Landfills

Landfills produce methane when organic matter in the landfill decays under anaerobic conditions. Landfill gas (LFG) is composed of about 50 percent methane and, when captured, can be a source of clean energy. It can also be used as a substitute for fossil fuel in industrial boilers or to generate electricity, or it can be refined and injected into the natural gas pipeline or used as vehicle fuel. Capturing and using LFG in these ways can yield substantial energy, economic, environmental, air quality, and public health benefits.

In 2010, global methane emissions from landfills were estimated to be 799 $MMTCO_2E$, which is approximately 11 percent of total anthropogenic methane emissions.[18] Over the next decade, landfill methane emissions are estimated to reach more than 855 $MMTCO_2E$.[19]

The United States has been a leader in the recovery and use of LFG and spent more than $1.3 million in 2010 to expand the productive use of LFG through GMI. Specific workshops and projects to capture and reuse methane from LFG are described below.

855 $MMTCO_2E$

estimated landfill methane emissions by 2020

[18] U.S. EPA, 2011.

[19] Idem.

LFG workshop in Santiago, Chile.

Delivering Information and Training via Workshops

In the past year, nearly 1,000 individuals have attended workshops on LFG recovery and use in 10 Partner Countries, including Argentina, Brazil, China, Colombia, Mexico, the Philippines, Poland, Russia, Serbia, and Ukraine.

The landfill team at EPA consistently works with its partners to develop training materials to build capacity in the waste sector. EPA has developed three core curricula to advance LFG energy: landfill operations and management, LFG collection system operations, and LFG energy project procurement. These trainings are targeted directly at landfill operators or municipalities with prospective projects and have served to improve the overall conditions at landfills in addition to advancing LFG energy.

Philippines Training for Site Assessment and Potential Emission Reductions

In June 2010, EPA staff facilitated a training session in conjunction with Landbank in Manila, Philippines, to build capacity for local officials on identifying project opportunities, as well as assessing LFG energy systems. The workshop provided guidance on assessing site characteristics, infrastructure, and operational practices to determine the potential for emission reductions. Representatives from Landbank's carbon finance unit, as well as several local landfill owners, attended the training.

International Solid Waste Association (ISWA) Organizes Forums Around the Globe

In June 2010, the ISWA Beacon Conference in Buenos Aires, Argentina, invited landfill owners and managers, government officials, project developers, and project financiers to a workshop covering the basics of LFG projects. Titled "Creating Viable LFG-to-Energy Projects in Latin America," the workshop provided an overview of the landfill sector, explained LFG energy systems, and reviewed the basics of project planning. Speakers shared strategies on how to bring a landfill online, as well as insights into project design and financing. Representatives from Partner Countries presented specific opportunities and project models for LFG capture and use in Latin America and also discussed financing and incentive programs.

In December 2010, ISWA held a conference in Novi Sad, Serbia, with representatives from Bulgaria, Poland, Serbia, and Ukraine in attendance. The one-day conference included an overview of gas collection and control systems, business models for LFG energy projects in southeastern Europe, and opportunities and barriers to developing such projects in the region. Speakers presented case studies of regional projects, including LFG energy projects in Poland.

Advancing LFG Data Collection and Analysis

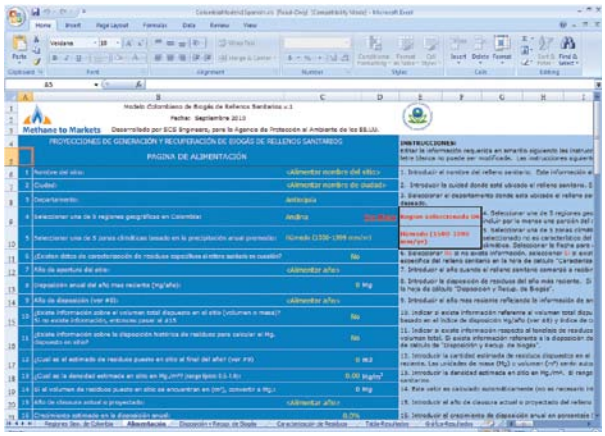
Nigerian Landfills Inventory

With support from EPA, Rutgers University received funding to develop an inventory of landfills in Nigeria. The 2009 grant built on a previous GMI grant that funded preliminary site visits

and assessments at landfills in two Nigerian cities: Lagos and Abuja. To complete a national landfill inventory, data collection targeted landfills in six other major population centers in Nigeria. The first phase of research entailed meeting with waste management authorities and landfill managers in Akure, Jos, Kano, Kaduna, Zaria, and Port Harcourt to explain the project and distribute a survey designed to collect information for GMI's International Landfill Database. After data collection, preliminary site assessments were conducted at 26 dumpsites, and results were shared with local officials. The next phase will require project leaders to explore partnerships with private companies to begin improving disposal sites and recovering LFG.

EPA's LFG Models Assist Project Development

EPA developed a new LFG model for Colombia, that can be used to estimate LFG generation rates from landfills and potential LFG recovery rates for landfills that have—or plan to have—gas collection and control systems. In September 2010, EPA held a workshop in Medellin, Colombia, to train people to use the new model. Approximately 60 individuals participated in the event, including representatives from federal, state, and local governments; employees from waste management companies; consultants; developers; and students.


Colombia's LFG Model.

LFG models were also developed for the Philippines, Ukraine, and Thailand; these models were completed and circulated in 2010 to help stakeholders estimate LFG generation and recovery potential in each country. The models provide recommended values for input variables based on climate data, waste characteristics, and disposal practices, and the estimated effect of these conditions on the amounts and rates of LFG generation. Each model has a companion user's manual for reference.

Collecting LFG for On- and Off-Site Uses

The Closed Mariupol Landfill is located in the city of Mariupol, Ukraine, and is owned by the Mariupol City State Administration. The landfill is located in a mixed-use area with residential, agricultural, commercial, and industrial uses. Until its closure in 2008, the landfill accepted domestic and commercial waste from the city of Mariupol. During its active phase, certain landfill management practices led to significant leachate production, stormwater runoff, and unintended fires.

In August and September 2008, EPA conducted pump tests at this landfill, which yielded a LFG recovery rate capable of supporting a flare and/or electricity project. In February 2009, the Mariupol City Council awarded the LFG capture and utilization project at two of the city's landfills to TIS Eco Company. GMI Project Network members TIS Eco Company, in partnership with Scientific Engineering Center (SEC) Biomass, began construction activities at the first landfill in June 2009. The system was commissioned in February 2010. In August 2010, the National Environmental Investment Agency issued a Letter of Approval to the "Collection and

recycling of methane from solid waste landfills, Mariupol, Ukraine" for a Joint Implementation project.

The collected LFG is being directed to a cogeneration plant, where up to 1.25 MW of electricity is expected to be generated and supplied to a distribution network. Some of the electricity produced will also offset the needs of the LFG collection and distribution system. Heat energy generated at the plant will provide an alternative energy source for a nearby greenhouse and brick manufacturing facility using an infrared heater or a kiln. Surplus LFG will be flared. The LFG collection system and cogeneration plant are expected to function for up to 15 years.

Generating Electricity at Gaoantun Landfill

Gaoantun Landfill is a sanitary landfill owned and operated by the Beijing Chaoyang District Garbage Innocent Disposal Center. In 2007, EPA conducted a pump test and produced a prefeasibility study on the potential to expand LFG utilization at this site. In 2010, EPA provided follow-up technical assistance and monitoring of the gas collection system to identify how the site could improve gas collection efficiency. As of August 2010, the gas collection system consisted of 150 gas extraction wells that were converted from passive vents. The owners then installed a 500-kilowatt (kW) reciprocating engine to generate electricity for the onsite leachate treatment plant in 2007; a second 500-kW engine was installed in 2008. Two new engines came online in January 2011, bringing the total electric-generating capacity to 2.5 MW.

The site plans to increase the power-generating capacity to 4 MW, and although current gas collection efficiencies are low, if the system can improve design and operation of the wells and gas header systems, a higher collection efficiency can be achieved, enabling the site to achieve its planned expansion to a 4-MW power plant.

When fully implemented, the project is expected to reduce GHG emissions by 306,000 TCO_2E from electricity generation and 213,000 TCO_2E through direct use. Additional environmental benefits include mitigated odors and reduced LFG migration in surrounding neighborhoods, as well as offsets from avoided fossil fuel. Social benefits from the project include revenues from the sale of unused electricity to the local power grid or the sale of certified emission reductions, as well as thermal energy for industrial or agricultural use. Two boilers have been installed to burn LFG to supply heat to the landfill staff canteen and the washing room.

China's Gaoantun Landfill