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:

ESTRE's Paulínia Landfill Gas Project (EPLGP).
Version 2 B
Date of the document: December 04th, 2005.

"The only changes made to this version of the PDD compared to the PDD dated 15/09/2005 referred to in the letter of approval of the DNA of Brazil are related to the recalculation of the build margin emission factor with the plant efficiencies recommended by the CDM Executive Board at its 22nd meeting and the necessary change of the starting date of the crediting period from 1 January 2006 to 1 May 2006.

A.2. Description of the project activity:

EPLGP is a landfill gas collection and flare project in Brazil. The project's core idea is to avoid methane emissions from the landfill managed by ESTRE in Paulínia municipality. This goal will be achieved through installing an active gas recovery with a flaring system in the landfill.

ESTRE's landfill in Paulínia counts on the best management practices for such business. Besides counting on a sorting system for recyclables, where the "dry matter" – recyclable – is sorted by the members of a cooperative, modern engineering has been applied during design, leachate is collected and sent for treatment, and all the pertinent environmental variables are continuously monitored.

The landfill gas is collected only through a passive system, with no systematic and monitored flare. Therefore, an extra-incentive is needed for ESTRE to make additional investments and enhance its landfill gas collection rate and install appropriate facilities to properly flare the methane produced at the site.

Landfill gas generation will be guaranteed throughout EPLGP's lifetime from various strategic aspects CGR Paulínia enjoys:

- CGR Paulínia is located in the metropolitan region of Campinas, which is formed by 18 municipalities, which, in most cases, do not have feasible areas where landfills could be developed. In fact, most of such municipalities are either facing problems regarding their rubbish dumps/landfills capacity or environmental demands by the environmental agency in state of São Paulo (CETESB), requiring the dumps' areas to be recovered and obliging the authorities to find proper destination to the waste generated.
- ESTRE has now 10 municipalities in the region under contract to dispose waste in CGR Paulínia. Considering these clients, as well as the private ones, CGR Paulínia receives around 2.500 tonnes of waste daily. Initially designed to receive 6.5 million tonnes, CGR Paulínia is now under expansion, with neighbour areas already under ESTRE's ownership. With this, CGR Paulínia will likely be twice as big in the near future.
- CGR Paulínia is strategically located in the metropolitan region of Campinas. Its location favours the landfill as the adequate destination for the municipalities and private clients nearby, as transportation costs are low and therefore make it more feasible to have ESTRE disposing the waste than opening and managing their own landfills. Studies conducted by ESTRE show that landfill development and operation is only feasible for waste disposition rates of at least 500 tonnes of waste per day. And moreover, there are no potential feasible areas for landfill

development in the region, as it is highly urbanized and fragile environmental systems are protected by legislation.

EPLGP has a major positive impact towards sustainable development. Firstly, while it is reducing methane emissions that would enhance climate change, it is also minimizing the risk that any explosions happen in the site – even though ESTRE's landfills count on the best engineering and design to avoid accidents. Second, this sort of initiative is still new in Brazil, which means technology transfer will need to be in place for project's implementation and operation. Third, specialized operators will be needed for project operation, which means a positive impact in employment and capacity-building. For all of these facts, it can be clearly seen the project contributes towards 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)	• Private entity ESTRE.	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.		

EPLGP project participant is a Brazilian private entity (ESTRE), being Brazil the only one Party to the Kyoto Protocol involved.

ESTRE (Empresa de Saneamento e Tratamento de Resíduos) is a 100% Brazilian company, founded in 1999. With its core business in the sanitation and waste treatment and final destination, ESTRE brought to Brazil various success experiences.

The company provides adequate solutions for final destination of waste class I, II and III[1], generated by municipalities, commerce and industrial companies.

ESTRE is present in the main metropolitan centers of state of São Paulo (São Paulo metropolitan region, Campinas metropolitan region, and Santos region). With the goal of adequately dispose industrial and municipal waste produced in such regions, ESTRE has already implemented five landfills.

[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, corrosivity, reactive properties, toxicity and pathogenicity. Class II residues are reactive, neither classified as class I nor class III, and may present the following characteristics: combustibility, biodegradability or water solubility. Class III residues are non-reactive, not presenting any soluble constituent in standard higher than potable water.

Mission

ESTRE's mission is to develop technologies and services in the environmental area, acting in sanitation processes, mainly in solid waste management, treatment and final disposition. The company seeks to provide, with an effective manner, adequate solutions for the destination of waste generated by municipalities, industrial and commercial companies. ESTRE ascertains to its clients safety, quality and guarantee in all steps of the process.

Social Compromise

Taking into account the compromise with people's life quality, ESTRE maintains in its centers for waste integrated management – *Centros de Gerenciamento Integrado de Resíduos (CGR)* – social projects and offers to interested people the possibility to get to know the initiatives developed in its landfills. Regularly, the company receives, for example, students from fundamental and medium level schools, from colleges and post-graduate courses. ESTRE is also developing projects to soon implement environmental education centers in its enterprises.

Besides that, the company already has projects together with some municipalities in state of São Paulo. In Paulínia, for example, it is active in the "zero waste" – *Lixo Zero* – campaign, whose goal is people's awareness of waste's right disposition, which is done through incentives to recycling of what is generated at local homes. CDR Pedreira, in turn, supports an educational project in *Parque Estadual da Cantareira*, a state park. The work is still in implementation process, but ESTRE already follows and checks the park limits and the pond which are in its area. Support materials will still be developed, dealing with the specific theme of waste, i.e., it is designed towards awareness of people in general.

In ESTRE's recycling projects, dozens of families are benefited. They form cooperatives that work in the recyclables sorting units in ESTRE's landfills. The company offers subsidies and the cooperative turns the sorted material in income for each of the ones working in the initiatives.

Because of ESTRE's enterprises' quality, a number of so-called "lixões", open dumps where the waste is usually disposed in Brazil, were closed, and the waste generated in the municipalities sent to ESTRE. See figure 1, which shows the situation of one of these *lixões*.

By that, ESTRE's presence provided a great benefit for people's quality of life, besides contributing to the development of the regions nearby the landfills. This result can also be quantified by the great number of industrial companies that send their waste to ESTRE.

Figure 1. Area of a *lixão* that was closed due to existence of CGR Paulínia.

Future

ESTRE seeks to always offer the best alternatives for final waste destination to its clients and, because of that, besides assessing the implementation of new enterprises and technologies, has studied new areas and evaluated the implementation of new transfers (”transbordos”) in strategic places – with the goal of diminishing logistic cost to its clients.

SERVICES

Sanitary Landfills

ESTRE’s landfills have safe and modern systems for treatment and final disposition of solid waste. Through environmental protection techniques, adequate alternatives are used, which contribute to nature’s preservation and for the region’s sustainable development.

Before the trucks enter in ESTRE’s enterprises, a waste admission control is carried out, assessing all waste’s documentation.

Soil impermeabilization is done through compacted clay layers and with high density polyethylene geomembrane (PEAD – *polietileno de alta densidade*) guaranteeing waste total isolation, preserving soil and water.

Percolates drainage, which guarantees generated effluents total control, is carried out through a PEAD pipeline and by small stones (“brita”) covered with a geotextile material. Liquid flows through the pipeline until the storage tank and is taken for treatment. Collected gases are also drained through PEAD pipes, according with the best practices for passive venting.

Rain water drainage is carried out through small canals, concrete pipes and sedimentation boxes.

There is also a green belt around each ESTRE landfill, and the company encloses and guarantees security in the area.

A constant monitoring is also carried out for the incoming waste, liquid and gaseous effluents, surface and underground water, and for the region's fauna and flora.

With the goal of consolidating an integrated management system for solid waste, ESTRE has implemented, besides the landfills, units for recycling and hydrocarbon contaminated soils treatment.

Bioremediation Unit

Bioremediation is a biological process, carried out in a controlled environment, which uses microorganisms existent in nature to treat soils contaminated by substances such as hydrocarbons.

It can be used to transform class I soils in class II, which may be disposed in landfills, or in class III, turning it into reusable soil.

ESTRE counts on a professional, highly skilled team, compromised with following-up all the process' phases.

Such services count on ESTRE's quality, in a partnership with Sapotec, subsidiary of German group Umweltschutz Nord, one of the world's leaders in contaminated areas remediation.

The complete solution

1. Sample collection and laboratory analysis
Soil samples are collected by a trained team. Afterwards, they are analyzed in specialized laboratories, which check soil classification and its contaminants.

2. Environmental Agency authorization
Necessary documentation and the analysis' result are taken to the various environmental authorities to be approved.

3. Process Follow-up
ESTRE offers support along the environmental authorities with the goal of facilitating and speeding-up the process.

4. Excavation and Transport
Through partnerships, ESTRE provides trained teams for soil excavation and collection. The company also takes the responsibility to transport residues until the treatment facility, even for those clients that have already collected the material.

5. Treatment
Soil is treated in a bioremediation process. After such treatment, a statement is issued, attesting the soil can be disposed in the landfill.

6. Final Disposition
CGR Paulínia is licensed and prepared to receive such soil.

Recycling

The great majority of products and services used by mankind nowadays is linked to some natural raw material extracted from non-renewable sources. This natural resource scarcity reinforces society's ecological awareness and adds value to initiatives such as recycling. Thinking about that, ESTRE maintains in its management centers a structure for sorting recyclables, guaranteeing natural resource conservation, when transforming waste in new material.

Operation is carried out by cooperatives that select households in the enterprises' region. Figures 2 and 3 show cooperates in the sorting tray, while figure 4 shows the recycling warehouse in CGR Paulínia.

Figure 2. Cooperative affiliates by the recycling tray

Figure 3. Cooperative affiliates by the recycling tray (2).

Figure 4. Recycling warehouse

LANDFILLS

CGR Paulínia

Started in May 2000 in Campinas metropolitan region, CGR Paulínia was designed to be the most complete structure for treatment and waste final disposition in the region. With an area of 705 thousand m^2 and capacity for 6.5 million tons of waste, the enterprise already counts on hundreds of clients, among public and private organizations, because it supplies the local demand with adequate alternatives towards household and industrial waste treatment. Figure 5 shows some cells at CGR Paulínia.

Figure 5. Cells at CGR Paulínia

The Center is constituted by a landfill, one bioremediation unit and one recyclables sorting unit. It can receive waste classes II and III, besides treating class I waste.

In January 2004, CGR Paulínia was certified under norm ISO 14001. Figure 6 shows the certificate.

DNV

OCA-0003

DET NORSKE VERITAS

CERTIFICADO DE SISTEMA DE GESTÃO AMBIENTAL

Certificado Nº 3086-2004-AE-SPA-INMETRO

A DET NORSKE VERITAS CERTIFICADORA LTDA. certifica que o Sistema de Gestão Ambiental da organização

ESTRE - EMPRESA DE SANEAMENTO E TRATAMENTO DE RESÍDUOS LTDA.

em

Estrada Municipal - PLN - 190 - s/nº
Paulinia, SP - Brasil

está em conformidade com os requisitos da Norma

NBR ISO 14001:1996

para o seguinte escopo de produtos e serviços:

ATERRO SANITÁRIO PARA CODISPOSIÇÃO DE RESÍDUOS SÓLIDOS DOMICILIARES E INDUSTRIAIS CLASSE II E III, UNIDADE DE TRIAGEM DE MATERIAIS RECICLÁVEIS E UNIDADE DE BIORREMEDIAÇÃO DE SOLOS.

Local e data de emissão:
São Paulo, 2004-02-06

Este Certificado é válido até:
2007-01-14

Pelo Organismo Credenciado:
DET NORSKE VERITAS CERTIFICADORA LTDA.
BRASIL

Data da Certificação original:
2004-01-14

INMETRO

A conformidade com a Norma para o escopo indicado foi verificada pelo Auditor Líder
SILVIO HIRATA
registrado pela DNV

Mauricio Venturin
Gerente de Certificação

A não observância das condições estabelecidas no Apêndice pode tornar este Certificado inválido

DET NORSKE VERITAS - Rua Sete de Setembro, 111 - 12º/14º andares - Rio de Janeiro, RJ - Brasil - CEP 20050-006

Figure 6. CGR Paulínia ISO 14001 certificate

CGR Itapevi

One of the most recent ESTRE enterprises, started in October 2003, CGR Itapevi was designed to satisfy the strong demand for sanitation solutions in the metropolitan region of São Paulo, offering modern methods in the treatment and final disposition of solid waste. With an area of 205.546 m^2 and capacity for 3.2 million tones, the Center is apt to receive waste class II and III, from household, commercial and industrial facilities.

CDR Pedreira

CDR Pedreira – *CDR: Centro de Disposição de Resíduos* – waste disposition center, located in the city of São Paulo, was inaugurated in 2001 and intends to maintain an efficient environmental policy and enhance population's life quality. It offers differentiated solutions in the management of waste class II and III, covers an area of 1,022,000 m^2, and has capacity for 21.5 million tones and an adequate system for wastes final disposition.

CDR Pedreira uses modern techniques for environmental protection, which range from drainage and treatment of generated liquid and gases, until surface and underground water monitoring.

Seeking to overcome expectations of its clients and reduce logistic costs, CDR counts also with the exclusive transfer service. The unit is located nearby *Cebolão*, a complex road hub downtown São Paulo. Waste is received and immediately transported by high capacity vehicles to CDR Pedreira for final disposition.

CDR Pedreira is also certified under ISO 14001 since January 2004.

CGR Piaçaguera

Another ESTRE recent enterprise, CGR Piaçaguera started its operations in January 2003 and is located in Santos metropolitan region, in the south coast of São Paulo state. It covers an area of 1,074,563 m^2 and capacity for nearly 3 million tons of waste. The landfill, which is ready to receive waste class II and III since its installation, has contributed to the closing of a number of *lixões*, so-called open dumps, benefiting life quality to the local inhabitants.

CGR Romeiros

Apt to receive waste class III and material contaminated with aluminum, iron and manganese, CGR Romeiros is also a project that started operations recently, in the end of 2003. It covers an area of 428,122 m^2 and can receive around 1.5 million tones of waste.

QUALITY

Monitoring and Research

In order to guarantee that everything always work within standards and quality that comply with the Brazilian legislation and also to ESTRE's procedures, the company maintains a rigorous control of all of its management processes.
Waste disposed in the landfills goes through preliminary tests in laboratories, following safety protocols from the Brazilian association of technical standards (ABNT). Besides that, a monitoring procedure is

constantly carried out for monitoring liquid and gaseous effluents, surface (rivers, lakes, small streams) and underground water, soil, air, fauna and flora quality.

It is through these analyses in specialized laboratories that waste to be disposed in each landfill is classified, following ABNT norms.

Natural Resources

In all ESTRE's waste management centers, techniques for local natural resources preservation are applied. One of them is the maintenance of the regions' native vegetation – there are now thousands of seedlings planted in all of its landfills.

Environmental Legislation

The stringent Brazilian environmental legislation (based on the Environmental Crimes Law), the increase in society's awareness – which demands care with the environment and good environmental faith from companies – represented mainly by Non-governmental organizations, and the National Environmental Policy, make the proper waste destination extremely important, also for companies to avoid possible administrative, legal and penal sanctions.

With the goal of falling within all of those demands, ESTRE's enterprises are licensed by the State Secretary of Environment and by CETESB – *Companhia de Tecnologia e Saneamento Ambiental*, state of São Paulo environmental agency.

Environmental Policy

Continuous seeking for improvements and consolidation of a system that guarantees nature preservation and complies with environmental legislation is ESTRE's environmental policy base. Therefore, the company established the following policy to guide its compromise with environment's protection:

1- **Comply with environmental standards established by Brazilian legislation and regulation**, as well as proceed in the management and treatment of solid waste, complying with the company's environmental management policy.

2- **Seek continuous improvement** in the environmental performance, through monitoring environmental protection facilities installed in its enterprises, according to the most modern practices, contributing to the improvement of the Environmental Management System, achieving ESTRE's goals and objectives.

3- **Keep an Environmental Management System that guarantees pollution prevention** in the productive process, giving special attention to waste management, treatment and final disposition.

4- **Incentive business partners to seek correct environmental practices**, building capacity and raising awareness in employees and third-parties' workers that execute any activity in the company.

ISO 14001

In January 2004, CGR Paulínia and CDR Pedreira were certified with ISO 14001:1996. The certificate was validated by DNV – Det Norske Veritas, being recognized by Inmetro – the Brazilian institute for metrology.

ESTRE believes ISO 14001 highlights its credibility in the environmental area. Certification seeking, also, was an incentive for the development of the company's professionals and for the consolidation of a system that would guarantee environmental preservation and comply with the standards established in the legislation.

For society, this is another proof of ESTRE's compromise with nature and people's life quality.

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

ESTRE's Paulínia Landfill is located in the municipality of Paulínia, around 130 km north of São Paulo city.

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:

Paulínia

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

The project activity will take place in *Centro de Gerenciamento de Resíduos (CGR) Paulínia*, ESTRE's landfill in municipality of Paulínia, around 130 km north of São Paulo city, as shown in figure 7.

Note: Paulínia is the region appearing in light blue.
Source: SEBRAE-SP[2]

Figure 7. Paulínia's location

[2] www.sebraesp.sp.gov.br

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

EPLGP is designed as a sectoral scope 13 – waste handling and disposal – project.

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

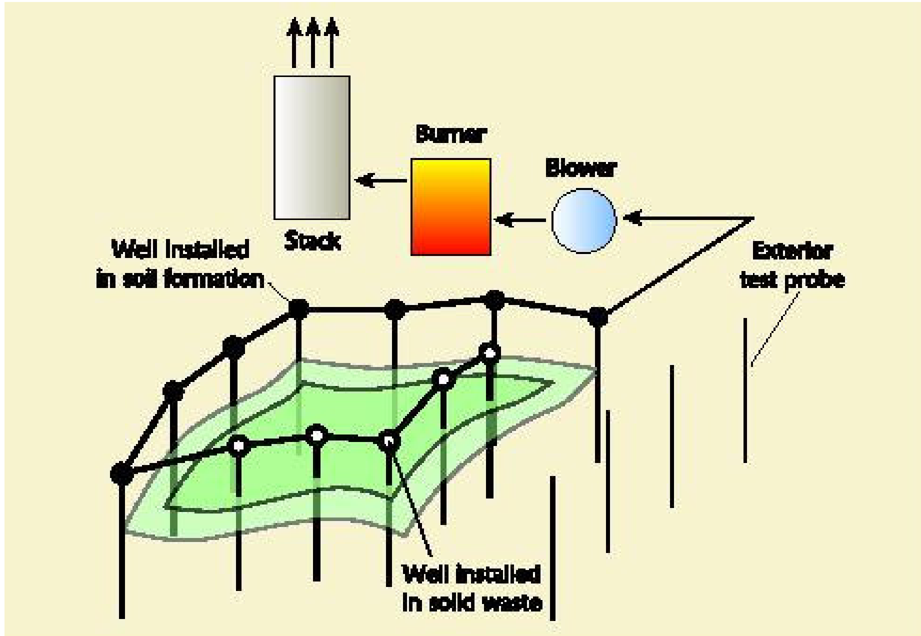
ESTRE uses only state-of-the-art landfill technology in its landfills. State of São Paulo environmental agency – CETESB (Companhia de Tecnologia de Saneamento Ambiental) – classifies the state's landfills according to technology used, management techniques and other criteria in its Landfill Quality Index (*IQR – Índice de Qualidade de Aterros de Resíduos*). ESTRE's Paulínia landfill was qualified with an IQR of 9.8 (range 0 to 10) in CETESB's 2002 assessment of the state's landfills[3].

The technology employed at Paulínia Landfill, as mentioned in page 5, comprises: high-density polyethylene membrane impermeable layer; leachate drainage system using high-density polyethylene pipes; landfill gas passive collection system; rain water drainage system; solid waste admission control; enclosed sites; green belt; revegetation practices; fauna, flora, surface and underground water monitoring; liquid and gas effluents monitoring.

The aim of the project is to enhance the already operational passive vent system, in order to increase the efficiency in collecting the gas and flare it systematically, continuously monitoring the operation. For that purpose, an active recovery system will be installed in the landfill, as well as a flare facility. This comprises connecting well heads through pipes, which are connected to a blower, where the gas is sent to the flare. Figure 8 illustrates the situation.

This kind of technology is still not widely applied in Brazil. Only very few landfills – the landfill situation is in fact not very common – maybe 2 or 3, have already installed equipment for degasifying its area. Therefore, ESTRE will need engineers and other specialists with experience in the field to assess the company implementing the project. These professionals will also perform training to local operators and engineers in order to let them operate and maintain the facilities moving. And even though there is a great potential to be explored degasifying rubbish dumps and landfills in Brazil, there is no national flares suppliers, for instance, meaning technology will have to come from abroad. Considering the locations where landfill gas flaring projects occur – mostly in the United States and Europe – where environmental legislation is extremely harsh, EPLGP will make use only of environmentally sound technology. This is also needed to keep the project along ESTRE's environmental guidelines, including its ISO 14001 procedures.

[3] CETESB – Companhia de Tecnologia de Saneamento Ambiental. *Inventário Estadual de Resíduos Sólidos Domiciliares*, 2002.



Source: O'Leary & Walsh[4].

Figure 8. Schematic situation of a landfill with active gas recovery

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:

Emission reductions will occur from the capture of the landfill gas and its controlled and monitored flaring. The current practice in Paulínia, as explained in A.4.3, is passive venting; with EPLGP's new facilities, it will be possible to efficiently flare the landfill gas. By that, methane that was previously released to the atmosphere will be flared and reduced to CO_2, therefore reducing the global warming effect, since methane is 21 times more powerful to the effect than carbon dioxide.

The emission reductions would not occur because improving landfill installations in order to reach the higher efficiency in collecting and flaring the gas is not the most economically attractive course of action, since ESTRE would not generate any additional revenues due to it.

Emission reductions from the first crediting period are expected to be 1.487.907 tCO_2e.

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

YEARS	ANNUAL ESTIMATION OF EMISSION REDUCTIONS IN TONNES OF CO_2E
2006	169.747

[4] O'Leary, P. & Walsh, P. *Landfill Gas Movement, Control and Energy Recovery*. Available at http://images.wasteage.com/files/121/landfill3.pdf. Visited on the 13th of December 2004.

2007	194.131
2008	215.757
2009	234.937
2010	251.949
2011	223.368
2012	198.019
TOTAL ESTIMATED REDUCTIONS (TONNES OF CO_2E)	1.487.908
TOTAL NUMBER OF CREDITING YEARS	7
ANNUAL AVERAGE OVER THE CREDITING PERIOD OF ESTIMATED REDUCTIONS (TONNES OF CO_2E)	212.558

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 EPLGP is AM0003, version 2, called "simplified financial analysis for landfill gas capture projects".

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

The chosen methodology is drawn upon option (b) of paragraph 48 of the CDM M&P. Considering significant investments will be made at the site in order to improve landfill gas collection and flare and by that reduce the global warming effect, an economic analysis on whether such investments would be made in the baseline scenario is necessary. The chosen methodology proposes a financial analysis to identify the baseline situation, and is therefore applicable to EPLGP.

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

The chosen methodology states the 4 steps necessary to be fulfilled for its applicability. The points below are remarks on each of these steps.

Step 1.

Considering there is no legislation in Brazil obliging landfills to flare the collected gas, ESTRE would not make the necessary investments to increase collection and flare the gas systematically under continuously monitoring, since the company investors would have no benefit from such investment. Therefore, there are only two plausible scenarios, which are the business-as-usual and the project ones.

Step 2.

The baseline methodology requests in its step 2 that an IRR for the project activity, excluding expected revenue from the sale of CERs, is conservatively calculated. For EPLGP, the IRR is zero, since no sort of income is expected from installing the infra-structure for actively collecting the gas and flaring it. The project will go ahead if, and only if, there are CERs revenues in place.

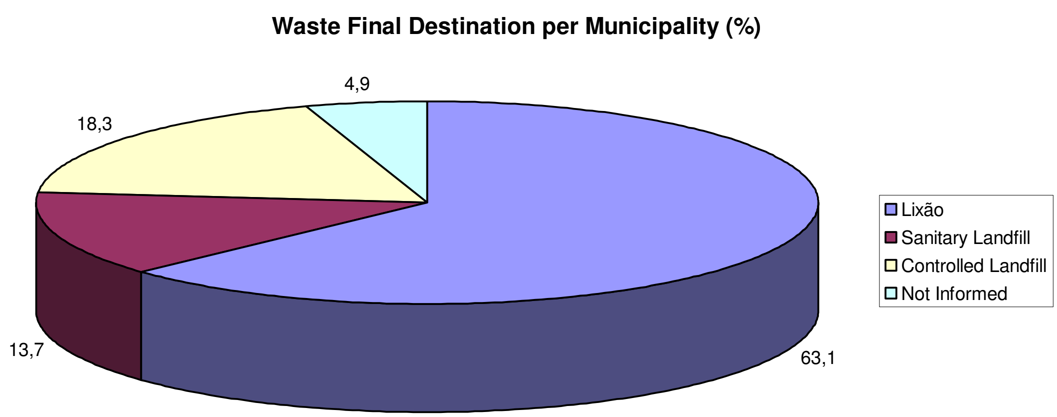
Step 3.

Considering the initiative does not bring revenues to the project owners, it is not attractive from the investors' standpoint. The project, therefore, is not economically attractive and the BAU is the most likely baseline scenario. By that, it is clear that the project is additional.

Step 4.

In terms of LFG flaring, it may be the case that future legislation requires landfills to quantify and flare a certain amount of the gas produced. However, such situation is not likely to happen in the near term, considering the waste disposition situation in Brazil, explained in more detail below.

It is important to note that a considerable effort will have to take place regarding the waste disposal practices in Brazil before any legislation on gas flaring is enforced. According to the latest official statistics on urban solid waste in Brazil – *Pesquisa Nacional de Saneamento Básico 2000* (PNSB 2000) – 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 towards uncontrolled areas – *lixões* – which are, in most of the cases, open dumps without any sort of proper infrastructure to avoid environmental hazards. Figure 9 shows the final destination of the waste per municipality, according to PNSB 2000.



Source: PNSB, 2000[5].

Figure 9. Waste Final Destination per Municipality in Brazil

Data used for determining the baseline scenario are displayed in table 1.

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

Table 1. Baseline determination information

Variable	Value	Justification	Source
CH_4 generation potential - L_0 (tCH_4/t of refuse)	0,057	Calculated	ESTRE's data.
CH_4 generation rate constant - k (1/yr)	0,12	Assuming an average of 6 years for the waste to decompose	
Year the site opened	2.000		ESTRE's data.
Year the site closes	2.010		ESTRE's data.
Average yearly waste disposition rate	597.361		ESTRE's data.

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:

The baseline scenario comprises the business-as-usual management practices at Paulínia's site. This means the LFG produced at the site is collected passively, and there is no systematic flaring of the gas and therefore no energy generation. For EPLGP, the default value of the Effectiveness Adjustment Factor (20%) is the one used. This value is considered to be in line with the best practices for passive collection and sporadic flare of landfill gas.

With the project, active recovery will be installed, and improvements will be made in order to enhance gas collection and continuously flare the gas, under monitoring procedures. Besides allowing gas flaring, which diminishes methane emissions therefore avoiding global warming, this configuration will make feasible the possibility of energy generation at the site, to be studied in the future.

Therefore, considering the values above, emission reductions will occur from flaring the gas with a high performance operation; in other words, the methane flared minus 20% (EAF).

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

The project activity will take place in *Centro de Gerenciamento de Resíduos (CGR) Paulínia*, ESTRE's landfill in municipality of Paulínia. In that site, ESTRE receives waste from various municipalities and company's located nearby.

The boundary is, in this case, the project activity site, where the landfill operations and LFG emissions take place and where gas flaring will take place. Figure 10 provides a picture of the boundary:

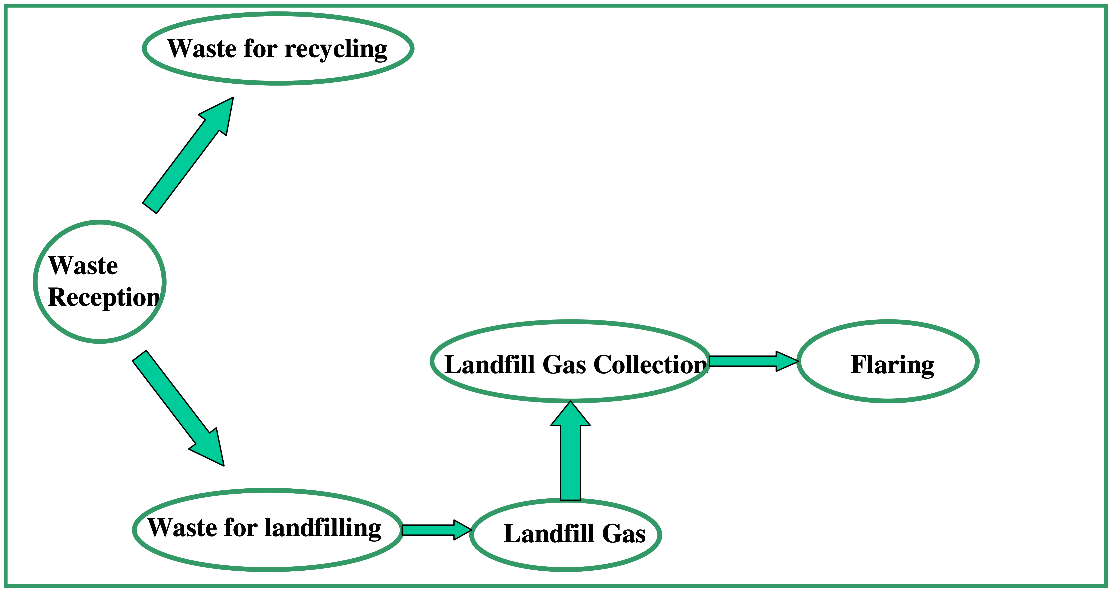


Figure 10. EPLGP Boundary

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 04/12/2005, by Econergy, which is not a project participant in the initiative. Contact information:

Marcelo Schunn Diniz Junqueira
junqueira@econergy.com.br
Tel: +55 (11) 3219 0068 ext 25
Fax: +55 (11) 3219 0693
www.econergy.com.br

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:

01/05/2006

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:

01/05/2006

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:

>>

C.2.2.2. Length:

>>

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 EPLGP is AM0003, version 2, called "Simplified Financial Analysis for Landfill Gas Capture Projects".

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

The chosen methodology is applicable to project activities that reduce greenhouse gas emissions through landfill gas capture and destruction of the methane by flaring and/or generation of electricity. In the case of EPLGP, such destruction will occur through flaring only. Moreover, the baseline methodology for the project is also AM0003, in accordance with the monitoring methodology. Therefore, AM0003 is fully applicable to EPLGP.

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

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

>>

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

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

>>

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	Amount of landfill gas to flares	Volume	m^3	m	Continuous	100%	Electronic	Measured by a flow meter. Data will be aggregated monthly and yearly.
2	Flare efficiency	Efficiency	%	m	Semi-annual, monthly if unstable	n/a	Electronic	Methane content of flare exhaust gas.
3	Methane fraction in the landfill gas	Composition	%	m	Continuous	100%	Electronic	Measured by continuous gas quality analyzer.
11	Regulatory requirements relating to landfill gas projects	n/a	Test	n/a	Annually	100%	Electronic	Required for any changes to the adjustment factor (AF) or directly $MD_{reg,y}$

The LFG temperature and pressure, flare temperature and flare working hours do not need to be monitored in this case because no complementary method is used here, just the direct measure of the above mentioned gas properties (to be measured by a continuous quality analyzer and flow meter, in accordance with AM0003).

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

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
4	Total amount electricity used for gas pumping	Electricity	kWh	m	Continuous	100%	Electronic	
5	Greenhouse gas emissions per kWh of electricity used	Emission factor	tCO_2e/kWh	c	Once for each crediting period	100%	Electronic	CO_2 emission intensity of the electricity being purchased from the grid will be determined through an approved baseline methodology, which is ACM0002. This data will be updated at the baseline renewal, in accordance with the considered methodology. Please refer to annex 3 – baseline determination, for how the emission factor will be determined. Data will be kept for two years after the end of the crediting period.

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

Considering leakage is the emissions occurring due to energy generation for on-site machinery feeding, the formula used is:

$Leakage = E * EF$, where E is the energy consumed by the gas extraction and flaring facility and EF is the emission factor associated with this energy generation.

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.)

$Emission\_reductions = Project\_emissions - baseline\_emissions - leakage$

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	*Low*	Flow meters will be subject to a regular maintenance and testing regime to ensure accuracy.
2	*Low*	Regular maintenance will ensure optimal operation of flares. Flare efficiency will be checked semi-annually, with monthly checks if the efficiency shows significant deviations from previous values.
3	*Low*	The gas analyzer will be subject to a regular maintenance and testing regime to ensure accuracy.
4	*Low*	A calibrated electricity meter will be installed with the blower apparatus in order to measure its electricity consumption. This meter will be subject to annual calibration to ensure accuracy.

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.

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

Econergy is the entity determining the monitoring methodology. Econergy is not a project participant in this project. Contact information:

Marcelo Schunn Diniz Junqueira
junqueira@econergy.com.br
Tel: +55 (11) 3219 0068 ext 25
Fax: +55 (11) 3219 0693

www.econergy.com.br

SECTION E. Estimation of GHG emissions by sources

E.1. Estimate of GHG emissions by sources:

EPLGP generates no emissions. Landfill gas methane emissions will be destroyed in the flares.

E.2. Estimated leakage:

In the case of EPLGP, leakages will be determined through the consumption of electricity (kWh) by the necessary apparatus to blow the gas from the landfill and the emission factor (tCO_2e) from this energy. Therefore:

$$L = E * Fe$$

Where:

L = Leakage (tCO_2e)
E = Electricity used by blower (kWh)
Fe = Emission factor (tCO_2/kWh)

The emission factor calculated according to ACM0002 is 0,2677 tCO_2e/MWh. The flaring facility is estimated to need around 3,000 MWh/year. That gives a leakage of 803 tCO_2e/year.

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

$$E.1 + E.2 = 0 + L = E * Fe$$

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 EPLGP, the first order decay approach was used:

$$Q = L_0 R(e^{-kc} - e^{-kt}) \quad \textbf{(1)}$$

Where:

Q = methane generated in current year (t/yr)
L_0 = methane generation potential (t/t of refuse)
R = average annual waste acceptance rate during active life (t/yr)
k = methane generation rate constant (1/yr)
c = time since solid waste disposal site (SWDS) closure (yr)
t = time since SWDS opened (yr)

However, considering waste disposal varies among years, IPCC recommends a slightly changed way to perform such estimations, in order to take into account such variances:

$$Q_{T,x} = kR_x L_0 e^{-k(T-x)} \quad \textbf{(2)}$$

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

Where:

$Q_{T,x}$ = the amount of methane generated in current year (T) by the waste R_x
X = the year of waste input
R_x = the amount of waste disposed in year x (t)
T = current year

With that in mind, one has to perform a sum in order to account for all the methane to be generated by each ton of waste, according to the deposition year. This fact can be expressed, according to the last equation presented, as:

$$Q_T = \sum Q_{T,x} \quad \textbf{(3)}$$

Where Q_T is the total amount of methane to be generated in the landfill during a certain timeframe.
To summarize, relevant factors for methane estimation are:

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

However, as considered in AM0003, an Effectiveness Adjustment Factor has to be used, as some methane is destroyed due to odour and safety reasons in the landfill. This is estimated to be 20% of the baseline emissions. Therefore, baseline emissions are:

$$Q_T = 0.8 * \sum Q_{T,x}$$

Baseline emissions are 4.3 million tCO_2e over the project's crediting period.

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

For EPLGP's estimates, however, a collection efficiency of 80% was considered. Emission reductions are therefore 80% of the baseline emissions minus project emissions minus leakage:

$$0.64 * \sum Q_{T,x} - E * Fe$$

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 EPLGP.

Project emission reductions are estimated to be 2.7 million tCO_2e over its 21 year crediting period.

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

Year	Estimation of project activity emission reductions (tonnes of CO_2e)	Estimation of the baseline emission reductions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of emission reductions (tonnes of CO_2e)
2006	169.747	0	0	169.747
2007	194.131	0	0	194.131
2008	215.757	0	0	215.757
2009	234.937	0	0	234.937
2010	251.949	0	0	251.949
2011	223.368	0	0	223.368
2012	198.019	0	0	198.019
Total (tonnes of CO_2e)	1.487.908	0	0	1.487.908

Emission reductions from the first crediting period are expected to be, therefore, 1,487.908 tCO_2e. 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 State Secretary of Environment (*SMA – Secretaria de Estado do Meio Ambiente*) through DAIA – Environmental Impact Assessment Department (*Departamento de Avaliação de Impacto Ambiental*) and CETESB – state of São Paulo environmental agency (*Companhia de Tecnologia de Saneamento Ambiental*). ESTRE has all the pertinent licenses for CGR Paulínia, and will carry out the necessary process in order to obtain the working license for the flaring facility. CGR Paulínia's working license is shown in figures 11 and 12.

There will be no transboundary impacts resulting from EPLGP. All the relevant impacts occur within Brazilian borders and will be mitigated to comply with the environmental requirements for 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:

There are no significant environmental impacts in EPLGP. The necessary infra-structure to flare the gas and produce energy will not likely cause any significant impacts in the site.

The *Centro de Gerenciamento de Resíduos Paulínia* has been considered one of the best managed sites in Brazil. CETESB, state of São Paulo's environmental agency, has graded CGR Paulínia with a 9.8, in a range from 0 to 10, showing ESTRE is totally committed to environmental integrity in its practices. CGR Paulínia is, as already mentioned, certified under ISO 14001 procedures, and the whole flaring facility will be incorporated in the norms procedures once in installation/operation.

Flaring gas, nevertheless, may cause gaseous emissions, such as volatile organic compounds and dioxins that have to be controlled. During the environmental licensing procedures, all the necessary measures will be taken to mitigate such impacts, as requested for issuance of the working licence by the environmental agency.

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

02 | Processo Nº 37/00007/02

LICENÇA DE FUNCIONAMENTO

Nº 37000099
Data 21/02/2002

Ampliação

IDENTIFICAÇÃO DA ENTIDADE

Nome: ESTRE EMPRESA DE SAN.E TRAT.DE RESÍDUOS LTDA-CGR PAULÍNIA
CNPJ: 03.147.393/0002-30
Logradouro: ESTRADA MUNICIPAL PLN 190
Cadastro na CETESB: 513 - 00271 - 6
Número | Complemento: S/N | Bairro: NOVA VENEZA | CEP: 13140-000 | Município: PAULÍNIA

CARACTERÍSTICAS DO PROJETO

Atividade Principal
Descrição: ATERRO SANITÁRIO
Código IBGE: 31.40.00-1
Bacia Hidrográfica: 14 - PIRACICABA
UGRHI: 5 - PIRACICABA/CAPIVARI/JUNDIAI
Corpo Receptor | Classe

Área (metro quadrado)
Terreno: 704924,69 | Construída | Atividade ao Ar Livre | Novos Equipamentos | Lavra(s)

Horário de Funcionamento (h): Início 06:00 às Término 06:00
Número de Funcionários: Administração 7 | Produção 25
Licença de Instalação: Data 07/02/2002 | Número 37000127

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, 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, exigidas pela legislação federal, estadual ou municipal;

A presente Licença de Funcionamento se refere aos locais, equipamentos ou processos relacionados no verso ou Folha Anexo;

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, com a redação dada pelo Decreto Estadual nº 15.425, de 23 de julho de 1980;

Alterações nas atuais atividades, processos ou equipamentos deverão ser precedidas de Licença de Instalação, nos termos do artigo 58 do Regulamento acima mencionado;

Caso venham 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: ID Nº 37000546
EMITENTE: Local: Agência Ambiental de Paulínia
ENTIDADE

CONTROLE Nº 350953

Figure 11. CGR Paulínia's working license (page 1 of 2)

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

02

Processo Nº 37/00007/02

LICENÇA DE FUNCIONAMENTO

Nº 37000099

Data 21/02/2002

LOCAIS, EQUIPAMENTOS OU PROCESSOS

A presente licença está sujeita a renovação nos termos da Lei nº 9.477 de 30/12/96 e seu Regulamento.

001 . Esta Licença de Funcionamento é válida para a disposição complementar de 2000 toneladas/dia de resíduos sólidos domiciliares e industriais classes 2 e 3, perfazendo um total licenciado de 3000 toneladas/dia, de acordo com os Processos nºs 37/00098/99, 37/00110/00 e 37/00010/01, não podendo conter líquidos livres, a ser comprovado (quando necessário), por ensaio de Paint Filter Liquids Test.

002 . O gerenciamento do Licenciamento do Centro de Gerenciamento de Resíduos da ESTRE - CGR PAULÍNIA, vem sendo trtado no Processo Nº 37/00098/99.

CETESB

SOUZA LEÃO

REG 37 13090

CETESB

CONTROLE Nº 350952

ENTIDADE

Pag. 2

Figure 12. CGR Paulínia's working license (page 2 of 2)

SECTION G. Stakeholders' comments

>>

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

Invitation for comments by local stakeholders is required by the Brazilian Designated National Authority as part of the procedures for analyzing CDM projects and issuing letters of approval. This procedure is the one to be followed by ESTRE to take its GHG mitigation initiative to the public.

In its first resolution, the DNA required project participants to communicate with the public through letters, to be sent inviting for comments to:

- The Brazilian national NGO's forum;
- The local attorneys' and prosecutors' agency;
- The municipality's chamber (mayor and assemblymen);
- State's and municipal's environmental authorities;
- Local communities' associations.

ESTRE sent letters to these participants and let a period of 30 days open for them to provide comments, to be sent directly to the validator.

G.2. Summary of the comments received:

No comments received.

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

Considering the consultation process resulted in no comments, ESTRE could not take them into account.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	ESTRE – Empresa de Saneamento e Tratamento de Resíduos Ltda.
Street/P.O.Box:	Av. Presidente Juscelino Kubitschek, nº 1.830, torre IV , 4º andar, sala 11
Building:	
City:	São Paulo
State/Region:	SP
Postfix/ZIP:	
Country:	Brazil
Telephone:	+55 11 3706 8833
FAX:	+55 11 3078 3355
E-Mail:	
URL:	www.estre.com.br
Represented by:	
Title:	Mr.
Salutation:	
Last Name:	Schlosser
Middle Name:	
First Name:	Alex
Department:	
Mobile:	(11) 7713 8562
Direct FAX:	
Direct tel:	(11) 3076 8877
Personal E-Mail:	alex@estre.com.br

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding involved in EPLGP.

Annex 3

BASELINE INFORMATION

Variable	Value	Justification	Source
CH_4 generation potential - L_0 (tCH_4/t of refuse)	0,057	Calculated	ESTRE's data.
CH_4 generation rate constant - k (1/yr)	0,12	Assuming an average of 6 years for the waste to decompose	
Year the site opened	2.000		ESTRE's data.
Year the site closes	2.010		ESTRE's data.
Average yearly waste disposition rate	597.361		ESTRE's data.

Leakages due to electricity purchased were estimated through approved methodology ACM0002 – Consolidated methodology for grid-connected electricity generation from renewable sources – version 2. In order to gather the daily dispatch data, which allows the application of option *b)* Simple adjusted OM, the manager of the electricity system (ONS) was consulted in order to provide the adequate 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.

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 comprised 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[7] from Jan. 1, 2002 to Dec. 31, 2004, the most recent information available at this stage).

[7] *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.

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

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.

$$EF_{OM,simple\_adjusted,2002} = (1-\lambda_{2001})\frac{\sum_{i,j} F_{i,j,2002}.COEF_{i,j}}{\sum_{j} GEN_{j,2002}} \therefore EF_{OM,simple\_adjusted,2002} = 0{,}4207 \text{ tCO}_2\text{/MWh}$$

$$EF_{OM,simple\_adjusted,2003} = (1-\lambda_{2003})\frac{\sum_{i,j} F_{i,j,2003}.COEF_{i,j}}{\sum_{j} GEN_{j,2003}} \therefore EF_{OM,simple\_adjusted,2003} = 0{,}4397 \text{ tCO}_2\text{/MWh}$$

$$EF_{OM,simple\_adjusted,2004} = (1-\lambda_{2004})\frac{\sum_{i,j} F_{i,j,2004}.COEF_{i,j}}{\sum_{j} GEN_{j,2004}} \therefore EF_{OM,simple\_adjusted,2004} = 0{,}4327 \text{ tCO}_2\text{/MWh}$$

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

$$EF_{OM,simple\_adjusted\ 2002\_2004} = 0{,}4310 \text{ tCO}_2\text{/MWh}$$

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%. Calculating such factor one reaches:

$$EF_{BM,2004} = 0{,}1045 \text{ tCO}_2\text{/MWh}$$

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:

$$EF_{electricity,2002-2004} = 0{,}5 * 0{,}4310 + 0{,}5 * 0{,}1045 = 0{,}2677 \text{ tCO}_2\text{/MWh}$$

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 applied here.

The baseline emissions would be then 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 ($EF_{electricity,2002\text{-}2004}$) with the electricity generation of the project activity.

$BE_{electricity,y} = EF_{electricity,2002\text{-}2004} . EG_y$

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

$\mathbf{BE_{electricity,y} = 0{,}2677\ tCO_2/MWh\ .\ EG_y}$ (in tCO_2e)

The leakage emissions would be then 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 ($EF_{electricity,2002\text{-}2004}$) 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 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)[8]:

"… 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 argumentation 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'".

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

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

(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	0,1045

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 are provided. Then, a table with the summarized conclusions of the analysis, with the emission factor calculation displayed. Finally, the load duration curves for the S-SE-MW system are presented.

ONS Dispatched Plants

	Subsystem*	Fuel source**	Power plant	Operation start [2, 4, 5]	Installed capacity (MW) [1]	Fossil fuel conversion efficiency (%) [2]	Carbon emission factor (tC/TJ) [3]	Fraction carbon oxidized [3]	Emission factor (tCO2/MWh)
1	S-SE-CO	H	Jauru	Sep-2003	121.5	1	0.0	0.0%	0.000
2	S-SE-CO	H	Gauporé	Sep-2003	120.0	1	0.0	0.0%	0.000
3	S-SE-CO	G	Três Lagoas	Aug-2003	306.0	0.3	15.3	99.5%	0.670
4	S-SE-CO	H	Funil (MG)	Jan-2003	180.0	1	0.0	0.0%	0.000
5	S-SE-CO	H	Itiquira I	Sep-2002	156.1	1	0.0	0.0%	0.000
6	S-SE-CO	G	Araucária	Sep-2002	484.5	0.3	15.3	99.5%	0.670
7	S-SE-CO	G	Canoas	Sep-2002	160.6	0.3	15.3	99.5%	0.670
8	S-SE-CO	H	Piraju	Sep-2002	81.0	1	0.0	0.0%	0.000
9	S-SE-CO	G	Nova Piratininga	Jun-2002	384.9	0.3	15.3	99.5%	0.670
10	S-SE-CO	O	PCT CGTEE	Jun-2002	5.0	0.3	20.7	99.0%	0.902
11	S-SE-CO	H	Rosal	Jun-2002	55.0	1	0.0	0.0%	0.000
12	S-SE-CO	G	Ibirité	May-2002	226.0	0.3	15.3	99.5%	0.670
13	S-SE-CO	H	Cana Brava	May-2002	465.9	1	0.0	0.0%	0.000
14	S-SE-CO	H	Sta. Clara	Jan-2002	60.0	1	0.0	0.0%	0.000
15	S-SE-CO	H	Machadinho	Jan-2002	1,140.0	1	0.0	0.0%	0.000
16	S-SE-CO	G	Juiz de Fora	Nov-2001	87.0	0.28	15.3	99.5%	0.718
17	S-SE-CO	G	Macaé Merchant	Nov-2001	922.6	0.24	15.3	99.5%	0.837
18	S-SE-CO	H	Lajeado (ANEEL res. 402/2001)	Nov-2001	902.5	1	0.0	0.0%	0.000
19	S-SE-CO	G	Eletrobolt	Oct-2001	379.0	0.24	15.3	99.5%	0.837
20	S-SE-CO	H	Porto Estrela	Sep-2001	112.0	1	0.0	0.0%	0.000
21	S-SE-CO	G	Cuiaba (Mario Covas)	Aug-2001	529.2	0.3	15.3	99.5%	0.670
22	S-SE-CO	G	W. Arjona	Jan-2001	194.0	0.25	15.3	99.5%	0.804
23	S-SE-CO	G	Uruguaiana	Jan-2000	639.9	0.45	15.3	99.5%	0.447
24	S-SE-CO	H	S. Caxias	Jan-1999	1,240.0	1	0.0	0.0%	0.000
25	S-SE-CO	H	Canoas I	Jan-1999	82.5	1	0.0	0.0%	0.000
26	S-SE-CO	H	Canoas II	Jan-1999	72.0	1	0.0	0.0%	0.000
27	S-SE-CO	H	Igarapava	Jan-1999	210.0	1	0.0	0.0%	0.000
28	S-SE-CO	H	Porto Primavera	Jan-1999	1,540.0	1	0.0	0.0%	0.000
29	S-SE-CO	D	Cuiaba (Mario Covas)	Oct-1998	529.2	0.27	20.2	99.0%	0.978
30	S-SE-CO	H	Sobragi	Sep-1998	60.0	1	0.0	0.0%	0.000
31	S-SE-CO	H	PCH EMAE	Jan-1998	26.0	1	0.0	0.0%	0.000
32	S-SE-CO	H	PCH CEEE	Jan-1998	25.0	1	0.0	0.0%	0.000
33	S-SE-CO	H	PCH ENERSUL	Jan-1998	43.0	1	0.0	0.0%	0.000
34	S-SE-CO	H	PCH CEB	Jan-1998	15.0	1	0.0	0.0%	0.000
35	S-SE-CO	H	PCH ESCELSA	Jan-1998	62.0	1	0.0	0.0%	0.000
36	S-SE-CO	H	PCH CELESC	Jan-1998	50.0	1	0.0	0.0%	0.000
37	S-SE-CO	H	PCH CEMAT	Jan-1998	145.0	1	0.0	0.0%	0.000
38	S-SE-CO	H	PCH CELG	Jan-1998	15.0	1	0.0	0.0%	0.000
39	S-SE-CO	H	PCH CERJ	Jan-1998	59.0	1	0.0	0.0%	0.000
40	S-SE-CO	H	PCH COPEL	Jan-1998	70.0	1	0.0	0.0%	0.000
41	S-SE-CO	H	PCH CEMIG	Jan-1998	84.0	1	0.0	0.0%	0.000
42	S-SE-CO	H	PCH CPFL	Jan-1998	55.0	1	0.0	0.0%	0.000
43	S-SE-CO	H	S. Mesa	Jan-1998	1,275.0	1	0.0	0.0%	0.000
44	S-SE-CO	H	PCH EPAULO	Jan-1998	26.0	1	0.0	0.0%	0.000
45	S-SE-CO	H	Guilmam Amorim	Jan-1997	140.0	1	0.0	0.0%	0.000
46	S-SE-CO	H	Corumbá	Jan-1997	375.0	1	0.0	0.0%	0.000
47	S-SE-CO	H	Miranda	Jan-1997	408.0	1	0.0	0.0%	0.000
48	S-SE-CO	H	Noav Ponte	Jan-1994	510.0	1	0.0	0.0%	0.000
49	S-SE-CO	H	Segredo (Gov. Ney Braga)	Jan-1992	1,260.0	1	0.0	0.0%	0.000
50	S-SE-CO	H	Taquaruçu	Jan-1989	554.0	1	0.0	0.0%	0.000
51	S-SE-CO	H	Manso	Jan-1988	210.0	1	0.0	0.0%	0.000
52	S-SE-CO	H	D. Francisca	Jan-1987	125.0	1	0.0	0.0%	0.000
53	S-SE-CO	H	Itá	Jan-1987	1,450.0	1	0.0	0.0%	0.000
54	S-SE-CO	H	Rosana	Jan-1987	369.2	1	0.0	0.0%	0.000
55	S-SE-CO	N	Angra	Jan-1985	1,874.0	1	0.0	0.0%	0.000
56	S-SE-CO	H	T. Irmãos	Jan-1985	807.5	1	0.0	0.0%	0.000
57	S-SE-CO	H	Itaipu 60 Hz	Jan-1983	6,300.0	1	0.0	0.0%	0.000
58	S-SE-CO	H	Itaipu 50 Hz	Jan-1983	5,375.0	1	0.0	0.0%	0.000
59	S-SE-CO	H	Emborcação	Jan-1982	1,192.0	1	0.0	0.0%	0.000
60	S-SE-CO	H	Nova Avanhandava	Jan-1982	347.4	1	0.0	0.0%	0.000
61	S-SE-CO	H	Gov. Bento Munhoz - GBM	Jan-1980	1,676.0	1	0.0	0.0%	0.000
62	S-SE-CO	H	S.Santiago	Jan-1980	1,420.0	1	0.0	0.0%	0.000
63	S-SE-CO	H	Itumbiara	Jan-1980	2,280.0	1	0.0	0.0%	0.000
64	S-SE-CO	O	Igarapé	Jan-1978	131.0	0.3	20.7	99.0%	0.902
65	S-SE-CO	H	Itauba	Jan-1978	512.4	1	0.0	0.0%	0.000
66	S-SE-CO	H	A. Vermelha (Jose E. Moraes)	Jan-1978	1,396.2	1	0.0	0.0%	0.000
67	S-SE-CO	H	S.Simão	Jan-1978	1,710.0	1	0.0	0.0%	0.000
68	S-SE-CO	H	Capivara	Jan-1977	640.0	1	0.0	0.0%	0.000
69	S-SE-CO	H	S.Osório	Jan-1975	1,078.0	1	0.0	0.0%	0.000
70	S-SE-CO	H	Marimbondo	Jan-1975	1,440.0	1	0.0	0.0%	0.000
71	S-SE-CO	H	Promissão	Jan-1975	264.0	1	0.0	0.0%	0.000
72	S-SE-CO	C	Pres. Medici	Jan-1974	446.0	0.26	26.0	98.0%	1.294
73	S-SE-CO	H	Volta Grande	Jan-1974	380.0	1	0.0	0.0%	0.000
74	S-SE-CO	H	Porto Colombia	Jun-1973	320.0	1	0.0	0.0%	0.000
75	S-SE-CO	H	Passo Fundo	Jan-1973	220.0	1	0.0	0.0%	0.000
76	S-SE-CO	H	Passo Real	Jan-1973	158.0	1	0.0	0.0%	0.000
77	S-SE-CO	H	Ilha Solteira	Jan-1973	3,444.0	1	0.0	0.0%	0.000
78	S-SE-CO	H	Mascarenhas	Jan-1973	131.0	1	0.0	0.0%	0.000
79	S-SE-CO	H	Gov. Parigot de Souza - GPS	Jan-1971	252.0	1	0.0	0.0%	0.000
80	S-SE-CO	H	Chavantes	Jan-1971	414.0	1	0.0	0.0%	0.000
81	S-SE-CO	H	Jaguara	Jan-1971	424.0	1	0.0	0.0%	0.000
82	S-SE-CO	H	Sá Carvalho	Apr-1970	78.0	1	0.0	0.0%	0.000
83	S-SE-CO	H	Estreito (Luiz Carlos Barreto)	Jan-1969	1,050.0	1	0.0	0.0%	0.000
84	S-SE-CO	H	Ibitinga	Jan-1969	131.5	1	0.0	0.0%	0.000
85	S-SE-CO	H	Jupiá	Jan-1969	1,551.2	1	0.0	0.0%	0.000
86	S-SE-CO	O	Alegrete	Jan-1968	66.0	0.26	20.7	99.0%	1.040
87	S-SE-CO	G	Campos (Roberto Silveira)	Jan-1968	30.0	0.24	15.3	99.5%	0.837
88	S-SE-CO	G	Santa Cruz (RJ)	Jan-1968	766.0	0.31	15.3	99.5%	0.648
89	S-SE-CO	H	Paraibuna	Jan-1968	85.0	1	0.0	0.0%	0.000
90	S-SE-CO	H	Limoeiro (Armando Salles de Oliviera)	Jan-1967	32.0	1	0.0	0.0%	0.000
91	S-SE-CO	H	Caconde	Jan-1966	80.4	1	0.0	0.0%	0.000
92	S-SE-CO	C	J.Lacerda C	Jan-1965	363.0	0.25	26.0	98.0%	1.345
93	S-SE-CO	C	J.Lacerda B	Jan-1965	262.0	0.21	26.0	98.0%	1.602
94	S-SE-CO	C	J.Lacerda A	Jan-1965	232.0	0.18	26.0	98.0%	1.869
95	S-SE-CO	H	Bariri (Alvaro de Souza Lima)	Jan-1965	143.1	1	0.0	0.0%	0.000
96	S-SE-CO	H	Funil (RJ)	Jan-1965	216.0	1	0.0	0.0%	0.000
97	S-SE-CO	C	Figueira	Jan-1963	20.0	0.3	26.0	98.0%	1.121
98	S-SE-CO	H	Furnas	Jan-1963	1,216.0	1	0.0	0.0%	0.000
99	S-SE-CO	H	Barra Bonita	Jan-1963	140.8	1	0.0	0.0%	0.000
100	S-SE-CO	C	Charqueadas	Jan-1962	72.0	0.23	26.0	98.0%	1.462
101	S-SE-CO	H	Jurumirim (Armando A. Laydner)	Jan-1962	97.7	1	0.0	0.0%	0.000
102	S-SE-CO	H	Jacui	Jan-1962	180.0	1	0.0	0.0%	0.000
103	S-SE-CO	H	Pereira Passos	Jan-1962	99.1	1	0.0	0.0%	0.000
104	S-SE-CO	H	Tres Marias	Jan-1962	396.0	1	0.0	0.0%	0.000
105	S-SE-CO	H	Euclides da Cunha	Jan-1960	108.8	1	0.0	0.0%	0.000
106	S-SE-CO	H	Camargos	Jan-1960	46.0	1	0.0	0.0%	0.000
107	S-SE-CO	H	Santa Branca	Jan-1960	56.1	1	0.0	0.0%	0.000
108	S-SE-CO	H	Cachoeira Dourada	Jan-1959	658.0	1	0.0	0.0%	0.000
109	S-SE-CO	H	Salto Grande (Lucas N. Garcez)	Jan-1958	70.0	1	0.0	0.0%	0.000
110	S-SE-CO	H	Salto Grande (MG)	Jan-1956	102.0	1	0.0	0.0%	0.000
111	S-SE-CO	H	Mascarenhas de Moraes (Peixoto)	Jan-1956	478.0	1	0.0	0.0%	0.000
112	S-SE-CO	H	Itutinga	Jan-1955	52.0	1	0.0	0.0%	0.000
113	S-SE-CO	C	S. Jerônimo	Jan-1954	20.0	0.26	26.0	98.0%	1.294
114	S-SE-CO	O	Carioba	Jan-1954	36.2	0.3	20.7	99.0%	0.902
115	S-SE-CO	O	Piratininga	Jan-1954	472.0	0.3	20.7	99.0%	0.902
116	S-SE-CO	H	Canastra	Jan-1953	42.5	1	0.0	0.0%	0.000
117	S-SE-CO	H	Nilo Peçanha	Jan-1953	378.4	1	0.0	0.0%	0.000
118	S-SE-CO	H	Fontes Nova	Jan-1940	130.3	1	0.0	0.0%	0.000
119	S-SE-CO	H	Henry Borden Sub.	Jan-1926	420.0	1	0.0	0.0%	0.000
120	S-SE-CO	H	Henry Borden Ext.	Jan-1926	469.0	1	0.0	0.0%	0.000
121	S-SE-CO	H	I. Pombos	Jan-1924	189.7	1	0.0	0.0%	0.000
122	S-SE-CO	H	Jaguari	Jan-1917	11.8	1	0.0	0.0%	0.000
				Total (MW) =	**64,478.6**				

* 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).

Summary table

Emission factors for the Brazilian South-Southeast-Midwest interconnected grid				
Baseline (including imports)	EF_{OM} [tCO2/MWh]	Load [MWh]	LCMR [GWh]	Imports [MWh]
2002	0,8504	275.402.896	258.720	1.607.395
2003	0,9378	288.493.929	274.649	459.586
2004	0,8726	297.879.874	284.748	1.468.275
	Total (2001-2003) =	861.776.699	818.118	3.535.256
	$EF_{OM, simple-adjusted}$ [tCO2/MWh]	$EF_{BM,2004}$	Lambda	
	0,4310	0,1045	λ_{2002}	
	Alternative weights	Default weights	0,5053	
	w_{OM} = 0,75	w_{OM} = 0,5	λ_{2003}	
	w_{BM} = 0,25	w_{BM} = 0,5	0,5312	
	EF_{CM} [tCO2/MWh]	Default EF_{OM} [tCO2/MWh]	λ_{2004}	
	0,3494	0,2677	0,5041	

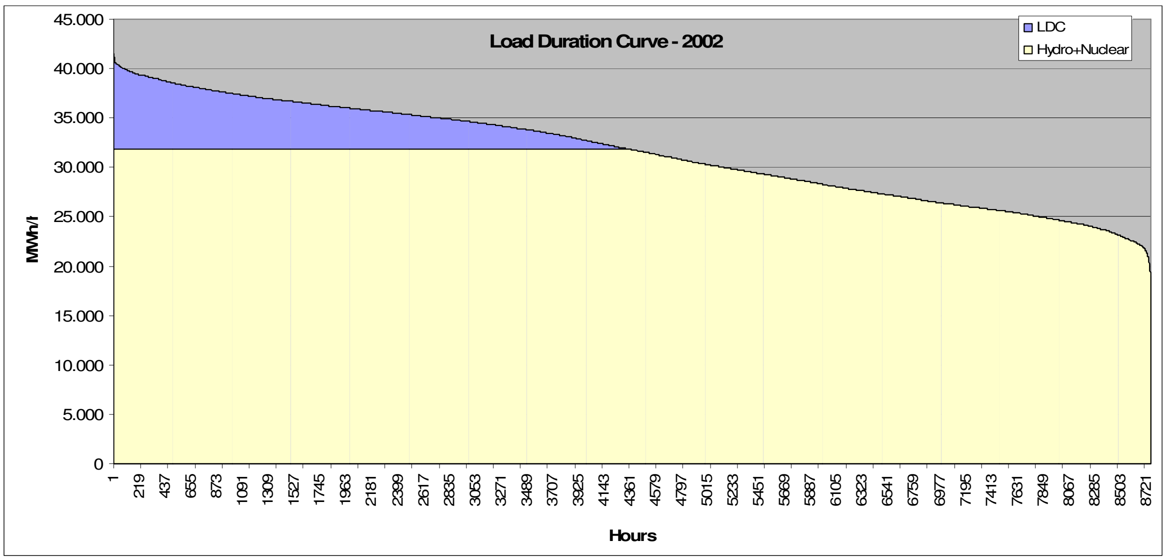


Figure A1. Load duration curve for the S-SE-MW system, 2002

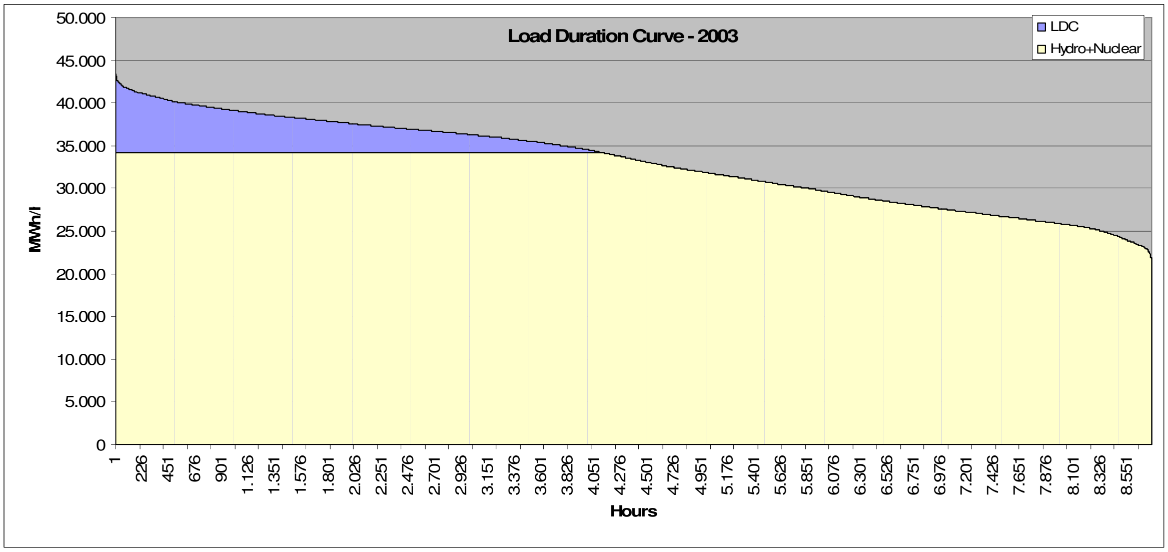


Figure A2. Load duration curve for the S-SE-MW system, 2003

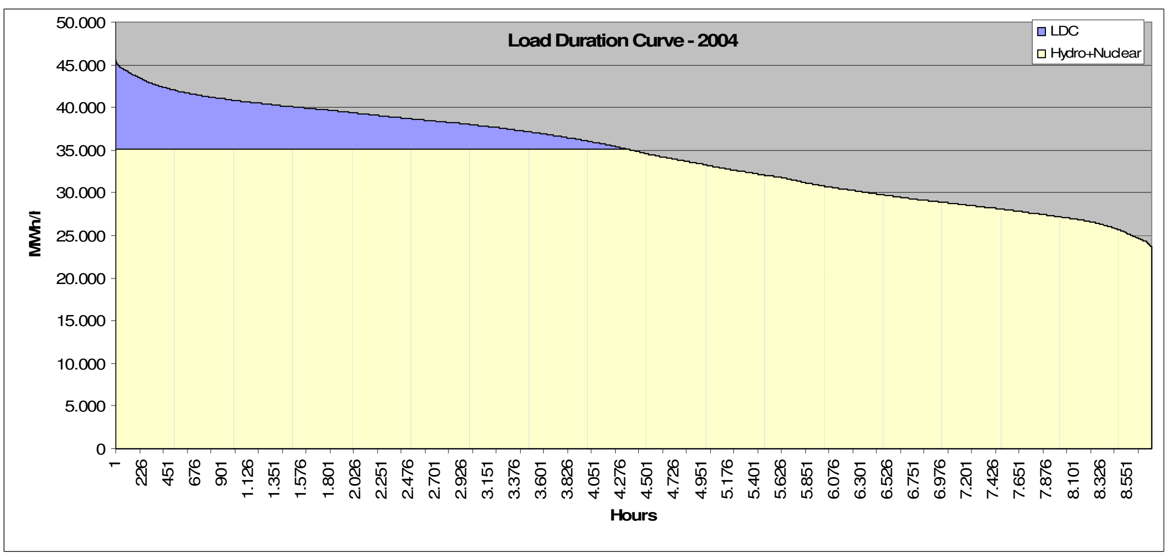


Figure A3. Load duration curve for the S-SE-MW system, 2004

Annex 4

MONITORING PLAN

As stated in section D of this document, the following variables need to be measured as to determine and account for emission reductions due to EPLGP.

- The amount of landfill gas being sent to flares;
- The amount of methane in the landfill gas;
- The flares' efficiencies;
- Regulatory requirements relating to landfill gas projects.

The first two will be measured on a continuous basis, through proper meters and analyzers for such purposes. The third one is to be carried out on an often basis, most likely on an annual basis. The last one is to be carried every year, during the crediting period and two years after.

Considering EPLGP's facilities will count on computer-based equipment, generating data continuously, 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 2. Summary worksheet for EPLGP

Estre's Paulínia Landfill Gas Project
MVP Workbook

Summary worksheet

Year	Landfill gas to flares (t)	Average methane in LFG (%)	Flare efficiency (%)	Methane flared (t)	Emission reductions (tCO_2e)
2006					
2007					
2008					
2009					
2010					
2011					
2012					

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 three 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 show how the flares' data are to be archived.

Table 3. Flare efficiency data

Flares' Efficiency Tests				
Flare #	Test Date	Methane Content in Exhaust Gas	Test Carried Out by	Approved by