Executive Summary

Solid waste management is usually one of the most labor- and cost-intensive services provided by local governments in developed and developing countries, and local government officials often face challenges in identifying the most appropriate solid waste management technologies and implementing solid waste management projects. Landfill gas energy (LFGE) is a small but important component of an integrated approach to solid waste management given that the use of landfills continues to remain the predominant method of solid waste disposal (SWD) in most countries. Many LFGE systems have been built, only to close shortly after costly start-up, operations and maintenance. As a result, helping local governments choose appropriate solid waste management strategies and technologies is critically important.

Best Practices to Overcome Barriers to Successful LFGE Projects

Use of the guide will help stakeholders address the five most common barriers:

- Resolving flaws in solid waste final disposal site design and operation
- Designing and operating successful LFG collection and control systems
- Estimating the volume of LFG available to the project
- Selecting appropriate technologies for energy recovery
- Securing financing for the project

Global Methane Initiative's (GMI) *International Best Practices Guide for Landfill Gas Energy Projects* provides a broad overview of the development process for LFGE projects in international settings and presents the technological, economic and political considerations that typically affect the success of LFGE projects. The goal of the guide is to encourage environmentally and economically sound LFGE projects by connecting stakeholders with available information, tools and services. The guide is not intended to provide a step-by-step protocol for project development.

Audience

The guide provides valuable information for representatives of national, regional and local governments, landfill owners, energy service providers, corporations and industries, and representatives of not-for-profit organizations. These and other stakeholders will benefit from information provided in this guide as they work together to develop successful LFGE projects. Less familiar stakeholders will learn about the basics of integrated solid waste management and be introduced to general concepts and considerations of LFGE projects, including examples of existing LFGE projects and access to key resources. Experienced, more technical stakeholders will be updated on technical considerations regarding site design and operation, provided insights into models for estimating landfill gas (LFG) generation and collection, and can investigate the many resources and tools identified throughout the guide that will assist them in making decisions about LFGE projects.

Best Practices

The guide identifies best practices for the major components of a LFGE project as discussed below.

Basic Concepts of Integrated Solid Waste Management. Rapid population growth and high rates of urbanization, coupled with increasing prosperity in developing countries, require a serious examination of the waste management process. Incorporating integrated solid waste management (ISWM) and LFGE best practices can help to protect human health and the environment from the dangers of improperly managed and discarded waste. Finding the proper mix of practices to meet a local community's means and needs will help ensure a healthier population and environment.

Solid Waste Disposal Site Design and Operational Considerations. Improving the conditions of an SWD site to the standard of a properly designed and operated sanitary landfill will likely improve the collection of LFG. It is important that stakeholders understand how the various components of an SWD site affect the generation of LFG, the methane content, and the collection efficiency of the LFG collection system, including how common flaws in design and overall operation can affect LFG generation. Implementing training opportunities can help to reduce these design and operational flaws. Well-designed and operated sanitary landfills will generate LFG that can be feasibly collected and used and provide cost savings over the life of the project.

Design, Construction and Operation of Landfill Gas Collection and Control Systems. The foundation of any LFGE project involves the design, construction and operation of a landfill gas collection and control system (GCCS). GCCSs require proper engineering design, construction and operation by trained personnel to maximize intended benefits. While the use of proper techniques and quality assurance procedures during construction help to ensure proper system operation and reliability, it is the operation of the GCCS that determines the success of the LFGE project. With periodic monitoring and adjustments to the GCCS, stakeholders will be able to adapt to constantly changing SWD site conditions.

Landfill Gas Energy Utilization Technologies. The overall feasibility of an LFGE project for a particular landfill depends on numerous technical considerations, such as waste composition and volume, quality and quantity of LFG, and availability and location of a suitable end user. Understanding, evaluating and selecting the appropriate LFGE utilization technologies is essential for the overall feasibility and success of LFGE projects. Proven and emerging technologies offer practical solutions to effectively implement LFGE projects for direct-use and electricity generation, including the treatment of LFG to remove moisture, particulates and other impurities.

Market Drivers for LFGE Projects. It is important that stakeholders recognize and understand how policy and market drivers affect the development of LFGE resources and support the long-term sustainability of LFGE projects. Policy and financing mechanisms are central to assessing the financial viability of LFGE projects. While market drivers and financing mechanisms will vary by country and region, the demand for renewable energy and cost-competitiveness of that energy compared with alternatives should be assessed carefully during the planning stages of an LFGE project to ensure that the most effective combination of revenue opportunities is harnessed.

Landfill Gas Modeling. Estimating the volume of LFG generation from a landfill is a critical component of project assessment and conceptualization because the collection projections are used to estimate the size of the project, expected revenues, project design requirements and capital and operating costs. However, accurately projecting the total LFG and methane generation for a landfill can be difficult for many stakeholders. It requires selection and use of an appropriate LFG model among several options, consideration of local conditions that affect LFG generation, and an understanding of the uncertainty inherent with LFG modeling. The value of LFG estimates also depends on the quality of data used in the model; proper consideration of factors such as annual waste composition, disposal rates and estimated growth rates; and the participation of an experienced LFG modeler.

Project Economics and Financing. The economic viability of a LFGE project relies heavily on identifying financial mechanisms to promote the development of LFGE resources. Options vary by country, but may include tax incentives, public-private partnerships, bond financing, direct municipal funding, loan guarantees and grants. It is important that stakeholders understand the range of financial mechanisms available for their LFGE project; evaluate carefully the economic feasibility of options, including non-price factors; and select the most viable project option to meet stakeholder goals.