



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

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**SECTION A. General description of project activity.****A.1 Title of the project activity:**

ESTRE's Paulinia Landfill Gas Project (EPLGP).

Version 3.1

Date of the document: 18/01/2012.

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"The 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:

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- related to the recalculation of the build margin emission factor with the plant efficiencies recommended by the CDM Executive Board at its 22nd meeting;
- the necessary change of the starting date of the crediting period from 1 January 2006 to 1 May 2006.
- revised monitoring plan including flare temperature, flare working hours of the flare and description of the equipments in landfill gas plant.
- Revised CERs spreadsheet correcting the amount of waste disposed in the landfill, methane generation potential (L_0) and methane generation rate constant (k).

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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 Paulinia municipality. This goal will be achieved through installing an active gas recovery with a flaring system in the landfill.

ESTRE's landfill in Paulinia 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 Paulinia enjoys:

- CGR Paulinia 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 several municipalities in the region under contract to dispose waste in CGR Paulinia. Considering these clients, as well as the private ones, CGR Paulinia has a capacity to receive up to 1,825,000 tonnes of waste per year (based on the operational license which establishes the daily capacity up to 5,000 tonnes of waste per day). Initially designed to receive 6.5 million

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tonnes, CGR Paulínia is now under expansion, with neighbour areas already under ESTRE's ownership. **In the end**, CGR Paulínia will **have received about 16 millions tonnes of waste**.

- 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.

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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 <u>Ambiental S/A.</u>	No
<u>United Kingdom of Great Britain and Northern Ireland</u>	• <u>NATIXIS Environment & Infrastructures</u> • <u>European Carbon Fund</u>	<u>No</u>
<u>France</u>	• <u>European Carbon Fund</u>	<u>No</u>
<u>Switzerland</u>	• <u>European Carbon Fund</u>	<u>No</u>

(*) 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.

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

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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 III¹, generated by municipalities, commerce and industrial companies.**

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:



Natixis Environment & Infrastructures, fully owned Natixis subsidiary, is a fund management company specialising in providing equity financing to environmental and infrastructure projects.

European Carbon Fund is the first privately owned carbon fund in Europe, launched in 2005 and sponsored by CDC Climat, Caisse des Dépôts' subsidiary dedicated to the fight against climate change, and BNP Paribas - Fortis Bank.

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 has been implemented and; ESTRE follows and checks the park limits and the pond which are in its area. Support materials is 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.

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.

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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. ¶

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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.

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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.

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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.

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Bioremediation Unit

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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.

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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.

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

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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.

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The complete solution

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1. Sample collection and laboratory analysis

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

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2. Environmental Agency authorization

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

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3. Process Follow-up

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

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4. Excavation and Transport

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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.

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5. Treatment

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

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6. Final Disposition

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CGR Paulínia is licensed and prepared to receive such soil.

Recycling

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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.

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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.

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Figure 2- Cooperative affiliates by the recycling tray

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

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Figure 4.- Recycling warehouse

LANDFILL**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. **In the end of the operation the total landfill area will be around 603 thousand m² and the capacity around 16 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.

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LANDFILLS¶

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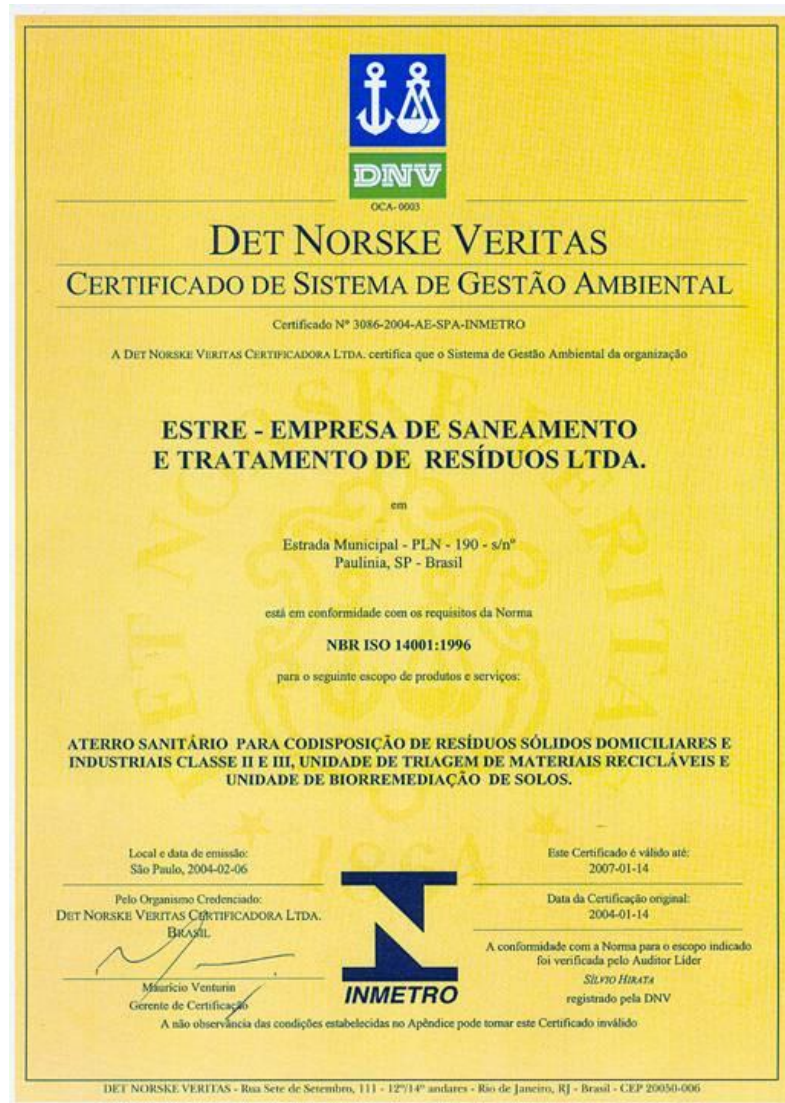


Figure 6 - CGR Paulínia ISO 14001 certificate

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**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.

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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 m² and capacity for 3.2 million tones, the Center is apt to receive waste class II and III, from household, commercial and industrial facilities.

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CDR Pedreira¶

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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 m², and has capacity for 21.5 ...

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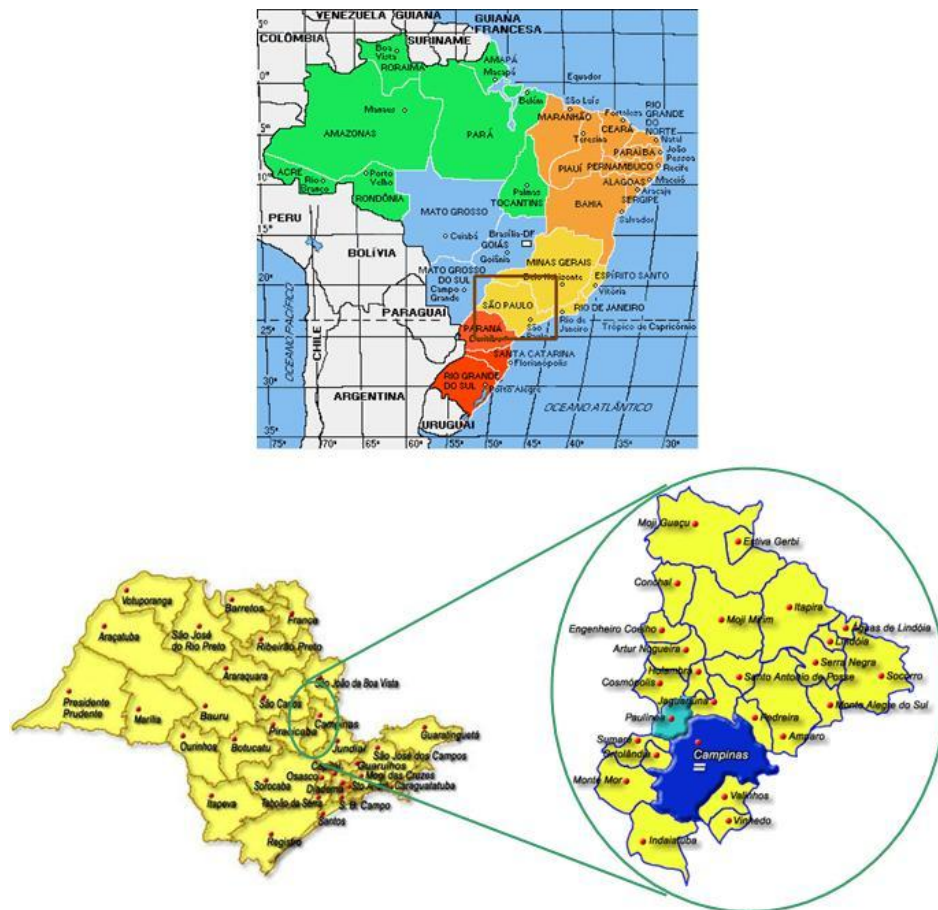
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Note: Paulínia is the region appearing in light blue.
Source: SEBRAE-SP³

Figure 7 - Paulínia's location

³ www.sebraesp.sp.gov.br

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**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 landfills⁴.

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.

The technical specifications of the equipments are presented below:

Blower specifications:

Blower 1	Year	2006
	Commissioning date	14/09/2006
	Model	77A1.03
	Serial number	0677A051
	Maximum capacity	5,000 Nm ³ /h
	Manufacturer	Continental Industrie
	Motor Capacity	75kW
Blower 2	Year	2006
	Commissioning date	14/09/2006
	Model	77A1.03
	Serial number	0677A050
	Maximum capacity	5,000 Nm ³ /h
	Manufacturer	Continental Industrie
	Motor Capacity	75kW

⁴ CETESB – Companhia de Tecnologia de Saneamento Ambiental. *Inventário Estadual de Resíduos Sólidos Domiciliares*, 2002.

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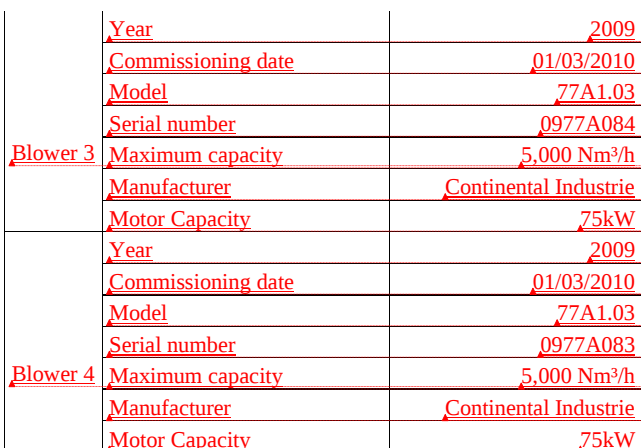
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Diesel generators specifications:

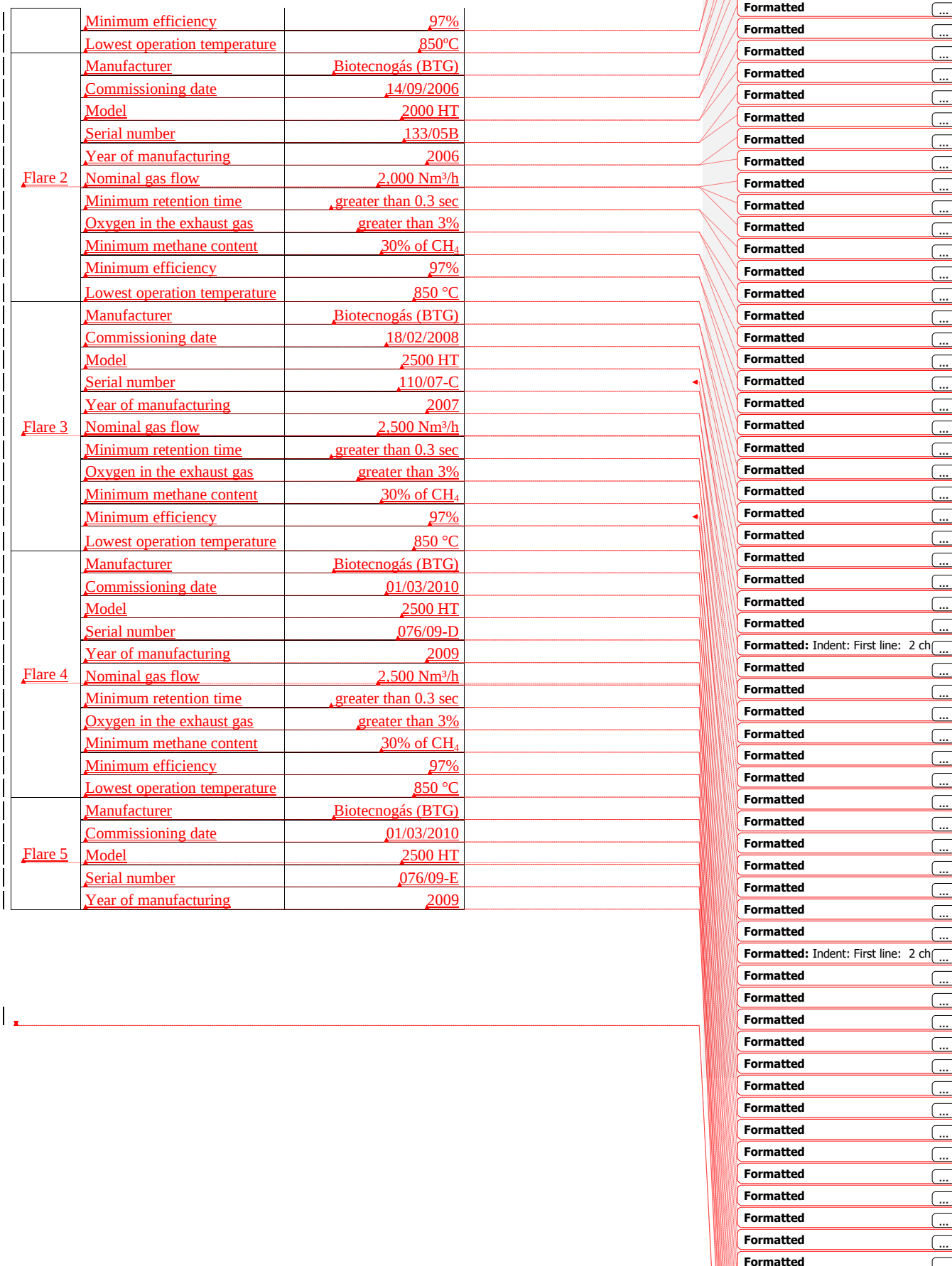
The system has installed 2 backup diesel generators, to supply electricity for the project in case of power shortage. The specification of these equipments is presented in the table below:

<u>Generator Manufacturer: STEMAC (WEG)</u>	<u>Generator Manufacturer: Heimer</u>
<u>Generator Model: GTA</u>	<u>Generator Model: 40/41</u>
<u>Engine Manufacturer: STEMAC (Cummins)</u>	<u>Serial Number: 9PO263</u>
<u>Engine Model: NTA63</u>	<u>Capacity: 512 kVA</u>
<u>Serial Number: 0450533001</u>	<u>Frequency: 60 Hz</u>
<u>Capacity: 450 kVA</u>	<u>Tension: 380V</u>
<u>Frequency: 60 Hz</u>	<u>Current: 1344</u>
<u>Tension: 380 V</u>	<u>Year: 10/2009</u>
<u>Current: 614 A</u>	<u>Commissioning date: 19/02/2010</u>
<u>Year: 10/2001</u>	
<u>Commissioning date: 14/09/2006</u>	

Flare specifications:

Flare 1	<u>Manufacturer</u>	<u>Biotechnogás (BTG)</u>
	<u>Commissioning date</u>	<u>14/09/2006</u>
	<u>Model</u>	<u>2000 HT</u>
	<u>Serial number</u>	<u>133/05A</u>
	<u>Year of manufacturing</u>	<u>2006</u>
	<u>Nominal gas flow</u>	<u>2,000 Nm³/h</u>
	<u>Minimum retention time</u>	<u>greater than 0.3 sec</u>
	<u>Oxygen in the exhaust gas</u>	<u>greater than 3%</u>
	<u>Minimum methane content</u>	<u>30% of CH₄</u>

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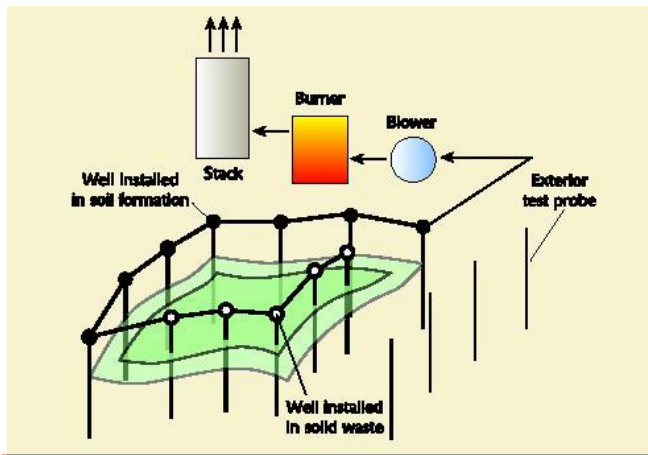




Nominal gas flow	2,500 Nm ³ /h
Minimum retention time	greater than 0.3 sec
Oxygen in the exhaust gas	greater than 3%
Minimum methane content	30% of CH ₄
Minimum efficiency	97%
Lowest operation temperature	850 °C

It is foreseen the installation of one more flare with 2,500 Nm³/h nominal gas flow in the period between 2012 and 2013.

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.



Source: O'Leary & Walsh⁵.

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

⁵ 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.

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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:

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Emission reductions will occur from the capture of the landfill gas and its controlled and monitored flaring. The current practice in Paulinia, 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 CO₂, therefore reducing the global warming effect, since methane is 21 times more powerful to the effect than carbon dioxide.

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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.

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

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For the first crediting period (from 14/09/2006 to 13/09/2013) the estimation of emission reductions is:

Years	Annual estimation of emission reductions in tonnes of CO ₂ e
14/09/2006	112,027
2007	513,090
2008	651,903
2009	767,859
2010	905,013
2011	1,028,315
2012	1,136,286
13/09/2013	735,657
Total estimated reductions (tonnes of CO ₂ e)	5,850,149
Total Number of crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO ₂ e)	835,736

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A.4.5. Public funding of the project activity:

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There is no public funding involved in this project activity.

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SECTION B. Application of a baseline methodology

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

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The baseline methodology applied to EPLGP is AM0003, version 3, called "simplified financial analysis for landfill gas capture projects".

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

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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.

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

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

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Step 1.

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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.

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Step 2.

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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.

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Step 3.

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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.

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Step 4.

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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.

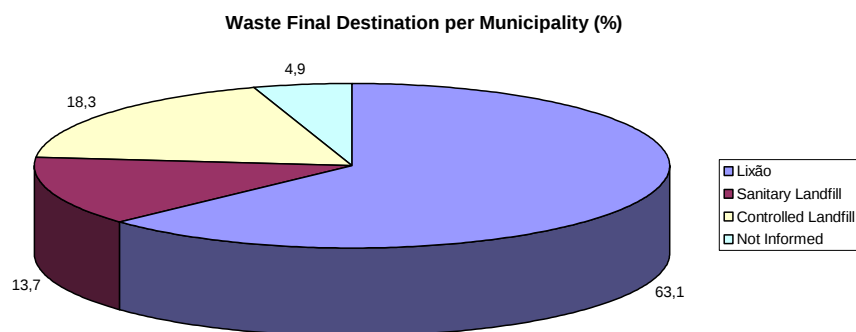
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It is important to note that a considerable effort will have to take place regarding the waste disposal practices in Brazil before any legislation on gas flaring is enforced. According to the latest official statistics on urban solid waste in Brazil – *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.

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Source: PNSB, 2000⁶.

Figure 9 - Waste Final Destination per Municipality in Brazil

Data used for determining the baseline scenario are displayed 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:

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:

⁶ IBGE - Instituto Brasileiro de Geografia e Estatística. *Pesquisa Nacional de Saneamento Básico*, 2000.

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Deleted: Table 1. Baseline determination information¶

Variable
CH ₄ generation potential - L ₀ (t refuse)
CH ₄ generation rate constant - Year the site opened
Year the site closes
Average yearly waste dispositic

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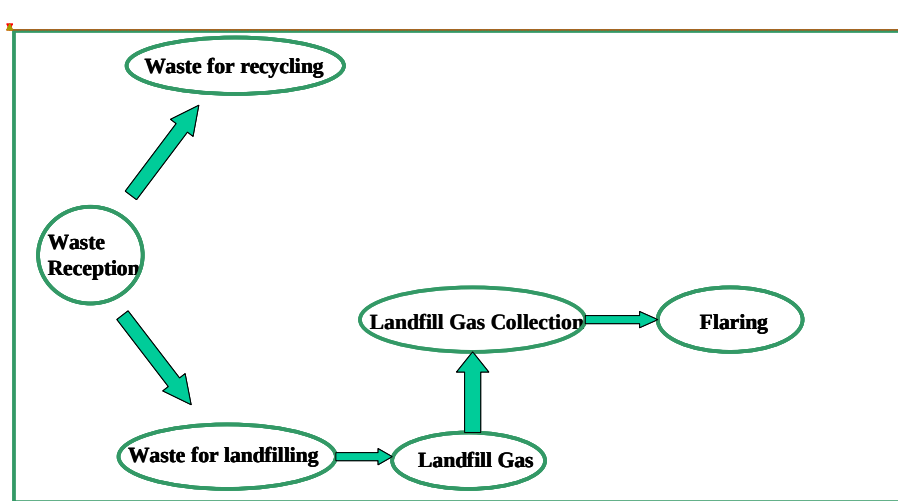


Figure 10. EPLGP Boundary

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 06/08/2011, by Econergy, which is not a project participant in the initiative. Contact information:

Mr. Francisco do Espírito Santo Filho

francisco.santo@econergy.com.br

Tel: +55 (11) 3555-5700

Fax: +55 (11) 3555-5735

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

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C.2 Choice of the <u>crediting period</u> and related information:	Formatted: Font: 11 pt
C.2.1. <u>Renewable crediting period</u>	Formatted: Font: 11 pt
C.2.1.1. Starting date of the first <u>crediting period</u>:	Formatted: Font: 11 pt
14/09/2006	Deleted: 01/05
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C.2.1.2. Length of the first <u>crediting period</u>:	Formatted: Font: 11 pt
7 years 0 months	Formatted: Font: 11 pt
C.2.2. <u>Fixed crediting period</u>:	Formatted: Font: 11 pt
C.2.2.1. Starting date:	Formatted: Font: 11 pt
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C.2.2.2. Length:	Formatted: Font: 11 pt
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SECTION D. Application of a <u>monitoring methodology</u> and plan	Formatted: Font: 11 pt
D.1. Name and reference of <u>approved monitoring methodology</u> applied to the <u>project activity</u>:	Formatted: Font: 11 pt
The methodology applied to EPLGP is AM0003, version 3, called “Simplified Financial Analysis for Landfill Gas Capture Projects”.	Formatted: Font: 11 pt
D.2. Justification of the choice of the methodology and why it is applicable to the <u>project activity</u>:	Formatted: Font: 11 pt
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.	Formatted: Font: 11 pt
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**D.2. 1. Option 1: Monitoring of the emissions in the project scenario and the baseline scenario**

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

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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 CO₂ equ.)

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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 :

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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

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D.2.1.4. Description of formulae used to estimate baseline emissions (for each gas, source, formulae/algorithm, emissions units of CO₂ equ.)

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**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	Nm ³	m	Continuous	100%	Electronic	Normal cubic meters represent the gas volume in cubic meters at standard conditions (0 °C and 1.013 bar). Data will be aggregated daily, monthly and yearly.
4	Flare efficiency	Efficiency	%	m and c	Quarterly	n/a	Electronic	Methane and Oxygen content of flare exhaust gas.
5	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	Internal / Third party company	Test	n/a	Annually	100%	Electronic	Required for any changes to the adjustment factor (AF) or directly MD _{reg,y}
-	Flare temperature	Temperature	°C	m	Continuous	100%	Electronic	Required to ensure the proper operation of the flares.
-	Flare working hours	Hours	hours	m	Continuous	100%	Electronic	Measured to determine the operation of the flares.

D.2.2.2. Description of formulae used to calculate project emissions (for each gas, source, formulae/algorithm, emissions units of CO₂ equ.):

There are no project emissions in the project activity.

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Deleted: The 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).¶

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

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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

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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
3.1	Total amount of electricity used for gas pumping from the grid	Electricity	MWh	m	Continuous	100%	Electronic	=
3.2	Total amount of electricity used for gas pumping from the diesel fuelled generator	Electricity	MWh	m	Continuous	100%	Electronic	=
4.1	Greenhouse gas emissions per kWh of electricity used	Emission factor	tCO ₂ e/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 version 2. 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

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								for two years after the end of the crediting period.
4.2	Greenhouse gas	Emission factor for diesel generation	tCO ₂ e/kWh	e	Once for each crediting period	100%	Electronic	CO ₂ emission intensity of the electricity being generated by diesel generator will be determined through an approved small scale methodology, which is AMS I.D version 13, Table I.D.1 This data will be updated at the baseline renewal, in accordance with the considered methodology. 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 CO₂ equ.)

Considering leakage is the emissions occurring due to energy consumption for on-site machinery feeding. There are two sources of leakage: electricity consumption from the grid and diesel generators.

$$L = (E_{grid} * EF_{grid}) + (E_{diesel} * EF_{diesel})$$

Where:

L = Leakage (tCO₂e)

E_{grid} = Electricity provided by the grid (kWh)

E_{diesel} = Electricity provided by the diesel generators (kWh)

EF_{grid} = Emission factor of the grid (tCO₂/kWh)

EF_{diesel} = Emission factor of the diesel (tCO₂/kWh)

The emission factor calculated according to ACM0002 is 0.2677 tCO₂e/MWh for the grid and 0.8 tCO₂e/MWh for the diesel according to AMS I.D, version 13.

The electricity consumption is presented below:

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where E is the energy consumed

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Year	Electricity consumption from the grid (MWh)	Electricity produced from diesel generators (MWh)	Total (MWh)
2006	159.8860	0.4060	160.2920
2007	619.8790	0.8360	620.7150
2008	746.7860	0.2450	747.0310
2009	896.0000	7.2500	903.2500
2010	1,249.6987	9.2940	1,258.9927
2011	1,429.2880	10.0000	1,439.2880
2012	1,929.5400	10.0000	1,939.5400
2013	1,012.4123	7.0833	1,019.4957
TOTAL			8,088.6044

Figure 11 - Electricity consumption

Leakage of the project activity is presented below:

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Year	Leakage from the grid (tCO ₂ e)	Leakage from the diesel generator (tCO ₂ e)	Project Leakage (tCO ₂ e)
2006	43	1	44
2007	166	1	167
2008	200	1	201
2009	240	6	246
2010	335	8	343
2011	383	8	391
2012	517	8	525
2013	272	6	278
TOTAL			2,195

Figure 12 - Leakage of the project activity**D.2.4. Description of formulae used to estimate emission reductions for the project activity (for each gas, source, formulae/algorithm, emissions units of CO₂ equ.)**

Emission _ reductions = baseline _ emissions – project _ 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.
Table D.2.2.1 item 1	Low	Flow meters will be subject to a regular maintenance and testing regime to ensure accuracy.



Table D.2.3.1 Items 3.1 and 3.2	Low	Two calibrated electricity meters are installed to measure electricity consumption from the grid and from diesel fuelled generators. Those meters are subject to annual calibration to ensure accuracy.
Table D.2.2.1. item 4	Low	Regular maintenance will ensure optimal operation of flares. Flare efficiency will be checked quarterly ⁷ .
Table D.2.2.1 item 5	Low	The gas analyzer will be subject to a regular maintenance and testing regime to ensure accuracy. It has also been calibrated yearly.
<u>Table D.2.2.1 (flare temperature)</u>	<u>Low</u>	<u>The thermocouples will be calibrated yearly.</u>
<u>Table D.2.2.1 (Flare working hours)</u>	<u>Low</u>	<u>Working hours are measured by the supervisory system and it does not need to be calibrated.</u>

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:

Mr. Francisco do Espírito Santo Filho

francisco.santo@econergy.com.br

Tel: +55 (11) 3555-5700

Fax: +55 (11) 355-5735

www.econergy.com.br

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⁷ ESTRE are conducting exhaust gas analyses every three months, in accordance with the AM0003 version 3 page 5 of the monitoring methodology.

**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) from the grid and diesel generators by the necessary apparatus of the landfill gas plant and the emission factor (tCO₂e) from this energy. Therefore:

$$L = (E_{grid} * EF_{grid}) + (E_{diesel} * EF_{diesel})$$

Where:

L = Leakage (tCO₂e)

E_{grid} = Electricity provided by the grid (kWh)

E_{diesel} = Electricity provided by the diesel generators (kWh)

EF_{grid} = Emission factor of the grid (tCO₂/kWh)

EF_{diesel} = Emission factor of the diesel (tCO₂/kWh)

The emission factor calculated according to ACM0002 is 0.2677 tCO₂e/MWh for the grid and 0.8 tCO₂e/MWh for the diesel according to AMS I.D, version 13.

The electricity consumption is presented below:

Year	Electricity consumption from the grid (MWh)	Electricity produced from diesel generators (MWh)	Total (MWh)
2006	159.8860	0.4060	160.2920
2007	619.8790	0.8360	620.7150
2008	746.7860	0.2450	747.0310
2009	896.0000	7.2500	903.2500
2010	1,249.6987	9.2940	1,258.9927
2011	1,429.2880	10.0000	1,439.2880
2012	1,929.5400	10.0000	1,939.5400
2013	1,012.4123	7.0833	1,019.4957
TOTAL			8,088.6044

Figure 13 - Electricity consumption

Leakage of the project activity is presented below:

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Year	Leakage from the grid (tCO ₂ e)	Leakage from the diesel generator (tCO ₂ e)	Project Leakage (tCO ₂ e)
2006	43	1	44
2007	166	1	167
2008	200	1	201
2009	240	6	246
2010	335	8	343
2011	383	8	391
2012	517	8	525
2013	272	6	278
TOTAL			2,195

Figure 14 - Leakage of the project activity**E.3. The sum of E.1 and E.2 representing the project activity emissions:**

$$E.1 + E.2 = 0 + L = (E_{grid} * EF_{grid}) + (E_{diesel} * EF_{diesel})$$

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 guidelines⁸. In the case of EPLGP, the first order decay approach was used:

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

Where:

Q = methane generated in current year (t/yr)

L₀ = 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:

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

Where:

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

X = the year of waste input

⁸ Revised 1996 IPCC Guidelines for National Greenhouse Gases Inventory.



R_x = the amount of waste disposed in year x (t)

T = current year

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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:

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

Where Q_T is the total amount of methane to be generated in the landfill during a certain timeframe.

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To summarize, relevant factors for methane estimation are:

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- 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)

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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:

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

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

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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:

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

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.

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

For the first crediting period (from 14/09/2006 to 13/09/2013) the estimation of emission reductions is:

Year	Estimation of project activity emission (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)
14/09/2006	0	112,071	44	112,027
2007	0	513,257	167	513,090
2008	0	652,104	201	651,903
2009	0	768,105	246	767,859
2010	0	905,356	343	905,013
2011	0	1,028,706	391	1,028,315
2012	0	1,136,811	525	1,136,286
13/09/2013	0	735,935	278	735,657
Total (tonnes of CO ₂ e)	0	5,852,344	2,195	5,850,149

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. An example of a CGR Paulínia's working license is shown in figures 15 and 16.

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

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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.

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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	Bairro	CEP	Município	
S/N		NOVA VENEZA	13140-000	PAULÍNIA	

CARACTERÍSTICAS DO PROJETO

Atividade Principal		
Denominação	Código IBGE	
ATERRO SANITÁRIO	31.40.00-1	
Bacia Hidrográfica	1003III	
14 - PIRACICABA	5 - PIRACICABA/CAPIVARI/JUNDIAÍ	
Corpo Receptor		Classe

Área (metro quadrado)

Terreno	Construída	Atividade no Ar Livre	Novos Equipamentos	Lama(s)
704924,69				

Horário de Funcionamento (h)

Número de Funcionários

Licença de Instalação

Início	Término	Administração	Produção	Data	Número
06:00	às 06:00	7.	25	07/02/2002	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 2468, de 2 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 em substituir quaisquer Alvarás ou Certificados de qualquer natureza, exigidos pela legislação federal, estadual ou municipal;

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

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

No caso de aquisição 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 2468, de 2 de setembro de 1976, com a redação dada pelo Decreto Estadual nº 15.425, de 23 de julho de 1980;

Aterroes nas atuais atividades, processos ou equipamentos deverão seguir os procedimentos de Licença de Instalação, nos termos do artigo 52 do Regulamento acima mencionado;

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

USO DA CETESB

EMITENTE

ID Nº
37000546

Local
Agência Ambiental de Paulínia

ENTIDADE

CONTROLE Nº 350953

1/10/2004

© 2003 MPM ECTE/TEC/STP e STP/ME/AM

Figure 15 – An example of a CGR Paulínia's working license (page 1 of 2)

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Figure 16 – An example of a CGR Paulínia’s working license (page 2 of 2)

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**SECTION G. Stakeholders' comments**

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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.

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

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- 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.

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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.

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G.2. Summary of the comments received:

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No comments received.

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

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

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**Annex 1****CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY****Project Participant 1**

Organization:	ESTRE Ambiental S/A.
Street/P.O.Box:	Estrada Municipal PLN190, s/nº - Parque da Represa
Building:	
City:	Paulínia
State/Region:	SP
Postfix/ZIP:	
Country:	Brazil
Telephone:	
FAX:	
E-Mail:	
URL:	www.estre.com.br
Represented by:	
Title:	Mr.
Salutation:	
Last Name:	Caldas
Middle Name:	
First Name:	Bruno
Department:	
Mobile:	
Direct FAX:	
Direct tel:	+55 (11) 3076-8877
Personal E-Mail:	bruno.caldas@estre.com.br

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<u>Organization:</u>	<u>European Carbon Fund</u>
<u>Street/P.O.Box:</u>	<u>5 Allée Scheffer</u>
<u>Building:</u>	
<u>City:</u>	<u>Luxembourg</u>
<u>State/Region:</u>	
<u>Postfix/ZIP:</u>	
<u>Country:</u>	<u>Luxembourg</u>
<u>Telephone:</u>	<u>+352 (4767) 2356</u>
<u>FAX:</u>	
<u>E-Mail:</u>	
<u>URL:</u>	<u>http://www.europecarbonfund.com/</u>
<u>Represented by:</u>	
<u>Title:</u>	
<u>Salutation:</u>	<u>Mr</u>
<u>Last Name:</u>	<u>QUERU</u>
<u>Middle Name:</u>	
<u>First Name:</u>	<u>Gautier</u>
<u>Department:</u>	
<u>Mobile:</u>	
<u>Direct FAX:</u>	
<u>Direct tel:</u>	<u>+352 (4767) 2356</u>
<u>Personal E-Mail:</u>	<u>gqueru@ei.natixis.com</u>

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**Annex 2****INFORMATION REGARDING PUBLIC FUNDING**

There is no public funding involved in EPLGP.

Annex 3**BASELINE INFORMATION**

Parameter	Value	Unit
Lo	140	m ³ CH ₄ /t waste
k	0.090	1/year
Collection efficiency	80	%
Effectiveness Adjustment Factor (EAF)	20	%
GWP Methane	21	tCO ₂ /tCH ₄
Year the site opened	2000	year
Year the site closes	2014	year

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 reports⁹ from Jan. 1, 2002 to Dec. 31, 2004, the most recent information available at this stage).

⁹ Acompanhamento Diário da Operação do Sistema Interligado 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.

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**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:

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

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

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

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.

$$EF_{OM, simple_adjusted, 2002} = (1 - \lambda_{2001}) \frac{\sum_{i,j} F_{i,j,2002} \cdot COEF_{i,j}}{\sum_j GEN_{j,2002}} \therefore EF_{OM, simple_adjusted, 2002} = 0.4207 \text{ tCO}_2/\text{MWh}$$

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$$EF_{OM, simple_adjusted, 2003} = (1 - \lambda_{2003}) \frac{\sum_{i,j} F_{i,j,2003} \cdot COEF_{i,j}}{\sum_j GEN_{j,2003}} \therefore EF_{OM, simple_adjusted, 2003} = 0.4397 \text{ tCO}_2/\text{MWh}$$

$$EF_{OM, simple_adjusted, 2004} = (1 - \lambda_{2004}) \frac{\sum_{i,j} F_{i,j,2004} \cdot COEF_{i,j}}{\sum_j GEN_{j,2004}} \therefore EF_{OM, simple_adjusted, 2004} = 0.4327 \text{ tCO}_2/\text{MWh}$$

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.

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

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:

$$EF_{electricity, 2002-2004} = 0.5 \cdot 0.4310 + 0.5 \cdot 0.1045 = 0.2677 \text{ tCO}_2/\text{MWh}$$

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 ($EF_{electricity, 2002-2004}$) with the electricity generation of the project activity.

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

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

$$BE_{electricity, y} = 0.2677 \text{ tCO}_2/\text{MWh} \cdot EG_y \text{ (in tCO}_2\text{e)}$$

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 ($EF_{electricity, 2002-2004}$) with the electricity purchase of the project activity, as put in section E.2.

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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.

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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.

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Nevertheless, even after the interconnection had been established, technical papers still divided the Brazilian system in two (Bosi, 2000)¹⁰:

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“... where the Brazilian Electricity System is divided into three separate subsystems:

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- (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)”

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

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“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’”.

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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.

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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 **landfill gas**), 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.

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¹⁰ Bosi, M. *An Initial View on Methodologies for Emission Baselines: Electricity Generation Case Study*. International Energy Agency. Paris, 2000.



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.

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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.

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In that regard, project proponents looked for a plausible solution in order to be able to calculate the emission factor 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.

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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](http://www.aneel.gov.br/arquivos/PDF/Resumo_Gr%C3%A1ficos_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.

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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.

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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.

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From the mentioned reference:

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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%.

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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.

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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.

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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.

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Summary table

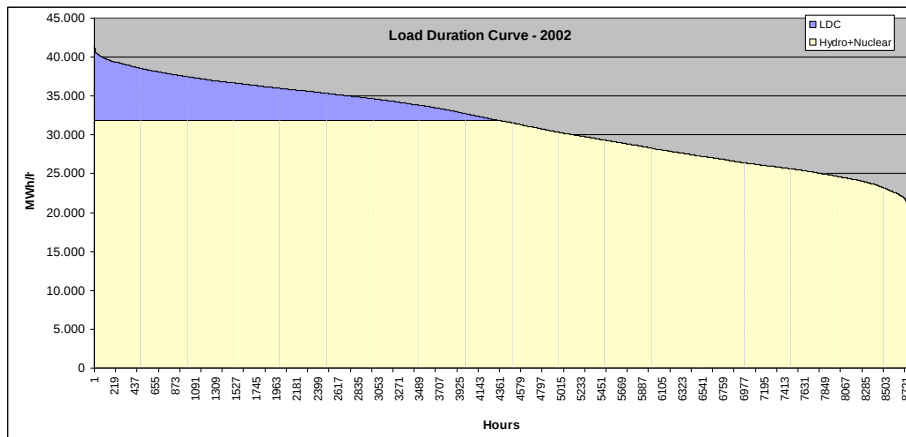


Figure A1. Load duration curve for the S-SE-MW system, 2002

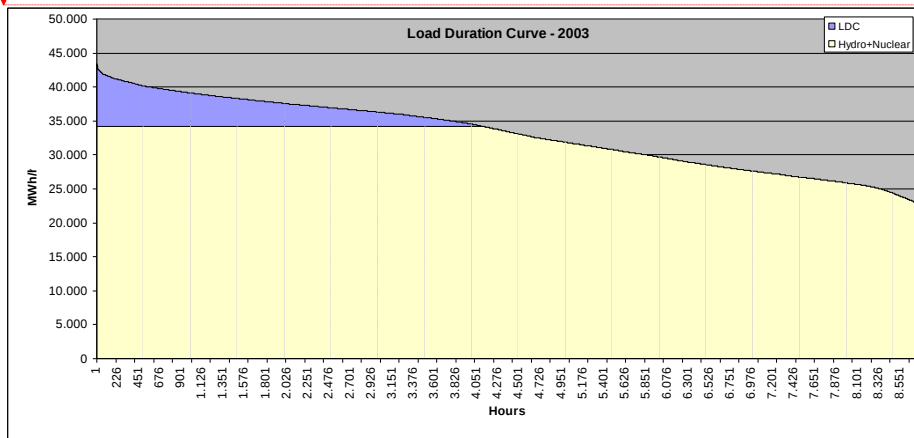


Figure A2. Load duration curve for the S-SE-MW system, 2003

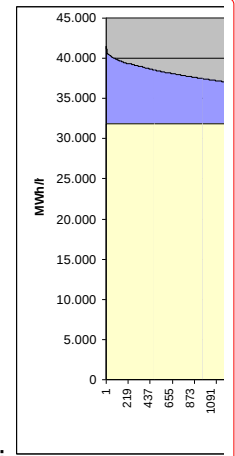
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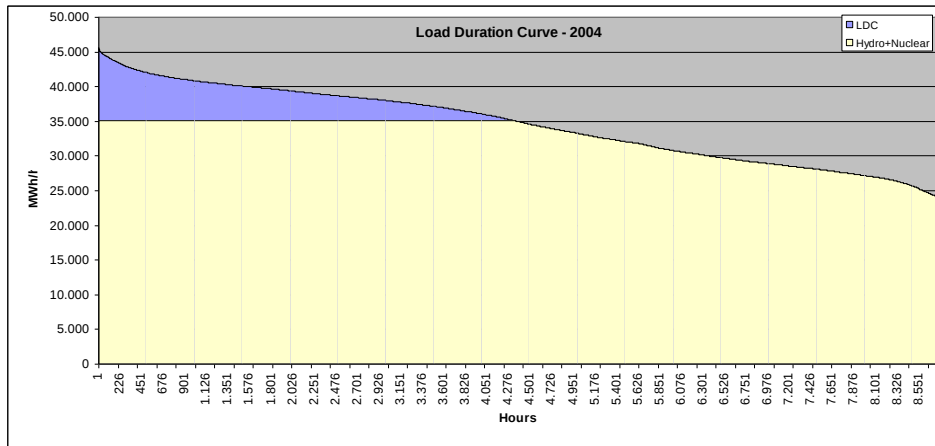


Figure A3. Load duration curve for the S-SE-MW system, 2004

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**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.

1. The amount of landfill gas being sent to flares;
2. The amount of methane in the landfill gas;
3. Total amount of electricity used for gas pumping from the grid;
4. Total amount of electricity used for gas pumping from the diesel fuelled generator;
5. The flares' efficiencies;
6. Working hours of the flares;
7. Flare temperature;
8. Regulatory requirements relating to landfill gas projects.

The parameters 1, 2, 3, 4 and 7 will be measured on a continuous basis, through proper meters and analyzers for such purposes. The parameter 5 is to be carried out on an often basis, quarterly. The parameter 6 is measured by the supervisory system. The parameter 8 is verified every year, during the crediting period and two years after.

Amount of LFG being sent to flares and the amount of methane in the landfill gas

The data will be collected continuously using flow meter located in the piping leading to the flares. The data will be aggregated hourly and daily for the flares in report sheets. The data will be archived for a minimum of two years after the end of the crediting period or the last issuance of CERs for this project activity, whichever occurs later. The concentration of methane will be measured in real time.

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.

The sheets will be presented to the verifier as the collected and stored data for verification purposes.

The flares' efficiencies

Project Participants will hire specialists to carry out exhaust gases analyses in order to determine if any methane is not being flared and, if so, how much of the gas is being released to the atmosphere. Data will be kept for two years after the end of the crediting period.

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Deleted: 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.

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Electricity consumption on site

There are two sources of electricity consumption:

- Electricity from the grid

The consumed electricity from the grid by the project activity will be continuously measured by electricity meter for the grid. The respective data will be electronically recorded.

- Electricity from diesel generators

The consumed electricity from the diesel generators by the project activity will be continuously measured by an electricity meter installed in Landfill gas Plant. The respective data will be electronically recorded.

Working hours of the flares

Information will be monitored and archived during the crediting period and for two years thereafter.

Flare temperature

The flare temperatures will be measured by thermocouples and archived during the crediting period and for two years thereafter.

Regulatory requirements relating to landfill gas projects

Regulatory requirements relating to LFG projects will be evaluated annually by investigating municipal, state and national regulations pertaining to LFG. This will be done through consultation with the appropriate regulatory bodies, ongoing discussion with regulators, and monitoring of publications delineating upcoming legislative changes governing landfills and LFG. In addition, there is software called “Green Solution” which regularly updates ESTRE about new regulations in Brazil.

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