**CLEAN DEVELOPMENT MECHANISM**
**PROJECT DESIGN DOCUMENT FORM (CDM-PDD)**
**Version 02 - in effect as of: 1 July 2004)**

**CONTENTS**



**Annexes**

## SECTION A. General description of project activity

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

Quitaúna Landfill Gas Project (QLGP)
Version 4
Date of the document: 24/07/2006

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

The QLGP aim is to capture and flare the landfill gas produced at Quitaúna Landfill, landfill owned by Quitaúna Serviços Ltda. and located in Guarulhos – São Paulo, to avoid emissions of methane to the atmosphere.

Started operations in October 2001, Quitaúna Landfill was designed to be one the most complete structure for treatment and waste disposal São Paulo Metropolitan Region, applying all the engineering technologies in order to respect the current environmental legislation limits. With an area of 109 500 $m^2$ and capacity to receive 2.8 million tons of waste, the landfill already receives waste from the city of Guarulhos, the second most populated city in the State of São Paulo, with about 1 230 511 inhabitants. Quitaúna Landfill fulfills local demand with alternatives for both household and industrial waste treatment.

Quitaúna Landfill current practice is to collect and burn the gas only through a passive system, with no systematic and monitored flare. Methane is emitted naturally to the atmosphere through the existing wells, and part of the gas is burned as a consequence of safety and odor concerns. Therefore, an extra-incentive is needed for Quitaúna to make additional investments in order to enhance its landfill gas collection rate and install appropriate facilities to flare the methane produced at the site. The project involves the development of a collection pipeline network and a flaring system. The collection system will be built using the existing wells. The wells will be covered and connected to a main pipeline to transport the landfill gas to the flare. A blower will be installed in order to increase the amount of landfill gas collected.

As mentioned above, Quitaúna Landfill applies modern technologies on solid waste final disposal. Through the application of NBR 8419/92 – "Apresentação de projetos de aterros sanitários de resíduos sólidos urbanos" (a technical standard to develop and operate landfills while respecting environmental, health and engineering concerns), the landfill obeys to the following requirements:

- Proofing of the landfill basis with both compacted clay barriers and with a polyethylene geomembrane;
- Compacting of the solid waste with specific equipment;
- Covering of the compacted solid waste with clay, to avoid the dispersion of odor and the appearance of rats, cockroaches, buzzards and bugs;
- Controlling of the amount of solid waste disposed at the landfill;
- Collection of leachate;
- Release of landfill gas to the atmosphere, to avoid internal increase of pressure;
- Monitoring of the subterraneous water quality.

Respecting current environmental legislation and good practices for landfill projects, construction and operation, Quitaúna Landfill received, in 2001, the definitive Operational License from CETESB –

Companhia de Tecnologia de Saneamento Ambiental (State of São Paulo's Environmental Agency) and complied with all environmental requirements.

QLGP will have a significant impact on sustainable development. First, while reducing methane emissions that would enhance climate change, it will also minimize the risk that any explosion occurs at the site – although Quitaúna Landfill's engineering and design specifically aims at avoiding this type of accidents. Second, given the fact that initiatives of this type are relatively new in Brazil, a significant technology transfer will be needed for the project's implementation and operation. Third, specialized operators will be needed for project operation, which means a positive impact on employment and capacity-building. The aforementioned elements concur in making the project extremely vital in the context of sustainable development.

**A.3. Project participants:**

| 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 wishes to be considered as project participant (Yes/No) |
|---|---|---|
| Brazil (host) | • Brazilian Private entity Quitaúna Serviços Ltda<br>• Brazilian Private Entity Econergy Brasil Ltda.. | No |
| (*) 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. | | |

QLGP participants are the Brazilian private entity called Quitaúna Serviços Ltda. and Econergy Brasil.

Quitaúna Serviços Ltda is a 100% Brazilian company, founded in 1968 was in civil construction. In the 70's, the company started concerning about the problematic of the solid waste disposal and began efforts on collection, transportation and adequate final destination in the city of Osasco, State of São Paulo. Some time later, the company started working with the city of Guarulhos, State of São Paulo. The company provides adequate solutions for final destination of the waste class II A and II B[1], with the goal to improve the environmental quality on solid waste disposal.

**A.4. Technical description of the project activity:**

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

Quitaúna Landfill is located in the city of Guarulhos, in the Metropolitan Region of São Paulo, at Cabuçu District.

[1]Residues in Brazil are classified under norm NBR 10004, issued in 1987, from ABNT, the Brazilian association for technical standards. Class I residues are classified as hazardous or present one of the following characteristics: flammability, power of corrosion, reactive properties, toxicity and pathogenicity. Class II A residues are reactive, neither classified as class I nor class II B, and may present the following characteristics: combustibility, biodegradability or water solubility. Class II B residues are non-reactive, not presenting any soluble constituent in standard higher than potable water.

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

Brazil

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

São Paulo

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

Guarulhos

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

Figure 1 shows the location of Quitaúna Landfill.

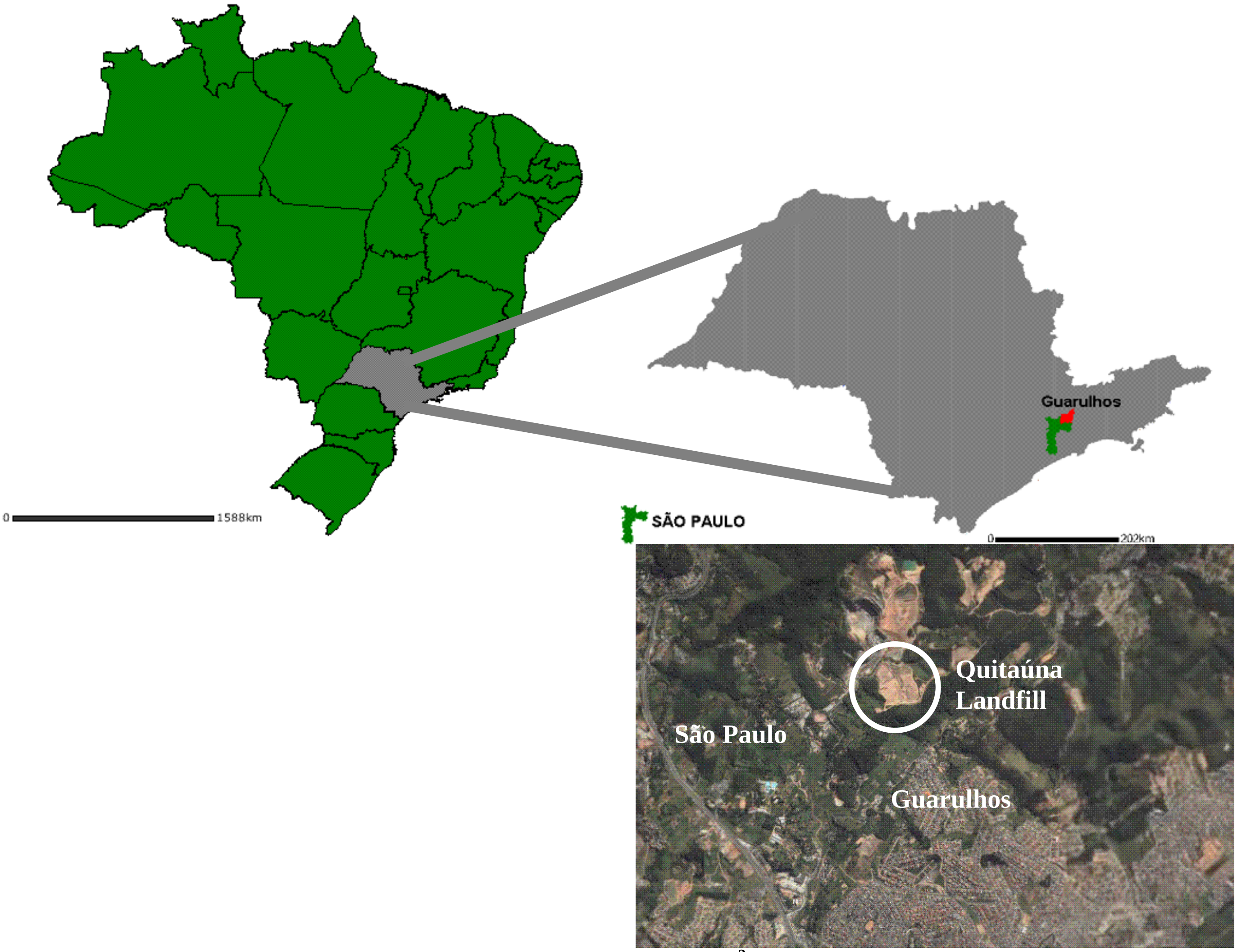


**Figure 1. Guarulhos location (Source: IBGE[2] and Google Earth)**

[2] Adapted from <http://mapas. ibge.gov.br >

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

QLGP is designed as a Sectoral Scope 13 – waste handling and disposal – project.

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

The technology to be employed will be the improvement of landfill gas collection and flaring, through the installation of an active recovery system composed by a collection and transportation pipeline network and a flaring system, as shown in Figure 2.

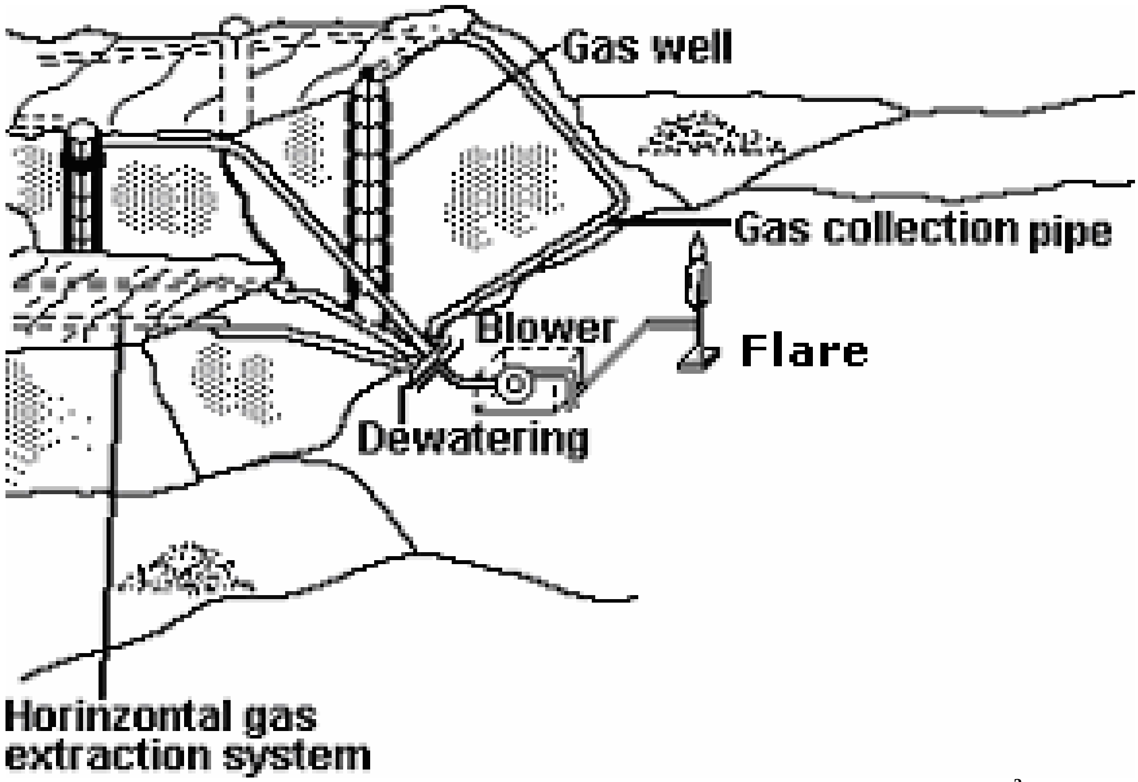


**Figure 2. Schematic situation of a landfill with active gas recovery (Source: WILHELM, 1991[3].)**

Following concrete examples from other landfill gas projects in the world, the QLGP may involve the installation of wellheads at the existing concrete wells to avoid the emission of methane to the atmosphere. An example of wellhead and the detail of its construction are shown on Figure 3 and Figure 4.

[3] **V. WILHELM;** *Safety Aspects of the Planning, Construction and Operation of Landfill Gas Plants*; paper; Sardinia 91 Third International Landfill Symposium; S. Margherita di Pula, Cagliari, Italy; 14 - 18 October 1991

**Figure 3. Example of wellhead (source: Biogás Ambiental[4])**

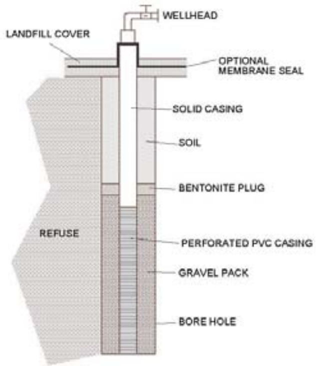


**Figure 4. Internal detail of a well and wellhead**

The use of the existing wells represents a distinct advantage since they are already installed and because at that location most of the gas flows to the atmosphere. However, some physical barriers might interrupt the gas flow from the generation point to the well, so new wells might need to be drilled.

A common practice all over the world is to use PVC equipment. It has the advantage to be more flexible and more resistant to high pressure, if compared to metal or concrete equipment. The disadvantage is represented by the high cost involved.

The wellheads are connected to a collecting pipeline. This pipeline transports the landfill gas to the manifolds. The manifolds are equipment that can be connected with more than 10 wellheads and transfer the collected gas to the transmission pipeline.

**Figure 5. Example of manifold, connected with the transmission pipeline**

The transmission pipeline is the last step of the collecting system. It transports the collected landfill gas to the flare. The transmission pipeline might be connected with all manifolds around the landfill.

In order to preserve the operation of the equipment, a dewatering system might be installed to remove the condensate.

[4] Biogás Ambiental; available at < http://www.biogas-ambiental.com.br/instalacaorede.htm>; accessed on Jan 31st, 2006.

**Figure 6. Example of a transmission pipeline**

The collecting pipeline and the transmission pipeline are both usually in PVC, because this material can support high pressures and is flexible. The transmission pipeline is finally connected to the flare.


**Figure 7. Example of flares (source: Biogás Ambiental)**

This kind of technology is still not widely applied in Brazil. Very few landfills have already installed equipment for improving the amount of landfill gas collected. Therefore, Quitaúna will need engineers and other specialists with experience in this area to advice the company while implementing the project. These professionals will also train local operators and engineers on operations and maintenance of the facilities.

Despite the fact that landfill gas projects can be of great potential in Brazil, the local market does not have flare suppliers. Technology will have to come from abroad and mainly from the United States and Europe. Technology transfer will hence occur from countries with strict environmental legislative requirements and environmentally sound technologies. Environmentally sound technologies are also needed for Quitaúna to comply with its environmental guidelines.

**A.4.4. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed CDM project activity, including why the**

**emission reductions would not occur in the absence of the proposed project activity, taking into account national and/or sectoral policies and circumstances:**

The project activity will burn all the landfill gas collected in a flare, through the monitoring of the amount of methane burned.

The current practice in Quitaúna Landfill, as explained in A.4.3, is passive venting. With QLGP's new facilities, it will be possible to efficiently flare the landfill gas. Accordingly, the methane that was previously released to the atmosphere, will be flared and reduced to $CO_2$. Global warming will also be reduced since methane is 21 times more powerful than carbon dioxide.

Emission reductions would not occur in the absence of the QLGP because the improvement of the landfill is not mandated by law and is not an economically attractive investment.

Emission reductions from the first crediting period are expected to be**793 073 tCO2e**.

**A.4.4.1. Estimated amount of emission reductions over the chosen crediting period:**

| YEARS | ANNUAL ESTIMATION OF EMISSION REDUCTIONS IN TONNES OF $CO_2$E |
|---|---|
| 2007 [1] | 73 529 |
| 2008 | 110 121 |
| 2009 | 122 326 |
| 2010 | 134 317 |
| 2011 | 121 460 |
| 2012 | 109 826 |
| 2013 | 99 299 |
| 2014 [2] | 22 197 |
| **TOTAL ESTIMATED REDUCTIONS** (TONNES OF $CO_2$E) | **793 073** |
| **TOTAL NUMBER OF CREDITING YEARS** | 7 |
| **ANNUAL AVERAGE OVER THE CREDITING PERIOD OF ESTIMATED REDUCTIONS (TONNES OF $CO_2$E)** | **113 296** |

Obs: [1] CERs will be requested from 01/04/2007 to 31/12/2007
[2] CERs will be requested from 01/01/2014 to 31/03/2014

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

There is no public funding involved in this project activity.

## SECTION B. Application of a baseline methodology

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

The baseline methodology applied to QLGP is ACM0001 - version 3: *"Consolidated baseline methodology for landfill gas project activities"*

**B.1.1. Justification of the choice of the methodology and why it is applicable to the project activity:**

This methodology is applicable to the QLGP because the baseline scenario is the partial or total atmospheric release of the gas and the project activities is the capture of the gas through a blower and the installation of a collecting system and the use of a flare to burn the methane.

**B.2. Description of how the methodology is applied in the context of the project activity:**

With the implementation of the QLGP, methane that would be naturally released to the atmosphere in the baseline scenario will be captured through the use of a collecting and flaring system. Only a part of the methane is flared at the baseline due to safety and odor concerns.

As mentioned in A.4.3, a complete collecting network pipeline and a flaring system will be installed in order do avoid the emission of methane to the atmosphere. Such a system ensures that methane will be captured, transported and flared under controlled conditions, in a way that it will be possible to measure the amount of methane flared on-site.

The Methodology ACM0001 states that greenhouse gas emission reduction achieved by the project activity during a given year "*y*" ($ER_y$) is the difference between the amount of methane actually destroyed/combusted during the year ($MD_{project,\ y}$) and the amount of methane that would have been destroyed/combusted during the year in the absence of the project activity ($MD_{reg\ ,y}$), times the approved Global Warming Potential value for methane ($GWP_{CH4}$), plus the emission reductions of the net electricity fed to the grid ($EL_{EX,\ LGFG} – EL_{IMP}$) minus the emission reduction due to the replacement of the fossil fuel used in the baseline, as follows:

$$ER_y = \left(MD_{project,y} - MD_{reg,y}\right) \times 21 + \left(EL_{EX,LGFG} - EL_{IMP}\right) \times CEF_{electricity} - ET_y \times CEF_{thermal} \ ,$$

where:

$ER_y$ = emission reductions of the project activity in year *y* ($tCO_2e$);
$MD_{project,\ y}$ = quantity of methane destroyed at year *y* ($tCH_4$);
$MD_{reg,\ y}$ = methane that would have been destroyed during the year *y* in the absence of the project activity ($tCH_4$);
$GWP_{CH4}$ = Global Warming Potential of Methane ($tCO_2e/tCH_4$);
$EL_{EX,\ LGFG}$ = net quantity of electricity exported during year y, produced using landfill gas (MWh).
$EL_{IMP}$ = net incremental electricity imported, defined as difference of project imports less any imports of electricity in the baseline, to meet the project requirements (MWh);
$CEF_{electricity}$ = $CO_2$ emissions intensity of the electricity displaced ($tCO_2e/MWh$);
$ET_y$ = incremental quantity of fossil fuel, defined as difference of fossil fuel used in the baseline and fossil use during project, for energy requirement on site under project activity during the year y (TJ);
$CEF_{thermal}$ = $CO_2$ emissions intensity of the fuel used to generate thermal/mechanical energy, ($tCO_2e/TJ$);

As the QLGP is not a project to produce and sell electricity to the grid and as the landfill did not consume fossil fuel for energy requirements in the baseline, $EL_{EX,\ LGFG} = 0$ and $ET_y = 0$.

So, the formula is updated to:

$$ER_y = \left(MD_{project,y} - MD_{reg,y}\right) \times 21 - EL_{IMP} \times CEF_{electricity}$$

The QLGP does not have any contractual obligations to burn methane; so $MD_{reg,\ y}$ is calculated based on the "Adjustment Factor", a value estimated as 20% of total methane produced at the baseline that is flared due to odor and security concerns:

$$MD_{reg,y} = 0{,}2 \times \mathrm{MD}_{\mathrm{project,\,y}}$$

and

$$ER_{y} = 0{,}8 \times MD_{project,y} \times 21 - EL_{IMP} \times CEF_{electricity}$$

The sum of the quantities fed to the flare, to the power plant and to the boiler must be compared annually with the total generated. The lowest value must be adopted as $MD_{project,y}$. The following procedure applies when the total generated is the highest.

$$MD_{project,y} = MD_{flared,y} + MD_{electricity,y} + MD_{thermal,y}$$

As the project won't produce electricity or replace a fossil fuel consumed in the baseline, the methane destroyed by the project activity $MD_{project,\,y}$ during year *y* is determined by monitoring only the quantity of methane actually flared:

$$MD_{project,y} = MD_{flared,y}$$

and

$$MD_{flared,y} = LFG_{flared,y} \times w_{CH_4} \times D_{CH_4} \times FE$$ , where

$MD_{flared,\,y}$ = quantity of methane destroyed by flaring during year y ($tCH_4$);
$LFG_{flared,\,y}$ = quantity of landfill gas flared during the year ($m^3_{LFG}$);
$w_{CH4,y}$,= methane fraction of the landfill gas ($m^3CH_4$/ $m^3_{LFG}$);
$D_{CH4}$ = methane density ($tCH_4/m^3CH_4$);
*FE* = flare efficiency (%);

The estimate of the amount of landfill gas produced during year y is shown in E.4. The data used to determine the baseline scenario is presented in Annex 3

**B.3. 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**:

**Application of the Tool for the demonstration and assessment of additionality.**

**Step 0. Preliminary screening based on the starting date of the project activity**
Since the QLGP will start its activities after the prompt-start date of 18/12/2004, the project participants will not benefit from the crediting period starting prior to the registration of the project activity.

Thus Step 0 is not applicable.

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

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

**1.** Since the project activity will not deliver commercial goods or services (i.e. electricity generation or thermal energy) and no other incentives will be obtained from the capture and flaring of the methane, and taking into account that there is no legislation that obligates the landfill to destroy the methane, the landfill would continue with its core business (final disposal of solid waste) and the methane would continue to be released to the atmosphere, according with the baseline scenario.

***Sub-step 1b: Enforcement of applicable laws and regulations***

**2.** The alternative, which is to continue with the business as usual situation before the decision of implementing this CDM project activity is consistent with Brazilian laws and regulations.
**3.** Not applicable.
**4.** Not applicable.

**Step 2. Investment analysis**

***Sub-step 2a. Determine appropriate analysis method***

As the CDM project activity does not generate any financial or economic benefit other than CDM related income, the simple cost analysis scenario is applied.

***Sub-step 2b. – Option I. Apply simple cost analysis***

As the baseline scenario is in accordance with national laws and regulations and as the project activity will not receive income from the sale of electricity or methane, the implementation of the project activity will have no other benefit than the CDM revenue.

**Step 4. Common practice analysis**

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

According to the latest official statistics on urban solid waste in Brazil – *Pesquisa Nacional de Saneamento Básico 2000* (PNSB 2000[5]) – the country produces 228.413 tons of waste per day, which corresponds to 1.35 kg/inhabitant/day. And though there is a worldwide trend towards reducing, reusing and recycling, therefore reducing the amount of urban solid waste to be disposed in landfills, the situation in Brazil is peculiar. Most of the waste produced in the country is sent to open dumps which are, in most of the cases, areas without any sort of proper infrastructure to avoid environmental hazards. Figure 8 shows the final destination of waste per municipality, according to PNSB 2000.

[5] IBGE - Instituto Brasileiro de Geografia e Estatística. *Pesquisa Nacional de Saneamento Básico*, 2000.

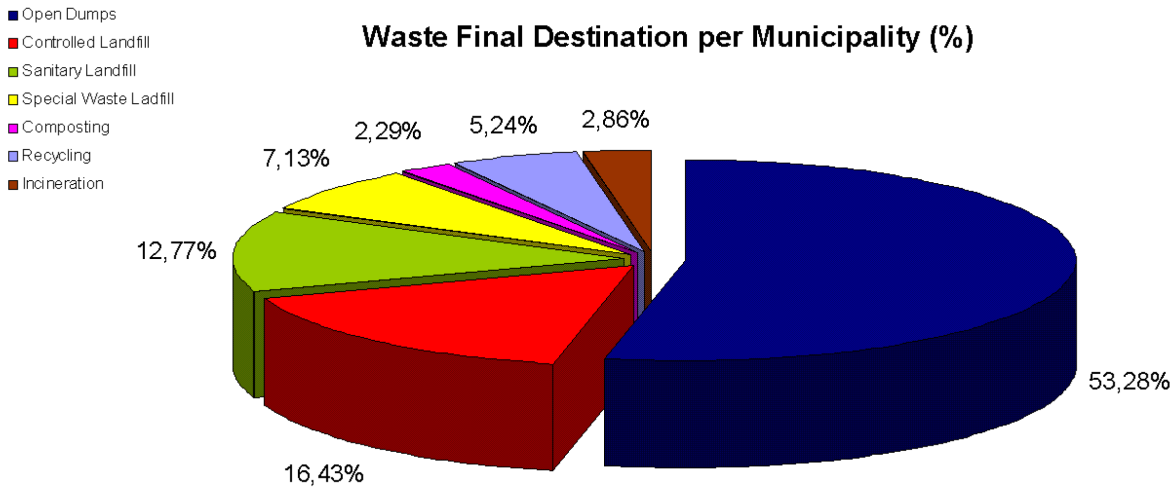


**Figure 8. Waste Final Destination per Municipality in Brazil (Source: PNSB, 2000)**

Only few of the existing Brazilian landfills have installed a collecting and flaring methane system. The majority of landfills operate with natural emission of methane to the atmosphere, through concrete wells.

***Sub-step 4b. Discuss any similar options that are occurring:***
Some landfills operate with a forced methane extraction and destruction, using blowers, collection systems and flaring systems: Bandeirantes Landfill (2 municipalities), Nova Gerar Landfill (1 municipality), Onyx Landfill (4 municipalities), Marca Landfill (8 municipalities), Sertãozinho Landfill (8 municipalities), Salvador da Bahia Landfill (1 municipality) and ESTRE Paulínia Landfill (8 municipalities).

This kind of project activity is not widely spread in Brazil and the landfills that operate this type of project represent only a small portion of the total existing landfills.

**Step 5. Impact of CDM registration**
CDM registration will reduce the economic and financial barriers to the project activity. The commercialization of the generated CERs represents the sole benefit of the project. Registration will reduce investment risk and foster the project owners into expanding business activities.

The benefits and incentives mentioned in the text of the Tool for demonstration and assessment of additionality, published by the CDM-EB, will be experienced by the project: anthropogenic GHG reductions; financial benefits from the revenue obtained by selling CERs; and, likelihood to attract new players and new technologies (currently there are companies developing new technologies of biogas extraction and extra-efficient flares and the purchase of such equipment is to be fostered by the CER sales revenue) thus reducing investor’s risk.

**B.4. Description of how the definition of the project boundary related to the baseline methodology selected is applied to the project activity:**

The boundary is the project activity site, where the landfill operations and LFG emissions take place and where gas flaring will take place. Figure 9 provides a picture of the boundary:

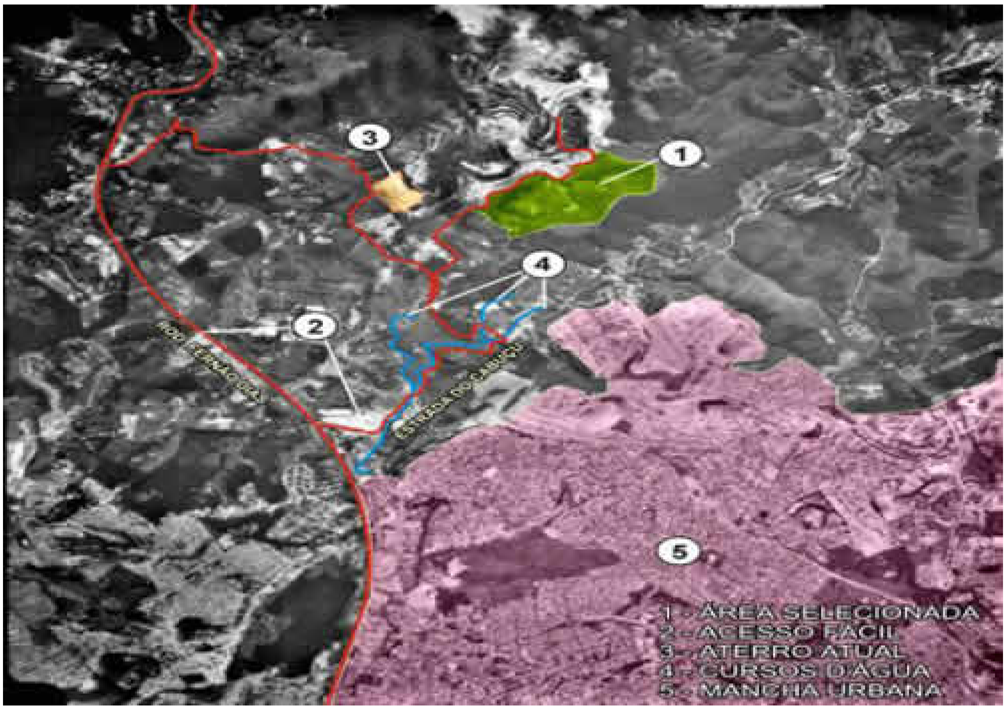


**Figure 9. QLGP Boundary (source: Quitaúna Serviços Ltda.)**
Obs: *1 = Quitaúna Landfill*
2 = Accesses
3 = Old open dump
4 = Water courses
5 = City of Guarulhos

**B.5. Details of baseline information, including the date of completion of the baseline study and the name of person (s)/entity (ies) determining the baseline:**

This baseline study was concluded on 24/07/2006, by Econergy, which is a ***Project Participant***. Contact information on Annex I.

## 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:

01/04/2007

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

21 years 0 months

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

**C.2.1. Renewable crediting period**

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

01/04/2007

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

7 years 0 months

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

**C.2.2.1. Starting date:**

Not applicable

**C.2.2.2. Length:**

Not applicable

## SECTION D. Application of a monitoring methodology and plan

**D.1. Name and reference of approved monitoring methodology applied to the project activity:**

The methodology applied to QLGP is ACM0001 - version 3: "*Consolidated monitoring methodology for landfill gas project activities*".

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

This methodology is applicable to the QLGP because the baseline scenario is the partial or total atmospheric release of the gas and the project activities is the capture of the gas through a blower and the installation of a collecting system and the use of a flare to burn the methane. Moreover, the baseline methodology for the project is also ACM0001 – version 3, in accordance with the monitoring methodology. Therefore, ACM0001 – version 3 is fully applicable to QLGP.

**D.2. 1. Option 1: Monitoring of the emissions in the project scenario and the baseline scenario**

**D.2.1.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:**

| ID number *(Please use numbers to ease cross-referencing to D.3)* | Data variable | Source of data | Data unit | Measured (m), calculated (c) or estimated (e) | Recording frequency | Proportion of data to be monitored | How will the data be archived? (electronic/ paper) | Comment |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| | | | | | | | | |

Left blank on purpose

**D.2.1.2. Description of formulae used to estimate project emissions (for each gas, source, formulae/algorithm, emissions units of $CO_2$ equ.)**

Left blank on purpose

**D.2.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived :**

| ID number *(Please use numbers to ease cross-referencing to table D.3)* | Data variable | Source of data | Data unit | Measured (m), calculated (c), estimated (e), | Recording frequency | Proportion of data to be monitored | How will the data be archived? (electronic/ paper) | Comment |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| | | | | | | | | |

Left blank on purpose

**D.2.1.4. Description of formulae used to estimate baseline emissions (for each gas, source, formulae/algorithm, emissions units of $CO_2$ equ.)**

Left blank on purpose

**D. 2.2. Option 2: Direct monitoring of emission reductions from the project activity (values should be consistent with those in section E).**

**D.2.2.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:**

| ID number *(Please use numbers to ease cross-referencing to D.3)* | Data variable | Source of data | Data unit | Measured (m), calculated (c) or estimated (e) | Recording frequency | Proportion of data to be monitored | How will the data be archived? (electronic/ paper) | Comment |
|---|---|---|---|---|---|---|---|---|
| 1. $LFG_{total}$ | Total amount of landfill gas captured | Flow-meter | $m^3$ | m | Continuously | 100% | Electronic and paper | Measured by a flow meter. Data to be aggregated monthly and yearly. |
| 2. $LFG_{flare, y}$ | Amount of landfill gas sent to flares | Flow meter | $m^3$ | m | Continuous | 100% | Electronic and paper | Measured by a flow meter. Data will be aggregated monthly and yearly. |
| 5. FE | Flare/combustion efficiency | Flare fabricant | % | *m/c* | (1) Continuous (2) quarterly, monthly if unstable | 100% | Electronic and paper | (1). Continuous measurement of operation time of flare (e.g. with temperature) (2) Periodic measurement of methane content of flare exhaust gas |
| 6. $w_{CH4, y}$ | Methane fraction in the landfill gas | Gas analyzer | % | m | Continuous | 100% | Electronic and paper | Measured by continuous gas quality analyzer. |
| 7. T | Temperature of the landfill gas | Temperature sensor | $^oC$ | m | Continuous | 100 % | Electronic and paper | Measured to determine the density of methane $D_{CH4}$. |
| 8. p | Pressure of the landfill gas | Pressure sensor | kPa | m | Continuous | 100% | Electronic and paper | Measured to determine the density of methane $D_{CH4}$. |
| 10 $EL_{IMP}$ | Total amount of Electricity imported to meet | Electricity meter installed in | MWh | m | Continuous | 100% | Electronic and paper | Required to determine $CO_2$ emissions from use of electricity to operate the project activity. |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | project requirement | the blower | | | | | | |
| 11 | $CO_2$ emission intensity of the electricity | Calculated | $tCO_2e/MWh$ | *c* | At the registration and at the baseline renewal. | 0% | Electronic and paper | Required to determine $CO_2$ emissions from use of electricity to operate the project activity |
| 13 | Regulatory requirements relating to landfill gas projects | | | | At the registration and at the baseline renewal. | 100% | Paper | Required for any changes to the adjustment factor (AF) or directly $MD_{reg, y}$. |

Obs: All data from the table above will be archived according to internal procedures, until 2 years after the end of the crediting period.

**D.2.2.2. Description of formulae used to calculate project emissions (for each gas, source, formulae/algorithm, emissions units of $CO_2$ equ.):**

$$EF_{OM,simple\_adjusted,y} = (1-\lambda_y)\frac{\sum_{i,j} F_{i,j,y}.COEF_{i,j}}{\sum_j GEN_{j,y}} + \lambda_y \frac{\sum_{i,k} F_{i,k,y}.COEF_{i,k}}{\sum_k GEN_{k,y}} \text{ (tCO}_2\text{e/GWh)}$$

$$EF_{BM} = \frac{\sum_{i,m} F_{i,m,y}.COEF_{i,m}}{\sum_m GEN_{m,y}} \text{ (tCO}_2\text{e/GWh)}$$

$$EF_{electricity} = \frac{EF_{OM} + EF_{BM}}{2} \text{ (tCO}_2\text{e/GWh)}$$

$F_{i,j(or\ m),y}$ Is the amount of fuel i (in a mass or volume unit) consumed by relevant power sources j in year(s) y

*j,m* Refers to the power sources delivering electricity to the grid, not including low-operating cost and must-run power plants, and including imports from the grid

$COEF_{i,j(or\ m)\ y}$ Is the CO2 emission coefficient of fuel i (tCO2 / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources j (or m) and the percent oxidation of the fuel in year(s) y, a

$GEN_{j(or\ m),y}$ Is the electricity (MWh) delivered to the grid by source j (or m)

Obs: project emissions will be measured directly at the site.

**D.2.3. Treatment of leakage in the monitoring plan**

**D.2.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project activity**

| ID number *(Please use numbers to ease cross-referencing to table D.3)* | Data variable | Source of data | Data unit | Measured (m), calculated (c) or estimated (e) | Recording frequency | Proportion of data to be monitored | How will the data be archived? (electronic/ paper) | Comment |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| | | | | | | | | |

According with ACM0001, no leakage will be accounted for the project activity.

**D.2.3.2. Description of formulae used to estimate leakage (for each gas, source, formulae/algorithm, emissions units of $CO_2$ equ.)**

Left blank on purpose.

**D.2.4. Description of formulae used to estimate emission reductions for the project activity (for each gas, source, formulae/algorithm, emissions units of $CO_2$ equ.)**

The Methodology ACM0001 states that greenhouse gas emission reduction achieved by the project activity during a given year "*y*" ($ER_y$) is the difference between the amount of methane actually destroyed/combusted during the year ($MD_{project,\ y}$) and the amount of methane that would have been destroyed/combusted during the year in the absence of the project activity ($MD_{reg\ ,y}$), times the approved Global Warming Potential value for methane ($GWP_{CH4}$), plus the emission reductions of the net electricity fed to the grid ($EL_{EX,\ LGFG} - EL_{IMP}$) minus the emission reduction due to the replacement of the fossil fuel used in the baseline, as follows:

$$ER_y = \left(MD_{project,y} - MD_{reg,y}\right) \times 21 + \left(EL_{EX,LGFG} - EL_{IMP}\right) \times CEF_{electricity} - ET_y \times CEF_{thermal}$$ , where:

$ER_y$ = emission reductions of the project activity in year *y* ($tCO_2e$);
$MD_{project,\ y}$ = quantity of methane destroyed at year *y* ($tCH_4$);
$MD_{reg,\ y}$ = methane that would have been destroyed during the year *y* in the absence of the project activity ($tCH_4$);
$GWP_{CH4}$ = Global Warming Potential of Methane ($tCO_2e/tCH_4$);
$EL_{EX,\ LGFG}$ = net quantity of electricity exported during year y, produced using landfill gas (MWh).

$EL_{IMP}$ = net incremental electricity imported, defined as difference of project imports less any imports of electricity in the baseline, to meet the project requirements (MWh);
$CEF_{electricity}$ = $CO_2$ emissions intensity of the electricity displaced ($tCO_2e/MWh$);
$ET_y$ = incremental quantity of fossil fuel, defined as difference of fossil fuel used in the baseline and fossil use during project, for energy requirement on site under project activity during the year y (TJ);
$CEF_{thermal}$ = $CO_2$ emissions intensity of the fuel used to generate thermal/mechanical energy, ($tCO_2e/TJ$);

As the QLGP is not a project to produce and sell electricity to the grid and as the landfill did not consume fossil fuel for energy requirements in the baseline, $EL_{EX,\ LGFG} = 0$ and $ET_y = 0$.

So, the formulae is updated to:

$$ER_y = (MD_{project,y} - MD_{reg,y}) \times 21 - EL_{IMP} \times CEF_{electricity}$$

The QLGP does not have any contractual obligations to burn methane; so $MD_{reg,\ y}$ is calculated based on the "Adjustment Factor", a value estimated as 20% of total methane produced at the baseline that is flared due to odor and security concerns:

$$MD_{reg,y} = 0{,}2 \times \mathrm{MD}_{\mathrm{project,\ y}}$$

and

$$ER_y = 0{,}8 \times MD_{project,y} \times 21 - EL_{IMP} \times CEF_{electricity}$$

The sum of the quantities fed to the flare, to the power plant and to the boiler must be compared annually with the total generated. The lowest value must be adopted as $MD_{project,y}$. The following procedure applies when the total generated is the highest.

$$MD_{project,y} = MD_{flared,y} + MD_{electricity,y} + MD_{thermal,y}$$

As the project won't produce electricity or replace a fossil fuel consumed in the baseline, the methane destroyed by the project activity $MD_{project,\ y}$ during year *y* is determined by monitoring only the quantity of methane actually flared:

$$MD_{project,y} = MD_{flared,y}$$

and

$$MD_{flared,y} = LFG_{flared,y} \times w_{CH_4} \times D_{CH_4} \times FE$$ , where

$MD_{flared,y}$ = quantity of methane destroyed by flaring during year y ($tCH_4$);
$LFG_{flared,y}$ = quantity of landfill gas flared during the year ($m^3_{LFG}$);
$w_{CH4,y}$,= methane fraction of the landfill gas ($m^3CH_4$/ $m^3_{LFG}$);
$D_{CH4}$ = methane density ($tCH_4/m^3CH_4$);
$FE$ = flare efficiency (%);

The estimate of the amount of landfill gas produced during year y is shown in E.4. The data used to determine the baseline scenario is presented in Annex 3

In other words, $ER_y$ is equal to:

$$ER_y = \left(0{,}8 \times LFG_{flared,y} \times w_{CH_4} \times D_{CH_4} \times FE \times 21\right) - EL_{IMP} \times CEF_{electricity}$$

| **D.3. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored** | | |
|---|---|---|
| Data *(Indicate table and ID number e.g. 3.-1.; 3.2.)* | Uncertainty level of data (High/Medium/Low) | Explain QA/QC procedures planned for these data, or why such procedures are not necessary. |
| 1. $LFG_{TOTAL}$ | *Low* | Flow meters should be subject to a regular maintenance and testing regime to ensure accuracy |
| 2. $LFG_{flare,y}$ | *Low* | Flow meters should be subject to a regular maintenance and testing regime to ensure accuracy |
| 5. FE | *Medium* | Regular maintenance should ensure optimal operation of flares. Flare efficiency should be checked quarterly, with monthly checks if the efficiency shows significant deviations from previous values. |
| 6. $w_{CH4,y}$ | *Low* | Gas analyzer should be subject to a regular maintenance and testing regime to ensure accuracy |
| 7. T | *Low* | Temperature sensors should be subject to a regular maintenance and testing regime to ensure accuracy |
| 9. p | *Low* | Pressure sensors should be subject to a regular maintenance and testing regime to ensure accuracy |

| | | |
|---|---|---|
| 10 $EL_{IMP}$ | *Low* | Direct measure from the blower's consumed electricity. |

**D.4 Please describe the operational and management structure that the project operator will implement in order to monitor emission reductions and any leakage effects, generated by the project activity**

There will be a team assigned to monitor emission reductions from the project. They will be responsible for collecting and archiving the pertinent data according to the monitoring plan.

This team and the responsibility of each member will be defined by the time of the project implementation.

**D.5 Name of person/entity determining the monitoring methodology:**

This monitoring study was concluded on 24/07/2006, by Econergy, which is a ***Project Participant***. Contact information in Annex 1

## SECTION E. Estimation of GHG emissions by sources

### E.1. Estimate of GHG emissions by sources:

The only source of GHG project emissions is the $CO_2$ emissions due to the import of electricity is calculated multiplying the grid's Emission Factor (EF) by the amount of electricity imported, in MWh, as presented on B.2 and on D.2.4.

As demonstrated on Annex 3, the EF for the Brazilian electric grid is equal to 0,2647 $tCO_2e$/MWh. Assuming that the blower is estimated to need around 3,000 MWh/year. That gives an emission due to the import of electricity equals to 794 $tCO_2e$/year. This data is determined *ex-ante*.

Quitaúna intends to produce a small amount of electricity, in the future, only to supply the internal uses. Thus, $EP_y$ may not be considered after the installation of the power generator. All legal aspects, like environmental licenses and authorizations, will be requested by the time of the generator's installation.

### E.2. Estimated leakage:

According with ACM0001, no leakage effects need to be accounted under this methodology.

Thus, **Ly = 0**.

### E.3. The sum of E.1 and E.2 representing the project activity emissions:

$E.1 + E.2 = 0{,}2647 \times 3000 + 0 = 794$ $tCO_2e$/year

### E.4. Estimated anthropogenic emissions by sources of greenhouse gases of the baseline:

GHG emissions by sources in the baseline were estimated using IPCC's guidelines[6]. In the case of QLGP, the derivative of first order decay model approach was used:

$$Q_{T,y} = \frac{k \times R_y \times L_0 \times \sum_{i=y}^{T} \sum_{j=y}^{i} \left[ e^{-k(i-j)} \right]}{F}$$ , where:

- $Q_{T,y}$ = landfill gas produced during year $T$ ($m^3_{LFG}$);
- $k$ = decay constant (1/year);
- $R_y$ = amount of waste disposed on year $y$ (kg);
- $L_0$ = methane potential generation ($m^3_{CH4}/Mg_{waste}$);
- $T$ = actual year;
- $y$ = year of waste disposal;
- $F$ = fraction of methane at the landfill gas (%)

To summarize, relevant factors for landfill gas estimation are:

• Year the site opened

[6] Revised 1996 IPCC Guidelines for National Greenhouse Gases Inventory.

• Year the site closed
• Amount of waste disposed at the site in a given year
• Methane generation rate constant (k)
• Methane generation potential ($L_0$)

Quitaúna provided waste flow data from year 2001 to year 2005 together with the estimative for 2006 to 2010. It has to be mentioned that Quitaúna wants to expand the landfill's area and extend the landfill's lifetime for 16 more years (until 2030). The emission reductions estimative were calculated only considering the landfill's closure year on 2010. All legal aspects, like environmental licenses and authorizations, will be requested by the time of the expantion's development.

According with USEPA[7], a collection efficiency for energy recovery between 75% and 85% sounds reasonable "because each cubic foot of gas will have a monetary value to the owner/operator". As QLGP´s only source of income are the CERs revenues from the destruction of methane, it can be assumed that for this project, the value of the each cubic feet of gas captured will also have a monetary value to the owner of the project. Adopting the range presented above, a conservative value of 75% of collection efficiency was used to estimate the amount of emission reductions. So, $LFG_{flare,y}$ is equal to 75% of total landfill gas emitted to the atmosphere at the baseline:

In other words, the amount of Methane destroyed by the project activity is calculated as follows:

$$MD_{project,y} = 0{,}8 \times 0{,}75 \times \frac{k \times R_y \times L_0 \times \sum_{i=y}^{T} \sum_{j=y}^{i} \left[ e^{-k(i-j)} \right]}{F} \times w_{CH_4} \times D_{CH_4} \times FE \times 21$$

or

$$MD_{project,y} = 0{,}6 \times \frac{k \times R_y \times L_0 \times \sum_{i=y}^{T} \sum_{j=y}^{i} \left[ e^{-k(i-j)} \right]}{F} \times w_{CH_4} \times D_{CH_4} \times FE \times 21$$

Baseline emissions are **798 632 t$CO_2$e** over the project's crediting period.

**E.5. Difference between E.4 and E.3 representing the emission reductions of the project activity:**

$$ER_y = \left( 0{,}6 \times \frac{k \times R_y \times L_0 \times \sum_{i=y}^{T} \sum_{j=y}^{i} \left[ e^{-k(i-j)} \right]}{F} \right) \times w_{CH_4} \times D_{CH_4} \times FE \times 21 - EC_y \times EF$$

This equation has been used for estimation purposes only, as the real emission reductions will be measured at the project site following the monitoring methodology for QLGP.

Project emission reductions are estimated to be **793 073 t$CO_2$e** over the first 7 year crediting period.

[7] **USEPA**; *Turning a Liability into an Asset: A Landfill Gas-to-Energy Project Development Handbook*; September 1996

**E.6. Table providing values obtained when applying formulae above:**

| Year | Estimation of project activity emission reductions (tonnes of $CO_2$e) | Estimation of the baseline emission reductions (tonnes of $CO_2$e) | Estimation of leakage (tonnes of $CO_2$e) | Estimation of emission reductions (tonnes of $CO_2$e) |
|---|---|---|---|---|
| **2007** [1] | 598 | 74.126 | 0 | 73.529 |
| **2008** | 794 | 110.915 | 0 | 110.121 |
| **2009** | 794 | 123.120 | 0 | 122.326 |
| **2010** | 794 | 135.111 | 0 | 134.317 |
| **2011** | 794 | 122.254 | 0 | 121.460 |
| **2012** | 794 | 110.620 | 0 | 109.826 |
| **2013** | 794 | 100.093 | 0 | 99.299 |
| **2014** [2] | 196 | 22.393 | 0 | 22.197 |
| **Total** (tonnes of $CO_2$e) | **5.559** | **798.632** | **0** | **793.073** |

Obs: [1] CERs will be requested from 01/04/2007 to 31/12/2007
[2] CERs will be requested from 01/01/2014 to 31/03/2014

Emission reductions from the first crediting period are expected to be, therefore, **793 073 t$CO_2$e**. Nevertheless, emission reductions will actually be measured directly at the project site.

## SECTION F. Environmental impacts

**F.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:**

The possible environmental impacts are to be analyzed by the CETESB, State of São Paulo’s environmental agency. Quitaúna has all the licenses for the Quitaúna Landfill operation, and will carry out the necessary process in order to obtain the Operational License for the QLGP’s facilities. From 2001 to 2004, the landfill received 6 temporary Operational Licences, until the definitive Operational Licence from 07 July 2004. The Quitaúna Landfill’s Operation License is shown in, Figure 10, Figure 11 and Figure 12.

GOVERNO DO ESTADO DE SÃO PAULO
SECRETARIA DO MEIO AMBIENTE
CETESB - COMPANHIA DE TECNOLOGIA DE SANEAMENTO AMBIENTAL

02 — Processo Nº 15/01150/00

Nº 15001196

# LICENÇA DE OPERAÇÃO

**VALIDADE ATÉ : 07/07/2009**

Data 07/07/2004

**de Novo Estabelecimento**

IDENTIFICAÇÃO DA ENTIDADE

Nome: QUITAÚNA SERVIÇOS S/C LTDA.
Logradouro: SÍTIO DAS PEDREIRAS

| Número | Complemento | Bairro | CEP | Município |
|---|---|---|---|---|
| S/Nº | | CABUÇU | 07075-210 | GUARULHOS |

CNPJ: 61.836.813/0001-00
Cadastro na CETESB: 336 - 04684 - 1

CARACTERÍSTICAS DO PROJETO

Atividade Principal

| Descrição | Código |
|---|---|
| ATERRO SANITÁRIO E INDUSTRIAL - RESÍDUOS CLASSES II E III | 31.40.02-4 |

| Bacia Hidrográfica | UGRHI |
|---|---|
| 2 - TIETÊ ALTO ZONA METROPOLITANA | 6 - ALTO TIETÊ |

Corpo Receptor — Classe

Área ( metro quadrado )

| Terreno | Construída | Atividade ao Ar Livre | Novos Equipamentos | Lavra(ha) |
|---|---|---|---|---|
| 413000,00 | 233,00 | 72305,00 | | |

| Horário de Funcionamento ( h ) Início | Término | Número de Funcionários Administração | Produção | Licença de Instalação Data | Número |
|---|---|---|---|---|---|
| 06:00 às | 22:00 | 4 | 20 | 30/03/2001 | 15000639 |

A CETESB-Companhia de Tecnologia de Saneamento Ambiental, no uso das atribuições que lhe foram conferidas pela Lei Estadual nº 997, de 31 de maio de 1976, regulamentada pelo Decreto nº 8468, de 8 de setembro de 1976, e suas alterações, concede a presente licença, nas condições e termos nela constantes;

A presente licença está sendo concedida com base nas informações apresentadas pelo interessado e não dispensa nem substitui quaisquer Alvarás ou Certidões de qualquer natureza, exigidos pela legislação federal, estadual ou municipal;

A presente Licença de Operação refere-se aos locais, equipamentos ou processos produtivos relacionados em folha anexa;

Os equipamentos de controle de poluição existentes deverão ser mantidos e operados adequadamente, de modo a conservar sua eficiência;

No caso de exigência de equipamentos ou dispositivos de queima de combustível, a densidade da fumaça emitida pelos mesmos deverá estar de acordo com o disposto no artigo 31 do Regulamento da Lei Estadual nº 997, de 31 de maio de 1976, aprovado pelo Decreto nº 8468, de 8 de setembro de 1976, e suas alterações;

Alterações nas atuais atividades, processos ou equipamentos deverão ser precedidas de Licença Prévia e Licença de Instalação, nos termos dos artigos 58 e 58-A do Regulamento acima mencionado;

Caso venham a existir reclamações da população vizinha em relação a problemas de poluição ambiental causados pela firma, esta deverá tomar medidas no sentido de solucioná-los em caráter de urgência.

USO DA CETESB — SD Nº 00156081

EMITENTE — Local: Agência Ambiental de Guarulhos

Engº Luis Carlos Rodrigues
Reg. 15.156

ENTIDADE

Pag. 1

CETESB COMPANHIA DE TECNOLOGIA DE SANEAMENTO AMBIENTAL

**Figure 10. Quitaúna Landfill's Operation License (page 1 of 3)**

GOVERNO DO ESTADO DE SÃO PAULO
SECRETARIA DO MEIO AMBIENTE
CETESB - COMPANHIA DE TECNOLOGIA DE SANEAMENTO AMBIENTAL

02 | Processo Nº 15/01150/00

# LICENÇA DE OPERAÇÃO

Nº 15001196

Data 07/07/2004

EXIGÊNCIAS TÉCNICAS

1. Elaborar um programa de monitoramento, resguardando todas as condições específicas de proteção das águas subterrâneas e superficiais, conforme previsto na norma ABNT NBR 13.896 - Aterros de Resíduos Não Perigosos - Critérios para Projeto, Implantação e Operação.
2. Realizar trimestralmente o monitoramento ambiental do aterro sanitário envolvendo análises periódicas das águas subterrâneas e superficiais, bem como o monitoramento geotécnico da massa de resíduos já dispostos.
3. O monitoramento geotécnico deverá ser efetuado durante a operação do aterro por meio de marcos superficiais, visando o registro das deformações verticais e deslocamentos horizontais da massa de lixo. Também deverá ser efetuada a leitura dos piezômetros para que se possa obter os níveis piezométricos desses locais. A freqüência de leitura e elaboração de gráficos propostos para o monitoramento deverá ser quinzenal em ambos os intrumentos. Com base nessas medições deverão ser realizadas análises de estabilidade do aterro para se avaliar o comportamento dos fatores de segurança com o aumento das cargas piezométricas.
4. O monitoramento das águas subterrâneas deve obedecer os parâmetros estabelecidos pela Portaria 36 do Ministério da Saúde, e o monitoramento das águas superficiais deve obedecer os parâmetros estabelecidos pela Resolução CONAMA 20/86, sendo que os resultados das análises deverão ser expressos em escala equivalente àquela indicada nos valores máximos permitidos pela legislação (Portaria 36 do Ministério da Saúde e Resolução CONAMA 20/86), para possibilitar eventuais confrontações. Deverão também ser apresentados com a indicação dos limites de detecção das metodologias empregadas.
5. Apresentar anualmente à CETESB, sempre até o dia 31 de janeiro, um relatório contendo as análises realizadas dos parâmetros de monitoramento, acompanhadas de estudos interpretativos dos resultados com sugestões para possíveis intervenções e/ou medidas compensatórias em caso de ocorrência de contaminação. Esse relatório deverá também contemplar a quantidade de resíduos recebida no ano anterior, juntamente com as correlações dos dados de pluviometria e geração de líquidos percolados.
6. Manter registro diário das viagens de encaminhamento de líquidos percolados por caminhões-tanque à Estação de Tratamento de Esgotos da SABESP, com identificação dos veículos e dos volumes transferidos.
7. Não poderão ser dispostos no aterro, resíduos contendo líquidos livres, conforme estabelecido na norma ABNT NBR 13.896 - Aterros de Resíduos Não Perigosos - Critérios para Projeto, Implantação e Operação. Para tal verificação deverá ser utilizada a norma ABNT NBR 12.988 - Líquidos Livres - Verificação em Amostra de Resíduo.
8. Operar o empreendimento de forma que, em momento algum, o mesmo se constitua em foco de atração de aves.
9. Fica proibida a emissão de substâncias odoríferas na atmosfera, em quantidades que possam ser perceptíveis fora dos limites de propriedade do empreendimento.
10. Deverá ser mantida a operação ininterrupta de compactação e cobrimento dos resíduos dispostos no aterro sanitário.
11. A disposição dos resíduos deverá ser feita em frente única de trabalho.
12. No caso de impossibilidade da cobertura imediata dos resíduos dispostos com material terroso, a sua cobertura deverá ser feita com manta de sacrifício de PVC até que seja efetuada a sua devida cobertura com terra.
13. Manter depósitos de material terroso, em local abrigado, para o cobrimento dos resíduos dispostos por, no mínimo, dois dias normais de atividade.
14. É vedado o recebimento de lodo fresco de ETE.
15. Realizar a drenagem de líquidos percolados na base dos taludes finais do aterro sanitário.
16. Manter uma patrulha de operação de reserva composta de trator sobre esteiras dotado de lâmina, pá carregadeira e caminhão basculante.
17. Apresentar semestralmente o "Plano de Monitorização da Fauna" contendo os resultados das ações mitigadoras empregadas para evitar a presença de aves e, se necessário, adoção de medidas. Esse relatório deverá ser encaminhado à CETESB, ao IAC (Instituto de Aviação Civil) e ao CENIPA (Centro de Investigação e Prevenção de Acidentes Aeronáuticos).

OBSERVAÇÕES

1. A área construída que totaliza 233,00 m², objeto da presente Licença, corresponde aos escritórios, sanitários e vestiário.
2. A presente Licença refere-se somente à operação do aterro sanitário para resíduos domésticos, não sendo válida

700934

TIDADE Pag. 2

Figure 11. Quitaúna Landfill's Operation License (page 2 of 3)

GOVERNO DO ESTADO DE SÃO PAULO
SECRETARIA DO MEIO AMBIENTE
CETESB - COMPANHIA DE TECNOLOGIA DE SANEAMENTO AMBIENTAL

02

Processo Nº 15/01150/00

Nº 15001196

LICENÇA DE OPERAÇÃO

Data 07/07/2004

para a disposição de resíduos industriais no local.

CETESB COMPANHIA DE TECNOLOGIA DE SANEAMENTO AMBIENTAL

CONTROLE Nº 700935

ENTIDADE

Pag. 3

**Figure 12. Quitaúna Landfill's Operation License (page 3 of 3)**

There will be no transboundary impacts resulting from the QLGP. All relevant impacts will occur within Brazilian borders and will be mitigated to comply with the environmental requirements for the project's implementation.

**F.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:**

The QLGP will not have significant environmental impacts. The infra-structure to collect and flare the gas will not likely generate significant impacts at the site.

The Quitaúna Landfill has the Environmental License from CETESB. It can be stated that Quitaúna is totally committed to environmental integrity in its practices.

Flaring gas, nevertheless, may cause gaseous emissions, such as volatile organic compounds and dioxins that need to be controlled. During the environmental licensing procedures, all the necessary measurements will be made in order to mitigate such impacts, as requested for the issuance of the Operational License by the environmental agency.

## SECTION G. Stakeholders' comments

**G.1. Brief description how comments by local stakeholders have been invited and compiled:**

Previously to the development of QLGP, Quitaúna made a public call for comments from local stakeholders when constructing Quitaúna Landfill.

Now, as required by the Interministerial Comission on Global Climate Change, the Brazilian DNA, invitations must be sent for comments to local stakeholders as part of the procedures for analyzing CDM projects and issuing letters of approval. This procedure has been followed by Quitaúna to take its GHG mitigation initiative to the public. Letters[8] and the Executive Summary of the project were sent to the following recipients:

- Prefeitura Municipal de Guarulhos – SP / *Municipal Administration of Guarulhos - SP*
- Secretaria Municipal do Meio-Ambiente / *Municipal Environmental Secretariat;*
- Câmara dos Vereadores de Guarulhos – SP / *Municipal Legislation Chamber of Guarulhos - SP*
- Secretaria Estadual do Meio Ambiente / *Environmental Secretariat of São Paulo State*
- Associação Consciência Ecológica;
- Casa de Cultura Água e Vida;
- Conselho Estadual do Meio-Ambiente / *State Environmental Council;*
- Departamento de Limpeza Urbana de Guarulhos – DELURB / *Guarulhos Department of Urban Waste Collection;*
- IBAMA – Instituto Brasileiro do Meio-Ambiente e dos Recursos Naturais Renováveis / *Brazilian Institute of Environment and Renewable Natural Resources;*
- Ministério Público do Estado de São Paulo / *Public Ministry of São Paulo State*
- Fórum Brasileiro de ONGs / *Brazilian NGO Forum*

[8] The copies of the invitations and comments are available in hold of Project participants.

**G.2. Summary of the comments received:**

No comments received.

**G.3. Report on how due account was taken of any comments received:**

As no comments were received, Quitaúna will continue with the development of the project.

Annex 1

## CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

**Project Participant 1:**

| | |
|---|---|
| Organization: | Quitaúna Serviços Ltda. |
| Street/P.O.Box: | Avenida Rotary, 400 |
| Building: | |
| City: | Guarulhos |
| State/Region: | SP |
| Postfix/ZIP: | 07042-000 |
| Country: | Brazil |
| Telephone: | +55 (11) 6421.6222 |
| FAX: | +55 (11) 6421.3220 |
| E-Mail: | tonynour@uol.com.br |
| URL: | www.quitauna.com.br |
| Represented by: | |
| Title: | Mr. |
| Salutation: | |
| Last Name: | Nour |
| Middle Name: | |
| First Name: | Antônio |
| Department: | Director |
| Mobile: | + 55 (11) 6421-6222 |
| Direct FAX: | + 55 (11) 6421-6222 |
| Direct tel: | + 55 (11) 9988.8654 |
| Personal E-Mail: | tonynour@uol.com.br |

**Project Participant -2:**

| | |
|---|---|
| Organization: | Econergy Brasil Ltda. |
| Street/P.O.Box: | Avenida Angélica, 25830 – cj 111 |
| Building: | Edifício Reynaldo Raucchi |
| City: | São Paulo |
| State/Region: | SP |
| Postfix/ZIP: | 01228-200 |
| Country: | Brazil |
| Telephone: | + 55 (11) 3555-5700 |
| FAX: | +55 (11) 3555-5735 |
| E-Mail: | - |
| URL: | http://www.econergy.com.br |
| Represented by: | |
| Title: | Mr. |
| Salutation: | |
| Last Name: | Diniz Junqueira |
| Middle Name: | Schunn |
| First Name: | Marcelo |
| Department: | - |
| Mobile: | +55 (11) 8263-3017 |
| Direct FAX: | Same above |
| Direct tel: | + 55 (11) 3555-5725 and/or mobile |
| Personal E-Mail: | junqueira@econergy.com.br |

Annex 2

## INFORMATION REGARDING PUBLIC FUNDING

There is no public funding for the QLGP.

Annex 3

## BASELINE INFORMATION

**Table 1. Baseline determination information**

| DATA | VALUE | UNIT | SOURCE |
|---|---|---|---|
| **$L_0$ (methane potential generation)** | 0,07 | $m^3_{CH4}/kg_{waste}$ | USEPA[9] |
| **k (decay constant)** | 0,1 | 1/year | |
| **Year of opening** | 2001 | | Quitaúna |
| **Year of closure** | 2010 | | |
| **$R_x$** | Variable | $kg_{waste}$ | |
| **EAF (Emission Adjustment Factor)** | 20 | % | |

USEPA (1996) suggest values of $k$ and $L_0$ to be applied to the model. Because of the uncertainty in estimating $L_0$, gas flow estimates derived from the model should also be bracketed by a range of plus or minus 50 percent. To make a conservativeness approach, $L_0$ was assumed to be minus 50% of the lowest value of the range (2,25-2,88 $ft^3/lb$). Converting the units to $m^3_{CH4}/kg_{waste}$, the value assumed for $L_0$ is *0,07*.

The value of *k* was estimated as *0,1/year*, the lowest of the suggested value, considering a wet climate.

The data of annual waste disposal was give by Quitaúna, from 2001 to 2005. Data from 2006 on were estimated by Quitaúna.

Project Emissions due to electricity purchased were estimated through approved methodology ACM0002 – Consolidated methodology for grid-connected electricity generation from renewable sources – version 5. In order to gather the daily dispatch data, which allows for the application of option *b)* Simple adjusted OM, the manager of the electricity system (ONS) was consulted in order to provide the data.

ACM0002 considers the determination of the emissions factor for the grid to which the project activity is connected as the core data to be determined in the baseline scenario. In Brazil, there are two main grids, South-Southeast-Midwest and North-Northeast, therefore the South-Southeast-Midwest Grid is the relevant one for this project.

The method that will be chosen to calculate the Operating Margin (OM) for the electricity baseline emission factor is the option (b) *Simple Adjusted OM*, since the preferable choice (c) *Dispatch Data Analysis OM* would face the barrier of data availability in Brazil.

[9] USEPA – United States Environmental Agency; *Turning a Liability into an Asset: a Landfill Gas-to- Energy Project Development Handbook*; LMOP – Landfill Methane Outreach Program, 1996

In order to calculate the Operating Margin, daily dispatch data from the Brazilian electricity system manager (ONS) needed to be gathered. ONS does not regularly provide such information, which implied in getting it through communicating directly with the entity.

The provided information covers years 2002, 2003 and 2004, and is the most recent information available at this stage (At the end of 2005 ONS supplied raw dispatch data for the whole interconnected grid in the form of daily reports[10] from Jan. 1, 2002 to Dec. 31, 2004, the most recent information available at this stage).

**Simple Adjusted Operating Margin Emission Factor Calculation**

According to the methodology, the project is to determine the Simple Adjusted OM Emission Factor ($EF_{OM,\ simple\ adjusted,\ y}$) . Therefore, the following equation is to be solved:

$$EF_{OM,simple\_adjusted,y} = (1-\lambda_y)\frac{\sum_{i,j} F_{i,j,y}.COEF_{i,j}}{\sum_j GEN_{j,y}} + \lambda_y \frac{\sum_{i,k} F_{i,k,y}.COEF_{i,k}}{\sum_k GEN_{k,y}} \text{ (tCO}_2\text{e/GWh)}$$

It is assumed here that all the low-cost/must-run plants produce zero net emissions.

$$\frac{\sum_{i,k} F_{i,k,y}.COEF_{i,k}}{\sum_k GEN_{k,y}} = 0 \text{ (tCO}_2\text{e/GWh)}$$

Please refer to the methodology text or the explanations on the variables mentioned above.

The ONS data as well as the spreadsheet data with the calculation of emission factors have been provided to the validator (DOE). In the spreadsheet, the dispatch data is treated as to allow calculation of the emission factor for the most three recent years with available information, which are 2002, 2003 and 2004.

The Lambda factors were calculated in accordance with methodology requests. More detailed information is provided in Annex 3. The table below presents such factors.

| Year | Lambda |
|---|---|
| 2002 | 0,5053 |
| 2003 | 0,5312 |
| 2004 | 0,5041 |

[10] *Acompanhamento Diário da Operação do Sistema Iterligado Nacional*. ONS-CNOS, Centro Nacional de Operação do Sistema. Daily reports on the whole interconnected electricity system from Jan. 1, 2002 to Dec. 31, 2004.

Electricity generation for each year needs also to be taken into account. This information is provided in the table below.

| Year | Electricity Load (MWh) |
|---|---|
| 2002 | 275.402.896 |
| 2003 | 288.493.929 |
| 2004 | 297.879.874 |

Using therefore appropriate information for $F_{i,j,y}$ and $COEF_{i,j}$, OM emission factors for each year can be determined, as follows.

$$EF_{OM,simple\_adjusted,2002} = (1-\lambda_{2002})\frac{\sum_{i,j} F_{i,j,2002}.COEF_{i,j}}{\sum_j GEN_{j,2002}} \therefore EF_{OM,simple\_adjusted,2002} = 0.4229 \text{ tCO}_2\text{/MWh}$$

$$EF_{OM,simple\_adjusted,2003} = (1-\lambda_{2003})\frac{\sum_{i,j} F_{i,j,2003}.COEF_{i,j}}{\sum_j GEN_{j,2003}} \therefore EF_{OM,simple\_adjusted,2003} = 0.4417 \text{ tCO}_2\text{/MWh}$$

$$EF_{OM,simple\_adjusted,2004} = (1-\lambda_{2004})\frac{\sum_{i,j} F_{i,j,2004}.COEF_{i,j}}{\sum_j GEN_{j,2004}} \therefore EF_{OM,simple\_adjusted,2004} = 0.4346 \text{ tCO}_2\text{/MWh}$$

Finally, to determine the baseline *ex-ante*, the full generation weighted-average among the three years is calculated, finally determining the $EF_{OM,simple\_adjusted}$.

$$EF_{OM,simple\_adjusted\,2002\_2004} = \frac{EF_{OM,simple\_adjusted,2002} * \sum_j GEN_{j,2002} + EF_{OM,simple\_adjusted,2003} * \sum_j GEN_{j,2003} + EF_{OM,simple\_adjusted,2004} * \sum_j GEN_{j,2004}}{\sum_j GEN_{j,2002} + \sum_j GEN_{j,2003} \sum_j GEN_{j,2004}} = 0.4332$$

According to the methodology used, a Build Margin emission factor also needs to be determined.

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y}.COEF_{i,m}}{\sum_m GEN_{m,y}}$$

Electricity generation in this case means 20% of total generation in the most recent year (2004), as the 5 most recent plants built generate less than such 20%. If 20% falls on part capacity of a plant, that plant is fully included in the calculation. Calculating such factor one reaches:

$$EF_{BM,2004} = 0,0962 \text{ tCO}_2\text{/MWh}$$

Finally, the electricity baseline emission factor is calculated through a weighted-average formula, considering both the OM and the BM, being the weights 50% and 50% by default. That gives:

$$EF_{electricity,2002-2004} = 0,5*0,4332 + 0,5*0,0962 = 0,2647 \text{ tCO}_2\text{/MWh}$$

It is important to note that adequate considerations on the above weights are currently under study by the Meth Panel, and there is a possibility that such weighing changes in the methodology here applied.

The baseline emissions would then be proportional to the electricity delivered to the grid throughout the project's lifetime. Baseline emissions due to displacement of electricity are calculated by multiplying the electricity baseline emissions factor ($EF_{electricity,2002-2004}$) with the electricity generation of the project activity.

$BE_{electricity,y} = EF_{electricity,2002-2004} \cdot EC_y$, where
$EC_y$ = electricity consumed by the blower during year $y$ (MWh);

Therefore, for the first crediting period, the baseline emissions will be calculated as follows:

$\mathbf{BE_{electricity,y} = 0{,}2647\ tCO_2/MWh \cdot EC_y}$ (in $tCO_2e$)

The project emissions would then be proportional to the electricity purchased from the grid throughout the project's lifetime. Leakage emissions due to purchase of electricity are calculated by multiplying the electricity emissions factor ($EF_{electricity,2002-2004}$) with the electricity purchase of the project activity, as put in section E.2.

The Brazilian electricity system has been historically divided into two subsystems: the North-Northeast (N-NE) and the South-Southeast-Midwest (S-SE-CO). This is due mainly to the historical evolution of the physical system, which was naturally developed nearby the biggest consuming centers of the country.

The natural evolution of both systems is increasingly showing that integration is bound to happen in the future. In 1998, the Brazilian government was announcing the first leg of the interconnection line between S-SE-CO and N-NE. With investments of around US$700 million, the connection had the main purpose, in the government's view, at least, to help solve energy imbalances in the country: the S-SE-CO region could supply the N-NE in case it was necessary and vice-versa.

Nevertheless, even after the interconnection had been established, technical papers still divided the Brazilian system in two (Bosi, 2000)[11]:

"… where the Brazilian Electricity System is divided into three separate subsystems:
(i) The South/Southeast/Midwest Interconnected System;
(ii) The North/Northeast Interconnected System; and
(iii) The Isolated Systems (which represent 300 locations that are electrically isolated from the interconnected systems)"

Moreover, Bosi (2000) gives a strong argument in favor of having so-called *multi-project baselines*:

"For large countries with different circumstances within their borders and different power grids based in these different regions, multi-project baselines in the electricity sector may need to be disaggregated below the country-level in order to provide a credible representation of 'what would have happened otherwise'".

[11] Bosi, M. *An Initial View on Methodologies for Emission Baselines: Electricity Generation Case Study*. International Energy Agency. Paris, 2000.

Finally, one has to take into account that even though the systems today are connected, the energy flow between N-NE and S-SE-CO is heavily limited by the transmission lines capacity. Therefore, only a fraction of the total energy generated in both subsystems is sent one way or another. It is natural that this fraction may change its direction and magnitude (up to the transmission line's capacity) depending on the hydrological patterns, climate and other uncontrolled factors. But it is not supposed to represent a significant amount of each subsystem's electricity demand. It has also to be considered that only in 2004 the interconnection between SE and NE was concluded, i.e., if project proponents are to be coherent with the generation database they have available as of the time of the PDD submission for validation, a situation where the electricity flow between the subsystems was even more restricted is to be considered.

The Brazilian electricity system nowadays comprises of around 91.3 GW of installed capacity, in a total of 1,420 electricity generation enterprises. From those, nearly 70% are hydropower plants, around 10% are natural gas-fired power plants, 5.3% are diesel and fuel oil plants, 3.1% are biomass sources (sugarcane bagasse, black liquor, wood, rice straw and biogas), 2% are nuclear plants, 1.4% are coal plants, and there are also 8.1 GW of installed capacity in neighboring countries (Argentina, Uruguay, Venezuela and Paraguay) that may dispatch electricity to the Brazilian grid. (http://www.aneel.gov.br/aplicacoes/capacidadebrasil/OperacaoCapacidadeBrasil.asp). This latter capacity is in fact comprised by mainly 6.3 GW of the Paraguayan part of *Itaipu Binacional*, a hydropower plant operated by both Brazil and Paraguay, but whose energy almost entirely is sent to the Brazilian grid.

Approved methodology ACM0002 asks project proponents to account for "all generating sources serving the system". In that way, when applying one of these methodologies, project proponents in Brazil should search for, and research, all power plants serving the Brazilian system.

In fact, information on such generating sources is not publicly available in Brazil. The national dispatch center, ONS – *Operador Nacional do Sistema* – argues that dispatching information is strategic to the power agents and therefore cannot be made available. On the other hand, ANEEL, the electricity agency, provides information on power capacity and other legal matters on the electricity sector, but no dispatch information can be got through this entity.

In that regard, project proponents looked for a plausible solution in order to be able to calculate the emission factor in Brazil in the most accurate way. Since real dispatch data is necessary after all, the ONS was contacted, in order to let participants know until which degree of detail information could be provided. After several months of talks, plants' daily dispatch information was made available for years 2002, 2003 and 2004.

Project proponents, discussing the feasibility of using such data, concluded it was the most proper information to be considered when determining the emission factor for the Brazilian grid. According to ANEEL, in fact, ONS centralized dispatched plants accounted for 75,547 MW of installed capacity by 31/12/2004, out of the total 98,848.5 MW installed in Brazil by the same date (http://www.aneel.gov.br/arquivos/PDF/Resumo_Gráficos_mai_2005.pdf), which includes capacity available in neighboring countries to export to Brazil and emergency plants, that are dispatched only during times of electricity constraints in the system. Such capacity in fact is constituted by plants with 30 MW installed capacity or above, connected to the system through 138kV power lines, or at higher voltages. Therefore, even though the emission factor calculation is carried out without considering all generating sources serving the system, about 76.4% of the installed capacity serving Brazil is taken into account, which is a fair amount if one looks at the difficulty in getting dispatch information in Brazil. Moreover, the remaining 23.6% are plants that do not have their dispatch coordinated by ONS, since: either they operate based on power purchase agreements which are not under control of the dispatch authority; or they are located in non-interconnected systems to which ONS has no access. In that way, this portion is not likely to be affected by the CDM projects, and this is another reason for not taking them into account when determining the emission factor.

In an attempt to include all generating sources, project developers considered the option to research for available, but non-official data, to supply the existing gap. The solution found was the International Energy Agency database built when carrying out the study “Road-Testing Baselines For Greenhouse Gas Mitigation Projects in the Electric Power Sector”, published in October 2002. Merging ONS data with the IEA data in a spreadsheet, project proponents have been able to consider all generating sources connected to the relevant grids in order to determine the emission factor. The emission factor calculated was found more conservative when considering ONS data only, as the table below shows the build margin in both cases.

| **IEA/ONS Merged Data Build Margin ($tCO_2/MWh$)** | **ONS Data Build Margin ($tCO_2/MWh$)** |
|---|---|
| 0,205 | 0,0962 |

Therefore, considering all the rationale explained, project developers decided for the database considering ONS information only, as it was capable of properly addressing the issue of determining the emission factor and doing it in the most conservative way.

The fossil fueled plants efficiencies were also taken from the IEA paper. This was done considering the lack of more detailed information on such efficiencies from public, reliable and credible sources.

From the mentioned reference:

> *The fossil fuel conversion efficiency (%) for the thermal power plants was calculated based on the installed capacity of each plant and the electricity actually produced. For most of the fossil fuel power plants under construction, a constant value of 30% was used as an estimate for their fossil fuel conversion efficiencies. This assumption was based on data available in the literature and based on the observation of the actual situation of those kinds of plants currently in operation in Brazil. The only 2 natural gas plants in combined cycle (totaling 648 MW) were assumed to have a higher efficiency rate, i.e. 45%.*

Therefore only data for plants under construction in 2002 (with operation start in 2002, 2003 and 2004) was estimated. All others efficiencies were calculated. To the best of our knowledge there was no retrofit/modernization of the older fossil-fuelled power plants in the analyzed period (2002 to 2004). For that reason project participants find the application of such numbers to be not only reasonable but the best available option.

The aggregated hourly dispatch data got from ONS was used to determine the lambda factor for each of the years with data available (2002, 2003 and 2004). The Low-cost/Must-run generation was determined as the total generation minus fossil-fuelled thermal plants generation, this one determined through daily dispatch data provided by ONS. All this information has been provided to the validators, and extensively discussed with them, in order to make all points crystal clear.

On the following pages, a summary of the analysis is provided. First, the table with the 130 plants dispatched by the ONS is provided. Then, a table with the summarized conclusions of the analysis, with the emission factor calculation displayed. Next, the load duration curves for the S-SE-MW system are presented. Finally, a graphic showing the total estimated methane generated at the baseline scenario and the methane captured and destroyed is presented.

**Table 2. ONS Dispatched Plants -1/2**

| | Subsystem* | Fuel source** | Power plant | Operation start [2, 4, 5] | Installed capacity (MW) [1] | Fuel conversion efficiency (%) [2] | Carbon emission factor (tC/TJ) [3] | Fraction carbon oxidized [3] | Emission factor (tCO2/MWh) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | S-SE-CO | G | Termo Rio | Nov-2004 | 423,3 | 0,30 | 15,3 | 99,5% | 0,670 |
| 2 | S-SE-CO | H | Candonga | Sep-2004 | 140,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 3 | S-SE-CO | H | Queimado | May-2004 | 105,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 4 | S-SE-CO | G | Norte Fluminense | Feb-2004 | 860,2 | 0,30 | 15,3 | 99,5% | 0,670 |
| 5 | S-SE-CO | H | Jauru | Sep-2003 | 121,5 | 1,00 | 0,0 | 0,0% | 0,000 |
| 6 | S-SE-CO | H | Gauporé | Sep-2003 | 120,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 7 | S-SE-CO | G | Três Lagoas | Aug-2003 | 306,0 | 0,30 | 15,3 | 99,5% | 0,670 |
| 8 | S-SE-CO | H | Funil (MG) | Jan-2003 | 180,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 9 | S-SE-CO | H | Itiquira I | Sep-2002 | 156,1 | 1,00 | 0,0 | 0,0% | 0,000 |
| 10 | S-SE-CO | G | Araucária | Sep-2002 | 484,5 | 0,30 | 15,3 | 99,5% | 0,670 |
| 11 | S-SE-CO | G | Canoas | Sep-2002 | 160,6 | 0,30 | 15,3 | 99,5% | 0,670 |
| 12 | S-SE-CO | H | Piraju | Sep-2002 | 81,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 13 | S-SE-CO | G | Nova Piratininga | Jun-2002 | 384,9 | 0,30 | 15,3 | 99,5% | 0,670 |
| 14 | S-SE-CO | O | PCT CGTEE | Jun-2002 | 5,0 | 0,30 | 20,7 | 99,0% | 0,902 |
| 15 | S-SE-CO | H | Rosal | Jun-2002 | 55,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 16 | S-SE-CO | G | Ibirité | May-2002 | 226,0 | 0,30 | 15,3 | 99,5% | 0,670 |
| 17 | S-SE-CO | H | Cana Brava | May-2002 | 465,9 | 1,00 | 0,0 | 0,0% | 0,000 |
| 18 | S-SE-CO | H | Sta. Clara | Jan-2002 | 60,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 19 | S-SE-CO | H | Machadinho | Jan-2002 | 1.140,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 20 | S-SE-CO | G | Juiz de Fora | Nov-2001 | 87,0 | 0,28 | 15,3 | 99,5% | 0,718 |
| 21 | S-SE-CO | G | Macaé Merchant | Nov-2001 | 922,6 | 0,24 | 15,3 | 99,5% | 0,837 |
| 22 | S-SE-CO | H | Lajeado (ANEEL res. 402/2001) | Nov-2001 | 902,5 | 1,00 | 0,0 | 0,0% | 0,000 |
| 23 | S-SE-CO | G | Eletrobolt | Oct-2001 | 379,0 | 0,24 | 15,3 | 99,5% | 0,837 |
| 24 | S-SE-CO | H | Porto Estrela | Sep-2001 | 112,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 25 | S-SE-CO | G | Cuiaba (Mario Covas) | Aug-2001 | 529,2 | 0,30 | 15,3 | 99,5% | 0,670 |
| 26 | S-SE-CO | G | W. Arjona | Jan-2001 | 194,0 | 0,25 | 15,3 | 99,5% | 0,804 |
| 27 | S-SE-CO | G | Uruguaiana | Jan-2000 | 639,9 | 0,45 | 15,3 | 99,5% | 0,447 |
| 28 | S-SE-CO | H | S. Caxias | Jan-1999 | 1.240,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 29 | S-SE-CO | H | Canoas I | Jan-1999 | 82,5 | 1,00 | 0,0 | 0,0% | 0,000 |
| 30 | S-SE-CO | H | Canoas II | Jan-1999 | 72,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 31 | S-SE-CO | H | Igarapava | Jan-1999 | 210,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 32 | S-SE-CO | H | Porto Primavera | Jan-1999 | 1.540,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 33 | S-SE-CO | D | Cuiaba (Mario Covas) | Oct-1998 | 529,2 | 0,27 | 20,2 | 99,0% | 0,978 |
| 34 | S-SE-CO | H | Sobragi | Sep-1998 | 60,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 35 | S-SE-CO | H | PCH EMAE | Jan-1998 | 26,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 36 | S-SE-CO | H | PCH CEEE | Jan-1998 | 25,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 37 | S-SE-CO | H | PCH ENERSUL | Jan-1998 | 43,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 38 | S-SE-CO | H | PCH CEB | Jan-1998 | 15,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 39 | S-SE-CO | H | PCH ESCELSA | Jan-1998 | 62,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 40 | S-SE-CO | H | PCH CELESC | Jan-1998 | 50,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 41 | S-SE-CO | H | PCH CEMAT | Jan-1998 | 145,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 42 | S-SE-CO | H | PCH CELG | Jan-1998 | 15,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 43 | S-SE-CO | H | PCH CERJ | Jan-1998 | 59,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 44 | S-SE-CO | H | PCH COPEL | Jan-1998 | 70,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 45 | S-SE-CO | H | PCH CEMIG | Jan-1998 | 84,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 46 | S-SE-CO | H | PCH CPFL | Jan-1998 | 55,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 47 | S-SE-CO | H | S. Mesa | Jan-1998 | 1.275,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 48 | S-SE-CO | H | PCH EPAULO | Jan-1998 | 26,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 49 | S-SE-CO | H | Guilmam Amorim | Jan-1997 | 140,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 50 | S-SE-CO | H | Corumbá | Jan-1997 | 375,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 51 | S-SE-CO | H | Miranda | Jan-1997 | 408,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 52 | S-SE-CO | H | Noav Ponte | Jan-1994 | 510,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 53 | S-SE-CO | H | Segredo (Gov. Ney Braga) | Jan-1992 | 1.260,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 54 | S-SE-CO | H | Taquaruçu | Jan-1989 | 554,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 55 | S-SE-CO | H | Manso | Jan-1988 | 210,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 56 | S-SE-CO | H | D. Francisca | Jan-1987 | 125,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 57 | S-SE-CO | H | Itá | Jan-1987 | 1.450,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 58 | S-SE-CO | H | Rosana | Jan-1987 | 369,2 | 1,00 | 0,0 | 0,0% | 0,000 |
| 59 | S-SE-CO | N | Angra | Jan-1985 | 1.874,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 60 | S-SE-CO | H | T. Irmãos | Jan-1985 | 807,5 | 1,00 | 0,0 | 0,0% | 0,000 |
| 61 | S-SE-CO | H | Itaipu 60 Hz | Jan-1983 | 6.300,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 62 | S-SE-CO | H | Itaipu 50 Hz | Jan-1983 | 5.375,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 63 | S-SE-CO | H | Emborcação | Jan-1982 | 1.192,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 64 | S-SE-CO | H | Nova Avanhandava | Jan-1982 | 347,4 | 1,00 | 0,0 | 0,0% | 0,000 |
| 65 | S-SE-CO | H | Gov. Bento Munhoz - GBM | Jan-1980 | 1.676,0 | 1,00 | 0,0 | 0,0% | 0,000 |

* Subsystem: S - south, SE-CO - Southeast-Midwest

** Fuel source (C, bituminous coal; D, diesel oil; G, natural gas; H, hydro; N, nuclear; O, residual fuel oil).

[1] Agência Nacional de Energia Elétrica. *Banco de Informações da Geração* (http://www.aneel.gov.br/, data collected in november 2004).

[2] Bosi, M., A. Laurence, P. Maldonado, R. Schaeffer, A.F. Simoes, H. Winkler and J.M. Lukamba. *Road testing baselines for GHG mitigation projects in the electric power sector.* OECD/IEA information paper, October 2002.

[3] Intergovernamental Panel on Climate Change. *Revised 1996 Guidelines for National Greenhouse Gas Inventories.*

[4] Operador Nacional do Sistema Elétrico. Centro Nacional de Operação do Sistema. *Acompanhamento Diário da Operação do SIN* (daily reports from Jan. 1, 2001 to Dec. 31, 2003).

[5] Agência Nacional de Energia Elétrica. Superintendência de Fiscalização dos Serviços de Geração. *Resumo Geral dos Novos Empreendimentos de Geração* (http://www.aneel.gov.br/, data collected in november 2004).

**Table 3. ONS Dispatched Plants -2/2**

| | Subsystem* | Fuel source** | Power plant | Operation start [2, 4, 5] | Installed capacity (MW) [1] | Fuel conversion efficiency (%) [2] | Carbon emission factor (tC/TJ) [3] | Fraction carbon oxidized [3] | Emission factor (tCO2/MWh) |
|---|---|---|---|---|---|---|---|---|---|
| 66 | S-SE-CO | H | S.Santiago | Jan-1980 | 1.420,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 67 | S-SE-CO | H | Itumbiara | Jan-1980 | 2.280,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 68 | S-SE-CO | O | Igarapé | Jan-1978 | 131,0 | 0,30 | 20,7 | 99,0% | 0,902 |
| 69 | S-SE-CO | H | Itauba | Jan-1978 | 512,4 | 1,00 | 0,0 | 0,0% | 0,000 |
| 70 | S-SE-CO | H | A. Vermelha (Jose E. Moraes) | Jan-1978 | 1.396,2 | 1,00 | 0,0 | 0,0% | 0,000 |
| 71 | S-SE-CO | H | S.Simão | Jan-1978 | 1.710,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 72 | S-SE-CO | H | Capivara | Jan-1977 | 640,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 73 | S-SE-CO | H | S.Osório | Jan-1975 | 1.078,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 74 | S-SE-CO | H | Marimbondo | Jan-1975 | 1.440,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 75 | S-SE-CO | H | Promissão | Jan-1975 | 264,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 76 | S-SE-CO | C | Pres. Medici | Jan-1974 | 446,0 | 0,26 | 26,0 | 98,0% | 1,294 |
| 77 | S-SE-CO | H | Volta Grande | Jan-1974 | 380,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 78 | S-SE-CO | H | Porto Colombia | Jun-1973 | 320,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 79 | S-SE-CO | H | Passo Fundo | Jan-1973 | 220,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 80 | S-SE-CO | H | Passo Real | Jan-1973 | 158,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 81 | S-SE-CO | H | Ilha Solteira | Jan-1973 | 3.444,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 82 | S-SE-CO | H | Mascarenhas | Jan-1973 | 131,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 83 | S-SE-CO | H | Gov. Parigot de Souza - GPS | Jan-1971 | 252,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 84 | S-SE-CO | H | Chavantes | Jan-1971 | 414,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 85 | S-SE-CO | H | Jaguara | Jan-1971 | 424,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 86 | S-SE-CO | H | Sá Carvalho | Apr-1970 | 78,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 87 | S-SE-CO | H | Estreito (Luiz Carlos Barreto) | Jan-1969 | 1.050,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 88 | S-SE-CO | H | Ibitinga | Jan-1969 | 131,5 | 1,00 | 0,0 | 0,0% | 0,000 |
| 89 | S-SE-CO | H | Jupiá | Jan-1969 | 1.551,2 | 1,00 | 0,0 | 0,0% | 0,000 |
| 90 | S-SE-CO | O | Alegrete | Jan-1968 | 66,0 | 0,26 | 20,7 | 99,0% | 1,040 |
| 91 | S-SE-CO | G | Campos (Roberto Silveira) | Jan-1968 | 30,0 | 0,24 | 15,3 | 99,5% | 0,837 |
| 92 | S-SE-CO | G | Santa Cruz (RJ) | Jan-1968 | 766,0 | 0,31 | 15,3 | 99,5% | 0,648 |
| 93 | S-SE-CO | H | Paraibuna | Jan-1968 | 85,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 94 | S-SE-CO | H | Limoeiro (Armando Salles de Olivie | Jan-1967 | 32,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 95 | S-SE-CO | H | Caconde | Jan-1966 | 80,4 | 1,00 | 0,0 | 0,0% | 0,000 |
| 96 | S-SE-CO | C | J.Lacerda C | Jan-1965 | 363,0 | 0,25 | 26,0 | 98,0% | 1,345 |
| 97 | S-SE-CO | C | J.Lacerda B | Jan-1965 | 262,0 | 0,21 | 26,0 | 98,0% | 1,602 |
| 98 | S-SE-CO | C | J.Lacerda A | Jan-1965 | 232,0 | 0,18 | 26,0 | 98,0% | 1,869 |
| 99 | S-SE-CO | H | Bariri (Alvaro de Souza Lima) | Jan-1965 | 143,1 | 1,00 | 0,0 | 0,0% | 0,000 |
| 100 | S-SE-CO | H | Funil (RJ) | Jan-1965 | 216,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 101 | S-SE-CO | C | Figueira | Jan-1963 | 20,0 | 0,30 | 26,0 | 98,0% | 1,121 |
| 102 | S-SE-CO | H | Furnas | Jan-1963 | 1.216,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 103 | S-SE-CO | H | Barra Bonita | Jan-1963 | 140,8 | 1,00 | 0,0 | 0,0% | 0,000 |
| 104 | S-SE-CO | C | Charqueadas | Jan-1962 | 72,0 | 0,23 | 26,0 | 98,0% | 1,462 |
| 105 | S-SE-CO | H | Jurumirim (Armando A. Laydner) | Jan-1962 | 97,7 | 1,00 | 0,0 | 0,0% | 0,000 |
| 106 | S-SE-CO | H | Jacui | Jan-1962 | 180,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 107 | S-SE-CO | H | Pereira Passos | Jan-1962 | 99,1 | 1,00 | 0,0 | 0,0% | 0,000 |
| 108 | S-SE-CO | H | Tres Marias | Jan-1962 | 396,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 109 | S-SE-CO | H | Euclides da Cunha | Jan-1960 | 108,8 | 1,00 | 0,0 | 0,0% | 0,000 |
| 110 | S-SE-CO | H | Camargos | Jan-1960 | 46,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 111 | S-SE-CO | H | Santa Branca | Jan-1960 | 56,1 | 1,00 | 0,0 | 0,0% | 0,000 |
| 112 | S-SE-CO | H | Cachoeira Dourada | Jan-1959 | 658,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 113 | S-SE-CO | H | Salto Grande (Lucas N. Garcez) | Jan-1958 | 70,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 114 | S-SE-CO | H | Salto Grande (MG) | Jan-1956 | 102,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 115 | S-SE-CO | H | Mascarenhas de Moraes (Peixoto) | Jan-1956 | 478,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 116 | S-SE-CO | H | Itutinga | Jan-1955 | 52,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 117 | S-SE-CO | C | S. Jerônimo | Jan-1954 | 20,0 | 0,26 | 26,0 | 98,0% | 1,294 |
| 118 | S-SE-CO | O | Carioba | Jan-1954 | 36,2 | 0,30 | 20,7 | 99,0% | 0,902 |
| 119 | S-SE-CO | O | Piratininga | Jan-1954 | 472,0 | 0,30 | 20,7 | 99,0% | 0,902 |
| 120 | S-SE-CO | H | Canastra | Jan-1953 | 42,5 | 1,00 | 0,0 | 0,0% | 0,000 |
| 121 | S-SE-CO | H | Nilo Peçanha | Jan-1953 | 378,4 | 1,00 | 0,0 | 0,0% | 0,000 |
| 122 | S-SE-CO | H | Fontes Nova | Jan-1940 | 130,3 | 1,00 | 0,0 | 0,0% | 0,000 |
| 123 | S-SE-CO | H | Henry Borden Sub. | Jan-1926 | 420,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 124 | S-SE-CO | H | Henry Borden Ext. | Jan-1926 | 469,0 | 1,00 | 0,0 | 0,0% | 0,000 |
| 125 | S-SE-CO | H | I. Pombos | Jan-1924 | 189,7 | 1,00 | 0,0 | 0,0% | 0,000 |
| 126 | S-SE-CO | H | Jaguari | Jan-1917 | 11,8 | 1,00 | 0,0 | 0,0% | 0,000 |
| | | | | Total (MW) = | 66.007,1 | | | | |

* Subsystem: S - south, SE-CO - Southeast-Midwest

** Fuel source (C, bituminous coal; D, diesel oil; G, natural gas; H, hydro; N, nuclear; O, residual fuel oil).

[1] Agência Nacional de Energia Elétrica. *Banco de Informações da Geração* (http://www.aneel.gov.br/, data collected in november 2004).

[2] Bosi, M., A. Laurence, P. Maldonado, R. Schaeffer, A.F. Simoes, H. Winkler and J.M. Lukamba. *Road testing baselines for GHG mitigation projects in the electric power sector.* OECD/IEA information paper, October 2002.

[3] Intergovernamental Panel on Climate Change. *Revised 1996 Guidelines for National Greenhouse Gas Inventories.*

[4] Operador Nacional do Sistema Elétrico. Centro Nacional de Operação do Sistema. *Acompanhamento Diário da Operação do SIN* (daily reports from Jan. 1, 2001 to Dec. 31, 2003).

[5] Agência Nacional de Energia Elétrica. Superintendência de Fiscalização dos Serviços de Geração. *Resumo Geral dos Novos Empreendimentos de Geração* (http://www.aneel.gov.br/, data collected in november 2004).

| Emission factors for the Brazilian South-Southeast-Midwest interconnected grid | | | | |
|---|---|---|---|---|
| **Baseline (including imports)** | **$EF_{OM}$ [tCO2/MWh]** | **Load [MWh]** | **LCMR [GWh]** | **Imports [MWh]** |
| **2002** | 0,8548 | 275.402.896 | 258.720 | 1.607.395 |
| **2003** | 0,9421 | 288.493.929 | 274.649 | 459.586 |
| **2004** | 0,8763 | 297.879.874 | 284.748 | 1.468.275 |
| | **Total (2002-2004) =** | **861.776.699** | **818.118** | **3.535.256** |
| | **$EF_{OM,\ simple\text{-}adjusted}$ [tCO2/MWh]** | **$EF_{BM,2004}$** | **Lambda** | |
| | 0,4332 | 0,0962 | $\lambda_{2002}$ | |
| | **Alternative weights** | **Default weights** | 0,5053 | |
| | $w_{OM}$ = 0,75 | $w_{OM}$ = 0,5 | $\lambda_{2003}$ | |
| | $w_{BM}$ = 0,25 | $w_{BM}$ = 0,5 | 0,5312 | |
| | **Alternative $EF_{CM}$ [tCO2/MWh]** | **Default $EF_{OM}$ [tCO2/MWh]** | $\lambda_{2004}$ | |
| | 0,3490 | **0,2647** | 0,5041 | |

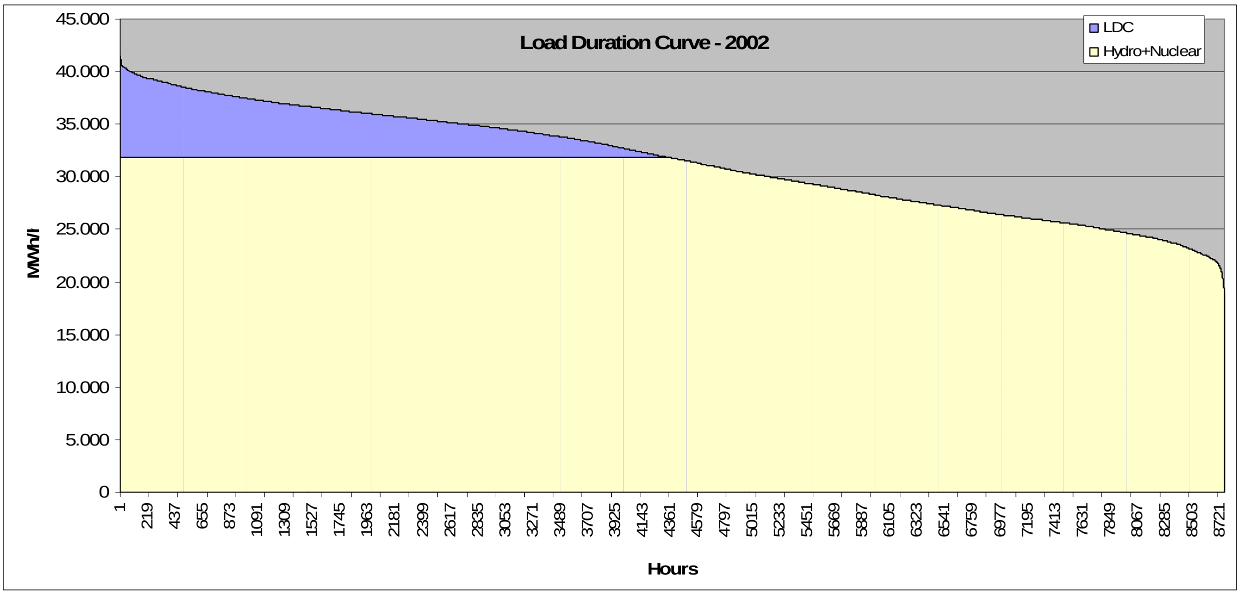


**Figure 13. Load duration curve for the S-SE-MW system, 2002**

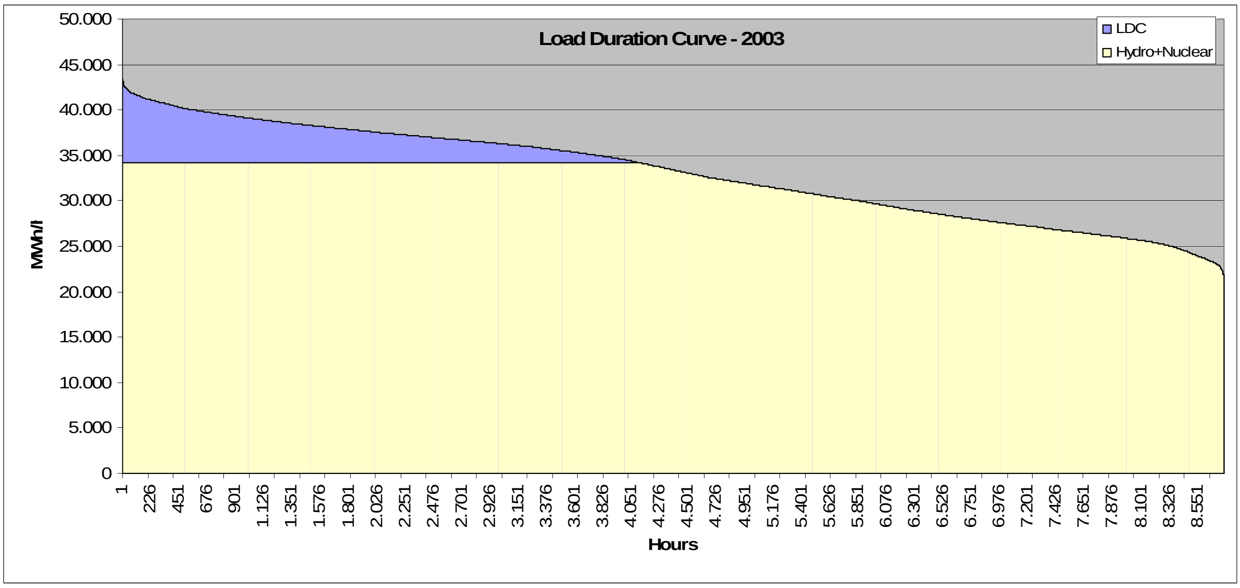


**Figure 14. Load duration curve for the S-SE-MW system, 2003**

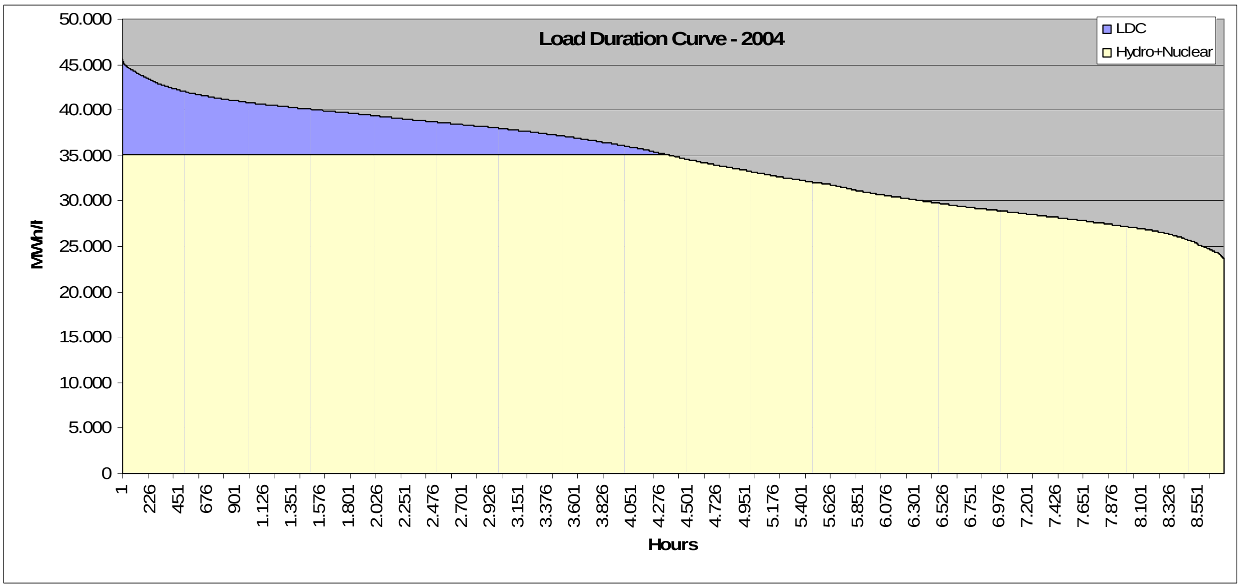


**Figure 15. Load duration curve for the S-SE-MW system, 2004**

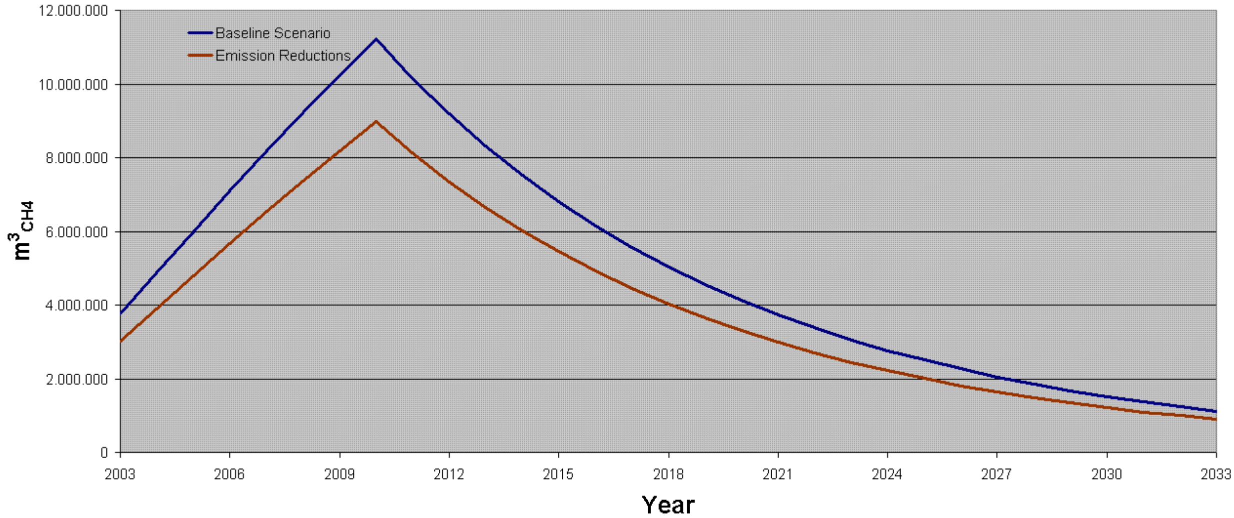


**Figure 16. Baseline Emission and Emission Reductions from Quitaúna Landfill**

## Annex 4

## MONITORING PLAN

### 1. Project Activity Emission Reductions

As stated in section D of this document, the following variables need to be measured in order to determine and account for emission reductions thanks to the QLGP.

- The amount of landfill gas captured;
- The amount of landfill gas being sent to flares;
- The amount of methane in the landfill gas;
- The flares' efficiency.
- The pressure of the gas;
- The temperature of the gas; and
- The electric consumption of the blower, in MWh.

Except from the flare efficiency, all other data need to be monitored continuously, through proper meters or analyzers. The flare efficiency will be measured continuously (by the operating hours of the flare and by the average temperature of the combustion chamber) and quarterly or monthly (if instable) through the percentage of methane in the fluegas.

Case more than one flare will be installed, the following parameters will need to be monitored for each flare:
- The amount of landfill gas being sent to each flares;
- The efficiency of each flares.

Considering that the QLGP's facilities will have computer-based equipment and generate continuous data, such equipment will be used for generating data relevant for the annual emission reduction verification report. The summary table for such report will be filled in, with the metered data provided as background.

**Table 4. Summary worksheet for QLGP**

| Date | LFG Collected (m3) | LFG to flare #1 (m3) | Methane on LFG (%) | Hours of flare operation | Average temperature of the combustion chamber ($^oC$) | LFG Pressure (mbar) | Blower's Electricity Consumptio (MWh) |
|---|---|---|---|---|---|---|---|
| 1/1/2007 | | | | | | | |
| 2/1/2007 | | | | | | | |
| 3/1/2007 | | | | | | | |
| 4/1/2007 | | | | | | | |
| 5/1/2007 | | | | | | | |
| 6/1/2007 | | | | | | | |
| 7/1/2007 | | | | | | | |
| 8/1/2007 | | | | | | | |
| 9/1/2007 | | | | | | | |

Landfill gas into flares and methane content in the landfill gas are metered through a flow meter and a gas analyzer installed at the facility and monitored electronically through a programmable logic control system. After that, once the flow, as well as flares' efficiencies, become inputs for the sheet, the amount flared is calculated. The sum of both quantities is the total methane destroyed. Discounting such number by 20% (Effectiveness Adjustment Factor), the emission reductions from the project are determined.

There will be similar sheets for the crediting periods. They will be presented to the verifier as the collected and stored data for verification purposes. The workbook will also keep electronic information on the flares' efficiencies, as tests are carried out accordingly. Table 3 shows how the flares' data are to be archived.

**Table 5. Flare efficiency data**

Flares' Efficiency Tests

| Flare # | Test Date | Methane Content in Exhaust Gas | Test Carried Out by | Approved by |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

As mentioned on Table D.2.2.1, the Emission Factor will be determined using the *ex-ante* approach. In the renewal of the baseline, EF will be recalculated using the most appropriate methodology.

The calculation of emission reductions will be made using the following formulae:

| | | |
|---|---|---|
| A | The lowest value between "Total LFG collected" and the baseline estimative for the year in question. | $m^3$ |
| B | Methane content on LFG | $\%_{methane}$ |
| C | Pressure of the LFG | bar |
| D | Temperature of the LFG | K |
| $E = B \times \frac{C \times A}{D} \times \frac{273}{1.013} \times 0.0007168$ | Methane collected | $t_{methane}$ |
| F | Flare Efficiency | % |
| G = E . F | Total methane destroyed | $t_{methane}$ |
| H | $CH_4$ Global Warming Potential | $tCO_2/tCH_4$ |
| I = H . 21 | Total $CO_2e$ destroyed | $tCO_2e$ |
| J = J . 0.2 | Total $CO_2e$ destroyed in the baseline | $tCO_2e$ |
| K = J – I | $CO_2e$ destroyed by the TALGP | $tCO_2e$ |
| L | Total electricity imported | MWh |
| M | Emission factor of the grid which the TALGP is connected | $tCO_2e/MWh$ |
| N = L . M | Emissions due to the import of electricity | $tCO_2e$ |
| O = J – N | Emissions reductions due to the TALGP | $tCO_2e$ |

The $CH_4$ Global Warming Potential (variable **H**) will be monitored according with the most recent version of IPCC's Guideliness.

## 2. Monitoring of Environmental Impacts

All environmental impacts will be monitored as requested by the last issued Operational Licence's. By the time of the validation, the last Operational Licence requested:

- develop a monitoring program aiming the protection of all surface and underground water, as stated by the NBR 13.986 – *Aterros de Resíduos Não Perigosos;*

- develop, quarterly, the environmental monitoring of the landfill, aiming the water analysis and the geotechnical monitoring of the disposed waste, through superficial marks. Present a report containing the analysis made to the monitoring parameters, including studies interpretation of the results and the amount of waste received in the previous year with the pluviometry data and leachate generation. The volume of leachate transported to SABESP's Waste-Water Treatment Facility and the truck identification might be recorded;
- avoid the emission of odor substances outside the landfill limits;
- maintain the constant waste compact and cover operations and keep a land storage to cover the waste disposed for two days of operation;
- present, twice a year, the "Fauna Monitoring Plan" including the results of mitigate actions to avoid the presence of birds.

**3. Monitoring of Social Impacts and Capacity Building**

The social impacts will be monitored through the number of new employers hired with the project activity. All these new employers will face a new technology to operate and must receive the proper training from the engineering company that will install the collection and burning system. The will learn how to operate and how to monitor the main variables of the project.

As Quitaúna has the intention to expand the project to a new area, more employers will be hired in order to install and operate all equipment in this new area.