Contact Research for Ministry of Environment, 2005

Project Research for CDM/JI, 2005

Coastal Land Disposal Area in Sao Paulo, Brazil
Research for Methane Gas Collection and Energy Utilization
(Outline)
Report

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Chapter 1; The Description of the Host Country, Brazil

1.1 General Description

Brazil is one of the largest countries in the South America region, and it has an extensive land, which is approximately 23 times of Japan. The population is about 1.8 million (Aug. 2004). Although Brazil was suffered from the inflation in the past, it is considered as one of the economic powerhouses in the world today. The GDP of Brazil has been also increased enough to be considered as economic power.

1.2 Energy

In 2001, there were several types of domestic energy supply systems in Brazil; oil and natural gases (approx. 52%), hydraulic and electric power (approx. 13%), and sugar cane energy (alcohol)(approx. 12%). One of the most distinctive energy systems in Brazil is the sugar cane energy supply procedure, and it covers high percentage of whole domestic energy supply systems. Today, sugar cane energy, alcohol, is considered as one of the most efficient energies; 20 % of ethanol is mixed in gasoline at all of the gas station in Brazil. Another distinctive trend in energy system of Brazil is increasing of natural gases consumption. Although today's natural gases consumption is only 3 % of whole energy systems in Brazil because of the lack of infrastructure, the government aims to increase the percentage of natural gases consumption up to 12% in 2010.

1.3 Electric Power

In Brazil, hydraulic power is the most utilized electrical power systems. At the end of 2002, gross weight of power generation facility was approx. 7,600,000 kW. Most of them are produced by hydraulic power system, and only 15 % of the amount was produced by thermal power generation and nuclear power system; only 7 % as heat value. Thermal Power generation is considered as the most useful power systems in the near future. ONS (Operador Nac. Do Sist. Eletrico) points out that thermal power generation system, especially based on natural gases, should be utilized more continuously from 2009/2010 because of today's electrical demands.

1.4 Inventory for GHG emission

Because of economical slumps in the 1980`s and utilization of renewable energy, the amount of CO2 emission was decreased temporarily, but it seems to be increased today, again. As classified, in terms of CO2 emission amounts, transport sector accounts for majority of CO2 emission; the manufacturing industry and energy industry are also

included as high CO2 emission industries. A growth rate of CO2 emission from 1990 to 1994 had been also increased in other industries; steel industry (approx. 32% increased), aluminum industry (approx. 25% increased), agriculture (approx. 25% increased), and automobile industry (approx. 17% increased). Considering about occupation ratio and increased ratio of all the amount of CO2 emission, it is clear that automobile industry affects on the total amount of CO2 emission.

About methane gas emission, approx. 68% of them are generated from agriculture, especially from the fermentation in the gastrointestinal tract of cows. Finally, 6.1% of methane gas generation is occupied by waste sector; the increasing ratio is approx. 12% from 1990 to 1994.

1.5 CDM Project in Brazil

In Brazil, DNA (Designated National Authority), which approves the CDM projects, is accompanied CIMGC (Interministerial Commission on Global Climate Change), and it is formed by the ministry, including science and technology ministry as the chair. For DNA, considering about the social issues in Brazil and contribution to the Brazilian economy are the most important aspects to approve the CDM projects in Brazil. As an example, employment contribution and distribution of profits have to be included in the PDD (Project Design Document). Large numbers of CDM projects are approved already in Brazil; these projects are operated by the development industries and certified bodies from Europe. Moreover, BM&F opens emission trading market and matches the CDM projects and various industries today.

1.6 The Present Condition of the Waste

Generation of waste has been increased along with the growth of economy today, and it is the severe issue for the local government. In 2000, 125,000t/day of waste was collected; 30% of them had not been taken any kind of anti-pollution measures (open-dumping), and 22% of them were disposed as cover soil. Because of fiscal situation, facilitating anti-pollution measures was very difficult. These are the causes of pollution of river and underground water.

Because of anti-pollution measures insufficiency, large numbers of local government are not able to obtain the permissions of TAC (Terms of Adjustment and Commitment) from environmental preservation authorities. Without TAC, they are not able to secure landfill site.

Figure 1-1 Waste in Brazil(2000)

contents			unit	
Collection amount			t/d	125,000
emission amount/person in a city			g/cap/d	800
final disposal procedure				
	land reclamation	open damping	%	30
		solid waste fill place	%	22
		sanitary landfill	%	43
	compost		%	3
	recycling		%	2

Chapter 2; Project Contents

2.1 Research Outline

Investigating the introduction of collection and effective utilization systems for land fill gas (LFG), which is generated at the waste landfill sites in Sao Paulo (Itanhaem city, Carapicuiba city, and Mogi Guacu city). Facilitating incineration equipment to burn the collected LFG at these three landfill sites in Sao Paulo. By operating this system, methane gas emission is going to be decreased. The methane gas has green house effect, which is 21 times as much as CO2. Contribute to the economical development in Brazil continuously by this project.

Although six cities, including Itanhaem city, were considered as the subject sites to facilitate waste landfill sites, only three cities were accepted.

2.2 Project Purpose

There are great numbers of the waste landfill sites, which pollute the environment, because of open dumping without any anti-pollution measures and permission of TAC. Financial difficulties and lack of know-how disturb the improvement of waste landfill sites.

This project would be considers as the good procedure to obtain CER, but also it contributes for the Brazilian economy by solving the environmental issues.

2.3 Project Operated Sites

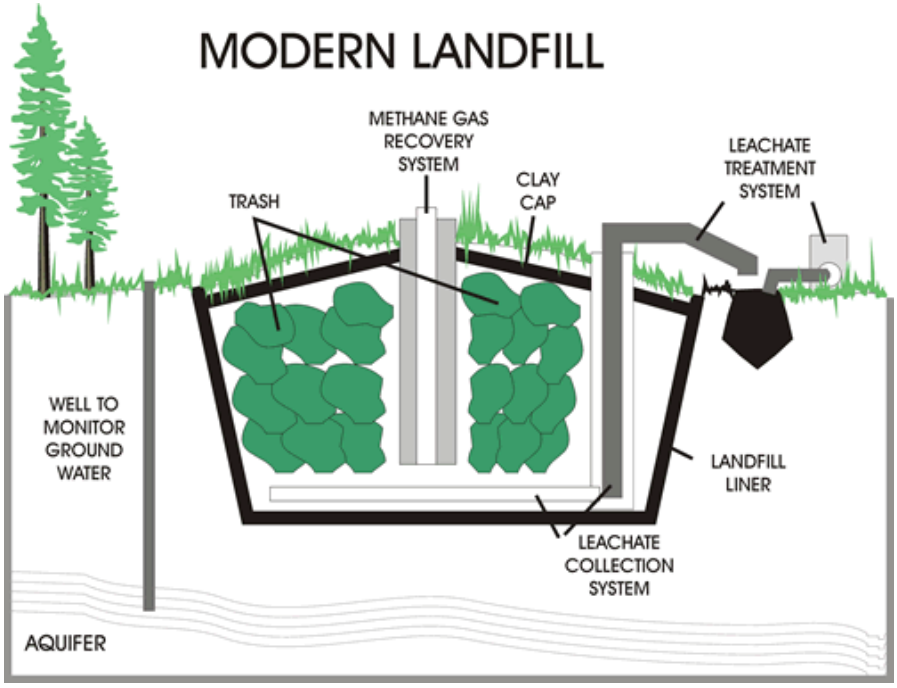
The projects operated sites are showed in Figure 2-1; Itanhaem city, Carapicuiba city、and Mogi Guacu city in Sao Paulo.

Figure 2-1 Project operated sites

2.4 Project Outline

Collecting LFG, which is discharged from the waste landfill sites, by operating LFG collecting system in three cities (Itanhaem city, Carapicuiba city, and Mogi Guacu city). Electric power supply is planned at each site, by the utilization of flare facility. The electric power is generated by gas engine or burning LFG.

Figure 2-2 design of the sites



2.5 Proof of Baseline Establishment and Additionality

ACM 0001, consolidated methodology for land fill gas project activities, is prepared for the baseline methodology to collect LFG from the waste landfill sites. To apply to this methodology, all of the conditions have to be applied as below.

[Precondition]

In baseline scenario, the part of the gas or all of them is discharged to the air; therefore any of these written conditions as below could be adapted.

[Adaptable Conditions]

A) Collected gas should be treated by flare system.

B) Although collected gas is going to be used as energy (ex. Generation/Heat energy), expectation to obtain credits from this system should not be concerned, by decreasing the amount of discharged CO2 emission caused by energy substitution

and evasion.

C) Using collected gas as energy (ex. Generation/Heat Energy) and expecting to obtain credits by decreasing the amount of discharged CO2 emission caused of energy substitution and evasion. In this situation, either baseline methodology, which is based on substituted generation and heat energy, or ACM 00002, "Consolidated methodology for grid-connected electricity generation from renewable sources", should be indicated and accepted. Circumstances of these situations; the amount of power generation is under 15MW or substituted heat energy is under 54TJ (15GWh), it could be the subject for the small scale CDM methodology.

This project fits to either A or B of the above, since LFG is discharged to the air, and collected gas is planned to be treated by flare system or generated at all of the sites, Itanhaem-city, Carapicuiba-city、and Mogi Guacu-city.

2.6 Baseline Scenario and Additionality

"Tool for the demonstration and assessment of additionality" has been used for the investigation for the baseline scenario and additionality for this project at 17th CDM Executive Board. There were three possible scenarios, and the first one was selected based on the investigation.

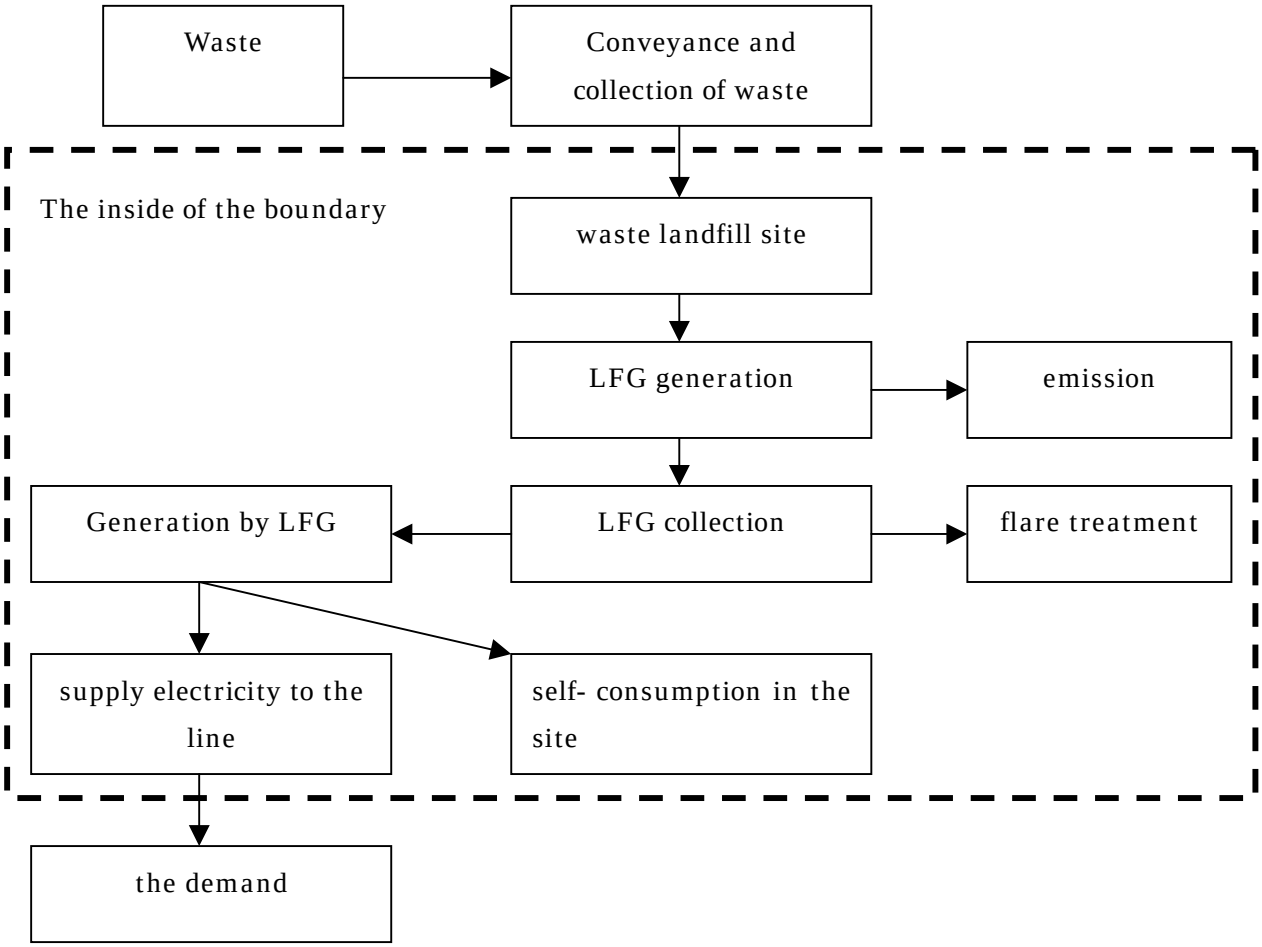
1. First choice; At the waste landfill sites, LFG is not collected and treated by flare system, or only part of the LFG is going to be treated by flare system for the security reasons. This procedure is considered as most general systems in Brazil. In this case, generation on the site is not operated, and there is no effect on the Brazilian combination with commercial power sources.
2. Second choice; The administrator at the waste landfill sites invests the money in the LFG collection and flare system to destroy LFG. In this case, generation on the site is not operated, and there is no effect on the Brazilian combination with commercial power sources.
3. Third choice; The administrator at the waste landfill sites invests the money in the LFG collection system and power generation facility to destroy LFG. In this case, generation on the site is going to be operated. Decreasing the amount of green house gas emission from the existing power source of the lines, by combination with commercial power sources and selling excess power to the Brazilian combination with commercial power sources.

2.7 Establishment of Project Boundary

The actual project boundaries are located in the facilities of Itanhaem city, Carapicuiba city, and Mogi Guacu city. These sites collect LFG and treat them by the flare system, and operate methane gas burning and destruction.

General idea of the boundary is showed in Figure 2-3.

Figure 2-3 Boundary of the Project



2.8 GHG Reduction and Leakage by Project Operation

The total decreased amount of GHG emission at Itanhaem city, Carapicuiba city、and Mogi Guacu city is showed in Figure 2-4, 2-5, and 2-6; within seven years, the amount is going to be 294,772t-CO2, and it is also going to be 698,067t-CO2 within 21 years.

Figure 2-4 Baseline scenario and GHG emission amount at Itanhaem city

ER credit amount (tCO_2e)	Emissions			
	baseline	project	gross ERs	Net ERs
7th year	229,862	101,705	128,157	100,475
10th year	288,630	120,070	168,560	132,151
14th year	344,008	137,376	206,632	162,000
21st year	400,691	155,089	245,602	192,552

Figure 2-5 Baseline scenario and GHG emission amount at Carapicuiba city

ER credit amount (tCO_2e)	Emissions			
	baseline	project	gross ERs	Net ERs
7th year	104,178	46,095	58,083	45,537
10th year	130,812	54,418	76,394	59,893
14th year	155,911	62,261	93,650	73,421
21st year	181,601	70,289	111,311	87,268

Figure 2-6 Baseline scenario and GHG emission amount at Mogi Guacu city

ER credit amount (tCO_2e)	Emissions			
	baseline	project	gross ERs	Net ERs
7th year	318,501	128,756	189,745	148,760
10th year	466,203	174,913	291,290	228,372
14th year	640,289	229,315	410,974	322,204
21st year	818,477	284,999	533,478	418,247

2.9 Comments of the Interested Parties

1) Brazilian DNA (Ministry of Science and Technology)

Great numbers of CDM projects have been operated in Brazil, but this program is differentiated from other programs. Through CDM projects, DNA eager to solve the environmental issues in Brazil. Even though solid waste management has various kinds of issues, DNA expects that there is a possibility that local governed waste landfill sites may have some environmental improvement by operating this project. DNA wants to accept CDM projects as many as they could, and they are eager to support this project.

2) Local Government

The cities, which have environmental issues, are eager to introduce this project to

improve the present environmental condition of waste landfill sites. Basically, the right of LFG belongs to city authority, a competition and selection is needed to operate CDM project.

Chapter 3; Economical Investigation

3.1 Funds Statement

The expenses for this project, for the facility and constructions, would be financed by governmental financial facilities, including Caixa Economical Federal, and local financial facilities. These financial facilities might fund for this project because of these reasons; this project is along the governmental thoughts, environmental improvement around the waste landfill sites, and it might bring expected fixed income by selling CER.

The conditions for the investigation are summarized in Figure 3-1.

Figure 3-1 Various Conditions

Contents	Conditions
exchange rate	1US$=2.26Rs
depreciation	residual value 10% repayment in 10 years （fixed percentage on cost）
corporation tax	34% （24% if the gain is less than 24,000Rs）
interest rate	6%
initial cost	Itanhaem city：US$ 546,570 Carapicuiba city：US$ 396,552 Mogi Guacu city：US$ 489,870
personal expenses	administrator：US$ 4,200/cap･yr×1person operator：US$ 1,392/cap･yr×6person
maintenance cost	Itanhaem city：US$18,000/yr Carapicuiba city：US$ 9,000/yr Mogi Guacu city US$ 12,000/yr
CDM project cost	Verification：US$ 5,000/yr Adaptation Fee：US$ 0.2/CER
generation cost	US$ 70.0/MWh
CER selling price	US$ 8.0/t-CO_2
selling excess power price	US$ 50.0/MWh

3.2 Economical Analysis

Based on the summary on the above (Figure 3-1), two cases are investigated; 1, only collecting and burning landfill gas. 2, collecting and burning landfill gas, and using them as power generation.

1) Gains

1, Cash flow without power generation

This project without power generation brought fiscal surplus to Mogi Guacu city within two years. During the project period, IRR became as 19.5%. From this information, it is clear that this project is going to produce profits under these conditions.

On the other hand, the results of this project in Itanhaem city and Carapicuiba city are not good. Although it went into black in the begging of this project in Itanhaem-city, it changed for the worse caused by decreasing of LFG emission amount.

2, Cash flow with power generation

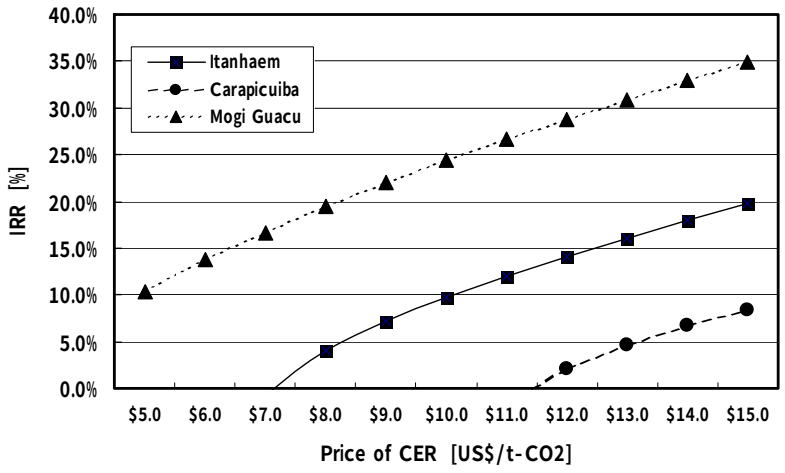
With power generation, all of the sites went into the red during the project period. Under these conditions, it would not be economically feasible to run this project as business.

2) Sensitivity Analysis based on CER price

Based on CER prices (from US$5.0 to 15.0), IRR and NPV (Net Present Value) were evaluated.

From this evaluation, IRR of Mogi Guacu city was 19.5%, when CER price was set as precondition ($8.0). From this analysis and result, Mogi Guacu city should be considered as the subject of investment. On the other hand, required earning rate (6%) is not be maintained in Itanhaem city and Carapicuiba city.

Figure 3-2 The result of Sensitiveness Analysis based on CER price



Chapter 4; Tasks for Future Projects

4.1 Economical Improvement

More ideas and thoughts are needed to improve CDM project to precede the small waste landfill sites economically, as we have discussed and planed.

The possible measures for the economical improvement;

- Maintaining the fixed amount of waste by putting together the waste landfill sites.
- Increasing the recovery rate by improving LFG collecting systems.
- Spreading the public financial assistance for CDM project.

4.2 Improvement of LFG Production Prediction

In order to estimate the amount of LFG emission more accuracy, all of the parameter, which are going to be used as model, should be match enough to the conditions at the sites. More definite research is needed to find out the factor, which affect the parameter setting.

4.3 Other Concerns

1) Understanding of Business Customs of the Sites

Understanding of business customs of Brazil is very important to practice research for the projects and feasibility study. It is also very common that important business matters are settled without documentation, and it is one of the considering points.

2) Tasks about the Rights of Waste Disposal

Not only in Brazil, but also in other counties have the structure of rights and interests in the solid waste management businesses.

This right and interests structure could be the possible obstacles in the future projects and business; more definitive research about this issue is also needed.