:	Measured by continuous gas quality analyzer.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be defined for each CPA
Description of measurement methods and procedures to be applied:	Measured continuously (average value in a time interval not greater than an hour) with a gas analyser by the Project Implementer; data to be aggregated monthly and yearly
QA/QC procedures to be applied:	The gas analyzer shall be subjected to regular maintenance and calibration, based on the manufacturer's recommended schedule and procedures, to ensure accuracy
Any comment:	$w_{CH4,\,y}$ is considered to be equivalent to the variable $fv_{CH4,h}$ (volumetric fraction of the component CH_4 in the landfill gas in the hour h) as described in the "*Tool to determine Project emissions from flaring gases containing methane*". Data will be kept for 2 years after end of crediting period

Data / Parameter:	**T**
Data unit:	^oC
Description:	Temperature of the landfill gas
Source of data to be used:	Project implementer
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be defined for each CPA
Description of measurement methods and procedures to be applied:	Measured continuously to determine the density of methane DCH_4. No separate monitoring is necessary when using flow meters that automatically measure the temperature and pressure, expressing LFG volumes in normalized cubic meters
QA/QC procedures to	Measuring instruments shall be subject to a regular maintenance and testing

be applied:	regime, based on the manufacturer's recommendations
Any comment:	Data will be kept for 2 years after end of crediting period

Data / Parameter:	**P**
Data unit:	Pa
Description:	Pressure of the landfill gas
Source of data to be used:	Project implementer
Value of data applied for the purpose of calculating expected emission reductions in section B.5	N/A
Description of measurement methods and procedures to be applied:	Measured continuously to determine the density of methane DCH_4. No separate monitoring is necessary when using flow meters that automatically measure the temperature and pressure, expressing LFG volumes in normalized cubic meters
QA/QC procedures to be applied:	Measuring instruments shall be subject to a regular maintenance and testing regime, based on the manufacturer's recommendations
Any comment:	Data will be kept for 2 years after end of crediting period

Data / Parameter:	**EL_{LFG}**
Data unit:	MWh
Description:	Net amount of electricity generated using LFG.
Source of data:	Project Implementer
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be defined for each CPA
Description of measurement methods and procedures to be applied:	Electricity will be measured continuously using an electricity meter.
QA/QC procedures:	Electricity meter will be subject to regular maintenance and testing in accordance with supplier recommendations to ensure accuracy.
Any comment:	Required to estimate the emission reductions from electricity generation from LFG.

Data / Parameter:	$EF_{grid, CM,y}$
Data unit:	tCO_2/MWh
Description:	Combined Margin CO_2 emission factor for the project electricity system in year y
Source of data to be used:	Calculated using the *Tool to calculate the emission factor for an electricity system*, based on published data from the Brazilian Ministry of Science and Technology (Brazil DNA)
Value of data applied for the purpose of calculating expected emission reductions in	To be defined for each CPA

section B.5	
Description of measurement methods and procedures to be applied:	Calculated as per the "*Tool to calculate the emission factor for an electricity system*" version 02.2.1.
QA/QC procedures to be used:	This value will be updated yearly as per the monitored data EFgrid,BM,y and EFgrid,OM,y using the latest published data from Brazil's DNA.
Any comment:	$EF_{grid, CM,y} = CEF_{elecy,BL,y} = EF_{EL,j,y}$ This value will be reported within each CPA, and will be monitored ex-post. Data will be kept for two years after end of crediting period

Data / Parameter:	$EF_{grid, BM,y}$
Data unit:	tCO_2/MWh
Description:	Build margin CO_2 emission factor for the project electricity system in year *y*
Source of data to be used:	Based on yearly published data from the Brazilian Ministry of Science and Technology (Brazilian DNA)
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be defined for each CPA
Description of measurement methods and procedures to be applied:	Monitored yearly using published data from the Brazilian Ministry of Science and Technology (Brazil DNA)
QA/QC procedures to be used:	This value will be updated and monitored as per the latest published data from Brazil's DNA.
Any comment:	This value will be reported within each CPA, and will be monitored ex-post. Data will be kept for two years after end of crediting period

Data / Parameter:	$EF_{grid,OM,y}$
Data unit:	tCO_2/MWh
Description:	Operating margin CO_2 emission factor for the project electricity system in year *y*
Source of data to be used:	Based on yearly published data from the Brazilian Ministry of Science and Technology (Brazilian DNA)
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be defined for each CPA
Description of measurement methods and procedures to be applied:	Monitored yearly using published data from the Brazilian Ministry of Science and Technology (Brazil DNA). The dispatch data analysis is used, option (C) of the "*Tool to calculate the emission factor for an electricity system*".
QA/QC procedures to be used:	This value will be updated and monitored as per the latest published data from Brazil's DNA.
Any comment:	This value will be reported within each CPA, and will be monitored ex-post. Data will be kept for two years after end of crediting period

Data / Parameter:	Operation of the energy plant
Data unit:	Hours
Description:	Operation of the energy plant(s) in a year y
Source of data to be used:	Project participants
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be defined for each CPA
Description of measurement methods and procedures to be applied:	Data will be recorded annually by the Project Implementer to ensure methane destruction is claimed for methane used in electricity plant when it is operational.
QA/QC procedures to be applied:	Equipment will be maintained in line with manufacturer's recommendations
Any comment:	Data will be kept for at least two years after the end of the crediting period

Data / Parameter:	$PE_{EC,y}$
Data unit:	tCO_2
Description:	Project emissions from electricity consumption by the project activity during the year y
Source of data to be used:	Calculated as per the "*Tool to calculate baseline, project and/or leakage emissions from electricity consumption*" version 01, using electricity consumption estimates based on technology used and operating hours
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be defined for each CPA
Description of measurement methods and procedures to be applied:	As per the "*Tool to calculate baseline, project and/or leakage emissions from electricity consumption*" version 01.
QA/QC procedures to be applied:	As per the "*Tool to calculate baseline, project and/or leakage emissions from electricity consumption*" version 01
Any comment:	Data will be kept for at least two years after the end of the crediting period

Data / Parameter:	$PE_{FC,j,y}$
Data unit:	t CO_2e
Description:	Project emissions from fossil fuel combustion
Source of data to be used:	Calculated as per the "*Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion*" , using monitored data for a similar project
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be defined for each CPA

Description of measurement methods and procedures to be applied:	As per the "*Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion*" version 02
QA/QC procedures to be applied:	As per the "*Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion*"
Any comment:	Data will be kept for at least two years after the end of the crediting period

Data / Parameter:	**$MG_{PR,y}$**
Data unit:	tCH_4
Description:	Amount of methane generated during year y of the project activity
Source of data to be used:	Project implementers
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Estimated using the actual amount of waste disposed in the landfill as per the latest version of the "Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site" version 05.1.0
Description of measurement methods and procedures to be applied:	Annually
QA/QC procedures to be applied:	As per the latest version of the "*Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site*"
Any comment:	This will be monitored only by CPAs where a specific system for collection and destruction of methane is mandated by regulatory or contractual requirements or is undertaken for other reasons

Data / Parameter:	**T_{flare}**
Data unit:	°C
Description:	Temperature in the exhaust gas of the flare
Source of data to be used:	Project Implementer
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be defined for each CPA
Description of measurement methods and procedures to be applied:	The temperature in the exhaust gas will be measured continuously with a type N thermocouple and continuously monitored as described in the "*Tool to determine project emissions from flaring gases containing methane*" EB 28 Annex 13.
QA/QC procedures to be used:	Measuring instruments will be subject to regular maintenance and testing regime, based on the manufacturer's recommendations
Any comment:	Required to determine adequate operation and operating hours of the flare. Data will be kept for at least two years after the end of the crediting period

Data / Parameter:	$t_{O2,h}$
Data unit:	--
Description:	Volumetric fraction of O_2 in the exhaust gas of the flare in the hour *h*
Source of data to be used:	Project Implementer
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be defined for each CPA
Description of measurement methods and procedures to be applied:	Monitored continuously as per the "*Tool to determine project emissions from flaring gases containing methane*". EB 28 Annex 13. A gas analyzer will be adopted. The gas analyzer will: 1) sample and analyze the methane, carbon dioxide and oxygen content of LFG, 2) provide continuous monitoring of the parameter and 3) transfer data to monitoring system for storage of the information
QA/QC procedures to be used:	Analyzers will be calibrated according to the manufacturer's recommendation. A zero check and a typical value check will be performed by comparison with a standard certified gas.
Any comment:	Monitoring of this parameter is due to continuous monitoring of the flare efficiency. Data will be kept for two years after end of crediting period.

Data / Parameter:	$fv_{CH4,h}$
Data unit:	--
Description:	Volumetric fraction of methane in the residual gas in the hour h
Source of data to be used:	Project implementer
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be defined for each CPA
Description of measurement methods and procedures to be applied:	Monitored continuously as per the "*Tool to determine project emissions from flaring gases containing methane*". EB 28 Annex 13. Ensure that the same basis (dry or wet) is considered for this measurement and the measurement of the volumetric flow rate of the residual gas ($FV_{RG,h}$) when the residual gas temperature exceeds 60 ºC
QA/QC procedures to be applied:	Analyzers will be periodically calibrated according to the manufacturer's recommendation. A zero check and a typical value check will be performed by comparison with a standard certified gas.
Any comment:	$fv_{CH4,h}$ is considered to be equivalent to the variable $w_{CH4,\,y}$ (methane fraction in the landfill gas on a wet basis). Data will be kept for two years after end of crediting period

Data / Parameter:	$FV_{RG,h}$
Data unit:	m^3/h
Description:	Volumetric flow rate of the residual gas in dry basis at normal (NTP) conditions in the hour h

Source of data to be used:	Project implementer
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be defined for each CPA
Description of measurement methods and procedures to be applied:	Monitored continuously as per the "*Tool to determine project emissions from flaring gases containing methane*". EB 28 Annex 13. Ensure that the same basis (dry or wet) is considered for this measurement and the measurement of the volumetric fraction of methane in the residual gas ($\mathbf{fv}_{CH4,h}$) when the residual gas temperature exceeds 60 ºC.
QA/QC procedures to be applied:	Flow meters are to be periodically calibrated according to the manufacturer's recommendations.
Any comment:	$FV_{RG,h}$ is considered the equivalent of the variable $LFG_{flared,y}$ (Amount of landfill gas flared at normal temperature and pressure). Monitoring of this parameter is due to continuous monitoring of the flare efficiency. Data will be kept for two years after end of crediting period

Data / Parameter:	$\mathbf{fv}_{CH4,FG,h}$
Data unit:	Mg/m^3
Description:	Concentration of methane in the exhaust gas of the flare in dry basis at normal conditions in the hour h
Source of data to be used:	Project implementer
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be defined for each CPA
Description of measurement methods and procedures to be applied:	Monitored as per the "*Tool to determine project emissions from flaring gases containing methane*". EB 28 Annex 13. Continuously measured. Values to be averaged hourly or at a shorter time interval.
QA/QC procedures to be applied:	Analysers will be periodically calibrated according to manufacturer's recommendation. Zero check and typical value check will be performed by comparison with a standard gas.
Any comment:	Data will be kept for two years after end of crediting period

Data / Parameter:	$\mathbf{FC}_{i,j,y}$
Data unit:	Mass or volume unit per year (e.g. ton / yr or m3 / yr)
Description:	Quantity of fuel type i combusted in process j during the year y
Source of data to be used:	On-site measurements
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be defined for each CPA

Description of measurement methods and procedures to be applied:	Data will be monitored monthly and aggregated yearly, and the specific CPA will indicate the equipment used for measurement. As per the the "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion" version 02, the following options may be used: • Use either mass or volume meters. In cases where fuel is supplied from small daily tanks, rulers can be used to determine mass or volume of the fuel consumed, with the following conditions: The ruler gauge must be part of the daily tank and calibrated at least once a year and have a book of control for recording the measurements (on a daily basis or per shift); • Accessories such as transducers, sonar and piezoelectronic devices are accepted if they are properly calibrated with the ruler gauge and receiving a reasonable maintenance; • In case of daily tanks with pre-heaters for heavy oil, the calibration will be made with the system at typical operational conditions.
QA/QC procedures to be applied:	Equipment will be maintained in line with manufacturer's recommendations, and the consistency of metered fuel consumption quantities will be cross-checked with available purchase invoices from the financial records.
Any comment:	Required to calculate project emissions from fossil fuel combustion. Data will be kept for at least two years after the end of the crediting period

Data / Parameter:	$\mathbf{NCV_{i,y}}$
Data unit:	GJ/m^3
Description:	Weighted average net calorific value of fuel type *i* in year y
Source of data to be used:	Values from the fuel supplier will be used.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be defined for each CPA
Description of measurement methods and procedures to be applied:	Values provided by the fuel supplier. Undertaken in line with national or international fuel standards. The NCV will be obtained for each fuel delivery, from which weighted average annual values should be calculated.
QA/QC procedures to be applied:	Values will be verified to check that they are within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines. If the values fall below this range collect additional information from the testing laboratory to justify the outcome or conduct additional measurements.
Any comment:	Data will be kept for at least two years after the end of the crediting period

Data / Parameter:	$\mathbf{EF_{CO2,i,y}}$
Data unit:	tCO_2/GJ
Description:	Weighted average CO_2 emission factor of fuel type i in year y

Source of data to be used:	If available, values provided by fuel supplier, but if not available then IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of chapter 1 of Vol 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be defined for each CPA
Description of measurement methods and procedures to be applied:	As per the "*Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion*" version 2.
QA/QC procedures to be applied:	Will be checked against any future revision of IPCC Guidelines
Any comment:	

Data / Parameter:	**W_x**
Data unit:	Tons
Description:	Total amount of organic waste prevented from disposal in year x (tons)
Source of data to be used:	Project Implementers
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be defined for each CPA
Description of measurement methods and procedures to be applied:	Amounts of waste being deposited will be monitored continuously, and aggregated annually
QA/QC procedures to be applied:	As per the "*Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site*" Version 0.5.1.0
Any comment:	This will be monitored only by CPAs where the variable $MG_{PR,y}$ needs to be monitored. Data will be kept for at least two years after the end of the crediting period

Data / Parameter:	**z**
Data unit:	**-**
Description:	Number of samples collected during the year x
Source of data used:	Sample measurements done by Project Implementers, or obtained from relevant studies applicable to the site**.**
Value of data applied for the purpose of calculating expected emission reductions in section B.5:	N/A

Description of measurement methods and procedures to be applied:	The parameter will be measured by the project participant. Amounts of waste being deposited will be sampled, when needed, to confirm the composition of the waste. As per the "*Tool to determine methane emissions avoided from disposal of waste at a solid waste disposal site*" version 05.1.0, this parameter only needs to be monitored for those CPAs where the waste prevented from disposal includes several waste categories *j*, as categorized in the tables for *DOCj* and *kj*. The waste composition may also be obtained from studies applicable to the site
QA/QC procedures to be applied:	
Any comment:	Data will be kept for at least two years after the end of the crediting period

Data / Parameter:	$EC_{PJ,y}$
Data unit:	MWh
Description:	Quantity of electricity consumed by the project activity during the year y
Source of data to be used:	Project Implementer
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be defined for each CPA
Description of measurement methods and procedures to be applied:	Electricity will be measured continuously using an electricity meter. Data will be aggregated at least annually as stated in the "*Tool to calculate Project emissions from electricity consumption*" version 01.
QA/QC procedures to be used:	Electricity meter will be subject to regular maintenance and testing in accordance with meter supplier recomendations
Any comment:	Required to calculate project emissions. Data will be kept for two years after end of crediting period

Data / Parameter:	**TDL_y**
Data unit:	%
Description:	Average technical transmission and distribution losses in the grid in year y for the voltage level at which electricity is obtained from the grid at the project site.
Source of data to be used:	Default value according to the *"Tool to calculate baseline, project and/or leakage emissions from electricity consumption*" version 01
Value of data applied for the purpose of calculating expected emission reductions in section B.5	20%
Description of measurement methods and procedures to be applied:	As per the tool, under scenario A (electricity consumption from the grid) and scenario C (Electricity consumption from the grid and (a) fossil fuel fired captive power plant(s)) , cases C.I and C.III : second option, case (a): "project or leakage electricity consumption sources;" To be applied annually
QA/QC procedures to be used:	N/A
Any comment:	Required to calculate project emissions from electricity consumption

Additional parameters to be monitored when the CPA may contain a component with scenario #3

Data / Parameter:	**$LFG_{PL,y}$**
Data unit:	m^3
Description:	Amount of LFG sent to Pipe Line at Normal Temperature and Pressure
Source of data:	Project Implementer
Value of data applied for the purpose of calculating expected emission reductions in section B.5	To be defined for each CPA
Description of Measurement methods and procedures to be applied:	Data will be measured with a flow meter and monitored continuously by the Project Developer. The flow meter will be maintained and calibrated regularly in line with the manufacturer's requirements. Data to be aggregated monthly and yearly.
QA/QC procedures:	Flow meters will be subject to a regular maintenance and testing regime to ensure accuracy.
Any comment:	Data will be kept for 2 years after end of crediting period

Data / Parameter:	**Operation of the upgrading gas plant**
Data unit:	Hours
Description:	Operation of the upgrading plant(s) in a year y
Source of data:	Project participants
Value of data applied for the purpose of calculating expected	To be defined for each CPA

emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Data will be recorded annually by the Project Implementer to ensure methane destruction is claimed for methane used in electricity plant when it is operational.
QA/QC procedures to be applied:	Equipment will be maintained in line with manufacturer's recommendations
Any comment:	Data will be kept for at least two years after the end of the crediting period

E.7.2. Description of the monitoring plan for a CPA:

Each CPA under this PoA will develop an operational plan that defines a standard against which the project performance will be measured in terms of its emission reductions and compliance with all standards and criteria under the PoA. Monitoring will be the responsibility the landfill operators at each individual site. The monitoring plan has the following purposes:

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

The monitoring plan covers:

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

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

Flow meters and gas analyzers will be recording continuously the amount of LFG destroyed/used in each CPA. This equipment is very sensitive, so rigid QA/QC procedures for equipment maintenance and calibration will be developed and performed by each landfill manager[31], who also will ensure that proper monitoring procedures are performed and monitoring information is sent on a regular basis to Caixa.

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

Devices and Methods for Data Collection:

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

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

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

Monitored Data:

Each CPA staff has operational and data collection obligations to fulfill, in order to maximize the GHG emissions reductions, ensuring that sufficient information is available to calculate ERs in a transparent and verifiable manner, allowing a fast and successful verification of these ERs.

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

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

E.8. Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies)

17/08/2010
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Claudia Barrera
World Bank Group, IBRD
Carbon Finance Unit
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Annex 1

CONTACT INFORMATION ON COORDINATING/MANAGING ENTITY and PARTICIPANTS IN THE PROGRAMME of ACTIVITIES

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding for the proposed PoA.

Annex 3

BASELINE INFORMATION

Details on Baseline Information will be included in CPA-DD

Annex 4

MONITORING PLAN

The relevant monitoring information is provided in section **E.7.2**

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