



VALIDATION REPORT

PROTOTYPE CARBON FUND

VALIDATION OF THE NOVA GERAR LANDFILL GAS TO ENERGY PROJECT, BRAZIL

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VALIDATION REPORT

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Summary:

PCF has commissioned DNV to validate the NovaGerar Landfill Gas project in Nova Iguaçu, Rio de Janeiro, Brazil (hereafter called “the project”). This report summarises the results of the validation of this project, performed on the basis of currently existing requirements for validation under the Clean Development Mechanism (CDM) in the Kyoto Protocol.

The validation has been performed as a desk review of the project documents presented by PCF. In addition, the Nova Iguaçu Municipality was visited and staff of S.A. Paulista and EcoSecurities has been interviewed. This has enabled the team to perform a risk-based review of material issues with impact on future claims of emission reductions from the project.

The project is likely to mitigate GHG emissions by collection and combustion or flaring of landfill gas (LFG) captured at the Marambaia and Adrianópolis Landfills and by generation and supply of electricity to the regional grid. Emission reductions attributable to the displacement of grid electricity will not be claimed by the project. The validation of the project design initially raised several concerns. Changes to the NovaGerar project design were thus necessary to resolve the validation team's concerns, and the project design documentation was revised and resubmitted for validation.

In the view of DNV's validation team, the NovaGerar Project, as described in the revised and resubmitted project design documentation of April 2003, meets all present and relevant UNFCCC and host country criteria. DNV will recommend the project for registration with the UNFCCC when procedures for this are established. Nevertheless, the values used for the GWP for methane and the gas collection efficiency are not seen as conservative.

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Abbreviations

BLS	Baseline Study
CDM	Clean Development Mechanism
CAR	Corrective Action Request
CEF	Carbon Emission Factor
CER	Certified Emission Reduction
CO ₂	Carbon dioxide
CH ₄	Methane
DNV	Det Norske Veritas
EMLURB	Empresa Municipal de Limpeza Urbana, a government agency responsible for waste collection and disposal
EPA	Environmental Protection Agency
FEEMA	State authority responsible for environmental licences
GHG	Greenhouse gas(es)
GJ	Giga joule
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change
KP	Kyoto Protocol
LFG	Landfill gas
MP	Monitoring Plan
MSW	Municipal Solid Waste
MWh	Mega watt hour
ODA	Official Development Assistance
PCF	Prototype Carbon Fund
PDD	Project Design Document
tC	Tonnes of carbon, units for carbon calculations
tCO ₂	Tonnes of carbon dioxide, units for carbon calculation
UNFCCC	United Nations Framework Convention for Climate Change



1 INTRODUCTION

The Prototype Carbon Fund (PCF) has commissioned DNV to validate the NovaGerar Landfill Gas project, Nova Iguaçu, Rio de Janeiro, Brazil (hereafter called “the project”). The project intends to reduce greenhouse gas (GHG) emissions by:

- Collection and combustion or flaring of landfill gas (LFG) captured at the Marambaia and Adrianópolis Landfills.
- Generation and use of electricity generated from landfill gas, reducing CO₂ emissions associated with the use of grid electricity.

However, potential emission reductions resulting from replacing grid electricity are not claimed by the project.

This report summarises the findings of the validation of the project, performed on the basis of UNFCCC criteria, as well as criteria given to provide for consistent project operations, monitoring and reporting.

The validation team consists of the following personnel:

Ms Mari Grooss Viddal	DNV Norway	Team Leader, GHG auditor
Mr Luis Filipe Aboim Tavares	DNV Brazil	GHG auditor
Mr Einar Telnes	DNV Norway	GHG auditor
Dr. Tsuyoshi Nakao	DNV Japan	GHG auditor, landfill expert
Mr Michael Lehmann	DNV Norway	Internal verifier

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 (MP), and the project's compliance with relevant UNFCCC and host country 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).

UNFCCC criteria refer to the Kyoto Protocol criteria and the CDM rules and modalities as agreed in the Marrakech Accords.

1.2 Validation Scope

The validation scope is defined as an independent review of the project design document (PDD)/1/, the project's baseline study (BLS)/2/, the monitoring plan (MP) /3/ and /5/, the monitoring workbook /4/. The information in these documents is reviewed against Kyoto Protocol requirements, UNFCCC rules and associated interpretations. The validation team has, based on the recommendations in PCF's Preliminary Validation Manual /9/ employed a risk-based approach in the validation, 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 PCF. However, stated requests for clarifications and/or corrective actions may provide input for improvement of the project design.

1.3 The Landfill Gas Energy Project

NovaGerar is a joint venture between EcoSecurities, an environmental finance company which specialises in greenhouse gas (GHG) mitigation issues and S.A. Paulista, a Brazilian civil engineering and construction firm based in the city of São Paulo, Brazil. S.A. Paulista manages the largest domestic waste transfer station in South America (Transbordo Ponte Pequena) responsible for 60% of all domestic waste from São Paulo, a city with a population of more than 10 million people.

In 2001, S.A. Paulista was granted a 20-year concession by the Empresa Municipal de Limpeza Urbana (EMLURB - Municipal Waste Collection Company, a Nova Iguaçu municipality government agency responsible for waste collection and disposal) to manage the Marambaia and Adrianópolis landfills (officially called 'Lixão de Marambaia' and 'Aterro Sanitário de Adrianópolis') in the state of Rio de Janeiro, and to explore the landfill gas potential of these sites. As part of this concession, S.A. Paulista is contractually obliged to decommission and rehabilitate the Lixão Marambaia site, which opened in 1986 and ceased operation in late 2002 with approximately 2 million tonnes of waste deposited. The Adrianopolis site will commence operation in early 2003 and it is anticipated that it will receive an average of 2,000 tonnes of municipal waste per day.

The objective of the project is to explore the landfill gas collection and utilization activities of the landfills managed by S.A. Paulista. This will involve investing in a gas collection system, leachate drainage system and a modular electricity generation plant at each landfill site (with expected final total capacity of 12 MW), as well as a generator compound at each site. The generators will combust the methane in the landfill gas to produce electricity for export to the grid. Excess landfill gas, and all gas collected during periods when electricity is not produced, will be flared.

The project will reduce greenhouse gas (GHG) emissions by:

- Collection and combustion or flaring of the landfill gas (LFG) captured at the Marambaia and Adrianópolis Landfills.
- Generation and supply of electricity to the regional grid. The Project will avoid the utility's carbon dioxide emissions otherwise emitted from non-renewable fuel use.

Carbon emission reductions resulting from displacing fossil-fuel based electricity generation will not be claimed by the project.



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.

2.1 Desk Review

Key project design documents submitted by PCF, i.e. the project design document /1/, the baseline study (BLS) /2/, the monitoring protocol (MP) /3/ /5/, and the monitoring workbook /4/ were reviewed in order to make sure that its content and structure will enable a subsequent validation. Additional background documents /6/-/11/ related to the project design and baseline have been consulted.

In order to ensure transparency, a validation protocol has been customised and used for the project, according to PCF's Preliminary Validation Manual /9/. 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 validation 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 two tables. The different columns in these tables are described in Figure 1.



Validation Protocol Table 1: Mandatory Requirements				
Requirement	Reference	Conclusion	Cross reference	
<i>The requirements the project must meet.</i>	<i>Gives reference to the legislation or agreement where the requirement is found.</i>	<i>This is either acceptable based on evidence provided (OK), or a Corrective Action Request (CAR) of risk or non-compliance with stated requirements. The corrective action requests are numbered and presented to the client in the validation report.</i>	<i>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.</i>	

Validation Protocol Table 2: Requirement checklist				
Checklist Question	Reference	Means of verification (MoV)	Comment	Conclusion
<i>The various requirements in Table 1 are linked to checklist questions the project should meet. The checklist is organised in three different sections. Each section is then further sub-divided. The lowest level constitutes a checklist question.</i>	<i>Gives reference to documents where the answer to the checklist question or item is found.</i>	<i>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.</i>	<i>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.</i>	<i>This is either acceptable based on evidence provided (OK), or a Corrective Action Request (CAR) of risk or non-compliance with the checklist question (See below). Clarification (CL) is used when the audit team has identified a need for clarification of the issue discussed.</i>

Figure 1 Validation protocol tables

2.2 Follow-up Interviews

In February 2003, the validation team member from DNV Brazil has performed site visits and follow-up interviews with key project stakeholders to confirm selected information and to resolve issues identified in the document review. Details of the interview program are included in Appendix B of this report. Concerns related to the GHG calculations, the monitoring and management system and baseline assumptions have been further elaborated through emails between the validation team and key project stakeholders.

2.3 Resolution of Outstanding Issues and Final Validation Opinion

Findings established during the validation can either be seen as a non-fulfilment of validation protocol criteria, or where a risk to the fulfilment of project objectives is identified. This is termed "Corrective Action Request". A "Corrective Action Request" in the validation context would be where;

- i) mistakes have been made with a direct influence on project results;
- ii) validation protocol 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 validation team has also used the term “Clarification Request”, which would be where:

- iv) additional information is needed to fully clarify an issue.

One objective of the validation is to resolve the requests for corrective actions and clarification, so that the validation team can positively conclude on the project design.

The *Corrective Action Requests* and *Clarification Requests* raised by the validation team have been resolved through communications between PCF, Nova Iguacu Municipality, EcoSecurities, S.A. Paulista and the DNV validation team. To guarantee the transparency of the validation process, the concerns raised are described in chapter 3 below and in the Validation Protocol, Appendix A.

3 VALIDATION FINDINGS

In the following sections the findings of the validation are stated. The validation findings for each validation subject are presented as follows:

- 1) The findings from the desk review of the original project design documents and the findings from interviews during the follow up visit are summarised. A more detailed record of these findings can be found in the Validation Protocol in Appendix A.
- 2) Where the validation team identified issues that needed clarification or that represented a risk to the fulfilment of the project objectives, a Clarification or Corrective Action Request, respectively, has been issued. The Clarification and Corrective Action Requests are stated, where applicable, in the following sections and are further documented in the Validation Protocol in Appendix A. The draft validation of the NovaGerar Landfill Gas to Energy Project resulted in four Corrective Action Requests and six Clarification Requests.
- 3) Where Clarification or Corrective Action Requests have been issued, the exchanges between PCF, NovaGerar and the DNV validation team to resolve these Clarification or Corrective Action Requests are summarised. These communications sufficiently addressed the Clarification and Corrective Action Requests, allowing DNV to positively conclude the validation.
- 4) The conclusions for each validation subject are presented.

The findings are structured to reflect the main parts of the validation scope:

- Compliance with mandatory requirements
- Project design
- Project baseline
- GHG emission accounting
- Monitoring plan



3.1 Compliance with Mandatory Requirements

3.1.1 Sustainable Development

The project will have a positive effect on health and amenity in the local area. An Environmental Impact Assessment (EIA-RIMA, in Brazil) was conducted as a requirement to obtain the environmental licenses to operate the new Adrianópolis landfill. This EIA was subject to a stakeholder consultation process which culminated in an official public hearing in 2001. The concerns of stakeholders are recorded in the official minutes of this hearing (Ata de Reunião de Audiência Pública), kept by FEEMA, the environmental agency responsible. A new stakeholder consultation process has been carried out in 2002.

By collecting and combusting landfill gas, the NovaGerar project's sanitary landfills will reduce emissions from uncontrolled releases and reduce the risks of toxic effects on the local community and local environment. Contaminated leachate and surface run-off from landfills can affect down-gradient ground and surface water quality consequently affecting the local environment. By managing the Marambaia and Adrianópolis landfill sites properly, the environmental and health risks and the potential for explosions is reduced. The project will close and remediate the Marambaia open dump.

The project will also have a small, but positive impact on employment in the local area as staff will need to be recruited to manage the landfill gas operations. Additionally, as a condition of the licence, NovaGerar will donate approximately 10% of the electricity generated on-site to the local municipal authority of Nova Iguaçu (where the project is located), to provide lighting for local schools, hospitals and other public buildings.

Economic benefits include the project acting as a clean technology demonstration project, encouraging less dependency on grid-supplied electricity and better management of landfills throughout Brazil, which could be replicated across the region. The NovaGerar project will also play an important demonstration effect, illustrating the use of a new financial mechanism for funding of the renewable energy sector, i.e. the Clean Development Mechanism.

Conclusion

The project contributes to the reduction of environmental and health risks and the potential for explosions. Also, NovaGerar will donate approximately 10% of the electricity generated on-site to the local municipal authority of Nova Iguaçu. The NovaGerar Project will hence likely be in line with Brazilian sustainable development indicators.

3.1.2 Real, Measurable and Additional Emission Reductions

The project is likely to mitigate GHG emissions by collection and combusting or flaring of the landfill gas (LFG) captured at the Marambaia and Adrianópolis landfills and by generation of electricity. The amount of methane emissions avoided by the project are measurable. Hence, the project is likely to result in real and measurable emission reductions.

The NovaGerar project is not a likely baseline scenario (see also section 3.3). The following investment barriers have been identified:

- Lack of legal requirements to collect and dispose LFG



- Internal Rate of Return is low compared to similar projects
- Risks related to the project, the currency and the country are identified
- Risks related to the sale of electricity are identified

Conclusion

The NovaGerar project will result in real and measurable GHG emissions reductions that are additional to what would have occurred in the absence of the project.

3.1.3 Other Mandatory Requirements

Based on the information received, the validation team has not encountered any information that indicates that the project is a substitution of Official Development Assistance (ODA) funding towards Brazil.

Current Brazilian legislation does not require that landfills collect and dispose of landfill gases. The project has obtained the necessary environmental licenses from FEEMA.

Conclusion

In the view of the validation team, the NovaGerar Project complies with relevant Brazilian legislation. Funding is additional to ODA.

3.2 Project Design

3.2.1 Boundaries

The project design is sound and the geographical (Marambaia and Adrianópolis Landfills) and temporal boundaries (21 years-crediting period) of the project are clearly defined. The project's system boundaries are clearly defined. The project consists of two components:

1. Collection and combustion or flaring of landfill gas, reducing the uncontrolled release of methane
2. Use of electricity generated from landfill gas, reducing CO₂ emissions associated with the use of grid electricity. These ERs are not claimed for in the project.

In addition, the project will lead to emission reductions attributable to the displacement of grid electricity, but these will not be claimed by the project.

3.2.2 Project Technology

The objective of the NovaGerar joint venture is to explore the landfill gas collection and utilization activities of the Marambaia and Adrianópolis landfills (officially called 'Lixão de Marambaia' and 'Aterro Sanitário de Adrianópolis') in the state of Rio de Janeiro, and to explore the landfill gas potential of these. This will involve investing in a gas collection system, leachate drainage and treatment system and a modular electricity generation plant at each landfill site (with expected final total capacity of 12 MW).

The proposed landfill gas collection system and electricity generation technology represent leading edge technology for landfill management in Brazil and the project design represents good practise. This includes landfill cells coated with an impermeable high-density polyethylene membrane and water residues will be channelled and treated in a wastewater treatment plant. Landfill gas will be collected by a gas collection system, and channelled to the electricity



generation units. Excess gas will be flared. Advice will be provided by EnerG, a British specialist landfill gas-to-energy company.

Leachate treatment will be carried out through evaporator facilities. Similar facilities in Brazil have problems and are not working. Additional information has been provided regarding leachate treatment in emergency situations.

3.2.3 Stakeholder Consultation

A Stakeholder Consultation process for the NovaGerar project was carried out by an independent organisation, ABES (Associacao Brasileira de Engenharia Sanitaria e Ambiental). The process was based on meetings and interviews and was concluded by the end of 2002. The conclusions from the consultation will be made available to the public.

All organisations agreed with the project concept. 50% of the contacted stakeholders recognised the project's contribution to mitigate climate change.

Conclusion

The project design is sound and the geographical and temporal boundaries of the project are clearly defined. The landfill gas collection system and the electricity generation technology represent good practise. A summary of the comments received from local stakeholders and a report indicating how due account was taken of any comments received has been presented to the validator as required by the modalities and procedures for the CDM.

Two clarification requests were issued regarding leachate treatment and stakeholder consultation. These were resolved.

Draft report clarifications and corrective action requests by validation team	Summary of NovaGerar response and validation team conclusion
CL1. The leachate treatment will be carried out through evaporator facilities. Similar facilities in Brazil have problems and are not working. More information is therefore needed about the effectiveness and alternative technology for leachate treatment.	<p>Response. NovaGerar will identify alternative ways to treat leachate during emergency situations.</p> <p>Validation team conclusion. The information provided regarding leachate treatment is seen as sufficient and the clarification request is resolved.</p>
CL2. As required by the modalities and procedures for the CDM, a summary of the comments received during local stakeholder consultations must be provided to the validator together with a report indicating how due account was taken of any comments received.	<p>Response. The stakeholder consultation was carried out and several stakeholders approved of the project. The summary has been sent to the validator by NovaGerar.</p> <p>Validation team conclusion. The summary of the stakeholder consultation has been reviewed by the validation team. The stakeholder consultation process has identified the relevant stakeholders and comments received have been incorporated in the project design.</p>



3.3 Project Baseline

The modalities for CDM projects as described in the Marrakech Accords adopted at CoP 7 require the validator to forward new baseline methodologies to the CDM executive board for review and approval.

The baseline methodology employed by the NovaGerar Project has not been previously approved by the CDM executive board. Hence, DNV submitted the methodology to the CDM executive board, 09 April 2003 for review. DNV has assessed the baseline methodology employed by the project and has made a determination concluding that the baseline methodology represents current best practise and will result in a transparent, reasonable and conservative baseline.

The baseline approach adopted is option 48(b) of the Marrakech Accords: The baseline is the scenario that represents “emissions from a technology that represents an economically attractive course of action, taking into account barriers to investment”.

The baseline is sustained by an analysis of the economic attractiveness of the NovaGerar project that compares the project IRR without revenue from carbon credits with what is considered a reasonable expected return on investment in Brazil. The results show that the project is not an economically attractive course of action.

Without CER revenues the IRR of the project is 3,25% and this IRR is considered to be too low compared to the perceived risk of the project.

The proposed baseline scenario is the continued non-utilization of LFG. This scenario is determined based on an analysis of current practices and current and foreseeable regulations in the waste management sector. Current Brazilian legislation does not require that landfills collect and dispose landfill gas. The Ministry of the Environment has no immediate plans to introduce legislation requiring the collection and flaring of landfill gas from landfill sites. A new waste management policy (National Policy for Solid Waste) is discussed. However, the policy does not consider landfill gas control.

The project is part of a large program initiated by the Municipality of Nova Iguaçu, of collection of urban waste in the municipality. The second phase of this program is based on the construction of a state-of-the-art Waste Treatment Plant, of which these landfills are a central component, together with units to treat hospital and construction waste, as well as a wastewater treatment plant. The program has already obtained the necessary environmental licenses from FEEMA (the state authority responsible). Hence, a further elaboration on the requirements in the environmental licenses and the content of the program has been reviewed to see whether LFG capture and electricity generation are unlikely to happen without the CDM project.

Conclusion

The baseline is the scenario that represents “emissions from a technology that represents an economically attractive course of action, taking into account barriers to investment”. An analysis of the investment barriers of the NovaGerar project demonstrates that the project is not a likely baseline scenario. The selected baseline is in general well documented and transparent. Two clarification requests regarding the investment barriers for LFG collection and the current practices and current and foreseeable regulations in the Brazilian waste management sector were



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resolved. In the opinion of the validation team, the selected baseline scenario, i.e. the continued non-utilization of LFG, is reasonable for the first crediting period of 2003-2009.

Draft report clarifications and corrective action requests by validation team	Summary of NovaGerar response and validation team conclusion
<p>CL 3 The project is part of a large program, initiated by the Municipality of Nova Iguaçu, to collect urban waste in the municipality. The second phase of this program is based on the construction of a state-of-the-art Waste Treatment Plant, of which these landfills are a central component. S.A. Paulista was granted a 20-year concession. DNV would like to clarify whether LFG capture and electricity generation are required by the program and/ or the concession.</p>	<p>Response.</p> <p>Adrianopolis There are no contractual/concession requirements on venting or flaring gas in the concession for the Adrianopolis site.</p> <p>Marambaia For the Marambaia landfill, the contract foresees remediation of the existing dump and installation of a rudimentary gas drain net and some flares for safety reasons as a part of the bidding documents.</p> <p>The bidding document requires installation of passive drainage wells only in 50m intervals and reaching 2m in depth and to flare the gas captured by the system. While the exact volume of gas such a system would capture is uncertain, it is highly likely that the volume captured would be very low given that most of the methane is generated in the deeper layers of the landfill (the dump is estimated to be 50-70m deep). The flow of gas from the top layer of the dumps (where decomposition is mostly aerobic) could actually be so low that no flaring would be possible and only venting would occur.</p> <p>The bidding documents contain no specification as to the percentage of gas that needs to be collected and flared to meet this contractual requirement. Given that the Marambaia site is away from any human settlements, it is reasonable to assume that no more than 20% of gas would need to be flared (as opposed to mere venting) to sufficiently mitigate the risk of explosions. It is also very likely that not even close to 20% could actually be captured and flared by the required system.</p> <p>Therefore, it is argued that the 20% discount on ERs claimed by the NovaGerar Project (included in the baseline study and monitoring plan to account for regulatory changes and improvements in waste management practices) more than sufficiently covers the volume of gas that would be flared to meet the requirements of the Marambaia concession/bidding documents.</p> <p>Validation team conclusion. The validation team acknowledges that LFG capture efficiency in the baseline scenario is likely to be low. Hence, discounting ERs by 20% is deemed sufficient to allow for potential flaring of LFG at the Marambaia landfill in the baseline scenario.</p>
<p>CL4. Additional information regarding the</p>	<p>Response.</p>

Draft report clarifications and corrective action requests by validation team	Summary of NovaGerar response and validation team conclusion
financial calculations and IRRs from typical waste management projects in Brazil is needed in order to verify the presented investment barrier for the project.	<p>There is no similar project in Brazil with LFG recovering and requesting CER.</p> <p>Validation team conclusion.</p> <p>The financial calculations resulted in a low IRR and the investment barrier of the project seems appropriate.</p>

3.4 GHG Emission Accounting

The project is likely to mitigate GHG emissions by avoiding methane emissions.

Based on currently contracted waste volumes and anticipated growth in waste it has been assumed that the Adrianopolis landfill will receive an average of 2,000 tonnes of waste per day over the licence period, with waste gradually increasing to over 3,000 tonnes per day.

Carbon emission reductions resulting from displacing fossil-fuel based grid electricity are currently not considered for crediting under CDM in this project.

The NovaGerar project is unlikely to result in any significant amount of leakage. The project is based on reducing on-site GHG emissions through the collection and combustion of landfill gas.

3.4.1 USEPA model

The calculations on expected baseline methane emissions are documented in a complete and transparent manner. The US EPA first order decay model equation from the US EPA manual 'Turning a Liability into an Asset: A Landfill Gas to Energy Handbook for Landfill Owners and Operators' (December 1994) has been applied.

The US EPA model is a common model and useful for the estimation of gas emitted from landfill. Because of the uncertainty in estimating the theoretical amount of LFG generated (L_0) and the rate of LFG generation (k), the US EPA suggests that gas flow estimates should be bracketed by a range of plus or minus 50 percent (USEPA, 1996, p2-6). Estimated methane emissions are discounted by 25% for uncertainties in this project, but for a more conservative estimate, LFG predictions must be discounted by 50% instead of 25% as recommended by US EPA.

US EPA indicates that gas collection efficiency of 75 – 85 percent is a reasonable assumption. Similar projects have used 75% or 80% as assumed gas collection efficiency. For estimating methane emissions from the project, a LFG collection efficiency of 85% is used. However, for a more conservative estimation of the methane emissions a lower LFG collection efficiency should be used.

3.4.2 Global Warming Potential

A Global Warming Potential (GWP) of 23 for methane was employed based on IPCC's Third Assessment Report (TAR), although it is not formally approved by the UNFCCC. The project is advised to use a GWP of 21 until the value of 23 is formally adopted by the UNFCCC.



3.4.3 Fraction of methane in Landfill Gas

In literature, the methane content is 45 – 60% and the IPCC default data is 0.5 /11/. Therefore, 0.5 is reasonable value for the estimation of methane. However, the methane content should be measured to determine the methane emissions from the landfills. The NovaGerar project has therefore revised the project documentation and plans to measure methane contents in LFG using gas analyzer.

3.4.4 Biogenic waste

Biogenic materials are defined as carbon-neutral and CO₂ emissions from methane combustion of biogenic material does hence not need to be accounted for as project emissions.

Conclusion

The calculations are documented in a complete and transparent manner, using the US EPA first order decay model equation. A LFG collection efficiency of 85% and the use of a GWP of 23 for methane are not conservative assumptions for estimating project ERs, and that the project may result in less ERs than estimated.

Draft report clarifications and corrective action requests by validation team	Summary of NovaGerar response and validation team conclusion
<p>CAR1. US EPA indicates that gas collection efficiency of 75 – 85% is a reasonable assumption. For estimating methane emissions, of the project, a LFG collection efficiency of 85% is used. However, for a more conservative estimation of the methane emissions a lower LFG collection efficiency should be used.</p>	<p>Response</p> <p>NovaGerar has reviewed the calculations and technical design of Marambaia and for Adrianópolis and has concluded that given the state of the art design of the collection systems using 85% as LFG collection efficiency is warranted.</p> <p>It should also be pointed out, that the 85% collection efficiency assumption is used only in estimation/forecasting of expected Emission Reductions. This collection efficiency assumption is not used in any way in the Monitoring Plan. The actual ERs are accurately measured based on:</p> <ul style="list-style-type: none"> ▪ Electricity produced and generator heat rate for the gas combusted in the engines and ▪ Measurement of methane content of landfill gas sent to the flares <p>Therefore, as the use of 85% collection efficiency assumption has no impact on the environmental integrity of the project, NCDMF suggest to stick to 85% based on the technical design of the project.</p> <p>Validation team conclusion</p> <p>The validation team acknowledges that the actual ERs are measured and that the collection efficiency of 85% is only used for estimating expected ERs. Moreover, we acknowledge that a 85% collection efficiency may be achieved. Nevertheless, the validation team would like to highlight that the current estimate is not conservative and that the project may result in less ERs than estimated.</p>
<p>CAR2. A Global Warming Potential (GWP) of 23</p>	<p>Response. It is correct that the Conference of the Parties of</p>



Draft report clarifications and corrective action requests by validation team	Summary of NovaGerar response and validation team conclusion
<p>for methane was employed based on IPCC Third Assessment Report (TAR), although it is not formally approved by the UNFCCC. The project is advised to use a GWP of 21 until a GWP of 23 is formally adopted by the UNFCCC.</p>	<p>the UNFCCC has not yet adopted GWP 23 (the latest GWP figure approved by IPCC) as the basis for national inventories.</p> <p>We have been informed that the Methodology Panel of the Executive Board has had some discussions on this issue. Therefore, we suggest to forward this question to the Methodology Panel of the Executive Board in the context of the review and approval process for a new baseline and monitoring methodology.</p> <p>Validation team conclusion</p> <p>The validation team acknowledges that a GWP of 23 as suggested by the TAR may be formally adopted by the COP and/or the CDM Executive Board. The GWP of methane should hence be monitored and the GWP adjusted when necessary. Verification and certification of ERs will need to verify whether a GWP of 21 or 23 can be used at the time of verification. Nevertheless, the validation teams would like to highlight that the prevailing GWP of methane of 21 is currently recommended by the COP, using a GWP of 23 does not result in a conservative estimate of expected ERs.</p>

3.5 Monitoring Plan

The provisions in the MP are consistent with the project boundaries in the baseline study and the choices of methodologies are reliable and complete to monitor project GHG emission reductions over time. The methane content of the LFG will be measured to determine the accurate amount of avoided methane emissions from the landfills. The revised project documentation includes a plan to measure methane contents in LFG using gas analyzer.

The baseline will be reconfirmed every 7 years. Baseline validity will be monitored every 7 years through a survey of a Brazilian Landfill Control Group with 12 similar units. Sustainability development indicators are defined and a separate part of the MP /5/ provides for the monitoring of these indicators. The monitoring methodology was submitted to the Executive Board the 9th April 2003 for review and approval.

The methodologies for calculating emission reductions are transparently documented and comply with existing good practice.

Procedures for monitoring and management of leachate have been sufficiently explained in the revised MP. However, waste disposed at the Adrianopolis landfill is recommended to be included in the MP.

Procedures for calibration of measurement equipment, emergency preparedness procedures, training systems and corrective action procedures are sufficiently described in the revised MP.



Conclusion

The provisions in the MP are consistent with the project boundaries in the baseline study and the choices of methodologies are reliable and complete to monitor project GHG emission reductions over time.

Two corrective action request related measurement of methane content and operational procedures, and two clarification requests related to management of leachate and monitoring of waste amount and content, were resolved and closed. The monitoring methodology has not yet been approved by the Executive Board, but has been submitted for review by DNV Certification.

Draft report clarifications and corrective action requests by validation team	Summary of NovaGerar response and validation team conclusion
<p>CAR3. The methane content should be measured to determine the methane emissions from the landfills. Other similar projects plan to measure methane contents in LFG using gas analyser. If NovaGerar plans not to measure the methane content, a more conservative value should be used.</p>	<p>Response NovaGerar and the operator EnerG has reviewed the monitoring plan and will establish a measurement system. A gas analyser will be installed in order to enable accurate measurement of the methane content of the landfill gas sent to flares. See section 3.1.1 of the MP.</p> <p>Validation team conclusion Monitoring the methane content of LFG with a gas analyser as proposed by NovaGerar will represents best practise and result in a sufficiently accurate determination of ERs.</p>
<p>CL5. Procedures for monitoring and management of leachate should be further explained in the MP.</p>	<p>Response. The intention is to treat 100% of leachate on both sites. Leachate produced will be collected and driven to the storage tanks and to the treatment equipment. To monitor efficiency of collection and treatment, ground water quality data will be collected. In addition, in case flow exceeds 1.2l/second, treatment capacity increased or excess treated in a waste water treatment plant. This procedure is included in as one of the Sustainable Development indicators in section 4 of the revised MP.</p> <p>Validation team conclusion. The responses given by NovaGerar are deemed sufficient.</p>
<p>CL6. Waste disposed at the Adrianapolis landfill should be included in the MVP.</p>	<p>Response. The amount and contents of waste disposed at the Adrianapolis landfill site will be monitored as a part of the normal operation of the landfill and in particular in the context of collection of the tipping fees for waste.</p> <p>However, we do not see the relevance of including monitoring of waste disposal in the MP as the relevant for the purposes of ERs is to monitor methane gas combusted in the engines and/or flared in the flares. Therefore, NCDMF suggests not to include this in the CDM MP for the project.</p> <p>Validation team conclusion.</p>



Draft report clarifications and corrective action requests by validation team	Summary of NovaGerar response and validation team conclusion
	<p>The validation team acknowledges that monitoring of waste disposal is not necessary for determining ERs. However, records on the amount of waste disposed at the site may be requested by the verifier of ERs for cross-checking purposes. The project developers should hence ensure that records on the amount of waste, which is monitored as a part of the normal operations, can be made available upon request by the verifier.</p>
<p>CAR4. Procedures for calibration of measurement equipment, emergency preparedness procedures, training systems and corrective action procedures are mentioned but not fully described in the MVP.</p>	<p>Response. Calibration of the measurement equipments is to be done monthly, in accordance with the requirements of the National Measurement Regulation Agency INMETRO (Instituto Nacional de Metrologia). See appendix A of the revised MP.</p> <p>Calibration of measurement equipment will be done monthly. The quality assurance measures include procedures to handle and correct non-conformities in the implementation of the Project or this Monitoring Plan.</p> <p>In addition, NovaGerar will prepare an Operational Manual which will include procedures for training, capacity building, proper handling of equipment, emergency plans, reforestation plans and work security. NovaGerar will also ensure that both NovaGerar staff, EPC operator staff and Paulista (landfill operator) staff will receive appropriate training on the implementation of the MP and of the project. See section 3.3. of the revised MP.</p> <p>Validation team conclusion. The information given from NovaGerar and the revised MP are deemed sufficient.</p>

4 COMMENTS BY PARTIES, STAKEHOLDERS AND NGOS

According to the modalities for the validation of CDM projects, the validator shall make publicly available the project design document and receive, within 30 days, comments on the validation requirements from Parties, stakeholders and UNFCCC accredited non-governmental organisations (NGO) and make them publicly available.

DNV has published the project documents on the DNV Climate Change Internet site (www.dnv.com/climatechange) and invited Parties, stakeholders and NGOs to comment on the validation requirements from 21 December 2002 to 20 January 2003. One comment was received from stakeholders. The unedited comment and a description of how DNV has taken due account of the comment received is included in Appendix C of this report.



5 VALIDATION OPINION

Det Norske Veritas (DNV) is performing a validation of the PCF NovaGerar Landfill Gas to Energy Project located in Nova Iguaçu, State of Rio de Janeiro, Brazil, on the basis of UNFCCC criteria, as well as criteria given to provide for consistent project operations, monitoring and reporting. UNFCCC criteria refer to the Kyoto Protocol criteria and the CDM rules and modalities as agreed in the Marrakech Accords.

The validation of the project design initially raised several concerns. Changes to the NovaGerar project design were thus necessary to resolve the validation team's concerns, and the project design documentation was revised and resubmitted for validation. In the view of DNV's validation team, the NovaGerar Project, as described in the revised and resubmitted project design documentation of April 2003, meets all relevant UNFCCC and host country criteria.

The project is likely to mitigate GHG emissions by a) collection and combustion or flaring of landfill gas (LFG) captured at the Marambaia and Adrianopolis landfills and b) generating electricity from LFG partly displacing fossil-fuel based grid electricity. However, potential emission reductions resulting from the supply of electricity to the regional grid will not be claimed by the project. The project results in the reduction of CH₄ emissions that are real, measurable and give long-term benefits and that are additional to what would have occurred in the absence of the project. Project funding is additional to ODA.

The determination of the baseline is well elaborated, transparent, sufficiently supported with facts and hence reasonable for the first 7-years crediting period, starting in 2003. The baseline and monitoring methodologies have been submitted by DNV Certification for review, but remain to be approved by the CDM executive board.

The project will contribute to the reduction of environmental and health risks and the potential for explosions. The project will donate approximately 10% of the electricity generated on-site to the municipality. The NovaGerar project is likely to be in line with sustainable development policies in Brazil.

The GHG emission calculations are documented in a complete and transparent manner. The algorithm and methodologies for accounting GHG emissions are appropriate and emission factors are generally deemed to be of sufficient accuracy. The values used for the GWP for methane and the gas collection efficiency are not seen as conservative. Hence, the project may result in less ERs than estimated.

DNV will recommend the project for registration with the UNFCCC when procedures for this are established.

The validation is based on the information made available to us and the engagement conditions detailed in this report. DNV can not guarantee the accuracy or correctness of this information. Hence, DNV can not be held liable by any party for decisions made or not made based on the validation opinion. All information provided and identified as confidential by PCF will be kept confidential by DNV.



REFERENCES

Category 1 Documents:

Documents provided by NOVAGERAR that relate directly to the project. These have been used as direct sources of evidence for the validation conclusions.

- /1/ EcoSecurities Ltda: NovaGerar Landfill Gas to Energy Project: Clean Development Mechanism *Project Design Document (CDM-PDD)*, December 2002, revised in April 2003.
- /2/ EcoSecurities Ltda: NovaGerar Landfill Gas to Energy Project: Baseline Study (BSL), December 2002, revised in April 2003.
- /3/ EcoSecurities Ltda: NovaGerar Landfill Gas to Energy Project: Monitoring Plan (MP), December 2002, revised in April 2003.
- /4/ *NovaGerar Monitoring Workbook*, EcoSecurities Ltda: December 2002, revised in April 2003.
- /5/ EcoSecurities Ltda: NovaGerar Landfill Gas to Energy Project: Sustainability Development Section of the Monitoring Plan(MP), January 2003.

Category 2 Documents:

Background documents related to the design and/or methodologies employed in the design or other reference documents. Where applicable, Category 2 documents have been used to check project assumptions and confirm the validity of information given in the Category 1 documents.

- /6/ DNV Pilot Validation of the Liepaja solid waste management project
http://www.prototypecarbonfund.org/docs/Latvia_validation_opinion.doc
- /7/ IPCC Global Warming Potential, Third Assessment Report
<http://www.unfccc.int/ipcc>
- /8/ EPA manual 'Turning a Liability into an Asset: A Landfill Gas to Energy Handbook for Landfill Owners and Operators'. <http://epa.gov/warmingclimate>
- /9/ Prototype Carbon Fund (PCF): Preliminary Validation Manual. November 2000.
<http://www.prototypecarbonfund.org>
- /10/ Energy Information Administration: *Country Analysis Brief - An overview of the energy situation in this country, An Energy Overview of Brazil, and Brazil: Environmental Issues*. <http://www.eia.doe.gov/>. August 12, 2002.
- /11/ F. Kreith, 1994, Handbook of Solid waste management

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APPENDIX B: SITE VISIT PROGRAM

Dates	Interviewees
11 February, 2003, meeting with Eco Securities	DNV: <ul style="list-style-type: none"> • Luis Filipe Tavares Eco Securities: <ul style="list-style-type: none"> • Nuno de Faria Cunha e Silva • Paulo Braga
11 February, 2003, meeting with Nova Iguaçu Municipality and SA Paulista	DNV: <ul style="list-style-type: none"> • Luis Filipe Tavares Nova Iguaçu Municipality <ul style="list-style-type: none"> • Paulo Castro Saldanha – Municipal Secretary • Gertrudes Nogueira, Msc Environmental Assessor S.A.Paulista: <ul style="list-style-type: none"> • Arthur César Oliveira - Oper. Manag. • Jofif Melamed - Ind. Director
11 February, 2003, site visit on Marambaia and Adrianópolis	DNV: <ul style="list-style-type: none"> • Luis Filipe Tavares S.A.Paulista: <ul style="list-style-type: none"> • Adriana V. M. Felipetto - Env. Engineer • Henrique Soares – Plant Engineer



APPENDIX C: STAKEHOLDER COMMENTS

Comments from Stakeholders	DNV Response
1) In appendix 3 of the baseline document since the organic content is known as 77% a more conservative approach would have been to use a factor of 22.36 (i.e. $23 \cdot 77 + 20.25 \cdot 23$) to account for the possible degradation of non organic content into methane. To increase the project benefits, would it not be possible to convert the trucks used to bring waste to the facility to methane so as to reduce the CO ₂ emissions from fuel use. This possibly could accounted for as additional CER. (Gilles Goepfert, Carbol. 27-12-2002)	<p>Although only 77% of the waste is of organic nature, CH₄ in LFG is almost to 100% biogenic. This is confirmed by the IPCC Guidelines which state that “CO₂ emissions from landfill gas recovery combustion are of biogenetic nature and should not be included” (Good Practise Guidance and Uncertainty Management in National Greenhouse Gas Inventories, p. 5.9).</p> <p>Conversion of trucks is seen as an improvement suggestion, but will not affect the conclusions of the validation as long as the transportation and landfill management comply with existing requirements.</p>

APPENDIX A

VALIDATION PROTOCOL

Table 1 Mandatory Requirements

Requirement	Ref	Concl	Cross Reference
UNFCCC/ Kyoto Protocol/ COP Requirements			
1.1. UNFCCC/Kyoto Protocol/ COP Requirements for Clean Development Mechanism activities			
1.1.1. 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	
1.1.2. Assist non-Annex I Parties in achieving sustainable development	Kyoto Protocol Art. 12.2	OK	1.2.5
1.1.3. Assist non-Annex I Parties in contributing to the ultimate objective of the UNFCCC?	Kyoto Protocol Art. 12.2.	OK	1.2.5
1.1.4. Voluntary participation of Parties involved (MoU or Lol)	Kyoto Protocol Art. 12.5a	-	Letter of approval by the Brazilian Government
1.1.5. The emission reductions should be real, measurable and give long-term benefits related to the mitigation of climate change	Kyoto Protocol Art. 12.5b	OK	1.3.6 2.2 – 2.5
1.1.6. Reduction in GHG emissions must be additional	Kyoto Protocol Art. 12.5.c	OK	2.2 – 2.5
1.1.7. Funding be additional to ODA	Kyoto Protocol Art. 12.5.c	OK	NovaGerar will not receive any ODA for the development of this project.
1.1.8. Comments by local stakeholders are invited, and a summary of these provided	Marrakech Accords Modalities for CDM projects	OK	Comments received from the stakeholder consultation process in 2002 have been provided to the validator.
1.1.9. Baseline and monitoring methodology is previously approved by the CDM executive board	Marrakech Accords Modalities for CDM projects	-	Baseline and monitoring methodology have been submitted to the CDM executive board for approval.
1.1.10. Parties, stakeholders and UNFCCC accredited NGOs have been invited to comment on the validation requirements and comments have been made publicly available	Marrakech Accords Modalities for CDM projects	OK	The PDD, BLS and MP were placed on the DNV GHG website (www.dnv.com/climatechange) for comments by Parties, stakeholders and

Requirement	Ref	Concl	Cross Reference
			NGO's from 21 December 2002 until 20 January 2003. One comment was received.
1.1.11. Parties participating in the CDM shall designate a national authority for the CDM	Marrakech Accords Modalities for CDM projects	OK	Brazil's DNA is Comissão Interministerial de Mudança Global do Clima
1.1.12. A documentation on the analysis of the environmental impacts of the project activity, including transboundary impacts, has been 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 has been carried out	Marrakech Accords Modalities for CDM projects	OK	1.2.5 – 1.2.8
1.1.13. Provisions for monitoring, verification and reporting are in accordance with decision 17/CP.7, the modalities described in the Marrakech Accords and relevant decisions of the COP/MOP	Marrakech Accords Modalities for CDM projects	OK	3.1 – 3.5
Non-UNFCCC/KP/COP Requirements			
1.2. International and Regional Requirements			
1.2.1. Is the project in compliance with international or regional directives, treaties or agreements?	International or regional legislation	OK	1.2
1.3. Host Country Requirements			
1.3.1. Is the project in line with relevant legislation and plans in the host country?	National legislation	OK	1.2
1.3.2. Is the project in line with host-country specific CDM requirements?	National legislation	OK	1.2

Table 2 Requirements Checklist

Checklist Question	Ref.	MoV*	Comments	Concl.
1. Project Description			<i>The project description is reviewed to ensure that all aspects related to direct and indirect emissions are captured in the project design and are considered in projecting emission reductions.</i>	
1.1. Project Boundaries			<i>Project boundaries are the limits and borders defining the GHG emission reduction project.</i>	
1.1.1. Are the project's spatial (geographical) boundaries clearly defined?	/1/ /2/ /3/	DR	The NovaGerar Marambaia and Adrianópolis Landfill in Nova Iguaçu, Rio de Janeiro, Brazil confines the project's spatial boundaries.	OK
1.1.2. Are the project's system (components and facilities used to mitigate GHG's) boundaries clearly defined?	/1/ /2/ /3/	DR	The project's system boundaries are clearly defined. The components and facilities used to mitigate GHGs are the collection and combustion or flaring of the landfill gas captured at the Marambaia and Adrianópolis Landfills. The electricity generated from landfill gas will be used for the combustion and replace CO ₂ emissions associated with the use of grid electricity. Emission reductions resulting from replacing grid electricity will not be claimed by the NovaGerar project.	OK
1.1.3. Are the project's temporal boundaries clearly defined?	/1/ /2/ /3/	DR	The project's temporal boundaries are clearly defined. The crediting time is defined as 21 years with baseline renewal after 7 and 14 years.	OK
1.2. Project Design			<i>Validation of project design focuses on the choice of technology, environmental impact and the design documentation of the project.</i>	
1.2.1. Does the project design engineering reflect current good practices?	/1/	DR I	Yes, the proposed landfill gas collection technology and energy generation technology represent leading edge technology for landfill management and the project design represents good practise. CL: The technology for leachate treatment needs to be further	OK

Checklist Question	Ref.	MoV*	Comments	Concl.
			explained, as there have been problems with similar technology in other landfills in Brazil. Response: The intention is to treat 100% of leachate on both sites. Leachate produced will be collected and driven to the storage tanks and to the treatment equipment. To monitor efficiency of collection and treatment, ground water quality data will be collected. In addition, in case flow exceeds 1.2l/second, treatment capacity increased or excess treated in a waste water treatment plant. This procedure is included in as one of the Sustainable Development indicators in section 4 of the revised MP	
1.2.2. Is the project technology state of the art technology or would the technology result in a significantly better performance than any commonly used technologies in the host country?	/1/	DR I	The landfill will be managed according to the latest technology, with additional advice provided by EnerG, a British specialist landfill gas-to-energy company. The waste disposal in Brazil is mainly dumps (lixões) or controlled landfills.	OK
1.2.3. Is the project technology likely to be substituted by other or more efficient technologies within the project period?	/1/	DR I	The landfill gas capture and combustion technology to produce electric energy will not likely be substituted by other more efficient technologies.	OK
1.2.4. Does the project require extensive initial training and maintenance efforts in order to work as presumed during the project period? Does the project make provisions for meeting training and maintenance needs?	/1/ /3/	DR I	The necessary provisions related to maintenance are established in the MP. CL: Training systems related to the new technology should be addressed in the MP. Response: NovaGerar will also ensure that NovaGerar staff, EPC operator staff and Paulista (landfill operator) staff will receive appropriate training on the implementation of the MP and of the project. See section 3.3. of the revised MP.	OK
1.2.5. Is the project in line with sustainable development policies of the host country?		DR	The project is likely to be in line with Brazil's sustainable development policies.	OK

Checklist Question	Ref.	MoV*	Comments	Concl.
1.2.6. Will the project create other environmental or social benefits than GHG emission reductions?	/1/ /2/ /3/	DR	An EIA was conducted for the new Adrianopolis landfill. By collecting and combusting landfill gas, the sanitary landfills will reduce emissions from uncontrolled releases and reduce risks of toxic effects. The collection and treatment of contaminated leachate and surface run-off will result in environmental improvements. Leachate treatment technology will be further investigated. In addition, some jobs will be created for operation and management. Ca. 10% of the electricity generated from the landfills will be donated to the municipality.	OK
1.2.7. Will the project create any adverse environmental or social effects?	/1/ /3/	DR	No adverse environmental or social effects are expected from the project. An EIA has been carried out.	OK
1.2.8. Have identified social and environmental impacts been addressed in the project design?	/1/	DR	Social and environmental impacts of the project have been sufficiently addressed in the BLS. An EIA has been carried out.	OK
1.3. Predicted Project GHG Emissions			<i>The validation of predicted project GHG emissions focuses on methodology transparency and completeness in predictions</i>	
1.3.1. Are all aspects related to direct and indirect GHG emissions captured in the project design?	/1/ /2/ /3/	DR	The aspects related to emissions are considered in the project design. CO ₂ emissions from combustion or burning methane are considered as carbon neutral.	
1.3.2. Are the GHG calculations documented in a complete and transparent manner? Have conservative assumptions been used?	/1/ /2/ /7/ I	DR	The GHG calculations are documented in a complete and transparent manner (spreadsheet) using US EPA first order decay model, and based on waste disposal projection. In order to adjust for uncertainties in the method, the values are discounted for by 25%. To ensure a conservative estimate, a conservative discount will be 50% instead of 25%. CAR: The amount of methane capture was considered as 85% according EnerG estimation, however, similar project have considered 75% or 80% as a conservative	OK

Checklist Question	Ref.	MoV*	Comments	Concl.
			<p>assumption. DNV questions whether an estimate of 85% is seen as conservative.</p> <p>Response: NovaGerar has reviewed the calculations and technical design and has concluded that given the state of the art design of the collection systems using 85% as LFG collection efficiency is warranted. It should also be pointed out, that the 85% collection efficiency assumption is used only in estimation/forecasting of expected Emission Reductions. This collection efficiency assumption is not used in any way in the Monitoring Plan. Therefore, as the use of 85% collection efficiency assumption has no impact on the environmental integrity of the project, NCDMF suggest to stick to 85% based on the technical design of the project.</p> <p>DNV Conclusion: The validation team acknowledges that the actual ERs are measured and that the collection efficiency of 85% is only used for estimating expected ERs. Moreover, we acknowledge that an 85% collection efficiency may be achieved. Nevertheless, the validation team would like to highlight that the current estimate is not conservative and that the project may result in less ERs than estimated.</p> <p>In the interest of conservatism, emission reductions will be discounted by 20% to account for possible improvement in waste management practice in Brazil over the first 7 years of the crediting period of the project. This will be revised for the next crediting period.</p> <p>CAR: A GWP of 23 for methane was selected, as established by IPCC TAR. However, this GWP has not yet been approved by CoP. The project is advised to use GWP 21 until 23 is formally adopted by CoP.</p>	

Checklist Question	Ref.	MoV*	Comments	Concl.
			<p>Response: we suggest to forward this question to the Methodology Panel of the Executive Board in the context of the review and approval process for a new baseline and monitoring methodology</p> <p>DNV Conclusion: The GWP of methane should be monitored and the GWP adjusted when necessary. Verification and certification of ERs will need to verify whether a GWP of 21 or 23 can be used at the time of verification. Nevertheless, the validation teams would like to highlight that the prevailing GWP of methane of 21 is currently recommended by the COP, using a GWP of 23 does not result in a conservative estimate of expected ERs.</p>	
1.3.3. Are uncertainties in the GHG emissions estimates properly addressed in the documentation?	/1/ /2/	DR	Yes, see above	OK
1.3.4. Have all relevant greenhouse gases and source categories listed in KP Annex A been identified and evaluated?	/1/	DR	Yes	OK
1.3.5. Is the assumed crediting time reasonable (seven years with two possible renewals or 10 years with no renewal)?	/1/	DR	The crediting time for the emission reductions resulting from landfill gas methane capture and destruction is 21 years (7 year crediting time with two possible renewals). This is reasonable.	OK
1.3.6. Will the project result in fewer GHG emissions than the baseline case?	/1/ /2/	DR	The project will result in fewer GHG emissions than the baseline case.	OK
1.3.7. Are potential leakage effects beyond the chosen project boundaries properly identified and have they been properly accounted for in calculations?	/1/ /2/	DR	The NovaGerar project is unlikely to result in any significant amount of leakage. Emissions due to the use of electricity for other activities were not considered, due to the difficulty to identify and estimate. Nevertheless, these emissions are likely to be lower than the potential emission reductions resulting in emissions arising from the displacement of more carbon intensive electricity which will not be included in the projects. This is seen as a conservative assumption.	OK

Checklist Question	Ref.	MoV*	Comments	Concl.
2. Project Baseline			<i>The validation of the project baseline has sought to establish whether the selected baseline is relevant and represents the most likely scenario of all possible baselines.</i>	
2.1. Regulatory Framework			<i>The relevant regulatory framework and its impact on project baseline and project performance are assessed.</i>	
2.1.1. Are there any existing host country laws that require the use of a particular technology or prescribe limits for emission and other pollution levels related to the project?	/1/ /2/	D	A new waste management policy (National Politic for Solid Waste) is under discussion. This does not consider landfill gas control.	OK
2.1.2. Is the current political situation in the host country likely to change in a direction that will create stricter environmental legislation or better enforcement of existing laws and regulations?	/1/ /2/	D	Not foreseen	OK
2.1.3. Will the macro-economic trends in the host country have an impact on project baseline or performance?	/1/ /2/	DR	Variations in energy price may have an impact on the project baseline.	OK
2.1.4. Will the political aspirations of the host country have any impact on project baseline or performance?	/1/ /2/		Not foreseen.	OK
2.2. Baseline Methodology			<i>The methodology used to select the baseline will be validated with respect to the suitability for the type of project and the transparency of its use.</i>	
2.2.1. Is the discussion and selection of the baseline methodology transparent?	/2/	DR	The baseline methodology applied is option 48(b) of the modalities and procedures for the CDM as agreed in the Marrakech Accords. The baseline is the scenario that represents “emissions from a technology that represents an economically attractive course of action, taking into account barriers to investment”.	OK
2.2.2. Is the application of the methodology and the discussion and determination of the chosen baseline transparent and conservative?	/2/	DR	Barriers for investment are demonstrated by NovaGerar using IRR calculations. When considering current energy price and Real currency, the IRR is very low compared to the risk.	OK
2.2.3. Is the baseline selection methodology compatible with the available data?	/2/	DR	The baseline scenarios for the methane destruction and the electricity production are supported by available data.	OK
2.2.4. Does the methodology comply with existing	/2/	DR	The baseline approach and methodology is consistent with	OK

Checklist Question	Ref.	MoV*	Comments	Concl.
good practices?			paragraph 48(b) of the modalities and procedures for the CDM as agreed in the Marrakech Accords.	
2.2.5. Does the methodology take into account uncertainties related to the assumptions made for the baseline?	/2/	DR I	<p>The approach and methodology considers some alternatives and chooses the most probable and conservative alternatives.</p> <p>CL: However, DNV questions whether LFG capture and electricity generation are required by the Environmental License and/or the Municipality Program.</p> <p>Response: There are no contractual/concession requirements on venting or flaring gas in the concession for the Adrianapolis site. For the Marambaia landfill, the contract foresees remediation of the existing dump and installation of a rudimentary gas drain net and some flares for safety reasons as a part of the bidding documents. The bidding documents contain no specification as to the percentage of gas that needs to be collected and flared to meet this contractual requirement. The 20% discount on ERs claimed by the NovaGerar Project (included in the baseline study and monitoring plan to account for regulatory changes and improvements in waste management practices) more than sufficiently covers the volume of gas that would be flared to meet the requirements of the Marambaia concession/bidding documents.</p>	OK
2.2.6. Is all literature and sources clearly referenced?	/2/	DR	Yes. Sustained by well elaborated documentation.	OK
2.3. Baseline Determination			<i>The choice of baseline is validated with focus on whether this is a likely scenario and whether the description is complete and transparent.</i>	
2.3.1. Has the UNFCCC accepted / registered similar projects as CDM projects?			No registration/approval of projects is yet established by the UNFCCC.	—
2.3.2. Does the selected baseline represent a likely scenario among other possible and/or discussed	/2/	DR	Yes	OK

Checklist Question	Ref.	MoV*	Comments	Concl.
baselines?				
2.3.3. Have the most relevant and likely operational characteristics and baseline indicators been chosen as reference for baseline emissions?	/2/	DR	The baseline scenario for the methane collection and destruction is based on the concession requirements that NovaGerar has received from the Municipality.	OK
2.3.4. Have financial/economic or other relevant indicators needed for determining the baseline been presented for all alternatives?	/2/ /5/	DR I	<p>Investment barriers for the project are demonstrated by IRR analyses (spreadsheet). It shows that the potential CER revenues significantly increase the project IRR.</p> <p>CL: However, a review of the financial calculations used to derive at the presented financial values is necessary. Moreover, the presented IRR should be compared with IRR's that are typically expected from waste management projects in Brazil in order to conclude on this.</p> <p>Response: There is no similar project in Brazil with LFG recovering and requesting CER.</p> <p>DNV Conclusion: The financial calculations resulted in a low IRR and the investment barrier of the project seems appropriate.</p>	OK
2.3.5. Are the baseline boundaries clearly defined and do they sufficiently cover sources and sinks for baseline emissions?	/2/	DR	Boundaries are clearly defined.	OK
2.3.6. Has the baseline been determined using conservative assumptions where possible?	/2/	DR	Yes.	OK
2.3.7. Have the major risks to the baseline been identified?	/2/	DR	Baseline risks are well elaborated in the baseline study and the baseline allows for uncertainties (see 2.2.5).	OK
2.4. Baseline GHG Emissions			<i>Validation of baseline GHG emissions will focus on methodology transparency and completeness in emission estimations.</i>	
2.4.1. Are the GHG calculations documented in a complete and transparent manner? Are the emission reduction projections conservative?	/2/ /7/	DR I	The Emission Reduction Calculations is explained according to US EPA first order decay model from EPA manual "Turning a Liability into an Asset: Landfill Gas to Energy	

Checklist Question	Ref.	MoV*	Comments	Concl.
			<p>Handbook, and consider 2,63cf /lb MSW, decay rate 0,10, Methane concentration in landfill gas = 50% and collection efficiency of project = 85%. DNV questions that the collection efficiency of 85% is a conservative assumption (ref. question 1.3.2).</p> <p>CAR: Methane content of 50% is reasonable. The methane content will be measured yearly. More frequent measurement of methane content should be included in the MP. If measurements are not carried out, a more conservative value should be selected.</p> <p>Response: NovaGerar and the operator EnerG has reviewed the monitoring plan and will establish a measurement system. A gas analyser will be installed in order to enable accurate measurement of the methane content of the landfill gas sent to flares. See section 3.1.1 of the MP</p> <p>The ER related to electric energy fuel displacement was not considered for CER. However, the expected amount of electricity generated was calculated using a generator heat rate = 10.000 GJ/MWh and a calorific value of methane = 0,0357 GJ/m³ CH₄.</p>	OK
2.4.2. Are uncertainties in the GHG emissions estimates properly addressed in the documentation?	/1/ /2/ /3/	DR	<p>Yes, the main uncertainties are related to the projection of waste disposal at the landfills and the amount of methane. This will be measured according to the MP. The concentration of methane in LFG will be measured daily and the average updated yearly, as well as generator efficiency and flare efficiency. This needs to be clarified in the MP.</p>	OK
2.4.3. Have the project baseline and the project emissions been determined using the same appropriate methodology and conservative assumptions?	/1/ /2/	DR	<p>Yes, both the baseline and the project emissions are determined based on the amount of methane collected and burned or used to generate electricity.</p>	OK

Checklist Question	Ref.	MoV*	Comments	Concl.
3. Monitoring Plan			<i>The MP review aims to establish whether all relevant project aspects deemed necessary to monitor report and verify reliable emission reductions are properly addressed.</i>	
3.1. MP Scope			<i>The review of the MP Scope aims to establish whether the scope objectives and use of the MP are clearly described.</i>	
3.1.1. Does the MP address requirements for all data and indicators that enable a later successful verification?	/3/	DR I	CL: Yes for methane, although measuring leachate amount is not considered in the MP. Response: This procedure is included in as one of the Sustainable Development indicators in section 4 of the revised MP.	OK
3.1.2. Is the MP clear and user friendly?	/3/	DR	The MP presents the monitoring and reporting of the main project components in a clear and transparent manner by the Marambaia and Adrianopolis Workbook spreadsheets.	OK
3.1.3. Does the MP clearly reference all literature used?	/3/	DR	Main references are included or annexed.	OK
3.1.4. Does the MP comply with relevant standards or good monitoring and reporting practices?	/3/	DR	Yes.	OK
3.2. Monitoring boundaries (MSW disposal and Methane collected/flaring)			<i>It is assessed whether the boundaries to monitor and measure project and baseline performance are defined and complete.</i>	
3.2.1. Are the monitoring and verification provisions in the MP consistent with the project boundaries in the baseline study?	/2/ /3/	DR	The provisions in the MP are consistent with the project boundaries in the baseline study. The boundaries of the MP are the Marambaia and Adrianopolis Landfills, however correlated information like amount of waste disposed is not considered in the MP.	OK
3.2.2. Are the monitoring boundaries clearly defined for baseline' and the project indicators relating to social and environmental issues?	/2/ /3/	DR	Sustainable Development indicators are available in a separate document as part of the MP.	OK
3.2.3. Are the monitoring boundaries clearly defined for baseline and the project indicators related to baseline validity?	/2/ /3/	DR	The baseline validity will be reconfirm at each seven year interval through survey of 12 landfills (Control Group)	OK
3.2.4. Have any needs for monitoring outside the	/2/	DR	The project is not likely to result in leakage and there is	OK

Checklist Question	Ref.	MoV*	Comments	Concl.
project boundaries been evaluated and if so included as applicable?	/3/		hence no need for monitoring outside the project boundaries.	
3.3. MP Methodologies			<i>It is assessed whether choices of methodologies are reliable and complete to monitor project GHG performance over time.</i>	
3.3.1. Does the choice of MP methodologies allow conservative transparent accurate and complete calculation of the ex post GHG emissions?	/3/	DR	The methodology of calculating ERs are transparently documented and comply with existing good practice.	OK
3.3.2. Are rationales for selection and use of methodologies clearly explained?	/3/	DR	Methodologies are clearly explained and rationales are provided.	OK
3.3.3. Are formulas used for calculations stated and calculations incorporated or referenced?	/2/ /3/	DR	Yes. The calculations include calculations of methane combustion in electricity generators and methane combustion in flares. Variables used will be confirmed periodically.	OK
3.3.4. If applicable is a methodology for updating the baseline and project emissions forecasts during the project lifetime included in the MP?	/2/ /3/	DR	The baseline is reconfirmed every 7 years	OK
3.3.5. Are methodologies for determining and/or mitigating possible monitoring errors or uncertainties addressed?	/2/ /3/	DR	CAR: Measurements of methane concentration in LFG should be clearly described in the MP. Response: A gas analyser will be installed in order to measure the methane content of the landfill gas sent to flares. Generator heat rate and flare efficiency, and also calibration procedures are described.	OK
3.3.6. Are methodologies for calculating emission reductions implemented in a sound conservative and transparent manner and do they comply with existing good practice?	/2/ /3/	DR	Methodologies are presented transparently and will when correctly applied enable conservative calculations of emission reductions.	OK
3.3.7. Are the selected methodologies supported by the monitored and recorded data?	/2/	DR	Yes.	OK
3.4. Indicators/data to be monitored and reported (MSW disposal and Methane collected/flaring)			<i>It is checked that choices of indicators are reasonable and complete to monitor the specific performance over time.</i>	
3.4.1. Are the choices of project GHG indicators	/3/	DR	Monitoring of methane collection and flaring, and electricity	OK

Checklist Question	Ref.	MoV*	Comments	Concl.
reasonable?			<p>generated (although CERs from energy are not claimed), are reasonable.</p> <p>CL: Waste disposed at the Adrianapolis landfill and measurements of methane concentration should be included in the MP.</p> <p>Response: The amount and contents of waste disposed at the Adrianapolis landfill site will be monitored as a part of the normal operation of the landfill and in particular in the context of collection of the tipping fees for waste. However, we do not see the relevance of including monitoring of waste disposal in the MP as the relevant for the purposes of ERs is to monitor methane gas combusted in the engines and/or flared in the flares. Therefore, NCDMF suggests not to include this in the CDM MP for the project.</p> <p>DNV Conclusion: The validation team acknowledges that monitoring of waste disposal is not necessary for determining ERs. However, records on the amount of waste disposed at the site may be requested by the verifier of ERs for cross-checking purposes. The project developers should hence ensure that records on the amount of waste, which is monitored as a part of the normal operations, can be made available upon request by the verifier.</p>	
3.4.1.1. Will it be possible to monitor / measure the specified project GHG indicators?	/2/ /3/	DR	Yes, it will be possible to monitor/ measure the specified indicators according to methodology description given in MP.	OK
3.4.1.2. Will the indicators give opportunity for real measurements of achieved emission reductions?	/2/ /3/	DR	Yes.	OK
3.4.1.3. Will the indicators enable comparison	/2/	DR	Yes, the proposed indicators enable the comparison of project	OK

Checklist Question	Ref.	MoV*	Comments	Concl.
of project data and performance over time?	/3/		data and performance over time.	
3.4.2. Have indicators for GHG leakage been included?	/1/ /2/	DR	Leakage is found to be negligible.	OK
3.4.2.1. Will it be possible to monitor the specified GHG leakage indicators?		DR	Not applicable.	OK
3.4.3. Is the choice of baseline indicators in particular for baseline emissions reasonable?	/1/ /2/	DR	Yes, a survey of 12 of the NovaGerar landfills peers will be conducted (control group). This will be repeated every 7 years.	OK
3.4.3.1. Will it be possible to monitor the specified baseline indicators?	/2/ /3/	DR	Yes, it will be possible.	OK
3.4.4. Is the choice of indicators for sustainability development (social environmental economic) reasonable?	/2/ /3/ /5/	DR	The indicators were defined in a separate document. Monitoring of ground water quality, biodiversity, health care of worker, job creation, Marambaia Remediation and Native Forest restoration seem reasonable.	OK
3.4.4.1. Will it be possible to monitor the specified sustainable development indicators?	/3/ /5/	DR	Yes.	OK
3.4.4.2. Are the sustainable development indicators in line with stated national priorities in Brazil?	/3/ /5/	DR	The Brazilian Government has not set any sustainable development targets yet.	OK
3.5. Project Management Planning			<i>It is checked that project implementation is properly prepared for and that critical arrangements are addressed.</i>	
3.5.1. Is the authority and responsibility of project management clearly described?	/3/	DR	Yes, project will be implemented by Nova Gerar	OK
3.5.2. Is the authority and responsibility for registration monitoring measurement and reporting clearly described?	/3/	DR	Yes, a named person in the NovaGerar office was designate as the responsible.	OK
3.5.3. Are procedures identified for training of monitoring personnel?	/3/	DR	Responsibility is defined for the Training and Health & Safety coordinator	
3.5.4. Are procedures identified for emergency preparedness?	/3/	DR I	CAR: Emergency preparedness procedures are mentioned but not fully described in the MP. Response: NovaGerar will prepare an Operational Manual	OK

Checklist Question	Ref.	MoV*	Comments	Concl.
			which will include procedures for training, capacity building, proper handling of equipment, emergency plans, reforestation plans and work security. NovaGerar will also ensure that NovaGerar staff, EPC operator staff and Paulista (landfill operator) staff will receive appropriate training on the implementation of the MP and of the project. (Ref. section 3.3. of the revised MP).	
3.5.5. Are procedures identified for calibration of equipment?	/3/	DR I	CAR: Procedures for calibration of measurement equipment (gas analyser, gas flow meter, electricity meter, etc.) are mentioned but not described. Response: Calibration of the measurement equipments is to be done monthly, in accordance with the requirements of the National Measurement Regulation Agency INMETRO (Instituto Nacional de Metrologia). See appendix A of the revised MP. Calibration of measurement equipment will be done monthly. The quality assurance measures include procedures to handle and correct non-conformities in the implementation of the Project or this Monitoring Plan.	OK
3.5.6. Are procedures identified for monitoring of maintenance needs for equipment and installations?	/3/	DR	Yes	
3.5.7. Are procedures identified for monitoring taking measurements and reporting?	/3/	DR	Yes	
3.5.8. Are procedures identified for day-to-day records handling including what records to keep storage of records and how to process performance documentation and possible data sensitivities?	/3/	DR	Storage of records and back-up systems are defined in the MP and spreadsheet.	OK
3.5.9. Are procedures identified for review of reported results/data?	/3/	DR	Storage of records and back-up systems are defined in the MP and spreadsheet.	OK

Checklist Question	Ref.	MoV*	Comments	Concl.
3.5.10. Are procedures identified for internal audits of GHG project compliance with operational requirements?	/3/	DR	Yes, internal audits will be performed by Engineer Manager, Operation Manager and Training and Health & Safety coordinator.	OK
3.5.11. Are procedures identified for project performance reviews?	/3/	DR	Yes	OK
3.5.12. Are procedures identified for corrective actions?	/3/	DR	CL: Not identified yet.	OK
3.6. Verification				
3.6.1. Does the MP contain adequate provisions for verification of emission reductions achieved in compliance with stated project requirements?	/3/	DR	Yes, provisions for verification are clearly stated and elaborated in the MP.	OK

* MoV = Means of Verification DR= Document Review SV=Site Visit Ref. = References on Intermediate Validation Report

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