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Waste-to-Energy & Renewables

Consistent with environmental policy and increased demand for electricity in Mexico, the Mexican Secretariat of Energy (SENER) encourages the usage of renewable energies in power generation. In 1995, SENER created the National Energy Savings Commission (CONAE)[1] in an effort to promote the development and implementation of these resources.

Forecast of Renewable Energies: 2003-2009

Sources of Energy	03 MW	04 MW	05 MW	06 MW	07 MW	08 MW	09 MW
Biomass -Sugar Cane Bagasse & Fire Wood	181	192	204	216	229	243	257
Small-Scale Hydro (Water)	162	171	182	192	204	216	229
Solar- Photovoltaic (PV)	16	17	18	19	21	22	23
Landfill Gas	11	12	13	14	15	15	16
Wind	125	132	140	149	158	167	177
TOTAL	**495**	**524**	**557**	**590**	**627**	**663**	**702**

Source: Prospectiva 2000-2009, SENER

Waste-to-Energy and Biomass

One area that has shown signs that it will develop faster than expected is the landfill gas and biomass segment. Biomass residues and animal slurries-based technologies have the following sources: forest production, dry matter, cereals as starch, sugar cane crops, and solid wastes, including (sewage, food waste), bagasse, manures, wood residues, straw, and others. Energy produced from these sources includes thermal energy, electric power, methane, and ethanol as a primary fuel or as a chemical additive mixed with gasoline (gasohol).

The best prospect to develop biomass energy is with solid wastes and sewerage gases (wastewater treatment sludge), and incineration. Because of the political and economic problems associated with traditional municipal waste management (including sludge) in Mexico, the market will provide biomass companies zero or negative cost access to these raw materials. Biomass opportunities also exist for industrial waste incineration or processing.

Currently, metropolitan Monterrey's waste management authority, SIMEPRODESO, is the only municipal waste utility generating electricity from biomass—a project recently completed with

[1] *Comisión Nacional de Ahorro de Energía*

World Bank funds. Other municipalities, such as Mexico City, Tlanepantla, Cancun, Naucalpan, Puebla, Queretaro, Aguascalientes, Guadalajara and Tijuana, are currently studying the possibility, and therefore represent a potential opportunity for Canadian firms with expertise in this field.

Other Good Prospects

- Solar and wind power in cement and mining sectors
- Mini-hydro—Veracruz, Jalisco
- Wind Power—Baja California and Oaxaca
- WB and CFE solar project – 30 MW – Gerardo Hiriart
- Incineration and gasification in large urban areas with good finances and an imminent waste disposal problem: Mexico City, Tlanepantla, Queretaro, Tijauna
- Geothermal in commercial and industrial applications
- Sugar cane to bagasse to power
- Manure to energy

Aguascalientes Landfill Gas Project Profile

Landfill Gas Recovery and Use in Aguascalientes LF-1

Project Type: Landfill Gas Recovery and Electricity Generation

Project Size: 1,500 tonnes of methane reduced per year generating on average 4.1 GWh/year

Estimated annual reduction of CO_2e	29,000 – 39,000 tonnes
Estimated total reduction of CO_2e over crediting lifetime	507,700 tonnes
Estimated cost/tonne	US$3.00/tonne

(negotiable)

Project Partners
The Municipal Government of Aguascalientes is the proponent of this project with technical support to be provided by the Institute for Electrical Research (IIE).

Project Description
The Las Cumbres landfill site was opened in 1986 to handle municipal solid waste from the city of Aguascalientes, a large city in the north of Mexico. The site was closed in 1998 and contains approximately 1,500,000 tonnes of waste. Pipes are already in place to allow the methane to be safely released, but the methane has never been collected for combustion. This project proposes to collect landfill gas by connecting the existing pipes in addition to 25 new wells, and to generate electricity to be used by the municipality of Aguascalientes for street lighting. Investors are being sought to finance the plant in exchange for all credits resulting from the project.

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Technology
Landfill gas will be captured through a collection system using the existing wells, and filtered and compressed for use in an internal combustion engine connected to a 600 kW generator. The plant is expected to produce an average of 4.1 GWh/year to be used for municipal streetlighting. The project could potentially showcase Canadian technology.

Contribution to the Sustainable Development of Mexico
The collection and treatment of landfill gas will also reduce other air contaminants thus improving local air quality and reducing risks of explosion around the site. By generating electricity from an existing resource, the project will reduce consumption of fossil fuels and provide a low-cost means of providing street lighting in Aguascalientes.

Baseline Approach
The baseline for the project assumes that methane will continue to be released as it is at present with no recuperation or electricity generation, because without CDM funds, the municipality would not be able to finance the equipment for collecting and using the landfill gas. Baseline methane emissions were estimated using a methodology developed at the IIE, confirmed with USEPA software EPLUS-1 software and validated with site measurements taken by the IIE in spring of 2001. The annual emission rate in 2002 is approximately 1964 tonnes of methane an amount that will decrease slightly each year. The baseline also includes the emissions from grid electricity that will be displaced through the project. (Note that a baseline methodology for electricity projects is currently being developed in Mexico by a coalition of partners , led by ATPAE, a Mexican NGO. This baseline work should lower the overhead costs of CDM projects).

Project Emissions
Approximately 15% of methane will continue to be released as only 85% will be captured. This amounts to an average of 300 tonnes of methane per year or 6200 tonnes of CO_2e. The CO2 emissions produced after the methane is burned will also be taken into account.

Leakage
None anticipated.

Calculation of Estimated Reduction of CO2e
Emissions reductions calculated using the EPLUS-1 software as follows:

	CH4 Reduction	**CO_2 Equivalent**	**CO_2 Avoided by Elec. Prod.***
	tonnes/year	tonnes/year	tonnes/yr
2002	1760	37,020	1,763
2003	1730	36,290	1,728
2004	1690	35,570	1,694
2005	1660	34,870	1,660
2006	1630	34,180	1,627
2007	1600	33,500	1,595
2008	1560	32,840	1,563

2009	1530	32,190	1,532
2010	1.50	31,550	1,502
2011	1470	30,930	1,472
2012	1440	30,310	1,443
2013	1410	29.710	1,415
2014	1390	29,120	1,387
2015	1360	28,550	1,359
2016	1330	27,980	1,332
TOTALS	23,060	484,610	23,072

*calculated using a coefficient of 379 tonnes/GWh, the difference between CO_2 produced from coal-based electricity and that produced from methane combustion.

Monitoring Plan
Instrumentation at the plant will track the quantity of methane recuperated as well as the electricity generated.

Investment (current and sought)
A total investment of US$1,180,651 is being sought for the project in exchange for carbon credits (any additional return to be negotiated with the municipality). In an economic analysis of the plant carried out without taking into consideration any income from the sale of emissions reductions, but including the price of electricity at an average of $0.1042 kWh, an internal rate of return of 23% was calculated for the project.

Local Support and Viability
The local government authorities of Aguascalientes are strongly supportive of the project as it will bring them a new source of electricity for local street lighting. According to the IIE the administration of Aguascaliente is one of the most competent and best organized in Mexico. IIE has carried out studies of six landfill sites in Mexico, and has selected the Aguascalientes site as its first priority.

Potential for Project Replication
Mexico has approximately 120 landfill sites with the potential for capturing methane emissions and generating electricity. A second landfill site in Aguascalientes could also be exploited for electricity generation.

Assessment of Project Risk
The project will be the first of its type in Mexico, so there is a slight risk of adapting the technology to local conditions. However, similar plants have been installed and are in operation at many landfill sites in North America.

Project Status
The municipality is prepared to begin the project as soon as funds are available.

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Other Renewable Power Generation Opportunities

The best renewable energy power generation opportunities are private projects developed in rural, off-the-grid communities. More than 5 million Mexicans in 88,000 rural populations are not connected to the national distribution network and therefore lack access to reliable supply, and in some cases, supply period.[2]

In Mexico, 6% of electric power generated is the product of renewable energies. Renewable energies are also used in Mexico as a primary source for thermal energy needs such as food preparation and water heating. It is estimated that by 2010 this percentage will reach at least 10% in Mexico.[3] Renewable energies come from, among others, the following sources:

- Solar
- Wind
- Biomass
- Small scale hydraulic
- Geothermal

Industrial Opportunities

- Mexicana de Aviación and Mexico City Airport—collection, treatment and recycling of used oils
- Cement producers: CEMEX and Apasco, waste to energy and renewables opportunities including:
  - Used oils

[2] www.solar.nmsu.edu
[3] Source: CONAE

- Drilling sludge from the oil and gas industry (emerging opportunity with good potential for growth);
- Used tires (growing market; Apasco has its own tire shredder, but requires collection and transportation services (but in most cases unwilling to pay for it);
- Garbage pellets (will only work if sponsored by the city government).
- CEMEX interested in developing wind power and solar power solutions, particularly in rural, off-the-grid locations.

- Grupo Penoles, interested in:
  - Acquiring technology to recycle and reuse metallurgical waste, including on-site remediation/reclamation of metal scrap and tailings, which later may be sold to the cement and construction industry.
  - Purchasing recycled computer chips and PC cards to use them in the company's input processes.
  - Developing solar, wind, photovoltaic, and tidal energy to power its facilities across the country, especially in its facilities of the main power grid (currently, the company uses some wind power in its Torreon, Coahuila facility).

- Grupo Herdez—alternative waste treatment methods (including waste to energy) for
  - large quantities of pineapple rinds, mango peels and pepper seeds.
  - used oils, used batteries, used reactive and chemical substances, and used solvents and bases

- Grupo Modelo—an important producer of yeast bagasse, is looking for treatment technology that will enable them to sell the product in the waste-to-fuel market.

- Guanajuato Ecology Institute—Interested in converting steer manure into BioOil

- Mexico Sugar Industry Chamber—Interested in exploring waste to energy opportunities

- Grupo Posada Hotels—interested in learning about viable solar and wind power technologies.