**CLEAN DEVELOPMENT MECHANISM**
**PROJECT DESIGN DOCUMENT FORM (CDM-PDD)**
**Version 03 - in effect as of: 28 July 2006**

**CONTENTS**



**Annexes**

## SECTION A. General description of project activity

### A.1. Title of the project activity:

**Project title:** *Barueri* Energy CDM Project Activity.

PDD version: 06

Date (DD/MM/YYYY): 10/08/2012

### A.2. Description of the project activity:

The *Barueri* Energy CDM Project Activity is owned by *FOXX Soluções Ambientais LTDA.*, a company focused on new technologies to manage urban waste (i.e. the organic matter present in domestic and commercial waste, organic industrial waste and municipal solid waste), originally intended for landfilling. Its purpose is to treat these materials through incineration while additionally fostering the generation of electrical energy.

The project activity avoids methane emissions by diverting organic waste from disposal at a landfill, where methane emissions are caused by anaerobic processes. Further the project focuses on the displacement of thermal energy through the utilization of combustion heat generated in the incineration process. By treating the fresh waste through an alternative treatment option, such as incineration, these methane emissions are avoided from landfills. The GHGs involved in the baseline and project activity are $CO_2$, $CH_4$ and $N_2O$.

Therefore, the *Barueri* Energy CDM Project Activity reduces emissions of greenhouse gases considering the scenario existing prior to the start of the project activity implementation, consistent with the baseline scenario:

1. Methane emissions ($CH_4$) due to the dumping of municipal solid waste historically sent to landfill, during the period of anaerobic decay. Methane is of a global warming potential 21 times greater than that of carbon dioxide ($CO_2$). The project activity seeks to avoid these emissions by incinerating the residues and additionally focuses on exploiting these materials as a source of combustion in the generation of electricity.

2. The project activity, by supplementing electrical energy to the Interconnected National System, reduces dependence on thermal fossil fuel powered energy plants, thereby decreasing the emission of greenhouse gases that would otherwise be produced in the absence of the project (considering an Emission Factor related to the national grid published by the Ministry of Science and Technology[1]).

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[1] Emission Factors available at < http://www.mct.gov.br/index.php/content/view/74689.html >. Accessed on September, 24th 2011.

Therefore the project activity complies with 2 sectorial scopes; being number *1: energy industries (renewable - / non-renewable sources)*, due to electricity generation, and number *13: waste handling and disposal* due to the Incineration of Municipal Solid Waste as specified in the CDM list[2].

The project consists of a concrete pit to store waste, allowing continuous treatment processing during periods lacking any waste supply. A waste feed system will lead the residues to the entrance of a boiler. In turn a pneumatic system pushes the waste into the boiler, based on the Rankine cycle, burning the residues over a grate.

The waste is incinerated on a multi-stage grate, ensuring an efficiency level of greater than 97%. The minimum temperature of combustion is 850°C. An auxiliary gas burner is used for the start-up of combustion prior to the waste feed, supplying heat to the combustion chamber at a minimum specified temperature. Ashes represent between 10% and 15% of the total waste mass. The exact amount considered in the project specifications is 13.5%.

The electrical generation has an installed capacity of 20 MW[3] with assured energy of 17.53 MW operating 7,800 hours/year and will provide energy for the operation of the thermal power plant. Energy surpluses will be delivered to the national grid through a substation.

The objective of the *Barueri* Energy CDM Project Activity is to help meet Brazil's rising demand for energy due (to economic growth) improving the supply of electricity and contributing to environmental, social and economic sustainability.

*Barueri* Energy CDM Project Activity further targets better income distribution, from job creation and increases wages (better described in section D and E of this document). The surplus of capital generated by the project could be translated into investments in education and health, directly benefiting the local population. The savings in expenditure result from a reduced necessity to "import" electricity from other regions in the country. This money would stay in the region and be used to provide better services, improving quality of life.

The *Barueri* Energy CDM Project Activity is environmentally safe and sound, evidenced by the opportunity to improve the treatment of municipal solid waste, Further the project activity is located in a surrounding area with low population density, at a reasonable distance from the urban concentrations. The site possesses the appropriate topographical, geological and zoning features for the proposed project activity.

This solution provides sustainable alternatives to a significant urban dilemma, in which the volume of waste generated is high and the availability of vacant land is almost nonexistent. There is international recognition for emission control technologies adopted by the European Union; Particularly for Persistent Organic Pollutants (POPs) and for the recovery of energy from municipal solid waste.

## A.3. Project participants:

[2] Available at < http://cdm.unfccc.int/DOE/scopelst.pdf>. Accessed on July, 2011.

[3] As per paragraph 4a of EB59, Annex 9, *the rated/installed capacity for renewable electricity generating units that involve turbine-generator systems shall be based on the installed/rated capacity of generator*. Refer to section A.4.3 for more details.

**Table 1:** Party(ies) and private/public entities involved in the project activity.

| Name of Party involved (*) ((host) indicates a Host Party) | Private and/or public entity(ies) project participants (*) (as applicable) | Kindly indicate if the Party involved whishes to be considered as project participant (Yes/No) |
|---|---|---|
| Brazil (host) | Foxx Soluções Ambientais Ltda. (private entity) | No |
| | Ecopart Assessoria em Negócios Empresariais Ltda. (private entity) | |
| (*) 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 project activity:**

**A.4.1. Location of the project activity:**

**A.4.1.1. Host Party(ies):**

Brazil.

**A.4.1.2. Region/State/Province etc.:**

State of *São Paulo*.

**A.4.1.3. City/Town/Community etc.:**

Municipality of *Barueri.*

**A.4.1.4. Details of physical location, including information allowing the unique identification of this project activity (maximum one page):**

*Barueri* Energy CDM Project Activity is located on *Pirarucu* Avenue, between the intersection of the following geographic coordinates:

**Table 2:** Geographic coordinates of *Barueri* Energy CDM Project Activity.

| *Geographic Coordinates* | *Barueri* Energy CDM Project Activity |
|---|---|
| *Longitude* (*West*) | 46º51'09.48" |

| | |
|---|---|
| *Latitude (South)* | 23º30'43.50" |

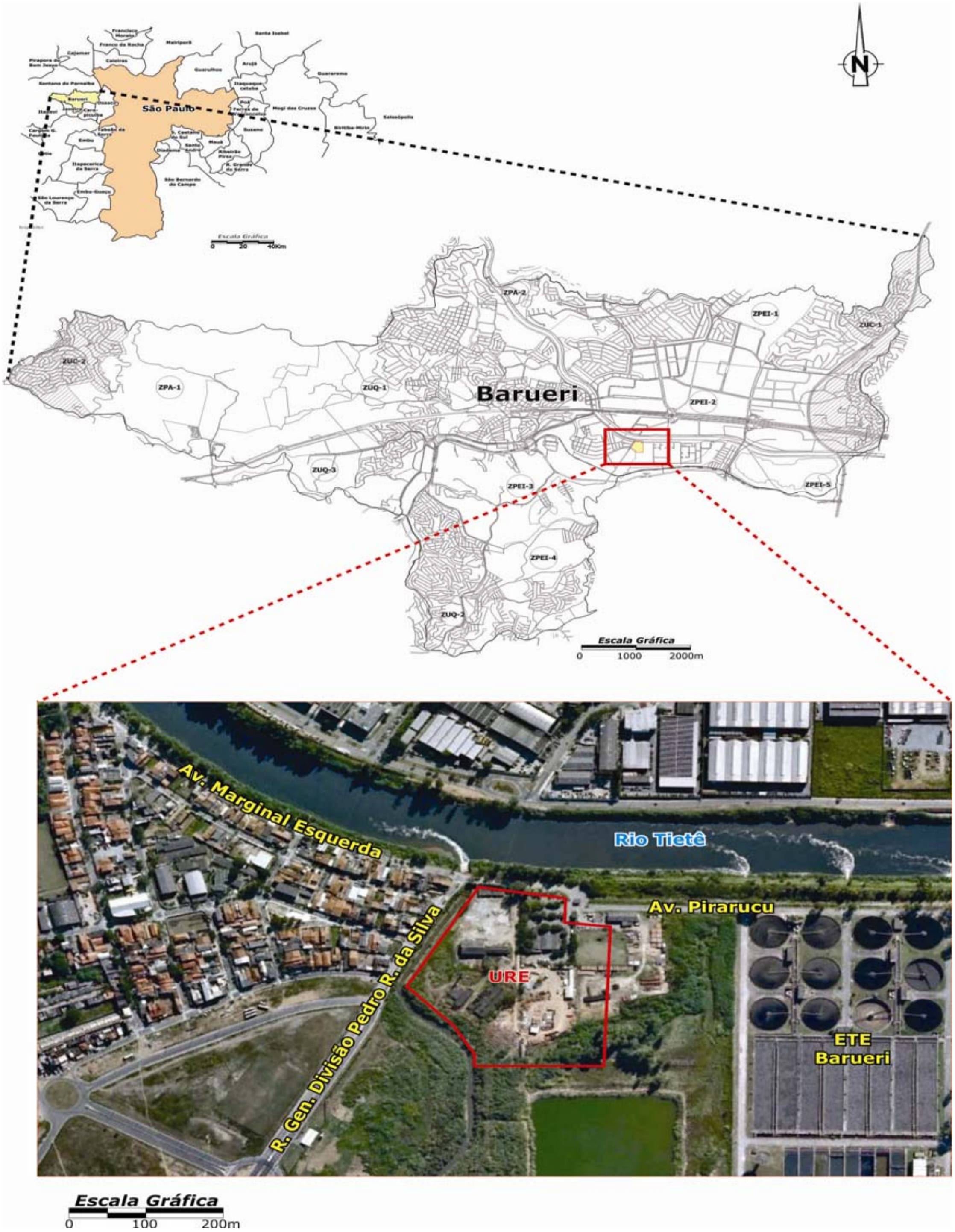


**Figure 1:** Details of the physical location of the project activity in red boundary. *URE* - Waste-to-Energy PlantWaste-to-Energy Plant (from the Portuguese *Usina de Recuperação de Energia*).

### A.4.2. Category(ies) of project activity:

According to Annex A of the Kyoto Protocol, this project fits:

Sectoral Scope: 1 – Energy industries (renewable - / non-renewable sources); and

Sectoral Scope 13 – Waste handling and disposal.

### A.4.3. Technology to be employed by the project activity:

The *Barueri* Energy CDM Project Activity focuses on the treatment of organic matter present in domestic and commercial waste, organic industrial waste and municipal solid waste, through incineration. Further the project seeks to exploit heat produced by the incineration process for the generation of electricity which is in turn delivered to the grid.

Alternative measures for the treatment of fresh waste, such as incineration, are more environmentally favorable than landfill dumping due to reduction in GHG emissions.

The project consists of a concrete pit to store waste, allowing continuous treatment processing during periods lacking any waste supply. A waste feed system will lead the residues to the entrance of a boiler. In turn a pneumatic system pushes the waste into the boiler, based on the Rankine cycle, burning the residues over a grate.

The possible residues to be burnt are: solid urban waste from near municipalities (domestic and commercial waste, waste from roads, drainage systems and other public facilities and sludge generated by public wastewater and water treatment stations.

The baseline scenario (as well as the scenario prior to the project activity implementation) is identified, following the AM0025 methodology. It consists of a *waste handling of disposing in a landfill and also the electricity generated by the national grid, where a mix of source energy is composed in a National Emission Factor*.

Furthermore, the company will assist operator training programs, start-ups, technical assistance and consulting, including all specialized engineering services related to the System: in the form of flow charts, data sheets, specifications, reports, manuals or other services required and not included among the items above. The specification given by the Environmental Secretariat of the State of *São Paulo* through Resolution SMA – 079 of November 4th 2009 will be followed regarding the directions and conditions to operate and license activities in the thermal treatment of solid waste in Waste-to-Energy Plants. Further, specialized companies will be hired for the maintenance of equipment, ensuring optimum system performance.

The monitoring equipment of the burning system, as described in section B.7.1, is located in the control room within the unit boundary. The generated energy IS monitored in the substation, with measurement equipment projected to register and cross-check the dispatched energy from the facility. Meters are located in the control room and also in the transformer substation (Bay) that is connected to a Substation.

**Table 3:** Specifications of the equipments to be installed in *Barueri* Energy CDM Project Activity.

| Incinerator/Boiler | |
|---|---|
| Manufacturer | Keppel Seghers |
| Type | Multi-stage Grate |
| Quantity | 1 |
| Steam generation (ton/hour) | 80 |
| Steam Temperature (°C) | 410 |
| Steam Pressure (bar) | 54 |
| Flue Gas Flow ($Nm^3/h$) | 157,580 |
| Lifetime (years) [4] | 25 |
| **Generator** | |
| Manufacturer | Not defined yet |
| Type | Synchronous |
| Quantity | 1 |
| Nominal Power (kVA) | 25 |
| Capacity Factor | 0.8 |
| Nominal Capacity (MW) | 20 |
| Lifetime (years) [5] | 25 |
| **Turbine** | |
| Manufacturer | Not defined yet |
| Type | Steam |
| Quantity | 1 |
| Nominal Power (MW) | 20 |
| Pressure (kgf/cm²) | 63 |
| Lifetime (years) [6] | 25 |

*Source: Information provided in the "Tratamento de Resíduos sólidos urbanos de Barueri - FOXX. Volume 2" presented to the Bidding process and also in the Final* Kepperl Seghers *Proposal- Solutions for a Cleaner Future for* Barueri *WtE Plant.*

The emissions sources and the greenhouse gases involved in the project activity, as defined also by the methodology AM0025 in its twelfth version, are $CH_4$, $CO_2$ and $N_2O$ due to the waste handling and the electricity generation in the baseline and project scenario.

### A.4.4. Estimated amount of emission reductions over the chosen crediting period:

In order to estimate the methane production and destruction, the Methodological tool "Emissions from solid waste disposal sites (version 06.0.1) is used. Methane emissions from the waste that would in the absence of the project activity be disposed at solid waste disposal sites are calculated with a first order decay model that presents a sequence of equations reaching a methane amount due to the quantity of solid

[4] Following specifications of *Keppel Seghers* Final proposal for *Barueri* Waste-to-Energy Plant signed in December, 15th 2011 (section 1.1.1 – Concept and Design philosophy).

[5] Following specifications of ANEEL Normative Resolution number 240, December 5th 2006 that establishes depreciation annual taxes for equipment in the electricity sector in Brazil for turbo-generator.

[6] Following specifications of ANEEL Normative Resolution number 240, December 5th 2006 that establishes depreciation annual taxes for equipment in the electricity sector in Brazil for turbo-generator.

waste of 750 tonnes/day[7] (to 825 tonnes/day[8]). Thus, the year average baseline emissions were estimated at 212,343 $tCO_2$. Further for the baseline emission calculation, the electricity generated by the project is multiplied by the National Emission Factor, yielding emissions that would be generated due to the absence of the project activity.

The Project Emissions estimative is fundamentally calculated for (based on the mentioned methodology): the on-site electricity consumption resulting from equipment used in the realization of the project activity, the fuel consumption on-site, the composting process and the waste incineration. However, the year average project emissions were estimated at 115,952 $tCO_2$, considering only waste incineration for this phase.

Potential sources of Leakage Emissions for this project activity are from the off-site transportation of waste materials and from the residual waste from the incinerator. Then, the year average Leakage emissions were estimated at 4,517 $tCO_2$. Therefore, the Emissions Reductions are 91,874 $tCO_2$/year.

The project activity considers a single period of 10 years. The full implementation of proposed project activity will generate the estimated annual reductions as described in Table 4:

**Table 4:** Emissions reductions Estimation.

| **Years** | **Annual estimation of emission reductions in tonnes of CO2e** |
|---|---|
| 2014* | -6,579[9] |
| 2015 | 4,994 |
| 2016 | 43,441 |
| 2017 | 70,204 |
| 2018 | 89,068 |
| 2019 | 102,577 |
| 2020 | 112,439 |
| 2021 | 119,803 |
| 2022 | 125,443 |
| 2023 | 129,880 |
| 2024** | 127,472 |
| **Total estimated reductions (tonnes of CO2e)** | **918,742** |

[7] Following specifications of the technical proposal signed under Public-Private Partnership between *Barueri* Municipality and FOXX in January, 27th 2012.

[8] Following specifications of *Keppel Seghers* Final proposal for *Barueri* Waste-to-Energy Plant signed in December, 15th 2011 (section 1.1 – General).

[9] The emission reductions from the first 2 years are negative due to the annual decay rate of the considered municipal waste. In the first and second years the project activity has greater emissions due to the project operation (PEy) than the decay of the considered municipal solid waste in the absence of the project activity (BEy). In the first 2 years this MSW present a low decay, which increase exponentially during the following years.

| | |
|---|---|
| **Total number of crediting years** | 10 |
| **Annual average over the crediting period of estimated reductions (tonnes of CO2e)** | 91,874 |

*Since August 1st

**Until July 31st

**A.4.5. Public funding of the project activity:**

This project does not receive any public funding from annex I parties and it is not a diversion of ODA.

## SECTION B. Application of a baseline and monitoring methodology

### B.1. Title and reference of the approved baseline and monitoring methodology applied to the project activity:

AM0025 - "Avoided emissions from organic waste through alternative waste treatment processes" (Version 13.0.0). The tools referenced in this methodology are:

- Tool for the demonstration and assessment of additionality (version 6.0.0)[10];
- Methodological tool "Emissions from solid waste disposal sites (version 06.0.1)[11];
- Project emissions from flaring (version 02.0.0)[12];
- Tool to calculate the emission factor of an electricity system (version 2.2.1)[13].

### B.2. Justification of the choice of the methodology and why it is applicable to the project activity:

The applicability conditions of AM0025 - "Avoided emissions from organic waste through alternative waste treatment processes" (Version 13.0.0). are all fulfilled by the proposed project activity as further detailed below.

The project activity involves one or a combination of the following waste treatment options for the fresh waste that in a given year would have otherwise been disposed in a landfill:

*(a) A composting process in aerobic conditions;*

*(b) Gasification to produce syngas and its use;*

*(c) Anaerobic digestion with biogas collection and flaring and/or its use;*

*(d) Mechanical/thermal treatment process to produce refuse-derived fuel (RDF)/stabilized biomass (SB) and its use. The thermal treatment process (dehydration) occurs under controlled conditions (up to 300 degrees Celsius). In case of thermal treatment process, the process shall generate a stabilized biomass that would be used as fuel or raw material in other industrial process. The physical and chemical properties of the produced RDF/SB shall be homogenous and constant over time;*

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[10] Available at < http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v6.0.0.pdf>. Access on July, 21st 2011.

[11] Available at <http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-04-v6.0.1.pdf>. Access on March, 13th 2012.

[12] Available at < http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-06-v2.0.pdf>. Access on November, 7th 2012.

[13] Available at < http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v2.2.1.pdf>. Access on July, 21st 2011.

*(e) Incineration of fresh waste for energy generation, electricity and/or heat. The thermal energy generated is either consumed on-site and/or exported to a nearby facility. Electricity generated is either consumed on-site, exported to the grid or exported to a nearby facility. The incinerator is rotating fluidized bed or circulating fluidized bed or hearth or grate type.*

The proposed activity is applicable to option (e), due to its description (also contained in section A.2 and A.4.3) of operation where the waste generated by municipal collection will be directed to an incineration process. Additionally there is the intention to produce electricity and in turn to export it to the national grid. Thus, a grate type of incinerator will be used.

- *In case of anaerobic digestion, gasification or RDF processing of waste, the residual waste from these processes is aerobically composted and/or delivered to a landfill;*

This is not applicable to the project activity, since there is no composting to treat the waste before delivery to the landfill, but instead an incineration process generating electricity by exploiting fresh municipal urban waste.

- *In case of composting, the produced compost is either used as soil conditioner or disposed of in landfills;*

This is not applicable to the project activity, since there is no composting to treat the waste in order to deliver to the landfill, but instead an incineration process generating electricity by exploiting fresh municipal urban waste.

- *In case of RDF/stabilized biomass processing, the produced RDF/stabilized biomass should not be stored in a manner that may result in anaerobic conditions before its use;*

This is not applicable to the project activity, since there is no treatment to stabilize the biomass, but instead an incineration process generating electricity by exploiting fresh municipal urban waste.

- *If RDF/SB is disposed of in a landfill, project proponent shall provide degradability analysis on an annual basis to demonstrate that the methane generation, in the life-cycle of the SB is below 1% of related emissions. It has to be demonstrated regularly that the characteristics of the produced RDF/SB should not allow for re-absorption of moisture of more than 3%. Otherwise, monitoring the fate of the produced RDF/SB is necessary to ensure that it is not subject to anaerobic conditions in its lifecycle;*

This is not applicable to the project activity, since there is no treatment to stabilize the biomass in order to dispose in a landfill, but instead an incineration process generating electricity by exploiting fresh municipal urban waste.

*• In the case of incineration of the waste, the waste should not be stored longer than 10 days. The waste should not be stored in conditions that would lead to anaerobic decomposition and, hence, generation of $CH_4$;*

The project activity meets this applicability condition, since it is stated that under normal operation the fresh municipal urban waste is burnt within 3 days (maximum 5 days), a condition of the technical proposal to *Barueri* Municipality. The waste will be stored below ground level reducing (waste pit) odor emissions to regions neighboring the facility. This structure will be of 6,000 $m^3$ volume to store the waste. Therefore, this condition is met by the proposed project activity.

*• The proportions and characteristics of different types of organic waste processed in the project activity can be determined, in order to apply a multiphase landfill gas generation model to estimate the quantity of landfill gas that would have been generated in the absence of the project activity;*

The project activity meets this applicability condition, since it is stated that the fresh municipal urban waste will undergo sample collection before incineration and treatment, as described in section B.7.2 below. It is predicted that the project activity will receive the following average percentages of waste: 8.22% paper, 0.55% wood, 71.25% food, 1.43% textile material, 14.24% plastics and 4.3% of inert material, such as glass and metal[14].

*• The project activity may include electricity generation and/or thermal energy generation from the biogas, syngas captured, RDF/stabilized biomass produced, combustion heat generated in the incineration process, respectively, from the anaerobic digester, the gasifier, RDF/stabilized biomass combustor, and waste incinerator. The electricity can be exported to the grid and/or used internally at the project site. In the case of RDF produced, the emission reductions can be claimed only for the cases where the RDF used for electricity and/or thermal energy generation can be monitored;*

The project activity meets this applicability condition, since the project activity focuses on the generation of electricity through the exploiting of heat produced in the incineration process which is in turn exported to the national grid. It is possible to monitor this value through national regulations and conditions of the sector by *CCEE*[15] and *ANEEL*[16] (as described in section B.7.2). Also the project activity will have internal consumption (as described in section B.6.3) and the energy surplus will be delivered to the national grid.

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[14] The waste gravimetric analysis of *Barueri* was published by the city of *Barueri* in Annex I - Reference Term related to the opening of the Bidding Process of Concession Process number 023/2010 from *Barueri* Municipality. Further details in section B.6.

[15] *Câmara de Comercialização de Energia Elétrica* that is translated to Commencialization Chamber of Electric Energy.

[16] *Agência Nacional de Energia Elétrica* that is translated to National Agency of Electric Energy.

• *Waste handling in the baseline scenario shows a continuation of current practice of disposing the waste in a landfill despite environmental regulation that mandates the treatment of the waste, if any, using any of the project activity treatment options mentioned above;*

The project activity meets this applicability condition, since in the absence of the project activity, as will be discussed in section B.4 below, the municipal waste would be disposed in landfills. There is no national regulation that obligates the treatment of the waste, since the National Policy of Solid Waste[17] (Brazilian Law No. 12,305, 2 August 2010) stipulates that the Federal District and Municipalities are responsible for the integrated management of solid waste generated in their territory, not defining specific measures for treatment.

• *The compliance rate of the environmental regulations during (part of) the crediting period is below 50%; if monitored compliance with the MSW rules exceeds 50%, the project activity shall receive no further credit, since the assumption that the policy is not enforced is no longer tenable;*

The project activity meets this applicability condition, since there is no national regulation that obligates the treatment of the waste in other ways besides landfilling in the country.

• *Local regulations do not constrain the establishment of RDF production plants/thermal treatment plants nor the use of RDF/stabilized biomass as fuel or raw material;*

The project activity is the incineration of fresh waste for energy generation and, therefore, this applicability condition does not meet the project activity scenario.

• *In case of RDF/stabilized biomass production, project proponent shall provide evidences that no GHG emissions occur, other than biogenic CO2, due to chemical reactions during the thermal treatment process (such as Chimney Gas Analysis report);*

The project activity is the incineration of fresh waste for energy generation and, therefore, this applicability condition does not meet the project activity scenario.

• *The project activity does not involve thermal treatment process of neither industrial nor hospital waste;*

The Project activity meets this condition, since it does not encompass the reception of industrial or hospital waste.

[17] Avilable at <http://www.planalto.gov.br/ccivil_03/_ato2007-2010/2010/lei/l12305.htm>. Accessed on August, 2011.

• *In case of waste incineration, if auxiliary fossil fuel is added into the incinerator, the fraction of energy generated by auxiliary fossil fuel is no more than 50% of the total energy generated in the incinerator.*

The project activity meets this applicability condition, since little fossil fuel will be used to start-up the incineration process. In all likelihood it will be LPG, however to date (validation phase) this item has not yet been defined. Unquestionably auxiliary fossil fuel will not represent more than 50% of the total energy generated in the incinerator. This will be confirmed through the operating conditions of the equipment.

*This methodology is not applicable to project activities that involve capture and flaring of methane from existing waste in the landfill. This should be treated as a separate project activity due to the difference in waste characteristics of existing and fresh waste, which may have an implication on the baseline scenario determination.*

This is not applicable to the project activity, since there is no landfill involved in the project, but instead incineration process generating electricity by exploiting fresh municipal urban waste that would, in the absence of the project activity, be disposed in a landfill.

In summary, the methodology AM0025 - "Avoided emissions from organic waste through alternative waste treatment processes" (Version 13.0.0). is applicable to the project activity where fresh waste (i.e. the organic matter present in domestic, and commercial waste/municipal solid waste), originally intended for landfilling, is treated through an incineration process. The project activity avoids methane emissions by diverting organic waste from disposal at a landfill, where methane emissions are caused by anaerobic processes and by displacing electricity energy through the combustion heat generated in the incineration process. By treating the fresh waste through alternative treatment options these methane emissions are avoided from the landfill. The GHGs involved in the baseline and project activity are $CO_2$, $CH_4$ and $N_2O$.

## B.3. Description of the sources and gases included in the project boundary:

As defined in the AM0025 - "Avoided emissions from organic waste through alternative waste treatment processes" (Version 13.0.0). *"The spatial extent of the project boundary is the site of the project activity where the waste is treated. This includes the facilities for processing the waste, on-site electricity generation and/or consumption, onsite fuel use, thermal energy generation, wastewater treatment plant and the landfill site. The project boundary does not include facilities for waste collection, sorting and transport to the project site. In the case that the project provides electricity to a grid, the spatial extent of the project boundary will also include those plants connected to the energy system to which the plant is connected".* On May 26th, 2008, the Brazilian Designated Authority published Resolution nr 8 defining the Brazilian Interconnected Grid as a single system comprising the fifth regions of the country[18]. And the following scheme is predicted:

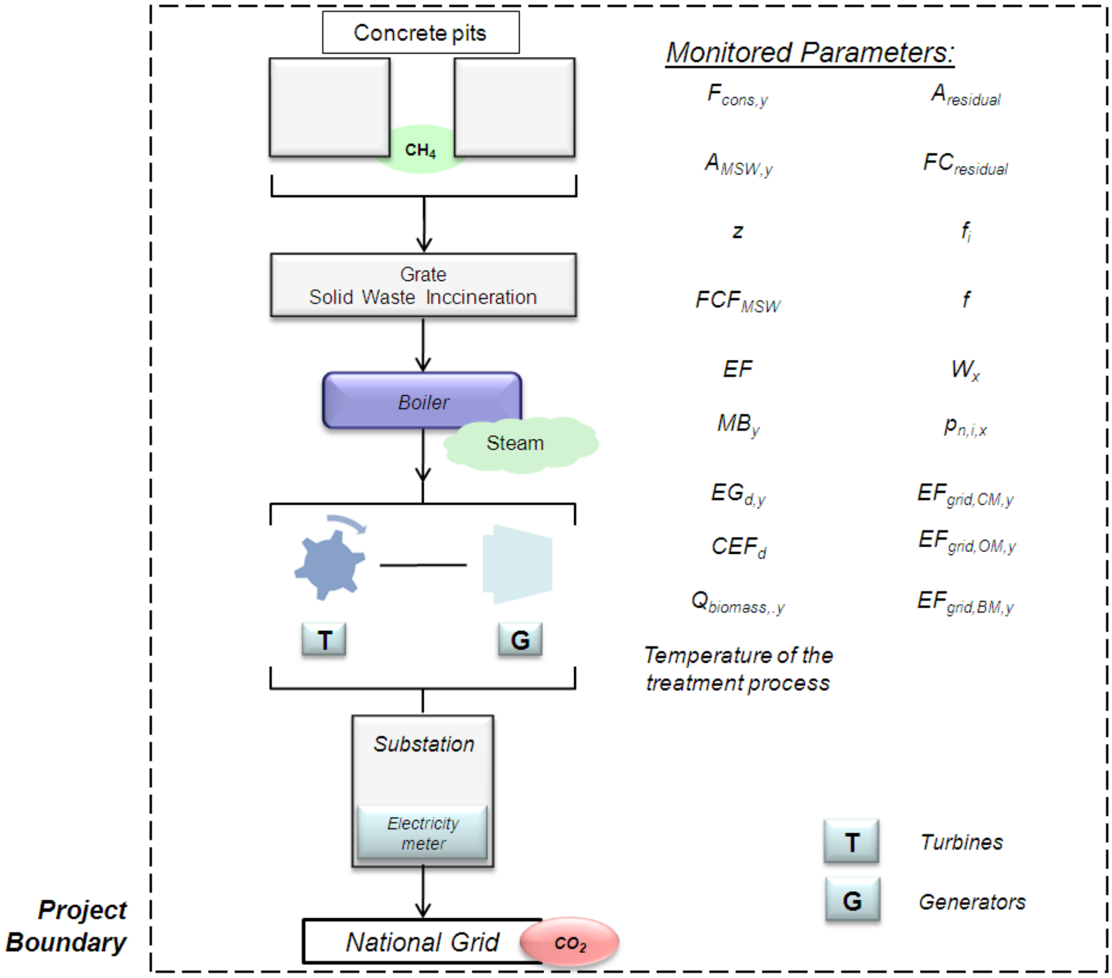


**Figure 2:** Project boundary scheme.

The greenhouse gases and emission sources included in or excluded from the project boundary are shown in the below table.

**Table 5:** Summary of gases and sources included in the project boundary and justification/explanation where gases and sources are not included.

| | Source | Gas | | Justification / Explanation |
|---|---|---|---|---|
| **Baseline** | Emissions from decomposition of waste at the | $CH_4$ | Included | The major source of emissions in the baseline. |
| | | $N_2O$ | Excluded | $N_2O$ emissions are small compared to $CH_4$ emissions from landfills. Exclusion of this gas is conservative. |

[18] CIMGC's Resolution nr 8 from May 26th, 2008 available at: <http://www.mct.gov.br/upd_blob/0024/24719.pdf>.

| | Source | Gas | | Justification / Explanation |
|---|---|---|---|---|
| | | $CO_2$ | Excluded | $CO_2$ emissions from the decomposition of organic waste are not accounted. |
| | Emissions from electricity consumption | $CO_2$ | Included | Electricity will be generated onsite in the baseline scenario. |
| | | $CH_4$ | Excluded | Excluded for simplification. This is conservative. |
| | | $N_2O$ | Excluded | Excluded for simplification. This is conservative. |
| | Emissions from thermal energy generation | $CO_2$ | Excluded | There is no thermal energy generation included in the project activity. |
| | | $CH_4$ | Excluded | There is no thermal energy generation included in the project activity. |
| | | $N_2O$ | Excluded | There is no thermal energy generation included in the project activity. |
| Project Activity | On-site fossil fuel consumption due to the project activity other than for electricity generation | $CO_2$ | Included | It will be an important emission source. It includes auxiliary fossil fuels needed to be added into incinerator. |
| | | $CH_4$ | Excluded | Excluded for simplification. This emission source is assumed to be very small. |
| | | $N_2O$ | Excluded | Excluded for simplification. This emission source is assumed to be very small. |
| | Emissions from on-site electricity use | $CO_2$ | Excluded | There is no electricity use in the project activity, besides internal generation. |
| | | $CH_4$ | Excluded | There is no electricity use in the project activity, besides internal generation. |
| | | $N_2O$ | Excluded | There is no electricity use in the project activity, besides internal generation. |
| | Emissions from thermal energy generation | $CO_2$ | Excluded | There is no thermal energy generation included in the project activity. |
| | | $CH_4$ | Excluded | There is no thermal energy generation included in the project activity. |
| | | $N_2O$ | Excluded | There is no thermal energy generation included in the project activity. |
| | Direct emissions from the waste treatment processes. | $N_2O$ | Included | $N_2O$ is emitted from incineration. |
| | | $CO_2$ | Included | $CO_2$ emissions from incineration are included. $CO_2$ emissions from the decomposition or combustion of organic waste are not accounted. |
| | | $CH_4$ | Included | $CH_4$ will be emitted from stacks from incineration. |
| | Emissions from waste water treatment | $CO_2$ | Excluded | There is no generation of waste water. |
| | | $CH_4$ | Excluded | There is no generation of waste water. |
| | | $N_2O$ | Excluded | There is no generation of waste water. |

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

Following the procedures given by the methodology AM0025 - "Avoided emissions from organic waste through alternative waste treatment processes" (Version 13.0.0)., the baseline scenario is below defined.

***Step 1: Identification of alternative scenarios***

Following the mentioned methodology, this step should use Step 1 of the latest version of the Tool for the demonstration and assessment of additionality (version 6.0.0), to identify all realistic and credible baseline alternatives.

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

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

Following the Tool for the demonstration and assessment of additionality (version 6.0.0), the realistic and credible baseline alternatives, considering relevant policies and regulations related to the management of landfill sites, gas capture or destruction requirements because of safety issues or local environmental regulations, processing of organic waste and also local economic and technological circumstances are defined below:

(a) The proposed project activity undertaken without being registered as a CDM project activity, where the municipal solid waste incineration and power generation reduces emissions of greenhouse gases in two ways, by avoiding (1) methane emissions in a landfill and (2) CO2e from the electricity generated by the Interconnected National System (M1, P1);

(b) The installation of a landfill gas recovery system, where the methane, which would have otherwise been released to the atmosphere, would be flared with the possibility of generating electricity. This alternative requires reliable technology and additional investment without any benefit. The electricity generation is provided by another grid-connected power plant (M2, P6);

(c) The continuation of the current situation where the collected waste is destined to a landfill, which presents gases venting and passive gas flaring for safety issues, and no electricity generation, is predicted. This is a regular practice in Brazil and does not face problems to be continued. The electricity generation is provided by another grid-connected power plant (M3, P6).

It is important to mention that, since the proposed project activity does not need heat to operate but electricity, it was considered the same scenarios for the Baseline and Project Scenarios, where no heat is needed and the electricity would be bought from the National Grid. The alternatives for the disposal/treatment of the fresh waste in the absence of the project activity, i.e. the relevant scenario for estimating baseline methane emissions include:

*M1: The project activity (i.e. composting, gasification, anaerobic digestion, RDF processing/thermal treatment without incineration of organic waste or incineration of waste) not implemented as a CDM project;*

*M2: Disposal of the waste at a landfill where landfill gas captured is flared;*

*M3: Disposal of the waste on a landfill without the capture of landfill gas.*

All the described scenarios **M1, M2 and M3** corresponding to the methane emissions are reasonable baseline scenarios, as described in items (a), (b) and (c).

The AM0025 - "Avoided emissions from organic waste through alternative waste treatment processes" (Version 13.0.0). determines that, if energy is exported to a grid and/or to a nearby industry, or used on-site realistic and credible alternatives, should also be separately determined for:

- Power generation in the absence of the project activity;
- Heat generation in the absence of the project activity.

For power generation, the realistic and credible alternative(s) may include, *inter alia*:

*P1: Power generated from by-product of one of the options of waste treatment as listed in M1 above, not undertaken as a CDM project activity;*

This is an alternative to the project activity baseline scenario.

*P2: Existing or Construction of a new on-site or off-site fossil fuel fired cogeneration plant;*

This is not an alternative to the project proponent, since the main objective of the proposed project activity is the use of waste that would be disposed in a landfill in the absence of the project activity. There is also no necessity of implementing a cogeneration system, due to the fact there is no demand for heat.

*P3: Existing or Construction of a new on-site or off-site renewable based cogeneration plant;*

This is not an alternative to the project proponent, since the main objective of the proposed project activity is the use of waste that would be disposed in a landfill in the absence of the project activity. There is also no necessity of implementing a cogeneration system, due to there is no heat demand to be attended.

*P4: Existing or Construction of a new on-site or off-site fossil fuel fired captive power plant;*

This is not an alternative to the project proponent, since the main objective of the proposed project activity is the use of waste that would be disposed in a landfill in the absence of the project activity. There is no necessity to install a captive power plant, due to the fact there is no demand for electricity in the absence of the project activity on site.

*P5: Existing or Construction of a new on-site or off-site renewable based captive power plant;*

This is not an alternative to the project proponent, since the main objective of the proposed project activity is the use of waste that would be disposed in a landfill in the absence of the project activity. There is also no necessity to install a captive power plant, due to the fact there is no demand for electricity in the absence of the project activity on site.

*P6: Existing and/or new grid-connected power plants.*

This is an alternative to the project activity baseline scenario.

For the Power generation, the scenarios **P1 and P6** are realistic for the project activity.

For heat generation, the realistic and credible alternative(s) may include, *inter alia*:

*H1: Heat generated from by-product of one of the options of waste treatment as listed in M1 above, not undertaken as a CDM project activity;*

*H2: Existing or Construction of a new on-site or off-site fossil fuel fired cogeneration plant;19*

*H3: Existing or Construction of a new on-site or off-site renewable based cogeneration plant;20*

*H4: Existing or new construction of on-site or off-site fossil fuel based boilers;*

*H5: Existing or new construction of on-site or off-site renewable energy based boilers;*

*H6: Any other source such as district heat;*

*H7: Other heat generation technologies (e.g. heat pumps or solar energy).*

For the project activity, there is no heat baseline scenario to be included, since the main objective of the proposed project activity is the use of waste that would be disposed in a landfill in the absence of the project activity to generate electricity. No heat is demanded for the project activity nor in its absence.

Outcome of Step 1a: The identified realistic and credible alternative scenarios to the project activity, as described above, are: **M1 + P1**; **M2 + P6** and **M3 + P6**.

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

[19] Scenarios P2 and H2 are related to the same fossil fuel cogeneration plant.

[20] Scenarios P3 and H3 are related to the same renewable energy based cogeneration plant.

According to the Tool for the demonstration and assessment of additionality (version 6.0.0), the alternatives shall be in compliance with all mandatory applicable legal and regulatory requirements, even if these laws and regulations have objectives other than GHG reductions, e.g. to mitigate local air pollution. (This Sub-step does not consider national and local policies that do not have legally-binding status.). According to the baseline methodology, relevant policies and regulations related to the management of landfill sites should be taken into account.

According to IBGE (2008)[21], from a total estimated volume of garbage collected in Brazil (183,488 t/day) 27.7% of the collected garbage was dumped in sanitary landfills, 22.5% was dumped on controlled landfills and 50.8% was dumped on open dumping sites without any control. Neither Brazilian State nor County legislation requires landfill gas to be captured, burnt or used. The focus is on improving the adequacy of dumping in order to avoid environmental contamination caused by leakage from waste residues reaching water and soil as well as reducing the amount of residues in the country through principles determined by the National Policy of Solid Waste (as described in section B.2).

Besides, in Brazil, regarding safety and odor concerns, landfills follow technical requirements from NBR 8419[22] in chapter about gas drainage. This indicates that an amount of landfill gas must be burnt to keep the landfill in safe operation. This item will be better described in section B.6.3, where the adjustment factor (AF) will consider the destruction efficiency of the system in the baseline.

Also in Brazil, improvements in landfill gas collection and combustion demand financial costs that challenge aims to reduce GHG emissions. There is no project activity implemented in the country with forced methane extraction and destruction, using blowers, collection system and flaring system without the CDM incentive. However, there are CDM project activities that do so, including the *Bandeirantes, Nova Gerar, Onyx, Marca, Sertãozinho, Salvador da Bahia, Estre Paulínia, Marca Espírito Santo, Caieiras, Lara, São João, Anaconda, Central de Resíduos do Recreio, Canabrava, Aurá, Quitaúna, Estre Itapevi, Terrestre Ambiental, Estre Pedreira, Alto Tietê, Santec, CTRS, Feira de Santana, Embralixo, CTRVV, Proactiva Tijuquinhas, Urbam,* and *João Pessoa* Landfills, among others[23].

**Outcome of Step 1b:** the identified realistic and credible alternative scenarios to the project activity are in compliance with mandatory legislation and regulations taking into account the enforcement in the region or country and EB decisions on national and/or sectoral policies and regulations.

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

For the electricity generation to the grid, in the absence of the project activity, all the energy would be supplied by other power plants from the interconnected grid. Hence, the baseline scenario is identified as the continuation of the current (previous) situation of electricity. The project activity reduces emissions of

[21] Available at <http://www.ibge.gov.br/home/estatistica/populacao/condicaodevida/pnsb2008/PNSB_2008.pdf>. Accessed October 3rd, 2011.

[22] Available at <www.abnt.org.br>.

[23] Available at < http://cdm.unfccc.int/Projects/projsearch.html>.

greenhouse gas (GHG) by also avoiding electricity generation by fossil fuel sources (and $CO_2$ emissions), which would be generated (and emitted) in the absence of the project.

According to ANEEL (2010), 68.93 % of the Brazil's installed capacity is composed by large hydropower plants which on average present large reservoirs and 25.32 % by thermal power stations and this affect the National Emission Factor[24].

***Step 3: 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).***

In order to assess which of the realistic alternatives should be excluded from further consideration; step 3 of the Tool for the demonstration and assessment of additionality (version 6.0.0) is chosen to demonstrate the baseline scenario. As provided in section B.5 below, alternative (a) (proposed project activity without CDM) has major investment and technological barriers and therefore is not the baseline scenario.

The most plausible baseline scenario for the waste treatment component is identified as the disposal of the waste in a landfill without capture of landfill gas or the disposal of the waste in a landfill site where the landfill gas is partly captured and subsequently being flared (as per Baseline scenario 1, stated in the methodology AM0025 - "Avoided emissions from organic waste through alternative waste treatment processes" (Version 13.0.0).).

The municipality of Barueri used a municipal landfill for waste disposal: Barueri landfill. However this landfill closed operations. Currently solid wastes of *Barueri* are being disposed in the private landfill of *Tecipar* (*Central de Tratamento de Resíduos Tecipar* – Central of Waste Treatment Tecipar) in a neighbouring municipality, *Santana de Parnaíba* (20 km far from *Barueri*). This situation is foreseen until the installation of the Waste-to-Energy plant in *Barueri* (project activity). As can be seen in "Sub-step 1b" above, in the case of the creation of any other landfill, the assumption that this new landfill would destroy or capture LFG without CDM incentives is not plausible, since there are no laws to enforce emission reductions from this source and LFG capture and destruction is not a common practice in the host country. Therefore, there is no reason to believe that Alternative (b) would happen and thus this alternative will be excluded from further analysis.

***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 baseline 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 described in the steps above and in the investment analysis below, the alternatives (a) and (b) are not credible and plausible. Therefore, the alternative (c) is the baseline scenario to the project activity, where the continuation of the current situation where the collected waste is destined to a landfill, which presents

[24] Calculated and publicly available at: http://www.mct.gov.br/index.php/content/view/72764.html

gases venting and passive gas flaring for safety issues, and no electricity generation, is predicted. The electricity generated by the project activity is provided by another grid-connected power plant (M3, P6). Following the AM0025 - "Avoided emissions from organic waste through alternative waste treatment processes" (Version 13.0.0)., the scenario 1 given in table 1 (*Combinations of baseline options and scenarios applicable to this methodology*) of the referred document is applicable to the project activity; where *the disposal of the waste in a landfill site without capturing landfill gas or the disposal of the waste in a landfill site where the landfill gas is partly captured and subsequently being flared. The electricity is obtained from an existing/new fossil based captive power plant or from the grid and heat from an existing/new fossil fuel based boiler*. This scenario comprehends the possible baseline alternatives: Waste – M2/M3; electricity – P4 or P6; and Heat – H4.

**B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality):**

Considering the "Glossary of CDM terms", the start date of a CDM project activity is:

"*The earliest date at which either the implementation or construction or real action of a project activity begins*".

Also, considering the definition above, the 41st EB Meeting Report states that:

"*The start date shall be considered to be the date on which the project participant has committed to expenditures related to the implementation or related to the construction of the project activity. This, for example, can be the date on which contracts have been signed for equipment or construction/operation services required for the project activity. Minor pre-project expenses, e.g. the contracting of services /payment of fees for feasibility studies or preliminary surveys, should not be considered in the determination of the start date as they do not necessarily indicate the commencement of implementation of the project. For those project activities which do not require construction or significant pre-project implementation (e.g. light bulb replacement) the start date is to be considered the date when real action occurs. In the context of the above definition, pre-project planning is not considered 'real action'*".

Considering the definition above, Project Participants held the timeline of the project:

**Table 6: Project activity timeline**

| Date | Event |
|---|---|
| 27-11-09 | *Ecopart* sent first Proposal for CDM Project Activity in *Barueri* |
| 04-02-10 | *Ecopart* sent revision of Proposal |
| 08-02-10 | *FOXX* accepted *Ecopart* Proposal for CDM Project Activity in *Barueri* |
| 12-02-10 | *Ecopart* sent Contract Minute to *FOXX* |
| 24-02-10 | *FOXX* hired *SGW* to develop the EIA for *Barueri* Waste-to-Energy Plant |
| 01-03-10 | Contract signed between *Ecopart* and *FOXX* |
| 01-04-10 | *FOXX* defines a Working Plan for the elaboration of the Environmental Impact Assessment for *Barueri* WtE Plant |
| 23-11-10 | *CETESB* sent a Reference Term for the Assessment of Environmental Impact of the |

| | |
|---|---|
| | WtE Plant in Barueri to the Municipality - License process is started under number 196/2010 following the Refence Term of the Technical advice # 103837/10/TA |
| 01-01-11 | *Kepperl Seghers* Proposal- Solutions for a Cleaner Future for *Barueri* WtE Plant |
| 18-03-11 | *Barueri* Municipality open the Bidding Process of Concession Process number 023/2010 |
| 22-09-11 | Technical Proposal to Municipality of *Barueri - Barueri* Municipality open proposals of the Bidding Process of Concession Process number 023/2010 |
| 15-12-11 | Final *Kepperl Seghers* Proposal- Solutions for a Cleaner Future for Barueri WtE Plant |
| 24-01-12 | The project participant protocols in *CETESB - Companhia de Tecnologia de Saneamento Ambiental* the Work Plan for the preparation of Environmental Impact Assessment (EIA) |
| 27-01-12 | Public-Private Partnership signed between *Barueri* Municipality and *FOXX,* that is the starting date of the project activity |

As can be observed, the project activity is still in development phase. So far there is no formal contract in order to either build the plant or operate it, but there is a Proposal issued by *Kepperl Seghers* that sets out the plant definitions. The Project Proponent will take this proposal as a basis to implement the Waste-to-Energy Plant in *Barueri*, however by December 2011 the contract was not signed yet. In all likelihood *Kepperl Seghers* will be the technology supplier since they are the only supplier that provides all technical requirements of the proposed project.

According to the definition of the 41$^{st}$ EB Meeting Report, the first date of the project is when the project sponsor committed expenditures for the project implementation. Thus, it is predicted that, by the end of 2011, the Public-Private Partnership contract will be signed between *Barueri* Municipality and *Foxx Soluções Ambientais Ltda.* It represents a real commitment to implement the project under specific conditions (following the presented technical proposal) as established by Federal Law No. 11,079/04, consisting of an innovative tool whose aim is to ensure the best use of public resources in the implementation and provision of public services. This contract represent an expenditure for the Project Proponent since the Guarantee Insurance Policy related to the 27$^{th}$ clause of the PPP contract "Guarantee for the performance of the contract" equivalents to 2% of the total value of the contract (BRL 3,645,942.04).

During the validation period, relevant contracts will be available for the Validation Team in order to identify this specific date.

Evidence related to the dates presented in the table above will be presented to DOE at the time of validation and are available with the Project Participants.

According to Guidelines on the demonstration and assessment of prior consideration for the CDM (version 3, EB 51), proposed project activities with a start date on or after August 2$^{nd}$, 2008, the project participant must inform a Host Party DNA and the UNFCCC secretariat in writing of the commencement of the project activity and of their intention to seek CDM status. Such notification must be made within six months of the project activity start date.

It is important to mention that CDM was seriously considered in the development of this project activity and also represents a "first of its kind" project (as discussed later following the Guidelines on

Additionality of first-of-its-kind project activities, version 01.0). In the presentation of the Technical Proposal to *Barueri* Municipality, CDM was stressed in order to alleviate barriers, reducing costs for the Municipality. This was an important issue in the acceptance of the Public-Private Partnership. Additionally, the project activity involves technology that is not a common practice in the treatment of the waste representing “state of the art” technology in the host country, and with several associated risks.

***Step 2. Investment analysis***

The Guidelines on the assessment of investment analysis (version 05) should be used together with the Tool for the demonstration and assessment of additionality (version 6.0.0). However, since the project activity represents a “first-of-its-kind” (FOIK) project activity, this step is not applied.

As given in the Guidelines on Additionality of first-of-its-kind project activities, version 01.0, in paragraph 6 where the additionality of the FOIK project activity is determined, *“a proposed project activity that was identified as the First-of-its-kind project activity is additional.”* And, therefore, it is not necessary this step, but “Barrier Analysis” (step 3) analyzing the FOIK Guidelines.

**Step 3. Barrier analysis**

In order to identify projects that are similar to the proposed project activity, the definitions presented in the Guidelines on Additionality of first-of-its-kind project activities, version 01.0, EB63, were used:

1. ***Applicable geographical area:*** *covers the entire host country as a default; if the technology applied in the project is not country specific, then the applicable geographical area should be extended to other countries. Project participants may provide justification that the applicable geographical area is smaller than the host country for technologies that vary considerably from location to location depending on local conditions.*

Since the technology used in the project activity is not country specific, then the PP extended the analysis following procedures described in the *Guidelines on Additionality of the first-of-its-kind project activities*, version 01.0. Information related to *Mercosul* region was included, since the project activity is located in this economic and political agreement and it is reasonable to compare them since the regulatory and policy framework are similar.

***Mercosul*** (Portuguese: *Mercado Comum do Sul*, English: Common Southern Market) is an economic and political agreement among Argentina, Brazil, Paraguay, Uruguay and Venezuela. Bolivia, Chile, Colombia, Ecuador and Peru currently have associate member status. Its purpose is to promote free trade and the fluid movement of goods, people and currency.

2. ***Measure:*** *is a broad class of greenhouse gas emission reduction activities possessing common features. Four types of measure are currently cover in the framework:*
   - *(a) Fuel and feedstock switch;*
   - *(b) Switch of technology with or without change of energy source (including energy efficiency improvement);*

(c) *Methane destruction;*

(d) *Methane formation avoidance.*

Considering the measures presented above, Barueri *Energy CDM Project Activity* can be classified as a "**fuel and feedstock switch**" due to the displacement of electricity generation from grid-connected power plants operated with fossil fuel, which is reflected in the combined margin emission factor and also "**methane formation avoidance**" due to the use of municipal solid waste as fuel to generate electricity instead of being disposed in a landfill where it would decay and end up on methane generation.

3. ***Output:*** *is goods or services with comparable quality, properties, and application areas (e.g. clinker, lighting, residential cooking).*

Therefore, in the case of Barueri *Energy CDM Project Activity*, the output considered is the **incineration of municipal solid waste to generate electrical energy by waste-to-energy plants**.

4. ***Different technologies:*** *are technologies that deliver the same output and differ by at least one of the following (as appropriate in the context of the measure applied in the proposed CDM project and applicable geographical area):*

(i) *Energy source/fuel*

*Barueri Energy CDM Project Activity* generates energy to the national grid based on the burn of municipal solid waste. Fuel fired generation commonly burns a homogeneous source of energy to generate heat. e.g. fossil fuel, biomass residues, biomass and biogas. However, urban residues are different fuel used in the project activity as definitions below:

- **Fossil fuel**[25] - Fossil energy resources remain abundant but contain significant amounts of carbon that are normally released during combustion.
- **Biomass residues** identified in ACM6 methodology as the biomass that is a by-product, residue or waste stream from agriculture, forestry and related industries. This shall not include municipal waste or other wastes that contain fossilized and/or non-biodegradable material (however, small fractions of inert inorganic material like soil or sands may be included).
- **Biomass** identified in ACM6 methodology as non-fossilized and biodegradable organic material originating from plants, animals and microorganisms. This shall include products, by-products, residues and waste from agriculture, forestry and related industries as well as the non-fossilized and biodegradable organic fractions of industrial and municipal wastes. Biomass also includes

[25] Definition available at: http://www.ipcc.ch/publications_and_data/ar4/wg3/en/ch4s4-3-1.html. Accessed on April, 2012.

gases and liquids recovered from the decomposition of non-fossilized and biodegradable organic material).

- **Biogas** is a mixture of biogenic gases composed mainly of methane and carbon dioxide produced from the decomposition of waste organic matter under anaerobic conditions.
- **Municipal solid waste (MSW)** - a **heterogeneous** mix of different solid waste types, usually collected by municipalities or other local authorities. MSW includes household waste, garden/park waste and commercial/institutional waste.

(ii) Feed stock

Not applicable.

(iii) Size of installation (power capacity)

- Micro (as defined in paragraph 24 of Decision 2/CMP.5 and paragraph 39 of Decision 3/CMP.6);
- Small (as defined in paragraph 28 of Decision 1/CMP.2);
- Large.

*Barueri Energy CDM Project Activity* has an installed capacity of 20 MW, therefore, **large scale plants** are considered (more than 15 MW).

Additionally, there is substantial difference between incineration and Stationary combustion technology. First, incineration (which has specific chapter in IPCC, 2006 – vol. 5 - Chapter 5) is defined as the combustion of solid and liquid waste in controlled incineration facilities. Modern refuse combustors have tall stacks and specially designed combustion chambers, which provide high combustion temperatures, long residence times, and efficient waste agitation while introducing air for ***more complete combustion***. Types of waste incinerated include municipal solid waste (MSW), industrial waste, hazardous waste, clinical waste and sewage sludge. The practice of MSW incineration is currently more common in developed countries, while it is common for both developed and developing countries to incinerate clinical waste. In spite of stationary combustion technology uses homogenous fuel source to generate electricity in furnaces/ turbines (which has specific chapter in IPCC, 2006 – vol. 2 – Chapter 2).

Following the Guidelines on Additionality of first-of-its-kind project activities, version 01.0, EB63, the analysis to identify a First-of-its-kind project activity in the applicable geographical area[26] is presented:

> *A) The project is the first in the applicable geographical area that applies a technology that is different from any other technologies able to deliver the same output and that have started commercial operation in the applicable geographical area before the start date of the project; and*

In Brazil, as can be evidenced by the report developed by *Abrelpe* – Brazilian Association of Public Cleaning Companies and Special Residues - for the Scenario of the Solid Waste in Brazil in 2010[27], incineration treatment using urban waste to generate electricity is not common.

[26] The applicable geographical area is, as a default, the entire host country.

The incineration in Brazil has representative potential to treat hospital waste not municipal solid waste, as it is presented in the mentioned document of *Abrelpe*, 2010. Further, the incineration process applied to treat hospital waste involves different technologies and does not generate electricity and therefore is not comparable to the project activity due to its different ***output*** and ***energy source***, as described above.

Considering information above, only the plants located in Brazil using the same technology and fuel (burn urban solid waste to generate electricity through a grate-type incinerator) would be considered.

However, in Brazil similar technologies to use urban solid waste to generate electricity is not common (WTERT, 2011[28]).

Considering the waste-to-energy sector, during the 2001-2007 period, the WTE capacity increased by about four million metric tons per annum. Japan and China built several plants that were based on direct smelting or on fluidized bed combustion of solid waste. In China there are about 50 WTE plants. Japan is the largest user in thermal treatment of MSW in the world with 40 million tons. It generates 25 kwatts of electricity and 25 kwatts of heat from waste water. Waste to energy technology includes fermentation, which can take biomass and create ethanol, using waste cellulosic or organic material. In the fermentation process, the sugar in the waste is changed to carbon dioxide and alcohol, in the same general process that is used to make wine. Normally fermentation occurs with no air present. Esterification can also be done using waste to energy technologies, and the result of this process is biodiesel. Gasification and pyrolysis by now can reach thermal conversion efficiencies from of up to 75%, however a complete combustion is superior in terms of fuel conversion efficiency. Some pyrolysis processes need an outside heat source which may be supplied by the gasification process, making the combined process self sustaining.

As presented, there are several categories of technology for WTE plants. Further, the PP accessed the Industcards.com/ppworld.htm and http://www.wtert.com.br/home2010/ in order to check similar WTE technology to the project activity in *Mercosul*. However, no WTE plants were observed in the mentioned countries.

In *Industcards*, it was identified 238 WTE plants in the world, located in Austria, China, Germany, Italy, Netherlands, Norway, Sweden, Taiwan, USA, Belgium, Denmark, France, Japan, Portugal, Spain, Switzerland and UK. These countries are not comparable to the project activity host country, as explained above when delimitating the applicable geographic area, and shouldn't be considered. Additionally, there in the Waste-to-Energy Research and Technology Council website[29], there are partners in many countries in the world (such as USA, Germany, Greece, China, Italy, India, Canada, Japan, UK, France and Mexico), but in *Mercosul* (excluding Brazil)[30].

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27 ABRELPE, Scenario of the Solid Waste in Brazil in 2010 (*Panorama dos residues sólidos no Brasil – 2010).* Available at < http://www.abrelpe.org.br/noticias_detalhe.cfm?NoticiasID=905>. Accessed on November, 2011.

28 WTERT – Waste-to-Energy Research and Technology Council. Which aims to encourage the advancement of technologies to recover energy and materials from MSW remaining after recycling and inform the public and policymakers about the benefits of power generation from MSW - WtE - and on all other means of sustainable waste management.

29 http://www.seas.columbia.edu/earth/wtert/partner.html

30 Accessed in May, 2012: http://www.seas.columbia.edu/earth/wtert/partner.html

Additionally, the electricity sector in Brazil is as described in the picture below and notably the electricity matrix is mainly composed of hydropower plants with large reservoirs and by thermal energy produced from fossil fuels.

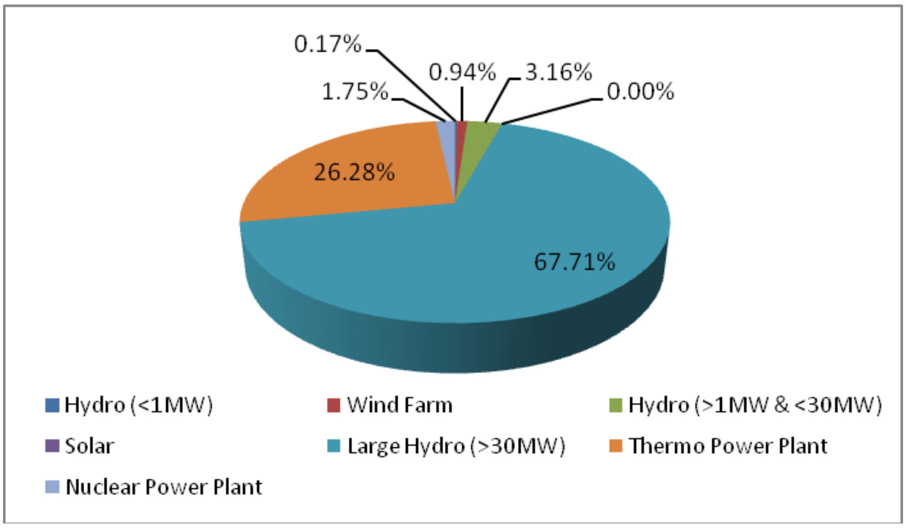


**Figure 3:** Brazil's generation capacity per type of energy source.
(Source ANEEL, 2011)[31]

Notably, 26.28% of installed capacity in Brazil is from thermal plants. From this percentage, the included fuels are: cane bagasse, black liquor, wood, biogas and rice husk. Thus, no MSW are considered in the electricity system in the country. Below it is presented a summary of the used fuel in Brazil:

| **Type of fuel** | **Number of plants (UTE)** |
|---:|---:|
| Sugarcane bagasse | 349 |
| Biogas | 19 |
| Elephant Grass | 2 |
| Mineral coal | 10 |
| Charcoal | 3 |
| Rice Husk | 8 |
| Effluent Gas | 2 |
| Sulfur | 5 |
| Blast Furnace Gas | 15 |
| Process Gas | 9 |
| Refinery Gas | 8 |
| Natural Gas | 106 |
| Steel Gas | 1 |
| Black Liquor | 14 |

[31] ANEEL (2011) Banco de Informações de Geração – BIG. Matriz de Energia Elétrica. Available at: <http://www.aneel.gov.br/aplicacoes/capacidadebrasil/OperacaoCapacidadeBrasil.asp>

| | |
|---|---|
| Fuel Oil | 33 |
| Palmiste Oil | 2 |
| Diesel Oil | 918 |
| Ultraviscous Oil | 1 |
| Wood residuos | 38 |
| Others | 3 |
| ***TOTAL*** | ***1546*** |

**Figure 4:** Brazil's generation capacity per type of energy source.
(Source ANEEL, 2012)[32]

Therefore, there are no Waste-to-Energy plants in Brazil and Mercosul, i.e., thermal plants that use this specific fuel: Municipal Solid Waste (MSW) such as the project activity.

Additionally, it is necessary for knowledgeable academics in Brazil to take the lead to inform the public by forming a web-based organization to link academic, industry and government agencies in Brazil who are concerned with advancing sustainable waste management[33]. The objectives of WTERT-Brazil are:

a) To link all research and development groups working on various aspects of waste management, in Brazil, and through the WTERT sister organizations, to share information on Sustainable Waste Management throughout the world.

b) Identify the most suitable technologies for the treatment of various waste materials in Brazil, encourage additional academic research as required, and disseminate this information within the nation in Portuguese; and also provide an English language window for the outside world to learn about problems and opportunities for advancing waste management in Brazil.

The same council is formed in many other countries, but *Mercosul*, such as USA, Germany, Greece, China, Italy, India, Canada, Japan, UK, France and Mexico. Which emphasize that the technology is a First-of-its-kind type in the applicable geographic area.

*B) Project participants selected a crediting period for the project activity that is a maximum of 10 years with no option of renewal.*

The mentioned period of 10 years with no option of renewal is applied[34].

***Outcome:*** The proposed project activity is a first-of-its-kind project activity in the applicable geographical area, since in *MERCOSUL* there are no waste-to-energy plants, which means that applies a

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[32] ANEEL (2012) Banco de Informações de Geração – BIG. Matriz de Energia Elétrica. Available at: <http://www.aneel.gov.br/aplicacoes/capacidadebrasil/GeracaoTipoFase.asp?tipo=2&fase=3>

[33] Information available on WTERT – Waste-to-energy research & Technology Council. http://www.wtert.com.br/home2010/arquivo/home/wtert_brazil_organization_and_objectives.pdf. Accessed on April, 2012.

[34] The project participants and developer are not in accordance with this definition from EB and a consultation will be held in order to ask for further clarification using the FORM FOR SUBMISSION OF “LETTER TO THE BOARD” version 01.1.During the validation process this will be discussed with the DOE.

technology that is different from any other technologies able to deliver the same output and that have started commercial operation in the applicable geographical area before the start date of the project.

**Step 4: Common practice analysis**

*Not applicable.* As given in the Guidelines on Additionality of first-of-its-kind project activities, version 01.0, in paragraph 6 where the additionality of the FOIK project activity is determined, *"a proposed project activity that was identified as the First-of-its-kind project activity is additional."* And, therefore, it is not necessary this step, but "Barrier Analysis" (step 3) analyzing the FOIK Guidelines.

## B.6. Emission reductions:

### B.6.1. Explanation of methodological choices:

Following the AM0025 - "Avoided emissions from organic waste through alternative waste treatment processes" (Version 13.0.0)., the calculation for the emission reductions is presented.

***Emission Reductions ($ER_y$)***

To calculate the emission reductions the project participant shall apply the following equation:

$ER_y = BE_y – PE_y – L_y$ **(Equation 1)**

Where:

| | | |
|---|---|---|
| $ER_y$ | = | Is the emissions reductions in year *y* (t $CO_2$e) |
| $BE_y$ | = | Is the emissions in the baseline scenario in year *y* ($tCO_2e$) |
| $PE_y$ | = | Is the emissions in the project scenario in year *y* ($tCO_2e$) |
| $L_y$ | = | Is the leakage in year *y* ($tCO_2e$) |

***Baseline Emissions ($BE_y$)***

To calculate the baseline emissions, project participants shall use the following equation:

$BE_y = (MB_y - MD_{reg,y}) + BE_{EN,y}$ **(Equation 2)**

Where:

| | | |
|---|---|---|
| $BE_y$ | = | Is the baseline emissions in year *y* ($tCO_2e$) |
| $MB_y$ | = | Is the methane produced in the landfill in the absence of the project activity in year *y* ($tCO_2e$) |

| | | |
|---|---|---|
| $MD_{reg,y}$ | = | Is methane that would be destroyed in the absence of the project activity in year *y* ($tCO_2e$) |
| $BE_{EN,y}$ | = | Baseline emissions from generation of energy displaced by the project activity in year *y* ($tCO_2e$) |

*Methane generation from the landfill in the absence of the project activity* ($MB_y$)

The amount of methane that is generated each year ($MB_y$) is calculated as per the *Methodological tool "Emissions from solid waste disposal sites (version 06.0.1)* considering the following additional equation:

$MB_y = BE_{CH4,SWDS,y}$ **(Equation 3)**

Where:

| | | |
|---|---|---|
| $BE_{CH4,SWDS,y}$ | = | Is the methane generation from the landfill in the absence of the project activity at year y that is methane emissions avoided during the year y from preventing waste disposal at the solid waste disposal site during the period from the start of the project activity to the end of the year y ($tCO_2e$) as calculated using Application B in the Methodological tool "Emissions from solid waste disposal sites (version 06.0.1). The tool estimates methane generation adjusted for, using adjustment factor ($f_y$), 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. |

The $BE_{CH4,SWDS,y}$, as previously described, represents the quantity of methane that would be released to the atmosphere in the absence of the project activity by a solid waste disposal site. In order to estimate it, a First Order Decay model (FOD model) is used, which differentiates the sorts of waste *j* relating them to their own decay rates $k_j$ and fractions of degradable organic carbon ($DOC_j$). The model takes first the sum of waste per year ($W_{j,x}$) and relates those different types of solid waste to their particular factors. Also, Application B of the mentioned tool is applied to the project activity (The CDM project activity avoids or involves the disposal of waste at a SWDS).So, the baseline amount of methane produced in the year *y* is given by the equation below:

$$\left.\begin{matrix} BE_{CH4,SWDS,y} \\ PE_{CH4,SWDS,y} \\ LE_{CH4,SWDS,y} \end{matrix}\right\} = \varphi_y \cdot (1 - f_y) \cdot GWP_{CH4} \cdot (1 - OX) \cdot \frac{16}{12} \cdot F \cdot DOC_{f,y} \cdot MCF_y \cdot \sum_{x=1}^{y} \sum_{j} W_{j,x} \cdot DOC_j \cdot e^{-k_j \cdot (y-x)} \cdot \left(1 - e^{-k_j}\right)$$

**(Equation 4)**

Where:

| | |
|---|---|
| $BE_{CH4,SWDS,y}$ | is the baseline methane emissions occurring in year y generated from waste disposal at a SWDS during a time period ending in year y ($tCO_2e$/year); |
| $\varphi_y$ | is the model correction factor to account for model uncertainties for year y; |
| $f_y$ | is the fraction of methane captured at the SWDS and flared, combusted or used in another manner that prevents the emissions of methane to the atmosphere in year y; |

$GWP_{CH4}$ is the Global Warming Potential of methane;

OX is the oxidation factor (reflecting the amount of methane from SWDS that is oxidised in the soil or other material covering the waste);

F is the fraction of methane in the SWDS gas (volume fraction);

$DOC_{f,y}$ is the fraction of degradable organic carbon (DOC) that decomposes under the specific conditions occurring in the SWDS for year y (weight fraction);

$MCF_y$ is the methane correction factor for year y;

$W_{j,x}$ is the amount of solid waste type *j* disposed or prevented from disposal in the SWDS in the year *x* (tons);

$DOC_j$ is the fraction of degradable organic carbon in the waste type *j* (weight fraction);

$k_j$ is the decay rate for the waste type *j* (1/year);

j is the type of residual waste or types of waste in the MSW;

x Years in the time period in which waste is disposed at the SWDS, extending from the first year in the time period (x = 1) to year y (x = y).;

y Year of the crediting period for which methane emissions are calculated (y is a consecutive period of 12 months).

For this formula, there are several defaults, even to differentiate the types of wastes, such as:

**Table 7 –Default values for data and parameters not monitored[35].**

| Parameter | Value | Explanation |
|---|---|---|
| $f_y$ | 0 | The value is null, since there is no percentage of methane that will be flared, combusted or used in another manner in the SWDS. |
| $GWP_{CH4}$ | 21 | Given by the IPCC for the first commitment period. |
| OX | 0.1 | As the managed solid waste disposal site of the project activity is covered with oxidizing material, such as soil and compost. |
| F | 0.5 | This factor reflects 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 2006 Guidelines for National Greenhouse Gas Inventories. |
| $DOC_{f,y}$ | 0.5 | Given by the IPCC 2006 Guidelines for National Greenhouse Gas Inventories. |
| $MCF_y$ | 1 | The Methodological tool "Emissions from solid waste disposal sites (version 06.0.1) suggests MCF to be selected as default if the project does not comprehend a water table above the bottom of the SWDS. It is used 1 for anaerobic managed solid waste disposal sites. These must have controlled placement of waste (i.e., waste directed to specific deposition areas, a degree of control of scavenging and a degree of control of fires) and will include at |

[35] More information about these values can be found in section B.6.2.

| | | |
|---|---|---|
| | | least one of the following: (i) cover material; (ii) mechanical compacting; or (iii) leveling of the waste. As the Project Activity presents the 3 options, the value must be 1.0. |
| $DOC_j$ (food) | 0.15 | Given by IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Tables 2.4 and 2.5) specific for food, food waste, beverages and tobacco (other than sludge) in wet waste, between a list of wood and wood products; pulp, paper and cardboard (other than sludge); food, food waste, beverages and tobacco (other than sludge); textiles; garden, yard and park waste; and glass, plastic, metal, other inert waste. |
| $DOC_j$ (wood) | 0.43 | Given by IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Tables 2.4 and 2.5) specific for wood and wood products; pulp, paper and cardboard (other than sludge) in wet waste, between a list of food, food waste, beverages and tobacco (other than sludge); food, food waste, beverages and tobacco (other than sludge); textiles; garden, yard and park waste; and glass, plastic, metal, other inert waste. |
| $DOC_j$ (textile) | 0.24 | Given by IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Tables 2.4 and 2.5) specific for textiles in wet waste, between a list of (wood and wood products; pulp, paper and cardboard (other than sludge); food, food waste, beverages and tobacco (other than sludge); food, food waste, beverages and tobacco (other than sludge); garden, yard and park waste; and glass, plastic, metal, other inert waste. |
| $DOC_j$ (paper) | 0.4 | Given by IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Tables 2.4 and 2.5) specific for pulp, paper and cardboard (other than sludge) in wet waste, between a list of (wood and wood products; pulp, paper and cardboard (other than sludge); food, food waste, beverages and tobacco (other than sludge); textiles; garden, yard and park waste; and glass, plastic, metal, other inert waste. |
| $k_j$ (food) | 0.4 | Given by IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Table 3.3) specific for Rapidly degrading of food, food waste, sewage sludge, beverages and Tobacco, under a Wet clime (MAP>1000mm). |
| $k_j$ (wood) | 0.035 | Given by IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Table 3.3) specific for slowly degrading of Wood, wood products and straw, under a Wet clime (MAP>1000mm). |
| $k_j$ (textile) | 0.07 | Given by IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Table 3.3) specific for slowly degrading of textiles, under a Wet clime (MAP>1000mm). |
| $k_j$ (paper) | 0.07 | Given by IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Table 3.3) specific for slow degrading of Pulp, paper, cardboard (other than sludge) under a Wet clime (MAP>1000mm). |

For the determination of the model correction factor (φy), ***Option 2: Determine φy based on specific situation of the project activity*** was used. For that, uncertainty analysis for the specific situation of the proposed project activity was considered to be applied in the following equation in order to determine the overall uncertainty of the determination of methane generation in year *y* ($v_y$).

$$v_y = \sqrt{(a^2 + b^2 + c^2 + d^2 + e^2 + g^2)} \qquad \textbf{(Equation 5)}$$

**Table 8 – Selection of values for the factors a, b, c, d, e and g.**

| Parameter | Meaning | Value | Explanation |
|---|---|---|---|
| $\varphi_y$ | - | 0.99 | Calculated as per Equation 6 |
| vy | - | 0.01 | Calculated as per Equation 5 |
| $a^2$ | W | 0.04% | The lower value, 2%, was used. Due to the solid waste will be weighed using accurate weighbridges, not measured from the depth and surface area of an existing SWDS. |
| $b^2$ | DOCj | 1% | The higher value, 10%, was used. DOCj is not measured, therefore the higher value is applicable. |
| $c^2$ | DOCf | 0.25% | The lower value, 5%, was used. Since more than 50% of the waste is rapidly degradable organic material and also the SWDS is located in a tropical climate. Organic percentage for the project is 81.46% (wood, paper, food waste, textiles and garden). |
| $d^2$ | F | 0.00% | The lower value, 0%, was used. Since more than 50% of the waste is rapidly degradable organic material. |
| $e^2$ | MCFy | 0.00% | The lower value, 0%, was used. Since the SWDS is managed. |
| $g^2$ | (e^(-kj*(y-x))*(1-e^(-kj)) | 0.25% | The lower value, 5%, was used. The project activity is under the following case: (i) Application B: where the residual waste is disposed at the SWDS and if the value of k is larger than 0.2 y^-1 ). The average of k is 0.144 (food = 0.4; paper = 0.07; textile = 0.07; wood = 0.035); which is larger than 0.2*2014^-1 (= 0.0000099304). |

$$\varphi_y = 1/(1 + v_y) \qquad \textbf{(Equation 6)}$$

And the value for $W_{j,x}$ (named as $A_{j,x}$ by the referred methodology) is given as the following equation, as it is under application B of the referred tool. This parameter represents the amount of organic waste type *j* prevented from disposal in the landfill in the year *x* (tonnes/year), this is the value to be used for variable $W_{j,x}$ in the Methodological tool "Emissions from solid waste disposal sites (version 06.0.1).

$$\mathbf{W_{j,x} = W_x * p_{j,x}} \qquad \textbf{(Equation 7)}$$

Where:

$W_{j,x}$ is the amount of solid waste type *j* disposed or prevented from disposal in the SWDS in the year *x* (tons);

$W_x$ is the total amount of solid waste disposed or prevented from disposal in the SWDS in the year *x* (tons);

$p_{j,x}$ is the average fraction of the waste type *j* in the waste in year *x* (weight fraction);

j is the types of solid waste;

x are the years in the time period for which waste is disposed at the SWDS, extending from the first year in the time period (x = 1) to year y (x = y)

The fraction of the waste type j in the waste for the year x are calculated as follows:

$$p_{j,x} = \frac{\sum_{n=1}^{z_x} p_{n,j,x}}{z_x}$$

**(Equation 8)**

Where:

$p_{j,x}$ is the average fraction of the waste type j in the waste in year x (weight fraction);

$p_{n,j,x}$ is the fraction of the waste type j in the sample n collected during the year x (weight fraction);

$z_x$ is the number of samples collected during the year x;

n is the samples collected in year x;

j is the types of solid waste;

x is the years in the time period for which waste is disposed at the SWDS, extending from the first year in the time period (x = 1) to year y (x = y).

*Adjustment Factor* (AF)

In cases where regulatory or contractual requirements do not specify $MD_{reg,y}$, an Adjustment Factor (AF) shall be used and justified, taking into account the project context. In doing so, the project participant should take into account that some of the methane generated by the landfill may be captured and destroyed to comply with other relevant regulations or contractual requirements, or to address safety and odour concerns. This value in Brazil is 0.54%, following technical expertise in the country[36].

$MD_{reg,y} = MB_y * AF$ **(Equation 9)**

Where:
AF = Is Adjustment Factor for $MB_y$ (%)

The 'Adjustment Factor' shall be revised at the start of each new crediting period taking into account the amount of GHG flaring that occurs as part of regulation at that point in the future.

*Rate of compliance*

Such as in Brazil there are no regulations that mandate the use of the project activity treatment option and is not being enforced, the baseline scenario is not identified as a gradual improvement of waste management practices to the acceptable technical options expected over a period of time to comply with the MSW Management Rules.

***Baseline emissions from generation of energy***

For Scenario 1 (identified in section B.4), the $BE_{EN,y}$ is determined as follow:

$BE_{EN,y} = BE_{elec,y} + BE_{thermal,y}$ **(Equation 10)**

Where:

| | | |
|---|---|---|
| $BE_{elec,y}$ | = | Is the baseline emissions from electricity generated utilizing the biogas/syngas collected/RDF/stabilized biomass/combustion heat from incineration/stabilized biomass co-fired with fossil fuel in the project activity and exported to the grid or displacing onsite/offsite fossil fuel captive power plant ($tCO_2e$) |
| $BE_{thermal,y}$ | = | Is the baseline emissions from thermal energy produced utilizing the biogas/syngas collected/RDF/stabilized biomass/combustion heat from incineration/stabilized biomass co-fired with fossil fuel in the project activity displacing thermal energy from onsite/offsite fossil fuel fueled boiler ($tCO_2e$) |

$BE_{elec,y} = EG_{d,y} * CEF_d$ **(Equation 11)**

[36] Reducing uncertainties about methane recovered (R) in inventories of emissions of greenhouse gases by waste treatment, and on the parameter Adjustment Factor (AF) in projects for the collection and destruction of methane in landfills under the Clean Development Mechanism (CDM). (from the free translation of the Portuguese *Redução das incertezas sobre o Metano recuperado (R) em inventários de emissões de gases de efeito estufa por tratamento de resíduos, e sobre o parâmetro Adjustment Factor (AF) em projetos de coleta e destruição de metano em aterros no âmbito do Mecanismo de Desenvolvimento Limpo (MDL).* MAGALHÃES, G. H. C., ALVES, J. W. S., SANTO FILHO, F., COSTA, R. M. and KELSON, M.. São Paulo, Brazil, 2010. Available at <http://homologa.ambiente.sp.gov.br/biogas/docs/artigos_dissertacoes/magalhaes_alves_santofilho_costa_kelson_pt.pdf> Access on November, 2011.

Where:

$EG_{d,y}$ = Is the amount of electricity generated utilizing the biogas/syngas collected/RDF/stabilized biomass/combustion heat from incineration/stabilized biomass co-fired with fossil fuel in the project activity and exported to the grid or displacing onsite/offsite fossil fuel captive power plant during the year *y* (MWh)

$CEF_d$ = Is the carbon emissions factor for the displaced electricity source in the project scenario ($tCO_2$/MWh)

The parameter $EG_{d,y}$ is determined based on the total electricity generation by the equipments minus the internal consumption. Which describes in the the Mass Balance of the "*Tratamento de Resíduos sólidos urbanos de Barueri - FOXX. Volume 2*" presented to the Bidding process the values of 17.526 MW * 7,800 hours/year - 0.826 MW * 7,800 hours/year.

Determination of $CEF_d$

In case the generated electricity from the combustion heat from incineration displaces electricity that would have been generated by other power plants in the grid in the baseline, $CEF_d$ should be calculated according to the Tool to calculate the emission factor of an electricity system (version 2.2.1).

Explanations as to how the quantity of net electricity generation supplied by the project plant/unit to the grid ($EG_{d,y}$) was estimated is presented below in section B.6.3. The calculation of the combined margin $CO_2$ emission factor for grid connected power generation ($EF_{grid,CM,y}$) follows, as recommended by AM0025 - "Avoided emissions from organic waste through alternative waste treatment processes" (Version 13.0.0)., the procedures established in the methodological Tool to calculate the emission factor of an electricity system (version 2.2.1).

According to this tool Project Participants shall apply six steps in order to calculate the baseline emission factor as further detailed below.

***STEP 1 - Identify the relevant electric power system***

According to the tool, "*If the DNA of the host country has published a delineation of the project electricity system and connected electricity systems, these delineations should be used. If such delineations are not available, project participants should define the project electricity system and any connected electricity system and justify and document their assumptions in the CDM-PDD*".

Brazilian DNA published Resolution #8, issued on 26th May, 2008, defines the Brazilian Interconnected Grid as a single system that covers all the five macro-geographical regions of the country (North, Northeast, South, Southeast and Midwest). Hence this figure will be used to calculate the baseline emission factor of the grid.

***STEP 2 – Choose whether to include off-grid power plants in the project electricity system (optional).***

Option I of the tool is chosen, which is to include in the calculation only grid power plants.

***STEP 3 - Select a method to determine the operating margin (OM).***

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

(a) Simple OM, or

(b) Simple adjusted OM, or

(c) Dispatch data analysis OM, or

(d) Average OM.

Dispatch data analysis in not an available option for the calculation of the operating margin since it is only applicable for the ex-post vintage. The simple operating margin can only be used where low-cost/must-run resources[37] constitute less than 50% of total grid generation in: 1) average of 5 most recent years, or 2) based on long-term normal for hydroelectricity production. The table below shows the share of hydroelectricity in the total electricity production for the Brazilian interconnected system. However, the results show the non-applicability of the simple operating margin to the proposed CDM Project Activity.

**Table 9 – Share of hydroelectricity generation in the Brazilian interconnected system, 2006 to 2010**

| Year | Share of hydroelectricity (%) |
|---|---|
| *2006* | 91.81% |
| *2007* | 92.79% |
| *2008* | 88.62% |
| *2009* | 93.27% |
| *2010* | 88.77% |

**Source:** ONS / Operador Nacional do Sistema: Histórico de Geração, 2011. Available at <http://www.ons.org.br/historico/geracao_energia.aspx>

The fourth alternative, an average operating margin, is an oversimplification and does not reflect the impact of the project activity in the operating margin at all. Therefore, the simple adjusted operating margin will be used in the project.

***STEP 4 - Calculate the operating margin emission factor according to the selected method***

According to the tool *"the simple adjusted OM emission factor ($EF_{grid,OM-adj,y}$) is a variation of the simple OM, where the power plants / units (including imports) are separated in low-cost/must-run power sources (k) and other power sources (m)."*

The simple adjusted OM was calculated based on the net electricity generation and a $CO_2$ emission factor for each power unit – i.e. similarly to **Option A** of the simple OM method – as follows:

[37] Low operating cost and must run resources typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation.

$$EF_{grid,OM-adj,y} = \left(1-\lambda_y\right)\cdot\frac{\sum_m EG_{m.y}\times EF_{EL,m,y}}{\sum_m EG_{m.y}} + \lambda_y\cdot\frac{\sum_k EG_{k,y}\times EF_{EL,k,y}}{\sum_k EG_{k,y}} \quad \textbf{(Equation 12)}$$

Where,

$EF_{grid,OM-adj,y}$ = Simple adjusted operating margin $CO_2$ emission factor in year *y* ($tCO_2$/MWh)

$\lambda_y$ = Factor expressing the percentage of time when low-cost/must-run power units are on the margin in year *y*

$EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)

$EG_{k,y}$ = Net quantity of electricity generated and delivered to the grid by power unit *k* in year *y* (MWh)

$EF_{EL,m,y}$ = CO2 emission factor of power unit *m* in year *y* (tCO2/MWh)

$EF_{EL,k,y}$ = CO2 emission factor of power unit *k* in year *y* (tCO2/MWh)

*m* = All grid power units serving the grid in year *y* except low-cost/must-run power units

*k* = All low-cost/must run grid power units serving the grid in year *y*

*y* = The relevant year as per the data vintage chosen in Step 3

*Determination of $EF_{EL,m,y}$*

Considering that only data on electricity generation and the fuel types used in each of the power units was available, the emission factor was be determined based on the CO2 emission factor of the fuel type used and the efficiency of the power unit, as per **Option A2** of the tool. The following formula was used:

$$EF_{EL,m,y} = \cdot\frac{EF_{CO2,m,i,y}\cdot 3.6}{\eta_{m,y}} \quad \textbf{(Equation 13)}$$

Where,

$EF_{EL,m,y}$ = CO2 emission factor of power unit *m* in year *y* (tCO2/MWh)

$EF_{CO2,m,i,y}$ = Average CO2 emission factor of fuel type *i* used in power unit *m* in year *y* (tCO2/GJ)

$\eta_{m,y}$ = Average net energy conversion efficiency of power unit *m* in year *y* (ratio)

*m* = All power units serving the grid in year *y* except low-cost/must-run power units

*y* = The relevant year as per the data vintage chosen in Step 3

*Determination of $EG_{m,y}$*

Information used to determine this parameter was supplied by the Electric System National Operator (from the Portuguese *Operador Nacional do Sistema – ONS*), which is an official source, as recommended by the tool. ONS is an entity of private right, non-profitable, created on 26 August 1998, responsible for coordinating and controlling the operation of generation and transmission facilities in the National Interconnected Power System (NIPS) under supervision and regulation of the Electric Energy National Agency (ANEEL)[38].

***STEP 5 - Calculate the build margin (BM) emission factor***

Option 2 (ex-post) was chosen, where for the first crediting period, the build margin emission factor shall be updated annually including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated ex ante, as described in Option 1 (ex-ante). For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. The sample group of power units *m* used to calculate the build margin consists of either:

(a) The set of five power units that have been built most recently, or

(b) The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

The build margin will also be calculated by the DNA. The number is published on the website and for estimation purposes the average for the most recent years is used.

The build margin emission factor is the weighted average emission factor ($tCO_2$/MWh) of all power units m during the most recent year y for which electricity generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} \qquad \textbf{(Equation 14)}$$

Where:

$EF_{grid,BM,y}$ = Build margin $CO_2$ emission factor in year *y* ($tCO_2$/MWh);

$EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit m in year *y* (MWh);

$EF_{EL,m,y}$ = $CO_2$ emission factor of power unit m in year *y* ($tCO_2$/MWh);

*m* = Power units included in the build margin;

*y* = Most recent historical year for which electricity generation data is available.

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[38] http://www.ons.org.br/institucional/modelo_setorial.aspx?lang=en

The $CO_2$ emission factor of power unit m in year *y* ( $EF_{EL,m,y}$ ) parameter is calculated as determined as per the guidance in step 3 (a) for the simple OM, option B1, using for *y* the most recent historical year for which electricity generation data is available, and using for *m* the power units included in the build margin.

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} \cdot NCV_{i,y} \cdot EF_{CO2,i,y}}{EG_{m,y}} \quad \textbf{(Equation 15)}$$

Where:

$EF_{EL,m,y}$ = $CO_2$ emission factor of power unit m in year *y* ($tCO_2$/MWh);

$FC_{i,m,y}$ = Amount of fossil fuel type i consumed by power unit m in year y (Mass or volume unit);

$NCV_{i,y}$ = Net calorific value (energy content) of fossil fuel type *i* in year *y* (GJ / mass or volume unit);

$EF_{CO2,i,y}$ = $CO_2$ emission factor of fossil fuel type *i* in year *y* ($tCO_2$/GJ);

$EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh);

*m* = All power units serving the grid in year y except low-cost / must-run power units;

*i* = All fossil fuel types combusted in power unit m in year *y*;

*y* = Either the three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option) or the applicable year during monitoring (ex post option), following the guidance on data vintage in step 2.

The Brazilian DNA made available the operating margin emission factor calculated following the “Tool to calculate the emission factor for an electricity system”, approved by the CDM Executive Board. This parameter will be annually up-dated applying the numbers provided by the Brazilian DNA. The number is published on the website and for estimation purposes the average of the most recent years is used.

***STEP 6 – Calculate the combined margin (CM) emissions factor (EFy).***

The combined margin calculation is based on method **a)** provided by the tool, as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \cdot w_{OM} + EF_{grid,BM,y} \cdot w_{BM} \quad \textbf{(Equation 16)}$$

Where,

$EF_{grid,BM,y}$ = Build margin $CO_2$ emission factor in year y ($tCO_2$/MWh);

$EF_{grid,OM,y}$ = Operating margin $CO_2$ emission factor in year y ($tCO_2$/MWh);

$w_{OM}$ = Weighting of operating margin emissions factor (%);

$w_{BM}$ = Weighting of build margin emissions factor (%).

According to the tool, for this type of project activities, weights are $w_{OM}$ = 0.5 and $w_{BM}$ = 0.5.

For the project activity, there is no heat baseline scenario to be included, since the main objective of the proposed project activity is the use of waste that would be disposed in a landfill in the absence of the project activity to generate electricity. There is no heat demand to be attended in the project scenario as well as in the absence of the project activity and, therefore, no calculation of baseline emissions from thermal energy produced utilizing the combustion heat from incineration in the project activity displacing thermal energy from onsite/offsite fossil fuel fuelled boiler (tCO2e) is not required.

***Project Emissions ($PE_y$)***

The project emissions in year *y* are:

$$PE_y = PE_{elec,y} + PE_{fuel,\ on\text{-}site,y} + PE_{c,y} + PE_{a,y} + PE_{g,y} + PE_{r,y} + PE_{i,y} + PE_{w,y} + PE_{co\text{-}firing,y} \quad \textbf{(Equation 17)}$$

Where:

| | | |
|---|---|---|
| $PE_y$ | = | Is the project emissions during the year *y* ($tCO_2e$) |
| $PE_{elec,y}$ | = | Is the emissions from electricity consumption on-site due to the project activity in year *y* ($tCO_2e$) |
| $PE_{fuel,\ on\text{-}site,y}$ | = | Is the emissions on-site due to fuel consumption on-site in year *y* ($tCO_2e$) |
| $PE_{c,y}$ | = | Is the emissions from composting in year *y* ($tCO_2e$) |
| $PE_{a,y}$ | = | Is the emissions from the anaerobic digestion process in year *y* ($tCO_2e$) |
| $PE_{g,y}$ | = | Is the emissions from the gasification process in year *y* ($tCO_2e$) |
| $PE_{r,y}$ | = | Is the emissions from the combustion of RDF/stabilized biomass in year *y* ($tCO_2e$) |
| $PE_{i,y}$ | = | Is the emissions from waste incineration in year *y* ($tCO_2e$) |
| $PE_{w,y}$ | = | Is the emissions from wastewater treatment in year *y* ($tCO_2e$) |
| $PE_{co\text{-}firing,y}$ | = | Is the emissions from thermal energy generation/electricity generation from on-site fossil fuel consumption during co-firing in year *y* ($tCO_2e$) |

***Emissions from electricity use on site ($PE_{elec,y}$)***

Where the project activity involves electricity consumption from an on-site fossil fuel fired power plant or consumed from the grid as a result of the project activity, $CO_2$ emissions are calculated using a carbon emission factor for electricity generation in the country. However, the project activity does not foresee any electricity consumption, since its objective is also supply the internal electricity demand before dispatching to the national grid. (Note: Project emissions from electricity consumption do not need to be calculated in case this electricity is generated by the project activity. In case of electricity generation from incineration, project emissions are estimated as per equations 12 ($PE_{g/r/i,f,y}$) and 13 (Ai) or 14 ($PE_{g/r/i,f,y}$) given by the methodology AM0025 - "Avoided emissions from organic waste through alternative waste treatment processes" (Version 13.0.0).).

As auxiliary fossil fuels are added into incinerator in order to guarantee a better burn, emissions from its use are estimated by using equation below.

***Emissions from fuel use on-site ($PE_{fuel,\ on-site,y}$)***

Project participants shall account for $CO_2$ emissions from any on-site fuel combustion (other than electricity generation, e.g. vehicles used on-site, heat generation, for starting the gasifier, auxiliary fossil fuels need to be added into incinerator, heat generation for mechanical/thermal treatment process, etc.). Emissions are calculated from the quantity of fuel used and the specific $CO_2$-emission factor of the fuel, as follows:

$PE_{fuel,\ on-site,y} = F_{cons,y} * NCV_{fuel} * EF_{fuel}$ **(Equation 18)**

Where:

| | | |
|---|---|---|
| $PE_{fuel,\ on-site,y}$ | = | Is the $CO_2$ emissions due to on-site fuel combustion in year *y* ($tCO_2$) |
| $F_{cons,y}$ | = | Is the fuel consumption on site in year *y* (kg) |
| $NCV_{fuel}$ | = | Is the net caloric value of the fuel (MJ/kg) |
| $EF_{fuel}$ | = | Is the $CO_2$ emissions factor of the fuel ($tCO_2$/MJ) |

Local values should be preferred as default values for the net calorific values and $CO_2$ emission factors. If local values are not available, project participants may use IPCC default values for the net calorific values and $CO_2$ emission factors.

***Emissions from composting ($PE_{c,y}$)***

Since the Project Activity does not comprehends composting process, this source is not considered.

***Emissions from anaerobic digestion ($PE_{a,y}$)***

The project activity does not present any anaerobic digestion, thus this source is not considered.

***Emissions from gasification ($PE_{g,y}$) or combustion of RDF/Stabilized Biomass ($PE_{r,y}$) or waste incineration($PE_{i,y}$)***

The project activity presents incineration process and, therefore, $PE_{i,y}$ is calculated as follows:

$PE_{i,y} = PE_{i,f,y} + PE_{i,s,y}$ **(Equation 19)**

Where:

| | | |
|---|---|---|
| $PE_{i,f,y}$ | = | Is the fossil-based waste $CO_2$ emissions from waste incineration biomass combustion in year *y* ($tCO_2e$) |
| $PE_{i,s,y}$ | = | Is the $N_2O$ and $CH_4$ emissions from the final stacks from waste incineration biomass combustion in year *y* ($tCO_2e$) |

***Emissions from fossil-based waste ($PE_{i,f,y}$)***

The $CO_2$ emissions are calculated based on the monitored amount of fossil-based waste fed into the waste incineration plant, the fossil-derived carbon content, and combustion efficiency. The calculation of $CO_2$ derived from incineration of waste of fossil origin including waste of fossil origin, is estimated using either of the following options:

**Option 1** requires the amount of waste type i fed into the waste incineration plant and the fraction of carbon content in waste type I and also demand a continuous monitoring of the amount of each waste type fed into the waste incineration plant. And then, **Option 2** is used.

**Option 2**

$$PE_{i,f,y} = A_{MSW,y} \times FCF_{MSW} \times EF \times \frac{44}{12}$$ **(Equation 20)**

Where:

| | | |
|---|---|---|
| $PE_{i,f,y}$ | = | Is the fossil-based waste $CO_2$ emissions from waste incineration in year $y$ ($tCO_2e$) |
| $A_{MSW,y}$ | = | Is the amount of MSW fed into the waste incineration plant(t/yr) |
| $FCF_{MSW}$ | = | Is the fraction of fossil carbon in MSW (fraction) |
| EF | = | Is the combustion efficiency for waste (fraction) |
| 44/12 | = | Is the conversion factor ($tCO_2/tC$) |

The $FCF_{MSW}$ is based on IPCC default value (2006 IPCC Guidelines for National Greenhouse Gas Inventories) given by its 5th volume, Chapter 2: Waste Generation, Composition and Management Data, table 2.4 (Default dry matter content, DOC content, total carbon content and fossil carbon fraction of different MSW components)[39].

The EF is based on IPCC default value (2006 IPCC Guidelines for National Greenhouse Gas Inventories) given by its 5th volume, section 5.4.1.3 Oxidation Factor, where for waste incinerators it is assumed that the combustion efficiencies are close to 100%, while the combustion efficiency of open burning is substantially lower. If oxidation factors of waste incineration below 100% are applied, these need to be documented in detail with the data source provided. Table 5.2 presents default oxidation factors by management practices and waste types. The Oxidation factor in % of carbon input for MSW is 100% for incineration).

***Emissions from waste incineration ($PE_{i,s,y}$)***

For the project activity, **Option 2** was chosen due to the available data:

**Option 2:**

$$PE_{g/r/i,s,y} = Q_{biomass,y} \cdot \left(EF_{N2O} \cdot GWP_{N2O} + EF_{CH4} \cdot GWP_{CH4}\right) \cdot 10^{-3}$$ **(Equation 21)**

Where:

| | | |
|---|---|---|
| $Q_{biomass,y}$ | = | Is the amount of waste incinerated in year $y$ (tonnes/yr) |
| $EF_{N2O}$ | = | Is the aggregate $N_2O$ emission factor for waste combustion ($tonN_2O$/tonne of waste) |
| $EF_{CH4}$ | = | Is the aggregate $CH_4$ emission factor for waste combustion ($tonCH_4$/tonne of waste) |

Tables 5.4 and 5.3, chapter 5, volume 5 of IPCC 2006 guidelines should be used to estimate $EF_{N2O}$ and $EF_{CH4}$ , respectively.

If IPCC default emission factor is used, a conservativeness factor should be applied to account for the high uncertainty of the IPCC default values. The level of the conservativeness factor depends on the uncertainty range of the estimate for the IPCC default $N_2O$ and $CH_4$ emission factor. Project participants shall select the appropriate conservativeness factor from Table 3 below and shall multiply the estimate for the $N_2O/CH_4$ emission factor with the conservativeness factor.

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[39] Available at < http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/5_Volume5/V5_2_Ch2_Waste_Data.pdf >. Accessed on November, 2011.

**Table 10 – Conservativeness factors**

| Estimated uncertainty range (%) | Assigned uncertainty band (%) | Conservativeness factor where higher values are more conservative |
|---|---|---|
| Less than or equal to 10 | 7 | 1.02 |
| Greater than 10 and less than or equal to 30 | 20 | 1.06 |
| Greater than 30 and less than or equal to 50 | 40 | 1.12 |
| Greater than 50 and less than or equal to 100 | 75 | 1.21 |
| Greater than 100 | 150 | 1.37 |

As per section 5.7.1 of chapter 5, volume 5 of IPCC 2006 guidelines, it is stated "Direct measurement or monitoring of emissions of $N_2O$ and $CH_4$ has less uncertainty. For continuous and periodic emission monitoring, uncertainty depends on the accuracy of measurement instruments and methods used. These are likely to be in order of ± 10 percent. For periodic measurement, uncertainty will also depend on the sampling strategy and frequency, and the uncertainties will be much higher. If default values for $N_2O$ and $CH_4$ emission factors are used, uncertainty ranges have been estimated to be ± 100 percent or more". Therefore, the value 1.37 is used.

***Emissions from wastewater treatment ($PE_{w,y}$)***

The project activity does not include wastewater release.

***Emissions from thermal energy generation/electricity generation (from on-site fossil fuel consumption during co-firing) ($PE_{co-firing,y}$)***

Project participants do not present any other $CO_2$ emissions associated to on-site fossil fuel combustion during co-firing with waste (other than electricity use as mentioned above ($PE_{elec,y}$) and from fuel use on-site ($PE_{fuel, on-site,y}$)).

***Leakage Calculation ($LE_y$)***

The sources of leakage considered in the methodology are $CO_2$ emissions from off-site transportation of waste materials in addition to $CH_4$ and $N_2O$ emissions from the residual waste from the anaerobic digestion, gasification processes and processing/combustion of RDF. In case of waste incineration, leakage emissions from residual waste of MSW incinerator should be accounted for. Positive leakage that may occur through the replacement of fossil-fuel based fertilizers with organic composts are not accounted for. If the project activity is exclusively composting, then $L_y = L_{COMP,y}$. Otherwise, leakage emissions should be estimated from the following equation:

$$L_y = L_{t,y} + L_{r,y} + L_{i,y} + L_{s,y} + L_{COMP,.y}$$ **(Equation 22)**

Where:

| | | |
|---|---|---|
| $L_{t,y}$ | = | Is the leakage emissions from increased transport in year *y* ($tCO_2e$) |
| $L_{r,y}$ | = | Is the leakage emissions from the residual waste from the anaerobic digester, the gasifier, the processing/combustion of RDF/stabilized biomass, in case it is disposed of in landfills in year *y* ($tCO_2e$) |

| | | |
|---|---|---|
| $L_{i,y}$ | = | Is the leakage emissions from the residual waste from MSW incinerator in year *y* ($tCO_2e$) |
| $L_{s,y}$ | = | Is the leakage emissions from end use of stabilized biomass |
| $L_{COMP,y}$ | = | Leakage emissions associated with composting in year *y* (t $CO_2e$ / yr) |

***Emissions from transportation*** ($L_{t,y}$)

The project activity does not result in a change in transport emissions. This occurs since the waste is transported from waste collecting points, in the collection area, to the treatment facility instead of to existing landfills, thus there is no significant increase.

The location of treatment described in this project is closer than the landfill and, therefore, is not considered. Refer to the following figure and table.

**Table 11:** Distances from *Barueri*, project and landfill.

| | Project Activity Location (*Estr. Dr. Cícero Borges de Moraes – Barueri – SP*) **(C)** | Landfill Location (*Estr. dos Romeiros – Santana do Parnaíba - SP*) **(B)** |
|---|---|---|
| *Barueri* **(A)** | 6 km | 17.3 km |
| Landfill Location (*Estr. dos Romeiros – Santana do Parnaíba - SP*) **(B)** | 11.4 km | 0 km |

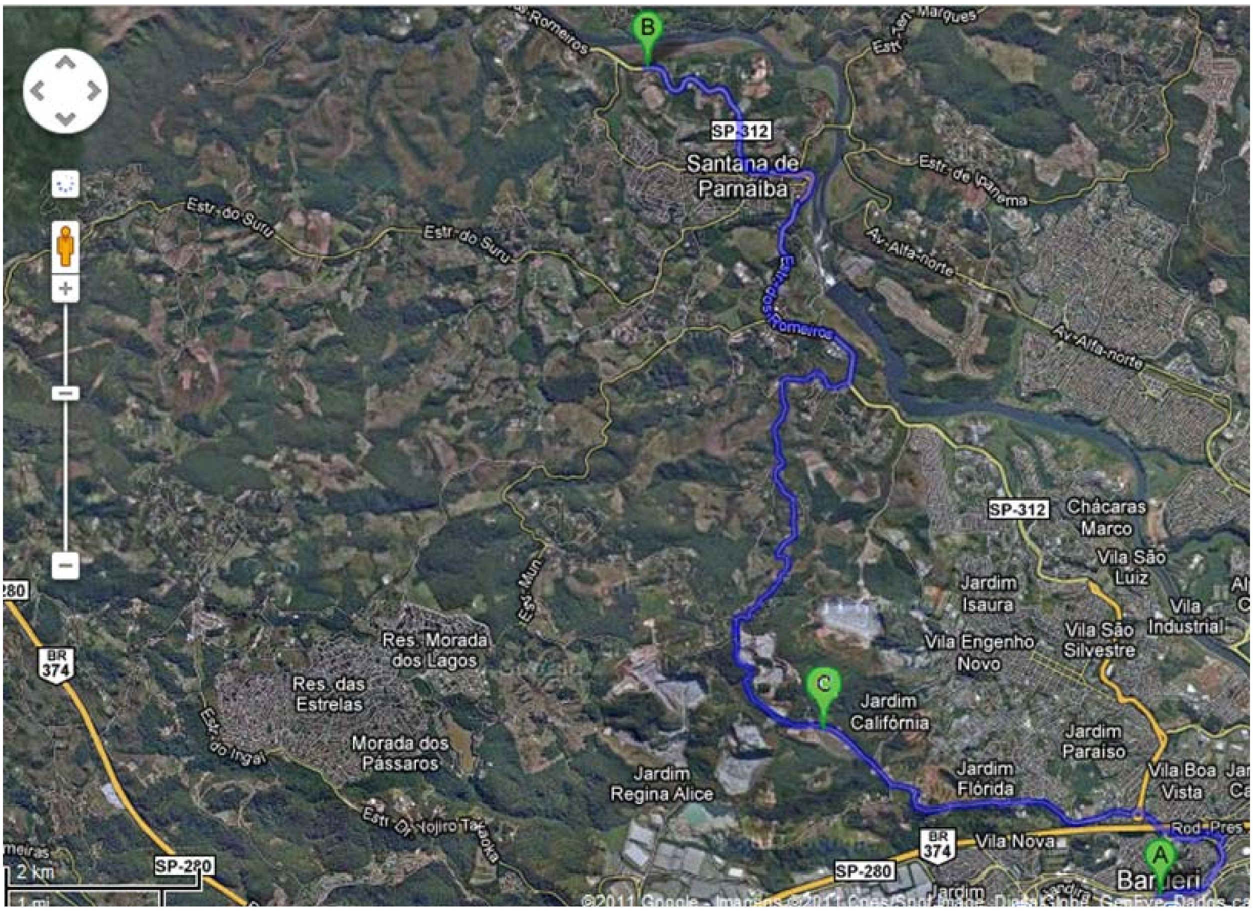


***Figure 5:*** *Project, landfill and* Barueri *Location*

Above, project participants documented an overview of collection points from where the waste will be collected, their approximate distance (in km) to the treatment facility, existing landfills and their approximate distance (in km) to the nearest end-user. And, therefore, no increase in transportation is predicted.

***Emissions from residual waste from anaerobic digester, gasifier, and processing/combustion of RDF/stabilized biomass or compost in case it is disposed of in landfills ($L_{r,y}$)***

For incineration, there is no residual waste from anaerobic digester to be considered.

***Leakage Emissions from the residual waste from MSW incineration ($L_{i,y}$)***

In case of waste incineration, leakage emissions from the residual waste of MSW incinerator should be accounted for using the following equations:

If the residual waste from the incinerator contains up to 5% residual carbon then:

$$L_{i,y} = A_{residual}.FC_{residual}.\frac{44}{12}$$ **(Equation 23)**

***Off-site Emissions from end use of the stabilized biomass*** ($L_{s,y}$)

The project activity does not comprehend emission associated to non-combustion end-use of stabilized biomass (SB). Therefore this LE is not accounted.

***Leakage emissions from composting ($LE_{COMP,y}$)***

The project activity does not comprehend any composting. Therefore this LE source is not accounted.

### B.6.2. Data and parameters that are available at validation:

This section shall include a compilation of information on the data and parameters that are not monitored throughout the crediting period but that are determined only once and thus remain fixed throughout the crediting period and that are available when validation is undertaken.

| **Data / Parameter:** | **OX** |
|---|---|
| Data unit: | - |
| Description: | Oxidation factor (reflecting the amount of methane from solid waste disposal site (SWDS) that is oxidized in the soil or other material covering the waste. |
| Source of data used: | Based on an extensive review of published literature on this subject, including the IPCC 2006 Guidelines for National Greenhouse Gas Inventories |
| Value applied: | 0.1 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | When methane passes through the top-layer, part of it is oxidized by methanotrophic bacteria to produce CO2. The oxidation factor represents the proportion of methane that is oxidized to CO2. This should be distinguished from the methane correction factor (MCF) which is to account for the situation that ambient air might intrude into the SWDS and prevent methane from being formed in the upper layer of SWDS |
| Any comment: | |

| **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 : | Upon biodegradation, organic material is converted to a mixture of methane and carbon dioxide. |
| Any comment: | |

| Data / Parameter: | $DOC_{f,default}$ |
|---|---|
| Data unit: | Weight fraction |
| Description: | Default value for the fraction of degradable organic carbon (DOC) in MSW that decomposes in the SWDS |
| 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 : | This factor reflects the fact that some degradable organic carbon does not degrade, or degrades very slowly, in the SWDS. This default value can only be used for<br>i) Application A; or<br>ii) Application B if the tool is applied to MSW. |
| Any comment: | The project activity is under Application B |

| Data / Parameter: | $MCF_{default}$ |
|---|---|
| Data unit: | - |
| Description: | Methane correction factor |
| Source of data used: | IPCC 2006 Guidelines for National Greenhouse Gas Inventories |
| Value applied: | 1.0 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | *Barueri* Landfill is an anaerobic managed SWDS, presenting a controlled placement of waste presenting the tree following characteristics specifying the deposition areas, a degree of control of scavenging and a degree of control of fires. And the project includes the presence of the cover material, mechanical compacting and leveling of the waste. |
| Any comment: | The MCF accounts for the fact that unmanaged SWDS produce less methane from a given amount of waste than managed SWDS, because a larger fraction of waste decomposes aerobically in the top layers of unmanaged SWDS. |

| Data / Parameter: | $DOC_j$ |
|---|---|
| Data unit: | - |
| Description: | Fraction of degradable organic carbon in the waste type *j* (weight fraction) |
| Source of data used: | IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Tables 2.4 and 2.5) |
| Value applied: | DOCj organic (food, food waste, beverages and tobacco (other than sludge)): 15%<br>DOCj Pulp, paper and cardboard (other than sludge): 40% |

| | |
|---|---|
| | DOCj wood and wood products 43%<br>DOCj Other (nonfood) organic putrescible garden and park waste 20% |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | These values were considered since represent fractions of degradable organic carbon in wet wastes, as it is applied for the project location. The procedure for the ignition loss test is described in BS EN 15169:2007 Characterization of waste. Determination of loss on ignition in waste, sludge and sediments.<br>The percentages listed in are based on wet waste bases which are concentrations in the waste as it is delivered to the SWDS. The IPCC Guidelines also specify DOC values on a dry waste basis, which are the concentrations after complete removal of all moist from the waste, which is not believed practical for this situation |
| Any comment: | |

| **Data / Parameter:** | $\mathbf{k_j}$ |
|---|---|
| Data unit: | 1/year |
| Description: | Decay rate for the waste type *j* |
| Source of data used: | IPCC 2006 Guidelines for National Greenhouse Gas Inventories (adapted from Volume 5, Table 3.3) - (Methodological tool "Emissions from solid waste disposal sites (version 06.0.1) |
| Value applied: | see table below |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Landfills in Brazil are an anaerobic and managed SWDS located in tropical regions (Mean Annual Temperature > 20°C) and wet (Mean Annual Precipitation > 1,000 mm). |
| Any comment: | |

| **Waste Type** | **Kj (Tropical and Wet)** |
|---|---|
| Pulp, paper and cardboard | 0.07 |
| Food, food waste, sewage sludge, beverages and tobacco | 0.40 |
| Textiles | 0.07 |
| Wood, wood products and straw | 0.035 |
| Other (nonfood) organic putrescible garden and park waste | 0.17 |
| MAT [40] | 21.3 °C |
| MAP | 1,516.5 mm |
| PET | Not applicable |

| **Data / Parameter:** | $\mathbf{GWP_{N2O}}$ |
|---|---|

[40] CIIAGRO - Centro integrado de informações agrometeorológicas *(Integrated Center of Agricultural meteorological information). http://www.ciiagro.sp.gov.br/ciiagroonline/Listagens/Resenha/LResenhaLocal.asp (search for Jundiaí and São Paulo that are the closest cities of Barueri)*

| | |
|---|---|
| Data unit: | $tCO_2e/tN_2O$ |
| Description: | Global Warming Potential (GWP) of N2O, valid for the relevant commitment period |
| Source of data used: | IPCC |
| Value applied: | 310 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | This value is applied for the first period of commitment period. Shall be updated according to any future COP/MOP decisions, if any. |
| Any comment: | |

| **Data / Parameter:** | **$GWP_{CH4}$** |
|---|---|
| Data unit: | $tCO_2e/tCH_4$ |
| Description: | Global Warming Potential of methane |
| Source of data used: | IPCC |
| Value applied: | 21 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | This value is applied for the first period of commitment period. Shall be updated according to any future COP/MOP decisions. |
| Any comment: | |

| **Data / Parameter:** | AF |
|---|---|
| Data unit: | % |
| Description: | Methane destroyed due to regulatory or other requirements |
| Source of data used: | Reducing uncertainties about methane recovered (R) in inventories of emissions of greenhouse gases by waste treatment, and on the parameter Adjustment Factor (AF) in projects for the collection and destruction of methane in landfills under the Clean Development Mechanism (CDM). MAGALHÃES, G. H. C., ALVES, J. W. S., SANTO FILHO, F., COSTA, R. M. and KELSON, M.. São Paulo, Brasil, 2010 (Available at <http://homologa.ambiente.sp.gov.br/biogas/docs/artigos_dissertacoes/magalhaes_alves_santofilho_costa_kelson.pdf>. Accessed on November, 2011). |
| Value applied: | 0.54% |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Following expert's study that states the understanding of methane emissions from passive systems in landfills in Brazil. |
| Any comment: | The Adjustment Factor shall be revised at the start of each new crediting |

| | |
|---|---|
| | period taking into account the amount of GHG flaring that occurs as part of common industry practice and/or regulation at that point in the future. Since this project activity will last 10 fixed years, this parameter will not be renewed. |

| **Data / Parameter:** | $NCV_{fuel}$ |
|---|---|
| Data unit: | MJ/kg |
| Description: | Net calorific value of fuel (natural gas) |
| Source of data used: | Country specific data given by *COMGÁS* – Gas Company of São Paulo State from free translation of Portuguese *Companhia de Gás de São Paulo* (available at: <http://www.comgas.com.br/quero_industria/gasnatural/beneficios.asp>. Accessed on November, 2011) as per guidance from the Board. |
| Value applied: | 51.34 |
| Justification of the choice of data or description of measurement methods and procedures actually applied: | Country specific data available on official site. |
| Any comment: | Ex ante |

| **Data / Parameter:** | $EF_{fuel}$ |
|---|---|
| Data unit: | $tCO_2$/MJ |
| Description: | Emission factor of the fuel |
| Source of data used: | 2006 IPCC Guidelines for National GHG Inventories - Volume 2: Energy - Table 2.2 |
| Value applied: | 0.0000561 |
| Justification of the choice of data or description of measurement methods and procedures actually applied: | IPCC default values were used since country or project specific data is not available or difficult to obtain. |
| Any comment: | Not applicable |

| **Data / Parameter:** | $EF_{N2O}$ |
|---|---|
| Data unit: | $kgN_2O$/tonne waste (dry) |
| Description: | Aggregate $N_2O$ emission factor for waste incineration |
| Source of data used: | Table 5.6 of 2006 IPCC Guidelines for National GHG Inventories |
| Value applied: | 0.05 |

| | |
|---|---|
| Justification of the choice of data or description of measurement methods and procedures actually applied: | IPCC default values were used since country or project specific data is not available or difficult to obtain. |
| Any comment: | |

| **Data / Parameter:** | $EF_{CH4}$ |
|---|---|
| Data unit: | $KgCH_4$/tonne waste (dry) |
| Description: | Aggregate $CH_4$ emission factor for waste incineration |
| Source of data used: | As per guidance from the Board, IPCC default values should be used only when country or project specific data are not available or difficult to obtain |
| Value applied: | 0.0002 |
| Justification of the choice of data or description of measurement methods and procedures actually applied: | IPCC default values were used since country or project specific data is not available or difficult to obtain. |
| Any comment: | |

### B.6.3. Ex-ante calculation of emission reductions:

Following the AM0025 - "Avoided emissions from organic waste through alternative waste treatment processes" (Version 13.0.0)., the calculation for the emission reductions is presented.

***Baseline Emissions ($BE_y$)***

To calculate the baseline emissions, project participants shall use Equation 2 explained in section B.6.1. The results are presented:

**Table 12 –Results for the Baseline Emissions calculation**

| | **BE y** | **MBy** | **MDreg,y** | **BEen,y** |
|---|---|---|---|---|
| | *tCO2* | *tCO2* | *tCO2* | *tCO2* |
| 2014 | 43,616 | 26,937 | 145 | 16,824 |
| 2015 | 125,463 | 85,546 | 462 | 40,378 |
| 2016 | 163,910 | 124,202 | 671 | 40,378 |
| 2017 | 190,672 | 151,110 | 816 | 40,378 |
| 2018 | 209,537 | 170,077 | 918 | 40,378 |
| 2019 | 223,046 | 183,659 | 992 | 40,378 |
| 2020 | 232,908 | 193,575 | 1,045 | 40,378 |
| 2021 | 240,271 | 200,978 | 1,085 | 40,378 |
| 2022 | 245,911 | 206,649 | 1,116 | 40,378 |

| | | | | |
|---|---|---|---|---|
| 2023 | 250,348 | 211,110 | 1,140 | 40,378 |
| 2024 | 197,745 | 175,137 | 946 | 23,554 |

With the intention of estimating the $MD_{reg,y}$ from equation 6, a conservative ex-ante estimation of the amount of methane that is destroyed/combusted during the year, in tonnes of CO2e, will be done following specifications of AM0025 - "Avoided emissions from organic waste through alternative waste treatment processes" (Version 13.0.0)., that proposes the use of the amount of methane that would be generated in the landfill converted to carbon dioxide ($BE_{CH4,SWDS,y}$) from premise in Equation 3 ($MB_y = BE_{CH4,SWDS,y}$) and also the emission related to the methane flared in the baseline (landfill), using an Adjustment Factor of 0.54% (source: Reducing uncertainties about methane recovered (R) in inventories of emissions of greenhouse gases by waste treatment, and on the parameter Adjustment Factor (AF) in projects for the collection and destruction of methane in landfills under the Clean Development Mechanism (CDM). MAGALHÃES, G. H. C., ALVES, J. W. S., SANTO FILHO, F., COSTA, R. M. and KELSON, M.. São Paulo, Brasil, 2010), as presented below:

**Table 13 –Results for the methane that would be destroyed in the absence of the project activity in year y (MDreg,y)**

| | **MDreg,y** | **MBy** | **AF** |
|---|---|---|---|
| | *tCO2* | *tCO2* | *%* |
| 2014 | 145 | 26,937 | 0.54% |
| 2015 | 462 | 85,546 | 0.54% |
| 2016 | 671 | 124,202 | 0.54% |
| 2017 | 816 | 151,110 | 0.54% |
| 2018 | 918 | 170,077 | 0.54% |
| 2019 | 992 | 183,659 | 0.54% |
| 2020 | 1,045 | 193,575 | 0.54% |
| 2021 | 1,085 | 200,978 | 0.54% |
| 2022 | 1,116 | 206,649 | 0.54% |
| 2023 | 1,140 | 211,110 | 0.54% |
| 2024 | 946 | 175,137 | 0.54% |

In order to calculate $MB_y$ is calculated as per the *Methodological tool "Emissions from solid waste disposal sites (version 06.0.1)*. In order to value the parameter $BE_{CH4,SWDS,y}$ the latest version of the mentioned tool must be used. The amount of methane that would, in the absence of the project activity, be generated from disposal of waste at the solid waste disposal site ($BE_{CH4,SWDS,y}$) is calculated based on a first order decay (FOD) model, which differentiates the types of waste (named by **j**) with respectively respective constant decay rates, $k_j$, and fractions of degradable organic carbon ($DOC_j$). The FOD model calculates the methane generated occurring in year y (a period of 12 consecutive months) or month m based on the waste streams of waste types j ($W_{j,x}$) disposed in the SWDS over a specified time period (years or months). The other parameters to be included in Equation 4 were described in section B.6.1 and B.6.2:

**Table 14 –Results for $BE_{CH4,SWDS,y}$**

| | BE CH4,swds,y |
|---|---|
| | *tCO2* |
| 2014 | 26,937 |
| 2015 | 85,546 |
| 2016 | 124,202 |
| 2017 | 151,110 |
| 2018 | 170,077 |
| 2019 | 183,659 |
| 2020 | 193,575 |
| 2021 | 200,978 |
| 2022 | 206,649 |
| 2023 | 211,110 |
| 2024 | 175,137 |

As it was shown in section B.6.1, the unique value that is not a default given by the methodology is $W_{j,x}$, that represents the amount of waste disposed in the SWDS in that year. The Equation 5 also differentiates the types of waste between a list given for DOC (degradable organic carbon) and k (decay rate), that reference to:

**Table 15 –List of type of waste, following DOC and k specifications**

| *DOC* | *k* |
|---|---|
| Wood and wood products | Pulp, paper, cardboard (other than sludge), textiles |
| Pulp, paper and cardboard (other than sludge) | Wood, Wood products and straw |
| Food, food waste, beverages and tobacco (other than sludge) | Other (non-food) organic putrescible garden and park waste |
| Textiles | Food, food waste, sewage sludge, beverages and tobacco |
| Garden, yard and park waste | - |
| Glass, plastic, metal, other inert waste | - |

Then, it is necessary to find the sort of waste following these lists in order to apply the correct factor for each type of waste (named as $A_{j,x}$ by the referred methodology). Therefore, for the Project Activity, the composition of waste was identified and also their percentages in the total amount, as they are presented in the table below:

**Table 16 – Proportion of each type of waste to be delivered to the Project Activity**

| **Waste Type** | | |
|---|---|---|
| Waste | Unit | Proportion |
| Wood, wood products | % | 0.55 |
| Pulp, paper and cardboard (other than | % | 8.22 |

| | | |
|---|---|---|
| sludge) | | |
| Food, food waste, sewage sludge, beverages and tobacco | % | 71.25 |
| Textiles | % | 1.43 |
| Glass, metal, Plastic, Styrofoam, pet, other inert waste | % | 18.54 |

Source: data provided by the project participant. Details are given in section B.7.2.

And, then, for the calculation of Equation 5, the amount (in tonnes per year) of wastes is:

**Table 17 – Amount of waste applying Equation 5**

| *Year* | *Food* | *Paper* | *Textile* | *Wood* |
|---|---|---|---|---|
| 2014 | 81,274 | 9,379 | 1,637 | 628 |
| 2015 | 195,057 | 22,510 | 3,928 | 1,506 |
| 2016 | 195,057 | 22,510 | 3,928 | 1,506 |
| 2017 | 195,057 | 22,510 | 3,928 | 1,506 |
| 2018 | 195,057 | 22,510 | 3,928 | 1,506 |
| 2019 | 195,057 | 22,510 | 3,928 | 1,506 |
| 2020 | 195,057 | 22,510 | 3,928 | 1,506 |
| 2021 | 195,057 | 22,510 | 3,928 | 1,506 |
| 2022 | 195,057 | 22,510 | 3,928 | 1,506 |
| 2023 | 195,057 | 22,510 | 3,928 | 1,506 |
| 2024 | 113,784 | 13,131 | 2,291 | 879 |

***Baseline emissions from generation of energy***

For Scenario 1 (identified in section B.4), the $BE_{EN,y}$ is determined considering only the baseline emissions from electricity generated utilizing the combustion heat from incineration in the project activity and exported to the grid, where the quantity of net electricity generation supplied by the project plant to the grid in year *y* ($EG_{d,y}$, in MWh/y, by Equation 8) was determined, for the purpose of *ex-ante* estimative as being equal to the average assured power (17.526 MW) multiplied by the number of hours of operation in the year (7,800 h). These figures result in an electricity generation by the plant considered in this CDM Project Activity equal to 136,702.8 MWh/year.

The $CO_2$ Emission Factor of the electric power generation verified in the National Interconnected System (*SIN – Sistema Interligado Nacional*) of Brazil is calculated from the generation registers of the dispatched plants consolidated by the National Operator of the Electric System (*ONS*) and, especially, for the thermoelectric plants (fossil fuel based). The calculation procedure of the $CO_2$ emission factor was developed jointly between the Ministry of Science and Technology (*MCT – Ministério de Ciência e Tecnologia*) and the Ministry of Mines and Energy (*MME – Minintério de Minas e Energia*), following as base the Tool to calculate the emission factor of an electricity system (version 2.2.1). This procedure is in accordance with the operative practices of SIN, regulated by the National Agency of Electrical Energy (*ANEEL*).

Following that systematic, the $CO_2$ Emission Factor started to be calculated by *ONS* for the Interconnected National System and it is available to be consulted online by the interested public and investors. Moreover, the *MCT* supplies, besides the emission factor, a descriptive manual of the formulas used in the factor calculations. Therefore, the resulting emission factor for 2010 ($EF_{grid,CM,y}$) is 0.3100 $tCO_2e/MWh$ for 2010, since the Operation Margin valued in 0.4796 $tCO_2e/MWh$ and the Build Margin in 0.1404 $tCO_2e/MWh$. Applying an arithmetic average, it achieve the 0.3100 $tCO_2e/MWh$ for the emission factor of Brazilian Electrical Grid, where was available data for the project activity.

The operating margin for the project boundary is calculated *ex- post* using the full generation-weighted average for the baseline year. The amount of fuel consumption for thermal generation for the project boundary is available for Brazilian DNA. The average $EF_{grid,OM,y}$ for the project activity is 0.4796 (kg $CO_2e/kWh$) in 2010. At the tables 13 below the values are given.

**Table 18 –Values of $EF_{grid,OM,y}$ in 2010**

| *Emission Factor of Brazilian National Grid 2010* | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Month Average Factor (tCO2/MWh)** | | | | | | | | | | | | |
| Month | | | | | | | | | | | | |
| Jan | Febr | March | April | May | June | July | Aug | Sept | Oct | Nov | Dec | ***Average*** |
| 0.2111 | 0.2798 | 0.2428 | 0.2379 | 0.3405 | 0.4809 | 0.4347 | 0.6848 | 0.7306 | 0.7320 | 0.7341 | 0.6348 | ***0.4796*** |

The build margin approach aims to make a "best guess" on the type of power generation facility that would have otherwise been built, in the absence of the GHG mitigation project. For the project activity the data based on year 2010 are provided through the *ONS*. The values for energy generation are defined through the wholesale electricity market operator (*CCEE*).

The build margin is estimated *ex-post,* based on the most recent built plants, which comprise the larger annual generation compared to the recently built 20%, thus they represent the capacity additions to the system. The $EF_{grid,BM,y}$ for the selected plants is 0.1404 in 2010.

Finally, the baseline emission factor $EF_{grid,CM,y}$ is calculated as the weighted average of the Operating Margin emission factor ($EF_{grid,OM,y}$) and the Build Margin emission factor $(EF_{grid,BM,y})$:

$$EF_{grid,CM,y} = (\omega_{BM} * EF_{grid,BM,y}) + (\omega_{OM} * EF_{grid,OM,y}) \quad \text{Equation 11}$$

Where:

$\omega_{BM} = 0.5$

$\omega_{OM} = 0.5$

Both $\omega_{BM}$ and $\omega_{OM}$ have a value of 0.5 because the project activity is not a wind and solar power generation project activity.

**Table 19 –Values of baseline electricity emission**

| | $BE_{EN,y}$ | BEelec,y |
|---|---|---|
| | *tCO2* | *tCO2* |
| 2014 | 16,824 | 16,824 |
| 2015 | 40,378 | 40,378 |
| 2016 | 40,378 | 40,378 |
| 2017 | 40,378 | 40,378 |
| 2018 | 40,378 | 40,378 |

| | | |
|---|---|---|
| 2019 | 40,378 | 40,378 |
| 2020 | 40,378 | 40,378 |
| 2021 | 40,378 | 40,378 |
| 2022 | 40,378 | 40,378 |
| 2023 | 40,378 | 40,378 |
| 2024 | 23,554 | 23,554 |

***Project Emissions ($PE_y$)***

The applicable sources for project emissions are, from Equation 12, emissions on-site due to fuel consumption on-site in year y ($PE_{fuel,\ on\text{-}site,y}$) and emissions from waste incineration in year y ($PE_{i,y}$). The considered fossil fuel in the first parameter is the natural gas used as auxiliary fossil fuels needed to be added into incinerator. The used $NCV_{fuel}$ is valued in 51.34 MJ/kg (where information provided by Comgas is used, as explained in section B.6.1 and B.6.2). Also, the $EF_{fuel}$ that represents the $CO_2$ emissions factor of the fuel was valued in 0.0000561 $tCO_2$/MJ (based on IPCC, 2006 as described in previous sections). The $F_{cons,y}$, the fuel consumption on site in year y, is considered to be an average of 497,900 kg per year (650,000 Nm3/year * 0.766 kg/m3[41] as technical expert declaration[42]). And the yearly value achieved by this type of Project Emission is 1,434 tCO2e.

The project emissions due to the incineration process, $PE_{i,y}$, is calculated based on fossil-based waste $CO_2$ emissions from waste incineration biomass combustion in year y and $N_2O$ and $CH_4$ emissions from the final stacks from waste incineration biomass combustion in year y in Equations 14, 15 and 16.

For the first estimative ($PE_{i,f,y}$), option 2 of the possibilities given by the mentioned methodology is used. A daily amount of 750 tonnes of waste is considered ($A_{msw,y}$) and the proportion given in table 16 above influences the $FCF_{msw}$ identification, which considers the plastic, textile[43] and paper to present Fossil Carbon Fraction. In order to calculate the FCF for each type of waste, the fossil carbon fraction of total carbon is multiplied by the total carbon content of dry weight and sequentially multiplied by the dry matter content in % of wet weight.

*The amount of 750 tonnes/day is an estimative provided in the section 4.2.2 of the Technical Proposal from* Foxx Soluções Ambientais Ltda. *to the Competitive Bidding Process 023/2010 of the Municipality of Barueri. From this total amount, it is predicted, based on provided information in 2010 (at the Biding process period), that 490.4 tonnes/day are from Barueri Municipality and 259.6 tonnes from other clients (Carapicuíba and Santana de Parnaíba).* This is an average for the entire period of the project (for 30 years of the signed contract).

The result is given below:

**Table 20 – $FCF_{msw}$ calculation**

[41] Given by local natural gas supplier. Available at <http://www.comgas.com.br/quero_industria/gasnatural/beneficios.asp>. Accessed on April, 2012.

[42] Following Paragraph 84 of the version 01.2 of the VVM *"The DOE shall cross check the information provided in the PDD with other verifiable and credible sources, such as local expert opinion, if available."* This information was provided by Keppel Seghers by email on March, 6th 2012. This information was available to the Validation Team.

[43] 40 percent of *textiles are* assumed to be synthetic (default). Expert judgement by the authors. IPCC, 2006

| | Fossil carbon fraction in % of total carbon | Total carbon content in % of dry weight | Dry matter content in % of wet weight | *FCF msw* |
|---|---|---|---|---|
| **Plastic** | 100% | 75% | 100% | ***75.00%*** |
| **Textile** | 20% | 50% | 80% | ***8.00%*** |
| **Paper** | 1% | 46% | 90% | ***0.41%*** |

In addition, the last parameter given in Equation 15 is the combustion efficiency for the incinerator, which is assumed to be close to 100% (IPCC, 2006). And, then, the $PE_{i,f,y}$ is given below:

**Table 21 – Fossil-based waste CO2 emissions from waste incineration in year y**

| | **PEi,f,y** | **A msw,y** | **FCF msw** | **EF** |
|---|---|---|---|---|
| | *tCO2* | *ton/y* | *fraction* | *fraction* |
| 2014 | 45,293 | 114,063 | 0.1083 | 1 |
| 2015 | 108,703 | 273,750 | 0.1083 | 1 |
| 2016 | 108,703 | 273,750 | 0.1083 | 1 |
| 2017 | 108,703 | 273,750 | 0.1083 | 1 |
| 2018 | 108,703 | 273,750 | 0.1083 | 1 |
| 2019 | 108,703 | 273,750 | 0.1083 | 1 |
| 2020 | 108,703 | 273,750 | 0.1083 | 1 |
| 2021 | 108,703 | 273,750 | 0.1083 | 1 |
| 2022 | 108,703 | 273,750 | 0.1083 | 1 |
| 2023 | 108,703 | 273,750 | 0.1083 | 1 |
| 2024 | 63,410 | 159,688 | 0.1083 | 1 |

For Equation 16, the following parameters are applied in order to estimate the Emissions from waste incineration through option 2 of the referred methodology.

**Table 22 – Parameters used for the project emissions calculation due to the waste incineration**

| **EF N2O** | **GWP N2O** | **EF CH4** | **GWP CH4** | **Conservativeness Factor** |
|---|---|---|---|---|
| *tonN2O/tonnes of waste* | *tonCO2/tonN2O* | *tonCH4/tonne of waste* | *tonCO2/tonCH4* | - |
| 0.0500 | 310 | 0.0002 | 21 | 1.37 |

Using these parameters in formula 16, a yearly tCO2e of 5,815 is achieved, being influenced by the amount of waste combusted in year y ($Q_{biomass,y}$).

**Table 23 –Project emissions estimative due to the incineration process**

| | **PEi,y** | **PEi,f,y** | **PEi,s,y** |
|---|---|---|---|
| | *tCO2* | *tCO2* | *tCO2* |
| 2014 | 47,716 | 45,293 | 2,423 |
| 2015 | 114,517 | 108,703 | 5,815 |

| | | | |
|---|---|---|---|
| 2016 | 114,517 | 108,703 | 5,815 |
| 2017 | 114,517 | 108,703 | 5,815 |
| 2018 | 114,517 | 108,703 | 5,815 |
| 2019 | 114,517 | 108,703 | 5,815 |
| 2020 | 114,517 | 108,703 | 5,815 |
| 2021 | 114,517 | 108,703 | 5,815 |
| 2022 | 114,517 | 108,703 | 5,815 |
| 2023 | 114,517 | 108,703 | 5,815 |
| 2024 | 66,802 | 63,410 | 3,392 |

***Leakage Calculation ($LE_y$)***

The source of leakage considered to the proposed project activity is the leakage emissions from the residual waste from MSW incinerator in year *y* ($L_{i,y}$). Equation 18 applies the following parameters:

**Table 24 –Parameters for $L_{i,y}$ calculation**

| | | |
|---|---|---|
| Residual waste from incineration | 15% | % |
| FC residual | 3% | % |

Since the project activity presents a residual waste from the incinerator containing up to 5% residual carbon, following supplier specifications[44], equation 18 is assumed, therefore:

**Table 25 – $L_{i,y}$ calculation**

| | L i,y | A residual | FC residual |
|---|---|---|---|
| | *tCO2* | *t/y* | *%* |
| 2014 | 1,882 | 17,109 | 3% |
| 2015 | 4,517 | 41,063 | 3% |
| 2016 | 4,517 | 41,063 | 3% |
| 2017 | 4,517 | 41,063 | 3% |
| 2018 | 4,517 | 41,063 | 3% |
| 2019 | 4,517 | 41,063 | 3% |
| 2020 | 4,517 | 41,063 | 3% |
| 2021 | 4,517 | 41,063 | 3% |
| 2022 | 4,517 | 41,063 | 3% |
| 2023 | 4,517 | 41,063 | 3% |
| 2024 | 2,635 | 23,953 | 3% |

***Emission Reductions ($ER_y$)***

[44] Based on *Kepel Seghers* guarantee – section 4.1. Document dated of December, 2011 Named “Proposal for: Barueri Waste-to-energy plant Guarantees” states that “the maximum total organic carbon (TOC) in the bottom ash will be less than 3%”.

The emission reductions figure the following:

| Year | | Project Emissions (tCO2) | Baseline Emissions (tCO2) | Leakage (tCO2) | Emissions Reductions (tCO2) |
|---|---|---|---|---|---|
| 1 | 2014* | 48,313 | 43,616 | 1,882 | (6,579) |
| 2 | 2015 | 115,952 | 125,463 | 4,517 | 4,994 |
| 3 | 2016 | 115,952 | 163,910 | 4,517 | 43,441 |
| 4 | 2017 | 115,952 | 190,672 | 4,517 | 70,204 |
| 5 | 2018 | 115,952 | 209,537 | 4,517 | 89,068 |
| 6 | 2019 | 115,952 | 223,046 | 4,517 | 102,577 |
| 7 | 2020 | 115,952 | 232,908 | 4,517 | 112,439 |
| 8 | 2021 | 115,952 | 240,271 | 4,517 | 119,803 |
| 9 | 2022 | 115,952 | 245,911 | 4,517 | 125,443 |
| 10 | 2023 | 115,952 | 250,348 | 4,517 | 129,880 |
| 11 | 2024* | 67,638 | 197,745 | 2,635 | 127,472 |
| Total | | ***1,159,516*** | ***2,123,426*** | ***45,169*** | ***918,742*** |

* Since August, 1st 2014 to July, 31st 2024.

**B.6.4 Summary of the ex-ante estimation of emission reductions:**

| **Year** | **Estimation of project activity emissions (tonnes of $CO_2e$)** | **Estimation of baseline emissions (tonnes of $CO_2e$)** | **Estimation of leakage (tonnes of $CO_2e$)** | **Estimation of overall emission reductions (tonnes of $CO_2e$)** |
|---|---|---|---|---|
| 2014* | 48,313 | 43,616 | 1,882 | -6,579 |
| 2015 | 115,952 | 125,463 | 4,517 | 4,994 |
| 2016 | 115,952 | 163,910 | 4,517 | 43,441 |
| 2017 | 115,952 | 190,672 | 4,517 | 70,204 |
| 2018 | 115,952 | 209,537 | 4,517 | 89,068 |
| 2019 | 115,952 | 223,046 | 4,517 | 102,577 |
| 2020 | 115,952 | 232,908 | 4,517 | 112,439 |
| 2021 | 115,952 | 240,271 | 4,517 | 119,803 |
| 2022 | 115,952 | 245,911 | 4,517 | 125,443 |
| 2023 | 115,952 | 250,348 | 4,517 | 129,880 |
| 2024** | 67,638 | 197,745 | 2,635 | 127,472 |
| **Total (tonnes of $CO_2e$)** | **1,159,516** | **2,123,426** | **45,169** | **918,742** |

*Since August 1st

** Until July 31st

## B.7. Application of the monitoring methodology and description of the monitoring plan:

Data monitored and required for verification and issuance will be kept for two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later. The parameters chosen for the calculation of the emissions factor were ex-ante (see Section B.6.2).

### B.7.1 Data and parameters monitored:

| **Data / Parameter:** | $\varphi_{default}$ |
|---|---|
| Data unit: | - |
| Description: | Default value for the model correction factor to account for model uncertainties |
| Source of data to be used: | Methodological tool “Emissions from solid waste disposal sites (version 06.0.1) - default value for humid/wet condition under Application B. |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 0.99 |
| Description of measurement methods and procedures to be applied:: | This value (tool) is required in the methodology AM0025 - “Avoided emissions from organic waste through alternative waste treatment processes” (Version 13.0.0). |
| QA/QC procedures to be applied: | Calculated annually |
| Any comment: | |

| **Data / Parameter:** | $F_{cons,y}$ |
|---|---|
| Data unit: | Kg |
| Description: | Fuel consumption on-site during year *y* of the crediting period |
| Source of data to be used: | Paid fuel invoices |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 497,900 (estimative number from technical expert information. Details in section B.6.3) |
| Description of measurement methods and procedures to be applied:: | Not applicable |
| QA/QC procedures | The amount of fuel will be derived from the paid fuel invoices (administrative |

| | |
|---|---|
| to be applied: | obligation) and monitored annually. |
| Any comment: | This parameter includes the auxiliary fossil fuels that need to be added in the incinerator or used for mechanical or thermal treatment process. For the ex-ante estimation, the value was used following technical expert declaration[45]. |

| **Data / Parameter:** | $A_{MSW,y}$ |
|---|---|
| Data unit: | tonnes/yr |
| Description: | Amount of MSW fed into the waste incineration plant |
| Source of data to be used: | Project participants |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 273,750 |
| Description of measurement methods and procedures to be applied: | By accessing the complex, the trucks be weighed with the waste (charged) in the "ENTRANCE" scale, then turn out the waste and will be weighed again in the "EXIT" scale.<br>A magnetic card reader and a card unique to each transport vehicle will be used to correlate the number of vehicle registration to the weight of the vehicle at the entrance and exit, and the tare, the amount of waste and the time of delivery.<br>All transactions will be recorded in the computer storage of weighing data. For vehicles that do not have a registered magnetic card, it will be necessary to incorporate details of the transaction manually. |
| QA/QC procedures: | These data will be stored and correlated in a similar manner to that described above. Alternatively, connect an intercom weighing the control room, so the transaction details will be incorporated into computer data storage by the operator. A ticket will be printed in the output of weighing all the details of the transaction. The accuracy of the weighing system is 99%, and the scales will be calibrated regularly according to current standards, as described in the Technical Proposal from *Foxx Soluções Ambientais Ltda.* to *Osasco* City Hall, *Ecoosasco Ambiental S.A.* |
| Any comment: | Continuously, aggregated at least annually |

| **Data / Parameter:** | **z** |
|---|---|
| Data unit: | - |
| Description: | Number of samples collected during the year x |
| Source of data to be used: | Project participants |
| Value of data applied for the purpose of calculating expected emission reductions | 1 (for ex-ante estimation) |

[45] Following Paragraph 84 of the version 01.2 of the VVM *"The DOE shall cross check the information provided in the PDD with other verifiable and credible sources, such as local expert opinion, if available."*

| | |
|---|---|
| in section B.5 | |
| Description of measurement methods and procedures to be applied: | Yearly. The contents of the recipients for the gravimetric analysis may be poured on the sorting table, consisting of two sieves in series with meshes. Each group may be weighed separately and groups of Thick and Medium should be forwarded for screening. Screening of the material and parcel of the sample, separated according to the following ratings for the group of Thick and Medium. Classification should be made in: Organic Waste, Paper / Cardboard, glasses, metals, composites, plastics, textiles, sanitary textiles, various fuels, various non-combustible and special wastes. Each material should be weighed separately to obtain the fraction of its gravimetric percentage composition of sample of the waste. |
| QA/QC procedures to be applied: | This parameter only needs to be monitored if the waste prevented from disposal includes several waste categories j, as categorized in the tables for $DOC_j$ and $k_j$. Since the project activity is under this case, the PP will monitor this parameter four times per year. |
| Any comment: | |

| **Data / Parameter:** | **a, b, c, d, e, g** |
|---|---|
| Data unit: | % |
| Description: | Effect of the uncertainty of different parameters |
| Source of data to be used: | Project participants |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | Used the instructions in the Methodological tool "Emissions from solid waste disposal sites (version 06.0.1).<br>Applied values:<br>a: 2%<br>b: 10%<br>c: 5%<br>d: 0%<br>e: 0%<br>g: 5% |
| Description of measurement methods and procedures to be applied: | Annually if the conditions described in the Instructions for selecting the factor in Table 3 of the Methodological tool "Emissions from solid waste disposal sites (version 06.0.1) have changed (e.g. a change in how the weight of the waste is measured). Once for the crediting period, if these conditions do not change. |
| QA/QC procedures to be applied: | - |
| Any comment: | For details, refer to section B.6.1. Used in Option 2 for determining the model correction factor. |

| **Data / Parameter:** | $FCF_{MSW}$ |
|---|---|
| Data unit: | Fraction |
| Description: | Fraction of fossil carbon in MSW |
| Source of data to be used: | Sample measurements by project participants |

| | |
|---|---|
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 0.1083 |
| Description of measurement methods and procedures to be applied: | The following standards should be used:<br>• ASTM D6866-08: "Standard Test Methods for Determining the Biobased Content of Solid, Liquid, and Gaseous Samples Using Radiocarbon Analysis";<br>• ASTM D7459-08: "Standard Practice for Collection of Integrated Samples for the Speciation of Biomass (Biogenic) and Fossil-Derived Carbon Dioxide Emitted from Stationary Emissions Sources" |
| QA/QC procedures to be applied: | The size and frequency of sampling should be statistically significant with a maximum uncertainty range of 20% at a 95% confidence level. As a minimum, sampling should be undertaken four times per year. Samples need to be representative of all categories of waste. DOEs should check the consistency between the sample composition sent to labs for determining fossil carbon in waste and the actual waste received on site. Project proponents are required to keep records of the composition of the waste sample sent for testing. Lab results reports for fossil carbon should also include the composition of the waste sample that was tested |
| Any comment: | |

| **Data / Parameter:** | EF |
|---|---|
| Data unit: | Fraction |
| Description: | Combustion efficiency for waste |
| Source of data to be used: | The source of data should be the following, in order of preference: project specific data, country specific data or IPCC default values. As per guidance from the Board, IPCC default values should be used only when country or project specific data are not available or difficult to obtain |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 1 |
| Description of measurement methods and procedures to be applied: | - |
| QA/QC procedures: | |
| Any comment: | Annually |

| **Data / Parameter:** | $MB_y$ |
|---|---|
| Data unit: | $tCH_4$ |
| Description: | Methane produced in the landfill in the absence of the project activity in year *y* |
| Source of data to be | Calculated as per the Methodological tool "Emissions from solid waste disposal |

| | |
|---|---|
| used: | sites (version 06.0.1) |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | <table><tr><th>Year</th><th>MBy ($tCO_2$)</th></tr><tr><td>2014</td><td>26,937</td></tr><tr><td>2015</td><td>85,546</td></tr><tr><td>2016</td><td>124,202</td></tr><tr><td>2017</td><td>151,110</td></tr><tr><td>2018</td><td>170,077</td></tr><tr><td>2019</td><td>183,659</td></tr><tr><td>2020</td><td>193,575</td></tr><tr><td>2021</td><td>200,978</td></tr><tr><td>2022</td><td>206,649</td></tr><tr><td>2023</td><td>211,110</td></tr><tr><td>2024</td><td>175,137</td></tr></table> |
| Description of measurement methods and procedures to be applied: | As per the Methodological tool "Emissions from solid waste disposal sites (version 06.0.1) |
| QA/QC procedures to be applied: | As per the Methodological tool "Emissions from solid waste disposal sites (version 06.0.1) |
| Any comment: | - |

| **Data / Parameter:** | $EG_{d,y}$ |
|---|---|
| Data unit: | MWh |
| Description: | Amount of electricity generated utilizing the combustion heat from incineration in the project activity displacing electricity in the baseline during the year *y* |
| Source of data to be used: | Electricity meter |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 130,260 |
| Description of measurement methods and procedures to be applied: | Electricity meter will be subject to regular (in accordance with stipulation of the meter supplier) maintenance and testing to ensure accuracy. The readings will be double checked by the electricity distribution company. |
| QA/QC procedures to be applied: | - |
| Any comment: | |

| **Data / Parameter:** | $CEF_d$ |
|---|---|
| Data unit: | $tCO_2$/MWh |
| Description: | Emission factor of displaced electricity by the project activity |
| Source of data to be | Captive power plant: estimated as per equation 23. |

| | |
|---|---|
| used: | Grid: Calculated based on data published by Brazilian/DNA, using the procedures in the latest approved version of the "Tool to calculate the emission factor of an electricity system (version 2.2.1). This procedure of calculation was made by Brazilian DNA for the National Interconnected System as described in section B.6.3. |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 0.3100 (base year: 2010 for ex-ante estimative) |
| Description of measurement methods and procedures to be applied: | Follow procedures as described in the Tool to calculate the emission factor of an electricity system (version 2.2.1). |
| QA/QC procedures: | In order to present the national emission factor, the National Operator of the System provides to *MCT* the original data to do the calculation procedure. |
| Any comment: | The monitoring frequency of the parameter is annually. |

| **Data / Parameter:** | $Q_{biomass,y}$ |
|---|---|
| Data unit: | tonne/yr |
| Description: | Amount of waste incinerated in year *y* |
| Source of data to be used: | |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 273,750 |
| Description of measurement methods and procedures to be applied: | All produced stabilized biomass will be trucked off from site. All trucks leaving site will be weighed. |
| QA/QC procedures to be applied: | |
| Any comment: | This parameter will be not measured to be included in the emission reductions calculation, thus this value will be considered the same amount as $A_{MSW,y}$. |

| **Data / Parameter:** | $A_{residual}$ |
|---|---|
| Data unit: | tonnes/yr |
| Description: | The amount of the residual waste from the incinerator |
| Source of data to be used: | Project participants |
| Value of data applied for the purpose of | 36,956 |

| | |
|---|---|
| calculating expected emission reductions in section B.5 | |
| Description of measurement methods and procedures to be applied: | Scale |
| QA/QC procedures to be applied: | Scale will be subject to periodic calibration (in accordance with stipulation of the weighbridge supplier) |
| Any comment: | |

| **Data / Parameter:** | $FC_{residual}$ |
|---|---|
| Data unit: | % |
| Description: | Fraction of residual carbon in the residual waste of MSW incinerator |
| Source of data to be used: | Sample measurements by project participants |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 5% |
| Description of measurement methods and procedures to be applied: | |
| QA/QC procedures to be applied: | |
| Any comment: | The size and frequency of sampling should be statistically significant with a maximum uncertainty range of 20% at a 95% confidence level. As a minimum, sampling should be undertaken four times per year. |

| **Data / Parameter:** | $\mathbf{W_X}$ |
|---|---|
| Data unit: | tons |
| Description: | Total amount of organic waste prevented from disposal in year *x* (tons) |
| Source of data to be used: | Measurements made by the project participant. |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5: | *Food*: 195,057; *Paper*: 22,510; *Textile*: 3,928; *Wood*: 1,506 |
| Description of measurement methods and procedures to be applied: | Continuously, aggregated at least annually. It is measured by the weighing scale in the entrance of the landfill. Trucks are weighted in the landfill entrance and exit. The difference of weights gives the amount of waste. |

| *Food* | *Paper* | *Textile* | *Wood* |
|---|---|---|---|
| 195,057 | 22,510 | 3,928 | 1,506 |

| | |
|---|---|
| QA/QC procedures to be applied: | This value will be measured by a weighing scale installed in the entrance of the landfill. They will be calibrated by an entity accredited by *INMETRO* (Brazilian institute for metrology and calibration). This calibration will follow the standards and procedures described in *Portaria INMETRO MICT 236/94*[46]. |
| Any comment: | |

| **Data / Parameter:** | $\mathbf{p_{n,i,x}}$ |
|---|---|
| Data unit: | - |
| Description: | Weight fraction of the waste type *j* in the sample *n* collected during the year *x* |
| Source of data to be used: | Sample measurements made by the project participant. |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5: | Organic: 0.7125<br>Paper: 0.0822<br>Textile: 0.0143<br>Wood: 0.0055<br>Refer to tables in the section B.6.3 and the CER spreadsheet. |
| Description of measurement methods and procedures to be applied: | Sample the waste prevented from disposal, using the waste categories *j*, as provided in the table for *DOCj* and *kj*, and weigh each waste fraction. The size and frequency of sampling should be statistically significant with a maximum uncertainty range of 20% at a 95% confidence level. As a minimum, sampling should be undertaken four times per year. |
| QA/QC procedures to be applied: | The gravimetric analysis is the transformation of partial weightings of the solid waste sample for each type of material found in the sample according to the quartering method. The scale will be calibrated as specifications. |
| Any comment: | This parameter only needs to be monitored if the waste prevented from disposal include several waste categories *j*, as categorized in the tables for *DOCj* and *kj*. |

| **Data / Parameter:** | $\mathbf{EF_{grid,CM,y}}$ |
|---|---|
| Data unit: | $tCO_2$/MWh |
| Description: | Combined margin emission factor for the grid in year y |
| Source of data to be used: | Calculated based on data published by Brazilian/DNA, using the procedures in the latest approved version of the "Tool to calculate the emission factor of an electricity system (version 2.2.1). This procedure of calculation was made by Brazilian DNA for the National Interconnected System as described in section B.6.3. |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5: | 0.3100 (base year: 2010 for ex-ante estimative) |
| Description of measurement methods and procedures to be applied: | Follow procedures as described in the Tool to calculate the emission factor of an electricity system (version 2.2.1). |

*[46] This procedure is available at: http://www.smfbalancas.com.br/calibracao/legislacao.htm. Accessed in November, 2011.*

| | |
|---|---|
| QA/QC procedures to be applied: | In order to present the national emission factor, the National Operator of the System provides to *MCT* the original data to do the calculation procedure. |
| Any comment: | |

| **Data / Parameter:** | $EF_{grid,OMy}$ |
|---|---|
| Data unit: | $tCO_2equ/MWh$ |
| Description: | $CO_2$ Operating Margin emission factor for the national grid |
| Source of data to be used: | DNA published data calculated according to Tool to calculate the emission factor of an electricity system (version 2.2.1) |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 0.4796 (base year 2010) |
| Description of measurement methods and procedures to be applied: | Follow procedures as described in the Tool to calculate the emission factor of an electricity system (version 2.2.1). |
| QA/QC procedures to be applied: | In order to present the national emission factor, the National Operator of the System provides to *MCT* the original data to do the calculation procedure. |
| Any comment: | |

| **Data / Parameter:** | $EF_{grid,BMy}$ |
|---|---|
| Data unit: | $tCO_2equ/MWh$ |
| Description: | $CO_2$ Build Margin emission factor for the Brazilian electrical System |
| Source of data to be used: | Data obtained from ONS (National Operator System) and calculated according to Tool to calculate the emission factor of an electricity system (version 2.2.1). |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | 0.1404 (base year: 2010) |
| Description of measurement methods and procedures to be applied: | Follow procedures as described in the Tool to calculate the emission factor of an electricity system (version 2.2.1). |
| QA/QC procedures to be applied: | In order to present the national emission factor, the National Operator of the System provides to *MCT* the original data to do the calculation procedure. |
| Any comment: | |

### B.7.2. Description of the monitoring plan:

The monitoring plan details the actions necessary to record all the variables and factors required by methodology AM0025 as detailed in section B.7.1 above. All data will be archived electronically, and backed up regularly. Moreover, it will be kept for the full crediting period, plus two years after the end of the crediting period or the last issuance of CERs for this project activity (whichever occurs later).

The monitoring equipment will be chosen carefully to be able to perform good measurements with great quality and lowest possible level of uncertainty. It will be calibrated and maintained according to the manufacturer requirements.

Foxx Soluções Ambientais Ltda. will be responsible for the monitoring process and will train the Project staff in order to satisfactorily fulfill their monitoring obligations with AM0025 - "Avoided emissions from organic waste through alternative waste treatment processes" (Version 13.0.0).. Detailed procedures for calibration of monitoring equipment, maintenance of monitoring equipment and installations, and for records handling are previously described in section B.7.1. All data to be monitored will be collected and cross checked by the Project Developer. The contracted company, under the guidance of the Project Proponent, will provide specialized engineers for electrical design, instrumentation and automation. The instrument engineers have accumulated experience with respect to instruments installed in furnaces, their specification, selection, erection, calibration and start-up. For the automation, standard programs are developed that already have proven their good operation in similar plants. The high degree of automation and the use of the specific grate control system enable the most efficient waste to energy management.

Electricity monitoring, counts on the use of meter equipment projected to register and verify bidirectionally the energy generated by the facility, *i.e.*, by the project owner and the National Chamber of Electric Energy Commercialization (from the Portuguese *Câmara de Comercialização de Energia Elétrica - CCEE*). This energy measurement is fundamental to verify and monitor the GHG emission reductions from this project activity. The Monitoring Plan permits the calculation of GHG emissions generated by the project activity in a straightforward manner, applying the baseline emission factor.

The project will proceed with the necessary measures for the power control and monitoring. Hence, it will be possible to monitor the power generation of the project. Additionally, information regarding power generation and energy supplied to the grid are controlled by the Chamber of Electrical Energy Commercialization *CCEE* (from the Portuguese *Câmara de Comercialização de Energia Elétrica*). *CCEE* makes feasible and regulates electrical energy commercialization.

The total energy generated by the plant to be considered when calculating the emission reduction is obtained by two meters (principal and backup) installed at the local substation, these meters will measure the dispatched energy to the grid. Both energy meters make a continuous and simultaneous reading of the electricity dispatched to the grid, *CCEE* demands that these meters are calibrated by an entity with Brazilian Calibration Net – RBC (from Portuguese *Rede Brasileira de Calibração*) credential.

There will be energy meters, all of them of the models specified by *CCEE*, located at the power plants' substation and also meters located in *Eletropaulo* Substation[47], where the project calculates electricity dispatched to the national grid, measuring net energy delivered to the grid. Following Module 12 of the grid Procedures from Brazilian National Power System Operator, that states in its submodule 12.2 (http://www.ons.org.br/download/procedimentos/modulos/Modulo_12/Submodulo%2012.2_Rev_1.0.pdf ) - Installation of a measurement system for billing– that the data must be integrated to *CCEE* system within intervals of 5 to 60 minutes (depending on the program of the company´s billing system).

The entire national grid (electric system) comprises of assets pertaining to measurement (power plants, generating units and loads), as well as the use of main and backup meters at defined measurement points.

[47] Eletropaulo *is a transmission and distribution company in* São Paulo *State.*

The entire national grid is modelled in order to represent a single-threaded system regarding the physical electric power consumers/producers network.

Thus, it is possible to check these values minute by minute, hourly, monthly and so on, since this data is directly connected to *CCEE*. The energy generated by the plants will be cross-checked by *CCEE*, which will generate an official report with the checked information. The compiled data will be used to certify the energy generation reported produced by the Project Participants (PP). Electricity supplied by the project activity to the grid will be checked by internal control and *Câmara Comercializadora de Energia Elétrica – CCEE* registries.

Recalibration of the meter´s is scheduled to occur every two years, the recalibration procedures will be executed by a specialized metrology company that will be hired for this specific purpose.

Foxx Soluções Ambientais Ltda. will ensure that the calibration of the meters occurs every 2 years. In addition to this, the company will be responsible for the maintenance of the monitoring equipment; for dealing with possible monitoring data adjustments and uncertainties; for reviewing reported results/data; for internal audits of GHG project compliance with operational requirements and for corrective actions; organising and training, as appropriate, the staff in the appropriate monitoring, measurement and reporting techniques.

The technical team for operation of *Barueri* Energy CDM Project Activity is responsible for project management, as well as for organizing and training of the staff in the appropriate monitoring, measurement and reporting techniques. The information requested for CER calculation, as described in section B.7.1 will be archived in electronic format. Also, Foxx Soluções Ambientais Ltda. is preparing operation, maintenance and emergency manuals, based on the common practice and procedures recommended by their equipment suppliers. The personal training programs will be implemented at the SHPP, capacitating operators in the operational, safety and emergency procedures.

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

Date of completing the final draft of this baseline section and the monitoring methodology (DD/MM/YYYY) 10/08/2012.

Ecopart Assessoria em Negócios Empresariais Ltda.

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Ecopart is the Project Advisor and also a Project Participant.

## SECTION C. Duration of the project activity / crediting period

### C.1. Duration of the project activity:

#### C.1.1. Starting date of the project activity:

27/01/2012 (DD/MM/YYYY)

According to the CDM Glossary of Terms the starting date of a CDM project activity is "*the earliest date at which either the implementation or construction or real action of a project activity begins*". Furthermore the guidance also clarifies that "*the start date shall be considered to be the date on which the project participant has committed to expenditures related to the implementation or related to the construction of the project activity (...), for example, the date on which contracts have been signed for equipment or construction/operation services required for the project activity*".

Considering the above information, the starting date of the project activity will be when the project proponent signs the Public-Private Partnership with *Barueri* Municipality and committed to expenditures to build the project under a Warranty Insurance Policyholder valued of BRL 3,645,942.04 valid until January, 22nd 2013. For details, check section B.5.

#### C.1.2. Expected operational lifetime of the project activity:

28 y – 0 m.[48]

### C.2. Choice of the crediting period and related information:

The project activity will use a fixed crediting period.

#### C.2.1. Renewable crediting period:

##### C.2.1.1. Starting date of the first crediting period:

Not applicable.

##### C.2.1.2. Length of the first crediting period:

Not applicable.

[48] Based on the Commercial Proposal (depreciation of the plant) of May, 16th 2011 applied for the Bidding Proposal for *Barueri* Municipality of Concetion Process number 023/2010. Available to the Validation Team.

**C.2.2. Fixed crediting period:**

**C.2.2.1. Starting date:**

01/08/2014 (DD/MM/YYYY).

**C.2.2.2. Length:**

10 y – 0 m.

## SECTION D. Environmental impacts

### D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

In Brazil, the sponsor of any project that involves construction, installation, expansion or operation of any polluting or potentially polluting activity or any other capable to cause environmental degradation is obliged to secure a series of permits from the relevant environmental agency (federal and/or local, depending on the project).

The environmental licensing process and the environmental impact assessment of polluting and potentially polluting activities were implemented by the Federal Law nr. 6,938 dated August, 31st 1981 - the National Environmental Policy (from the Portuguese *Política Nacional do Meio Ambiente – PNMA*[49]).

The National Environmental Council Resolution (from the Portuguese *Conselho Nacional do Meio Ambiente - CONAMA*) was also implemented by the *PNMA* and is a consultative and deliberative organ which aims advise, study and propose to the Government guidelines of policies for the environment and the natural resources and deliberate on norms and standards that are in light with an ecologically balanced environment and essential to a healthy quality of life.

In addition to the *PNMA*, other norms and laws were issued by *CONAMA* in order to regulate the permitting process and the environmental impact assessment according to the activity characteristics.

*CONAMA* Resolution n. 001[50] states in its 2nd Article, item II that power plants with installed capacity greater than 10 MW of installed capacity must apply the permitting process, do the Environmental Impact Assessment (from the Portuguese *Estudo de Impacto Ambiental*) and submit it to the respective environmental state agency in order to obtain the necessary permits for the project.

*Barueri* Energy CDM Project Activity consists of the construction of a Waste-to-Energy Plant (in a free translation from the Portuguese *Usina de Recuperação de Energia*) which use solid urban waste in order to generate electricity and avoid that the urban waste would be sent landfills.

Also *CONAMA* Resolution n. 237[51], issued on December, 19th 1997, requires the following permits as part of the permitting process:

- *Preliminary License* (*Licença Prévia* or LP);
- Construction License (*Licença de Instalação* or LI); and
- Operation License (*Licenca de Operação* or LO).

[49] Available at: http://www.planalto.gov.br/ccivil_03/leis/L6938.htm
[50] Available at: http://www.mma.gov.br/port/conama/res/res86/res0186.html
[51] Available at: http://www.mma.gov.br/port/conama/res/res97/res23797.html

The process starts with a previous consultation to the local environmental department, which in the case of the project activity is the Technology Company of Environmental Sanitation, linked to the Secretariat of Environment of the State Government (*CETESB - Companhia de Tecnologia de Saneamento Ambiental*). The project participant protocols in *CETESB* the Work Plan for the preparation of Environmental Impact Assessment (EIA) accompanied by the development and characterization of a simplified diagnosis of its area of influence, as well as the methodology and content of studies needed to assess the relevant environmental impacts. The Work Plan of *Barueri* Energy CDM Project Activity has been filed in 24/Jan/2012 by *SGW* – company hired to develop the EIA for *Barueri* Waste-to-Energy Plant.

Docketed the Work Plan with the necessary documentation, the developer shall submit, within fifteen (15) days, the vouchers relating to the publication in the Official Diary of the State, in a newspaper of general circulation and in a local newspaper, the opening of the term forty-five (45) days for consultation on the project to be forwarded to CETESB. Based on the analysis of the Work Plan and other information in the process, CETESB defines the Reference Terms setting a deadline of 180 days to prepare the Environmental Impact Assessment to publish that decision, which is condition for which the developer may require a preliminary license (LP), which presents the following information in summary:

- Project sponsor identification;
- Project characterization:
    - Reasons for the project implementation;
    - Project location;
    - Description of project implementation and operation.
- Description of legal and institutional aspects;
- Environmental diagnosis:
    - Description of physical, biota and socioeconomic aspects.
- Identification and assessment of environmental impact;
- Proposition of mitigating measures;
- Development of Environmental Programs.

It is required license concerning:

- Incineration Plant and Associated Units;
- Incinerator;
- Substation;
- Transmission line;
- Lines of Steam and Hot Water;
- Other support units.

After the first evaluation of the documents and the EIA, *CETESB* issues a Technical Conclusive Opinion, which may:

a) Refuse the license application, whereas the EIA showed no environmental feasibility of the project and publish in the Official Diary of the State to dismiss.
b) Indicate the environmental viability of the project, the conditions for the Installation License and Operating License.

Approved the study in above case (b), *CETESB* issues the Preliminary License (*LP*) indicating its validity.

This analysis of the project and its EIA are made by the Plenary of State Council on the Environment *(CONSEMA - Conselho Estadual do Meio Ambiente)* when requested by the Secretary of the Environment or by decision of a Plenary, at the request of one fourth of its members.

After the Plenary of State Council on the Environment's evaluation, a resolution approving the project issued by this entity is forwarded to *CETESB* issuing the Preliminary License, establishing its validity, and publishes in the Official Diary of the State.

The result of those assessments is the Preliminary Permit (LP), which reflects the local environmental agency positive understanding regarding the environmental project concepts.

*Barueri* Energy CDM project activity is a Recovery Energy Plant or *URE* located at *Barueri* municipality, state of *São Paulo*. Considering the particular characteristic presented by *UREs* the Environmental State Agency of *São Paulo* (*CETESB – Companhia de Tecnologia de Saneamento Ambiental*), issued on November, 04th 2009, the SMA-079[52], that states about guidelines and conditions concerning to the operation and the permitting process of the thermal treatment of solid waste on *UREs*. Further, *CONAMA* 316[53], issued on October, 29th 2002, regulates procedures and criteria for the operation of waste thermal treatment systems, in which Recovery Energy Plants (from the Portuguese *Usinas de Recueperação de Energia – UREs)* can be included.

The Resolution SMA-079 defines a *URE* as "*A unit that perform a thermal treatment of solid waste, recovering the thermal energy generated through the combustion.*"

The main points raised by this Resolution considering the *UREs* are described below.

> *Article 4: "The location, construction, installation, extension, alteration and operation of a URE depends on a previous permitting process of the Environmental Agency, observing the specifications of CONAMA 316, not excluding other required permits."*
>
> *Article 6: "The URE installation shall be projected, equipped, constructed and operated in a way that the emissions levels do not surpass the limits (Annex I) established by this Resolution."*
>
> *Article 10: "The first verification concerning the emission limits fulfillment shall occur at least at full load capacity and before the Operation Permit issuance."*

[52] Available at: http://www.ambiente.sp.gov.br/legislacao/estadual/resolucoes/2009_res_est_sma_79.pdf
[53] Available at: http://www.mma.gov.br/port/conama/res/res02/res31602.html

*Article 12: "The installation and operation of the air pollutant continuously monitoring system shall be previously assessed by the Environmental Agency."*

Considering the mentioned Laws and Resolutions above, it is clear that this kind of project will have to perform the Licensing process in order to implement and start operation.

Considering that *Barueri* Energy CDM Project Activity consists of the implantation of a *URE*, the following legal and institutional aspects will be considered in order to perform the Environment Assessment and obtainment of the project licenses mentioned below:

- CONAMA Resolution – refer to the Environmental Licensing;
- CONAMA Resolution nr. 316 dated October, 29th 2002 establishes procedures and criteria concerning waste thermal treatment systems;
- SMA 079 Resolution, dated November, 4th 2009 which refer to the environmental licensing of solid waste thermal treatment in Energy Recovery Facility (from the Portuguese *Usina de Recuperação de Energia – URE*);
- Law of the state of São Paulo 12,300 dated March, 16th 2006, which established the State Policy of Solid Waste;
- Atmospheric polutant emission and noise level limits;
- Natural Resources Protection Law (air, water, soil, fauna and flora);
- Brazilian Forest Code (from the Portuguese *Código Florestal Brasileiro*) and the protection of special areas (from the Protuguese *Área de Preservação Permanente - APP*);
- Compensation Measures in Conservation Units Law.

In addition, the following programs are proposed during the project implementation and operation:

- Social Communication Program;
- Civil works mobilization and demobilization Program;
- Environmental Control Program of Civil Work;
- Environmental Management Program;
- Monitoring Programs;
- Environmental Compensation Program.

Besides, the deficit of areas around the main metropolis for the licensing and implementation of new landfills and the depletion of the operational landfills, some technologies as the Energy Recovery Facility are being developed as a solution for the urban waste disposal. This kind of technology which uses solid waste as fuel in order to produce electricity reduces considerably the solid waste which would be sent to landfills.

Regarding the impacts that the proposed project activity will present, the below list is presented:

- Air quality: a comparative study points out that emissions from Waste-to-energy plants will stop immediately after its closure, while in landfills, emissions continue even after the dozens of years of closure, due to the difficulties of capturing the biogas and manure. Further, the project activity will provide the installation of a control system of atmospheric emissions (reactor and fabric filter), the realization of Fire Test and implementation of a Monitoring plan of Air Quality;
- Noise levels: the operational activity will be audible in the west area of the project. The mitigation proposal recommends that it is measured actual levels of noise and proceed to the acoustic modeling, considering each equipment, topography and existing and to be constructed buildings, estimating with greater certainty the noise level to determine the required noise attenuation and the implementation of a monitoring program noise;
- Biota: considering the strong anthropic existing Area Directly affected, and therefore the absence of natural vegetation cover, it was not detected impacts on the biota.

Moreover, there are a large number of positive impacts. Some examples are:

- Increase of work opportunity during construction and operation period;
- Improvement in community perception towards waste management, which would have a significant impact to other regions;
- Decrease of large areas to treat and dispose municipal waste.

Further, with the presentation of the mentioned EIA to CETESB on August, 7th 2012, the Preliminary License was required by the Project Participant. The next step is to hold a public audience within next 45 days right after the above date to continue the License Process. The project was considered feasible at environmental point of view, as per the presented EIA.

**D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:**

As mentioned above, *Barueri* Energy CDM Project Activity is under Preliminary License stage, elaborating the EIA. Therefore, there are no studies or conclusions about the new project concerning the environmental aspects. When the studies and Licenses are issued, theses aspects will be evaluated. However the Project Participants inform that all the described licensing procedure will be accomplished. Otherwise, the project will not start operation, as guaranteed by the local environmental agency of São Paulo State – *CETESB* and national regulations.

Through an appropriate management, the incineration will be made removing the risk of toxic effects on the local community and environment, including odour nuisances, air quality and pollutants, thermal treatment of the municipal waste, noise levels and so on. Besides, there will be an improvement of air quality, since the odors related to CH4 production will be reduced. Thus, the installation of a set of wells designated for incineration will lead into a daily monitoring and proper operation and no significant adverse impacts are expected due to the project activity implementation.

According to the federal and local states legislation, the environmental licensing process requests public hearings with the local community. Also, the same legislation requests the announcement of the issuance of the licenses (LP, LI and LO) in the Official Diary of the State (*Diário Oficial do Estado*) and in the regional newspapers. The announcements for the project are available for consultation under request.

## SECTION E. Stakeholders' comments

### E.1. Brief description how comments by local stakeholders have been invited and compiled:

The Brazilian Designated National Authority, *"Comissão Interministerial de Mudança Global do Clima"*, requests comments from local stakeholders and the validation report issued by an authorized DOE according to the Resolution nr. 1 issued on September 11th, 2003 and rectified by Resolution n. 7 issued on March 5th, 2008, in order to provide the letter of approval.

Resolution n. 7 determines that copies of the invitations for comments must be sent by the project proponents at least to the following agents involved in and affected by the project activities and at least 15 days before the Global Stakeholder Process (GSP):

- Federal Attorney for the Public Interest;
- State Attorney for the Public Interest;
- Brazilian Forum of NGOs and Social Movements for Environment and Development;
- State Environmental Agency;
- City Hall;
- City Council;
- Municipal Environmental Agency;
- Community Associations;

Invitation letters were sent to the following agents (copies of the letters and post office confirmation of receipt communication are available upon request):

- Federal Attorney for the Public Interest;
- State Attorney for the Public Interest of *São Paulo*;
- Brazilian Forum of NGOs and Social Movements for Environment and Development;
- State Environmental Agency of *São Paulo* (*Companhia de Tecnologia de Saneamento Ambiental – CETESB*);
- City Hall of *Barueri*;
- City Council of *Barueri*;
- Environmental Agency of *Barueri* (*Secretaria de Recursos Naturais e Meio Ambiente de Barueri*);
- Community Association of *Barueri* (*Sindicato dos Servidores Municipais de Barueri*).

Copies of the letters and post office confirmation of receipt are available upon request and will be submitted to the DOE during the validation of the Project Activity.

## E.2. Summary of the comments received:

During the GSP, the project activity received a comment from Mariel Vilella on behalf of Global Alliance for Incinerator Alternatives (GAIA) has sent letter requiring information about the environmental integrity in a major way of the project and raised questions on the subject of the additionality.

## E.3. Report on how due account was taken of any comments received:

Considering the comments received, Project Participants responded the correspondence letter explaining the points raised by Mariel Vilella and GAIA - Global Alliance for Incinerator Alternatives.

- **Threat of waste pickers and recyclers jobs:** GAIA claims that, by burning recyclable materials, waste pickers will lose their jobs. PPs explain that the incinerated waste is the residue of the municipal recycling cooperative. Therefore, no recyclable waste is burnt. Also, social programs will be implemented as establish in the contract signed by the project proponent.
- **Lack of Environmental Impact Assessment:** PPs clarify that the Environmental Impact Assessment will be developed to obtain the licenses required by the Brazilian regulation.
- **Increased levels of pollution:** PPs ensure the respect to the Brazilian environmental regulation.
- **Stakeholder's inappropriate consultation:** As mentioned above, the stakeholder consultation was carried out according to the Resolution nr. 7 issued by the Brazilian DNA. Additionally, a public meeting was held with the participation of the waste pickers' cooperative and local population.
- **Impact on recycling rates:** PPs reinforce that the waste destined to the incineration passed thought a screening to separate recycled material.
- **Lack of alternate scenarios:** PPs clarify that different alternatives and technologies were analyzed during the project conception and validation.

## Annex 1

### CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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## Annex 2

### INFORMATION REGARDING PUBLIC FUNDING

No public funding is involved in the present project.

This project is not a diverted ODA from an Annex 1 country.

# Annex 3

## BASELINE INFORMATION

The Brazilian electricity system, for the purpose of CDM activities, was delineated as a single interconnected system comprehending the five geographical regions of the country (North, Northeast, South, Southeast and Midwest). This was determined by the Brazilian DNA through its Resolution nr. 8 dated 26th May, 2008.

More information on how the Interconnected System is delineated and the emission factor values is available at the Brazilian DNA's website <**http://www.mct.gov.br/index.php/content/view/74689.html**>.

The following figures are the information provided by *Keppel Seghers* that composed the table designed in section B.5 related to the Common Practice Analysis.

**Annex 4**

**MONITORING INFORMATION**

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