



---

# VALIDATION REPORT

---

## “BANDEIRANTES LANDFILL GAS TO ENERGY PROJECT” (BLFGE) IN SÃO PAULO, BRAZIL

REPORT No. 2005-0387

REVISION No. 04

DET NORSKE VERITAS



## VALIDATION REPORT

|  |   |
|--|---|
| Date of first issue:<br>2005-04-01                 | Project No.:<br>28624550 (16)   |
| Approved by:<br>Einar Telnes<br>Technical Director | Organisational unit:<br>DNV Certification, International<br>Climate Change Services |
| Client:<br>Biogas Energia Ambiental S/A            | Client ref.:<br>Manuel Antonio Avelino Silva  |

DET NORSKE VERITAS AS

DNV Certification

Veritasveien 1,  
1322 HØVIK, Norway  
Tel: +47 67 57 99 00  
Fax: +47 67 57 99 11  
<http://www.dnv.com>  
Org. No: NO 945 748 931 MVA

### Summary:

Det Norske Veritas Certification Ltd. (DNV) has performed a validation of the “Bandeirantes Landfill Gas to Energy Project” (BLFGE) in Brazil on the basis of UNFCCC and host Party criteria’s for the CDM, as well as criteria given to provide consistent project operations, monitoring and reporting. UNFCCC criteria refer to Article 12 of the Kyoto Protocol, the CDM modalities and procedures and the subsequent decisions by the CDM Executive Board.

The validation consisted of the following three phases: i) a desk review of the project design documents, ii) follow-up interviews with project stakeholders and iii) the resolution of outstanding issues and the issuance of the final validation report and opinion. This validation report summarizes the findings of the validation.

The only changes made to this version of the validation report compared to the validation report rev. 03 dated 11 August 2005 referred to in the letter of approval of the DNA of Brazil are linked to the status of issuance of the letter of approval by the DNA of Brazil, the recalculation of the build margin emission factor with the plant efficiencies recommended by the CDM Executive Board at its 22nd meeting and the data vintage for calculating the operating and build margin emission factors (data for the years 2002-2004 instead of data for the year 2001-2003).

In summary, it is DNV’s opinion that the “Bandeirantes Landfill Gas to Energy Project” (BLFGE) as described in the revised PDD of December 2005, meets all present and relevant requirements for the CDM and all relevant host country criteria and correctly applies the baseline and monitoring methodology ACM0001 in combination with ACM0002. Hence, DNV will request the registration of the “Bandeirantes Landfill Gas to Energy Project” (BLFGE) as CDM project activity.

|  |  |                               |  |  |  |   |  |
|--|--|-------------------------------|--|--|--|---|--|
| Report No.:<br>2005-0387   |  | Subject Group:<br>Environment |  | <b>Indexing terms</b><br><br>Key words<br>Climate Change<br>Kyoto Protocol<br>Validation<br>Clean Development<br>Mechanism |  | Service Area<br>Verification  |  |
| Report title:<br>“Bandeirantes Landfill Gas to Energy Project”<br>(BLFGE) in São Paulo, Brazil |  |                               |  |  |  | Market Sector   |  |
| Work carried out by:<br>Luis Filipe Aboim Tavares<br>Cintia Dias                               |  |                               |  |  |  | Process Industry  |  |
| Work verified by:<br>Michael Lehmann   |  |                               |  |  |  |   |  |
| Date of this revision:<br>2005-12-05   |  | Rev. No.:<br>04               |  | Number of pages:<br>13   |  | <input checked="" type="checkbox"/> No distribution without permission from the client or responsible organisational unit |  |
|  |  |                               |  |  |  | <input type="checkbox"/> free distribution within DNV after 3 years   |  |
|  |  |                               |  |  |  | <input type="checkbox"/> Strictly confidential  |  |
|  |  |                               |  |  |  | <input type="checkbox"/> Unrestricted distribution  |  |

© 2002 Det Norske Veritas AS

All rights reserved. This publication or parts thereof may not be reproduced or transmitted in any form or by any means, including photocopying or recording, without the prior written consent of Det Norske Veritas AS.



| <b><i>Table of Content</i></b>                                 | <b><i>Page</i></b> |
|--|--------------------|
| 1 INTRODUCTION .....   | 1                  |
| 1.1 Validation Objective                                       | 1                  |
| 1.2 Scope  | 1                  |
| 1.3 Bandeirantes Landfill Gas to Energy Project                | 1                  |
| 2 METHODOLOGY .....  | 2                  |
| 2.1 Review of Documents  | 4                  |
| 2.2 Follow-up Interviews                                       | 4                  |
| 2.3 Resolution of Clarification and Corrective Action Requests | 4                  |
| 3 VALIDATION FINDINGS .....                                    | 5                  |
| 3.1 Participation Requirements                                 | 5                  |
| 3.2 Project Design   | 5                  |
| 3.3 Project Baseline and Additionality                         | 6                  |
| 3.4 Monitoring Plan  | 8                  |
| 3.5 Calculation of GHG Emissions                               | 8                  |
| 3.6 Leakage  | 9                  |
| 3.7 Environmental Impacts                                      | 9                  |
| 3.8 Comments by Local Stakeholders                             | 9                  |
| 4 COMMENTS BY PARTIES, STAKEHOLDERS AND NGOS .....             | 9                  |
| 5 VALIDATION OPINION .....                                     | 10                 |
| REFERENCES .....   | 12                 |

## Appendix A Validation Protocol

**Abbreviations**

|                  |  |
|------------------|--|
| ANEEL            | Agência Nacional de Energia Elétrica (Brazilian Electricity Regulatory Agency) |
| BM               | Build margin   |
| BNDES            | Brazilian Bank for Development   |
| BLFGE            | Bandeirantes Landfill Gas to Energy  |
| CAR              | Corrective Action Request  |
| CDM              | Clean Development Mechanism  |
| CEF              | Carbon Emission Factor   |
| CER              | Certified Emission Reduction   |
| CETESB           | São Paulo Environment State Agency   |
| CH <sub>4</sub>  | Methane  |
| CL               | Clarification request  |
| CO <sub>2</sub>  | Carbon dioxide   |
| CO <sub>2e</sub> | Carbon dioxide equivalent  |
| DNV              | Det Norske Veritas   |
| DNA              | Designated National Authority  |
| GHG              | Greenhouse gas(es)   |
| GWP              | Global Warming Potential   |
| IPCC             | Intergovernmental Panel on Climate Change                                      |
| MAE              | Mercado Aberto Energia   |
| MP               | Monitoring Plan  |
| MVP              | Monitoring and Verification Plan   |
| N <sub>2</sub> O | Nitrous oxide  |
| NGO              | Non-governmental Organisation  |
| ODA              | Official Development Assistance  |
| OM               | Operating margin   |
| PDD              | Project Design Document  |
| SELIC            | Brazilian bond interest rate   |
| S-SE-CO          | South/ Southeast/Midwest (one of two regional grids in Brazil)                 |
| UNFCCC           | United Nations Framework Convention on Climate Change                          |



## 1 INTRODUCTION

Biogás Energia Ambiental S/A. and Econergy Brazil have commissioned Det Norske Veritas Certification Ltd. (DNV) to validate the “Bandeirantes Landfill Gas to Energy Project” (BLFGE) at São Paulo Municipality, São Paulo State, Brazil.

This report summarises the findings of the validation of the project, performed on the basis of UNFCCC and host Party criteria for CDM projects, as well as criteria given to provide for consistent project operations, monitoring and reporting. The only changes made to this version of the validation report compared to the validation report rev. 03 dated 11 August 2005 referred to in the letter of approval of the DNA of Brazil are linked to the status of issuance of the letter of approval by the DNA of Brazil, the recalculation of the build margin emission factor with the plant efficiencies recommended by the CDM Executive Board at its 22nd meeting and the data vintage for calculating the operating and build margin emission factors (data for the years 2002-2004 instead of data for the year 2001-2003).

The validation team consisted of the following personnel:

|                        |                    |  |
|------------------------|--------------------|--|
| Mr Luis Filipe Tavares | DNV Rio de Janeiro | Team leader, Waste sector expert         |
| Mrs Cintia Dias        | DNV Rio de Janeiro | GHG auditor                              |
| Mr Michael Lehmann     | DNV Oslo           | Energy sector expert, Technical reviewer |

### 1.1 Validation Objective

The purpose of a validation is to have an independent third party assess the project design. In particular, the project's baseline, the monitoring plan, and the project's compliance with relevant UNFCCC and host Party criteria are validated in order to confirm that the project design as documented is sound and reasonable and meets the identified criteria. Validation is a requirement for all CDM projects and is seen as necessary to provide assurance to stakeholders of the quality of the project and its intended generation of certified emission reductions (CERs).

### 1.2 Scope

The validation scope is defined as an independent and objective review of the project design document (PDD). The PDD is reviewed against the criteria stated in Article 12 of the Kyoto Protocol, the CDM modalities and procedures as agreed in the Marrakech Accords and relevant decisions by the CDM Executive Board. The validation team has, based on the recommendations in the Validation and Verification Manual /9/ employed a risk-based approach, focusing on the identification of significant risks for project implementation and the generation of CERs.

The validation is not meant to provide any consulting towards the project participants. However, stated requests for clarifications and corrective actions may provide input for improvement of the project design.

### 1.3 Bandeirantes Landfill Gas to Energy Project

The Bandeirantes landfill started operation in 1979. The landfill has a total capacity of 30 million tons of waste, with an expected lifetime of 30 years. Until 2003 the landfill gas (LFG) was collected only through a passive system. The collected LFG was vented and occasionally flared



at the head of the wells for safety reasons and odour control. In December 2003, a LFG collection and treatment system was installed to significantly increase the LFG collection efficiency to 80% and to utilise the collected LFG to generate electricity by installing 24 gas engines with a total capacity of 22 MW.

The project is a landfill gas collection and electricity generation project in Brazil. The project's core idea is to avoid methane emissions from the landfill managed by Bandeirantes in the São Paulo municipality and to displace grid electricity that is partly generated with fossil fuel, with electricity generated by the combustion of LFG.

The estimated amount of GHG emission reductions from the project is 7 494 404 million tonnes of CO<sub>2</sub>e during the first crediting period (7 years), consisting of 7 176 800 tonnes of CO<sub>2</sub>e from avoiding methane emissions and 317 604 tonnes of CO<sub>2</sub>e from electricity displacement, and resulting in estimated average annual emission reductions of 1 070 629 tCO<sub>2</sub>e.

## 2 METHODOLOGY

The validation consists of the following three phases:

- i) a desk review of the project design and the baseline and monitoring methodology;
- ii) follow-up interviews with project stakeholders;
- iii) the resolution of outstanding issues and the issuance of the final validation report and opinion.

In order to ensure transparency, a validation protocol was customised for the project, according to the Validation and Verification Manual [7]. The protocol shows, in a transparent manner, criteria (requirements), means of verification and the results from validating the identified criteria. The validation protocol serves the following purposes:

- It organises, details and clarifies the requirements a CDM project is expected to meet;
- It ensures a transparent validation process where the validator will document how a particular requirement has been validated and the result of the validation.

The validation protocol consists of three tables. The different columns in these tables are described in Figure 1.

The completed validation protocol for the “Bandeirantes Landfill Gas to Energy Project” is enclosed in Appendix A to this report.

Findings established during the validation can either be seen as a non-fulfilment of validation criteria or where a risk to the fulfilment of project objectives is identified. *Corrective Action Requests* (CAR) are issued, where:

- i) mistakes have been made with a direct influence on project results;
- ii) CDM or host Party requirements have not been met; or
- iii) there is a risk that the project would not be accepted as a CDM project or that emission reductions will not be certified.

The term *Clarification* may be used where additional information is needed to fully clarify an issue.



| <b>Validation Protocol Table 1: Mandatory Requirements for CDM Project Activities</b> |   |   |   |
|---|---|---|---|
| <b>Requirement</b>  | <b>Reference</b>  | <b>Conclusion</b>   | <b>Cross reference</b>  |
| The requirements the project must meet.   | Gives reference to the legislation or agreement where the requirement is found. | This is either acceptable based on evidence provided ( <b>OK</b> ), a <b>Corrective Action Request (CAR)</b> of risk or non-compliance with stated requirements or a request for <b>Clarification (CL)</b> where further clarifications are needed. | Used to refer to the relevant checklist questions in Table 2 to show how the specific requirement is validated. This is to ensure a transparent Validation process. |

  

| <b>Validation Protocol Table 2: Requirement Checklist</b>   |   |  |  |  |
|---|---|--|--|--|
| <b>Checklist Question</b>   | <b>Reference</b>  | <b>Means of verification (MoV)</b>   | <b>Comment</b>   | <b>Draft and/or Final Conclusion</b>   |
| The various requirements in Table 1 are linked to checklist questions the project should meet. The checklist is organised in seven different sections. Each section is then further sub-divided. The lowest level constitutes a checklist question. | Gives reference to documents where the answer to the checklist question or item is found. | Explains how conformance with the checklist question is investigated. Examples of means of verification are document review (DR) or interview (I). N/A means not applicable. | The section is used to elaborate and discuss the checklist question and/or the conformance to the question. It is further used to explain the conclusions reached. | This is either acceptable based on evidence provided ( <b>OK</b> ), or a <b>Corrective Action Request (CAR)</b> due to non-compliance with the checklist question (See below). A request for <b>Clarification (CL)</b> is used when the validation team has identified a need for further clarification. |

  

| <b>Validation Protocol Table 3: Resolution of Corrective Action Requests and Requests for Clarification</b>   |  |  |  |
|---|--|--|--|
| <b>Draft report corrective action requests and requests for clarifications</b>  | <b>Ref. to Table 2</b>   | <b>Summary of project participants' response</b>   | <b>Final conclusion</b>  |
| If the conclusions from the draft Validation are either a Corrective Action Request or a Clarification Request, these should be listed in this section. | Reference to the checklist question number in Table 2 where the Corrective Action Request or Clarification Request is explained. | The responses given by the project participants during the communications with the validation team should be summarised in this section. | This section should summarise the validation team's responses and final conclusions. The conclusions should also be included in Table 2, under "Final Conclusion". |

**Figure 1 Validation protocol tables**



## 2.1 Review of Documents

The initial Project Design Document (PDD) /1/ of December 2004 and a final revised PDD of August /2/ submitted by Biogas Energia Ambiental S/A and Econergy were assessed by DNV. Finally, a further revised version of the PDD /3/ was submitted on 4 December 2005, in which the build margin emission factor was recalculated based on the plant efficiencies recommended by the CDM Executive Board at its 22nd meeting. Also complementary spreadsheets documenting the financial analysis of the project /4/ and the LFG baseline calculations /5/ were provided by Biogas and Econergy in March 2005 and assessed by DNV. In addition, spreadsheets containing detailed calculations for the combined margin emission coefficient applied by the project were assessed /6/.

Other documents, such as Quality Information Control, Environmental Impact Assessment, Environmental and other Licences, were reviewed during the site visit on 4 March 2005 in order to assure the accuracy of relevant information.

## 2.2 Follow-up Interviews

On 4 March 2005 DNV performed interviews with Biogas Energia Ambiental S/A and Econergy and the Municipality of São Paulo during a site visit at the Bandeirantes landfill in the São Paulo municipality, São Paulo State, to confirm and to resolve issues identified during the document review.

The main topics of the interviews were:

- Baseline scenarios and emission calculations
- Management System
- Environmental aspects control
- Environmental licenses.

On 11 March 2005 DNV had a meeting with Logos Engenharia and Econergy to review the financial analysis /4/ used to justify the additionality of project.

On 6 April 2005, DNV met Biogas Energia Ambiental S/A and Econergy in order to discuss in more detail the role of all parties involved in the project.

## 2.3 Resolution of Clarification and Corrective Action Requests

The objective of this phase of the validation was to resolve any outstanding issues which need to be clarified for DNV's positive conclusion on the project design.

The initial validation of the project identified 05 (five) *Corrective Action Requests* and 05 (five) requests for *Clarification*. The identified *Corrective Action Requests* and requests for *Clarification* were discussed with Biogas Energia Ambiental S/A and Econergy. In order to respond to these requests, Bandeirantes and Econergy submitted a revised version of the PDD /2/. The revised PDD and responses provided by Bandeirantes and Econergy sufficiently addressed the *Corrective Action Request* and requests for *Clarification* to DNV's satisfaction. To guarantee the transparency of the validation process, the concerns raised and responses given are summarised in chapter 3 below and documented in more detail in the validation protocol in Appendix A.





### 3 VALIDATION FINDINGS

The findings of the validation are stated in the following sections. The validation criteria (requirements), the means of verification and the results from validating the identified criteria are documented in more detail in the validation protocol in Appendix A.

The validation findings relate to the project design as documented and described in the PDD of December 2005 /3/.

#### 3.1 Participation Requirements

The project participants are Biogás Energia Ambiental S/A, and the municipality of São Paulo. The São Paulo Municipality has been added as project participant in the final PDD as it is an owner of 50% of the emission reductions generated by the project.

Unibanco, a Brazilian private bank, who leases the electricity generation equipment from Biogeracao, who owns the electricity generators, has a private agreement with Biogas on the distribution of the credits between them. It has been clarified during the interviews with Biogas that Unibanco does not figure as a project participant for the purpose of the registration of the project as a CDM project.

The host Party Brazil meets all relevant participation requirements and has provided written approval of voluntary participation in the project /8/. No Annex I Party has yet been identified for the project.

#### 3.2 Project Design

The “Bandeirantes Landfill Gas to Energy Project” reduces GHG emissions by avoiding methane emissions and by displacing grid electricity that is partly generated with fossil fuel, with electricity generated by combusting LFG. The recovered LFG will be as far as possible combusted in the generator and surplus gas will be burnt with a flaring system.

The technology employed at the landfill comprises the following components:

- A high-density polyethylene membrane impermeable layer,
- A Leachate drainage system using high-density polyethylene pipes,
- A rain water drainage system,
- A LFG exhaust, including a polyethylene pipe net connected to several collectors to control methane concentration,
- The LFG treatment through cooling and condensing,
- 24 Cartepilar generators with capacity of 925 KW each.

The aim of the project is to enhance the already operational passive venting system in order to increase the efficiency of LFG collection, to utilise the LFG for electricity generation, to flare surplus LFG systematically and to continuously monitor the operations. For this purpose, an active recovery system as well as a generation facility is currently being installed on the landfill, which is still being filled and in its final stage. This comprises connecting well heads through pipes, which are connected to a blower, where the gas is sent to the LFG treatment facility from where it is sent to the electricity generators. This size of facilities is amongst the biggest in the world.



The “Bandeirantes Landfill Gas to Energy Project” contributes to sustainable development in several ways:

- it is reducing methane emissions that would enhance climate change;
- it is minimizing the risk that any explosions happen on the site;
- the initiative results in a technology transfer as part of the project’s implementation and operation;
- specialized operators were needed for project operation, resulting in employment and capacity-building.

The project complies with the Brazilian policy for sustainable development, and the DNA of Brazil has confirmed that the project assists in achieving sustainable development /8/.

The project will be funded by Biogas Energia Ambiental S/A and Unibanco and the validation did not reveal any information that indicates that the project can be seen as a diversion of ODA funding towards Brazil.

The “Bandeirantes Landfill Gas to Energy Project” has an expected operational lifetime of 21 years and applies for a renewable crediting period of 7 years starting 23 December 2003.

### 3.3 Project Baseline and Additionality

The project applies the approved baseline methodology ACM0001 “Consolidated baseline methodology for landfill gas project activities” /10/. To calculate the emission reductions of displacing grid electricity, the project applies the approved baseline methodology ACM0002 - Consolidated methodology for grid-connected electricity generation from renewable sources /11/.

The methodology ACM0001 is applicable to project activities that reduce greenhouse gas emissions through landfill gas capture and destruction of the methane by flaring and/or generating electricity. In the case of “Bandeirantes Landfill Gas to Energy Project”, such destruction will occur through the combustion of the gas in the electricity generators and the flaring of surplus LFG.

The additionality of the “Bandeirantes Landfill Gas to Energy Project” is demonstrated in accordance with the “Tool for demonstration and assessment of additionality”:

*Step 0 -Preliminary screening based on the starting date of the project activity:* Since the project’s crediting period starts before the registration of the project, evidence shall be provided which demonstrates that the incentive from the CDM was seriously considered in the decision to proceed with the project activity. The “Project Idea Note” issued by Van der Wiel, (a shareholder of the project) in August 2002 and presented to DNV clearly evidences that CER revenues were considered in the decision to proceed with the project activity.

*Step 1 - Identification of alternatives to the project activity consistent with current laws and regulations:* Unibanco intended to use the generated electricity for its own offices in São Paulo in order to avoid the high electricity prices for commercial entities. However, due to different interpretations of the Brazilian legislation governing energy production for one’s own use, this is not an option for the time being. The project also applied for the permission to sell the electricity to PROINFA for a price of 161R\$. However, the project was not approved because it did not have the installation licence in place at the time of its application. As it is not possible to re-apply



to PROINFA a second time, the only two realistic and credible scenarios are the selling of the electricity to the open market for a price currently at about 60R\$ (project scenario) or the continuation of the situation prior to project implementation (limited LFG collection and flaring i.e. the baseline scenario). There is no legislation in Brazil obliging landfills to collect and flare/use the gas.

*Step 2 - Investment analysis:* An investment analysis, namely benchmark analysis, is presented to demonstrate that - under non-CDM conditions - the investments to increase the efficiency of the LFG collection system and to install the LFG treatment system and the gas engines in order to utilise the LFG for electricity generation would not have been undertaken. It is demonstrated that the project IRR is smaller than the current interest rate for Brazilian government bonds chosen as an indicator for the benchmark analysis. The calculation of the IRR was done considering separate companies i.e. the landfill gas collecting and the electricity generating company. Complementary information received and verified during the meeting with Logos Engenharia/Econergy evidenced that the IRR calculation was based on the price paid by Biogeração for the LFG produced by Biogas and based on investment costs and operation and maintenance costs. For Biogeração the IRR was calculated based on the income from selling electricity to the grid and based on costs related to the rent of the generation equipment, investment costs and operating and maintenance costs. However, an IRR analysis ideally includes relevant cash flows both from the revenue from selling the electricity on the open market and the total investment and operating and maintenance costs for both the capture and utilization equipment. DNV thus requested additional information in order to aggregate the two separate sets of financial information and to assess the realism of the assumptions.

A sensitivity analysis carried out by DNV showed that, unless the price per MWh rises considerably on the open energy market (MAE) or unless Unibanco reaches an agreement to use the electricity for its own offices, the NPV of the investment is negative at a discount rate of 19%. Both these scenarios are not deemed to happen in the near future. Hence, given the prevailing circumstances, the project is not deemed financially attractive. The project is thus not a baseline scenario and emission reductions are hence additional.

*Step 3 - Barrier analysis:* No barrier analysis is carried out.

*Step 4 - Common practice analysis:* Collection and utilisation of LFG to generate electricity is not common practise in Brazil (with the exception of a few projects proposed as CDM project activities).

*Step 5 - Impact of CDM registration:* It is demonstrated that the registration of the project as CDM project activity will alleviate the financial hurdles for the project.

Considering that LFG was already collected and occasionally burnt at the head of the wells for safety and odour control prior to project implementation, it is assumed that 20% of the LFG collected and utilised by the project would also have been collected and flared in the absence of the project. The selected adjustment factor (AF) of 20% is deemed reasonable considering the project specific circumstances and considering that legislation that requires landfills to collect and flare a certain amount of the LFG produced is not likely to be implemented in the short term in Brazil.



### 3.4 Monitoring Plan

The project applies the approved monitoring methodology ACM0001 “Consolidated baseline methodology for landfill gas project activities” /10/.

The methodology ACM0001 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 the “Bandeirantes Landfill Gas to Energy Project”, such destruction will occur through electricity generation and flaring of the surplus.

Details of the data to be collected, the frequency of data recording, its certainty, and format and storage location are described. The recording frequency of the data seems appropriate for the project. Algorithms and formulae used have also been clearly established.

During the site visit, it could be verified that the Quality Control and Quality Assurance procedures for the project identify several monitoring routines, including auditing, corrective actions and data review procedures, including the review of emission reduction calculations by the municipality of São Paulo.

### 3.5 Calculation of GHG Emissions

The emission reductions for LFG combustion will be directly monitored and calculated *ex-post* using the approach of the approved methodology.

The *ex-ante* estimation of emission reductions are calculated using a first order decay model and based on historic and expected future waste amounts from 1979 to 2006 when the landfill is foreseen to be closed. An Adjustment Factor of 20% is used to account for LFG collected and flared in the baseline scenario. The assumptions for the *ex-ante* estimation of emission reductions are reasonable, including the LFG collection efficiency of 80 % that is assumed for the project.

An *ex-ante* determined emission coefficient for calculating emission reductions from displacing grid electricity is selected. The emission coefficient is calculated in accordance with ACM0002 based on electricity generation data provided by the Brazilian Electricity Agency (ANEEL) and the National Electricity System Operator (ONS) on electricity generation in the S-SE-CO grid in the years 2002-2004. For the determination of the operating margin (OM) emission coefficient, average plant efficiencies for different power plant types established in an IEA study on the Brazilian grid /13/ and IPCC carbon emission factors for specific fuels were applied to calculate plant specific emission coefficients. For the calculation of the build margin emission coefficient, the conservative plant efficiencies recommended by the CDM Executive Board at its 22<sup>nd</sup> meeting were applied. The resulting simple-adjusted OM emission coefficient is 0.4310 tCO<sub>2</sub>e/MWh (applying an average  $\lambda$  of 0.5135) and the BM emission coefficient 0.1045 tCO<sub>2</sub>e/MWh, resulting in a combined margin emission coefficient of 0.2677 tCO<sub>2</sub>e/tCO<sub>2</sub>e/MWh (weighted average of the build and operating margin). Generation data for the years 2002-2004 are the most recent statistics available. The emission coefficient calculations were transparently presented in spreadsheets /6/ submitted to and verified by DNV. It must be noted that no hourly dispatch data is publicly available. Hence,  $\lambda$  was calculated by interpolating daily dispatch data for thermal power plants and daily dispatch data for hydropower plants. The selected approach for calculating  $\lambda$  is in accordance with ACM0002.



Having in mind the relatively high standard deviation inherent in *ex-ante* landfill gas generation potential calculations by model calculations and provided the project continues its implementation and operation as designed, these forecast emission reduction potential is deemed realistic and conservative.

### **3.6 Leakage**

In accordance with ACM0001 no leakage must be considered because all energy used for LFG pumping and operating of other project equipment is supplied by electricity generated by the project.

### **3.7 Environmental Impacts**

The project has an Operational Environmental Licence for electricity generation with LFG issued by the state environment agency after the Environmental Impact Assessment carried out for the project was evaluated by the state environment secretary.

The Environmental Licences and the project's compliance with conditional clauses were verified during the site visit.

### **3.8 Comments by Local Stakeholders**

Local stakeholders were invited to comment on the project in accordance with the requirements of Resolution 1 of the Brazilian DNA. The Municipal Government, the state and municipal agencies, the Brazilian forum of NGOs, neighbouring communities and the office of the attorney general were invited to comment on the project. The letters sent to these local stakeholders /7/ were verified during the site visit. No comments were received.

## **4 COMMENTS BY PARTIES, STAKEHOLDERS AND NGOS**

DNV Certification published the draft PDD /1/ on the DNV Climate Change web site (<http://www.dnv.com/certification/ClimateChange>) and stakeholders were through the UNFCCC CDM web site invited to provide comments within a 30 days period from 28 January 2005 to 27 February 2005. No comments were received.



## 5 VALIDATION OPINION

*Det Norske Veritas Certification Ltd. (DNV) has performed a validation of the “Bandeirantes Landfill Gas to Energy Project” at São Paulo municipality; São Paulo State, Brazil (hereafter called “the project”). The validation was performed on the basis of UNFCCC criteria for CDM project activities and relevant Brazilian criteria, as well as criteria given to provide for consistent project operations, monitoring and reporting.*

*The project participant are Biogás Energia Ambiental S/A and São Paulo Municipality. The participating host Party Brazil meets the requirements to participate in the CDM requirements and has provided written approval of voluntary participation in the project. No Annex I Party has yet been identified.*

*The project proposes to collect and to utilise the landfill gas (LFG) captured at the Bandeirantes landfill to generate electricity displacing grid electricity. The project is not expected to have considerable environmental impacts. The project has an Operation Environmental Licence issued after the project’s Environmental Impact Assessment was assessed by the relevant government agency.*

*By promoting renewable energy, the project is in line with the current sustainable development priorities of Brazil. The DNA of Brazil confirmed that the project assists in achieving sustainable development.*

*The project applies the approved baseline and monitoring methodology ACM0001, i.e. “Consolidated baseline methodology for landfill gas project activities”. To determine an emission coefficient for the grid electricity displaced by the project, the consolidated approved baseline and monitoring methodology ACM0002 “Consolidated methodology for grid-connected electricity generation from renewable sources” is applied. The methodologies have been applied correctly and the assumptions made for the selected baseline scenario are sound. It is sufficiently demonstrated that the project is not a likely baseline scenario and that emission reductions attributable to the project are additional to any that would occur in the absence of the project activity.*

*A combined margin emission coefficient of 0.2677 tCO<sub>2</sub>e/MWh (weighted average of the build and operating margin) is calculated in accordance with the baseline methodology ACM0002. The determination of this combined margin emission coefficient is based on actual electricity generation data provided by the National Electricity System Operator (ONS) for the years 2002-2004 in the South-Southeast-Midwest grid.*

*Through the tool for the demonstration and assessment of additionality, it is sufficiently demonstrated that the project is not a likely baseline scenario and that emission reductions attributable to the project are additional to any that would occur in the absence of the project activity.*

*The monitoring plan sufficiently specifies the monitoring requirements of the main project indicators.*

*By combusting or flaring the landfill gas and displacing grid electricity, the project results in the reduction of CH<sub>4</sub> and CO<sub>2</sub> emissions that are real, measurable and give long-term benefits to the*





*mitigation of climate change. Given that the project is implemented as designed, the project is likely to achieve the estimated amount of emission reductions.*

*Local stakeholder comments were invited according to the Brazilian DNA Resolution 1 and Parties, stakeholders and NGOs were invited to comment on the validation requirements. No comments were received.*

*In summary, the “Bandeirantes Landfill Gas to Energy Project” (BLFGE) as described in the revised and resubmitted project design document of 4 December 2005, meets all present and relevant UNFCCC requirements for the CDM and all relevant host country criteria and correctly applies the baseline and monitoring methodology for ACM0001 in combination with ACM0002. Hence, DNV will request the registration of the “Bandeirantes Landfill Gas to Energy Project” (BLFGE) as CDM project activity.*



## REFERENCES

*Documents provided by the project proponent that relate directly to the project:*

- /1/ Econergy & Biogás Energia Ambiental S/A: *Project Design Document PDD of “Bandeirantes Landfill Gas to Energy Project”*, Version 1 (December 2004).
- /2/ Econergy & Biogás Energia Ambiental S/A: *Project Design Document PDD of “Bandeirantes Landfill Gas to Energy Project”*, Version 2 (August 2005).
- /3/ Econergy & Biogás Energia Ambiental S/A: *Project Design Document PDD of “Bandeirantes Landfill Gas to Energy Project”*, Version 2B (4 December 2005).
- /4/ Econergy & Biogás Energia Ambiental S/A: *Datasheet to demonstrate IRR Calculation*, Excel spreadsheets, March 2005.
- /5/ Econergy & Biogás Energia Ambiental S/A: *Datasheet to calculate LFG baseline emissions*, Excel spreadsheets, March 2005.
- /6/ Econergy: *Spreadsheet for Calculation of Combined Margin* (ONS Emission Factor SSECO 2002-2004 v 2005-11-29.xls)
- /7/ Econergy & Biogás Energia Ambiental S/A: *Letters sent to local stakeholders*
- /8/ Comissão Interministerial de Mudança Global do Clima (DNA of Brazil): *Letter of Approval*. 12 September 2005

*Background documents related to the design and/or methodologies employed in the design or other reference documents:*

- /9/ International Emission Trading Association (IETA) & Prototype Carbon Fund (PCF): *Validation and Verification Manual*. <http://www.vvmanual.info>.
- /10/ Approved Baseline and Monitoring methodology ACM0001, *Consolidated Baseline Methodology for Landfill Gas Project Activities*, Version 02 of 30 September 2005.
- /11/ Approved Baseline and Monitoring methodology ACM0002, *Consolidated methodology for grid-connected electricity generation from renewable sources*. Version 04 of 28 November 2005.
- /12/ CDM Executive Board: *Tool for the demonstration and assessment of additionality*. Version 02 of 28 November 2005
- /13/ Bosi, M., A. Laurence, P. Maldonado, R. Schaeffer, A. F. Simoes, H. Winkler and J.-M. Lukamba: *Road testing baselines for greenhouse gas mitigation projects in the electric power sector*. OECD and IEA information paper, October 2002.

*Persons interviewed during the validation, or persons contributed with other information that are not included in the documents listed above:*

- /14/ Antonio Carlos Delbin – Technical Director of Biogás
- /15/ Helvécio Guimarães – Consultant of Econergy





- /16/ Lucio Martins Laginha – Engineer of the Municipality of São Paulo
- /17/ José Carlos Melo de Oliveira - Engineer of the Municipality of São Paulo
- /18/ Manoel Antonio Avelino Silva - Engineer of Logos Engineering
- /19/ Marcelo Shunn Diniz Junqueira – Director of Econergy

- o0o -

## **APPENDIX A**

---

### **CDM VALIDATION PROTOCOL**

**Table 1 Mandatory Requirements for Clean Development Mechanism (CDM) Project Activities**

| Requirement  | Reference  | Conclusion | Cross Reference / Comment   |
|--|--|------------|---|
| 1. The project shall assist Parties included in Annex I in achieving compliance with part of their emission reduction commitment under Art. 3  | Kyoto Protocol Art.12.2  | OK         | Table 2, Section E.4.1<br>No participating Annex I Party  |
| 2. The project shall assist non-Annex I Parties in achieving sustainable development and shall have obtained confirmation by the host country thereof  | Kyoto Protocol Art. 12.2,<br>CDM Modalities and Procedures §40a  | OK         | Table 2, Section A.3<br>.   |
| 3. The project shall assist non-Annex I Parties in contributing to the ultimate objective of the UNFCCC  | Kyoto Protocol Art.12.2.   | OK         | Table 2, Section E.4.1  |
| 4. The project shall have the written approval of voluntary participation from the designated national authority of each party involved  | Kyoto Protocol Art. 12.5a,<br>CDM Modalities and Procedures §40a | OK         | DNA of Brazil: Letter of Approval 12 September 2005   |
| 5. The emission reductions shall be real, measurable and give long-term benefits related to the mitigation of climate change   | Kyoto Protocol Art. 12.5b  | OK         | Table 2, Section E  |
| 6. Reduction in GHG emissions shall be additional to any that would occur in absence of the project activity, i.e. a CDM project activity is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the registered CDM project activity | Kyoto Protocol Art. 12.5c,<br>CDM Modalities and Procedures §43  | OK         | Table 2, Section B.2  |
| 7. Potential public funding for the project from Parties in Annex I shall not be a diversion of official development assistance  | Decision 17/CP.7   | OK         | The validation did not reveal any information that indicates that the project can be seen as a diversion of ODA funding towards Brazil. |
| 8. Parties participating in the CDM shall designate a national authority for the CDM   | CDM Modalities and Procedures §29                                | OK         | The Brazilian designated national authority for the CDM is the Comissão Interministerial de Mudança Global do Clima                     |

| Requirement   | Reference                            | Conclusion | Cross Reference / Comment   |
|---|--------------------------------------|------------|---|
| 9. The host Party and the participating Annex I Party shall be a Party to the Kyoto Protocol  | CDM Modalities §30/31a               | OK         | Brazil has ratified the Kyoto Protocol on 23 August 2002  |
| 10. The participating Annex I Party's assigned amount shall have been calculated and recorded   | CDM Modalities and Procedures §31b   | NA         | No participating Annex I Party  |
| 11. The participating Annex I Party shall have in place a national system for estimating GHG emissions and a national registry in accordance with Kyoto Protocol Article 5 and 7  | CDM Modalities and Procedures §31b   | NA         | No participating Annex I Party  |
| 12. Comments by local stakeholders shall be invited, a summary of these provided and how due account was taken of any comments received   | CDM Modalities and Procedures §37b   | OK         | Table 2, Section G  |
| 13. Documentation on the analysis of the environmental impacts of the project activity, including transboundary impacts, shall be submitted, and, if those impacts are considered significant by the project participants or the Host Party, an environmental impact assessment in accordance with procedures as required by the Host Party shall be carried out. | CDM Modalities and Procedures §37c   | OK         | Table 2, Section F  |
| 14. Baseline and monitoring methodology shall be previously approved by the CDM Executive Board   | CDM Modalities and Procedures §37e   | OK         | Table 2, Section B.1.1 and D.1.1  |
| 15. Provisions for monitoring, verification and reporting shall be in accordance with the modalities described in the Marrakech Accords and relevant decisions of the COP/MOP   | CDM Modalities and Procedures §37f   | OK         | Table 2, Section D  |
| 16. Parties, stakeholders and UNFCCC accredited NGOs shall have been invited to comment on the validation requirements for minimum 30 days, and the project design document and comments have been made publicly available  | CDM Modalities and Procedures §40    | OK         | Presented for public comments in the period from 28 January 2005 to 27 February 2005 on <a href="http://climatechange.dnv.com">climatechange.dnv.com</a> and comments were invited via the UNFCCC CDM website. No comments were received. |
| 17. A baseline shall be established on a project-specific basis, in a transparent manner and taking into account relevant national and/or sectoral policies and circumstances   | CDM Modalities and Procedures §45c,d | OK         | Table 2, Section B.2  |

| Requirement   | Reference   | Conclusion | Cross Reference / Comment                                     |
|---|---|------------|---|
| 18. The baseline methodology shall exclude to earn CERs for decreases in activity levels outside the project activity or due to force majeure | CDM Modalities and Procedures §47                     | OK         | Table 2, Section B.2  |
| 19. The project design document shall be in conformance with the UNFCCC CDM-PDD format  | CDM Modalities and Procedures Appendix B, EB Decision | OK         | PDD is in accordance with CDM-PDD (version 02 of 1 July 2004) |

**Table 2 Requirements Checklist**

| Checklist Question   | Ref. | MoV* | Comments  | Draft Concl | Final Concl |
|--|------|------|---|-------------|-------------|
| <b>A. General Description of Project Activity</b><br><i>The project design is assessed.</i>  |      |      |   |             |             |
| <b>A.1. Project Boundaries</b><br><i>Project Boundaries are the limits and borders defining the GHG emission reduction project.</i>  |      |      |   |             |             |
| A.1.1. Are the project's spatial (geographical) boundaries clearly defined?  | /1/  | DR   | The "Bandeirantes Landfill Gas to Energy Project" is located in the municipality of São Paulo between km 24 and 26 off the Bandeirantes highway.  |             | OK          |
| A.1.2. Are the project's system (components and facilities used to mitigate GHGs) boundaries clearly defined?  | /1/  | DR   | The project system's boundaries are limited to the geographic area of the Bandeirantes Landfill site and include a landfill gas capture, a flaring system and an electricity generation system.                       |             | OK          |
| <b>A.2. Technology to be employed</b><br><i>Validation of project technology focuses on the project engineering, choice of technology and competence/maintenance needs. The validator should ensure that environmentally safe and sound technology and know-how is used.</i> |      |      |   |             |             |
| A.2.1. Does the project design engineering reflect current good practices?   | /1/  | DR   | The project design engineering reflects good practice through the use of the top and bottom cover, a land fill gas recovery, a flaring system and electricity generation facilities, one of the biggest of the world. |             | OK          |
| A.2.2. Does the project use state of the art technology  | /1/  | DR   | Yes, common practice in Brazil is landfilling   |             | OK          |

\* MoV = Means of Verification, DR= Document Review, I= Interview

| Checklist Question   | Ref. | MoV* | Comments   | Draft Concl     | Final Concl |
|--|------|------|--|-----------------|-------------|
| or would the technology result in a significantly better performance than any commonly used technologies in the host country?              |      |      | without landfill gas treatment and LFG flaring only for safety reasons.  |                 |             |
| A.2.3. Is the project technology likely to be substituted by other or more efficient technologies within the project period?               | /1/  | DR   | The project is unlikely to be substituted by other more efficient technologies.  |                 | OK          |
| A.2.4. Does the project require extensive initial training and maintenance efforts in order to work as presumed during the project period? | /1/  | DR   | The project needs expertise for the operation of the gas collection and treatment system and the biogas power plant. These operation capabilities were transferred to the landfill operators through Van der Wiel, a Dutch firm, shareholder of Biogas, and expert on LFG recovery and utilisation technologies. |                 | OK          |
| A.2.5. Does the project make provisions for meeting training and maintenance needs?  | /1/  | DR   | See A.2.4  |                 | OK          |
| <b>A.3. Contribution to Sustainable Development</b><br><i>The project's contribution to sustainable development is assessed.</i>           |      |      |  |                 |             |
| A.3.1. Is the project in line with relevant legislation and plans in the host country?   | /1/  | DR   | Yes, the biogas power plant has the required Operation License issued by CETESB according to the EIA presented to SMA/DAIA.<br><br>It needs to be clarified whether the project has also received an authorization by ANNEL.   | <del>CL-1</del> | OK          |
| A.3.2. Is the project in line with host-country specific CDM requirements?   | /1/  | DR   | Yes, the consultation of local stakeholders was carried out according to Resolution 1 of the Brazilian DNA.  |                 | OK          |
| A.3.3. Is the project in line with sustainable   | /1/  | DR   | The project is in line with current  |                 | OK          |

\* MoV = Means of Verification, DR= Document Review, I= Interview

| Checklist Question  | Ref. | MoV* | Comments   | Draft Concl | Final Concl |
|---|------|------|--|-------------|-------------|
| development policies of the host country?   |      |      | sustainable development priorities in Brazil. The DNA of Brazil confirmed that the project assists in achieving sustainable development.   |             |             |
| A.3.4. Will the project create other environmental or social benefits than GHG emission reductions?   | /1/  | DR   | The project created many jobs during its implementation and some staff was employed for operation. The project creates also environmental benefits by avoiding odour from the landfill.  |             | OK          |
| <b>B. Project Baseline</b><br><i>The validation of the project baseline establishes whether the selected baseline methodology is appropriate and whether the selected baseline represents a likely baseline scenario.</i> |      |      |  |             |             |
| <b>B.1. Baseline Methodology</b><br><i>It is assessed whether the project applies an appropriate baseline methodology.</i>  |      |      |  |             |             |
| B.1.1. Is the baseline methodology previously approved by the CDM Executive Board?  | /1/  | DR   | The project applies the approved baseline methodology ACM0001 "Consolidated Baseline Methodology for Landfill Gas Project Activities". In addition, ACM0002 "Consolidated methodology for grid-connected electricity generation from renewable sources" is applied for determining an emission factor for displacing grid electricity. |             | OK          |
| B.1.2. Is the baseline methodology the one deemed most applicable for this project and is the appropriateness justified?  | /1/  | DR   | Yes, the project fulfils the conditions under which ACM0001 defines the applicability, it means that the captured gas is used to produce electricity and emission reductions   |             | OK          |

\* MoV = Means of Verification, DR= Document Review, I= Interview



| Checklist Question   | Ref. | MoV* | Comments   | Draft Concl      | Final Concl |
|--|------|------|--|------------------|-------------|
|  |      |      | are claimed for displacing energy generating from other sources.   |                  |             |
| <b>B.2. Baseline Determination</b><br><i>The choice of baseline will be validated with focus on whether the baseline is a likely scenario, whether the project itself is not a likely baseline scenario, and whether the baseline is complete and transparent.</i> |      |      |  |                  |             |
| B.2.1. Is the application of the methodology and the discussion and determination of the chosen baseline transparent?  | /1/  | DR   | <p>Yes, the arguments which are presented demonstrate that the project's establishment is in compliance with the chosen baseline methodology ACM0001.</p> <p>The application of the baseline methodology ACM0002 for determining the emission factor for displacing electricity is not documented in the PDD and must be included.</p> | <del>CAR-1</del> | OK          |
| B.2.2. Has the baseline been determined using conservative assumptions where possible?   | /1/  | DR   | It is mentioned that an Adjustment Factor (AF) of 20 % is selected to account for occasional flaring in the baseline. However, in the CER calculation this figure seems to be omitted.   | <del>CAR-2</del> | OK          |
| B.2.3. Has the baseline been established on a project-specific basis?  | /1/  | DR   | Yes, the baseline methodology is applied taking into account project specific circumstances, such as the project specific requirements contained in the license for operating the landfill and a project specific financial analysis.  |                  | OK          |
| B.2.4. Does the baseline scenario sufficiently take into account relevant national and/or sectoral policies, macro-economic trends and political   | /1/  | DR   | Yes, the environment regulation in Brazil is more concerned with waste disposal in an adequate way (landfill) and no changes are   |                  | OK          |

\* MoV = Means of Verification, DR= Document Review, I= Interview

| Checklist Question   | Ref. | MoV* | Comments  | Draft Concl      | Final Concl |
|--|------|------|---|------------------|-------------|
| aspirations?   |      |      | foreseen with regard to requiring LFG recovery and destruction.   |                  |             |
| B.2.5. Is the baseline determination compatible with the available data?   | /1/  | DR   | The baseline emissions are estimated based on a first order decay model, using the amount of waste dumped from 1979 until 2006 when the landfill is foreseen to be closed. However the AF of 20% was not used when calculating the baseline emissions.  | <del>CAR-2</del> | OK          |
| B.2.6. Does the selected baseline represent the most likely scenario among other possible and/or discussed scenarios?  | /1/  | DR   | The PDD discusses, according to the "Tool for demonstration and assessment of additionality" two scenarios (continued LFG release and implementation of electricity generation with LFG). However other possible scenarios were not mentioned.  | <del>CL-2</del>  | OK          |
| B.2.7. Is it demonstrated/justified that the project activity itself is not a likely baseline scenario (e.g. through (a) a flow-chart or series of questions that lead to a narrowing of potential baseline options, (b) a qualitative or quantitative assessment of different potential options and an indication of why the non-project option is more likely, (c) a qualitative or quantitative assessment of one or more barriers facing the proposed project activity or (d) an indication that the project type is not common practice in the proposed area of implementation, and not required by a Party's legislation/regulations)? | /1/  | DR   | <p>The PDD in section B.3 includes a series of questions according to the "Tool for demonstration and assessment of additionality" that justify why the project is not a likely baseline scenario, by means of an investment analysis.</p> <p>The approach was the benchmark analysis, considering the Brazilian interest rate for government bonds (SELIC) as comparable index for the IRR analysis. However, the demonstration of the IRR analysis was made by separating the cash flow of two companies (Biogas and Biogeração) without detailing and relating important figures.</p> <p>DNV requests more information in order to assure more transparency in the</p> | <del>CAR-3</del> | OK          |

\* MoV = Means of Verification, DR= Document Review, I= Interview

| Checklist Question   | Ref. | MoV* | Comments   | Draft Concl | Final Concl |
|--|------|------|--|-------------|-------------|
|  |      |      | additionality justification. Moreover, in accordance with the requirements in the “Tool for demonstration and assessment of additionality”, the investment analysis shall be presented in a transparent manner and all the relevant assumptions shall be provided in the PDD, so that a reader can reproduce the analysis and obtain the same results. Critical techno-economic parameters and assumptions (such as capital costs, fuel prices, lifetimes, and discount rate or cost of capital) must be clearly presented and justified in a manner that can be validated by the DOE. |             |             |
| B.2.8. Have the major risks to the baseline been identified?   | /1/  | DR   | Yes, the monitoring plan includes the review of Brazilian regulations with respect to LFG regulations.   |             | OK          |
| B.2.9. Is all literature and sources clearly referenced?   | /1/  | DR   | Yes  |             | OK          |
| <b>C. Duration of the Project/ Crediting Period</b><br><i>It is assessed whether the temporary boundaries of the project are clearly defined.</i>                                  |      |      |  |             |             |
| C.1.1. Are the project's starting date and operational lifetime clearly defined and reasonable?  | /1/  | DR   | Yes, the project start date is 23 December 2003 and the project's expected operational lifetime is 21 years.   |             | OK          |
| C.1.2. Is the assumed crediting time clearly defined (renewable crediting period of seven years with two possible renewals or fixed crediting period of 10 years with no renewal)? | /1/  | DR   | A renewable 7 years crediting period starting on 23 December 2003 has been chosen.   |             | OK          |

| Checklist Question   | Ref. | MoV* | Comments  | Draft Concl    | Final Concl |
|--|------|------|---|----------------|-------------|
| <b>D. Monitoring Plan</b><br><i>The monitoring plan review aims to establish whether all relevant project aspects deemed necessary to monitor and report reliable emission reductions are properly addressed ((Blue text contains requirements to be assessed for optional review of monitoring methodology prior to submission and approval by CDM EB).</i> |      |      |   |                |             |
| <b>D.1. Monitoring Methodology</b><br><i>It is assessed whether the project applies an appropriate baseline methodology.</i>   |      |      |   |                |             |
| D.1.1. Is the monitoring methodology previously approved by the CDM Executive Board?   | /1/  | DR   | The project applies the approved monitoring methodology called ACM0001 "Consolidated monitoring methodology for landfill gas to project activities" and ACM0002 for determining the emission factor for displacing electricity. |                | OK          |
| D.1.2. Is the monitoring methodology applicable for this project and is the appropriateness justified?   | /1/  | DR   | Yes, the GHG emissions reductions will be obtained through direct measurement according to the approved monitoring methodology.   |                | OK          |
| D.1.3. Does the monitoring methodology reflect good monitoring and reporting practices?  | /1/  | DR   | The monitoring table D.2.2.1 does not mention for how long archived data is kept.   | <del>CL3</del> | OK          |
| D.1.4. Is the discussion and selection of the monitoring methodology transparent?  | /1/  | DR   | Yes, in line with one of the applicability conditions, the captured gas is used to produce energy and emission reductions are claimed for LFG destruction and displacing energy generation from other sources.                  |                | OK          |

\* MoV = Means of Verification, DR= Document Review, I= Interview

| Checklist Question  | Ref. | MoV* | Comments  | Draft Concl                         | Final Concl  |
|---|------|------|---|-------------------------------------|--------------|
| <b>D.2. Monitoring of Project Emission Reductions</b><br><i>It is established whether the monitoring plan provides for reliable and complete project emission data over time.</i>   |      |      |   |                                     |              |
| D.2.1. Does the monitoring plan provide for the collection and archiving of all relevant data necessary for estimation or measuring the greenhouse gas emissions within the project boundary during the crediting period? | /1/  | DR   | <p>The monitoring methodology of ACM0001 is correctly applied and project emission reductions are directly monitored. However, the monitoring plan does not mention for how long archived data is kept</p> <p>The monitoring does not apply the relevant elements of the monitoring methodology In ACM0002 which is applied for determining an emission factor for displacing energy generation from other sources. The monitoring plan must include the relevant monitoring indicators of ACM0002.</p> | <del>CL-3</del><br><br><b>CAR-4</b> | OK<br><br>OK |
| D.2.2. Are the choices of project GHG indicators reasonable?  | /1/  | DR   | Yes   |                                     | OK           |
| D.2.3. Will it be possible to monitor / measure the specified project GHG indicators?   | /1/  | DR   | Yes   |                                     | OK           |
| D.2.4. Will the indicators give opportunity for real measurements of achieved emission reductions?  | /1/  | DR   | Yes   |                                     | OK           |
| D.2.5. Will the indicators enable comparison of project data and performance over time?   | /1/  | DR   | Yes   |                                     | OK           |
| <b>D.3. Monitoring of Leakage</b><br><i>It is assessed whether the monitoring plan provides for reliable and complete leakage data over time.</i>   |      |      |   |                                     |              |
| D.3.1. Does the monitoring plan provide for the   | /1/  | DR   | No leakage needs to be accounted for  |                                     | OK           |

\* MoV = Means of Verification, DR= Document Review, I= Interview

| Checklist Question   | Ref. | MoV* | Comments  | Draft Concl    | Final Concl |
|--|------|------|---|----------------|-------------|
| collection and archiving of all relevant data necessary for determining leakage?   |      |      | under methodology ACM0001.  |                |             |
| <b>D.4. Monitoring of Baseline Emissions</b><br><i>It is established whether the monitoring plan provides for reliable and complete project emission data over time.</i>   |      |      |   |                |             |
| D.4.1. Does the monitoring plan provide for the collection and archiving of all relevant data necessary for determining baseline emissions during the crediting period?  | /1/  | DR   | Not applicable. According to the approved methodology ACM0001 project emission reductions are directly monitored. |                | OK          |
| <b>D.5. Monitoring of Sustainable Development Indicators/ Environmental Impacts</b><br><i>It is checked that choices of indicators are reasonable and complete to monitor sustainable performance over time.</i> |      |      |   |                |             |
| D.5.1. Does the monitoring plan provide the collection and archiving of relevant data concerning environmental, social and economic impacts?   | /1/  | DR   | Neither ACM0001 nor ACM0002 nor the Brazilian DNA requires monitoring of sustainable development indicators.      |                | OK          |
| <b>D.6. Project Management Planning</b><br><i>It is checked that project implementation is properly prepared for and that critical arrangements are addressed.</i>   |      |      |   |                |             |
| D.6.1. Is the authority and responsibility of project management clearly described?  | /1/  | DR   | Need to be verified on site visit   | <del>CL4</del> | OK          |
| D.6.2. Is the authority and responsibility for registration, monitoring, measurement and reporting clearly described?  | /1/  | DR   | Ditto   |                | OK          |
| D.6.3. Are procedures identified for training of monitoring personnel?   | /1/  | DR   | Ditto   |                | OK          |

\* MoV = Means of Verification, DR= Document Review, I= Interview

| Checklist Question  | Ref. | MoV* | Comments | Draft Concl | Final Concl |
|---|------|------|----------|-------------|-------------|
| D.6.4. Are procedures identified for emergency preparedness for cases where emergencies can cause unintended emissions?   | /1/  | DR   | Ditto    |             | OK          |
| D.6.5. Are procedures identified for calibration of monitoring equipment?   | /1/  | DR   | Ditto    |             | OK          |
| D.6.6. Are procedures identified for maintenance of monitoring equipment and installations?   | /1/  | DR   | Ditto    |             | OK          |
| D.6.7. Are procedures identified for monitoring, measurements and reporting?  | /1/  | DR   | Ditto    |             | OK          |
| D.6.8. Are procedures identified for day-to-day records handling (including what records to keep, storage area of records and how to process performance documentation) | /1/  | DR   | Ditto    |             | OK          |
| D.6.9. Are procedures identified for dealing with possible monitoring data adjustments and uncertainties?   | /1/  | DR   | Ditto    |             | OK          |
| D.6.10. Are procedures identified for review of reported results/data?  | /1/  | DR   | Ditto    |             | OK          |
| D.6.11. Are procedures identified for internal audits of GHG project compliance with operational requirements where applicable?   | /1/  | DR   | Ditto    |             | OK          |
| D.6.12. Are procedures identified for project performance reviews before data is submitted for verification, internally or externally?                                  | /1/  | DR   | Ditto    |             | OK          |
| D.6.13. Are procedures identified for corrective actions in order to provide for more accurate future monitoring and reporting?   | /1/  | DR   | Ditto    |             | OK          |

\* MoV = Means of Verification, DR= Document Review, I= Interview

| Checklist Question   | Ref. | MoV* | Comments   | Draft Concl      | Final Concl |
|--|------|------|--|------------------|-------------|
| <b>E. Calculation of GHG Emissions by Source</b><br><i>It is assessed whether all material GHG emission sources are addressed and how sensitivities and data uncertainties have been addressed to arrive at conservative estimates of projected emission reductions.</i> |      |      |  |                  |             |
| <b>E.1. Predicted Project GHG Emission Reductions</b><br><i>The validation of predicted project GHG emissions focuses on transparency and completeness of calculations.</i>  |      |      |  |                  |             |
| E.1.1. Are all aspects related to direct and indirect GHG emissions captured in the project design?  | /1/  | DR   | <p>IPPC's first order decay model has been applied to estimate expected LFG generation based on the historic and expected future waste volume. Based on the LFG generation rate, the CH<sub>4</sub> emissions avoided by the project are estimated.</p> <p>The project considers the methodology ACM0002 to calculate the Carbon Emission Factor. However, the emission coefficient considered was not demonstrated or related with public information.</p> <p>DNV requests more information about the source of this figure and requests that a transparent calculation of this emission factor is included in the PDD.</p> | <del>CAR</del> 5 | OK          |
| E.1.2. Are the GHG calculations documented in a complete and transparent manner?   | /1/  | DR   | <p>The expected collection efficiency of the LFG recovery system and the assumed methane fraction in the LFG is not mentioned. Moreover, the choice of k = 0.105 and L<sub>o</sub> = 0.105 (missing unit) is not</p>   | <del>CL</del> 5  | OK          |

\* MoV = Means of Verification, DR= Document Review, I= Interview



| Checklist Question  | Ref. | MoV* | Comments   | Draft Concl | Final Concl |
|---|------|------|--|-------------|-------------|
|   |      |      | justified.<br>Electricity displacement: See E.1.1  |             |             |
| E.1.3. Have conservative assumptions been used to calculate project GHG emissions?  | /1/  | DR   | See E.1.1 and E.1.2  |             | OK          |
| E.1.4. Are uncertainties in the GHG emissions estimates properly addressed in the documentation?  | /1/  | DR   | See E.1.1 and E.1.2  |             | OK          |
| E.1.5. Have all relevant greenhouse gases and source categories listed in Kyoto Protocol Annex A been evaluated?  | /1/  | DR   | Yes.   |             | OK          |
| <b>E.2. Leakage</b><br><i>It is assessed whether there leakage effects, i.e. change of emissions which occurs outside the project boundary and which are measurable and attributable to the project, have been properly assessed.</i> |      |      |  |             |             |
| E.2.1. Are potential leakage effects beyond the chosen project boundaries properly identified?  | /1/  | DR   | No leakage must be considered because the energy used for pumping LFG and operating other project equipment is generated on site.  |             | OK          |
| <b>E.3. Baseline Emissions</b><br><i>The validation of predicted baseline GHG emissions focuses on transparency and completeness of calculations.</i>   |      |      |  |             |             |
| E.3.1. Have the most relevant and likely operational characteristics and baseline indicators been chosen as reference for baseline emissions?   | /1/  | DR   | The landfill is almost full and hence there is no big uncertainty with regards to the amount of waste landfilled until its closure. Emission reductions are directly measured. |             | OK          |

\* MoV = Means of Verification, DR= Document Review, I= Interview

| Checklist Question  | Ref. | MoV* | Comments   | Draft Concl      | Final Concl |
|---|------|------|--|------------------|-------------|
| <b>E.4.Emission Reductions</b><br>Validation of baseline GHG emissions will focus on methodology transparency and completeness in emission estimations.                                       |      |      |  |                  |             |
| E.4.1. Will the project result in fewer GHG emissions than the baseline scenario?   | /1/  | DR   | The project is expected to abate - during the first credit period – 7 176 800 tonnes of CO <sub>2</sub> e due to LFG destruction and 317 604 tonnes of CO <sub>2</sub> e due to electricity displacement. The project applies conservative and sound assumptions, having in mind the general uncertainties inherent in the <i>ex-ante</i> methane generation potential calculation by the widely used first order decay model. However the amount of emission reductions due LFG destruction was not deducted according to the selected AF of 20%. | <del>CAR 2</del> | OK          |
| <b>F. Environmental Impacts</b><br><i>Documentation on the analysis of the environmental impacts will be assessed, and if deemed significant, an EIA should be provided to the validator.</i> |      |      |  |                  |             |
| F.1.1. Has an analysis of the environmental impacts of the project activity been sufficiently described?  | /1/  |      | Yes, an Operational License was issued by CETESB according the EIA presented to SMA/DAIA.  |                  | OK          |
| F.1.2. Are there any Host Party requirements for an Environmental Impact Assessment (EIA), and if yes, is an EIA approved?  | /1/  | DR   | See F.1.1  |                  | OK          |
| F.1.3. Will the project create any adverse environmental effects?   | /1/  | DR   | Not foreseen   |                  | OK          |
| F.1.4. Are transboundary environmental impacts  | /1/  | DR   | Not foreseen   |                  | OK          |

\* MoV = Means of Verification, DR= Document Review, I= Interview

| Checklist Question  | Ref. | MoV* | Comments  | Draft Concl | Final Concl |
|---|------|------|---|-------------|-------------|
| considered in the analysis?   |      |      |   |             |             |
| F.1.5. Have identified environmental impacts been addressed in the project design?  | /1/  | DR   | No negative environmental impacts are foreseen for the project, only positive ones with regard to the methane combustion and odour reduction. |             | OK          |
| F.1.6. Does the project comply with environmental legislation in the host country?  | /1/  | DR   | Yes   |             | OK          |
| <b>G. Stakeholder Comments</b><br><i>The validator should ensure that a stakeholder comments have been invited and that due account has been taken of any comments received.</i>                      |      |      |   |             |             |
| G.1.1. Have relevant stakeholders been consulted?   | /1/  | DR   | The consultations of local stakeholders were done according to the Brazilian DNA Resolution 1.  |             | OK          |
| G.1.2. Have appropriate media been used to invite comments by local stakeholders?   | /1/  | DR   | No comments were received.  |             | OK          |
| G.1.3. If a stakeholder consultation process is required by regulations/laws in the host country, has the stakeholder consultation process been carried out in accordance with such regulations/laws? | /1/  | DR   | See G.1.1   |             | OK          |
| G.1.4. Is a summary of the stakeholder comments received provided?  | /1/  | DR   | See G.1.2   |             | OK          |
| G.1.5. Has due account been taken of any stakeholder comments received?   | /1/  | DR   | See G.1.2   |             | OK          |

\* MoV = Means of Verification, DR= Document Review, I= Interview

**Table 3 Resolution of Corrective Action and Clarification Requests**

| Draft report corrective action requests and requests for clarifications   | Ref. to Table 2         | Summary of project participants' response   | Final conclusion  |
|---|-------------------------|---|---|
| <p>CAR 1</p> <p>The application of the baseline methodology ACM0002 for determining the emission factor for displacing electricity is not documented in the PDD and must be included.</p> | B.2.1                   | <p>According to this request the PDD has been revised to incorporate all emission factor calculation.</p>   | <p>OK. The revised PDD (V2 of August 2005), provides the requested clarification, including new figures to calculate the combined margin according to ACM0002 which is presented in complementary spreadsheets and made available for consultation by Econergy.</p>   |
| <p>CAR 2</p> <p>The baseline mention the Adjustment Factor AF of 20 % as established in the baseline methodology. However, in the ER calculation this figure was omitted</p>              | B.2.2<br>B.2.5<br>E.4.1 | <p>The ER calculation considers that 20% of the methane would be flared anyway in the venting equipment (the Effectiveness Adjustment Factor). Therefore, it is mentioned in the PDD at the baseline calculation section.</p> | <p>OK. The revised PDD (V2 of August 2005) and the complementary datasheets identify more clearly the application of the AF. The calculation of the emissions were improved: only the waste dumped on more recent cells is considered and only the gas emitted after the start up of the project is considered.</p> |

| Draft report corrective action requests and requests for clarifications   | Ref. to Table 2 | Summary of project participants' response  | Final conclusion  |
|---|-----------------|--|---|
| <p><b>CAR 3</b></p> <p>DNV requests more information in order to assure more transparency in the additionality justification. In accordance with the requirements in the "Tool for demonstration and assessment of additionality", the investment analysis shall be presented in a transparent manner and all the relevant assumptions shall be provided in the PDD, so that a reader can reproduce the analysis and obtain the same results. Critical techno-economic parameters and assumptions (such as capital costs, fuel prices, lifetimes, and discount rate or cost of capital) must be clearly presented and justified in a manner that can be validated by the DOE.</p> | B.2.7           | <p>According to the meeting with the auditor Luis Filipe, the financial figures were made available, as well as the PDD was updated to clarify such request.</p> | <p>Econergy/ Bandeirantes/ Logos presented two datasheet (BIOGAS and BIOENERGY) with detailed IRR calculations.</p> <p>However, DNV still requests that, in accordance with the requirements in the "Tool for demonstration and assessment of additionality", the investment analysis shall be presented in a transparent manner and all the relevant assumptions shall be provided in the PDD.</p> |
| <p><b>CAR 3 (continued)</b></p> <p>However, DNV still requests that, in accordance with the requirements in the "Tool for demonstration and assessment of additionality", the investment analysis shall be presented in a transparent manner and all the relevant assumptions shall be provided in the PDD</p>  |                 | <p>PDD reviewed including more information</p>   | <p>OK. The clarifications provided during a meeting carried out with the project participants at the DNV office in Rio on 7 March 2005 and complementary information included in the PDD of April 2005 sufficiently state the relevant assumptions for the investment analysis.</p>   |

| Draft report corrective action requests and requests for clarifications   | Ref. to Table 2 | Summary of project participants' response   | Final conclusion   |
|---|-----------------|---|--|
| <p>CAR 4</p> <p>The monitoring does not apply the relevant elements of the monitoring methodology of the ACM0002 "Consolidated methodology for grid-connected electricity generation from renewable sources", which is applied for determining a emission factor for displacing energy generation from other sources. The monitoring plan must include the relevant monitoring indicators of ACM0002.</p> | D.2.1           | <p>ACM0001 does not require monitoring of the mentioned data, only of the emission factor, which is done accordingly, as put in table D.2.2.1 in the PDD.</p> <p>Nevertheless, in the revised version of the PDD, the emission factor calculation was considered, as requested in ACM0002. The spreadsheets for determining this value are attached to this protocol as supporting documents.</p> | <p>OK. The complementary datasheets document the figures used to calculate the combined margin carbon emission factor. As the combined margin is determined <i>ex-ante</i> and neither the OM nor the BM is monitored <i>ex-post</i> (OM and BM are only updated at renewal of the crediting period), the information included in the monitoring plan was considered satisfactory.</p> |
| <p>CAR 5</p> <p>The project considers the methodology ACM0002 to calculate the Carbon Emission Factor. However the figure considered was not demonstrated or related with public information.</p> <p>DNV request more information about the source off this figure and requests that a transparent calculation of this emission factor is included in the PDD.</p>  | E.1.1           | <p>This figure has been calculated using data made available from the ONS – Operador Nacional do Sistema Elétrico, the national operator of the electricity system, and from ANEEL, the electricity authority. This information is available in a spreadsheet which shows the calculation.</p>  | <p>The revised PDD (V2 of August 2005) includes new figures to calculate the combined margin carbon emission factor and the calculations are presented in complementary datasheets.</p> <p>However, DNV still requests that a transparent calculation of the combined margin emission factor is included in the PDD.</p>   |

| Draft report corrective action requests and requests for clarifications  | Ref. to Table 2 | Summary of project participants' response        | Final conclusion   |
|--|-----------------|--|--|
| <p>CAR 5 (continued)</p> <p>DNV requests that a transparent calculation of the combined margin emission factor is included in the PDD. The PDD should among other state:</p> <ul style="list-style-type: none"> <li>- the source of the data used for calculating the combined margin</li> <li>- present the underlying assumptions and the results of the OM, BM and <math>\lambda</math> calculations</li> <li>- clarify that the calculations are based on a 3-year average, based on the most recent statistics, and that neither the OM nor the BM will be monitored ex-post</li> </ul> |                 | PDD reviewed and included additional information | OK. Additional figures included in the PDD and the complementary spreadsheet evidences that the calculation of the combined margin took into consideration the information from the Brazilian Electricity Agency (ANEEL/ONS) for the years 2002 to 2004, including hourly dispatch data used to calculate the adjustment factor $\lambda$ for the operation margin. To calculate the build margin the 20% most recent power plants built were considered. Hence, the combined margin is calculated according to the ACM0002. |
| <p>CL 1</p> <p>Although the project start up on December 2003, no information was mentioned about ANNEL authorization</p>  | A.3.1           | This has been clarified during the site visit.   | OK, It was verified during the site visit that the project received the necessary ANNEL authorization (Resolution ANEEL 511 of November 26,2001 for Electric Energy Generation with 20 MW capacity).   |

| Draft report corrective action requests and requests for clarifications  | Ref. to Table 2 | Summary of project participants' response   | Final conclusion   |
|--|-----------------|---|--|
| <p>CL 2</p> <p>The PDD discusses, according the Tool for demonstration and assessment of additionality, two scenarios (continue the LFG release and implementation of electricity generation with LFG). However other possible scenarios were not mentioned.</p> | B.2.6           | <p>The tool for demonstration and assessment of additionality asks project developers to consider all other plausible and credible alternatives to the project activity that deliver outputs and on services (e.g. electricity, heat or cement) with comparable quality, properties and application areas. In the case of BLFGE, simple LFG destruction does not apply as it does not deliver comparable services as in the project's case.</p> | <p>OK. The clarifications provided by the project participant during the interviews justify that the only plausible baseline is the continuous release of LFG.</p> |
| <p>CL 3</p> <p>The monitoring table D.2.2.1 does not mention for how long archived data is kept.</p>   | D.1.3<br>D.2.1  | <p>There is a conflict between the table used in the approved methodology ACM0001 and the one presented by the CDM-EB in its PDD version 2. Nevertheless, in the "comments" column in the revised PDD, project participants state data will be kept for two years after the end of the crediting period, as requested by ACM0001.</p>   | <p>OK. The reviewed PDD (V2 of August 2005) includes the requested information.</p>  |



| Draft report corrective action requests and requests for clarifications   | Ref. to Table 2        | Summary of project participants' response  | Final conclusion   |
|---|------------------------|--|--|
| <p>CL 4</p> <p>Procedures for QA/QC should be verified during site visit</p>  | <p>D.6.1 to D.6.13</p> | <p>All procedures are in place and were checked during the site visit.</p>   | <p>OK. During the site visit the structure for managing the operation of Biogas and Biogeração, including defined responsibilities, the Operation Manual implemented by the LFG treatment supplier (Van der Wiels) and training records, an Emergency plan and maintenance programme was presented. Calibration records for the measurement of LFG were presented. Also, it could be verified that there are routines to review daily and monthly figures of LFG burned in the flare and the generators and electricity generated.</p> |
| <p>CL 5</p> <p>The expected collection efficiency of the LFG recovery system and the assumed methane fraction in the LFG is not mentioned. Moreover, the choice of <math>k = 0.105</math> and <math>L_o = 0.105</math> (missing unit) is not justified.</p> | <p>E.1.2</p>           | <p>In fact, emission reductions estimates used <math>L_o</math> of 0,055, not 0,105 as stated. As explained in the revised PDD, these numbers are a conservative approach to Van der Wiel's model. ACM0001 requests project participants to use publicly available LFG estimation models, and by that the alternative found was to consider <math>k</math> and <math>L_o</math> factors that would replicate Van der Wiels estimates, under a conservative approach.</p> | <p>OK. The complementary spreadsheets received and verified by DNV evidence that the baseline emissions were calculated based only on the new cells and considering 80% efficiency collection. The calculations are correct and the chosen parameters adequate.</p>  |

- o0o -