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

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Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

ESTRE's Paulínia Landfill Gas Project (EPLGP).

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:

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.

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

[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.

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

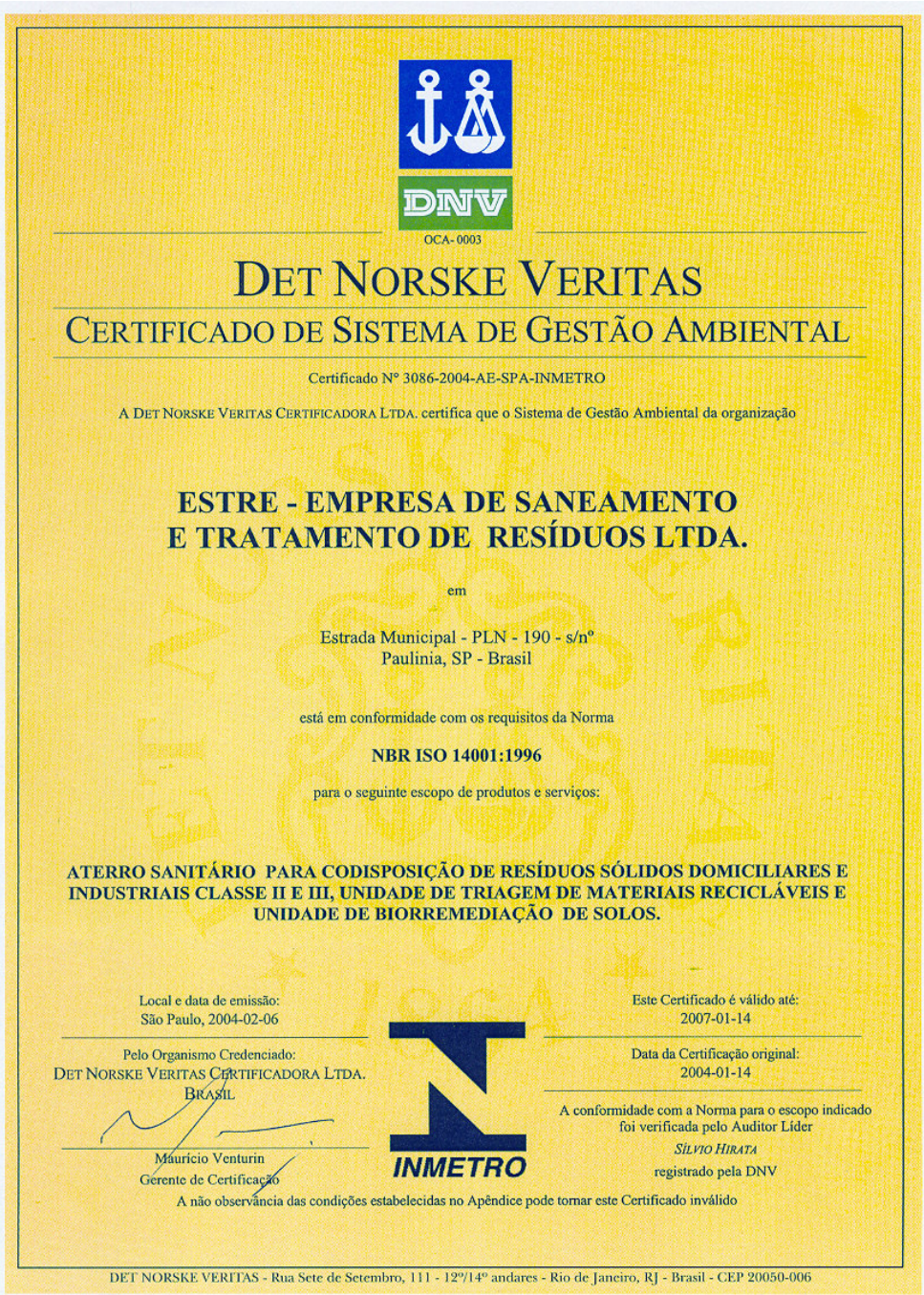
CGR Paulínia

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

Maurício Venturin
Gerente de Certificação

INMETRO

Data da Certificação original:
2004-01-14

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

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.:

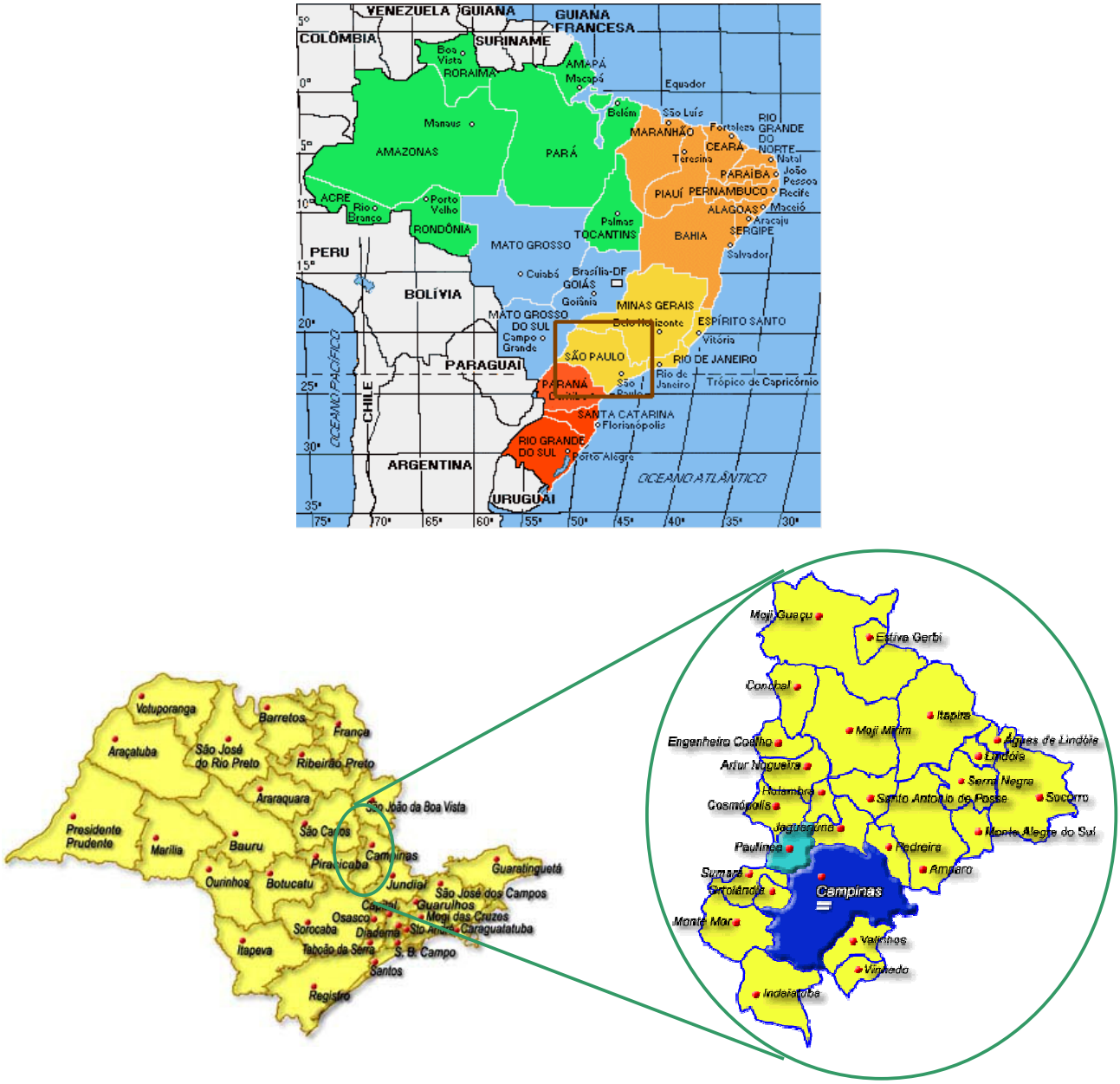
São Paulo

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.

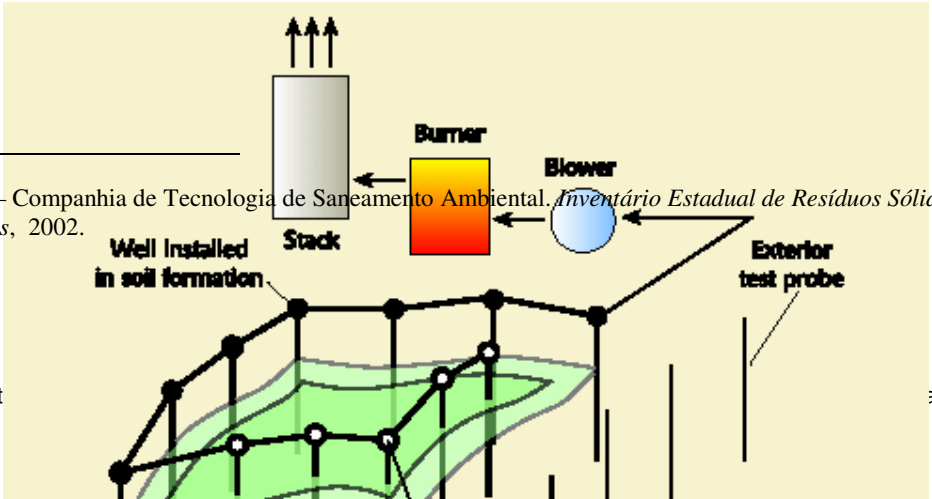
A.4.3. Technology to be employed by the project activity:

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 1,487,775 tCO_2e.

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

The chosen crediting period ranges from 2006 to 2026. Estimated annual emission reductions are as follows:

Year	Emission Reductions (tCO_2e)	Year	Emission Reductions (tCO_2e)	Year	Emission Reductions (tCO_2e)
2006	169,728	2013	175,517	2020	75,305
2007	194,112	2014	155,577	2021	66,697
2008	215,738	2015	137,891	2022	59,062

[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.

2009	234,918	2016	122,206	2023	52,290
2010	251,930	2017	108,294	2024	46,284
2011	223,349	2018	95,955	2025	40,958
2012	198,000	2019	85,011	2026	36,233

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, 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.

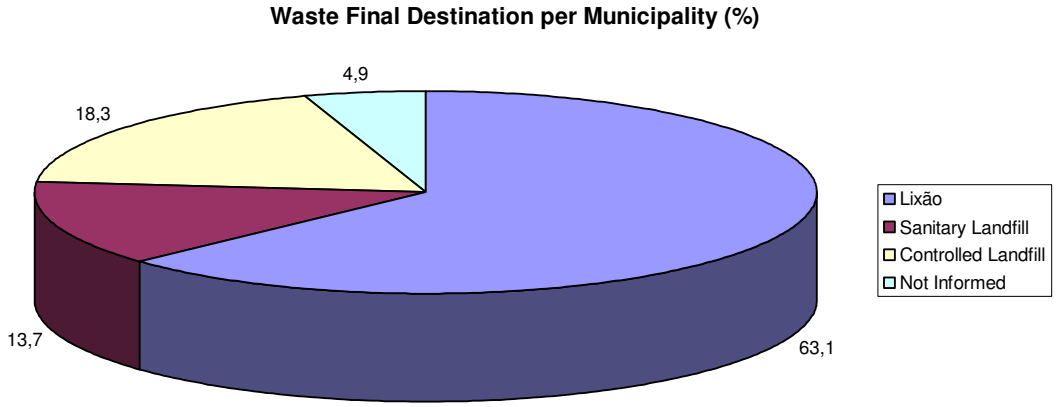
Step 3.

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:

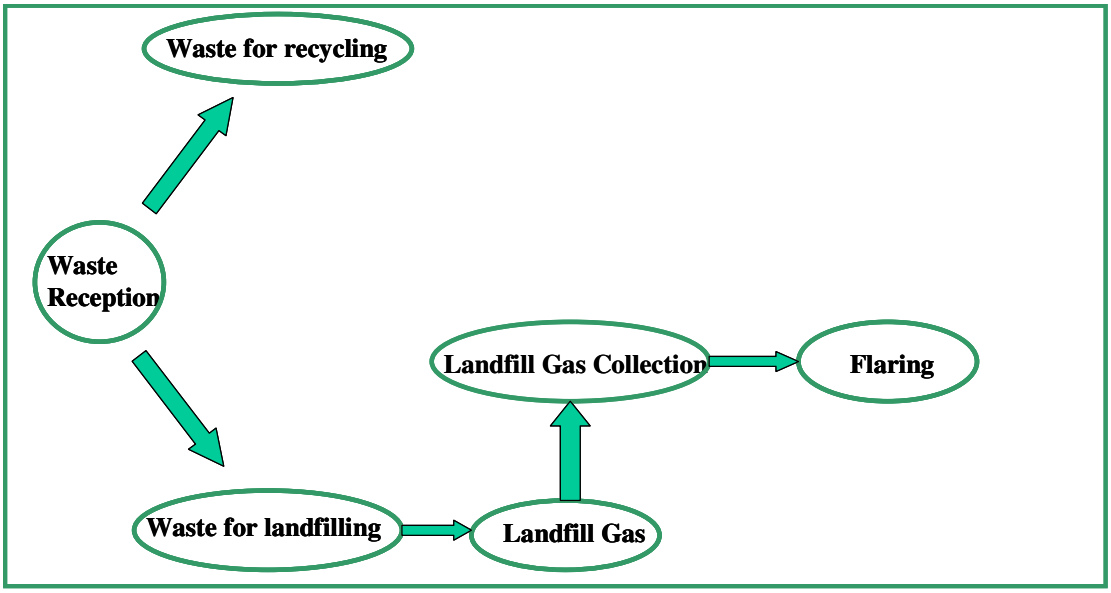


Figure 10. EPLGP Boundary

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 01/10/2004, 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:

01/01/2006

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:

01/01/2006

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, 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.

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 AM0015. 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.)

$$Emission\_reductions = \Pr oject\_emissions - baseline\_emissions - leakage$$

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 AM0015 is 0.274 tCO_2e/MWh. The flaring facility is estimated to need around 3,000 MWh/year. That gives a leakage of 822 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:

Emission Reductions from EPLGP for the first crediting period

Year	Emission Reductions (tCO_2e)
2006	169,728
2007	194,112
2008	215,738
2009	234,918
2010	251,930
2011	223,349
2012	198,000

Emission reductions from the first crediting period are expected to be, therefore, 1,487,775 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: S/N | Complemento | 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	Construída	Atividade ao Ar Livre	Novos Equipamentos	Lavra(ha)
704924,69				

Horário de Funcionamento (h)

Início		Término
06:00	às	06:00

Número de Funcionários

Administração	Produção
7	25

Licença de Instalação

Data	Número
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 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

SD Nº 37000546

ENTIDADE

EMITENTE

Local: Agência Ambiental de Paulínia

SELO DE AUTENTICIDADE CETESB

LUIZ EDUARDO SOUZA LEÃO
Agência Ambiental de Paulínia
CREA/SP 60.217 REG 37 1309-0

Pag. 1

CONTROLE Nº 350953

3.3.10.0253-4

40.022 FLS. NUM. CONTR. 315.081 A 355.100 - 06/2001

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

Nº 37000099

Data 21/02/2002

LICENÇA DE FUNCIONAMENTO

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 tratado no Processo Nº 37/00098/99.

CETESB
Engº EDUARDO SOUZA LEÃO
CREA/SP 60.217 REG 37 1309-0

ENTIDADE

Pag. 2

CONTROLE Nº 350952

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 AM0015 – Bagasse- based cogeneration connected to an electricity grid. 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.

According to such approach, the emission intensity of the electricity at the margin of the grid is determined through the determination of an Operating Margin emission factor and a build margin emission factor (please refer to AM0015 for more details)

$$EF_{OM,simple\_adjusted,y} = (1-\lambda_y)\frac{\sum_{i,j} F_{i,j,y}.COEF_{i,j}}{\sum_j GEN_{j,y}} + \lambda_y \frac{\sum_{i,k} F_{i,k,y}.COEF_{i,k}}{\sum_k GEN_{k,y}} \ (tCO_2e/GWh)$$

$$EF_{BM} = \frac{\sum_{i,m} F_{i,m,y}.COEF_{i,m}}{\sum_m GEN_{m,y}} \ (tCO_2e/GWh)$$

$$EF_{electricity} = w_{OM} EF_{OM} + w_{BM} EF_{BM} \ (tCO_2e/GWh)$$

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

$$\frac{\sum_{i,k} F_{i,k,y}.COEF_{i,k}}{\sum_k GEN_{k,y}} = 0 \ (tCO_2e/GWh)$$

Where:

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

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

$COEF_{i,j(or\ m)\ y}$ Is the CO_2 emission coefficient of fuel *i* (tCO_2 / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources j (or m) and the percent oxidation of the fuel in year(s) y

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

λ is the fraction of time during a year when low-cost/must run sources are operating at the margin of the grid.

$EF_{electricity,y}$ Is the CO_2 baseline emission factor for the electricity.

w refers to the weight given to the Operating Margin and the Build Margin.

ONS' data has been provided to the validator as a supporting document. 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 2001, 2002 and 2003. Therefore:

$$EF_{OM,simple\_adjusted,2001} = (1-\lambda_{2001})\frac{\sum_{i,j} F_{i,j,2001}.COEF_{i,j}}{\sum_{j} GEN_{j,2001}} \therefore EF_{OM,simple\_adjusted,2001} = 515\ tCO_2/GWh$$

$$EF_{OM,simple\_adjusted,2002} = (1-\lambda_{2002})\frac{\sum_{i,j} F_{i,j,2002}.COEF_{i,j}}{\sum_{j} GEN_{j,2002}} \therefore EF_{OM,simple\_adjusted,2002} = 419\ tCO_2/GWh$$

$$EF_{OM,simple\_adjusted,2002} = (1-\lambda_{2003})\frac{\sum_{i,j} F_{i,j,2003}.COEF_{i,j}}{\sum_{j} GEN_{j,2003}} \therefore EF_{OM,simple\_adjusted,2003} = 405\ tCO_2/GWh$$

The Operating Margin emission factor is then calculated as the weighted average of the above numbers and the total electricity dispatched by the plants analyzed in each of the considered years. This gives:

$$EF_{OM,simple\_adjusted,2001-2003} = 452\ tCO_2/GWh$$

Build Margin Calculation

AM0015 gives two options for calculating the build margin emission factor. In this case, the second option presented is the one chosen, where the build margin emission factor is calculated taking into account the power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

As stated in the methodology, the Build Margin can be determined as:

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

Applying the pertinent ONS data for this determination, EF_{BM} is:

$$EF_{BM} = 96{,}1\ tCO_2/GWh$$

Electricity Emission Factor Calculation

The combined margin is determined according to AM0015 as:

$$EF_{electricity} = w_{OM} EF_{OM} + w_{BM} EF_{BM}$$

Applying the default values for w_{OM} and w_{BM}, in accordance with AM0015, the emission factor is:

$$EF_{electricity} = 274\ tCO_2e/GWh.$$

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

$BE_{electricity,y}$ = 0,274 tCO_2/MWh . EG_y (in tCO_2e), where EG_y is the electricity purchased in year y for the operation of the degassing and flaring facilities.

Moreover, other ONS data was required, this one obtained through the manager's website and direct communication with it. Such information is necessary to calculate the lambda factor, and the load duration curves from which the factor was inferred are shown below.

Below the Load Duration Curves obtained with data from ONS (www.ons.org.br) used to calculate the lambda factor for the subsystem S/SE/MW, to which EPLGP will be connected. The calculated values are shown in the table below:

Lambda Determination	
Year	**Value**
2001	0,457
2002	0,550
2003	0,582
Mean average	0,529

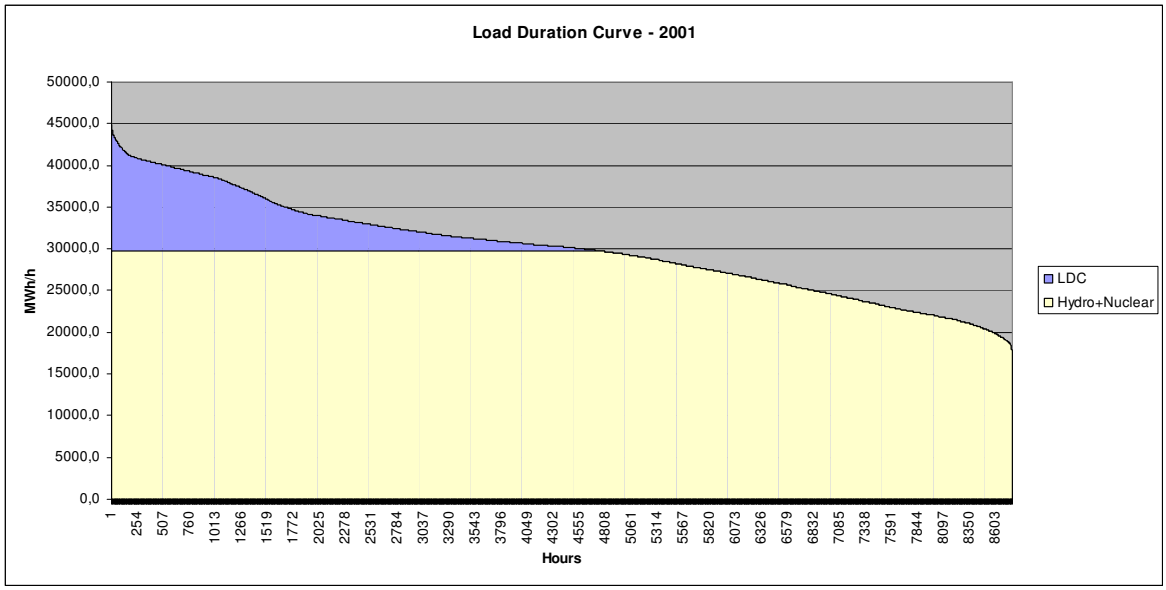


Figure A1: 2001 Load Duration Curve S/SE/MW (source: ONS – Operador Nacional do Sistema)

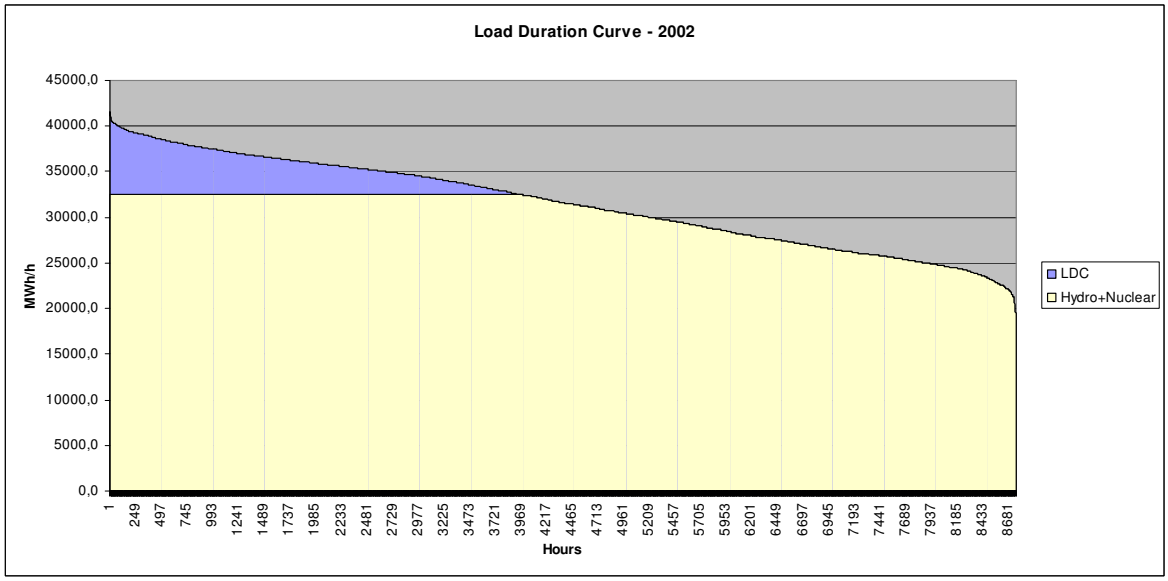


Figure A2: 2002 Load Duration Curve S/SE/MW (source: ONS – Operador Nacional do Sistema)

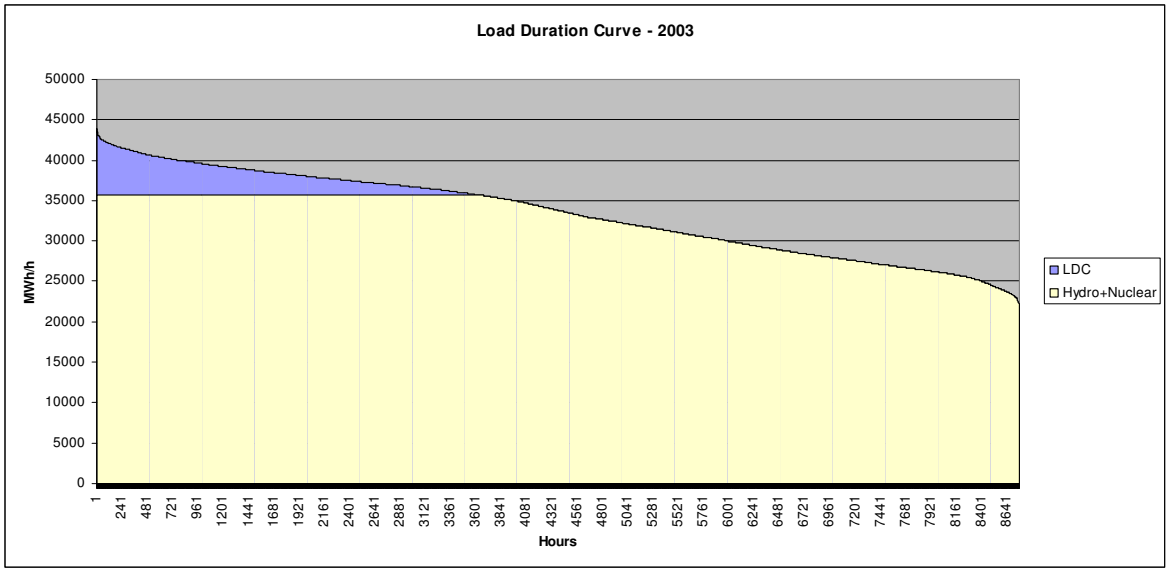


Figure A3: 2003 Load Duration Curve S/SE/MW (source: ONS – Operador Nacional do Sistema)

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.

The first two will be measured on a continuous basis, through proper meters and analyzers for such purposes. The other one is to be carried out on an often basis, most likely on an annual basis.

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**