LFG Energy: Latest Trends and Future Drivers

The use of LFG as an energy resource over the last 40 years has resulted in significant environmental and economic benefits. LFG energy will continue to be a part of an integrated solid waste management system for communities.

By Kirsten Cappel and Brent Dieleman

The landfill gas (LFG) industry is celebrating a milestone birthday this year—it has been 40 years since the first LFG energy project was established back in 1974 at the Palos Verdes Landfill in Los Angeles County, CA. Since that time, LFG energy projects have become increasingly popular with growth in the industry leading to the establishment of more than 630 operational projects in the U.S. The U.S. EPA's Landfill Methane Outreach Program (LMOP) was established in 1994 to provide technical assistance and support to landfill owners, communities and end users interested in exploring LFG as a local, reliable and renewable energy resource. LMOP's role to advance cost-effective voluntary energy recovery projects at landfills is part of the White House Climate Action Plan- Strategy to Reduce Methane Emissions (March 2014).[1]

The LFG energy industry has grown significantly over the last 40 years. Based on LMOP's database of LFG energy projects, as of July 2014, there are 636 projects operating in 48 states and Puerto Rico (see Figure 1, page 24). The widespread locations of these projects across many different regions and climates indicate that LFG is successfully used as a suitable renewable fuel under many different conditions.

These operational projects generate 1,978 megawatts (MW) of electricity and supply 305 million standard cubic feet per day (mmscfd) of LFG to industries for energy use. The environmental impact of these projects is substantial. LMOP estimates that nearly 8.0 million tons of carbon dioxide equivalent (tCO_2e) emissions are avoided each year by the power projects with another more than 2.6 million tCO_2e of emissions avoided through the direct use of LFG to industries.

Untapped landfills also exist that may supply LFG for future energy projects. Approximately 440 landfills have been identified by LMOP as "candidate" landfills with the potential to supply LFG as a renewable fuel. The potential energy output of these sites is equivalent to about 885 MW of power or 490 mmscfd of gas.

This article will discuss the current state of the LFG energy industry and highlight some of the factors impacting its growth. It will also outline future trends impacting the growth and development of the industry.

Waste Management Trends

The use of LFG as an energy resource is oftentimes part of a community's broader integrated solid waste management system. According to the U.S. EPA report, *Municipal Solid Waste Generation, Recycling and Disposal in the United States: Facts and Figures for 2012*, 135 million tons or about 53.8 percent of solid waste generated in the U.S. is disposed of in landfills. This makes disposing of waste in landfills the predominant method for managing solid waste, ensuring the continued importance of LFG energy capture and use for decades to come.

Even though landfills remain the primary disposal option for the majority of solid waste, the quantity and availability of LFG is still impacted by waste management trends. Over the last five years, there has been a continued push for greater waste diversion from landfills. In particular, communities are implementing programs to recover food scraps and other organic materials for composting and anaerobic digestion. From 2008 to 2012, U.S. EPA estimates that the amount of food scraps diverted from landfills has more than doubled—from 0.80 million tons to 1.74 million tons.

Other waste management trends have impacted the LFG energy industry. Since the implementation of the Resource Conservation and Recovery Act (RCRA) Subtitle D landfill regulations took effect in the mid-1990s, the number of operating landfills has significantly decreased. This trend has not only been

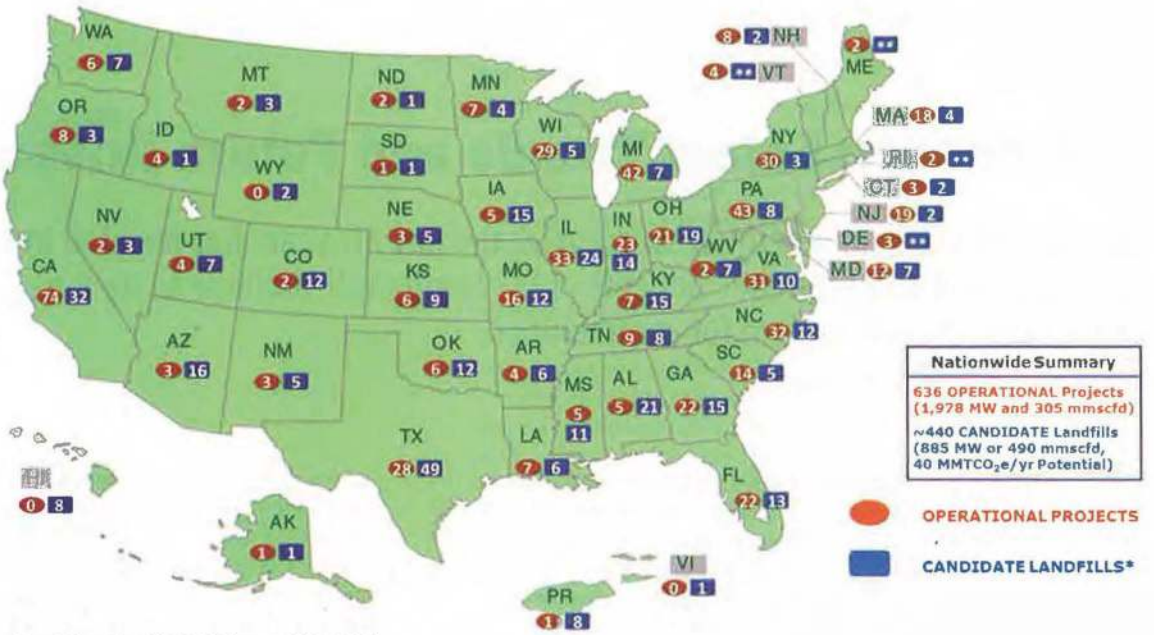

Figure 1
Operational LFG Energy Projects and Candidate Landfills by State: Candidate landfills are sites that are accepting waste or have been closed for five years or less, have at least one million tons of waste in place, and do not have an operational or under construction LFG energy project; they can also be designated based on actual interest.
Figure courtesy of www.epa.gov/lmop/index.html.

http://www.epa.gov/lmop

facilitated by tighter regulatory controls, but also by the establishment of large regional landfills, the consolidation of private waste management companies and economies of scale.

In the public sector, municipalities that desire to retain control over their own solid waste operations and disposal sites are increasingly looking to neighboring municipalities to develop larger regional solid waste management sites in order to minimize costs and risks associated with the management of a landfill. These larger landfills that usually accept waste for longer periods of time, improve the economics of capturing and using LFG as an energy resource.

Landfill Gas Energy Trends

While some trends help to facilitate the recovery and use of LFG energy, other trends make these projects more challenging. The number of projects operating in the U.S. is at an all-time high. This represents a 335 percent increase in the number of operational projects since 1995. About 75 percent of these projects use LFG to generate electricity, while the remaining 25 percent of projects use LFG in a direct-use application.

Despite continued growth, these projects have become more challenging to implement in recent years. What makes these projects successful is their ability to produce and provide an energy resource using LFG at a cost less than that of traditional fossil fuels. With the significant drop in natural gas prices from a peak of $13.06 per million British thermal unit (MMBtu) in 2008 to $5.00/MMBtu in 2013 (U.S. Energy Information Administration, www.eia.gov/naturalgas), the economic viability of LFG energy projects has become more difficult to achieve in markets where LFG offsets the use of natural gas. Corporations and industries that may have an interest in using LFG to promote sustainability are having a harder time justifying the switch to LFG as they are often sensitive to fuel prices. Overcoming this barrier often requires a significant commitment to being "green," as well as community support and creativity in order to implement a successful project.

Incentive programs have also facilitated the growth in the number of operational LFG energy projects. However, in recent years market conditions have reduced the impact of many of these programs. For example, 29 states and the District of Columbia have established renewable portfolio standards (RPS) that encourage the generation of electricity from qualified renewable resources. Producers of electricity from these resources have been able to benefit in two main ways: 1) Premium pricing for the sale of "green" energy to a utility, and 2) the sale of renewable energy credits (RECs) that are generated under many state RPS programs. However, market conditions such as the oversupply of credits have reduced REC prices and their demand.

Other incentive programs that have driven LFG energy projects, such as carbon credits and the Section 45 Production Tax Credit are also facing an uncertain future. It remains unclear how effective these incentives will be in encouraging the development of these projects in the future.

LFG Energy Project Future Drivers

Given the current conditions impacting the LFG energy industry, what is the potential for industry growth and development? Based on our understanding of trends, LMOP believes that LFG recovery and use will remain an important consideration for landfill owners and end users, and will continue to present an opportunity for communities looking to enhance their sustainability efforts.

Landfills and LFG energy projects are subject to a number of regulations that are designed to protect human health and the environment. Recently, EPA published a proposed rule that addresses LFG emissions – "Standards of Performance for Municipal Solid Waste Landfills" (79 FR 41796, July, 17, 2014), which is also known as the New Source Performance Standards (NSPS) for Municipal Solid Waste (MSW) landfills. EPA also published an Advanced Notice of Proposed Rulemaking (ANPRM) for the "Emission Guidelines and Compliance Times for Municipal Solid Waste Landfills" (79 FR 41772, July 17, 2014). The proposed NSPS rule would require new MSW landfills subject to the rule to begin controlling LFG emissions at a lower threshold than currently is required. Under the proposal, landfills would capture two-thirds of their methane and air toxics emissions by 2023—13 percent more than required under current regulations. The ANPRM seeks broad public feedback on options for further reducing LFG emissions from existing MSW landfills. The porential impacts on LFG energy projects will be assessed throughout the regulatory development process.

Project economics also will continue to drive the development of LFG energy projects. LFG energy projects either will be made more or less attractive based on changes in fuel and electricity prices. Fossil fuel price increases could foster the development of LFG energy projects. Similarly, federal or state incentive programs, such as state RPS, could also increase the viability of LFG energy projects.[2]

Many LFG energy projects in operation are successful due to strong community support. Communities that have a desire to be sustainable and use local energy resources or minimize air emissions, have been successful in implementing LFG energy projects even when the economics of the projects are not as clear-cut. Projects need to make financial sense, but for some communities, sustainability is enough of a priority to push a project forward even with some economic uncertainty.

There is evidence that the beneficial use of LFG is becoming more specialized. LMOP has observed a significant growth in the development of high-Btu LFG energy projects. Over the last 10 years, the number of high-Btu LFG energy projects has increased by about 135 percent to a total of 54 projects in 2013. This high-energy value gas is used in a number of applications, most notably for injection into natural gas pipelines and for the production of vehicle fuel. Interest in these projects continues to increase and the latest technologies have resulted in successful smaller-scale projects. Based on LMOP's data, the average size of a high-Btu project has decreased by 28 percent over the last 10 years. Also driving the development of these projects is a landfill owner's ability to sell high-Btu gas at a higher price than is typical for selling a medium-Btu gas for generating electricity or direct use. These projects also have helped industries and municipalities stabilize their fuel costs in comparison to the volatile prices of conventional fossil fuels.

Summary

The use of LFG as an energy resource over the last 40 years has resulted in significant environmental and economic benefits. LFG energy will continue to be a part of an integrated solid waste management system for communities. There are trends in the solid waste management industry that not only encourage the development of these projects, but also have the potential to restrict or limit their success. Evaluating the potential for an LFG energy project at a specific landfill will come down to the local market conditions and opportunities that exist for the site. Communities that have a desire to be sustainable, use local energy resources, or minimize air emissions, have been successful in implementing LFG energy projects even when the economics of these projects were not clear-cut. | **WA**

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LMOP is available to provide technical assistance to landfill owners and other stakeholders interested in evaluating the energy potential of their landfill and end users that are interested in an energy needs assessment. For more information, visit www.epa.gov/lmop.

Notes

1. Climate Action Plan- Strategy to Reduce Methane Emissions, March 2014, accessed from www.whitehouse.gov on August 14, 2014.
2. To date, 29 states plus the District of Columbia have implemented a Renewable Portfolio Standard (www.dsireusa.org, accessed August 13, 2014).