

Purpose and overview of survey

The Kyoto Protocol, adopted at the Third Conference of the Parties to the United Nations Framework Convention on Climate Change (COP3) convened in December 1997, requires that developed nations reduce their average greenhouse gas (GHG) emissions for the period from 2008 to 2012 by around 5%, which is below (in Japan's case, 5%) 1990 levels, in order to reduce global warming. The Kyoto Mechanism was incorporated into the Kyoto Protocol to allow some flexibility in attaining this target, and includes measures such as the Clean Development Mechanism (CDM) and Joint Implementation (JI).

To achieve this target reduction, the Japanese government established the Chikyu Ondanka Suishin Taiko ("General Principles to Promote Global Warming Measures") (March 2002), in which the Kyoto Mechanism is assigned an important role in helping Japan meet its commitment under the Kyoto Protocol in a cost-effective manner.

On June 4, 1992, Brazil became the first country to sign the United Nations Framework Convention on Climate Change (UNFCCC). This was followed by ratification on February 28, 1994. It is also Brazil that proposed the CDM, and already over 50 projects have been brought to the Brazilian government as candidates for the CDM. The relatively high number of projects for Brazil submitted to the CDM Executive Board for the process of new-methodology approval means that there is a high likelihood of CDM projects being implemented in Brazil.

Of these CDM projects, special attention is being paid to those involving methane gas collection: the greenhouse effect of methane gas is 21 times that of carbon dioxide, so such projects have the potential to significantly reduce greenhouse gas emissions. In addition, as many of the applications for the approval of new methodologies have been filed with the CDM Executive Board for projects involving the collection and use of the landfill gas (LFG) discharged in large volumes from waste landfill sites, and some have already been approved, it is certainly worthwhile acquiring a greater knowledge of the potential for earning carbon credits through projects for the collection and use of LFG.

The aim of this survey, therefore, was to gain a greater knowledge of the carbon-credit earning potential of an operation to collect the LFG discharged in large volumes from the São João landfill in the São Paulo municipality, and to make effective use of this gas

as an energy source.

For the survey, we conducted a baseline study, calculated GHG reductions, carried out a stakeholder analysis and assessment of environmental impact, and explored and drew up trial project plans.

1. Overview of the location

1) Brazilian initiatives to prevent global warming

Brazil was the first nation to sign the UNFCCC (June 4, 1992) and, facing most prominently the problem of declining forestry resources in the Amazon and other of its regions, has developed and implemented various programs and studies involving climate change on a regional, national, and international level. Programs in Brazil cover not only climate change, but a wide range of issues with a direct and indirect impact on the mitigation of climate change, such as renewable energy, fossil-fuel conversion, and greater energy efficiency.

On July 7, 1999, the Interministerial Commission on Global Climate Change (Comissão Interministerial de Mudança Global do Clima, CIMGC) was established by Presidential decree to coordinate the government's response to the climate-change issue in Brazil. The Commission is chaired by the Minister of Science and Technology, with the Environment Minister acting as deputy chairman and the Ministry of Science and Technology acting as the Executive Secretariat.

2) Status of general waste landfills in Brazil

According to a national survey on basic sanitation (PNSB), approximately 97.9% of waste in Brazil is disposed of in general waste landfills or at dumps, as shown in Table 1 below (IBGE, 1992). Furthermore, in a recent household survey (PNAD), it was found that 85% of the population receives waste collection services (IBGE, 1996).

Amount of collected waste(PNSB-1989)(t/day)										
Total	Dump		Landfill			Other	%			
	Open	Flood -ed	Controll -ed	Sanit -ary	Other		Open	Flood -ed	Land -fill	Other
241,614	182,190	1,588	30,082	22,456	107	5,191	75.4	0.7	21.8	2.1

Table-1 Solid waste destination in Brazil

(Source : METHANE EMISSIONS FROM WASTE TREATMENT AND DISPOSAL)

3) Treatment of general waste in São Paulo City

The collection and treatment of waste in the city of São Paulo is administered and operated by the waste control division of the public works bureau (SSO). All operations involving waste, including cleaning, collection, transport, and treatment, are carried out by nine private companies currently contracted to perform the work, and the waste control division is responsible for concluding contracts with these companies, providing technical guidance, and administering and supervising operations.

Approximately 10,000 tons of general waste are currently collected in São Paulo City daily. Fourteen percent, or approximately 1,400 tons, of this is taken to composting stations; the remainder, however, is dumped at two landfill sites.

4) Use of LFG in Brazil

According to a GHG inventory compiled by the São Paulo State environment bureau in 1994, Brazil has over 6,000 landfills, the vast majority of which are not controlled in any way. In fact, approximately 76% of general waste generated in Brazil is simply thrown into garbage dumps (lixoes) that are totally uncontrolled and have no LFG collection or drainage. The remaining 24% is disposed of at "controlled" landfills that cannot be called sanitary landfills. Brazilian law does not require LFG collection or treatment at landfills, and the vast majority of landfills do not collect LFG, although some sanitary landfills do collect and flare off around 20% of LFG for safety reasons.

The following is a description of some of the leading LFG collection projects either planned or actually underway in Brazil.

- LFG power generation project at NovaGerar landfill

This project, located at the NovaGerar landfill approximately 10 km from the center of the city of Nova Iguaçu in Rio de Janeiro State, is intended to improve the rate of LFG collection and to use LFG for generating 12 megawatts of electricity. The project is to be carried out mainly by an environmental finance company EcoSecurities Limited and the Brazilian firm S. A. Paulista, with the World Bank Netherlands Clean Development Facility (WBNCDF) purchasing carbon credits. The project has already received approval for its methodology from the CDM Executive Board (AM0003: "Simplified Financial Analysis for Landfill Gas Capture Projects"), and is expected to reduce emissions by approximately 10.7 million tons over 21 years.

- LFG project at the Salvador landfill in Bahia State

This project, located at the Salvador landfill in Bahia State, approximately 20 km northeast of Salvador City, is intended to improve the rate of LFG collection and to use LFG in ultimately generating 40 megawatts of electricity. The project will be carried out by VEGA Bahia Tratamento de Resíduos S.A., a subsidiary of SUEZ Environment of France. The project has already received CDM Executive Board approval for its methodology (AM0002: "Greenhouse Gas Emission Reductions through Landfill Gas Capture and Flaring where the Baseline is established by a Public Concession Contract"), and is expected to reduce emissions by approximately 14.5 million tons over 17 years.

- LFG collection at the SASA landfill

LFG collection project at the SASA landfill in the city of Tremembé, São Paulo State, to be implemented by French company ONYX and subsidiary SASA. Received new-methodology approval (NM0021) at the 12th meeting of the CDM Executive Board, and is expected to reduce emissions by approximately 70 million tons over 10 years.

2. Overview of the São João Landfill Gas to Energy Project

1) Overview of the project

The project involves improving systems at the general waste landfill at São João,

located approximately 45 kilometers from the center of São Paulo City, the largest city in South America, in the Republic of Brazil, to boost the collection rate of LFG consisting primarily of methane gas from the landfill, and to use that LFG to generate electricity, in order to assist in preventing global warming.

At present, the vast majority of landfills in Brazil are totally uncontrolled, and not only is the LFG (consisting primarily of methane gas) they generate contributing enormously to global warming, these landfills are also causing degradation of the global environment through foul odors and the danger of fire and explosions. Even in the fewer than 25% of Brazilian landfills that are controlled, the average rate of LFG collection is extremely low, at under 10%. By improving the rate of LFG collection at the São João landfill and making effective use of LFG as an energy source, the objective of this project is to make improvements on a global scale to the global environment, to bring environmental and economic benefits to the region, and to contribute to sustainable development.

The project will involve improvements to the current LFG collection system, estimated to be collecting around 30% of LFG for safety reasons, and is intended to raise LFG collection to around 75%. A flaring system will also be installed to burn methane gas and convert it into carbon dioxide, thereby reducing gas emissions by the equivalent volume of CO₂. A gas-engine generating plant (with an ultimate generating capacity of around 25 megawatts) will also be installed to supply electricity via the grid system, contributing to the sustainable development of Brazil and the region.

The following two technologies will be employed:

The first is the LFG collection technology for use at the São João landfill. A water barrier made from impermeable high-density polyethylene (HDPE), wastewater treatment facilities, and LFG gas collection wells have already been installed; however, the technology to be used will include improvements to collection wells such as vertical gas extraction wells and horizontal gas extraction wells, in addition to a flaring system. The other technology to be used is that for the power generation plant, i.e., the installation of a gas-engine generating plant. At present, the plan is to install the power generation plant following installation of the methane gas collection facilities.

2) Baseline

The baseline selection method employed for this survey was AM0003 “Simplified financial analysis for landfill gas capture projects.” This method was approved on January 12, 2004 under the UNFCCC.

The baseline scenario for the proposed project can be expressed as follows.

Because the volume of LFG collected at the landfill disposal site is low and its treatment is inadequate, there is unrestricted discharge of LFG into the atmosphere. There is a possibility, however, that at some point in the future the collection and treatment of LFG will be required under law, or will become an economically attractive business practice.

3) Project boundaries

The flowchart in Figure 1 shows all boundaries of the project and the system. The flowchart contains all elements that could possibly be present in the LFG collection system and power generation equipment.

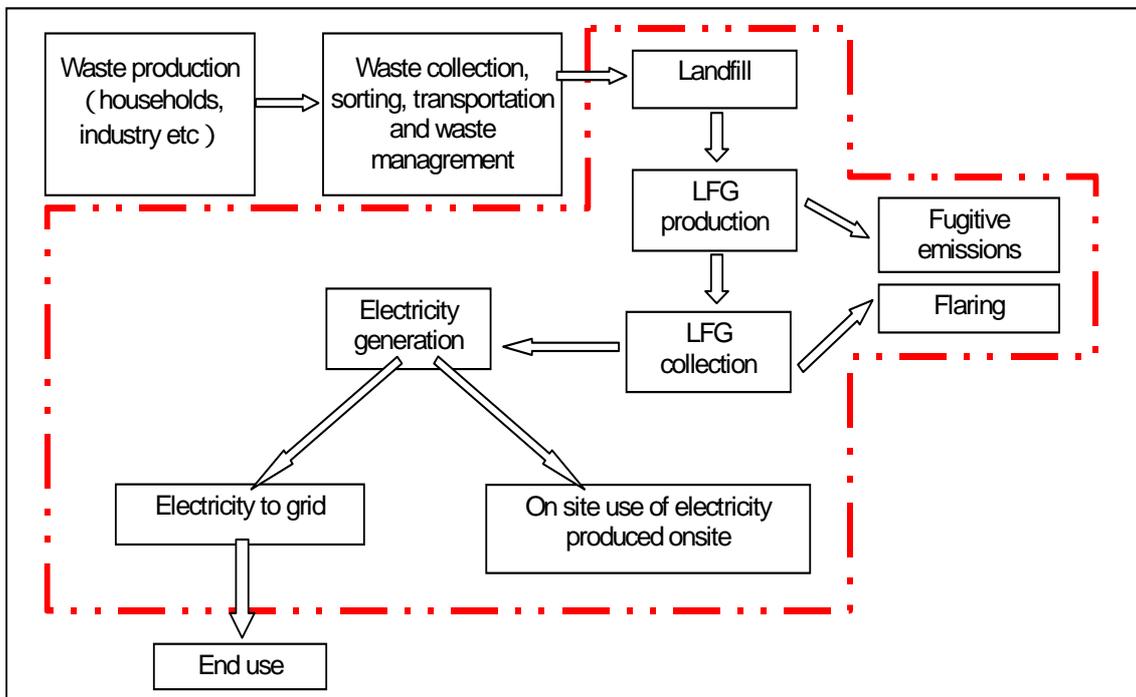


Figure-1 System boundaries

4)Monitoring

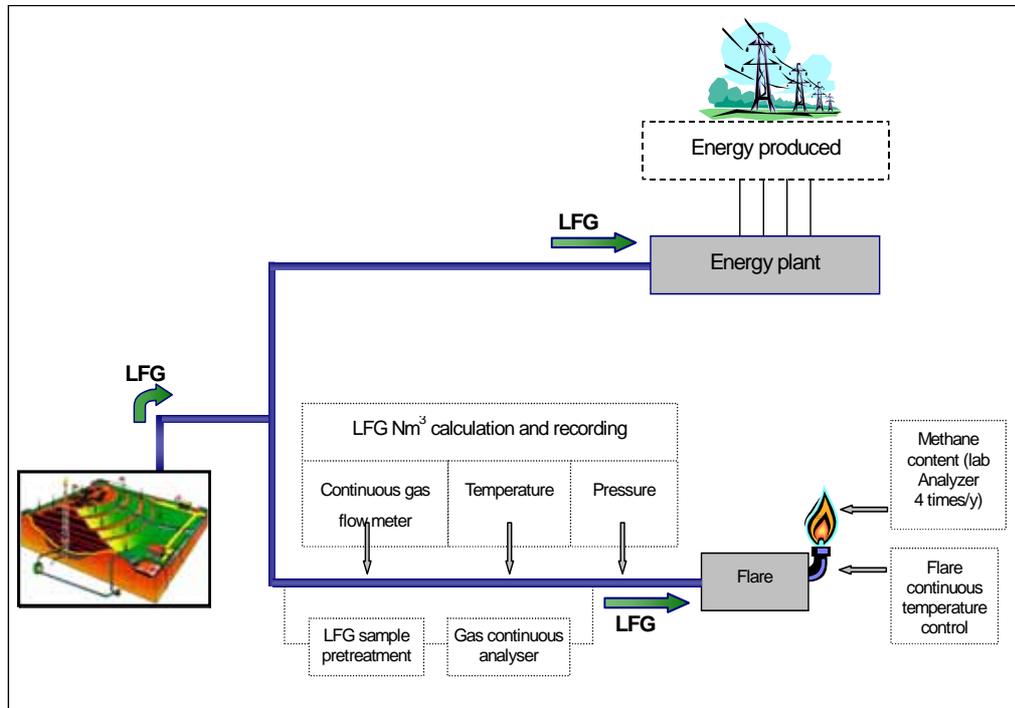


Figure-2 Scheme of project activities and monitoring project activities

5)GHG Emission Reductions Calculation

Year	Emissions Baseline	Emissions Project	ERUs
2005	1,845,554	659,126	1,186,428
2006	2,082,057	743,592	1,338,465
2007	2,296,054	820,019	1,476,035
2008	2,077,556	741,984	1,335,572
2009	1,879,850	671,375	1,208,475
2010	1,700,959	607,485	1,093,474
2011	1,539,091	549,675	989,416
2012	1,392,627	497,367	895,260
2013	1,260,101	450,036	810,065
2014	1,140,187	407,210	732,977
2015	1,031,684	368,458	663,225
2016	933,506	333,395	600,111

2017	844,671	301,668	543,003
2018	764,290	272,961	491,329
2019	691,558	246,985	444,573
2020	625,748	223,481	402,266
2021	566,200	202,214	363,986
2022	512,319	182,971	329,348
2023	463,565	165,559	298,006
2024	419,451	149,804	269,647
2025	379,535	135,548	243,987
Total	24,446,566	8,730,917	15,715,650

Table-2 Summary of Baseline and Project Emissions (in tCO_{2e})

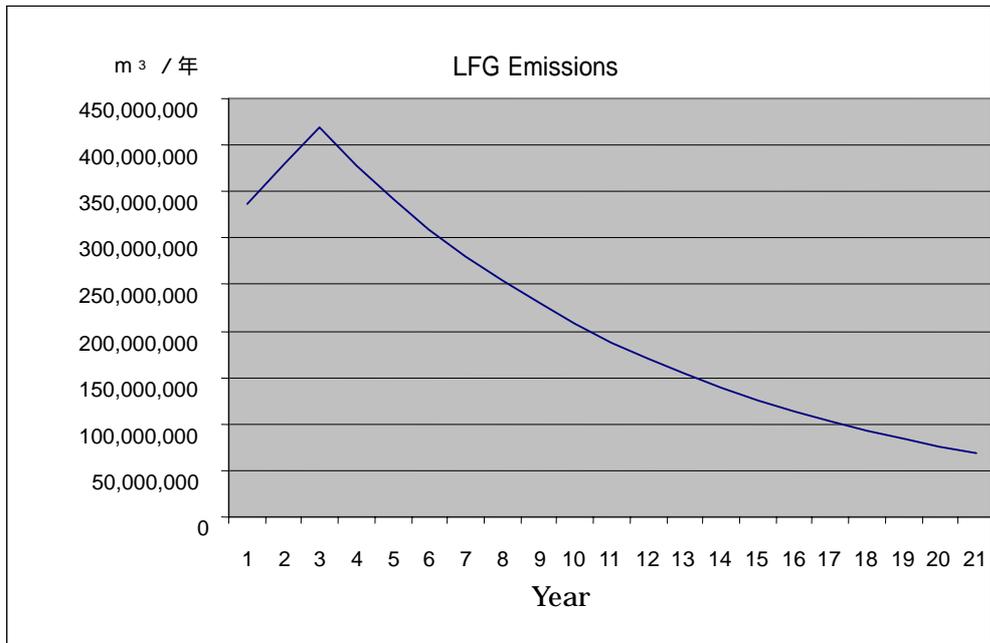


Chart-3 LFG Emissions

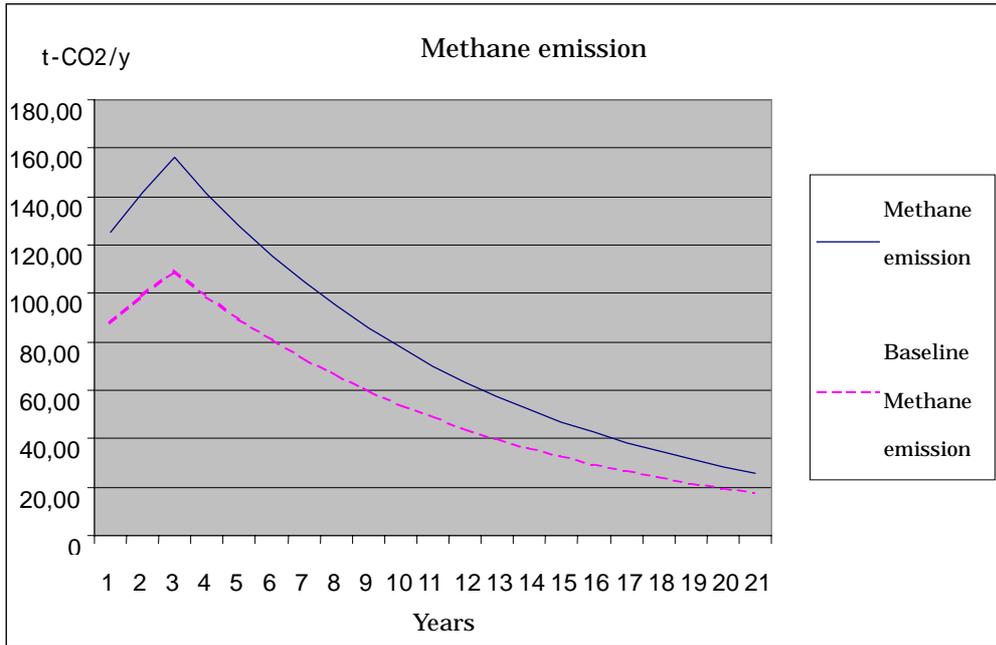


Chart-4 Methane emission

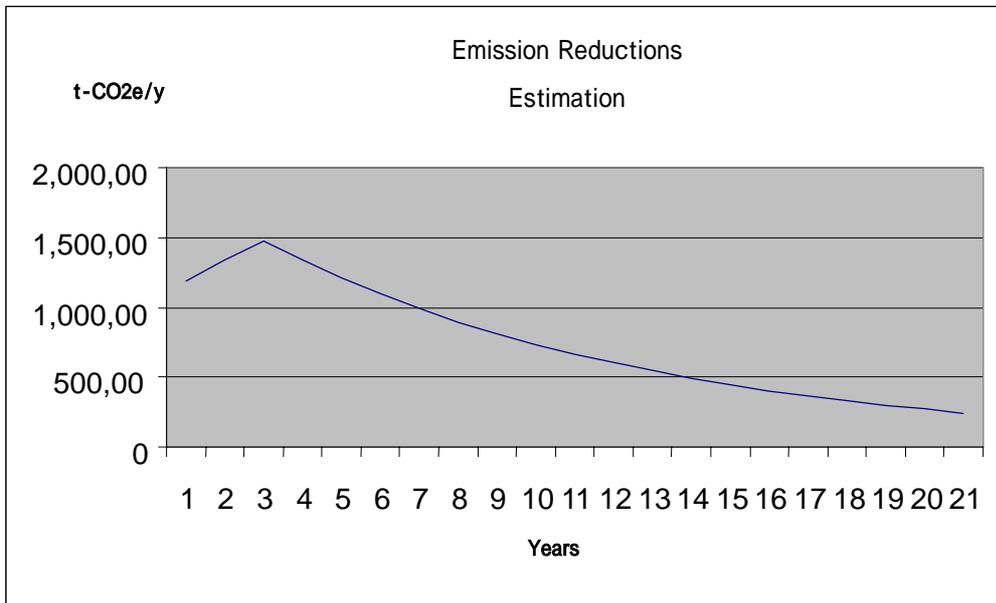


Chart-5 Emission Reductions Estimation

3. Financial Evaluation for the project

The Project IRR that is calculated under the conditions described in the text 5 is as follows :

	CO2 Credit Price (US\$/t-CO2)	Credit Period	PIRR (%)
With Credit	4	21 years	27.2
Without Credit	-	-	14.8

Table-3 PIRR