



Best Practice: Landfill Emissions Control

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CITY: SÃO PAULO

POLICY AREAS: CLIMATE CHANGE; WASTE MANAGEMENT

BEST PRACTICE

The City of São Paulo's **landfill emissions control program** is a public-private venture that renovated two of the world's largest landfills. Thermoelectric plants are installed at the landfill to collect gas from decaying waste that is then converted to clean energy. It also generates critical revenue through the sale of certified carbon credits that the city then uses to fund development (socio-environmental projects in the landfills' surroundings). This landfill project was approved as a United Nations Clean Development Mechanism (CDM) project, making São Paulo one of the only cities to benefit from the carbon finance concept, normally reserved for the national level.

ISSUE

While São Paulo's two largest landfills, Bandeirantes and São João, were nearing their maximum storage capacity in 2004, the City of São Paulo was faced with how to address environmental concerns arising from continued greenhouse gas production by decaying landfill waste.

GOALS AND OBJECTIVES

The landfill emissions control program aims at creating a secure and sustainable waste facility that collects gas and converts waste gas emissions into clean energy. Overall, São Paulo will reduce emissions by 11 million tons of greenhouse gas by the year 2012. Certified emission reduction credits (CER) earned through this program generates revenue for the city and its private partners. City revenue from the project is directed to urban revitalization projects in surrounding neighborhoods.

IMPLEMENTATION

Background

Waste disposal accounted for 25% of the City of São Paulo's greenhouse gas emissions in 2005.

The daily production of domestic waste in the City of São Paulo is approximately 15,000 ton/day. Waste collection is divided between the North-West and South-East regions and is managed by private companies, such as *Loga* and *EcoUrbis*, respectively, through contracts with the municipal government. The contract covers homes and hospitals, as well as selective street sweeping collection. The waste is disposed of at 4 different locations near the city, including:

- São Joao landfill (located in Sao Mateus); municipal property, receives 1,000 tons per day. (Closed operations in 2009)
- Bandeirantes landfill (located in Perus); municipal property (closed operations in 2007)
- Waste layout center of 'Pedreira' (located in Guarulhos); private property, receives 4,000 tons per day
- Waste layout center of 'Caieiras' (distance of 35 km from São Paulo); private property, receives 5,000 tons per day

In addition, the city has distribution stations where waste is stored to be later deposited in distant landfills.

Program Development

The Clean Development Mechanism (CDM) allows emission-reduction (or emission removal) projects in developing countries to earn certified emission reduction (CER) credits, each equivalent to one ton of CO₂. These CER's can be traded and sold, and used by industrialized countries to meet a part of their emission reduction targets under the Kyoto Protocol. Operational since the beginning of 2006, the mechanism has already registered more than 1,000 projects and is anticipated to

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produce CER's amounting to more than 2.7 billion tonnes of CO₂ equivalent in the first commitment period of the Kyoto Protocol, 2008–2012.

Through a public bidding process, the City of São Paulo granted a contract to a consortium of Brazilian and Danish private companies managed by Biogas Co (Biogas actually is the consortium's name) to install thermoelectric power plants to burn biogases emitted by decaying waste from the landfills to produce clean energy and prevent the emission of greenhouse gases.

Plant construction began in 2003. A year later a project design document (PDD) was prepared with the aim to successfully register the project as a CDM project and to obtain emission certificates (CER's) for the project. Biogas and the City of São Paulo agreed that 50% of all certificates should be transferred to the municipality of São Paulo for further use. This is an achievement for the City of São Paulo—in most public-private CDM projects the public partner receives 15-20% of the CER's. Biogas was primarily responsible in assuring compliance with CDM regulations on behalf of the project.

Landfill renovations have been implemented in São Joao and Bandeirantes landfills. These two projects represent approximately 5% of the total carbon credits obtained in Brazil and nearly 48% of the waste-management carbon credits worldwide.

How does it work?

By capturing and burning methane gas, the landfills generate the equivalent to 7% of the electricity consumed in the city. This previously unused methane generates more than 175,000 MW/year in each power plant, enough to supply a population of 700,000 for 10 years (it is enough to supply this population during the gas capture period, which varies from 10 to 20 years).

100% of the energy and 50% of the carbon credits produced by the landfills belong to the private companies to be traded in the private sector, while the City of São Paulo has the right to sell the other half of carbon credits in public auctions. UNIBANCO S.A., the financing bank, uses the generated energy to power their own buildings and UNIBANCO also sells the remaining energy to private entities via a regular distribution system.

São João Landfill

- Location: Sapopemba Road km 33, Sao Mateus
- Year of use: 1992 to 2009
- Area: 80 hectares / Maximum height of garbage storage: 150 m
- Amount of waste storage: 26 million tons
- Project concept: cells of compacted waste 5m thick, sealed with layers of 0.5m of clay

Degassing and cleaning system:

- Collection capacity: 20,000 Nm³/h of biochemical gas (50% of methane).
- Pipelines extension: 30 km of PEAD pipes with the diameters of 110 mm to 300 mm

Contractors: Central Termelétrica and LT

- Generation: 16 CAT motors mod. G 3520, with nominal unit power of 1.54 MW each.
- Annual capacity: 200,000 MW
- Transmission lines: 27 km until ETD Eletropaulo in Nações Unidas Road, in 34.5 kV
- Gas consumption for generation: 12.000 Nm³/h (the capacity of energy generation represents 60% of the landfill's collection capacity)
- S E São João, capacity 25 MVA of 4,16/34,5KV
- ETD Nações Unidas Road - capacity 25 MVA of 34.5kV/88kV

Banderirantes Landfill

- Location: Bandeirantes Road km 26, in Perus
- Years of use: 28 years, from 1979 to 2007 (currently used only for methane capture)
- Area: 150 hectares / Maximum height: 100 m
- Amount of waste storage: 5 million tons

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- Project Concept: cells of compacted waste 5m thick, sealed with layers of 0.5m of clay

Degassing and cleaning system:

- Pipelines extension: 35 km; PEAD with diameters of 110 mm to 300 mm.
- Wells connected: 250
- System collection capacity: 18,000 Nm³/h
- Flaring capacity: 5,000 m³/h

Contractor: Central Térmica Biogás, SPE (UNIBANCO)

- Generated energy: 170,000 MW/year
- Gas consumption for generation: 13,000 Nm³/h (the capacity of energy generation represents 72.22% of the landfill's collection capacity)

COST

Costs to install a Thermoelectric Power Plant Project

The cost of the facility is based on the capacity of the plant to be installed and the size of the transmission lines. It has been calculated that for each Mega-Watt/hour of energy generation capacity of a power plant, an investment of US\$ 1.5 million is necessary.

Revenue from the project

The energy produced in power plants is sold by Biogas Co. at regular market price to local consumers.

RESULTS AND EVALUATION

Environmental Impact

Since 2005 São Paulo has reduced its emissions by 20% as a result of the renovation of these landfills. Waste disposal, previously 25% of the city's emissions, is now only 5% of the total emissions.

Certified Carbon Credit Auction in São Paulo

The decision to auction credits generated from the project led to the first city-sponsored carbon credit auction. Holding a global carbon credit auction provides more transparency for the transaction than selling the credits in private markets. To date the city has received a total of €26 million from these auctions.

In September 2007, the City of São Paulo held, through the Securities, Commodities and Futures Exchange (BM&F), the first auction. On this occasion, R\$ 34 million were collected to public accounts, from the offering 808.450 credits accumulated from the Bandeirantes Landfill between December 2003 and December 2006. The minimum stipulated price set by City Hall was of €12,70 per credit, and the winning enterprise (*Fortis Bank NV/SA*, from the Netherlands) paid €16,20 per credit.

A second auction, held in September 25th of 2008, offered 713 thousand carbon credits (454.343 coming from the Bandeirantes Landfill, representing the capture of the period between January 1st 2007 and March 31st 2008 and 258.657 from the São Joao Landfill, captured between May 22nd 2007 and 31st March 2008). This auction collected R\$ 37 million and the winner was the Suisse enterprise *Mercuria Energy Trading*, paying €19,20 per credit. Another auction is scheduled to be held in March 2010, in the hopes that carbon credit prices will rise following the COP15 summit in December 2009. (The hold to the next auction is also due to the international financial crisis, which has impacted carbon certificate prices)

Social impacts of the Project

The city's share of the project's revenue is directed to social policies that support the socioeconomic development of regions surrounding the Bandeirantes Landfill. An important social investment area is the region of Perus, which received R\$ 58 million from the two auctions. This money is used to implement the following development projects, including:

- "Programa de Praças"

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- “Plano de Bairro”
- “Banco Esportivo Cultural”
- “Urbanização de Favelas”

Revitalized Public Space

On February 21, of 2009, two public squares, Cuitegi and Mogeiro, in the borough of Perus, surrounding Bandeirantes landfill, were inaugurated by Mayor Gilberto Kassab. The Cuitegi Square has 2,300m² of leisure space, playgrounds, benches, and the Sao Paulo City Hall preserved fruit trees planted by local dwellers. Also, the area connected two streets that were previously separated, facilitating mobility within the local community. The Mogeiro Square has 6,897m² of leisure space and offers a walking path, gym station, playground, benches and a community space. Perus Linear Park is currently under construction.

TIMELINE

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|------|---|
| 2003 | Construction begins on the Bandeirantes landfill and power plant |
| 2004 | Biogas submitted a project design document (PDD) to the UNFCCC to apply for certified emissions reduction; the Bandeirantes landfill gas capture is operational |
| 2007 | First CER auction is held, generating R\$ 34 |
| 2008 | Second CER auction is held, generating R\$ 37
A power plant was installed in Sao Joao landfill |
| 2009 | Cuitegi and Mogeiro Squares are opened to the public. |
| 2010 | Third CER auction will be held in March
Municipal Fund has begun to build affordable housing for residents living near the landfills |

LEGISLATION

Sao Paulo's Municipal Act on Climate Change, approved in June 2009, foresees a reduction of 30% of GHG emissions until 2012, over the baseline announced in 2005. It also foresees the replacement of municipal buses in order to have the entire public bus fleet running on renewable fuels until 2018, among other targets and addresses key topics for the city, creating the necessary mechanisms and incentives for the promotion of sustainable policies.

LESSONS LEARNED

While the landfill emissions project was a successful public-private partnership, the city is hopeful that they will have more autonomy in subsequent CDM projects. CDM funding was critical and the city will have more direct access this important funding and revenue system in the future.

TRANSFERABILITY

A similar renovation of landfills to reduce greenhouse gasses has been implemented in Jakarta at the the Sumur Batu landfill in Bekasi. In this case, a flaring facility, built by clean-air engineers PT Gikoko, collects the methane gas generated during the decomposition process in the landfill and then flares it, effectively reducing the greenhouse gases emitted. Under the agreement for Bekasi, the World Bank as trustee for the Netherlands Clean Development Mechanism Facility, will purchase 250,000 tons of CO₂-equivalent of Certified Emissions Reductions (CER) up to the end of 2012.

A cost-benefit analysis has shown that Jakarta's landfill emissions-reduction and energy generation system would be economically viable for cities of over 500,000 residents.



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This report is based on an exhibition from the 2009 Copenhagen Climate Summit for Mayors Future Cities Exhibition. Innovative initiatives demonstrating how cities around the world are combating climate change were on display. For more information, visit www.climatesummitformayors.dk.