

**Updated Project Information Document (PID)****Report No: AB764**

<b>Project Name</b>	BRAZIL - Nova Gerar Landfill Rio de Janeiro		
<b>Region</b>	Latin America and Caribbean Region		
<b>Sector</b>	Power (50%); Solid waste management (50%)		
<b>Theme</b>	Climate change (P); Other urban development (S)		
<b>Project</b>	P079182		
<b>Borrower(s)</b>	NOVA GERAR		
<b>Implementing Agency(ies)</b>	NOVA GERAR		
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<b>Environment Category</b>	B (Partial Assessment)		
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<b>Bank Approval Date</b>	April 23, 2004		

**1. Country and Sector Background**

The NovaGerar Project attempts to seize an opportunity created by a novel Carbon Market. It also addresses issues in two main sectors:

- Waste management & the environment
- Power generation

The strategic significance of the Carbon Market for Brazil and each one of those sector issues will be discussed separately.

**1a. The Carbon Market**

The CDM, as defined in the Kyoto Protocol, represents the first global environmental trading scheme. Brazil's private sector is prepared for taking advantage for this market, which is estimated to generate several billion dollars per year to development countries. This is the reason why several market analysts evaluate that Brazil will be able to take a significant share of this market.

Although the Kyoto Protocol has not entered into force yet, significant market transactions are already under way. But even without the Kyoto Protocol entering into force, it is expected that the market will accept the CDM as a project based emission reduction mechanism for countries and companies that have voluntarily adopted a policy to reduce GHG emissions. More importantly, it is expected that the credits generated by the CDM can be used by European companies covered by the European Emissions Trading Scheme. Several countries have already set up funds that will purchase Emissions Reductions through the CDM and the Chicago Climate Exchange has expressly permitted trading of CDM projects from Brazil. It is expected that the carbon market is here to stay, although it is yet too early to estimate the exact overall volume of carbon credits to be traded.

**1b. Waste Management & the Environment**

The CAS states that improvements in environmental management are ongoing. However, the improvement of environmental problems and waste management in particular still represents a huge challenge.

According to the latest survey published by IBGE in 2000 (National Sanitation Research 2000), 47,1% of all waste collected in Brazil is dumped in sanitary landfills, 22,3 % in controlled landfills and 30,5% in open dumps (*lixões*). That would mean that more than 69% of all the collected household waste is disposed of in a sanitary or controlled landfill. But if this analysis is based on the number of municipalities, the result is much less positive: 63,6% of the total of 5.507 municipalities informed that their waste was disposed of in open dumps and only 32,2% declare that operate adequate final disposal sites (Sanitary and controlled landfills). According to the same survey, Brazil maintains 817 sanitary landfills, compared to a total number of 3,834 open dumps. According to parallel surveys in some States, the amount of open dumps might be even higher. According to UNICEF (1999), more than 43,000 children live in and from garbage, most of them in the Northeast of Brazil.

The Ministry of Cities has indicated that the priority for investments should consider the (i) reduction of open dumps by 50% within 5 years; (ii) unification and coordination of existing financing lines and programs; (iii) capacity building with focus on the elaboration of integrated solid waste management plans for municipalities and states, as well as on research and support to NGOs and other technical assistance programs; and (iv) promotion of programs with social- economic objectives linked to waste collection, such as creation and enhancement of solid waste collection cooperatives, recycling programs, selective collection programs, capacity building programs, etc.

In the case of the metropolitan area of Rio de Janeiro, that generates more than 14 tons of solid waste per day, the situation is more than precarious. Current waste disposal sites that receive 90% of the municipal waste of the region will close down and have to be replaced, which will probably create a disposal bottleneck very shortly.

### **1c. Power Generation**

The Government of Brazil (GOB) has been fostering the expansion of generation capacity and the diversification of energy sources. After the rationing crisis in 2001-2002, it became conspicuous that the electric sector in Brazil could not rely solely on large hydro-based generation plants, which will make power supply vulnerable in years of low rainfall.

In addition to the reliability aspects, Brazil wants to diversify its energy matrix by introducing renewable sources of energy. Law 10.438, enacted in early 2002, established a special program, named PROINFA (Programa de Incentivo a Fontes Alternativas) to provide specific incentives to renewable sources of power generation, such as wind, solar and biomass. ELETROBRÁS will act as a single buyer, and will contract up to 3,300 MW until 2006. From those, 1,100 MW are earmarked for initiatives like co-generation and power produced in landfills. The government expects to have the first call for bids in the month of February 2004. The price to be paid for this energy is still under discussion. Currently, there is a public hearing, where both government and potential investors are trying to agree on a price, differentiated by each source, which is satisfactory for both parties.

### **2. Objectives**

The overarching objective of the NovaGerar Project is to demonstrate that carbon finance can catalyze profitable waste management with appropriate gas collection systems and electricity generation under the highest environmental and social standards.

The specific objectives of the Project will encompass maximizing the reduction of greenhouse gases and social and environmental benefits by investing in a gas collection system and in a modular electricity generation plant at the landfill sites and further upgrading the waste management disposal system.

The Project will start with two solid waste management sites in the municipality of Nova Iguaçu: the former open dump located in Marambaia and the sanitary landfill located in Adrianópolis. The Project is designed as an umbrella project and can be expanded to other sites in the metropolitan area of Rio de Janeiro under the condition that (i) all parties agree to the inclusion of additional projects, (ii) the additional projects qualify as CDM projects, (iii) the additional projects satisfy the World Bank's safeguard policies, and (iv) the same sponsor will execute the additional projects.

Final generation capacity installed in the two sites is 11.4 MW in total. The generators will burn the methane contained in the landfill gas to produce electricity for export to the electric grid, to which they will be connected. It is expected that combustion of the methane will reduce emissions of 11.8 million tons of CO<sub>2</sub>e over the next 21 years and 2.5 million until 2012. To a minor extent, it is also expected that the project will lead to emission reductions attributable to the displacement of thermal generation in the interconnected grid. These benefits will not be taken into account in the analysis of this project.

The carbon credit component of the NovaGerar Project will be funded by the Netherlands Clean Development Mechanism Facility (NCDMF), which is managed by the World Bank. The NCDMF supports projects which are expected to generate GHG emission reductions (ER) while complying with requirements of the CDM of the Kyoto Protocol (KP), Art. 12.

### **3. Rationale for Bank's Involvement**

- The NovaGerar Project will create a show-case for best practices in waste management in Brazil and thus serve as an example to many other metropolitan areas, currently facing multiple problems related to improper handling of waste disposal. These lessons learned are currently being disseminated in seminars and workshops organized by the World Bank.
- The NovaGerar Project created a first-of-a kind Clean Development Project in Brazil which is now ready to be replicated. The Project sponsor and the World Bank worked together on setting up and having approved a specific baseline methodology for CDM projects that is now available to the public. Furthermore, the Project documents relevant to the Kyoto Protocol framework, such as the Project Design Document, the Monitoring Protocol and the Baseline Study serve as a model for other municipalities.
- The NovaGerar Project was also the first project presented to the National Designated Authority and could help stimulate the national debate on CDM and on the creation of national procedures for project approvals.
- By virtue of its umbrella concept, the Project can be easily expanded to other open dump sites in the metropolitan area of Rio de Janeiro.
- The Project also represents a model for a Public Private Partnership, as it associates the municipality of Nova Iguaçu and its waste management company, EMLURB to the private company S.A. Paulista. Further partners are the state environmental agency FEEMA, the federal environmental agency IBAMA, the Ministry of the Environment, and the General Attorney Office (*Ministerio Publico*).

#### 4. Description

The Project components include investments in a gas collection system and in modular electricity generation plants at the former open dump in Marambaia and a new sanitary landfill in Adrianópolis.

The understanding of the Project components can be enhanced by looking first at the landfill operations. Although the Project has not directly invested in the construction and operation of the landfill, the World Bank analyzed the design and operational practices related to the waste management and will monitor them very closely during the project cycle. The Adrianópolis landfill is divided in four sections, for which the operator has received an operational environmental license for one section only. If the operator does not receive a renewal of this operational license or is unable to obtain licenses for the other sections, the Project targets for emission reduction will not be achieved and the contract between the Bank and the project sponsor (ERPA) will enter into default.

The main Project components for both the Marambaia and Adrianópolis sites include:

- Gas collection system
- Flares
- Power generators

The gas collection system will use state-of-the-art technology. The landfill uses cells coated with an impermeable high-density polyethylene membrane; water residues will be channeled and treated in a waste water treatment plant. Landfill gas will be collected and channeled to the power generation units; excess gas will be flared. Vertical wells will be used to extract gas, and their spacing is optimized, aiming at maximizing gas collection and minimizing costs. Gas headers will be designed as a looping system in order to allow for partial or total loss of header function in one direction without losing gas system functionality. Condensate extraction and storage systems will be designed at strategic low points throughout the gas system. Efforts will be made to minimize condensate handling.

The flares, to be installed in parallel with the generator sets, will be 2000 m<sup>3</sup>/hour Modular Ground Gas Flares. The flares employ a biogas technology design and will be skid or base frame mounted ground flares. Ground flare stacks enable higher burning temperature to ensure low emissions, in accordance with current best practice guidelines in the UK. The burner unit is fully adjustable to enable high temperature flaring of the landfill gas, which will vary in both quality and quantity from site to site, and over time. The unit is comprised of multiple stainless steel burner nozzles mounted onto a pedestal which supports the flare stack and houses the primary and secondary air supply ductwork. Manual and actuated louvers are provided to control the air supply and manual valves in the pipe work to control the gas supply.

In terms of power generators, British landfill-gas-to-power company EnerG has recommended the use of modular engines, such as the Caterpillar G 3516TA LE spark ignition engines. A modular reciprocating engine facility requires considerably less initial capital expenditure, but does incur higher maintenance costs. Given the inherent uncertainty of gas supply, the smaller modular reciprocating engine generators units offer a significant advantage to adapt the equipment to the site-specific gas volumes. This flexibility enables a small pilot plant to be established at a relatively low cost. As gas volume decreases over time, the modules can be relocated to other sites. Each generating set is rated 0.95 MW. A total of 8 generators will be installed by 2012.

Global Components

## **5. Financing**

### **Source (Total ( US\$m))**

BORROWER (\$12.39)

PROTOTYPE CARBON FUND (\$8.52)

**Total Project Cost: \$20.91**

## **6. Implementation**

### **The Project Sponsor**

NovaGerar Eco-Energia Ltda. (NovaGerar) is a Special Purpose Company (SPC) representing a 50-50 joint venture between EcoSecurities Brasil Ltda (EcoSecurities) and S.A. Paulista de Construções e Comércio (S.A. Paulista). EcoSecurities is an environmental finance company which specializes in the GHG mitigation business; its parent company has headquarters in the UK.

S.A. Paulista is in charge of landfill operations, while NovaGerar will explore all businesses related to the use of the GHG and hold all the assets related to gas collection and power generation. It is therefore the legal contractual partner of the NCDMF. Through an agreement with S.A. Paulista, NovaGerar will have access and full priority to all the gas produced by Marambaia and Adrianópolis, at no cost.

NovaGerar will sign an agreement with EnerG for leasing and operation of the gas collection devices and the power plants.

Funding for the Project will come in its majority from two major sources. First, EnerG will facilitate the deployment of the energy generation equipment, which accounts for a significant part of the Project investments, through a leasing arrangement. Second, a long-term ERPA will provide the carbon credits through the NCDMF, which can also be used as financial guarantees for the leasing contract between NovaGerar and EnerG.

### **The Netherlands Carbon Development Mechanism Fund - NCDMF**

The NCDMF was established in May 2002 between the IBRD and the State of the Netherlands as a facility to purchase GHG ER credits. The agreement, signed with the Netherlands' Ministry of Environment, Housing and Spatial Planning (VROM), supports projects in developing countries in exchange for ER credits under the CDM established by the Kyoto Protocol.

The NCDMF has a target of placing up to 70 million Euros in projects over the first two years of its agreement, leading to emission reductions of approximately 16 million metric tons of CO<sub>2</sub> equivalent until the end of 2012. Over the next two years, the NCDMF will enter into purchase agreements to purchase ER credits from renewable energy, energy efficiency, and fuel switching CDM project activities.

### **The Brazilian Government**

The role of the Brazilian Government in supporting the CDM and the Kyoto Protocol acquires vital importance for the Project. The Government of Brazil has created two important arrangements to deal with global climate change: a) the Inter-ministerial Commission on Global Climate Change ( IMCCC); and (b) the Brazilian Forum on Climate Changes.

At the end of the Project preparation, after validation, the project needs to be approved by the IMCCC. Only after the Government has provided a Letter of Approval (LoA), certifying that the CDM project is contributing effectively to sustainable development in the host country, the CER may become valid under the Kyoto Protocol and registered at the UNFCCC. The IMCCC issued Resolution no. 1, on December 2, 2003, outlining the approval process of CDM projects in Brazil. The Nova Gerar project is expected to be the first approved CDM project in Brazil. In fact, the project was presented at the IMCCC meeting on February 11, 2003. The ICC has 60 days to issue the approval letter.

## **Deal Structure**

### **Main actors and arrangements**

The municipal concession to SA Paulista establishes that 10% of all revenues from all businesses developed by the concessionaire at the landfill, other than the handling and depositing of the Nova Iguacu solid waste, will be transferred to the municipality. This includes all revenues related to special waste treatment, recycling activities, power generation and the commercialization of CER. As the original concession agreement was mute about the LFG exploration rights, a special amendment was later approved by the parties to define S.A. Paulista ownership of the gas.

According to final negotiations, NovaGerar will sign agreements with two EnerG subsidiaries for leasing and operation of the gas collection devices and the power plants. The leasing and administration contracts will include a fixed payment and a variable payment based on output. NovaGerar will be paying EnerG about US\$ 36 per MWh of electricity output sold from the sites, plus 25% of the project gross margin (EBITDA). This overall price is considered high, but may be deemed acceptable considering the complex scope of responsibilities assumed by EnerG.

The commercial arrangements for the sale of the energy produced by NovaGerar have not been finalized. Currently, NovaGerar is analyzing several options, including purchase power agreements with LIGHT (the local distribution company), and sale of part of the energy to Nova Iguacu to satisfy the municipality own needs. One of the most promising options as an off-taker of NovaGerar's power output is ELETROBRAS, which has the legal responsibility of establishing long term PPAs with renewable-based generators under the PROINFA.

### **Special considerations about the ERPA**

The current ERPA draft establishes that NovaGerar has to install generators whenever the corresponding financial conditions are favorable (e.g. long term PPA with adequate prices), but it does not foresee a default in case of noncompliance. The ERPA states a fine to be paid by Nova Gerar, which is equivalent to the carbon credit foregone due to the non-replacement of fossil-fueled generation. As this value is extremely low compared to the revenues from the methane flaring, the ERPA fine is not an effective deterrent to non-deployment of generation by NovaGerar. The reason for this is that the NCDMF was not concerned with economic productive issues and did not want to link the carbon credits to conditions other than those directly associated with generation of emission reductions. In projects that are financed by the World Bank, and not intermediated for a Carbon Purchaser, more effective conditions would have been chosen to enforce energy generation.

## **7. Sustainability**

The Project is expected to be sustainable. In its Carbon Finance operations, one of the Bank's main concerns is that the Project be technically and financially sound, and therefore be able to generate environmentally credible GHG ER. Both, the landfill operation and the gas collection and power generation are deemed financially feasible and are expected to be sustainable until the closing date of the Project, 2012. The Project has satisfactorily complied with the Bank's Safeguard Policy and it is expected to continue doing so. It is deemed that in Brazil the stability of the regulatory and policy environment, the solidity of the Project sponsor, and the capacity of the Government to play its role in adding value to the emissions reductions achieved by the Project through ratifying and following its obligations under the UNFCCC and its Protocols, enhance the sustainability prospects.

## **8. Lessons learned from past operations in the country/sector**

Waste management projects considered by the World Bank Carbon Finance unit include projects in Argentina, Bolivia, India, Mexico, and South Africa under different stages of development.

(i) While it is not related to waste management, it is relevant to mention the Plantar project, the first Brazilian CDM project signed by the PCF (September 5, 2002), where the WB pioneered the CDM in Brazil, setting a first model to be replicated.

(ii) The first waste management project in operation supported by the World Bank Carbon Funds is located in Monterrey, Mexico. The Simeprodeso landfill was established on a greenfield site with a total landfill area of 212 ha. Since operation began in September, 1990, the landfill has been taking mostly non-hazardous domestic and commercial waste as well as some non-hazardous hospital and industrial waste.

(iii) A landfill gas to energy project in Latvia in the city of Liepaja has been fully negotiated and will start operations shortly. The monitoring methodology used in the Latvia Liepaja project is directly replicated in the NovaGerar Monitoring Plan.

(iv) A landfill CDM project, currently being developed in Durban, South Africa, involves the collection of LFG and the generation of power in three landfills within the urban area of the city. The design and baseline are very similar to the NovaGerar project. In comparison to the Brazilian project, the Durban project receives not only credits for the destruction of methane but also for the replacement of CO<sub>2</sub> by the generation of power, due to South Africa's high reliance on coal generation. The Durban project has not been yet approved, due to the pending disclosure of the Environmental and Social Assessment. The Prototype Carbon Fund intends to set up a separate community fund, created with a contribution of US\$ 0.30 per ton of CO<sub>2</sub>e out of the CER sold by the project, to finance small scale community projects in the neighborhood.

## **9. Environment Aspects (including any public consultation)**

**Issues** : The CAS states that improvements in environmental management are ongoing. However, the improvement of environmental problems and waste management in particular still represents a huge challenge.

The primary focus of the Project is the efficient collection of biogas and power generation using methane. The Project is expected to (i) reduce methane, a greenhouse gas, by generation of electricity from landfill gas, and to (ii) improve the management of municipal waste in the municipality and is expected to have

significant positive benefits notably the protection of the environment and human beings through the mitigation of potential risks associated with improper waste disposal.

Potential adverse impacts from the energy generation component are noise from the operation of generators, generation of waste residues (lubricant oils, spent coolant liquid, condensates), accidents (fires, gas leakages), electric discharges along transmission lines. Although a decision is yet to be made as to the mode of transmission of energy that will be generated from Adrianópolis and Marambaia, no resettlement is envisaged as a result of installation of transmission lines. In the case of Adrianópolis landfill, the site shares a border with a FURNAS 500 kV power substation, and as such any environmental impacts associated with the installation of the lines are expected to be minor. In the case of the Marambaia site, there is some 600-800 meters between the power substation and the point of connection at Marambaia. In order to ensure that adequate measures are taken to safeguard people and the environment, the client will submit any plans, work programs and environmental assessments to the Bank for approval prior to implementation.

The main impacts associated with the construction of the Adrianópolis landfill have been identified in a report of study of alternatives *Estudo Ambiental de Alternativas Locacionais* carried out under the project by the municipal entity responsible for waste management, EMLURB. Project impacts are associated with construction activities at the sites of the Adrianópolis sanitary landfill and the Marambaia dump. Main impacts during the construction phase include (i) loss of vegetation and fauna from clearing of secondary forests for site preparation; (ii) reduced replenishment of the underlying aquifer; and (iii) other potential impacts such as construction nuisance including disposal of construction waste, noise, increased traffic, dust, impacts on other road users. Potential impacts during operations include increased traffic, odor, noise, litter, visual impacts, health and safety of workers on the site (dealing with healthcare and municipal waste, operation of sensitive and/or heavy equipment), disposal of solid and liquid waste streams generated on site. All these impacts are being addressed through environmental guidelines and targeted mitigation activities.

With respect to the Marambaia dumpsite closure, the environmental impacts are expected to be largely positive given the deplorable conditions - presence of disease causing vectors, visual impact, soil and water contamination by leachate, associated with the practice of uncontrolled open dumping and exposure to risks thereof by scavengers.

As with all landfill construction and dump closure projects, potential impacts after site closure include: (i) fires; (ii) methane migration from the site which if not adequately mitigated could have severe consequences. Both possibilities are being avoided to the extent possible through proper planning and targeted mitigation measures.

#### **Environmental category and justification/rationale for category rating: B – Partial Assessment**

The project has been classified as a category 'B' because potential adverse impacts though varied, can be mitigated. The engineering design of the proposed Adrianópolis landfill and the Marambaia dumpsite closure, incorporate the mitigation of the polluting effects of landfill leachate. Mitigation of potential adverse post-closure effects are also addressed in the environmental monitoring plan. In addition, appropriate measures have been included for the mitigation of any potentially harmful by-products of the energy generation component. A Social Plan has been developed by the municipality to address the compensation of scavengers whose activities at the Marambaia dumpsite must cease upon closure of the site.

## Special Features:

### 1. Vegetation Enrichment Plan

To address the loss of vegetation as a result of clearing for construction purposes, the project sponsor has prepared a vegetation enrichment plan which will involve the reforestation with native species, of areas cleared during construction activities; restoration of 30ha of degraded land in the Federal Biological Reserve of Tingua; and planting of a green belt to reduce any visual impacts of the landfill. A similar vegetation enrichment plan will be embarked upon at the Marambaia site. At Adrianópolis landfill, the reforestation will also serve to improve water retention around the water spring area. No use of pesticides is envisaged for reforestation activities. Control of ants (*formigas cortadeiras*) will be carried out by (i) mechanical methods involving excavation until nests of fungus housing the queen are encountered, for small areas; (ii) cultural methods that involve use of plant species such as *Sesamum indicum*, *Ruta spp* and *Vandalia spp.*, that possess pest control properties.

### 2. Environmental education program

An auditorium with classrooms will be constructed on-site for the purpose of providing education by way of lectures and classes to members of the community on environmental protection and management as well as training to site workers.

### 3. Public Consultation:

Public consultation with stakeholders was conducted in three distinct stages: (i) Prior to the issuance of environmental licences, stakeholder consultation was conducted by the municipality and the landfill operator, which culminated in an official public hearing in June 2001. The concerns of the stakeholders are recorded in the official minutes of the hearing (*Ata de Audiência Pública*) kept by FEEMA; (ii) An opinion survey on the remediation of the dumpsite and implementation of the Adrianópolis landfill with energy generation; and (iii) Interviews and specific questionnaires for the scavengers (*Catadores*).

It is important to note that in response to stakeholder concerns the project sponsors among other actions, agreed to remediate and close the highly polluting Marambaia dumpsite.

### 4. Monitoring Plan:

The project will monitor and measure the following project impacts on the environment consistent with the EMPs:

- Monitoring of groundwater quality in the Marambaia and Adrianópolis sites
- Restoration with native species of 30ha of land with vegetation; and enrichment of 10ha of land with native species to form green belt.
- Monitoring of bird population in Adrianópolis
- Monitoring of air emissions from energy generation component
- Monitoring of emission reductions to achieve 120,700 tons of methane reduction by 2012.

## 10. List of factual technical documents:

- Nova Gerar Landfill Gas to Energy Project Monitoring Plan, EcoSecurities, December, 2002;
- NovaGerar Landfill Gas to Energy Project, Project Design Document, EcoSecurities, February, 2004
- Evaluation of the emission reductions potential of the Nova Gerar Landfill Gas to Energy Project, Final Baseline Report, EcoSecurities, December 2002
- Emission Reductions Purchase Agreement
- Pesquisa de Opinião sobre a Remediação do Lixão e Implantação do Aterro Sanitário de Nova

- Iguaçu com Aproveitamento Energético do Gás Metano, ABES, February, 2003
- Relatório Ambiental e Social do Lisão de Marambaia, Nova Gerar, April 2003
  - Relatório Ambiental - Central de Tratamento e Disposição Final de Resíduos de Nova Iguaçu, Nova Gerar, April 2003
  - Relatório Ambiental de Geração de Energia, Nova Gerar, April, 2003
  - Aterros Sanitário de Nova Iguaçu, Projeto Executivo, S.A. Paulista, 2001
  - Licitação por Concorrência Pública, EMLURB, Maio 2000

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**Note: This is information on an evolving project. Certain components may not be necessarily included in the final project.**