

Global Environment Facility

MOHAMED T. EL-ASHRY
CHIEF EXECUTIVE OFFICER
AND CHAIRMAN

March 29, 2000

Dear Council Member:

The World Bank, as the Implementing Agency for the project, *Uruguay: Landfill Methane Recovery Demonstration Project*, has attached the proposed project document for CEO endorsement prior to final approval of the project document in accordance with World Bank procedures. This medium-sized project of over US\$750,000 was approved by the Council as part of the Intersessional Work Program in February 2000.

The Secretariat has reviewed the project document. It is consistent with the proposal approved by the Council and the proposed project remains consistent with the Instrument and GEF policies and procedures. The attached explanation prepared by the World Bank satisfactorily details how Council's comments and those of the STAP reviewer have been address. I am, therefore, endorsing the project document.

We have today posted the proposed project document on the GEF website at www.gefweb.org. If you do not have access to the Web, you may request the local field office of UNDP or the World Bank to down load the document for you. Alternatively, you may request a copy of the document from the Secretariat. If you make such request, please confirm for us your current mailing address.

Sincerely,

Cc: Alternates, Implementing Agencies, STAP

OFFICE MEMORANDUM

RECEIVED

DATE: March 27, 2000

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TO: Mr. Mohamed El-Ashry, CEO/Chairman, GEF

GEF SECRETARIAT

FROM: Lars Vidaeus, GEF Executive Coordinator 

EXTENSION: 34188

SUBJECT: **URUGUAY – Methane Recovery Demonstration Project (MSP)
CEO Endorsement**

Please find attached the final MSP Brief for CEO endorsement for the above-mentioned project which is now ready for Bank management approval.

We present below the Bank's response to comments received from Council members during the recent Inter-Sessional Council review. As discussed with the Program Manager, we propose that issues raised by Council members be dealt with during project implementation, as outlined below.

We also note that, looking beyond this Uruguayan initiative, the Mexico Methane Gas Capture and the Indonesia West Java/Jakarta Environmental Management projects will also directly address issues raised by Council and support development of better information and best practices to orient future replication efforts.

Comments from France 03/08/00

The replicability of the process is linked to the repurchase mechanism of the energy produced, which, in the long run, should be paid by electricity users (and no longer by the GEF in order to be sustainable). The project appraisal could provide more details on this mechanism.

We agree that the long-term financial sustainability of methane capture projects in developing countries depends to a large extent on the price of electricity paid by users. The higher the price, the less need for financial support from GEF or any other external grant program. However, financial sustainability also depends on the range of costs involved. That is, even at a higher price of electricity, an inefficient operation may render a project unfeasible. Since there is no relevant experience in Latin America about the range of costs involved, this pilot project provides for a real case illustration of capital and operation costs. In particular, our aim is to demonstrate how much operation costs can be reduced with proper incentives to a private operator. During implementation, the Monitoring and Evaluation Plan (see section VI of the MSP), a financial performance indicator, electricity revenues earned by the municipality and the private operator's operations and maintenance

costs, will be tracked and evaluated. This will enable an assessment of the effectiveness of the incentive imbedded in the revenue sharing arrangement (see section "Sustainability and Risk Assessment" of the MSP). We believe this evaluation will be an useful lesson for replicability.

Comments from Germany 03/08/00

The project constitutes in principle a good demonstration how to make use of such landfills.

However, the important matter of replication possibilities may have to be followed up more in detail as the location may not be appropriate. As it is even stated in the document (para. E. (b).) the municipality selected has a high per capita income for Uruguay and for Latin America. Therefore, to become in the long run a model to be set up without external grants, the question is not only whether the additional investment and operating cost can be covered by power sales revenues. The actual problem could be the financing of the investment and operation cost by revenues from the respective municipality. Consideration how to deal with this possible problem should be included in the project documentation.

The lack of financial capacity in municipalities across Latin America to address solid waste management is indeed a serious limitation for methane capture projects; it is actually the factor explaining the low number of adequate disposal facilities in the first place. Realistically speaking, methane capture would most likely be considered in municipalities that have already or are planning to invest (or pay the private sector to invest) in landfill facilities. This means that these municipalities are likely to be the first set interested in learning about this project and would be target for the dissemination activities. In our view, the viability of this type of project is not strictly related to the income per capita of the municipality but to the waste disposal capacity, efficiency in electricity generation, and to the selling price of electricity. This pilot aims at drawing lessons about the efficiency gains that can be obtained. The pilot location responds to high commitment from local stakeholders (as shown by their financial contribution to the project) and a good level of technical competence on which the project can build the methane capture experience.

Concerning the cost figures, the values in Para II (incremental cost assessment, in particular column 2 – e.g. operating cost) seem not to match with the figures in Para III/Table 3.

The figures do not match because Para II/table II reflects the operating costs of the entire project time framework, i.e. 15 years, while Para III-/Table 3 is the project budget for the first 4 years of the project lifetime as indicated in Para I of the same section.

With these clarifications, we look forward to receiving CEO endorsement for the Uruguay MSP proposal, so that we may approve the GEF grant and initiate project start-up with our Uruguayan partners.

Many thanks for your attention to this matter. We look forward to hearing from you soon.

cc: Messrs./Mmes. King, GEF Program Coordination (GEFSEC), C. Kimes, T. Bradley, M. Isaac (LCSES); Sharma, Aryal (ENVGC); ENVGC ISC, Regional Files

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PROJECT BRIEF

1. IDENTIFIERS:

PROJECT NUMBER: UY-GM-58303
PROJECT NAME: Uruguay Landfill Methane Recovery Demonstration Project
DURATION: Four years
IMPLEMENTING AGENCY: World Bank
EXECUTING AGENCY: Ministerio de Vivienda, Ordenamiento Territorial y Medio Ambiente (MVOTMA)
REQUESTING COUNTRY OR COUNTRIES: República Oriental del Uruguay / Oriental Republic of Uruguay
ELIGIBILITY: Uruguay ratified the United Nations Framework Convention on Climate Change on July 22, 1994
GEF FOCAL AREA: Climate Change
GEF PROGRAMMING FRAMEWORK: Short-term measure

2. SUMMARY: The Project's primary objective is to eliminate the emission of 18,962 tons of methane from the municipal landfill of Las Rosas in Maldonado. The project builds a methane recovery system upon the existing landfill and produces electricity to be sold the national grid, owned by UTE. The Project's second objective is to create local capacity for properly managing a landfill gas recovery project as part of Uruguay's action plan for improving municipal solid waste management and to draw lessons for replication elsewhere in Uruguay and Latin America. A third goal is to raise public awareness about methane recovery within the context of Uruguay's climate change response strategy.

3. COSTS AND FINANCING (MILLION US):

| | | |
|--|--|---|
| GEF: | -Project | US\$ 975,200 |
| | - PDF: | US\$ 24,800 |
| | Subtotal GEF: | US\$1,000,000 |
| CO-FINANCING: | -IA: | n/a |
| | -Other International: | US\$50,000 (for independent evaluation) |
| | -Government of Uruguay: | |
| | Municipality of Maldonado | US\$2,926,400 |
| | MVOTMA | US\$ 60,000 |
| | -Private Operator | US\$ 100,000 |
| | Subtotal Co-Financing: | US\$3,136,400 |
| | TOTAL PROJECT COST (excluding PDF): | US\$4,111,600 |
| <u>4. ASSOCIATED FINANCING (MILLION US\$)</u> | | n/a |

5. OPERATIONAL FOCAL POINT ENDORSEMENT:

Name: Luis Santos **Title:** *Coordinador de la Unidad de Cambio Climático*
(Coordinator of the Climate Change Unit)
Organization: MVOTMA (Ministry of Housing, Land Management and Environment) **Date:** December 15, 1999

6. IA CONTACT:

Christine Kimes, Global Environment Coordinator, LAC Region
Tel. 202-473-3689
Fax: 202-522-3132
Internet: CKimes@Worldbank.org

Global Environmental Facility (GEF)

U R U G U A Y

Methane Recovery Project

GEF Medium-Sized Project

PROJECT BRIEF

March 8, 2000

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CURRENCY

All figures are listed in US dollars.

LIST OF ABBREVIATIONS AND ACRONYMS

| | |
|--------|---|
| CSP | Cost Sharing Project |
| DINAMA | Dirección Nacional de Medio Ambiente, or MVOTMA's Environment Directorate |
| FCCC | Framework Convention on Climate Change |
| GEF | Global Environment Facility |
| GOU | Government of Uruguay |
| LFG | Landfill Gas |
| IMM | <i>Intendencia Municipal de Maldonado</i> (Municipality of Maldonado) |
| MVOTMA | Ministry of Housing, Land Management, and Environment |
| NGO | Non-Governmental Organization |
| PDF | Project Development Facility of the GEF |
| PU | Project Unit |
| SWM | Solid Waste Management |
| UCC | Unidad de Cambio Climático, or Climate Change Unit under MVOTMA's Environment Directorate |
| UNDP | United Nations Development Programme |
| UTE | Usinas y Transmisiones Eléctricas, the national electric utility |

Project Summary

| PROJECT IDENTIFIERS | |
|---|--|
| 1. <i>Project name:</i> Uruguay Landfill Methane Recovery Demonstration Project | 2. <i>GEF Implementing Agency:</i> Ministerio de Vivienda, Ordenamiento Territorial y Medio Ambiente (MVOTMA) |
| 3. <i>Country in which the project is being implemented:</i> República Oriental del Uruguay / Oriental Republic of Uruguay | 4. <i>Country eligibility:</i> Uruguay ratified the United Nations Framework Convention on Climate Change on July 22, 1994 |
| 5. <i>GEF focal area:</i> Climate Change | 6. <i>Operational program/short-term measure:</i> Short-term measure. |
| <p>7. <i>Project linkage to national priorities, action plans, and programs:</i></p> <p>Improved municipal solid waste management (SWM) is a national priority for Uruguay. In 1995, the MVOTMA carried out a sectoral analysis of SWM, which concluded with a national policy to improve local capacity by increasing investments and strengthening institutions in charge of SWM. This national policy program is based on two components: technical and financial assistance from the national government to the regional governments. The program is being implemented by the MVOTMA and the Municipalities. In 1996, the Inter-institutional National Commission on Solid Waste Management was created to implement the policy, including the establishment of a SWM Master Plan. Under the direction of MVOTMA, the Plan will be carried out over a period of ten years.</p> <p>In 1998, in compliance with its commitments as a signatory to the United Nations Framework Convention on Climate Change (FCCC), Uruguay presented the 1994 national greenhouse gases (GHG) inventory and submitted the Initial National Communication (INC). These inventories identified carbon dioxide (CO₂) and methane (CH₄) as the principal greenhouse gases. Uruguay's INC identified electricity generation through methane capture as a low-cost national short-term mitigation measure.</p> | |
| <p>8. <i>GEF national operational focal point and date of country endorsement:</i></p> <p>Luis Santos Coordinator of the Climate Change Unit (UCC) MVOTMA (Ministry of Housing, Land Management, and Environment) Montevideo, Uruguay Tel: (59-82) 917-0752; Fax: (59-82) 916-1895 Date of Country Endorsement: December 15, 1999</p> | |

| PROJECT OBJECTIVES AND ACTIVITIES | | | | | | | | | | | | | | | | | | | | | | |
|--|---|-----------|---------|--|---------------------|-----------|--|-----------------------------|--|-----------|----------|--|--------|--------------------|--|---------|-----------------------------|--|--------|--------------|------------------|--|
| <p>9. <i>Project rationale and objectives:</i></p> <p>(i) Reduce Uruguay's emissions of greenhouse gases (short-term measure) by capturing methane from the municipal landfill of Las Rosas in Maldonado.</p> <p>(ii) Create local capacity for properly managing a landfill gas recovery project and draw lessons for replication elsewhere.</p> <p>(iii) Encourage the replication of the project elsewhere and raise public awareness about methane recovery as part of the country's climate change response strategy.</p> | <p><i>Indicators:</i></p> <p>(i) Reduction in methane emissions relative to the without project scenario. Methane output would be measured as the stream of annual volumes of landfill gas (LFG) captured from the landfill and methane composition based on sample tests.</p> <p>(ii) The management performance of the LFG recovery project would be measured in terms of the electricity generated and sold to the electric utility (Usinas y Transmisiones Eléctricas), and the ability of the landfill operator to maximize generation above an agreed benchmark.</p> <p>(iii) expressions of interest and visits from other municipalities and landfill operators, and direct requests for technical information.</p> | | | | | | | | | | | | | | | | | | | | | |
| <p>10. <i>Expected outcomes:</i> The primary outcome is the estimated 18,962 tons of methane emissions avoided over 15 years at a reasonable cost of \$7.55/ton of carbon. Secondary outcomes are the lessons drawn from operation of the landfill gas recovery project; increased understanding about this kind of project by other municipalities and the general public; and the increment in the installed and electric generation capacity.</p> | | | | | | | | | | | | | | | | | | | | | | |
| <p>11. <i>Project activities to achieve outcome:</i> The Project supports investments in civil works and equipment (gas capture, 0.8 MW generation plant, monitoring) and technical assistance (engineering planning, project management, training, dissemination, and evaluation).</p> | <p><i>Indicators:</i> Project activities will be tracked according to a time-bound implementation plan. The planning, construction and start-up phase is expected to last 12 months and the full operation phase will last 15 years. The Bank will supervise the Project over 4 years, a period deemed sufficient to evaluate project performance.</p> | | | | | | | | | | | | | | | | | | | | | |
| <p>12. <i>Estimated budget (in US\$):</i></p> <table> <tbody> <tr> <td>GEF</td> <td>975,200</td> <td></td> </tr> <tr> <td>Local Co-financing:</td> <td>3,086,400</td> <td></td> </tr> <tr> <td>- Municipality of Maldonado</td> <td></td> <td>2,926,400</td> </tr> <tr> <td>- MVOTMA</td> <td></td> <td>60,000</td> </tr> <tr> <td>- Private Operator</td> <td></td> <td>100,000</td> </tr> <tr> <td>International Co-financing:</td> <td></td> <td>50,000</td> </tr> <tr> <td>Total</td> <td>4,111,600</td> <td></td> </tr> </tbody> </table> | | GEF | 975,200 | | Local Co-financing: | 3,086,400 | | - Municipality of Maldonado | | 2,926,400 | - MVOTMA | | 60,000 | - Private Operator | | 100,000 | International Co-financing: | | 50,000 | Total | 4,111,600 | |
| GEF | 975,200 | | | | | | | | | | | | | | | | | | | | | |
| Local Co-financing: | 3,086,400 | | | | | | | | | | | | | | | | | | | | | |
| - Municipality of Maldonado | | 2,926,400 | | | | | | | | | | | | | | | | | | | | |
| - MVOTMA | | 60,000 | | | | | | | | | | | | | | | | | | | | |
| - Private Operator | | 100,000 | | | | | | | | | | | | | | | | | | | | |
| International Co-financing: | | 50,000 | | | | | | | | | | | | | | | | | | | | |
| Total | 4,111,600 | | | | | | | | | | | | | | | | | | | | | |

| |
|---|
| INFORMATION ON INSTITUTION SUBMITTING PROJECT BRIEF |
| 13. <i>Information on project proponent:</i> MVOTMA was created by legal decree 16.112 on June 8, 1990 with responsibility for the formulation, execution, supervision, and evaluation of national environmental protection plans and policies. |
| 14. <i>Information on proposed executing agency (if different from above):</i> Under MVOTMA's National Environment Directorate, a Climate Change Unit (UCC- <i>Unidad de Cambio Climático</i>) was established by Ministerial Resolution on December 29, 1995. MVOTMA/UCC will execute the Project within the framework of a UNDP Cost Sharing Project agreement co-signed by the municipality and the private operator. |
| 15. <i>Date of initial submission of project concept:</i> April 22, 1998 |
| INFORMATION TO BE COMPLETED BY IMPLEMENTING AGENCY |
| 16. <i>Project identification number:</i> UY-GM-58303 |
| 17. <i>Implementing Agency contact person:</i> Laura Tlaiye, Task Leader, Latin America and Caribbean Region (202-473-1841) Christine Kimes, Global Environment Coordinator, LAC Region, (202-473-3689) |
| 18. <i>Project linkage to Implementing Agency program(s):</i> The Project is consistent with the World Bank's Country Assistance Strategy for Uruguay (June 5, 1997), which identifies increasing urban pollution problems among the country's main environmental concerns. Recent dialogue between the GOU and the World Bank has resulted in preparation of projects addressing coastal pollution, fisheries management and municipal development (including solid waste management). Project preparation is currently underway for a Bank and GEF-financed Maritime Management Project. A Bank and GEF Energy Efficiency Project is also in the early stages of preparation. |

I. DETAILED PROJECT DESCRIPTION

A. Background

Greenhouse Gases and Uruguay's Response

In 1998, Uruguay presented the 1994 national greenhouse gases (GHG) inventory and submitted the Initial National Communication (INC) in compliance with its commitments as a signatory to the United Nations Framework Convention on Climate Change (FCCC). These inventories identified carbon dioxide (CO₂) and methane (CH₄) as the principal greenhouse gases. In particular, methane emissions grew by 11 percent between 1990 and 1994 and account for the second largest source of greenhouse gases: 737,000 tons of methane were emitted in 1994 compared to 3,344,000 tons of CO₂ emissions (net of sinks). Furthermore, solid waste generates eight percent of total methane emissions with the agriculture sector accounting for the balance.

SWM in Uruguay.

Uruguay has approximately 40 solid waste disposal sites distributed throughout the country. The situation, however, is far from adequate, with the majority of solid wastes disposed in open-air dumps. In 1995, the Ministry of Housing, Land Management, and Environment (MVOTMA) carried out a sectoral analysis of solid waste management in Uruguay, which concluded with a commitment to evaluate, strengthen, and improve solid waste management. Completion of this study was assisted by UNDP, the World Health Organization, and the Federal Republic of Germany. A four-year, \$3 million national program to improve solid waste management evolved out of the analysis, which the MVOTMA is presently executing. In 1996, the Inter-institutional National Commission on Solid Waste Management was created to implement a national policy related to waste management, including the establishment of a Master Plan for Management and Investment in the Solid Waste Sector in Uruguay. Execution of the Plan will be carried out over a period of ten years, directed by MVOTMA.

In agreement with a national emphasis on improved SWM, Uruguay's INC on greenhouse gases identified methane capture from solid waste landfills for electricity generation as a low-cost short-term mitigation measure. Independent power generation is now possible due to changes to the power sector legal framework.

Power Sector Reforms.

Demand for electricity has steadily grown over the past decades and the country has resorted to imports of electricity from Argentina in recent years. The government has recently reformed the legal framework governing the power sector, enabling the establishment of independent power producers (Law No. 16.832 and Decree No. 22/999). While specific rules of this reform have not been yet enacted, the project proponents (UCC) have consulted UTE (*Usinas y Transmisiones Eléctricas*), the national utility, and obtained assurances that a purchase contract could be signed in support of this project.

B. Project Background

In support of the national priority to capture methane from landfills as a short-term mitigation measure, the UCC approached the World Bank in 1998 and proposed a collaboration for a demonstration project. In view of the limited experience in Latin America with landfill gas capture and electricity generation, the Bank agreed to support this initiative and a Block A grant for site identification and evaluation was approved. Based on Block A-supported analysis, the Las Rosas landfill was selected for three primary reasons: (i) the site was properly managed as an engineered landfill and would enable efficient methane capture; (ii) the municipality where Las Rosas is located was very interested and was willing to invest in the demonstration project; and (iii) a contractual arrangement with a private operator was already in place that could be easily modified to incorporate the methane capture project.

Current Situation (Baseline): Las Rosas landfill in the municipality of Maldonado (IMM)

Located in the Department of Maldonado, this landfill is one notable example of an environmentally sound solution for an existing open dump. IMM had been operating the site as an open dump since 1989 with a waste recovery, recycling and compost generating system. The dump lacked a capping system (i.e., waste was rarely covered) with the resulting negative impacts on the environment and nuisance to the surrounding population, including pollution of surface waters, presence of rodents and seagulls, odors, and visual impacts.

In 1996, the IMM opened a bidding process for the construction and operation of a landfill – its main technical characteristics are summarized in Table 1.

The IMM awarded a 3-year operation contract to ABORGRAMA, S.A. in 1997 for the construction and operation of two cells and management of the waste pile. IMM pays ABORGAMA a disposal fee of US\$9.06 per ton of urban solid waste and US\$92 per ton of healthcare waste (disposed in a security cell and soon to be treated in a steam autoclave). The initial investment costs by ABORGAMA included land, engineering design, machinery, weighbridge, and the leachate treatment plant. The contract establishes that once the first wastes are deposited into the landfill the ownership of the land is transferred to the IMM.

ABORGAMA's has filled the first cell over the past 2.5 years and the second cell will be filled by June 2000. Construction of four more cells is planned over the next six years. Operation of the six cells will require 9.7 hectares while the total surface of the waste disposal site is 19 hectares. The remaining land (9.3 hectares) could accommodate additional cells extending the site's life by 12 more years for a total site lifetime of 20 years.

Table 1. Las Rosas (Maldonado) Landfill: Main Technical Characteristics

| | |
|--|--|
| Location: | 15 kms from Punta del Este. |
| Total Size of Waste Disposal Facility: | 19 hectares |
| Population Served off-season: | 115,000 |
| Population Served peak-season: | 350,000 |
| Annualized average volume of waste received: | 145 tons/day |
| Average waste generation per capita: | 0.9 kg/day |
| Depth of Cells: | 12 meters |
| Surface of Cell: | |
| Top (h=+6 mts): | 6750 m ² (0.67 hectares) |
| Ground Level (h=0 mts): | 12,200 m ² (1.22 hectares) |
| Type of waste received: | domestic and commercial (no industrial waste, street sweeping or construction and demolition waste is received). |
| Cell Slope: | 7% |
| Walls Maximum slope: | 1:1 |
| Bottom Layer: | The natural ground is leveled and compacted, and a sealing layer of clay is applied. The thickness of the bottom layer is of 0.7 meters while the permeability is lower than 10E-7 cm/seg. |
| Top Layer: | 0.8 meters of clay with a permeability of below 10E-7 cm/seg and a slope of 2% |
| Daily Capping System: | 0.1 meters |
| Total capacity under current contract: | 160,100 Tons |
| Leachate management in place: | Two-stage lagoon system, anaerobic and aerobic, respectively. Facility must comply with regulation 253/79, which establishes the limits for leachate treatment plants. |
| Composition of waste: | 60% organic (dry base-estimated). |

C. Objectives and Project Description

The project's primary objective as a short-term measure is to eliminate the emission of 18,962 tons of methane from the municipal landfill of Las Rosas in Maldonado. The project will build a methane recovery system upon the existing waste pile and six landfill cells and produce electricity to be sold to the national grid owned by UTE. The project's second objective is to create local capacity for properly managing a landfill gas recovery project as part of Uruguay's action plan for improving municipal SWM and to draw lessons for replication elsewhere in Uruguay and Latin America. A third goal is to raise public awareness about methane recovery within the context of Uruguay's climate change response strategy.

To achieve the above objectives, the Project consists of two main components:

- (i) construction and operation of the methane capture system; and
- (ii) technical assistance.

Construction of the methane capture system requires investments for the gas plant and equipment for the collection system; gas suction system, and electricity generation. The gas collection system will consist of 56 wells laid out in the waste pile and the six cells as they are constructed by ABORGAMA. Table 2 presents the expected volumes and LFG collected at each cell. The waste volume already disposed in the open pile is about 300,000 tons and will be divided into 2 LFG generating cells. The start-up of the methane recovery Project would ideally coincide with the construction of cell No. 3. (more details on Project activities and financial inputs are described in Section F).

| Table 2. Methane Recovery Project – Estimated Waste and Gas Volumes | | | | |
|--|--------------|---|--------------------------|----------------------------|
| Capacity of Cells: | | | | |
| | Waste (tons) | Disposal Period | Total CH4 Captured in m3 | Total CH4 Captured in tons |
| Existing Open Dump (2 cells) | 300,000 | 1989-1997 | 2,025,000 | 1,418 |
| Operating Cells (Nos.1 and 2) | 160,000 | Oct 1997- Oct 2000 | 8,800,000 | 6,160 |
| Future Cells (Nos. 3 and 4) | 165,000 | Nov 2001- Oct 2003 | 8,570,991 | 6,000 |
| Future Cells (Nos. 5 and 6) | 170,000 | Nov 2004- Oct 2006 | 7,692,500 | 5,385 |
| TOTAL | | | 27,088,491 | 18,962 |
| Average LFG generation rate over 15 years | | 90 m3/ton (old dump) 220 m3/ton (new cells) | | |
| Average LFG Yield per vertical well: | | 28 m3/h (based on site sampling described in “ <i>Descripcion Actividades de Campo,</i> ” <i>Unidad de Cambio Climatico Montevideo, Julio 1998</i>). | | |
| Number of Planned LFG Extraction Wells: | | 56 | | |

The technical assistance component aims to support engineering planning, project management, training, dissemination, and evaluation.

With the view of enabling the implementation of the Project, the Municipality’s legislature has already approved the renewal of ABORGAMA’s contract for another 6 years. Once the implementation of this project is completed (2006), the IMM may opt to renew the operator’s contract or re-bid the exploitation of the present facility until completing the full capacity of the site.

D. Eligibility Criteria

The involvement of the GEF in the proposed Project is consistent with the guidance for access to the GEF Climate Change short-term window in that:

- (a) it supports a country priority (improved municipal SWM) and implements a short-term measure identified in Uruguay's Initial National Communication and GHG Inventories submitted under the United Nations Framework Convention on Climate Change (1997, 1998);
- (b) with the requested support from GEF, the project is cost-effective at US\$ 7.57/ton of equivalent carbon avoided; and,
- (c) implementation of this projects builds upon a functional contractual arrangement and thus is likely to succeed.

As for World Bank eligibility, this project is consistent with the Country Assistance Strategy in that it supports Uruguay's efforts to address environmental issues of urban areas and to draw lessons on measures to fulfill its obligations under the Climate Change Convention.

E. Project Outcomes

The primary expected outcome, based on conservative assumptions, is that 18,962 tons of methane emissions or more will be avoided over 15 years. Secondary outcomes include the lessons drawn from operation of the landfill gas recovery project and increased interest from other municipalities and the general public about this kind of project.

The amount of methane captured estimated at 18,962 tons is based upon conservative and technologically feasible assumptions summarized in Annex 1. The key assumptions are: a 15-year generation period, a bell-shaped LFG generation curve averaging 220 m³/ton of waste, and a methane content in LFG of 50%. The derived total capture of LFG over the project's lifetime of 54.1 million m³. The 15-year LFG generation period is used as the basis for analysis because it is consistent with the international experience in conventional methane recovery technology¹ and is sufficient to meet the project's primary purpose as a pilot program. Extending the period of analysis was considered inappropriate because it would imply additional investments in landfill expansion which this Project is not proposing to finance.

The equivalent total amount of carbon abated by the Project is 129,147 tons, which includes the reduction of 108,600 tons of carbon from methane capture and 20,547 tons carbon savings which arise because power generated from the landfill gas would displace power that would otherwise be generated using a fossil fuel. This estimate is based on the fact that on a mass basis methane absorbs 21 times more energy than carbon dioxide; thus, the equivalent amount of CO₂ reduced by capturing methane is 398,202 tons.

Methane output would be measured as the stream of annual volumes of landfill gas (LFG) captured from the landfill and methane composition based on sample tests. The

¹ Conventional methane recovery technology involves LFG collection and utilization over 10 to 20 years. The "Enhanced Bioreactive Landfill" technology accelerates the gas generation process to about half the time of conventional technology but requires waste compaction and leachate recirculation. The associated much higher investments and operating costs are unaffordable for the scale of this Project.

performance of the LFG recovery project would be measured in terms of the electricity in kWh generated and sold to UTE, and the ability of the landfill operator to maximize generation above an agreed benchmark. Thus, the financial performance of the project is a derived indicator. Finally, indicators of awareness would include expressions of interest and visits from other municipalities and landfill operators, and direct requests for technical information. (Details are provided in Section VI. Monitoring and Evaluation).

F. Activities and Financial Inputs Needed

The proposed Project is complementary to the baseline situation because the activities for the methane recovery system require that the landfill cells continue to be built and operated. Thus, the financial resources needed for the proposed Project are additional to the baseline investments that IMM will make in the Las Rosas landfill. Namely, IMM's baseline investments from the years 2000 to 2004 (the period of Project implementation) will be \$692,000 for cell construction (civil works, loading vehicles, and equipment) and \$1.6 million for operating and maintenance (O&M) costs.

The proposed Project adds the following financial inputs (see Budget Table 3 for cross reference):

Component 1: Construction and Operation of Methane Recovery System

- (a) **investments:** These include civil works for the gas plant (gas pumping and generation stations); equipment for the gas collection system (vertical extraction wells for waste pile and already finished cells, and horizontal drains placed during infilling of waste in new cells); gas suction system (vacuum pumps, fittings, monitoring equipment and control system); and electricity generation (two 430 kW gas engine/generators). The investments for the methane recovery system are estimated to cost approximately \$1,097,300. GEF would finance \$785,400 and the balance would be financed by the Municipality and ABORGAMA.
- (b) **O&M costs:** Includes labor, maintenance, and supplies which will be financed by the municipality and transferred to the private contractor on a per ton of waste basis. These costs are estimated at \$287,900.

Component 2: Technical Assistance

- (c) **project management and training:** these activities include support for engineering planning, project management, training, and evaluation. The estimated cost is \$372,700 of which GEF would support \$189,800 and MVOTMA and the Municipality would support \$182,900.
- (d) **dissemination activities:** includes targeted workshops and materials about the results of the project. The estimated cost is \$18,000 and will be financed by the national government.

In summary, GEF would be supporting \$785,400 for investments and \$189,800 for technical assistance adding to a total of \$975,200.

E. Sustainability Analysis and Risk Assessment

Financial sustainability is a critical element of a successful methane recovery demonstration project. Assuming that GEF approves the requested grant of \$975,200, the proposed Project will be sustainable because the financial inputs from the country stakeholders (MVOTMA, IMM and ABORGAMA) adequately support investment and operating requirements of the Project. More specifically, the maintenance and operating costs to be incurred by the private operator will be covered by the municipality on the basis of an agreed per ton of payment, which will be additional to the current \$9.06/ton fee. This additional payment will be agreed between the municipality and the private operator on the basis of supplier recommendations of the specific equipment purchased for the project and expert opinion. The amount of the payment will be subject to annual revisions.

The potential risks affecting this Project and the measures and factors mitigating such risks are presented below.

| Main Risks | Mitigating Measures and Factors |
|--|--|
| <p>(a) electricity sales may not be high enough to cover methane O&M costs:</p> | <p>UTE has sent a written commitment to purchase electricity from the Project at a price of 2.7 cents/kWh for 15 years. A formal long-term purchase agreement between UTE and IMM will be sought and will be a condition of grant agreement effectiveness. To further reduce the risk of insufficient electricity sales, the project is designed to maximize the volume of gas generated by providing the private contractor an extra benefit when exceeding an agreed benchmark based on the average yield. The private operator would receive normally 10% of electricity sales as a partial compensation for its \$100,000 counterpart investment. If the operator produces more electricity than the kWh established by the benchmark (see Monitoring Indicators), it would receive 50% of the <u>incremental</u> revenues, with the other 50% accruing to the municipality.</p> |
| <p>(b) Counterpart financing could be insufficient or not materialize: the up-front investments required from local counterpart for the methane recovery system for the first four years are \$494,800 (excludes recurrent costs, see section III. Budget);</p> | <p>The Project has the political and financial backing of MVOTMA, the municipality of Maldonado, and the private operator. Maldonado has a good record of paying the landfill operator and is capable of contributing the pledged counterpart; it has the highest per capita income in Uruguay and in 1998, its investment budget was US\$8.4 million.</p> |
| <p>(c) Project implementation and operation may be difficult since there is no local experience in managing a LFG recovery project, including a required supervisory role.</p> | <p>The operation of the methane recovery project will be incorporated into a modification to the existing contractual arrangement between the municipality and the private operator. Therefore, the project does not create a new institutional arrangement beyond the supervisory role that the municipality and MOVTMA will assume to evaluate the experience. To mitigate the risk of limited local operational</p> |

| | |
|---|---|
| | <p>and management experience in this kind of project, the technical assistance component will train the operator and municipal staff on the technical and managerial requirements of a LFG recovery project, including the electricity sale and worker safety aspects. Finally, to further reduce operational risks and provide incentives for efficient operation, the operator will be compensated for increased electricity sales as described in (a) above.</p> |
| <p>(d) Technical risks: (i) a decrease in the amount of organic waste matter leading to less LFG and electricity than anticipated, (ii) a lower efficiency of the utilization equipment than expected.</p> | <p>Technical risks will be mitigated by three factors:</p> <p>(i) Through effective education programs and the community’s adherence to waste disposal procedures, the municipality of Maldonado can ensure an adequate influx of organic material to the landfill. The high organic content is explained by the fact that the landfill does not receive street sweeping, construction and demolition, or industrial wastes. The landfill only receives domestic and commercial waste.</p> <p>(ii) The efficiency of the electricity generators will be guaranteed by the supplier as part of the purchase contract.</p> <p>(iii) An additional mitigation factor is that the technology chosen is conventional and has been proven in most industrialized countries. Hence, with good training this technology should render the expected results.</p> |

F. Stakeholder Involvement and Environmental Assessment

From the Project’s early conception stages, UCC made a conscious effort to engage the main stakeholders (IMM, the public contractor, and UTE) and inform the public about the potential benefits of this initiative. Regular meetings and discussion have been made with the municipal government, including presentations to Maldonado’s legislature, and the private contractor. Media coverage and events have been organized to demonstrate the feasibility of generating electricity from a landfill. Furthermore, in terms of environmental assessment, the Las Rosas landfill project was subject to the legally required permitting process.

The initial technical work required to test the LFG generation potential was conducted with the support of the University of the Republic (Montevideo). LFG samples were drawn to determine the quantity and quality of the generated gas, using a domestic vacuum cleaner attached to the extraction well. Subsequently, two events were held to demonstrate the generation of electricity from gas extracted from the Las Rosas landfill. First, a small-scale gas engine was shown to produce electricity to power a few light bulbs. A second, much larger demonstration involved the connection of a blower and a portable 20 kW gas engine loaded on a truck, which powered a full scale workshop with tools (drill, press, etc.), an office, and a kitchen (domestic appliances). The expenses for the second event were covered by the private operator and the IMM, demonstrating their interest in promoting this Project. The event was featured in national TV and newspapers.

II. INCREMENTAL COST ASSESSMENT

The incremental cost assessment compares the costs of the baseline situation, the continued construction and operation of the landfill in Maldonado, to the alternative project which adds to the landfill a methane recovery system. The Incremental Cost Analysis is presented in detail in Annex 1 (Table 1). Additionally, Annex 1 (Table 2) presents a detailed breakdown of the GEF Alternative's costs, as well as technical assumptions and other data (Tables 3 and 4). As presented below in the incremental cost summary, the present value of the incremental cash flow stream is US\$975,200.

| Cost Category (All figures are PV @ 10%) | Baseline: Continue Landfill w/o Methane Recovery | Alternative: Continue Landfill with Methane Recovery | Incremental Costs (Alternative – Baseline) |
|--|---|---|--|
| Domestic Benefits | | 6935 MWh/year of electricity generated from methane capture | |
| Global Benefits | 0 tC abated | 129,147 tC abated | 129,147 tC abated |
| INVESTMENT COSTS | 479,142 | 1,729,177 | 1,250,035 |
| OPERATING COSTS | \$2,184,613 | \$2,969,331 | \$784,718 |
| ELECTRICITY SALES | \$0 | (\$1,059,553) | (\$1,059,553) |
| NET INCREMENTAL COST | \$2,663,755 | \$3,638,955 | \$975,200 |

III. BUDGET

The Project's budget (financing plan) was calculated for the four-year period (2000-2004) which will be subject to World Bank supervision. The total budget of \$4,111,600 shown below includes the baseline investments and O&M costs and the complementary investments and O&M costs associated with the methane recovery system.

GEF would finance approximately 24% of the 2000-2003 financing requirements, the IMM would finance 73%, the MOVTTMA 1%, and the private contractor about 2%. Recurrent costs have not been discounted for simplicity of presentation and comparison with the tables in Annex 1.

Table 3. Project Budget

| Component | GEF | Municipality of Maldonado | National Government (MVOTMA) | Private Contractor | International Co-financing | Project Total |
|----------------------------------|----------------|---------------------------|------------------------------|--------------------|----------------------------|------------------|
| Landfill (Baseline) | | | | | | |
| - Investments | | 692,000 | | | | 692,000 |
| - O&M Costs | | 1,611,700 | | | | 1,611,700 |
| Subtotal | | 2,303,700 | | | | 2,303,700 |
| Methane Recovery | | | | | | |
| Civil Works | | 75,600 | | | | 75,600 |
| Equipment for: | | | | | | |
| - gas collection system | 105,000 | | | 20,000 | | 125,000 |
| - gas suction and monitoring | 110,000 | 29,300 | | 35,000 | | 174,300 |
| - Electricity Generation | 570,400 | 107,000 | | 45,000 | | 722,400 |
| Subtotal | 785,400 | 211,900 | | 100,000 | | 1,097,300 |
| Technical Assistance: | | | | | | |
| - Engineering contracts | 18,800 | 66,200 | | | | 85,000 |
| - Project Unit and Experts | 116,600 | 26,600 | 5,000 | | | 148,200 |
| - Office Equipment/Supplies | 3,000 | | 3,000 | | | 9,100 |
| - Travel | 18,000 | 8,000 | 2,000 | | | 28,000 |
| - Training | 33,400 | | | | | 33,400 |
| - Dissemination | | | 18,000 | | | 18,000 |
| - UNDP Fee | | 19,000 | 32,000 | | | 51,000 |
| Subtotal | 189,800 | 122,900 | 60,000 | | | 372,700 |
| Subtotal Methane Recovery | 975,200 | 334,800 | 60,000 | 100,000 | | 1,470,000 |
| | | | | | | |
| - Independent Evaluation | | | | | 50,000 | 50,000 |
| - Methane O&M Costs | | 287,900 | | | | 287,900 |
| | | | | | | |
| PROJECT TOTAL | 975,200 | 2,926,400 | 60,000 | 100,000 | 50,000 | 4,111,600 |

Total GEF support for the proposed Medium Size Project would amount to \$1 million, comprising \$24,800 for the Block A preparation grant and \$975,200 for MSP implementation.

IV. Implementation Arrangements and Implementation Plan

A. Implementation Arrangements

The roles and responsibilities of entities involved in project implementation are:

- (a) A Project Unit under the Climate Change Unit within *DINAMA (Dirección Nacional de Medio Ambiente-MVOTMA)* will be responsible for the overall execution of the Project's activities in terms of technical and operational aspects, as well as acting as a liaison between the Project's stakeholders (IMM and ABORGAMA). Additional information on the executing agency is presented in Attachment 1;
- (b) the Office of the Mayor of the Municipality of Maldonado, will be responsible for modifying the current contract with ABORGAMA, ensuring the operational sustainability of the LFG recovery system, and will take an active part in negotiating the power purchasing agreement with UTE;

- (c) ABORGAMA, S.A., the current private operator of the landfill, will assume responsibility for operating the methane recovery project efficiently, will take part in training activities, and will support project performance monitoring activities.
- (d) The World Bank will supervise the overall implementation of the Project and will oversee compliance with the Grant Agreement covenants regarding project execution, financial management, and procurement procedures.

The proposed GEF Grant would be made to *República Oriental del Uruguay* (the Recipient); the Recipient will carry out the Project through its Ministry of Housing, Land Management and Environment (MVOTMA). In turn, MVOTMA will enter into an Implementation Agreement with the municipality of Maldonado for the municipality's participation in carrying out the project. The municipality would then revise its landfill operation contract with ABORGAMA to incorporate mutual obligations under the methane recovery project, including the municipality's obligation to pay ABORGAMA the increased disposal fee to account for O&M costs of the methane recovery system and ABORGAMA's obligation to operate the system efficiently. Signing of the revised operation contract will be a condition of grant effectiveness.

Since this Project is supported financially by three country stakeholders (MVOTMA, IMM, and ABORGAMA) and none of them wished to handle funds from others, a third party was sought to receive and administer the project funds. MVOTMA asked UNDP (Montevideo office) to act as administrative agent for this Project, enabling project funds (both GEF and counterpart) to be deposited into a common project account, while the Project Unit would manage the technical aspects of the project. Although the funds will be managed in a project account for all funds, UNDP will clearly track GEF funds to assist the Project Unit in meeting Bank reporting requirements for the GEF-financed portion of the project. UNDP has agreed in principle and is now working with MVOTMA on a Cost Sharing Project (CSP) agreement. Signing of this CSP agreement will be a condition of grant effectiveness. The CSP agreement will outline the division of responsibilities between UNDP and the Project Unit for procurement, administrative, and financial management. The Recipient and UNDP would carry out all procurement and financial reporting activities for the GEF cost-shared portion of the project in accordance with Bank guidelines. UNDP will charge an administrative fee equal to 3.5% of the total project cost, which will be paid by MVOTMA from its own funds.

UNDP will follow the Bank's procurement procedures and Project accounts will be audited annually by an independent auditor acceptable to the Bank. Direct disbursements to UNDP are expected to be requested by the Project Unit on the basis of semi-annual disbursement projections (withdrawal applications supported by a Project Management Report) as stipulated in the CSP (there will be no need for the Recipient to open a Special Account). Additional information on the project's procurement, disbursement, and audit arrangements is presented in Attachments 2 and 3.

The Project Unit (PU) to be established within UCC will be small and staffed with technical and management personnel suitable to this Project. The current staff preparing the Project (one technical consultant financed under the PDF Block A grant, and a staff member from DINAMA) have shown significant capacity and professionalism; therefore, it would be desirable if these two persons remained during project implementation. The

PU staff would, *inter alia*, prepare and propose terms of reference for training and dissemination activities, draft equipment specifications, and oversee project implementation. UNDP would contract and pay for the goods and services. The planning and timing of each project task will be described in a detailed Project Implementation Plan, with major milestones as presented below.

B. PROJECT IMPLEMENTATION PLAN

The Project main milestones will be agreed with the UCC and the other stakeholders before Project launch. The indicative timetable for the Project's main activities are shown in Table 4.

Table 4. Project Implementation Plan

| Activities | 2000 | | | | 2001 | | | | 2002 | | | | 2003 | | | |
|--|------|----|----|----|------|----|----|----|------|----|----|----|------|----|----|----|
| | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 |
| Grant Approval | ■ | | | | | | | | | | | | | | | |
| Establishment of Administrative Project Unit | ■ | | | | | | | | | | | | | | | |
| Contract Signing: MVOTMA/MM/ABORGAMA | ■ | ■ | | | | | | | | | | | | | | |
| Contract Signing with UTE | ■ | ■ | | | | | | | | | | | | | | |
| Contract Signing with Engineering Design Consultant Firm | ■ | ■ | | | | | | | | | | | | | | |
| Engineering Design | | ■ | ■ | | | | | | | | | | | | | |
| Civil Works | | | ■ | ■ | | | | | | | | | | | | |
| Remediation of Existing Dump | | | ■ | ■ | | | | | | | | | | | | |
| Equipment Procurement | | | ■ | ■ | | | | | | | | | | | | |
| Installation of Biogas Collecting System | | | | ■ | ■ | | | | | | | | ■ | | | |
| Installation of Suction and Monitoring System | | | | ■ | ■ | | | | | | | | | | | |
| Installation of Utilization System | | | | ■ | ■ | | | | ■ | | | | | | | |
| Training For System Operators | | | | ■ | ■ | | | | | | | | | | | |
| Test and Trials | | | | ■ | ■ | | | | | | | | | | | |
| Start-up | | | | ■ | ■ | ■ | | | | | | | | | | |
| Public Participation (1) | | ■ | ■ | ■ | ■ | ■ | ■ | | | | | | | | | |
| Monitoring and Evaluation (2) | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |

(1): Consultative workshops during project preparation. After the launch of the methane recovery and electricity generation system, informative workshops, public awareness campaigns, and planned visits.

(2): Periodic analysis, monitoring and data collection of captured biogas, electricity generation, organic content of waste, utilization system efficiency,

V. Public Involvement Plan

Given the demonstration role of the Project, the public participation activities are not only foreseen to disseminate the lessons of this project in Uruguay (there are about 6

medium size cities and the capital city of Montevideo that could benefit) and in neighboring countries, but also raise public awareness about the greenhouse gases and climate change. Hence, the following activities are planned during project implementation:

- (a) Consultative workshops will be organized with the goal of exchanging information and ideas among project participants and interested groups (NGOs, representatives of service organizations, community representatives, operators and technicians from MVOTMA and IMM and the UCC).
- (b) Dissemination workshops will be organized on a regular basis, informing the local community, the media, decision makers, teaching centers, as well as the authorities and technical staff from other municipalities in Uruguay and neighboring countries, on the Project's objectives, anticipated results and benefits, employed technologies, and the possibilities for replicating this project in other areas.
- (c) Informative events will be held, in which local technical staff participate in conferences, workshops organized by public and private institutions, NGOs, teaching centers, with a view to disseminating information on the Project and promoting its replication.
- (d) Public awareness about the Project will be raised through various forms of media—local newspapers, videos and a web page—to widely distribute information on the Project in an effort to increase the community's knowledge and interest.

The national government has allocated \$18,000 of its own funds for these activities and it plans to complement this allocation with support from other interested parties, such as regional professional associations specializing in solid waste management (e.g., Latin American chapter of ISWA-International Solid Waste Association) and other technical bodies.

Comprehensive Waste Management Planning for Methane Abatement

The lessons from this Project could be incorporated into a more comprehensive dissemination plan involving other countries in Latin America and expanding the scope to include a recognition of other waste management options to abate methane emissions, such as composting to reduce organic content in waste. The monitoring activities of this Project would easily transfer information to such program. The design and funding for this broader programmatic approach to methane abatement is SWM may be the subject of a separate activity or as part of a full size project now under preparation for Mexico.

VI. Monitoring and Evaluation Plan

Local Monitoring: The Project Unit at MVOTMA/UCC, in coordination with the other project stakeholders, will oversee project monitoring and will provide progress reports to the Bank every six months. An evaluation of the overall project would be conducted upon completion using three types of indicators: implementation, outcome, and environmental indicators.

Independent Evaluation: The implementation experience and the achievement of the proposed targets will be evaluated by an independent international expert, who will provide progress reports to the Bank every year. This expert will also advise the Bank about best practice during the construction phase. These advisory services will be co-financed by bilateral trust funds available through the World Bank.

A. Implementation indicators track the efficiency of project activities against targets to be agreed as part of the Implementation Plan. The implementation indicators to be considered are:

- (a) time elapsed between signing of the CSP agreement and the establishment of the project unit;
- (b) time elapsed in finalizing the modification to ABORGAMA's landfill operation contract;
- (c) effectiveness of training in terms of improved LFG operational parameters (e.g., improved capture, reduced risks, etc.);
- (d) time elapsed in the establishment of recording systems for the methane capture and electricity generation process;
- (e) time elapsed in establishing administrative arrangements within the municipality to invoice and collect from UTE the electricity sale invoices; and
- (f) tracking of preventive and periodic maintenance of the generator equipment and the collection systems.

B. Outcome indicators will track the results of the project in terms of a selected number of commercial-operational and financial indicators.

(a) Commercial and Operational Indicators

Generation of LFG from both the existing waste dump and the new cells are crucial for project sustainability and have been estimated on an extremely conservative basis. The amount actually generated (m³/ton of waste) and collected from both gas streams will be monitored and recorded as both will have a clear impact on the electricity generation and the associated revenues. The expected LFG generation amounts are shown below:

| Year | LFG Generation Rate(m3) |
|-------|-------------------------|
| 1 | 1,513,500 |
| 2 | 2,308,329 |
| 3 | 2,934,105 |
| 4 | 3,155,205 |
| 5 | 3,948,840 |
| 6 | 4,590,495 |
| 7 | 4,912,158 |
| 8 | 4,798,935 |
| 9 | 4,692,360 |
| 10 | 4,242,300 |
| 11 | 4,088,475 |
| 12 | 3,921,015 |
| 13 | 3,220,065 |
| 14 | 3,120,390 |
| 15 | 2,730,810 |
| Total | 54,176,982 |

The quantity of LFG will be monitored automatically in the gas pumping station, and the content of methane will be analyzed on monthly basis.

- The methane content should be in the range of: 45-55%
- The aggregate amount of LFG collected in the first four years should be in the range of 9,911,1139 m3 +/- 15%
- The aggregate amount of electricity generated in the first four years should be in the range of 15,546 MWh +/- 15%
- Organic Content: Not lower than 50% (waste to be tested every 4 months)
- Utilization Equipment Efficiency: Not lower than 1.65 KWh/m3 of gas.

(b) Financial Indicator

The Project would monitor the electricity revenues earned by the municipality which are expected to offset recurrent costs starting in year 5. To increase the operator's incentive to recurrent reduce costs while maximizing electricity generation, the following generation benchmark will be agreed with the private contractor as the basis for the 10% share of revenues the contractor would receive:

| Year 1 | Year 2 | Year 3 | Year 4 |
|---------------|---------------|--------------|---------------|
| 2,497,275 kWh | 3,808,743 kWh | 4,841,273kWh | 5,206,088 kWh |

Any additional sales above this benchmark would be distributed between the municipality and the private operator on a 50/50 basis.

C. Environmental Indicators

- The amount of methane captured during the first three year period should be in the range of 3,300,000 m³ +/- 15%
- Groundwater , Surface water and Leachate Quality: This indicator will be monitored during the first four years according to table 2, the results will be compared with the current situation in order to evaluate the impact of the methane capture system.

| | | |
|-------------------------------|---------------|--|
| Surface Water | Semi-annually | Temp, pH, EC, DO, CL, COD |
| Groundwater | Semi-annually | Water Level, Temp, pH, EC, DO, NH ₄ -N, Cl |
| Leachate at Discharge Points | Monthly | Discharge Volume, pH, Temp, EC, |
| | Semi-annually | NH ₄ -N, Cl, BOD, COD, TOC |
| Leachate at Monitoring Points | Monthly | Leachate Level, Temp, pH, EC |
| | Semi-annually | As monthly plus: Cl, NH ₄ -N, SO ₄ , COD, BOD, TOC |

DO: Dissolved Oxygen

EC: Electrical Conductivity

Temp: Temperature

COD: Chemical Oxygen Demand

BOD: Biochemical Oxygen Demand

TOC: Total Organic Carbon

TABLE 1. INCREMENTAL COST ANALYSIS (US\$)
LAS ROSAS METHANE CAPTURE PROJECT

| | YEAR 0 2000 | YEAR 1 2001 | YEAR 2 2002 | YEAR 3 2003 | YEAR 4 2004 | YEAR 5 2005 | YEAR 6 2006 | YEAR 7 2007 | YEAR 8 2008 | YEAR 9 2009 | YEAR 10 2010 | YEAR 11 2011 | YEAR 12 2012 | YEAR 13 2013 | YEAR 14 2014 | YEAR 15 2015 |
|--|---------------------|-----------------|-----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| INCREMENTAL INVESTMENT COSTS | -860,641 | -93,941 | -455,141 | -46,900 | 0 | 0 | -31,200 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Landfill (Baseline Project) | 266,000 | 96,000 | 64,000 | 266,000 | 96,000 | 64,000 | -326,440 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Landfill + EE Generation (Alternative Project) | 1,126,641 | 189,941 | 519,141 | 312,900 | 96,000 | 64,000 | -295,240 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| INCREMENTAL SALES | 0 | 67,426 | 102,836 | 130,714 | 140,564 | 175,921 | 204,507 | 218,837 | 213,793 | 209,045 | 188,994 | 182,142 | 174,681 | 143,454 | 139,013 | 121,658 |
| Landfill (Baseline Project) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| EE Generation (Alternative Project) | 0 | 67,426 | 102,836 | 130,714 | 140,564 | 175,921 | 204,507 | 218,837 | 213,793 | 209,045 | 188,994 | 182,142 | 174,681 | 143,454 | 139,013 | 121,658 |
| INCREMENTAL O&M COSTS | 0 | 95,965 | 95,965 | 95,965 | 123,276 | 123,276 | 123,276 | 123,276 | 123,276 | 123,276 | 123,276 | 123,276 | 123,276 | 123,276 | 123,276 | 95,965 |
| Landfill (Baseline Project) | 302,392 | 477,374 | 514,407 | 317,492 | 492,475 | 529,508 | 598,592 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Landfill + EE Generation (Alternative Project) | 302,392 | 573,339 | 610,372 | 413,457 | 615,751 | 652,784 | 721,868 | 123,276 | 123,276 | 123,276 | 123,276 | 123,276 | 123,276 | 123,276 | 123,276 | 95,965 |
| SALES - COSTS (INCREMENTAL) | 0 | -28,539 | 6,871 | 34,749 | 17,289 | 52,645 | 81,231 | 95,561 | 90,517 | 85,769 | 65,719 | 58,866 | 51,406 | 20,178 | 15,738 | 25,692 |
| INCREMENTAL CASH FLOW | -860,641 | -122,479 | -448,270 | -12,151 | 17,289 | 52,645 | 50,031 | 95,561 | 90,517 | 85,769 | 65,719 | 58,866 | 51,406 | 20,178 | 15,738 | 25,692 |
| NPV (10%, 16 Years) | -975,200 US\$ | | | | | | | | | | | | | | | |
| C Abatement Costs | 7.551081 US\$/ton C | | | | | | | | | | | | | | | |

SUMMARY OF INCREMENTAL COSTS ON NPV BASIS
TABLE 1. INCREMENTAL COST ANALYSIS (US\$)
SUMMARY OF INCREMENTAL COSTS ON NPV BASIS

| | | |
|---------------------------------|-------------|------------------|
| NPV Baseline Investment (1) | 479,142 | |
| NPV Alternative Investment (2) | 1,729,177 | |
| Difference (2-1) | | 1,250,035 |
| NPV Baseline O&M Costs (3) | \$2,184,613 | |
| NPV Alternative O&M Costs (4) | \$2,969,331 | |
| Difference (4-3) | | \$784,718 |
| Alternative's Electricity Sales | | (\$1,059,553) |
| Net Incremental Cost | | \$975,200 |

TABLE 2. DETAILED COST DATA - LAS ROSAS LANDFILL AND METHANE CAPTURE PROJECT
(Figures are in US\$; additional data and assumptions are presented in Attachment 3)

| | YEAR 0 | YEAR 1 | YEAR 2 | YEAR 3 | YEAR 4 | YEAR 5 | YEAR 6 | YEAR 7 | YEAR 8 | YEAR 9 | YEAR 10 | YEAR 11 | YEAR 12 | YEAR 13 | YEAR 14 | YEAR 15 |
|--|------------------------|-----------------|-------------------|-----------------|-----------------|-----------------|-----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
| INVESTMENT COSTS (US\$) | | | | | | | | | | | | | | | | |
| Landfill Investment Costs* | | | | | | | | | | | | | | | | |
| Earth and Civil Works | 248,000 | 78,000 | 55,000 | 248,000 | 78,000 | 55,000 | 0 | | | | | | | | | |
| Equipment and Vehicles** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | | | | | |
| Leachate Treatment Plant | 18,000 | 18,000 | 9,000 | 18,000 | 18,000 | 9,000 | 0 | | | | | | | | | |
| Salvage Value | 0 | 0 | 0 | 0 | 0 | 0 | -326,440 | | | | | | | | | |
| Sub Total Landfill | 266,000 | 96,000 | 64,000 | 266,000 | 96,000 | 64,000 | -326,440 | | | | | | | | | |
| Methane Capture Investment Costs | | | | | | | | | | | | | | | | |
| Implementation, Processing and Dissemination | 171,441 | 93,941 | 93,941 | | | | | | | | | | | | | |
| Civil Works | 75,600 | | | | | | | | | | | | | | | |
| Extraction Wells and Pipelines | 78,100 | | | 46,900 | | | 31,200 | | | | | | | | | |
| Utilization , Suction and monitoring System | 535,500 | | 361,200 | | | | | | | | | | | | | |
| Sub Total Methane Capture | 860,641 | 93,941 | 455,141 | 46,900 | 0 | 0 | 31,200 | | | | | | | | | |
| Total Investment Costs | -1,126,641 | -189,941 | -519,141 | -312,900 | -96,000 | -64,000 | 295,240 | | | | | | | | | |
| GENERATION SALES (US\$) | | | | | | | | | | | | | | | | |
| E.E.sales (existing dump) | | 15,036 | 16,539 | 17,291 | 17,592 | 17,892 | 18,193 | 16,990 | 15,787 | 13,532 | 12,029 | 10,525 | 9,021 | | | |
| E.E. sales (Cells 1/2) | | 52,391 | 57,630 | 61,821 | 63,917 | 66,012 | 67,584 | 69,680 | 62,869 | 55,010 | 47,152 | 41,913 | 39,293 | 35,626 | 33,530 | 31,434 |
| E.E. sales (Cells 3/4) | | | 28,667 | 51,602 | 59,056 | 60,776 | 62,496 | 65,936 | 67,656 | 70,523 | 57,336 | 51,602 | 47,015 | 44,722 | 43,002 | 38,988 |
| E.E. sales (Cells 5/6) | | | | | | 31,240 | 56,233 | 66,230 | 67,480 | 69,979 | 72,478 | 78,102 | 79,351 | 63,106 | 62,481 | 51,235 |
| Total Sales | 0 | 67,426 | 102,836 | 130,714 | 140,564 | 175,921 | 204,507 | 218,837 | 213,793 | 209,045 | 188,994 | 182,142 | 174,681 | 143,454 | 139,013 | 121,658 |
| O&M COSTS (US\$) | | | | | | | | | | | | | | | | |
| Landfill O&M Costs | 302,392 | 477,374 | 514,407 | 317,492 | 492,475 | 529,508 | 598,592 | | | | | | | | | |
| Methane Capture O&M Costs | | 95,965 | 95,965 | 95,965 | 123,276 | 123,276 | 123,276 | 123,276 | 123,276 | 123,276 | 123,276 | 123,276 | 123,276 | 123,276 | 123,276 | 95,965 |
| Total O&M Costs | 302,392 | 573,339 | 610,372 | 413,457 | 615,751 | 652,784 | 721,868 | 123,276 | 123,276 | 123,276 | 123,276 | 123,276 | 123,276 | 123,276 | 123,276 | 95,965 |
| Sales – O&M Costs | -302,392 | -505,913 | -507,536 | -282,743 | -475,187 | -476,863 | -517,361 | 95,561 | 90,517 | 85,769 | 65,719 | 58,866 | 51,406 | 20,178 | 15,738 | 25,692 |
| Annual Cash-flow | -1,429,033 | -695,853 | -1,026,677 | -595,643 | -571,187 | -540,863 | -222,121 | 95,561 | 90,517 | 85,769 | 65,719 | 58,866 | 51,406 | 20,178 | 15,738 | 25,692 |
| NPV. (10%, 16 years) | -3,638,955 US\$ | | | | | | | | | | | | | | | |

* Detailed description in ATTACHMENT 4

** Investment has already been made in year 0 of baseline project (1997).

**TABLE 3. TECHNICAL ASSUMPTIONS AND OTHER DATA
Las Rosas Methane Recovery Project**

METHANE CAPTURE PROJECT

| Waste Disposal Capacity | Waste Quantity | Unit | Disposal Period | Total LFG Potential production in m3 | LFG Generation in Analyzed Years of Emissions in Nm3/Ton/Yr | Analyzed period of emissions in years | Capture % | Total LFG Captured | Content of CH4 | Total CH4 Captured in m3 | Total Generated Energy in kWh | Energy Generated per Year in kWh/year | Installed Capacity in kW |
|-------------------------|----------------|--------------|----------------------|--------------------------------------|---|---------------------------------------|-----------|--------------------|----------------|--------------------------|-------------------------------|---------------------------------------|--------------------------|
| Old Open Dump | 300,000 | tons. | 1989-97 | 27,000,000 | 90 | 12 | 15% | 4,050,000 | 50% | 2,025,000 | 6,682,500 | 556,875 | 70 |
| Operating Cells (1-2) | 160,000 | tons. | oct. '97- oct. 2000 | 35,200,000 | 220 | 15 | 50% | 17,600,000 | 50% | 8,800,000 | 29,040,000 | 1,936,000 | 242 |
| Future Cells (3-4) | 165,000 | tons. | nov. 2000- oct. 2003 | 34,283,965 | 208 | 14 | 50% | 17,141,983 | 50% | 8,570,991 | 28,284,271 | 2,020,305 | 253 |
| Future Cells (5-6) | 170,000 | tons. | nov. 2003- oct. 2006 | 30,770,000 | 181 | 11 | 50% | 15,385,000 | 50% | 7,692,500 | 25,385,250 | 2,307,750 | 288 |
| Total | 795,000 | tons. | | 127,253,965 | | | | 54,176,983 | | 27,088,491 | 89,392,021 | 6,820,930 | 853 |

| Calculation of Abated Carbon | Unit | Ratio | ELECTRIC ENERGY | | |
|--|---------------------|--------------------------|-----------------------------------|-------------------|------------|
| Weight of CH4 | 0.7 kg/m3 | | EE Rate (UTE Dic 98) | 0.027 | US\$/kWh |
| Total Content of CH4 | 18,962 tons | | Electric Energy Generation | | |
| Total Equivalents tons. of CO2 (Mass of CH4 absorbs 21 times more energy than CO2) | 398,201 tons. | | Biogas Captured | 54,176,983 | m3 |
| C Abated due to EE Generation | 108,600 tons | 27.3% | CH4 Captured | 27,088,491 | m3 |
| Equivalent Fuel Oil for EE Generation | 26,684 tons | 1 kg. generates 3,35 kWh | Generation Efficiency | 1.65 | kWh/m3 |
| C Abated Due to no Fuel Oil Consumption | 20,547 ton | 1 kg. 77% weight of CO2 | EE Generation | 89,392,021 | kWh |
| Total C Abated | 129,147 | | | | |

| OPERATION AND MAINTENANCE COSTS | | |
|---|--------------------------|--|
| MAINTENANCE | | |
| Cost of Maintenance as a Percentage of Investment | 5% | |
| Annual Maintenance Costs of U&M System | 46,518 US\$/year | |
| Annual Maintenance Costs of Collecting System | 8,103 US\$/year | |
| MAINTENANCE TOTAL ANNUAL COST | 54,621 US\$/year | |
| OPERATION | | |
| Salaries + Social Benefits | 43,200 US\$/year | |
| Consultants | 9,000 US\$/year | |
| Monitoring | 7,500 US\$/year | |
| Fixed Costs | 8,955 US\$/year | |
| TOTAL OPERATION COSTS | 68,655 US\$/year | |
| TOTAL OPERATION AND MAINTENANCE COSTS | 123,276 US\$/year | |

| CAPITAL AND DISSEMINATION INVESTMENTS | | |
|--|------------------|-------------|
| 1 - BIOGAS COLLECTING SYSTEM | | |
| Collecting System | 148,762 | US\$ |
| Contingency (5%) | 7,438 | US\$ |
| Investment per cell | 19,525 | US\$ |
| Number of Wells per Cell | 7 | |
| Number of Cells | 8 | |
| Total Number of Wells | 56 | |
| SUB-TOTAL Collecting System | 156,200 | US\$ |
| 2 - IMPLEMENTATION PROCESSING AND DISSEMINATION | | |
| Implementation, Processing and Dissemination | 365,392 | US\$ |
| Contingencies (2%) | 7,307 | US\$ |
| SUB-TOTAL Implementation | 372,700 | US\$ |
| 3 - CIVIL WORKS | | |
| Civil Works | 37,000 | US\$ |
| Closure of Old Dump | 35,000 | US\$ |
| Contingencies (5%) | 3,600 | US\$ |
| SUB-TOTAL Civil Works | 75,600 | US\$ |
| 4 - UTILIZATION AND MONITORING SYSTEM | | |
| Suction and Monitoring System | 166,000 | US\$ |
| Utilization System (2 Units of 430 kW each) | 688,000 | US\$ |
| Installed Capacity (MW) | 0.86 | MW |
| Contingencies Suc. And Monitoring System (5%) | 8300 | US\$ |
| Contingencies Utilization System (5%) | 34400 | US\$ |
| Imprevistos (5%) | 42,700 | US\$ |
| SUB-TOTAL Utilization and Monitoring System | 896,700 | US\$ |
| TOTAL INVESTMENT | 1,501,200 | US\$ |

TABLE 4. BASELINE PROJECT: SANITARY LANDFILL INVESTMENTS AND O&M COSTS

| DESCRIPTION | Year 97-99 | Year 00 | Year 01 | Year 02 | Year 03 | Year 04 | Year 05 | Year 06 | Total |
|---|----------------|----------------|---------------|---------------|----------------|---------------|---------------|---------|------------------|
| INVESTMENT COSTS | | | | | | | | | |
| Earth and Civil Works | 497,000 | 248,000 | 78,000 | 55,000 | 248,000 | 78,000 | 55,000 | | 1,259,000 |
| Land (5 hectares) | 60,000 | | | | | | | | 60,000 |
| Land (7 hectares) | | 50,000 | | | | | | | 50,000 |
| Land (7 hectares) | | | | | 50,000 | | | | 50,000 |
| Earth Works (Cell 1 and 2) | 300,000 | | | | | | | | 300,000 |
| Earth Works (Cell 3 and 4) | | 180,000 | 70,000 | 50,000 | | | | | 300,000 |
| Earth Works (Cell 5 and 6) | | | | | 180,000 | 70,000 | 50,000 | | 300,000 |
| Internal Roads | 35,000 | 8,000 | 8,000 | 5,000 | 8,000 | 8,000 | 5,000 | | 77,000 |
| Lightnings and Power Outlets | 10,000 | 10,000 | | | 10,000 | | | | 30,000 |
| | | | | | | | | | 0 |
| Buildings | 92,000 | | | | | | | | 92,000 |
| Workshop and Storage Building | 72,000 | | | | | | | | 72,000 |
| Admiistrative Building | 20,000 | | | | | | | | 20,000 |
| | | | | | | | | | 0 |
| Equipment | 125,000 | | | | | | | | 125,000 |
| Truck Loader Michigan 2 1/2 jc | 30,000 | | | | | | | | 30,000 |
| Bulldozer JCB 428 | 75,000 | | | | | | | | 75,000 |
| Office Materials | 20,000 | | | | | | | | 20,000 |
| | | | | | | | | | 0 |
| Vehicles | 20,000 | | | | | | | | 20,000 |
| VW Gol (2) | 20,000 | | | | | | | | 20,000 |
| | | | | | | | | | 0 |
| Leachate Treatment Plant | 75,000 | 18,000 | 18,000 | 9,000 | 18,000 | 18,000 | 9,000 | | 165,000 |
| Leachate Lagoon | 20,000 | | 5,000 | | | 5,000 | | | 30,000 |
| Leachate Injection and Main Drainage Pipe | 35,000 | 18,000 | 8,000 | 9,000 | 18,000 | 8,000 | 9,000 | | 105,000 |
| Pumps and Blowers | 20,000 | | 5,000 | | | 5,000 | | | 30,000 |
| | | | | | | | | | |
| TOTAL INVESTMENT | 717,000 | 266,000 | 96,000 | 64,000 | 266,000 | 96,000 | 64,000 | | 1,569,000 |

| O&M COSTS | | | | | | | | | |
|--|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|---------|
| Salaries and Social Benefits | 244,800 | 122,400 | 122,400 | 122,400 | 122,400 | 122,400 | 122,400 | 122,400 | 122,400 |
| Fuel | 40,800 | 20,400 | 20,400 | 20,400 | 20,400 | 20,400 | 20,400 | 20,400 | 20,400 |
| Equipment Maintenance | 24,000 | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 | 12,000 |
| Transport and Materials | 45,600 | 22,800 | 22,800 | 22,800 | 22,800 | 22,800 | 22,800 | 22,800 | 22,800 |
| Equipment Rent | 276,000 | 138,000 | 138,000 | 138,000 | 138,000 | 138,000 | 138,000 | 138,000 | 138,000 |
| Telephone | 14,400 | 7,200 | 7,200 | 7,200 | 7,200 | 7,200 | 7,200 | 7,200 | 7,200 |
| General Expences (electricity, gas, etc) | 6,480 | 3,240 | 3,240 | 3,240 | 3,240 | 3,240 | 3,240 | 3,240 | 3,240 |
| Sub-total Recurrent Costs | 652,080 | 326,040 | 326,040 | 326,040 | 326,040 | 326,040 | 326,040 | 326,040 | 326,040 |
| Operator's Profit | 285330 | -23,648 | 151,334 | 188,367 | -8,548 | 166,435 | 203,468 | 272,552 | |
| TOTAL O&M COSTS | 937,410 | 302,392 | 477,374 | 514,407 | 317,492 | 492,475 | 529,508 | 598,592 | |

STAP Technical Review

STAP Roster Independent Technical Review by Gautam S. Dutt, Nov. 27, 1999

1. OVERALL IMPRESSIONS

The project is well formulated. The region (Uruguay and its larger neighbor Argentina) has no landfill gas recovery project operating so far. So this project would have an important demonstration value. Also, since Uruguay does not have its own natural gas resources, it is a good location for the project. The reviewer endorses the project.

2. RELEVANCE AND PRIORITY

Methane emissions are a very significant part of the greenhouse gas inventories (in CO₂ equivalent terms) of both Uruguay and Argentina. As the first solid-waste methane emissions control program of the region (as far as I know), this project would fill an important need.

The project location near the popular beach resort city (Punta del Este) gives it a potentially important demonstration value to the general public, contributing to more such projects in the region. The project brief mentions that significant publicity has already been given to demonstrate the feasibility of the proposed landfill gas to electricity project.

The experience gained through the proposed project will make a major contribution towards capacity building for future projects in the region.

Solid waste management has been given priority by the Uruguay government, so that besides GHG mitigation, the proposed project would contribute towards national development objectives.

3. PROJECT APPROACH

The project is defined as a Cost Sharing Project, with the participation of the municipality, the national government, a private operator, the national electric company, with financial and technical support from GEF. This seems appropriate given the content of the project, and its relation to existing activities (such as refuse collection) involving some of the same actors.

4. OBJECTIVES

Project objectives are clearly stated. They are valid both within the national context as well as for global climate change goals. The objectives are likely to be obtained with the resources available to the project. Likely problems and risks appear to have been contemplated in the project brief.

5. BACKGROUND AND JUSTIFICATION

The background and justification has been clearly stated. There is a great deal of technical information about the current situation that has been condensed and presented in a form that makes it easy to interpret (e.g. Table 1). The technology chosen has been proven elsewhere, so that there are no unusual risks for the first project of this kind in the region. The cost effectiveness calculations have been presented in detail in a series of Annexes. The only doubt this reviewer has would be on the choice of discount rate. The calculations are based on a 5% discount rate, which appears to be low. (Also, the Table that appears in the section on Incremental Cost Assessment refers to *Present Values*. The Budget (Section III) presents a table with a four-year financing plan, which presumably is in *Current Dollars*. Nevertheless the same figure for GEF contribution (\$990,000) appears in both tables. This reviewer was not able to analyze all the Annexes in detail, and perhaps this discrepancy does not exist.)

The fact that the project brief is so well prepared suggests that the institutional capacity is there for project implementation.

6. CRITICAL ANALYSIS OF THE SITUATION

The situation has been clearly analyzed in the project brief.

7. ACTIVITIES

The activities have been summarized in Section I D and appear to be appropriate. GEF's contribution (investment support as well as technical assistance) has been clearly stated.

8. NATIONAL PRIORITIES AND COMMUNITY PARTICIPATION

The proposed activity is consistent with national objectives related to solid waste management, which were set forth as a Master Plan in 1996. The project includes the active participation of the Municipality of Maldonado where the project will be sited and where it will contribute to solid waste disposal procedures. The project will involve the current operator responsible for collecting municipal solid waste, as a major stakeholder with economic incentives derived from successful recovery of gas and its conversion to electricity. The involvement of all local stakeholders (MVOTMA, the Municipality and ABORGAMA) should contribute to success.

9. INSTITUTIONAL ARRANGEMENTS

Section IV clearly states the institutional arrangements for project implementation. The principal revenue derived from the additional costs of methane recovery is through electricity sales. While the electric company (UTE) is not an active participant in project implementation, it has pledged "to purchase the electricity generated by the project for at least US\$ 0.027/kWh." This value is conservative, and it is likely that the project would be able to obtain at least this price for its electricity production. As an alternative, it could sell the electricity to a group of local users, possibly at a higher price.

10. TIME FRAME

It is very likely that project objectives would be met in the proposed time frame.

11. FUNDING

The proposed GEF funding level appears to be appropriate. I have analyzed all components of the incremental costs (gas recovery, engine, operation and maintenance) and have found them to be consistent with values published in EPA reviews. The only doubt I have already stated is with respect to the assumed 5% discount rate, and any discrepancy that might arise between this value and market interest rates that the private operator might incur for its financial commitment to the project.

12. INNOVATIVE FEATURES / REPLICABILITY

The project is innovative insofar as it is the first such project in the region. As such it will have a demonstration value, even beyond national boundaries. However, replicability would depend on whether the countries or the international community could commit the resources necessary for a project of this type. Substantial additional investments are needed and operation and maintenance for gas recovery and conversion are also substantially higher than a sanitary landfill without methane recovery. The availability of additional funds would depend on how local air pollution reduction, reduced explosion risk as well as GHG abatement is valued.

13. SUSTAINABILITY

Insofar as the projected revenues are higher than operational expenses, the project is cost effective once the initial investment has been amortized, in this case with contribution from the GEF. Thus the project is sustainable after completion of GEF funding, with a significant economic incentive for the private operator, especially as the initial experience should help lower maintenance costs.

14. DEVELOPMENT DIMENSIONS AND RATIONALE FOR GEF SUPPORT

As already stated, improved solid waste management is an important need in many developing countries. Also there are extensive opportunities for methane emissions control in all countries, but little has been done in developing countries. This project would thus contribute to development objectives with emphasis in an area (methane) that has perhaps received less attention than it deserves.

15. ADDITIONAL COMMENTS

In summary, the project is very clearly formulated, with excellent documentation of assumptions, which are all reasonable. It merits GEF support.

World Bank Response to STAP Reviewer's Comments

The Bank team found the comments of the STAP Reviewer, Guatam S. Dutt, a helpful contribution to the preparation and the presentation of this Project Brief.

With regard to the comments raised in point 9 on Institutional Arrangements, the Board of UTE issued a resolution on December 9, 1999, pledging to purchase electricity at 2.7 cents/kWh for 15 years. A letter, advising the Bank of this resolution, is available in the Bank's Project files.

In regards to the comments raised in points 5 and 11 on Justification and Funding, respectively, the original economic analysis, based on a 5% discount rate, was adjusted to 10% to address the STAP Reviewer's comments and to comply with the Bank's standard practice on economic analysis.

Additional Information on the MSP Proposer

1. Full legal name of Institution

Project Proposer: *Ministerio de Vivienda, Ordenamiento Territorial y Medio Ambiente (MVOTMA)* – Ministry of Housing, Land Management, and Environment

Project Executing Agency: *Unidad de Cambio Climatico (UCC)* – Climate Change Unit under the Dirección Nacional de Medio Ambiente/National Environment Directorate (DINAMA) of the Ministry of Housing, Land Management, and Environment (MVOTMA)

2. Background

MVOTMA was created by legal decree 16.112 on June 8, 1990 with responsibility for the formulation, execution, supervision, and evaluation of national environmental protection plans and policies.

Under MVOTMA's National Environment Directorate, a Climate Change Unit (UCC) was established by Ministerial Resolution on December 29, 1995.

Purpose: The UCC is a technical body under MVOTMA, responsible for organizing and coordinating national activities concerning the United Nations Framework Convention on Climate Change (UNFCCC).

3. Type of organization

The UCC is a government unit within the Ministry of Housing, Land Management, and Environment (MVOTMA). The UCC works in coordination with other governmental and non-governmental agencies, and is staffed to develop and maintain national and international relations in the sector (IPCC, Secretariat of the Convention, technical cooperation agencies, etc.). The UCC, as well as MVOTMA, maintain adequate coordination with Government Departments and the respective agencies responsible for managing municipal solid waste.

4. Names of Governing board members, officers and key personnel

- Carlos Cat, Minister of Housing, Land Management, and Environment
- Ricardo Gorosito Zuluaga, Vice-Minister of Housing, Land Management, and Environment
- Daniel Sztern, National Director of Environment
- Luis Santos, Coordinator of the UCC and Project's Technical Coordinator
- Carlos Grezzi, UCC Technical Adviser
- Miguel Horta, UCC Consultant
- Virginia Sena, UCC Technical Assistant
- Susana Miles, UCC Administrative Assistant

5. Recent programs/projects/activities

The UCC is the executing agency of a GEF/UNDP Project to Institutionally Strengthen MVOTMA in the application of the United Nations Framework Convention on Climate Change. Under the Project, Uruguay completed and published the 1990 and 1994 national greenhouse gas inventories, and a Comparative Study of GHG Emissions for 1990 and 1994. It also submitted the Initial National Communication (INC) in October 1997. The UCC recently completed a study on the Identification of GHG Emission Mitigation Measures in the Energy Sector.

The UCC was also responsible for executing the activities under the PDF Block A grant for the preparation of the Methane Recovery Project.

6. Publications (list)

- National GHG Inventory: 1990 (March 1997)
- Initial National Communication (October 1997)
- National GHG Inventory: 1994 (October 1998)
- Comparative Study of GHG Emissions for 1990 and 1994 (October 1998)
- Study for the Identification of GHG Emission Mitigation Measures in the Energy Sector (November 1999)

7. Annual Budget and Sources of Revenue

The UCC does not have its own government budget. It financially depends on the DINAMA and MVOTMA budgets, which provide supplies and required investments for its operations.

8. Experience with managing grant-financed projects

| Name of Project | Financing Agency | Amount | Period |
|---|------------------|-----------|--------------------|
| Institutional Strengthening of MVOTMA for the application of the UNFCCC | GEF | \$700,000 | Mar. 96/ Dec.99 |
| PDF Block A Grant for the Landfill Methane Recovery Demonstration Project | GEF | \$24,800 | Sept. 98/ Sept. 99 |

9. Administration and accounting-control procedures; current auditing arrangements

Accounting: The MVOTMA has an Administrative and Financial Department for the management of all its financial resources.

The external financial resources corresponding to specific projects related to Climate Change are managed independently by the UCC, with UNDP administrative assistance, following donors' requirements and procedures to allow the production of independent financial statements for each source of financing. The financial statements are prepared following international accounting standards.

There is an automatic system for the registration and processing of the accounting information.

Uruguay's fiscal year begins on January 1 and ends on December 31.

Auditing: With respect to the management of government budget allocations, an external audit is undertaken annually by the *Tribunal de Cuentas de la República* (Accounting Tribunal of the Republic).

The financial information of the specific projects executed by the UCC is periodically reviewed and audited in compliance with the donor agencies' requirements.

10. Description of how the institution procures and contracts for goods, services and works

Goods: The UCC, as an executing agency, is responsible for the procurement of goods. Procurement of goods is carried out on the basis of at least three quotations requested from at least three suppliers. The quotations are evaluated on the basis of: price, technical specifications, and quality. Provided that the supplier is qualified to perform the contract, the lower quotation is selected.

The UCC follows UNDP guidelines for the procurement of equipment and supplies, in which the threshold for procurement of goods is as follows:

| Total Cost | Process | Responsible |
|----------------------|--|---|
| \$1 to \$999 | Three quotations | Project National Director |
| \$1,000 to \$29,999 | Competitive Bidding, preferably including international suppliers, in which 3 to 6 possible suppliers invited to quote prices. | Project National Director |
| \$30,000 to \$99,999 | International Competitive bidding, in which 6 to 12 possible suppliers invited to bid. | Project National Director/ Project's Local Contracts Committee |
| = or > \$100,000 | International Competitive Bidding, in which 6 to 12 possible suppliers invited to bid. | Project National Director/ Project's Local Contracts Committee |

Services: Consultants' selection for Climate Change projects is also managed by the UCC. The UCC is responsible for preparing terms of reference, requesting at least three proposals, and selecting the most qualified consultant from the proposals received.

11. Contact Person: Ing. Luis Santos
 Coordinador de la UCC
 Address: MVOTMA (Ministry of Housing, Land Management, and Environment)
 Montevideo, Uruguay
 Telephones: (59-82) 917-0752/917-0222/916-1899
 Fax: (59-82) 916-1895

Procurement Under the Project

Procurement Responsibilities

The Project Unit (PU) within UCC will be responsible for overseeing the procurement of goods and services, according to the Procurement Plan shown in Table 1. The project will be implemented under a UNDP cost-sharing arrangement for procurement, administrative, and financial management functions. Under this arrangement, UNDP will follow Bank guidelines for the procurement of goods and services.

Procurement Procedures

Procurement of goods and services, as well as contracting of consultants with Grant funds, would be carried out in accordance with Guidelines for Procurement under IBRD loans and IDA credits (January 1995, revised January and August 1996, September 1997, and January 1999) and the Guidelines for the Use of Consultants (January 1997, revised September 1997 and January 1999).

Procurement Methods

Goods: The Grant will finance the purchase of smaller goods and equipment, such as a biogas collecting system and office equipment, and larger equipment for a suction and monitoring system and a utilization system. Office equipment will be acquired by shopping, whereby at least three quotations will be requested and the goods will be purchased at a reasonable price. Contracts for the biogas collecting system, the suction and monitoring system, and the utilization system are expected to be higher than \$100,000 and will be procured through National Competitive Bidding (NCB) and International Competitive Bidding (ICB). Contracts above \$250,000 will be procured following ICB procedures, and will be subject to the Bank's prior review. The first two contracts procured following NCB procedures will also be subject to the Bank's prior review. The procurement methods to be used are described in Table 1. No works are expected to be financed by the Grant.

Consulting Services: The project will select consulting firms on the basis of their experience and competence relevant to the assignment (Selection Based on Consultants' Qualifications - CQ); individual consultants will be employed on assignments for which teams of personnel are not required and the experience and qualifications of the individual are the paramount requirement. Individual consultants will be selected on the basis of their qualifications for the assignment. All contracts for (i) firms greater than \$100,000 and (ii) individual consultants greater than \$50,000 will be subject to the Bank's prior review. Assignments below the prior review threshold would require the Bank's review of Terms of Reference.

Travel Expenditures: The Grant will also finance travel expenditures, which include the costs of travelling from Montevideo to the municipality of Maldonado to supervise the project, and the costs of visiting other landfills to gain managerial and technical knowledge.

Procurement Monitoring

The PU will establish procedures for monitoring project execution and impact, procurement implementation, including monitoring of contracts for goods and services modifications, variations, and extension of completion periods. The PU will maintain detailed records of procurement activities financed under the Grant.

Table 1. Procurement Plan for Goods and Services (Including Consulting Services)

| Category | Amount (US\$) | Method | Year |
|---|--------------------------|---------------|-------------|
| 1. Goods and Equipment | | | |
| Utilization System | 570,400 | ICB | 1, 3 |
| Suction and Monitoring System | 110,000 | NCB | 1 |
| Biogas Collecting System | 105,000 | NCB | 1, 4 |
| Office Equipment | 3,000 | NS | 1 |
| 2. Consulting Services | | | |
| Consultants (Project Manager, Engineer, Analyst) | 116,600 | Other | 1, 2, 3, 4 |
| Technical Assistance and training | 33,400 | Other | 1, 2, 3, 4 |
| Engineering Design | 18,800 | CQ | 1 |
| 3. Travel Expenditures | 18,000 | N/A | 1, 2 |
| TOTAL | 975,200 | | |

Note: ICB = International Competitive Bidding

NCB = National Competitive Bidding

NS = National Shopping

CQ = Selection Based on Consultants' Qualifications

Other = Selection of individual consultants (per Section V of Consultant Guidelines)

Project Management Reports, Disbursements, and Audit

Project Management Reports

The Project Unit (PU) within UCC will prepare and forward to the Bank semi-annual Project Management Reports (PMRs), which comprise financial reports, Project progress reports, and procurement management reports. The Project progress report of the PMR will cover progress in achieving the activities and targets corresponding to each six-month period for the Project (Table 3). The financial reports of the PMR will include sources and uses of funds for the Project, expenditures financed out of proceeds of the grant, and projected expenditures for the next six-month period. The procurement management reports will monitor the procurement process and contract expenditures under the Project. These PMRs will be submitted within 45 days following the end of each six-month period.

Disbursements

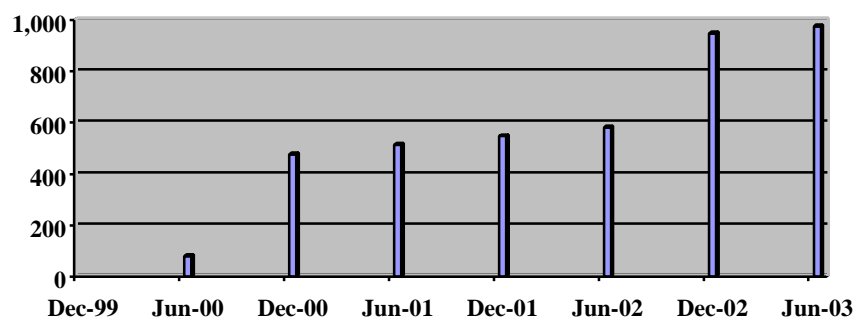
Direct disbursements to UNDP are expected to be requested by the Project Unit on the basis of the semi-annual disbursement projections included in the PMR. Payment requests (withdrawal applications and the supporting PMR) would be submitted to the Bank based on semi-annual statements reflecting disbursements both cumulatively and for the period covered by the PMR, and the Project's planned expenditures and six-month cash flow forecast. Grant proceeds will be disbursed to a single project account administered by UNDP.

The following table (Table 1) sets forth the Categories of items to be financed out of the proceeds of the Grant, the allocation amounts of the Grant to each Category, and the percentage of expenditures for items to be financed in each Category. In addition, Table 2 provides a profile of cumulative grant disbursement estimates for each six-month period of the Project.

Table 1. Allocation of Grant Proceeds

| <u>Categories</u> | <u>Amount</u> (US\$) | <u>Financing Percentage</u> |
|------------------------|-------------------------|---|
| 1. Goods | 788,400 | 100% foreign expenditures 100% local expenditures (ex-factory) 85% local expenditures |
| 2. Consultant Services | 168,800 | 100% |
| 3. Travel Expenditures | 18,000 | 100% |
| TOTAL | 975,200 | |

Table 2. Cumulative Disbursements Estimate ('000s)



**Table 3. Projected Disbursements
Project Year 1**

| Project Activities | July-Dec 2000 | Activity Targets | Jan-Jun 2001 | Activity Targets |
|--|----------------------------|--|-----------------------------|---|
| 1. Establishment of the Project Administrative Unit (i) Consultant Services, including training (ii) Office equipment | 30,900 3,000 | Hire consultants and training by 10/00 Office equipment purchased by 12/00 | 36,750 | Hire consultants and training by 4/01 |
| 2. Preparation of engineering design for the methane recovery system (i) Consultant Services | 18,800 | Hire consultants 9/00 | | |
| 3. Installation of equipment for the methane recovery system (i) Equipment for the Biogas Collection System (ii) Equipment for the Suction and Monitoring System (iii) Equipment for the Utilization System | 11,000 17,000 40,000 | Contract signed for installation of equipment by 12/00 Contract signed for installation of equipment by 12/00 Contract signed for installation of equipment by 12/00 | 67,100 93,000 267,700 | Equipment installed by 6/01 Equipment installed by 6/01 Equipment installed by 6/01 |
| 4. Supervision of methane recovery system and site visits to other landfills (i) Travel Expenditures | 9,000 | | 5,500 | |
| Total Funds Required | 129,700 | | 470,050 | |

Project Year 2

| Project Activities | July-Dec 2001 | Activity Targets | Jan-Jun 2002 | Activity Targets |
|---|---------------|--|--------------|------------------|
| 1. Establishment of the Project Administrative Unit (i) Consultant Services, including training | 12,600 | Hire consultants and training by 12/01 | 4,100 | Training by 5/02 |
| 4. Supervision of methane recovery system and site visits to other landfills (i) Travel Expenditures | 3,500 | | | |
| Total Funds Required | 16,100 | | 4,100 | |

Project Year 3

| Project Activities | July-Dec 2002 | Activity Targets | Jan-Jun 2003 | Activity Targets |
|--|---------------|--|----------------|-----------------------------|
| 1. Establishment of the Project Administrative Unit (i) Consultant Services, including training | 21,450 | Hire consultants and training by 12/02 | 18,600 | Hire consultants 4/03 |
| 3. Installation of equipment for the methane recovery system (i) Equipment for the Utilization System | 40,000 | Contract signed for installation of equipment by 12/02 | 222,700 | Equipment installed by 5/03 |
| Total Funds Required | 61,450 | | 241,300 | |

Project Year 4

| Project Activities | July-Dec 2003 | Activity Targets | Jan-Jun 2004 | Activity Targets |
|--|------------------|--|-----------------|------------------|
| 1. Establishment of the Project Administrative Unit (i) Consultant Services, including training | 25,600 | Hire consultants and training by 12/03 | | |
| 1. Installation of equipment for the methane recovery system (i) Equipment for the Biogas Collecting System | 26,900 | Equipment installed by 12/03 | | |
| Total Funds Required | 52,500 | | | |

Project Financial Statements and Financial Reporting

Project financial statements will include a statement of receipts and sources and uses of funds. The funds flow statement will indicate sources (GEF) and expenditures in accordance with main project components and disbursement categories. Project financial statements will show actual payments against those budgeted. Information reported will also include the value of contracts signed, i.e., commitments, relative to actual payments.

The PU will maintain separate records for project expenditures as well as a register of assets purchased with Grant funds. The PU will also have the responsibility for preparing the project's financial statements, including balance sheets and sources and uses of funds statements, according to international accounting standards.

Audit

Auditing of the project accounts will be done following existing auditing arrangements of the UCC, that have been judged satisfactory by the Bank (see Attachment 1). Project Accounts will be audited, in accordance with international accounting standards applied by independent auditors acceptable to the Bank. UNDP shall make available to the PU all financial and other information that may be required in connection with the audit. Audit reports will be sent to the Bank no later than six months after the end of the UCC's Fiscal Year.