



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, it can also be a source of clean energy. LFG can be used to generate electricity, used as a substitute for direct fossil fuel consumption, or refined and injected into the natural gas pipeline. Capturing and using LFG in these ways can yield substantial energy, economic, environmental, air quality, and public health benefits.

In 2005, global methane emissions from landfills were estimated to be nearly 750 MMTCO₂E. The United States has been a leader in recovery of LFG and, in this reporting year, has spent more than \$2.4 million to expand the productive use of LFG through Methane to Markets. Highlights of these efforts are summarized below.

Co-Hosting the Ecuador LFG Project Expo

In collaboration with the Ecuadorian Ministry of Environment, EPA organized and co-hosted a project expo, “Exploring Opportunities for Landfill Biogas in Latin America,” in Guayaquil, Ecuador. More than 40 developers, investors, and technology providers joined with representatives from 13 municipalities to participate in the workshop and learn about the results of landfill assessments and pre-feasibility studies conducted by EPA at 14 landfills in Argentina, Colombia, Ecuador, and Mexico. If all of these projects were implemented, they would result in annual methane emission reductions of 1.5 MMTCO₂E over the projects’ lifetimes. After the

Expo, EPA continued to provide technical assistance to several of these landfills to advance project development.

Providing Operations and Maintenance Landfill Operator Training in Ukraine

EPA piloted the first operations and maintenance (O&M) training course for landfill operators in Ukraine. Qualified landfill operators from the United States delivered the training at Kiev and Rivne landfills, with 20 landfill managers, operators, city officials, and other personnel in attendance. The training presented best practices in landfill O&M and site conditions to enhance the prospects for landfill gas recovery, including working face management (including landfilling methods and compaction), equipment and well-field maintenance, LFG recovery, and health and safety. EPA plans to deliver this course in other Methane to Markets Partner Countries.

Building Capacity Through LFG Energy Workshops in Brazil, China, and Colombia

In conjunction with a seminar sponsored by Colombia’s National Association of Public Services Companies entitled “Climate Change and Its Impact on Public Services,” EPA conducted a training workshop for Colombian solid waste officials on LFG energy.

Approximately 40 participants attended the workshop, including landfill and solid waste officials representing several municipalities. The workshop covered the basics of LFG capture, estimating gas recovery potential, and energy utilization technologies.



Attendees of EPA-CETESB workshop touring Bandeirantes Landfill Gas Project in São Paulo.

In Brazil, EPA co-organized a similar workshop with the São Paulo State Environment Sanitation Agency (CETESB). More than 125 participants from government, the non-profit sector, and universities attended, including representatives from municipal landfills. The seminar included basic information on LFG utilization, monitoring methane emissions from landfills, and the status of LFG projects in the United States.

In Shenzhen and Beijing, China, EPA assisted with two LFG energy workshops on Methane to Markets and the basics of landfills, beneficial use, the solid waste market in China, and carbon finance for projects. Attendees represented the solid waste, engineering, and academic sectors as well as project developers.



Gaoyan Landfill in Guiyang City, China: site of a U.S.-funded assessment report that was displayed at the Partnership Expo in Beijing .

Pre-Feasibility and Assessment Studies in Brazil, India, and Korea

Pre-feasibility and assessment studies estimate LFG availability, evaluate a range of energy recovery technologies, and make a preliminary assessment of a LFG energy project's economic feasibility. These studies accelerate project implementation by outlining important project data for developers and investors.

- EPA completed assessment studies for 11 landfills in Brazil. Next, EPA will attend and coordinate stakeholder meetings at three to four of the landfills with the most project potential. At these meetings, EPA will report its findings and engage potential end-users of the gas, local government officials, financiers, and other project stakeholders in the project opportunities.
- After receiving a grant from EPA, the Korean District Heating Corporation conducted pre-feasibility studies for three Korean landfills. The studies recommended the installation of reciprocating engines ranging from 0.6 to 2 MW of electric generating capacity at each of the three landfills. The studies also recommended that developers discuss green power premium pricing with the Korea Electric Power Company for these projects.
- EPA conducted two pre-feasibility studies for the Pirana and Pune landfills in India. These studies explored the economic viability of several project alternatives, including electricity generation, flare-only, and a pipeline to a nearby industry. The studies are intended to provide the necessary data to issue a request for proposals for a methane capture and use project at each site.

Partnering with the International Energy Agency (IEA)

EPA and the IEA developed a case study titled "Turning a Liability into an Asset: Landfill Methane Utilization Potential in India." At present, India is transitioning from open dumps to more managed landfills. The study concluded that new landfills should consider LFG management and capture efficiencies as part of the initial landfill design process. In order to launch a LFG energy industry in India, the study recommended, utilities should offer green power premium pricing for LFG-generated electricity and landfills should take advantage of existing government subsidies for LFG energy.

Refining Country-Specific Landfill Models for Mexico and Ecuador

LFG modeling plays a very important role in evaluating potential project opportunities. These models more accurately assess how local climates, waste streams, and landfilling practices in developing countries affect LFG generation. EPA continues to develop and refine country-specific models for Mexico and Ecuador in order to expand the use of LFG in these countries.

- EPA updated the LandGEM LFG model for Mexico with data collected from recent pumping trials sponsored by EPA and USAID. These data enable users to produce typical LFG generation and recovery rates for landfills located in various regions of Mexico.
- EPA created a LandGEM LFG model for Ecuador using local climate and waste stream data. EPA also calibrated the model using data from recent pumping trials at the Las Iguanas and Pichacay Landfills. The model accounts for several local landfill



Extraction well monitoring at the Uruli Devachi Landfill in Pune, India.

conditions including excess rainfall infiltration (as a result of permeable cover and capping), high leachate levels, shallow waste depths, and high percentages of food wastes. EPA also created a matrix of model inputs to account for various moisture levels across different landfills in Ecuador.

Sharing U.S. LFG Expertise with International Stakeholders

Delegates from Argentina, Brazil, Colombia, and Ecuador attended EPA's LMOP conference in Washington, D.C. These delegates attended technical sessions covering a variety of innovative LFG energy projects. Before the conference, delegates also toured the I-95 Landfill in Fairfax, Virginia. During the tour, the delegates asked questions about landfill operations and maintenance, LFG collection, and LFG energy. The I-95 Landfill uses LFG to generate electricity, fuel infrared heaters in its maintenance facility, and dehydrate sludge from the adjacent wastewater treatment plant.