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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

CDR Pedreira Landfill Gas Project (EPLGP)
Version 2
05/09/2006

A.2. Description of the project activity:

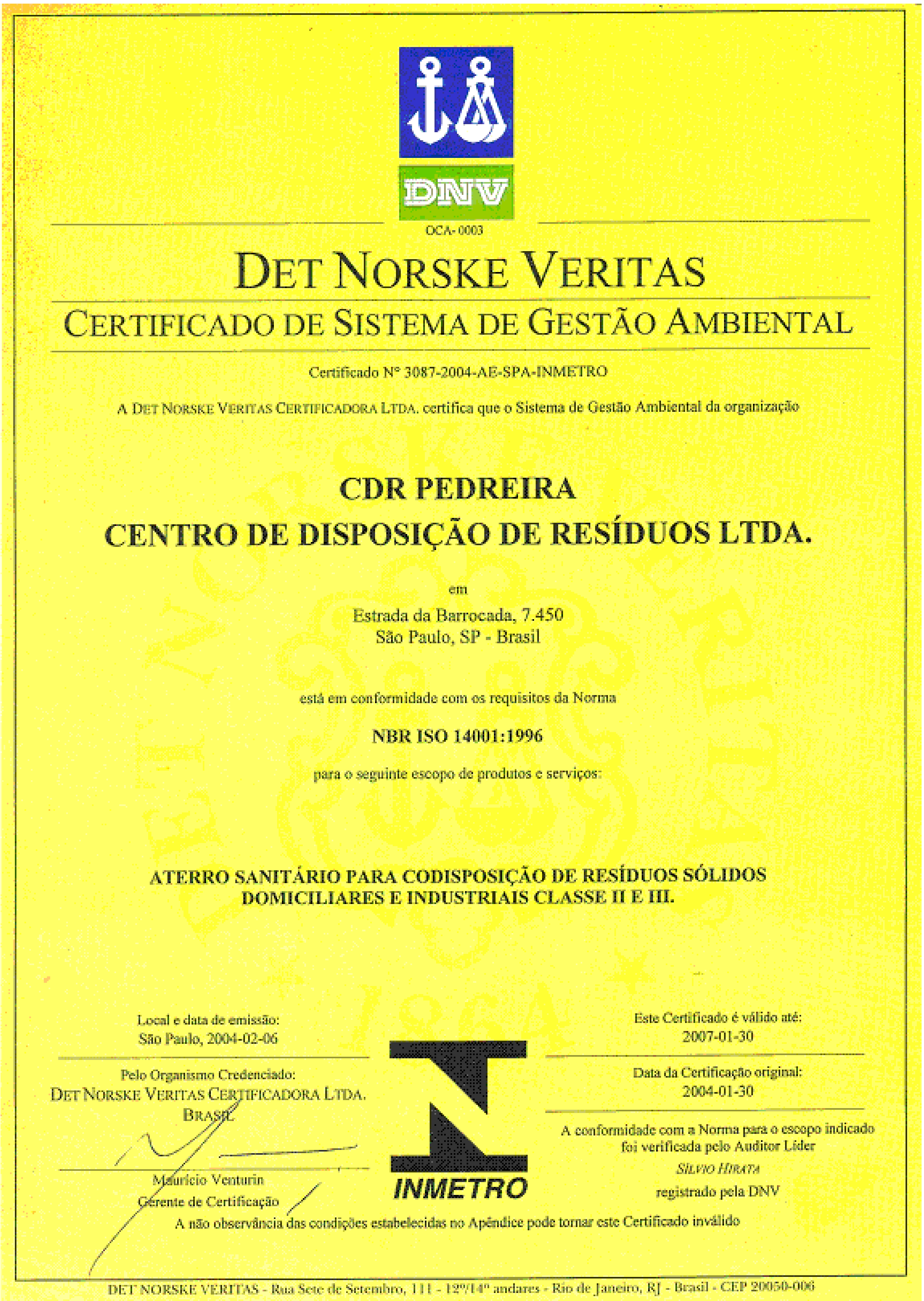
The EPLGP aim is to capture and flare the landfill gas produced at CDR Pedreira, landfill owned by CDR Pedreira – CENTRO DE DISPOSIÇÃO DE RESÍDUOS LTDA. and located in São Paulo, to avoid emissions of methane to the atmosphere.

CDR Pedreira landfill started operation in October 2001 and was designed to be a center of excellence in the treatment and waste disposal in São Paulo. A mining site was used to install the landfill. The landfill's total area is 562.052 m^2, of which 412.437 m^2 are still available. An additional area of 290.400 m^2 is used as a legal green belt reserve. The CDR Pedreira landfill has the capacity to receive 16,7 million tones of waste. The landfill counts with 3 main clients, which dispose approximately 360 ton/day in the landfill. CDR Pedreira landfill fulfills all technical and environmental requirements applicable for both household and industrial waste treatment.

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

Respecting current environmental legislation and good practices for landfill projects, construction and operation, CDR Pedreira landfill is licensed from both the State Secretary of Environment (Secretaria do Estado do Meio Ambiente – SMA) and the state of São Paulo environmental agency (Companhia de Tecnologia de Saneamento Ambiental – CETESB) for the treatment and disposal of household and industrial waste. CDR Pedreira landfill ISO 14001 Certificate in 2004 (Figure 1).

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



DNV

OCA- 0003

DET NORSKE VERITAS

CERTIFICADO DE SISTEMA DE GESTÃO AMBIENTAL

Certificado N° 3087-2004-AE-SPA-INMETRO

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

CDR PEDREIRA
CENTRO DE DISPOSIÇÃO DE RESÍDUOS LTDA.

em
Estrada da Barrocada, 7.450
São Paulo, 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.

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

Pelo Organismo Credenciado:
DET NORSKE VERITAS CERTIFICADORA LTDA.
BRASIL

Maurício Venturin
Gerente de Certificação

INMETRO

Este Certificado é válido até:
2007-01-30

Data da Certificação original:
2004-01-30

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 1 - ISO 14001 Certificate

A.3. Project participants:

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity (ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Brazil (host)	• Brazilian Private entity: CDR Pedreira – CENTRO DE DISPOSIÇÃO DE RESÍDUOS LTDA. • Brazilian Private entity: Econergy Brasil Ltda	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party (ies) involved is required.		

One of CDR Pedreira – CENTRO DE DISPOSIÇÃO DE RESÍDUOS LTDA.'s shareholders is ESTRE (Empresa de Saneamento e Tratamento de Resíduos), 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 II-A and II-B[1], generated by municipalities, commerce and industrial companies.

ESTRE is present in the main metropolitan centres 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.

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

CDR Pedreira landfill is located in the Northeast region of São Paulo, capital of São Paulo state, at Estrada da Barrocada, 7 450 – Tremembé district.

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:

São Paulo

[1] Residues in Brazil are classified under standard NBR 1004, from ABNT, from November 2004. Class I residues are classified as hazardous or present one of the following characteristics: flammability, power of corrosion, reactive properties, toxicity and pathogenicity. Class II residues are classified as non-hazardous residues and divided into II-A Class – Non-Inerts, not classified as Class I residues nor Class II-B, might present the following characteristics: biodegradability, power of combustion or water solubility. Class II-B residues are inerts, not presenting constitutants when solubilized in standard above the potable water.

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

Figure 2 shows the location of São Paulo and CDR Pedreira.

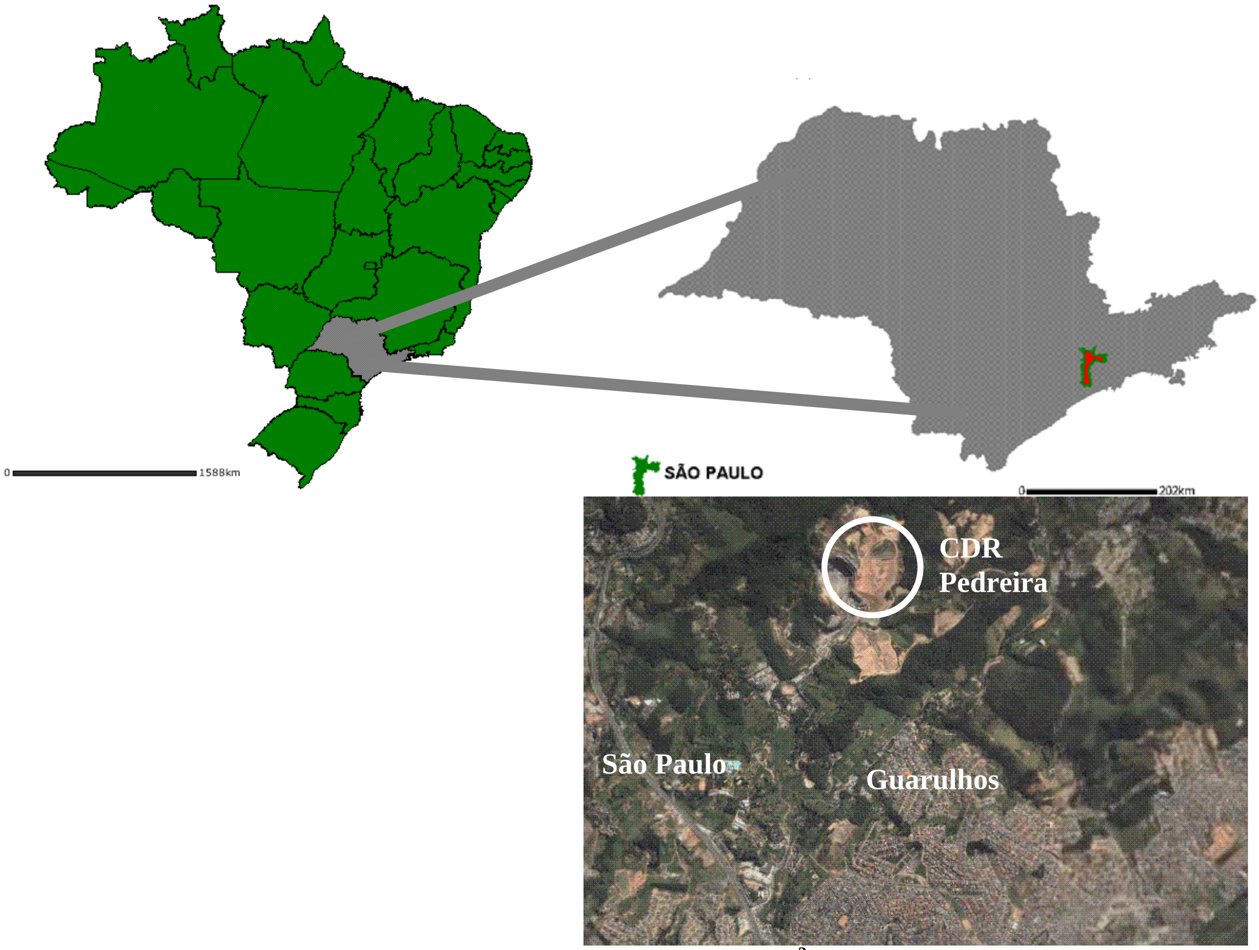


Figure 2. São Paulo location (Source: IBGE[2])

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:

The technology to be employed will be the improvement of landfill gas collection and flaring, through the installation of an active recovery system composed by a collection and transportation pipeline network and a flaring system, as shown in Figure 3.

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

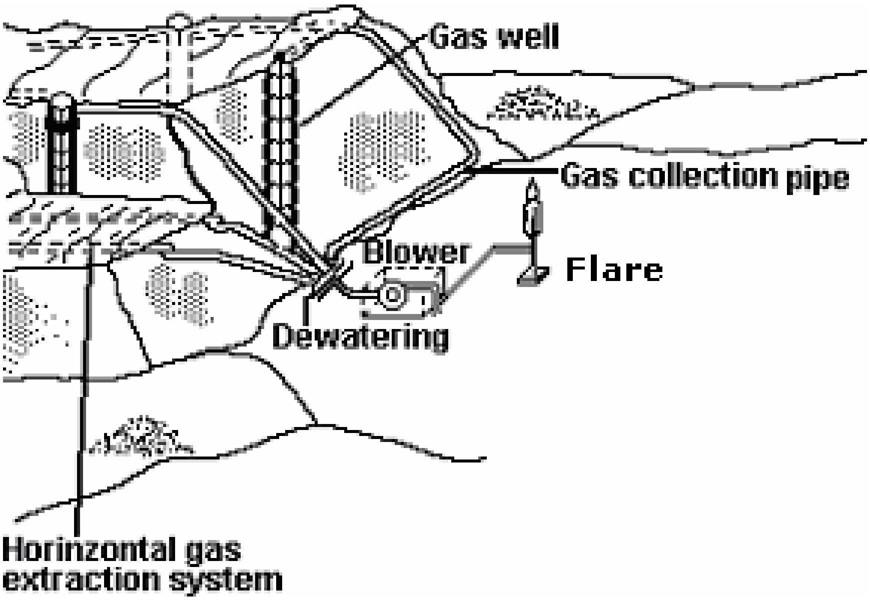


Figure 3 - Schematic situation of a landfill with active gas recovery (Source: WILHELM, 1991 .)

Following concrete examples from other landfill gas projects in the world, the EPLGP may involve the installation of wellheads at the existing concrete wells to avoid the emission of methane to the atmosphere. An example of wellhead and the detail of its construction are shown on Figure 4 and Figure 5.

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

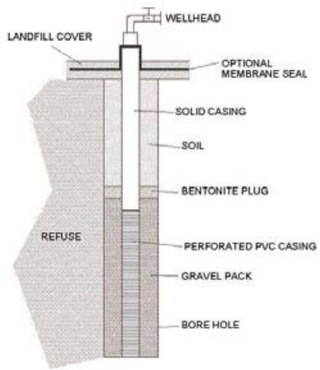


Figure 5. Internal detail of a well and wellhead

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

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

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

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

Figure 6. Example of manifold, connected with the transmission pipeline

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

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

Figure 7. Example of a transmission pipeline

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

Figure 8. Example of flares (source: Biogás Ambiental)

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

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

A.4.4. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed CDM project activity, including why the emission reductions would not occur in the absence of the proposed project activity, taking into account national and/or sectoral policies and circumstances:

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

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

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

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

Years	Annual estimation of emission reductions in tonnes of CO_2e
2007	143 285
2008	169 288
2009	194 141
2010	220 600
2011	252 484
2012	286 629
2013	320 833
Total estimated reductions (tonnes of CO_2e)	**1 587 260**
Total Number of crediting years	**7**
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	**226 751**

A.4.5. Public funding of the project activity:

There is no Annex I 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 ACM0001 – version 4: *"Consolidated baseline methodology for landfill gas project activities"*

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

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

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

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

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

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

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

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

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

So, the formula is updated to:

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

The EPLGP does not have any contractual obligations to burn methane; so, as suggested by Approved Methodology AM0003, $MD_{reg, y}$ is calculated based on the “Adjustment Factor”, a value estimated as 20% of total methane produced at the baseline that is flared due to odor and security concerns:

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

and

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

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

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

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

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

and

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

$MD_{flared,y}$ = quantity of methane destroyed by flaring during year y (tCH_4);
$LFG_{flared,y}$ = quantity of landfill gas flared during the year (Nm^3_{LFG});
$w_{CH4,y}$,= methane fraction of the landfill gas (Nm^3CH_4/Nm^3_{LFG});
D_{CH4} = methane density (0,0007168 tCH_4/Nm^3CH_4 at 0^oC and 1,013 bar);
FE = flare efficiency (%);

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

B.3. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity:

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

Step 0. Preliminary screening based on the starting date of the project activity
Since the EPLGP will start its activities after the prompt-start date of 18/11/2004, the project participants will not benefit from the crediting period starting prior to the registration of the project activity.
Thus Step 0 is not applicable.

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

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

Sub-step 1b: Enforcement of applicable laws and regulations
The alternative, which is to continue with the business as usual situation before the decision of implementing this CDM project activity is consistent with Brazilian laws and regulations.

Step 2. Investment analysis

Sub-step 2a. Determine appropriate analysis method
As the CDM project activity does not generate any financial or economic benefit other than CDM related income, the simple cost analysis scenario is applied.

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

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

Step 4. Common practice analysis

Sub-step 4a: Analyze other activities similar to the proposed project activity
According to the latest official statistics on urban solid waste in Brazil – *Pesquisa Nacional de Saneamento Básico 2000* (PNSB 2000[4]) – the country produces 228.413 tons of waste per day, which corresponds to 1,35 kg/inhabitant/day. And though there is a worldwide trend towards reducing, reusing and recycling, therefore reducing the amount of urban solid waste to be disposed in landfills, the situation in Brazil is peculiar. Most of the waste produced in the country is sent to open dumps which are, in most of the cases, areas without any sort of proper infrastructure to avoid environmental hazards. Figure 9 shows the final destination of waste per municipality, according to PNSB 2000.

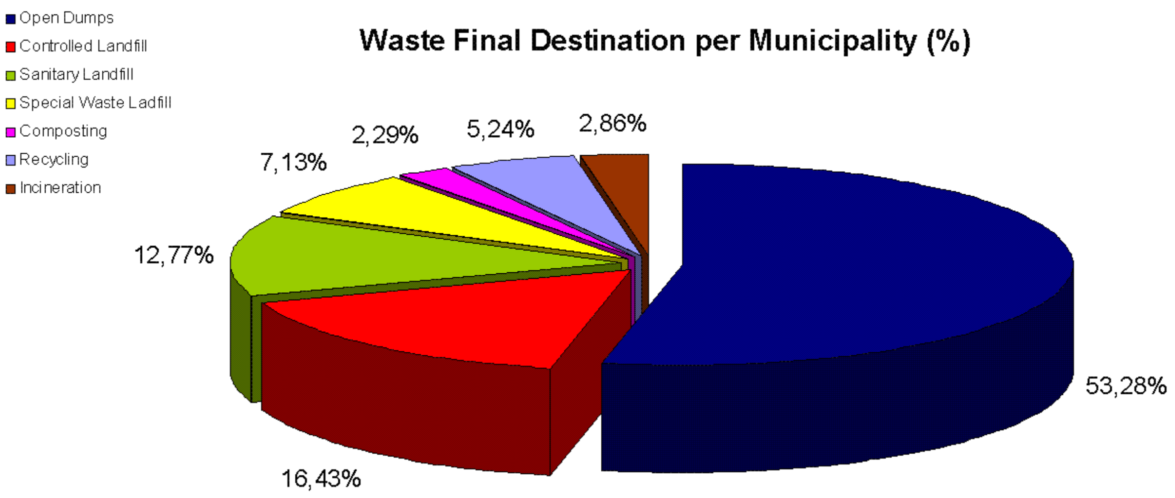


Figure 9. Waste Final Destination per Municipality in Brazil (Source: PNSB, 2000)

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

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

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

Step 5. Impact of CDM registration

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

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

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

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

The boundary is the project activity site, where the landfill operations and LFG emissions take place and where gas flaring will take place.

Figure 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 05/09/2006, by Econergy Brasil. Contact information on Annex I.

SECTION C. Duration of the project activity / Crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

01/01/2007

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

21 years 0 months

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

C.2.1. Renewable crediting period

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

01/01/2007

C.2.1.2. Length of the first crediting period:

7 years 0 months

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

Not applicable

C.2.2.2. Length:

Not applicable

SECTION D. Application of a monitoring methodology and plan

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

The methodology applied to EPLGP is ACM0001 – version 4: *"Consolidated monitoring methodology for landfill gas project activities"*.

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

This methodology is applicable to the EPLGP because the baseline scenario is the partial or total atmospheric release of the gas and the project activities is the capture of the gas through a blower and the installation of a collecting system and the use of a flare to burn the methane. Moreover, the baseline methodology for the project is also ACM0001 – version 4, in accordance with the monitoring methodology. Therefore, ACM0001 – version 4 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

Not applicable

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

Not applicable

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

Not applicable

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

Not applicable

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
2. $LFG_{flare,\,y}$	Amount of landfill gas sent to flares	Flow meter	m^3	m	Continuously	100%	Electronic and paper	Measured by a flow meter. Data will be aggregated monthly and yearly.
5. FE	Flare/combustion efficiency determined by the operation hours (1) and the methane content in the exhaust gas (2)	Flare fabricant	%	*m/c*	(1) Continuously (2) Enclosed flares shall be monitored yearly, with the first measurement to be made at the time of installation	100%	Electronic and paper	(1). Continuous measurement of operation time of flare (e.g. with temperature or run time meter) (2) The enclosed flares shall be operated and maintained as per the specifications prescribed by the manufacturer.
6. $w_{CH4,\,y}$	Methane fraction in the landfill gas	Gas analyzer	m^3_{CH4}/m^3_{LFG}	m	Continuously	100%	Electronic and paper	Measured by continuous gas quality analyzer.
7. T	Temperature of the landfill gas	Temperature sensor	^oC	m	Continuously	100 %	Electronic and paper	Measured to determine the density of methane D_{CH4}.
8. p	Pressure of the landfill gas	Pressure sensor	kPa	m	Continuously	100%	Electronic and paper	Measured to determine the density of methane D_{CH4}.

10 EL_{IMP}	Total amount of Electricity imported to meet project requirement	Electricity meter installed in the blower	MWh	m	Continuously	100%	Electronic and paper	Required to determine CO_2 emissions from use of electricity to operate the project activity.
11.	CO_2 emission intensity of the electricity	Calculated	tCO_2e/MWh	*c*	In the validation and in the baseline renewal	0%	Electronic and paper	Required to determine CO_2 emissions from use of electricity to operate the project activity
13.	Regulatory requirements relating to landfill gas projects	Laws	text	n/a	In the validation and in the baseline renewal	100%	Paper	Required for any changes to the adjustment factor (AF) or directly $MD_{reg, y}$.

Obs 1: All data from the table above will be archived according to internal procedures, until 2 years after the end of the crediting period.
Obs 2: According with the Meth Panel's recommendation AM_CLA_0028 and ACM0001, when a landfill project only flares the methane, only one flow-meter must be installed provided that the meter used is calibrated periodically by an officially accredited entity.

Note that for the "Simple Adjusted OM" as well as the "BM, was chosen a data vintage based on ex ante Monitoring. Thus, it will be required to recalculate the combined margin at any renewal of a crediting period, using steps 1-3 in the baseline methodology ACM0002.

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

$EF_{OM,simple\_adjusted,y} = (1-\lambda_y)\frac{\sum_{i,j} F_{i,j,y}.COEF_{i,j}}{\sum_{j} GEN_{j,y}} + \lambda_y \frac{\sum_{i,k} F_{i,k,y}.COEF_{i,k}}{\sum_{k} GEN_{k,y}}$ (tCO_2e/GWh) $EF_{BM} = \frac{\sum_{i,m} F_{i,m,y}.COEF_{i,m}}{\sum_{m} GEN_{m,y}}$ (tCO_2e/GWh) $EF_{electricity} = \frac{EF_{OM} + EF_{BM}}{2}$ (tCO_2e/GWh) $\mathbf{PE_y} = EL_{IMP} \times CEF_{electricity}$	$F_{i,j(or\ m),y}$ Is the amount of fuel i (in a mass or volume unit) consumed by relevant power sources j in year(s) y *j,m* Refers to the power sources delivering electricity to the grid, not including low-operating cost and must-run power plants, and including imports from the grid $COEF_{i,j(or\ m)\ y}$ Is the CO2 emission coefficient of fuel i (tCO2 / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources j (or m) and the percent oxidation of the fuel in year(s) y, a $GEN_{j(or\ m),y}$ Is the electricity (MWh) delivered to the grid by source j (or m) $CEF_{electricity}$ Is the CO2 baseline emission factor for the electricity. PE_y: Are the project emissions during the year y in tons of CO_2;

	EL_{IMP} are the electricity consumed by the blower during the year *y*, in MWh

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

D.2.3. Treatment of leakage in the monitoring plan

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

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

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

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

Left blank on purpose.

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

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

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

ER_y = emission reductions of the project activity in year *y* (tCO_2e);

$MD_{project,\,y}$ = quantity of methane destroyed at year *y* (tCH_4);

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

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

So, the formulae is updated to:

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

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

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

and

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

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

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

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

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

and

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

$MD_{flared,y}$ = quantity of methane destroyed by flaring during year y (tCH_4);
$LFG_{flared,y}$ = quantity of landfill gas flared during the year (Nm^3_{LFG});
$w_{CH4,y}$,= methane fraction of the landfill gas (Nm^3CH_4/Nm^3_{LFG});
D_{CH4} = methane density (0,0007168 tCH_4/Nm^3CH_4 at 0^oC and 1,013 bar);
FE = flare efficiency (%);

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

In other words, ER_y is equal to:

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

D.3. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored		
Data *(Indicate table and ID number e.g. 3.-1.; 3.2.)*	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
2. $LFG_{flare,y}$	*Low*	Flow meters should be subject to a regular maintenance and testing regime to ensure accuracy.
5. FE	*Medium*	Regular maintenance should ensure optimal operation of flares. As EPLGP will install an enclosed flare, flare efficiency should be checked yearly, with the first measurement to be made at the installation.
6. $w_{CH4,y}$	*Low*	Gas analyzer should be subject to a regular maintenance and testing regime 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.
The team and the operational and management structure and the responsibility of each member will be defined by the time of the project operation.

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

This monitoring study was concluded on 05/09/2006, by Econergy Brasil. Contact information in Annex I.

SECTION E. Estimation of GHG emissions by sources

E.1. Estimate of GHG emissions by sources:

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

As demonstrated on Annex 3, the EF for the S-SE-CO Brazilian electric grid is equal to 0,2611 tCO_2e/MWh. Assuming that the blower is estimated to need around 3.000 MWh/year, the emission due to the import of electricity equals to 783 tCO_2e/year. This data is determined *ex-ante*.

E.2. Estimated leakage:

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

Thus, **Ly = 0**.

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

$E.1 + E.2 = 0,2611 \times 3000 + 0 = 783$ tCO_2e/year

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

GHG emissions by sources in the baseline were estimated using IPCC's guidelines[5]. In the case of EPLGP, the derivative of first order decay model approach was used:

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

, where:

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

To summarize, relevant factors for landfill gas estimation are:

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

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

CDR Pedreira provided waste flow data from year 2001 to year 2005 together with the estimative for 2006 through 2020.

According with USEPA[6], a collection efficiency for energy recovery between 75% and 85% sounds reasonable "because each cubic foot of gas will have a monetary value to the owner/operator". A conservative value of 65% of collection efficiency was adopted for EPLGP. So, $LFG_{flare,y}$ is equal to 65% of total landfill gas emitted to the atmosphere at the baseline

Also, according with flare manufacturers, an enclosed flare at determined conditions of temperature and residence time of the gas inside the combustion chamber might destroy above 99% of the methane. Although this value could be use as standard value, for conservative reasons it shall be adopted a 90% flare efficiency value.

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

$$MD_{project,y} = 0,8 \times 0,65 \times \frac{k \times R_y \times L_0 \times \sum_{i=y}^{T} \sum_{j=y}^{i} \left[e^{-k(i-j)} \right]}{F} \times w_{CH_4} \times D_{CH_4} \times 0,9 \times 21$$

or

$$MD_{project,y} = 0,52 \times \frac{k \times R_y \times L_0 \times \sum_{i=y}^{T} \sum_{j=y}^{i} \left[e^{-k(i-j)} \right]}{F} \times w_{CH_4} \times D_{CH_4} \times 0,9 \times 21$$

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

$$ER_y = \left(0,52 \times \frac{k \times R_y \times L_0 \times \sum_{i=y}^{T} \sum_{j=y}^{i} \left[e^{-k(i-j)} \right]}{F} \right) \times w_{CH_4} \times D_{CH_4} \times 0,9 \times 21 - EC_y \times EF$$

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

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

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

Year	Estimation of project activity emission (tonnes of CO_2e)	Estimation of the baseline emission (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of emission reductions (tonnes of CO_2e)
2007	783	144 068	0	143 285
2008	783	170 072	0	169 288
2009	783	194 924	0	194 141
2010	783	221 383	0	220 600
2011	783	253 267	0	252 484
2012	783	287 412	0	286 629
2013	783	321 617	0	320 833
Total (tonnes of CO_2e)	**5 483**	**1 592 743**	**0**	**1 587 260**

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 CETESB – São Paulo environmental agency. CDR Pedreira has all the licenses for the landfill’s operation, and will carry out the necessary process in order to obtain the Operational License for the EPLGP’s facilities.

According to the “Resolução CONAMA 01”, all pollution sources must be analyzed via an EIA – Estudo de Impacto Ambiental. CDR Pedreira developed an EIA to the landfill’s environmental licencing process. The conclusion of the Assess was that the landfill is adequate from the environmental point of view. The environmental impacts analyzed are low and the ecosystem is capable to absorb possible changes on its actual quality.

The landfill encompasses different systems of environmental protection and is also benefit the area used to belong to a mining company and the operation of the landfill, as described, will recover all impacts from the previous activity.

The adoption of these two practices – natural resources protection systems and the use of an old mining area - generates an economy of the region’s natural resources as the same area will be recovered and used to install a pollution source that might have minimum impact if operated as described.

The CDR Pedreira landfill’s License is shown in Figure 11 and Figure 12.

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

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

02

Processo Nº 29/00930/00

Nº 29002236

Data 06/09/2005

LICENÇA DE OPERAÇÃO PARCIAL
VALIDADE ATÉ : 06/09/2010

de Novo Estabelecimento LO PARCIAL

IDENTIFICAÇÃO DA ENTIDADE

Nome: CDR PEDREIRA - CENTRO DE DISPOSIÇÃO DE RESÍDUOS LTDA.
CNPJ: 04.434.120/0001-58
Logradouro: ESTRADA DA BARROCADA
Cadastro na CETESB: 100 - 47281 - 6

Número	Complemento	Bairro	CEP	Município
7450		TREMEMBÉ	02282-000	SÃO PAULO

CARACTERÍSTICAS DO PROJETO

Atividade Principal

Descrição	Código
ATERRO SANITÁRIO	9000-0/02

Bacia Hidrográfica: 2 - TIETÊ ALTO ZONA METROPOLITANA
UGRHI: 6 - ALTO TIETÊ
Corpo Receptor:
Classe: 4

Área (metro quadrado)

Terreno	Construída	Atividade ao Ar Livre	Novos Equipamentos	Lavra(ha)
1022231,00		15615,00		

Horário de Funcionamento (h) Início		Término	Número de Funcionários Administração	Produção	Licença de Instalação Data	Número
06:00	às	06:00	5	20	30/03/2001	29000813

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

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

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

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

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

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

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

A renovação da licença de operação deverá ser requerida com antecedência mínima de 120 dias, contados da data da expiração de seu prazo de validade.

0956646

USO DA CETESB: SD Nº 29003082

EMITENTE: Local São Paulo

ENTIDADE

AUTENTICAÇÃO

06 SET 2005

CETESB COMPANHIA DE TECNOLOGIA DE SANEAMENTO AMBIENTAL

Engº MAURO KAZUO SATO
Gerente da Agência
Ambiental de Santana
Reg. 01.2595-4 CREA 87 716/D

Pág. 1

AUTENTICAÇÃO
0673AC075205

Figure 11. CDR Pedreira Operational Licence (page 1 of 2)

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

02

Processo Nº 29/00930/00

LICENÇA DE OPERAÇÃO PARCIAL

Nº 29002236

Data 06/09/2005

EXIGÊNCIAS TÉCNICAS

1. Fica proibida a emissão de substâncias odoríferas na atmosfera, em quantidades que possam ser perceptíveis fora dos limites de propriedade do empreendimento.
2. Deverá ser apresentado cronograma detalhado de execução das obras de infra-estrutura da segunda etapa do aterro.
3. Quanto ao encaminhamento de líquidos percolados à Estação de Tratamento de Esgotos da SABESP, por caminhão-tanque, a empresa deverá manter registro diário das viagens, com identificação dos veículos e dos volumes transferidos. Informar à CETESB, trimestralmente, os totais de viagens e volumes de líquidos percolados transportados. Os líquidos percolados deverão atender aos padrões do artigo 19-A do Regulamento da Lei nº 997/76, aprovado pelo Decreto nº 8468/76.
4. Não poderão ser dispostos no aterro resíduos contendo líquidos livres, conforme estabelecido na norma NBR 13.896 - "Aterros de Resíduos Não Perigosos - Critérios para Projeto, Implantação e Operação". Para tal verificação, deverá ser utilizada a norma NBR 12.988 - " Líquidos Livres - Verificação em Amostra de Resíduo".
5. Os resultados das análises de monitorização da qualidade das águas superficiais e subterrâneas deverão ser expressos em escala equivalente àquela indicada nos valores máximos permitidos pela legislação, ou seja, a Resolução CONAMA nº 357/2005 e Portaria nº 36 de 19/01/90 do Ministério da Saúde, para possibilitar eventuais confrontações. Deverão ser também apresentados com a indicação das metodologias empregadas.
6. Deverá ser mantida anualmente até 31 de janeiro do ano subsequente, a apresentação do relatório compreendendo a tabulação dos resultados das monitorações realizadas e quantidade de resíduos recebida no ano anterior, juntamente com as correlações dos dados de pluviometria e de geração de líquidos percolados.

OBSERVAÇÕES:

1. A presente licença refere-se a implantação da Etapa 1 do aterro para codisposição de resíduos sólidos domiciliares e industriais classe II e III, para a área de atividade ao ar livre de 15.615,00m².

CETESB COMPANHIA DE TECNOLOGIA DE SANEAMENTO AMBIENTAL
Engº MAURO KAZUO SATO
Gerente da Agência Ambiental de Santana
Reg. 01.2505-1 CREA 67.719/D

16 SET 2005

AUTENTICAÇÃO
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ENTIDADE

Pag 2

Figure 12. CDR Pedreira Operational Licence (page 2 of 2)

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

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

The CDR Pedreira landfill is one of the few landfills that has the Environmental License from CETESB. It can be stated that CDR Pedreira – CENTRO DE DISPOSIÇÃO DE RESÍDUOS LTDA. is totally committed with the environmental integrity in its practices.

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

SECTION G. Stakeholders' comments

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

As required by the Interministerial Commission on Global Climate Change, the Brazilian DNA, invitations must be sent for comments to local stakeholders as part of the procedures for analyzing CDM projects and issuing letters of approval. This procedure was followed by CDR Pedreira – CENTRO DE DISPOSIÇÃO DE RESÍDUOS LTDA.to take its GHG mitigation initiative to the public. Letters and the Executive Summary of the project were sent to the following recipients:

- Prefeitura Municipal de São Paulo – SP / *Municipal Administration of São Paulo – SP*.
- Secretaria do Verde e Meio Ambiente/ *Municipal Secreteriat of Environment of São Paulo – SP*.
- Câmara Municipal de São Paulo – SP / *Municipal Legislation Chamber of São Paulo –SP;*
- Ministério Público Estadual / *State Prosecutor's Office ;*
- Fórum Brasileiro de ONGs / *Brazilian NGO Forum ;*
- CETESB – Companhia de Tecnologia de Saneamento Ambiental / *Environmental Agency of the State of São Paulo;*
- Secretaria de Estado do Meio Ambiente */ Environment Secretary of State;*
- Rotary Clube de São Paulo - SP / *Rotary Club of São Paulo – SP*.

G.2. Summary of the comments received:

A comment from *Secretaria de Estado do Meio Ambiente* was received. According with the comment, project with landfill gas recovery are useful and present a lot of benefits. However, the project must be in accordance with the local legislation. Also, the material sent does not mention the quantitative of NOx emitted, the CERs produced and a future production of electricity or thermal energy, which could increase the benefits related to the baseline scenario.

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

ESTRE appreciated the comment from *Secretaria de Estado do Meio Ambiente de Itapevi* and argued that the material sent for analysis is only an idea of the project and its benefits related to the global warming. The amount of CERs equivalent can be found in the PDD, which stayed in GSC process from 20 June 2006 to 19 July 2006. As the GSC version is preliminary and future recommendation could be made during the validation process, CDR Pedreira did not present the estimative and decided to wait until the final version, approved by the Brazilian DNA and submitted for registration to the EB.

About the energetic use of the landfill gas, CDR Pedreira informs that has been studding different ways to use the gas, as these alternatives have been widely applied in the US and in Europe. However, at this moment the estimative of landfill gas generation are not favourable, once the landfill started its operations only in 2001 and as most of the equipment produced are not economically interesting as are produced in Europe and in the US. Thus, any calculation made at this moment to estimate the production of landfill gas in the future might not reflects the reality as the landfill might receive more or less waste than the estimated and, consequently, produce more or less gas than the estimated.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Project Participant 1:

Organization:	CDR Pedreira – CENTRO DE DISPOSIÇÃO DE RESÍDUOS LTDA.
Street/P.O.Box:	Av. Presidente Juscelino Kubitschek, nº 1.830
Building:	Torre IV, 4º andar, sala 11
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State/Region:	SP
Postfix/ZIP:	04543-900
Country:	Brazil
Telephone:	+55 11 3706 8833
FAX:	+55 11 3078 3355
E-Mail:	alex@estre.com.br
URL:	http://www.estre.com.br
Represented by:	Alex Schlosser
Title:	Mr.
Salutation:	
Last Name:	Schlosser
Middle Name:	
First Name:	Alex
Department:	Environmental Manager
Mobile:	+ 55 11 7713 8562
Direct FAX:	+55 11 3078 3355
Direct tel:	+ 55 11 3076 8877
Personal E-Mail:	alex@estre.com.br

Project Participant 2:

Organization:	Econergy Brasil Ltda.
Street/P.O.Box:	Av. Angélica, 2530, cj 111
Building:	Edifício Reaynaldo Rucci
City:	São Paulo
State/Region:	SP
Postfix/ZIP:	01228-200
Country:	Brazil
Telephone:	+ 55 (11) 3555-5700
FAX:	+ 55 (11) 3555-5735
E-Mail:	-
URL:	http://www.econergy.com.br
Represented by:	
Title:	Mr.
Salutation:	
Last Name:	Diniz Junqueira / Cerchia
Middle Name:	Schunn
First Name:	Marcelo / Francesca
Department:	-
Mobile:	+55 (11) 8263-3017 / + 55 (11) 8584-2228
Direct FAX:	Same above
Direct tel:	+ 55 (11) 3555-5700
Personal E-Mail:	junqueira@econergy.com.br / cerchia@econergy.com.br

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no Annex 1 public funding for the EPLGP.

Annex 3

BASELINE INFORMATION

Table 1. Baseline determination information

DATA	VALUE	UNIT	SOURCE
L_0 (methane potential generation)	0,07	m^3_{CH4}/kg_{waste}	USEPA[7]
k (decay constant)	0,1	1/year	
Year of opening	2001		CDR Pedreira
Year of closure	2020		
R_x	Variable	kg_{waste}	
EAF (Emission Adjustment Factor)	20	%	

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

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

The data of annual waste disposal was give by CDR Pedreira – CENTRO DE DISPOSIÇÃO DE RESÍDUOS LTDA., from 2001 to 2005. Data from 2006 on were estimated by CDR Pedreira – CENTRO DE DISPOSIÇÃO DE RESÍDUOS LTDA.

Project Emissions due to electricity purchased were estimated through approved methodology ACM0002 – Consolidated methodology for grid-connected electricity generation from renewable sources – version 6. In order to gather the daily dispatch data, which allows for the application of option *b)* Simple adjusted OM, the manager of the electricity system (ONS) was consulted in order to provide the data.

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

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

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

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

Simple Adjusted Operating Margin Emission Factor Calculation

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

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

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

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

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 2003, 2004 and 2005.

The Lambda factors were calculated in accordance with methodology requests. The table below presents such factors.

Year	Lambda
2003	0,5312
2004	0,5055
2005	0,5130

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

Year	Electricity Load (MWh)
2003	288.933.290
2004	302.906.198
2005	314.533.592

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

$$EF_{OM,simple\_adjusted,2003} = (1-\lambda_{2003})\frac{\sum_{i,j} F_{i,j,2003}.COEF_{i,j}}{\sum_{j} GEN_{j,2003}} \therefore EF_{OM,simple\_adjusted,2003} = 0{,}4605 \text{ tCO}_2\text{/MWh}$$

$$EF_{OM,simple\_adjusted,2004} = (1-\lambda_{2004})\frac{\sum_{i,j} F_{i,j,2004}.COEF_{i,j}}{\sum_{j} GEN_{j,2004}} \therefore EF_{OM,simple\_adjusted,2004} = 0{,}4531 \text{ tCO}_2\text{/MWh}$$

$$EF_{OM,simple\_adjusted,2005} = (1-\lambda_{2005})\frac{\sum_{i,j} F_{i,j,2005}.COEF_{i,j}}{\sum_{j} GEN_{j,2005}} \therefore EF_{OM,simple\_adjusted,2005} = 0{,}3937 \text{ tCO}_2\text{/MWh}$$

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

$$EF_{OM,simple\_adjusted\ 2003\_2005} = \frac{EF_{OM,simple\_adjusted,2003} * \sum_{j} GEN_{j,2003} + EF_{OM,simple\_adjusted,2004} * \sum_{j} GEN_{j,2004} + EF_{OM,simple\_adjusted,2005} * \sum_{j} GEN_{j,2005}}{\sum_{j} GEN_{j,2003} + \sum_{j} GEN_{j,2004} + \sum_{j} GEN_{j,2005}} = 0{,}4349$$

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

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

Electricity generation in this case means 20% of total generation in the most recent year (2005), as the 5 most recent plants built generate less than such 20%. If 20% falls on part capacity of a plant, that plant is fully included in the calculation. Calculating such factor one reaches:

$$EF_{BM,2005} = 0{,}0872 \text{ tCO}_2\text{/MWh}$$

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:

$$EF_{electricity,2003-2005} = 0{,}5 * 0{,}4349 + 0{,}5 * 0{,}0872 = 0{,}2611 \text{ tCO}_2\text{/MWh}$$

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

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

Nevertheless, even after the interconnection was established, technical papers continue to divide the Brazilian system in three (Bosi, 2000)[8]:

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

Moreover, the ACM0002 version 6 suggests using the regional grid definition, in large countries with layered dispatch systems (e.g. state/provincial/regional/national), where DNA guidance is not available. A state/provincial grid definition may indeed in many cases be too narrow given significant electricity trade among states/provinces that might be affected, directly or indirectly, by a CDM project activity;

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.

The Brazilian electricity system nowadays comprises of around 101,3 GW of installed capacity, in a total of 1.482 electricity generation enterprises. From those, nearly 70% are hydropower plants, around 10% are natural gas-fired power plants, 4,5% are diesel and fuel oil plants, 3,2% are biomass sources (sugarcane bagasse, black liquor, wood, rice straw and biogas), 2% are nuclear plants, 1,4% are coal plants, and there are also 8,17 GW of installed capacity in neighboring countries (Argentina, Uruguay, Venezuela and Paraguay) that may dispatch electricity to the Brazilian grid[9]. This latter capacity is in fact comprised by mainly 5,65 GW of the Paraguayan part of *Itaipu Bi-national*, a hydropower plant operated by both Brazil and Paraguay, but whose energy almost entirely is sent to the Brazilian grid.

The approved methodology ACM0002 asks project proponents to account for "all generating sources serving the system". In that way, project proponents in Brazil should search for, and research, all power plants serving the Brazilian system.

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

In that regard, project proponents looked for a plausible solution in order to be able to calculate the emission factor in Brazil in the most accurate way. Since real dispatch data is necessary after all, the ONS was specifically contacted and the reason for data collection was explained. After several months of talks, plants' daily dispatch information was made available by ONS.

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

[9] www.aneel.gov.br

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[10], which includes capacity available in neighboring countries to export to Brazil and emergency plants, that are dispatched only during times of electricity constraints in the system. Such capacity in fact is constituted by plants with 30 MW installed capacity or above, connected to the system through 138kV power lines, or at higher voltages. Therefore, even though the emission factor calculation is carried out without considering all generating sources serving the system, about 76,4% of the installed capacity serving Brazil is taken into account, which is a fair amount if one looks at the difficulty in getting dispatch information in Brazil. Moreover, the remaining 23,6% are plants that do not have their dispatch coordinated by ONS, since: either they operate based on power purchase agreements which are not under control of the dispatch authority; or they are located in non-interconnected systems to which ONS has no access. In that way, this portion is not likely to be affected by the CDM projects, and this is another reason for not taking them into account when determining the emission factor.

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

IEA/ONS Merged Data Build Margin (tCO_2/MWh)	**ONS Data Build Margin (tCO_2/MWh)**
0,205	0,0872

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

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

From the mentioned reference:

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

Therefore only data for plants under construction in 2005 (with operation start in 2003, 2004 and 2005) 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 (2003 to 2005). For

[10] www.aneel.gov.br/arquivos/PDF/Resumo_Gráficos_mai_2005.pdf

that reason project participants find the application of such numbers to be not only reasonable but the best available option.

The aggregated hourly dispatch data received from ONS was used to determine the lambda factor for each of the years with available data (2003, 2004 and 2005). The Low-cost/Must-run generation was determined as the total generation minus the generation from fossil-fuelled thermal plants generation. All this information has been provided to the validators, and extensively discussed with them, in order to make all points crystal clear.

On the following pages, a summary of the analysis is provided. The Table 5 shows the summarized conclusions of the analysis of the emission factor calculation and Figures 13, 14 and 15 present the load duration curves for the S-SE-CO subsystem. Finally, the Figure 16 shows the estimated generation of methane in the baseline scenario and the methane captured and fired.

Table 2. Emission factors for the Brazilian South-Southeast-Midwest Subsystem

Emission factors for the Brazilian South-Southeast-Midwest interconnected grid

Baseline (including imports)	EF_{OM} [tCO2/MWh]	Load [MWh]	LCMR [MWh]	Imports [MWh]
2003	0,9823	288.933.290	274.670.644	459.586
2004	0,9163	302.906.198	284.748.295	1.468.275
2005	0,8086	314.533.592	296.690.687	3.535.252
	Total (2003-2005) =	**906.373.081**	**856.109.626**	**5.463.113**
	$EF_{OM, simple-adjusted}$ [tCO2/MWh]	$EF_{BM,2005}$	Lambda	
	0,4349	0,0872	λ_{2003}	
	Weights	**Default weights**	0,5312	
	w_{OM} = 0,50	w_{OM} = 0,5	λ_{2004}	
	w_{BM} = 0,50	w_{BM} = 0,5	0,5055	
	EF_y [tCO2/MWh]	Default EF_y [tCO2/MWh]	λ_{2005}	
	0,2611	0,2611	0,5130	

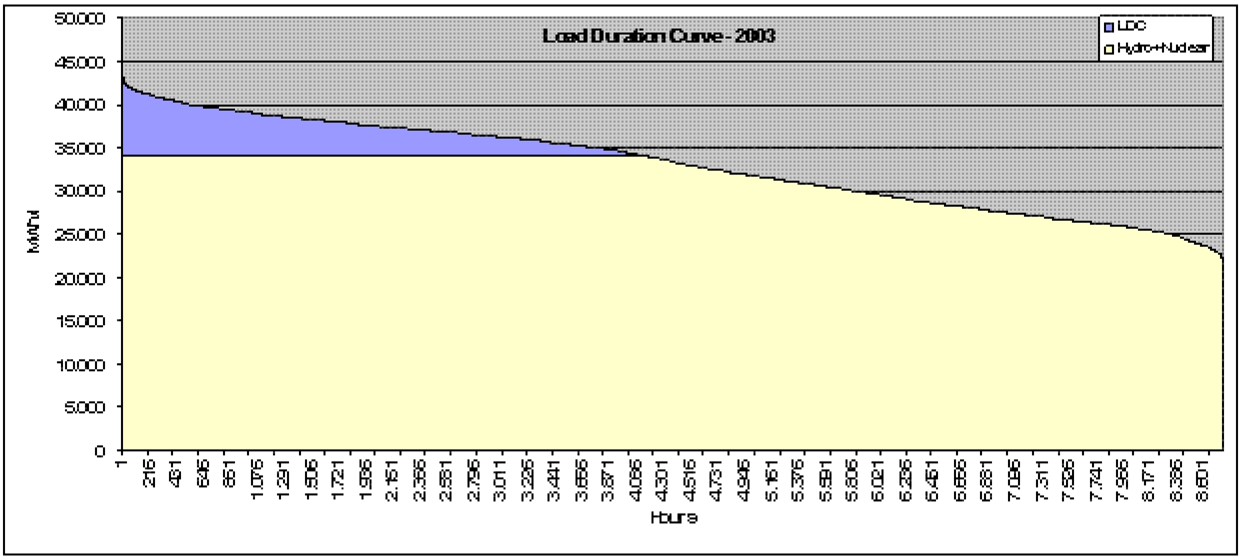

Figure 13. Load duration curve for the S-SE-CO subsystem, 2003

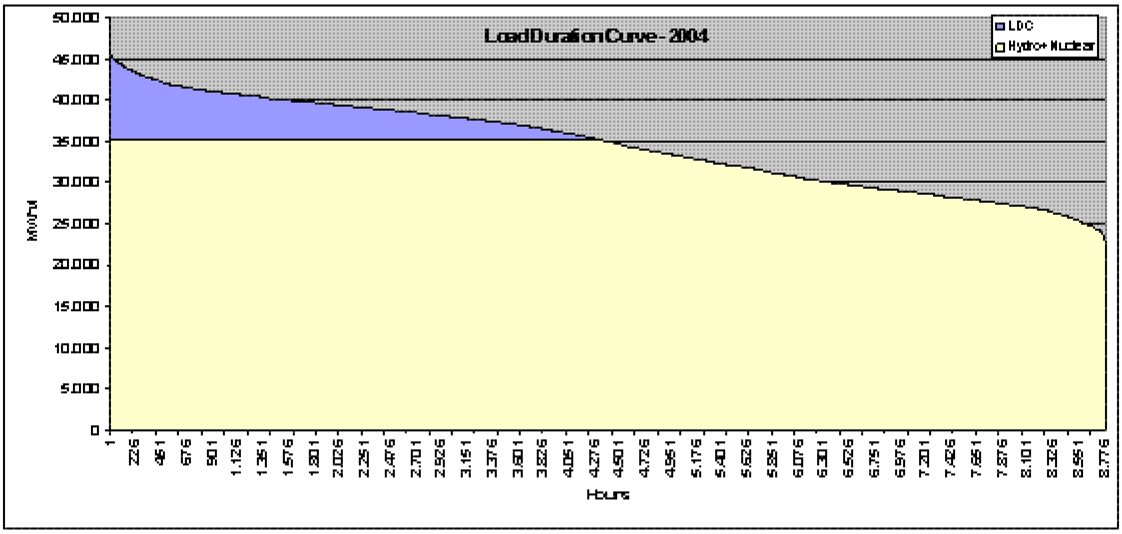

Figure 14. Load duration curve for the S-SE-CO subsystem, 2004

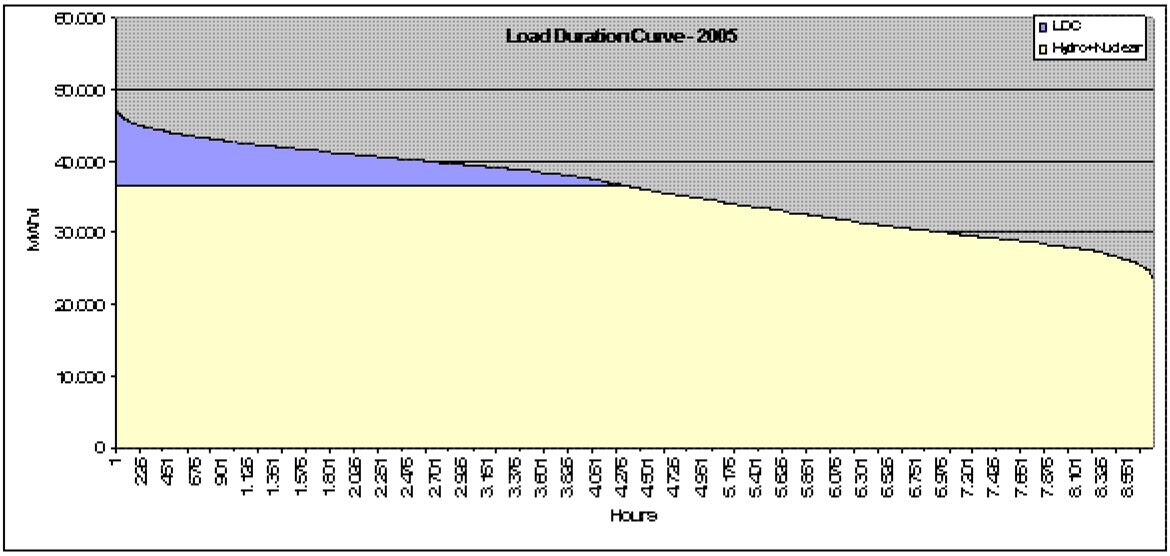

Figure 15. Load duration curve for the S-SE-CO subsystem, 2005

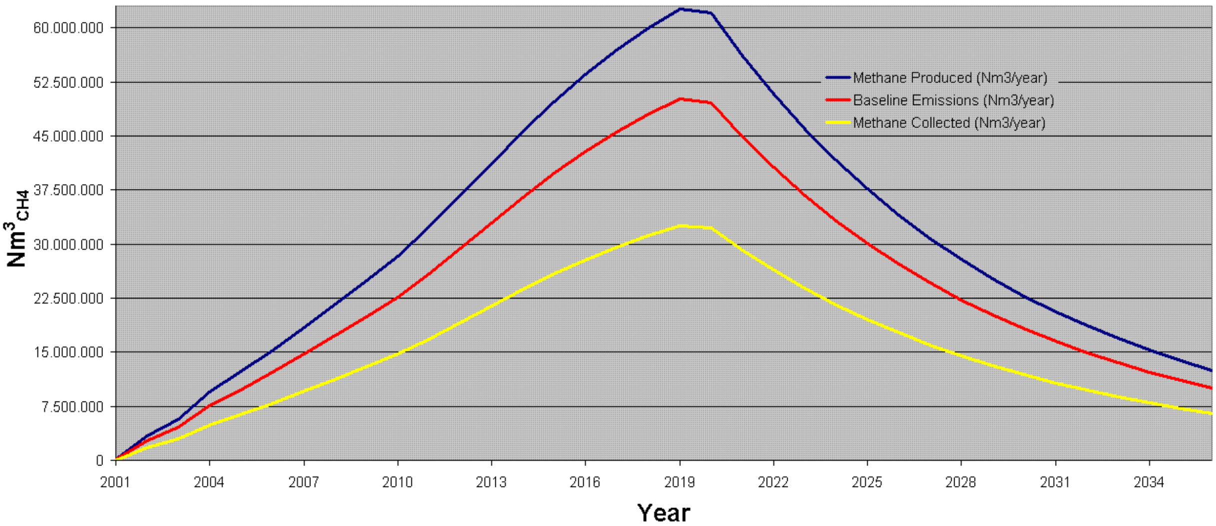

Figure 16. Methane estimative for EPLGP

Annex 4

MONITORING PLAN

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

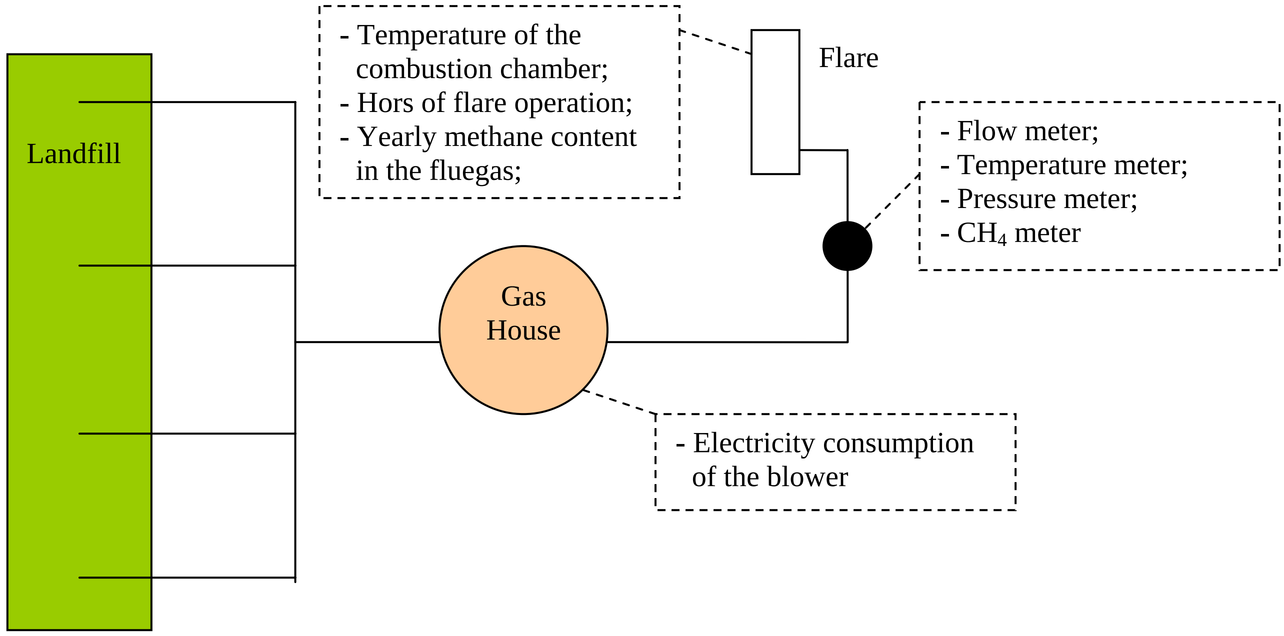

Figure 17. Scheme of the monitoring of EPLGP

- The amount of landfill gas being sent to flares;
- The amount of methane in the landfill gas;
- The flares' efficiencies:
  a) Temperature of the combustion chamber;
  b) Hours of .flare operation;
  c) Yearly analysis of methane content in the fluegas;
- The pressure of the gas;
- The temperature of the gas; and
- The electric consumption of the blower, in MWh.

Except from the flare efficiency, all other data need to be monitored continuously, through proper meters or analyzers. The flare efficiency will be measured continuously (by the operating hours of the flare and by the average temperature of the combustion chamber) and, as EPLGP will install an enclosed flare system (it's not defined how many flares will be installed), yearly with the first measurement to be made at the time of installation. through the percentage of methane in the fluegas.

Case more than one flare will be installed, the following parameters will need to be monitored for each flare.

Considering that the EPLGP's facilities will have computer-based equipment and generate continuous data, such equipment will be used for generating data relevant for the annual emission reduction verification report. The summary table (table 3) for such report will be filled in, with the metered data provided as background.

Table 3. Summary worksheet for EPLGP

DAY	Total EPLGP - Estre Pedreira Landfill Gas Project												
	LFG Collected (m3)	Temperature (°C)	Pressure (mbar)	LFG Collected (Nm3)	Methane (%)	Methane Collected (N.m³)	Temperature FLARE #1 (°C)	Hours of Operation FLARE #1	Temperature FLARE #2 (°C)	Hours of Operation FLARE #2	Flare Efficiency (%)	Methane Destroyed (Nm3)	Electricity Consumed from the Grid(MWh)
1/1/2007			36,0000	0,0000	52,2	0,0000					99,78%	0,0000	
2/1/2007				0,0000		0,0000						0,0000	
3/1/2007				0,0000		0,0000						0,0000	
4/1/2007				0,0000		0,0000						0,0000	
5/1/2007				0,0000		0,0000						0,0000	
6/1/2007				0,0000		0,0000						0,0000	
7/1/2007				0,0000		0,0000						0,0000	
8/1/2007				0,0000		0,0000						0,0000	
9/1/2007				0,0000		0,0000						0,0000	
10/1/2007				0,0000		0,0000						0,0000	
11/1/2007				0,0000		0,0000						0,0000	
12/1/2007				0,0000		0,0000						0,0000	
13/1/2007				0,0000		0,0000						0,0000	
14/1/2007				0,0000		0,0000						0,0000	
15/1/2007				0,0000		0,0000						0,0000	
16/1/2007				0,0000		0,0000						0,0000	
17/1/2007				0,0000		0,0000						0,0000	
18/1/2007				0,0000		0,0000						0,0000	
19/1/2007				0,0000		0,0000						0,0000	
20/1/2007				0,0000		0,0000						0,0000	
21/1/2007				0,0000		0,0000						0,0000	
22/1/2007				0,0000		0,0000						0,0000	
23/1/2007				0,0000		0,0000						0,0000	
24/1/2007				0,0000		0,0000						0,0000	
25/1/2007				0,0000		0,0000						0,0000	
26/1/2007				0,0000		0,0000						0,0000	
27/1/2007				0,0000		0,0000						0,0000	
28/1/2007				0,0000		0,0000						0,0000	
29/1/2007				0,0000		0,0000						0,0000	
30/1/2007				0,0000		0,0000						0,0000	
31/1/2007				0,0000		0,0000						0,0000	

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. The Table 4 shows how the flares' data are to be archived.

Table 4. Flare efficiency data

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

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

A	LFG sent to flares	m^3
B	Methane content on LFG	$\%_{methane}$
C	Pressure of the LFG	bar

D	Temperature of the LFG	K
$E = B \times \frac{C \times A}{D} \times \frac{273}{1.013} \times 0.0007168$	Methane collected	$t_{methane}$
F	Flare Efficiency	%
G = E . F	Total methane destroyed	$t_{methane}$
H	CH_4 Global Warming Potential	tCO_2/tCH_4
I = H . 21	Total CO_2e destroyed	tCO_2e
J = J . 0.2	Total CO_2e destroyed in the baseline	tCO_2e
K = J – I	CO_2e destroyed by the EPLGP	tCO_2e
L	Total electricity imported	MWh
M	Emission factor of the grid which the EPLGP is connected	tCO_2e/MWh
N = L . M	Emissions due to the import of electricity	tCO_2e
O = J – N	Emissions reductions due to the EPLGP	tCO_2e