6 June 2008

Methane to Markets Partnership Landfill Subcommittee

United States Profile of Solid Waste Disposal Practices
and Strategic Plan for Landfill Gas Management

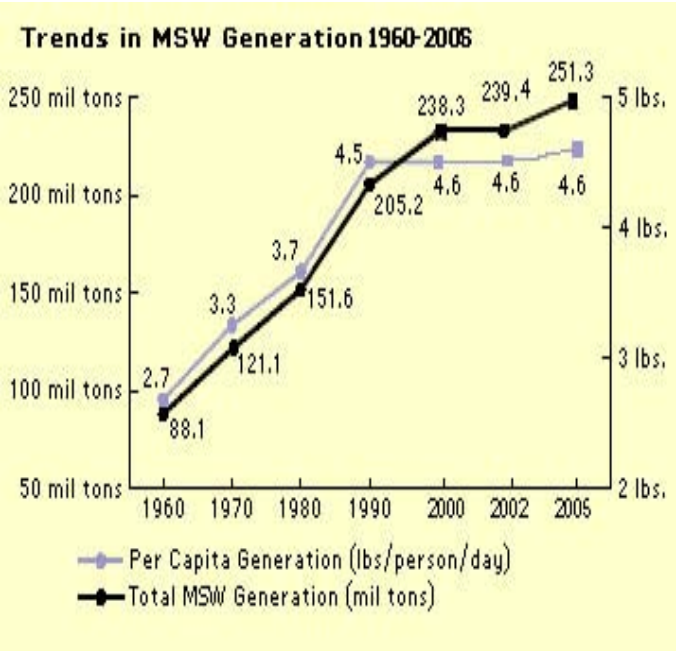
Introduction

In 2005 the landfill subcommittee had directed all Partner Countries to prepare a profile of national solid waste and landfill gas sectors. In response, eight Partner Countries submitted a profile. At its meeting on 31 October 2007, the Steering Committee decided to direct the four Subcommittees to develop country-specific strategic plans that would help to more strategically focus subcommittee activities on the experiences and needs of each individual country. The landfill subcommittee decided to update and expand the profile forms to strategically identify and rank country-specific barriers or offers of support.

The United States (U.S.) Profile of Solid Waste Disposal Practices and Strategic Plan for Landfill Gas Management outlines the current statistics, policies, technologies, and stakeholders that impact the U.S. landfill gas market. The document also provides an overview of U.S. involvement in international landfill gas activities under the Methane to Markets Partnership. It also outlines a strategy for future U.S. contributions to the landfill subcommittee and the international landfill gas community.

1. Summary of the Solid Waste Management Sector

In 2006, U.S. residents, businesses, and institutions produced more than 251 million tons of municipal solid waste (MSW), which is approximately 4.6 pounds of waste per person per day.



In the United States (U.S.), federal, state, Indian tribal, and local governments have adopted an integrated approach to waste management. This approach involves a hierarchy of waste management methods: decreasing the amount and/or toxicity of waste that must be disposed of by producing less waste to begin with (source reduction/reuse); increasing recycling of materials such as paper, glass, steel, plastics, and aluminum, thus recovering these materials rather than discarding them; and providing safer disposal capacity by improving the design and management of incinerators and landfills.

Currently, in the U.S., 32.5 percent of municipal solid waste is recovered and recycled or composted, 12.5 percent is burned at combustion facilities, and the remaining 55 percent is disposed of in landfills.

Although source reduction, reuse, recycling, and composting can divert large portions of MSW from disposal, some waste still must be placed in landfills. Modern landfills are well-engineered facilities that are located, designed, operated, monitored, closed, cared for after closure, cleaned up when necessary, and financed to insure compliance with federal regulations. The federal regulations were established to protect human health and the environment. In addition, these new landfills can collect potentially harmful landfill gas emissions and convert the gas into energy.

Over the past few years there has been increasing interest in demonstrating and potentially put into practice the wet landfill or bioreactor landfill. A bioreactor landfill operates to rapidly transform and degrade organic waste. The increase in waste degradation and stabilization is accomplished through the addition of liquid and air to
enhance microbial processes. This bioreactor concept differs from the traditional “dry tomb” municipal landfill approach.

The bioreactor accelerates the decomposition and stabilization of waste. At a minimum, leachate is injected into the bioreactor to stimulate the natural biodegradation process. Bioreactors often need other liquids such as storm water, wastewater, and wastewater treatment plant sludges to supplement leachate to enhance the microbiological process by purposeful control of the moisture content and differs from a landfill that simple recirculates leachate for liquids management. Landfills that simply recirculate leachate may not necessarily operate as optimized bioreactors.

Potential advantages of bioreactors include:

- Decomposition and biological stabilization in years vs. decades in “dry tombs”;
- Lower waste toxicity and mobility due to both aerobic and anaerobic conditions;
- Reduced leachate disposal costs;
- A 15 to 30 percent gain in landfill space due to an increase in density of waste mass;
- Significant increased LFG generation that, when captured, can be used for energy use onsite or sold; and
- Reduced post-closure care.

Currently, there are no full scale commercial bioreactor landfills in operation in the U.S. However, bioreactor landfills are in operation in a number of states for research and demonstration purposes.

2. Key Stakeholders In The Solid Waste Disposal Sector And LFG Industry

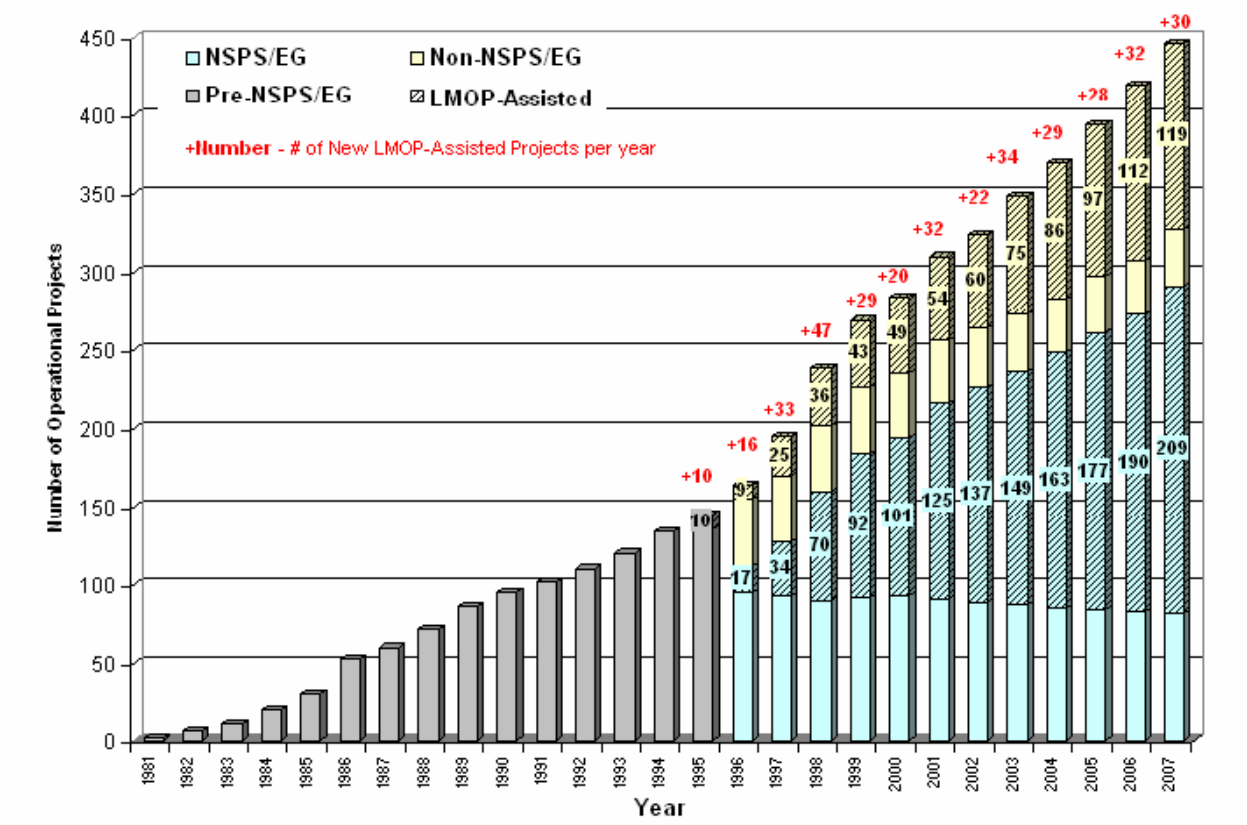
Federal Government

U.S. Environmental Protection Agency (EPA) Office of Solid Waste and Emergency Response, Office of Air Quality Planning & Standards, Office of Research and Development, Office of Enforcement and Compliance, and Office of Air and Radiation are primarily charged with solid waste and air emissions programs. These offices and programs address promulgation of rules and regulations, research, and enforcement and compliance aspects related to the municipal solid waste management sector.

One of EPA's successful voluntary programs aimed at addressing methane emissions from landfills is the Landfill Methane Outreach Program (LMOP). Established by EPA in 1994, LMOP promotes the use of LFG as a renewable energy source. By preventing emissions of methane - a powerful greenhouse gas - through the development of LFG energy projects, LMOP helps businesses, states, and communities protect the environment and build a sustainable future. LMOP works with landfill owners/operators, industry organizations, energy providers and marketers, state agencies, communities, end-users, and other stakeholders to help them overcome barriers to LFG energy development.

- From 1994 until December 31, 2007 LMOP has assisted in the development of over 360 LFG energy projects. As of December 31, 2007, LFG energy projects with LMOP involvement have cumulatively prevented more than 106.3 (132.7 when including flaring-only) million metric tons of carbon dioxide equivalent from direct and avoided emissions reductions into the atmosphere.
- LMOP has more than 700 Partners that have signed voluntary agreements to work with EPA to develop cost-effective LFG energy projects.
- The collective results of EPA's voluntary methane partnership programs have been substantial. Total U.S. methane emissions in 2006, were 8.4% below 1990 levels in spite of significant economic growth over that time period. Methane emissions from landfills in 2006 were 16 percent below 1990 levels. EPA expects that these programs will maintain emissions below 1990 levels in the future due to expanded industry participation and the continuing commitment of the participating companies to identify and implement cost-effective technologies and practices.

The chart below illustrates that growth of landfill gas (LFG) utilization projects has more than tripled since LMOP's inception. The chart also demonstrates the number of LFG utilization projects effected by the NSPS/EG rules.



State and Local Governments

Rules and regulations, permits, renewable incentive programs, and policies for LFG projects and gas

collection systems vary greatly from state to state and jurisdiction to jurisdiction. State regulations must usually be as stringent as applicable Federal regulations.

Non-Governmental Organizations (NGOs)

The primary NGOs representing the solid waste industry are the Solid Waste Association of North America (SWANA) and the National Solid Waste Management Association (NSWMA). Both of these organizations represent public and private sector solid waste professionals and whose goals is to provide their members with educational and training opportunities, research, dissemination of information about solid waste management, and advocacy capability.

Public and Private Landfill Owners

Landfills in the U.S. are owned by a combination of public (e.g., municipalities, counties, state environmental authorities), and private entities. As of March 2008, 45 percent of landfills with operational
LFG energy project(s) are publicly owned and the remaining landfills with LFG energy projects are privately owned. Landfill owners may choose to self-develop an LFG project, where the landfill owner directly hires individual consultants and contractors to fulfill each role that the landfill personnel can not perform themselves. Alternately, owners may choose to work with a project developer to manage the LFG project.

Utilities and Electric Cooperatives

Power providers may be able to use LFG to generate electricity and meet the requirements or goals of their renewable energy portfolios. As of May 1, 2008, 30 out of the 50 U.S. states plus the District of Columbia have enacted an RPS or a renewable portfolio goal (RPG). See Section 6 of this document for more information on green power in the U.S.

Project Developers

A project developer will finance, manage construction of, obtain necessary approvals for the project, and own and operate the LFG project. In return for accepting project risks, most developers receive a relatively large share of the project profits and retain ownership and control of the project. Project developers may have significant experience with working on other LFG projects which allow them the economies of scale to reduce capital and operation and maintenance costs.

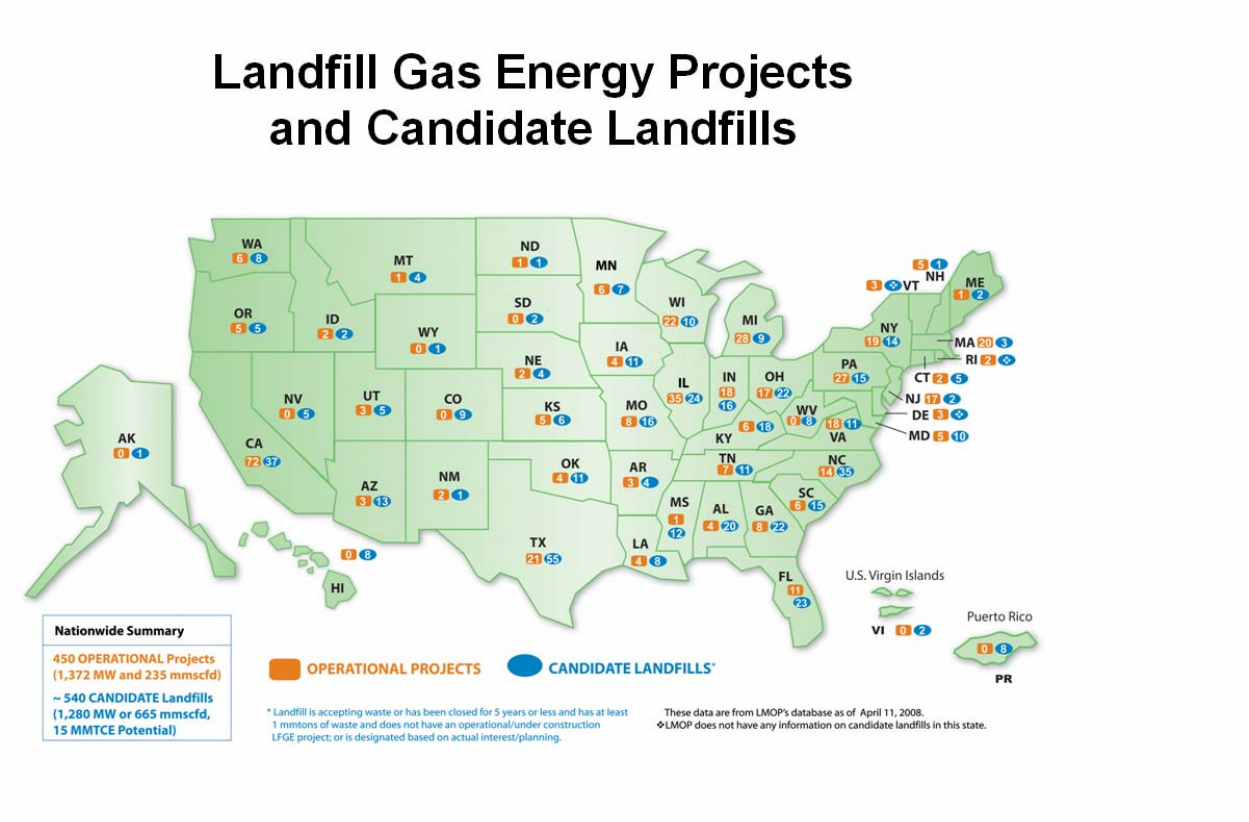
3. Overview Of LFG Potential From Existing Disposal Sites

The number of open landfills in the U.S is steadily decreasing—from 8,000 in 1988 to 1,754 in 2006. The capacity, however, has remained relatively constant. New landfills are much larger than in the past. Of these landfills, U.S. EPA estimates that approximately 540 additional landfills present attractive opportunities for project development. A majority of these sites are sanitary landfills and some of these landfills are older unlined sites that would be considered controlled landfills.

The total volume of MSW going to landfills was 138.2 million tons in 2006. The net per capita discard rate (after recycling, composting, and combustion for energy recovery) was 2.53 pounds per person per day. Organic materials continue to be the largest component of MSW. Paper and paperboard products account for 34 percent, with yard trimmings and food scraps accounting for 25 percent. Plastics comprise 12 percent; metals make up 8 percent; and rubber, leather, and textiles account for 7 percent. Wood follows at 6 percent, and glass at 5 percent. Other miscellaneous wastes made up approximately 3 percent of the MSW generated in 2006.

4. List Of Existing Or Planned Landfill Gas Capture And/Or Use Projects

As of April 2008, approximately 450 LFG energy projects were operational in the U.S. These 450 projects generate approximately 12 billion kilowatt-hours of electricity per year and deliver 235 million cubic feet per day of LFG to direct-use applications.



LFG energy projects also have a positive impact on U.S. economic growth and cost savings. A typical 3 megawatt LFG electricity project is estimated to have the following national benefits (direct, indirect, and induced) during the construction year:

- Increase the output of the U.S. economy by more than $14 million;
- Increase U.S. employee earnings by more than $3 million (e.g., wages, salaries); and
- Employ nearly 70 people (expressed in fulltime equivalents per year).

These projects bring significant cost savings and long-term energy price stability to LFG end users:

- BMW Manufacturing expects a savings at their Greer, SC plant of more than $1 million per year.
- General Motors expects savings of more than $5 million per year from their 4 current direct use LFG projects.
- SC Johnson estimates $1 million in savings per year at its plant in Racine, WI.

5. Legal and Policy Frameworks for Landfill Methane Recovery

a. Current legal framework (e.g., licensing, royalties, environmental regulations, permits)

Principal Federal Landfill Regulations

Under the Resource Conservation and Recovery Act (RCRA), enacted by Congress in 1976 and amended

in 1984, landfills that accept MSW are primarily regulated by state, tribal, and local governments. The Environmental Protection Agency (EPA), however, established Criteria for Municipal Solid Waste Landfills (40 CFR Part 258) under RCRA on October 9, 1991 that municipal solid waste landfills must meet in order to stay open. The criteria contain location restrictions, design and operating standards, groundwater monitoring requirements, corrective actions, financial assurance requirements, LFG migration control, closure requirements, and post closure requirements. Under the design standards new landfills and lateral expansions that occur on or after October 9, 1993, are required to line the bottom and sides of the landfill prior to waste deposition. In addition, all landfills operating after October 9, 1991, must place a final cap over the landfill surface. The placement of liners and caps reduces the potential for subsurface and surface LFG migration and groundwater contamination. While additional federal, state, and local landfill rules and regulations are in place, RCRA represents the primary laws covering land disposal of municipal solid waste.

Principal Federal Landfill Air Emissions Regulations

Because of the benefits of collecting and controlling LFG, the 1996 EPA Standards of Performance for New Stationary Sources (NSPS) and Guidelines for Control of Existing Sources, and the recently published National Emission Standards for Hazardous Air Pollutants (NESHAP) require "large" MSW landfills to collect LFG and combust it to reduce NMOC by 98% (or to an outlet concentration of 20 ppmv).

A "large" landfill is defined as having a design capacity of at least 2.5 million metric tons and 2.5 million cubic meters and a calculated or measured uncontrolled NMOC emission rate of at least 50 metric tons (megagrams) per year. Landfills are meeting these gas destruction standards using flares or energy recovery devices including reciprocating engines, gas turbines, and boilers. In addition to gas destruction requirements, the NSPS and NESHAP require that gas collection systems be well designed and well operated. They require gas collection from all areas of the landfill, monthly monitoring at each collection well, and monitoring of surface methane emissions to ensure that the collection system is operating properly and to reduce fugitive emissions. Smaller MSW landfills are not required to control emissions by the NSPS or NESHAP, but can still greatly reduce emissions of NMOC by collecting and combusting LFG for energy recovery or in a flare.

b. Climate change position (e.g., signatory to Kyoto Protocol, CDM/JI opportunities)

This U.S. did not ratify the Kyoto Protocol and there are currently no mandatory federal requirements to reduce greenhouse gas emissions. There are state and regional climate change initiatives including the Regional Greenhouse Gas Initiative (RGGI) and the California Global Warming Solutions Act, which set mandatory caps on greenhouse gas emissions from certain industries. In recent years, several private U.S. businesses have purchased voluntary emission reductions from a variety of sources, including LFG projects, on the voluntary markets.

c. Policies or mandates that may affect waste streams (e.g., organic waste diversion, recycling)

There are no federal mandates for recycling or organic waste diversion. Typical materials that are recycled in the U.S. include batteries, recycled at a rate of 99%, paper and paperboard at 52%, and yard trimmings at 62%. In 1996, recycling of solid waste in the U.S. prevented the release of 33 million tons of carbon into the air. The recycling rates are driven by local government policies and available infrastructure.

6. Market Assessment And Reform Issues

a. Market Assessment

There are many conventional and innovative opportunities for converting LFG to energy. Below are descriptions of some of the typical project types and emerging technologies.

Electric Generation

The generation of electricity from LFG makes up about two-thirds of the currently operational projects in the U.S. Electricity for on-site use or sale to the grid can be generated using a variety of different technologies, including internal combustion engines, turbines, and microturbines. The vast majority of projects use internal combustion (reciprocating) engines or turbines, with microturbine technology being used at smaller landfills and in niche applications.

Direct Use

Directly using LFG to offset the use of another fuel (natural gas, coal, and fuel oil) is occurring in about one-third of the currently operational projects. This direct use of LFG can be in a boiler, dryer, kiln, greenhouse, or other thermal applications. It can also be used directly to evaporate leachate. Current industries using LFG include auto manufacturing, chemical production, food processing, pharmaceutical, cement and brick manufacturing, wastewater treatment, consumer electronics and products, paper and steel production, and prisons and hospitals.

Cogeneration

Cogeneration (also known as combined heat and power or CHP) projects using LFG generate both electricity and thermal energy, usually in the form of steam or hot water. Several cogeneration projects have been installed at industrial operations, using both engines and turbines.

Alternate Fuels

Production of alternate fuels from LFG is an emerging area. LFG has been successfully delivered to the natural gas pipeline system as both a high-Btu and medium-Btu fuel. LFG has also been converted to vehicle fuel in the form of compressed natural gas (CNG) and liquefied natural gas (LNG).

b. Market Reform

There are several market reforms that have occurred over the last 30 years to promote markets for LFG projects. These reforms are listed below.

PURPA

The federal Public Utilities Regulatory Policy Act (PURPA) of 1978 was an early driver for the development of an independent power generation industry in the U.S., including the LFG industry. The Act authorized contracts between utilities and qualifying facilities for the purchase of electric power based on the concept of a utility's avoided cost of generating that power. The Energy Policy Act of 2005 amended PURPA to add federal standards for net metering (discussed below) and fuel source diversity.

Green Pricing and Green Power

Green-pricing programs have developed in many states to directly value renewable energy by allowing customer choice of the source of energy provided by utilities. Allowing customers direct access to green power suppliers provides a mechanism to pass through generation costs.

Renewable Portfolio Standard (RPS): a policy that states can use to remove market barriers to renewable power and ensure that green power continues to play a role in the competitive environment that follows restructuring of the electricity generating industry. In their simplest form, RPSs specify that a percentage

of all electricity generated must come from identified renewable energy sources, such as wind, hydro, solar, LFG, geothermal, and biomass. Some states require that a minimum percentage must come from new renewable sources, with this percentage increasing gradually over time. Under a more market-based approach, a state or group of states allow the RPS to be met with tradable renewable energy credits (RECs). Under this system, utilities and other electricity retailers earn credits for all renewable-generated power they produce and sell each year, and submit those credits to demonstrate compliance with the standard. Utilities with excess credits can sell them to others that have not met the standard.

Net Metering

Net metering is a low-cost, easily administered method to encourage customer investment in renewable energy technologies. It allows the electric meters of customers with generating facilities to turn backwards when the generators are producing energy in excess of the customers' demand. Customers are thus able to use their own generation to offset their consumption over a billing period. This offset means that customers receive retail prices for the excess electricity they generate. Without net metering, a second meter is usually installed to measure the electricity that flows back to the provider, with the provider purchasing the power at a rate much lower than the retail rate.

Carbon Credits

Some LFG projects in the U.S. currently receive financial compensation for reducing methane emissions from landfills. There are certain restrictions on project start dates and if the landfill is required by law to collect and combust LFG, then it cannot receive credit for methane reductions. Landfills can join a voluntary emissions trading program, such as the Chicago Climate Exchange (CCX). Bilateral trading and carbon credit sales are other voluntary sources of revenue. Unlike the CCX, bilateral trades are project-specific and are negotiated directly between a buyer and seller of GHG credits. In these cases, corporate entities or public institutions, such as universities, may wish to obtain a "green" image or meet internal sustainability goals, but do not have direct access to developing their own project. Therefore, a buyer may help finance a specific project in exchange for the credit of offsetting GHG emissions from their organization.

7. Financing Options

There are several financing options offered at both the state and federal levels to encourage LFG projects. The deadlines and applicability of these programs vary from year to year. U.S. EPA LMOP maintains a Web site (http://www.epa.gov/lmop/res/guide/index.htm) to track these finance opportunities.

Federal Incentives

The Energy Policy Act of 2005 was signed into law on August 8, 2005. The law includes provisions for renewed and expanded tax credits for LFG, provides bond financing, tax incentives, grants, and loan guarantees, and extends renewable energy production incentives to LFG that are placed in service prior to January 1, 2009. The credit is currently 1.0 cents/kWh for LFG projects.

The Renewable Energy Production Incentive (REPI) provides incentive payments for electricity sold by new qualifying renewable facilities, including LFG, biomass, anaerobic digestion, and fuel cells employing renewable fuels. A LFG project is eligible for REPI if it is operational by October 1, 2016. Eligible projects can receive annual incentive payments for the first ten years of the project if federal funds are available.

State Incentives

Financing options vary widely from state to state. Some states do not have financial incentives other than

those available at the federal level; whereas, some states offer several incentives. Typical funding mechanisms available for LFG energy projects include:

Grants provide direct financial support and are usually awarded by government and nonprofit agencies. Grants are often, but not always, made for research activities in a particular subject area (e.g., to develop or demonstrate a LFG energy project or technology).

The Pennsylvania Departments of Environmental Protection (DEP) and Agriculture initiated a $5 million Energy Harvest Grant Program in 2003 to improve air quality, preserve land and protect local watersheds while providing economic opportunities for the state's agricultural community. The initiative, Pennsylvania Energy Harvest, helps finance the implementation of clean and renewable-energy technologies that will have measurable benefits in terms of pollution reduction, environmental quality, and reduced energy usage rather than those that focus solely on public outreach and communication. In February 2004, Pennsylvania's governor announced plans to expand the Energy Harvest initiative by $80 million over four years.

Loans are arrangements in which a lender (e.g., a government agency or a non-profit organization) provides money to a borrower (e.g., a LFG energy project developer), and the borrower agrees to repay the money, along with interest, at some future date.

EXAMPLE: The Georgia Environmental Facilities Authority (GEFA) provides state-backed loans to cities, counties, and solid waste management authorities for water, sewer, and solid waste management projects. GEFA offers low interest loans for up to $3 million for solid waste management projects, particularly those that help minimize waste streams or mitigate environmental hazards.

Production incentives are financial payments, usually on a cents-per-kWh basis, for electricity generated by qualifying LFG energy facilities.

EXAMPLE: North Carolina GreenPower is a statewide green power program designed to encourage the use of renewable energy in North Carolina. Electricity generators are required to enter into power-purchase agreements with their utilities and with NC GreenPower. Production payments are based on the estimated payment that is needed to make the installation of renewable energy systems approach economic feasibility. Payments are made on a per-kWh basis and vary by technology.

Tax credits and exemptions reduce the tax liability of eligible parties. A tax exemption for a LFG energy project might exclude equipment and facilities used in generating energy from LFG from property taxes. Tax credits for LFG energy projects are generally offered on a specified cents-per-kWh basis.

Research and Development Resources

Research and Development funding have recently been awarded to projects that convert LFG to alternative fuels and emerging technologies such as liquefied natural gas (LNG), compressed natural gas (CNG), and fuel cells.

Examples: Delaware Research and Development Program grants are available to applicants located within the state for projects conducted in the state Subject to availability of funds, the Research and Development Program offers grants up to 35% of the cost of qualifying projects and shall not exceed $250,000 per project. U.S. Department of Energy has also offered several grants in recent years including a Small Business Innovation Research grant funded a demonstration project for a fuel cell, and a Brookhaven National Laboratory study to create LNG from LFG to fuel a solid waste fleet.

8. U.S. Strategy

Municipal solid waste landfills are the second largest source of human-related methane emissions in the U.S., accounting for nearly 23 percent of these emissions in 2006. At the same time, methane emissions from landfills represent a lost opportunity to capture and use a significant energy resource.

U.S. EPA created sector-specific programs to encourage reductions of methane emissions and energy recovery from the country's four largest sources of human-related methane emissions. The landfill sector program, known as LMOP, works with companies, utilities, and communities to encourage the use of LFG for energy. U.S. EPA has established goals for annual methane reduction from landfills that LMOP must meet.

Data Collection and Information Products

LMOP maintains a database of active LFG projects and landfills that are considered candidates for energy recovery. This data source is based on voluntarily reported information including: state solid waste reports, conversations, phone calls, and e-mails to LFG project stakeholders, news articles, and conference presentations. This database is intended to both track progress on LFG project development and identify new project opportunities.

In order to develop a successful LFG project in the U.S., many technical, institutional, and political barriers must be overcome. LMOP has authored technical fact sheets on how to configure boiler equipment to use LFG. LMOP has created a funding guide and a fact sheet of the Federal Energy Policy Act of 2005 to publicize how various funding incentives apply to LFG projects. LMOP has also created several presentations, posters, flyers, to familiarize a community with the benefits of LFG projects.

Information Sharing

The LMOP Web-site contains a wealth of data, maps, tables, downloadable documents, economic modeling tools, and other resources on LFG projects. Also on the LMOP Web site is a list of over 700 Partners that make up the majority of stakeholders in the U.S. LFG industry. LMOP allows users to search by name, company headquarter location, and area of expertise.

LMOP maintains a list-serv to distribute e-mails related to relevant conference announcements for LFG, requests for proposals for developing LFG projects and supplying utilities with renewable energy, and announcing funding opportunities, such as grants.

Targeted Information Exchange

Each year, LMOP prioritizes its areas of emphasis to balance the regions and sectors it can serve with available funding. As a result of these priorities, LMOP may select "target" states to receive site visits to landfills, meetings with state and local officials, or presentations at technical conferences in order to relay new incentives, technologies, or case study examples from recent LFG project successes.

LMOP may also target certain energy intensive industries to communicate the advantages of adopting LFG at their facilities. For example, in response to the rapidly growing biofuels market in the U.S. LMOP has targeted the biofuels industry to relay how LFG may be a viable source of local and renewable energy to "green" biodiesel and ethanol production.

Capacity Building

There is an Annual LMOP Conference and Project Expo to highlight successful LFG projects and relay information on a variety of LFG-related topics including: landfill regulations, federal energy policy, finance mechanisms, and technologies. There are several exhibitors at the event to answer questions and network with what has grown to be over 700 attendees. The project expo component of the event features

10 to 15 landfills from various regions of the U.S that are in search of developing LFG projects. LMOP will prepare an informational pamphlet for these sites that conveys information on available gas, nearby industries that may potentially use the gas, and basic landfill technical and contact information to generate interest in the project.

LMOP offers a variety of tools and services to LFG stakeholders with learning the industry and evaluating specific project opportunities. LMOP may model potential gas and energy availability at a landfill in order to match industries with similar energy demands. LMOP may also take these results and use the LFGcost model to evaluate the economic feasibility of a particular energy application (e.g., reciprocating engine, combined heat and power, or leachate evaporator). LMOP has a tool to map the distances between major industries and landfills throughout the U.S. in order to help corporations or landfills identify the distances between landfills and potential energy users or electrical substations. LMOP also answers specific public inquiries on technical topics related to LFG such as questions related to permitting requirements.

9. U.S. Support of International Landfill and LFG Sector Activities

The U.S. Government (USG) has several organizations promoting LFG recovery and use in Methane to Markets Countries. These U.S. organizations include: Agency for International Development, Environmental Protection Agency, Department of Energy, Department of State, and Trade and Development Agency, by offering a broad spectrum of outreach, education, technical and financial (e.g., grant) assistance services to countries interested in LFG project development.

Since 1998, the USG has assessed the technical and economic feasibility of LFG project development at selected landfills in a number of countries around the world. Specific countries that have been evaluated as potential hosts for LFG project development include: Argentina, Brazil, China, Colombia, Ecuador, Guatemala, India, Mexico, Philippines, Republic of Korea, Russia, Thailand and Ukraine. The objective of these feasibility assessments is to identify economical and technically feasible project development opportunities, both in the host country and for international project developers, and to promote the benefits of LFG use as a local source of renewable energy. As the studies are completed, the USG is posting them on the Methane to Markets Project Tracking Database. The USG also created posters for 36 of the landfills it evaluated to display at the 2007 Methane to Markets Partnership Expo in Beijing China and the 2008 LMOP Annual Conference and Project Expo.

As part of its efforts to evaluate the technical feasibility of LFG projects in various countries, the USG has developed LFG models with parameters specific to the climates and waste streams of various countries or regions. These models were created to improve the estimates of gas availability from landfills. To date the USG has completed models for Central America and Mexico and Ecuador. The USG is also developing models for Argentina and China. The USG also held workshops in El Salvador, Mexico, and Ecuador to teach local stakeholders how to use the models and interpret the results.

Another aspect of the USG international efforts is to assist and participate in workshops, training opportunities, and side events at major international conferences. These efforts are conducted overseas under sponsorship by EPA and other organizations. To date, the USG has held workshops in Brazil, China, Ecuador, El Salvador, Germany, India, Italy, Korea, Mexico, Poland, Russia, Thailand, Turkey, and Ukraine. International activities have also been featured during recent LMOP Annual Conference and Project Expo events.

The USG developed the International Landfill Database, as a contribution to the Landfill Technical Subcommittee of the Methane to Markets Partnership. The database serves as a Web-based, voluntary data repository to promote the development of LFG energy projects. The application is being launched for data

entry and we anticipate increasing amounts of landfill information in the upcoming months. The database can be used to identify suitable landfills for LFG energy project evaluation.

The USG has also sponsored trainings to help U.S. companies enter international LFG markets. In January 2006, there was a workshop on "How to Enter the Mexican LFG Energy Market".

10. "Wish List"

Moving forward, the U.S. is hoping to provide the following specific activities to the Methane to Markets Partnership:

- Technical assistance and feasibility assessments (with or without pump tests) to identify and quantify opportunities to reduce global methane emissions to enhance economic growth, promote energy security, improve the environment, and reduce greenhouse gases.
- Training modules for best management practices for landfill operations and maintenance.
- Continued maintenance of the International Landfill Database
- Open channels for private industries to transfer expertise from their U.S. LFG experience.
- Grant funding for technology demonstration projects, capacity building, and data collection.

11. Conclusions and Observations

The domestic solid waste and LFG sectors in the U.S. present opportunity for future investment and growth in new LFG projects, new technologies, and new finance mechanisms. Recent policy developments aimed at encouraging local and renewable energy sources and reducing emissions of greenhouse gases have encouraged smaller landfills to install LFG collection systems and energy recovery applications. LMOP estimates that there are 540 landfills that are candidates for LFG recovery. If electricity projects were generated at all of these sites, it would add an additional 1,280 MW of generating capacity and reduce emissions equivalent to 55 million metric tons of CO_2per year.

The USG has supported international LFG projects for 10 years and remains firmly committed to the Methane to Markets Partnership. USG funding for the Partnership in fiscal year (FY) 2006 was $12.9 million, bringing the total U.S. financial commitment to the Partnership since its inception in 2004 to $18.3 million. Within the landfill sector, the USG has put greater emphasis on supporting pre-feasibility studies and pump tests at potential LFG project sites, developing LFG models, and training.

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