

Landfill Gas-to-Energy Project



Overview

This project tests the application of a Stirling engine matched to a 55-kW generator to generate electricity from landfill gas. It addresses two concerns about electricity generation at landfill sites:

- Small- to medium-size landfills have not been able to make an economic case for generating electricity from gas because of the capital costs. The gas is generally just burned off. This project may offer an economical alternative so the gas can be utilized to produce electricity.
- Landfill gas contains contaminants that can cause engine failure in internal-combustion engines. The moving components of a Stirling engine do not come in contact with its fuel so these compounds should not affect engine life.

Madison Gas and Electric develops projects like this to educate ourselves and our customers about new technologies. Together, we can plan our energy future.

Project location

Metropolitan Refuse District Landfill, 5211 Hwy. Q, Middleton, Wis., is a medium-size landfill site containing about 1 million tons of garbage and has a reliable gas-extraction system. The gas at the site is of typical quality in terms of methane and does not have a high concentration of nuisance components.

Companies/governments involved

- Madison Gas and Electric, Dave Toso, project manager, 252-5641
- Foth & Van Dyke and Associates, Marten Cieslik, project manager, 242-5958
- Unison Solutions (Stirling engine distributor)
- City of Middleton
- Village of Shorewood Hills
- Village of Waunakee

Landfill gas background

Methane, a greenhouse gas 20 times more harmful than carbon dioxide, is produced as garbage decomposes in a landfill. Decomposition is a slow process, so the gas may be present in the landfill for decades. Landfills are required to establish systems to control the release of the gas. Without these systems, the gas could gather and possibly explode.

Depending on the size of the landfill, the gas is either a nuisance or a resource. Smaller landfills generally just vent or burn off the gas. It's the only economically viable alternative. Bigger landfills, about 5 million tons or more, create more gas. At this size, there is a pay-back for investing in a generator. Many large landfills have generated electricity since the 1980s.

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This project provides an electricity-generation option for landfills that are smaller scale. The Stirling technology can serve a size range of about 1 million tons of garbage. Many of these landfills have wanted to find a way to utilize their methane but haven't had any options.

Stirling engine background

Traditional gas or diesel internal-combustion engines mix fuel and air inside the cylinder. The mixture is ignited causing the combustion that pushes against the piston. The Stirling engine works differently. It contains a working gas that is sealed inside the engine and is used over and over. Rather than burning fuel inside the cylinder, the Stirling engine uses external heat to expand the gas contained inside the cylinder. As it expands, the gas pushes against the

pistons. The Stirling engine then recycles the captive working gas by cooling and compressing it, then reheating it again to expand and drive the pistons which, in turn, drive a generator.

As a result, this engine provides benefits for many power applications. They include smooth, clean and quiet engine performance. In addition, the Stirling engine is highly efficient and durable.

Need more information

For more information about this project, call our business services number, 252-7007.

Additional resources

www.stmpower.com

www.mge.com