

## **Final Technical Report**

**Award Number:** DE-FG36-06GO86008

**Recipient:** Madison County  
PO Box 635  
Wampsville, New York 13163

**Project Location(s):** Madison County Landfill  
663 Buyea Road  
Canastota, New York 13032

**Project Period:** June 1, 2006 through December 31, 2010

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## Final Technical Report

The Canastota Renewable Energy Facility project, DOE award number GO86008, was completed by Madison County under the direction of James Zecca. Waste Management Renewable Energy, LLC (WMRE) acted as a cost-sharing partner in the project.

The project was implemented at the Madison County Landfill located in the Town of Lincoln, Madison County, New York. Madison County has owned and operated the solid waste and recycling facilities at the Buyea Road site since 1974. At the onset of the project, the County owned and operated facilities there to include three separate landfills, a residential solid waste disposal and recycled material drop-off facility, a recycling facility and associated administrative, support and environmental control facilities. These facilities were all under the control of the Department of Solid Waste and Sanitation.

The County accepts and landfills approximately 60,000 tons of solid wastes generated annually within the County. Recycling of an additional 8,136 tons is accomplished through a source-separation system. The County's solid waste and recycling programs are self-sustaining through competitive disposal prices and a local law that regulates solid waste disposal and recycling. The annual intake of landfilled material consists of approximately 62 % of putrescible waste.

This putrescible waste undergoes anaerobic decomposition within the waste mass and generates landfill gas, which is approximately 50% methane. In order to recover this gas, the landfill was equipped with gas collection systems on both the east and west sides of Buyea Road which bring the gas to a central point for destruction. In order to derive a beneficial use from the collected landfill gases, the County decided to issue a Request for Proposals (RFP) for the future use of the generated gas.

### **Task 1 - Identify available technologies for landfill gas utilization.**

Due to the relatively small quantity of landfill gas produced at the County landfill facility in comparison to larger upstate New York landfills, the County first conducted an interest survey to determine the presence of entities wishing to develop landfill gas utilization projects at the landfill. This survey was sent to known developers of landfill gas to energy facilities, as well as various energy development companies. After receiving positive feedback regarding interest in utilization of the landfill gas, the County determined that it should move forward with developing a Request for Proposals (RFP).

The County determined that the most cost effective way to evaluate potential technologies for use of the gas was to immediately issue an RFP allowing for the submittal of a broad range of proposals for gas usage from those at the forefront of the industry. An RFP was issued on April 13, 2007 and distributed to parties of known interest, advertised in regional newspaper

publications, and posted on the US Environmental Protection Agency website. The purpose of the RFP read:

*“This Request for Proposals seeks proposals from experienced, successful, landfill gas developers to develop a landfill gas (LFG) utilization project at the Madison County landfill facilities located astride Buyea Road in the town of Lincoln, Madison County, New York. Mature, innovative and emerging technologies will be considered provided the proposal thoroughly demonstrates the feasibility and proven success of the proposed technology and ability of the Respondent to satisfactorily complete the project as proposed. Projects using the heat value of the gas, generating electricity or combined heat and power and other projects will be considered. A team of County officials, staff and a paid consultant will evaluate proposals received in response to this request. Criteria such as environmental benefits, demonstrated experience, financial capability, technical ability, personnel, job creation and other factors as well as the economic, environmental and operation benefit of the project for Madison County will be used to evaluate proposals.”*

The County set a deadline for receipt of responses to the proposals of May 24, 2007. A total of eleven responses were received for consideration.

While the approach of utilizing a broad RFP allowed for the County to receive responses covering a varied spectrum of approaches for gas utilization, each response received outlined a proposal to develop an electricity generation project at the site. While the methods of electricity generation varied, and some responses included options for waste heat utilization and the use of additional fuels for increased electrical generation, it was evident from the responses received that the preferred utilization method was landfill gas to electricity.

### **Task 2.0 Evaluate Responses to the Requests for Proposals**

Representatives of the County Department of Solid Waste and Sanitation, the County Planning Department, and the County’s consultant, Barton & Loguidice, P.C. were called upon to review each proposal and present their recommendations to the Solid Waste Committee of the Madison County Board of Supervisors. Each entity presented a summary of their findings according to a set of criteria that included quality of proposal, initial capital costs, annual revenue to the county, project schedule, strength of project team, and implementation schedule.

The preliminary recommendations of each group were presented to the Committee on June 14, 2007. Based on the recommendations received and extensive discussion at the presentation meeting, the Committee narrowed the field of respondents to a list of the top five for further consideration. The committee developed a list of questions for each of these top five respondents, the answers to which would help to clarify the proposals and allow the County to further narrow the list of viable proposals. Each respondent was provided with the list of questions in writing and given the opportunity to respond.

Based on the responses to the inquiries, the County, again with assistance from their engineering consultant was able to further narrow the field to the top two proposals. Each respondent was asked to appear before the Solid Waste Committee to present their proposal

and to be interviewed regarding both their proposed project and their company and staff experience that would qualify them to undertake the proposed project.

After much consideration, the County chose the proposal by Waste Management Renewable Energy for implementation at the site. This decision was based, most importantly, on the proposal by WMRE to utilize a proved conversion technology that could be adapted for energy generation at the landfill site, their extensive experience with similar types of projects throughout the country, and their familiarity with unique challenges associated with operating such a system at an active solid waste landfill facility. Additionally, the project provided an attractive payout to the County, as well as providing the most direct environmental benefit by converting the gas directly to renewable electricity to be sold to and used by the local electrical grid.

### **Task 3.0 Project Authorization**

Once it was determined that WMRE would be the developer at the site, negotiation of the details of the project was underway. The Solid Waste Committee, the County Attorney, and outside legal counsel worked with WMRE to develop and contract and terms that were agreeable to all parties. While the agreed upon contract generally reflected the terms in the original proposal, there were some minor changes agreed upon during negotiations. The most notable change was the agreement by WMRE to construct a brick and mortar building to house the engine in lieu of a containerized unit. This larger building would allow Madison County to utilize the facility as part of its public education efforts at the landfill to demonstrate the beneficial use of landfill gas.

An agreement between WMRE and Madison County was signed on December 11, 2007.

### **Task 4.0 Project Implementation**

A landfill gas to energy facility was constructed at the site, which utilized an engine-generator, designed to be fueled by landfill gas and to produce electricity to be sold to the utility grid. The funded project consisted of the procurement and installation of an engine-generator, gas compression equipment, transformers, electrical switchgear and ancillary equipment. Installed, this equipment had an overall footprint of approximately 2600 square feet. The project funding did not cover any operation or maintenance of the generator except for the period directly related to the installation and validation.

In order to effectively utilize landfill gas as a fuel in the Caterpillar 3520 engine, it is necessary to compress and treat the landfill gas prior to combustion. The compression and treatment system provides the necessary vacuum to extract landfill gas from the site, pressurizes the fuel so that the final fuel pressure at the engine is approximately 3 psig, removes a significant amount of the moisture in the collected landfill gas, and removes particulate matter prior to utilization by the engine. Due to the possibility of future increases of gas flows, the gas compression system was also designed with the ability to increase its capacity by a simple change of the motor to a larger system. The fuel system also includes a gas chromatograph for frequent analysis of the fuel delivered, and a flow computer for calculation of flow rates and totalized fuel consumption.

The Caterpillar 3520 engine was selected based on expected fuel availability from the Madison County landfill. The 3520 produces 1.6 MW of power compared to Caterpillar's 3516 engine at 0.8 MW in a similar footprint with similar support equipment requirements. Therefore, the 3520 provided a more efficient installation in terms of cost/MW. The 3520 engine also offers advantages relative to a slightly improved thermal efficiency and lower NOx emissions.

Should gas production increase in the future, the facility also has provisions for adding additional electrical switchgear and space for placement of an additional containerized engine/generator. Conduits were installed beneath the foundation to facilitate the possibility of a future expansion.

Equipment and piping were also included in the design for the recovery of waste heat from the Caterpillar 3520 jacket water system and exhaust.

The landfill gas fired renewable energy facility is operated by WMRE who also acted as a subcontractor to Madison County for the project. The procurement and installation of the equipment was performed by WMRE, with reimbursement from Madison County. WMRE purchased the engine-generator to be utilized in the project in January 2007, with construction and installation complete by April 2009. The engine-generator, gas compression equipment, electrical switchgear, and ancillary equipment are installed in a masonry building. The new engine-generator was considered operational on June 11, 2009.

In addition to producing electricity, the Caterpillar 3520 engine driving the electrical generator also produces heat which would normally be rejected from its cooling water system through a horizontal radiator installed outside of the building. Other heat is also rejected through the engine exhaust. At the Canastota Renewable Facility, Madison County also takes advantage of this otherwise wasted energy source. Heat exchangers were installed on the engine's jacket water cooling system and engine exhaust. Jacket water heat is utilized to heat the recycling center, scale house, and break room facility located at the Madison County Landfill. Excess waste heat from the jacket water, not utilized for on-site heating, as well as heat from the exhaust system heat exchanger is slated for use at the planned Agriculture and Renewable Energy (ARE) Park on County-owned property adjacent to the landfill.

At full load on the Caterpillar 3520 engine, approximately 2,500,000 Btu/hour is recoverable from the engine's jacket water heat rejection system and an additional 2,500,000 Btu/hour is recoverable from the engine's exhaust.

### **Task 5.0 Project Management and Reporting**

In its first year of operation (June 11, 2009 through May 31, 2010) the 1.6 MW engine successfully converted over 220 million cubic feet of methane gas into almost 10,000 MWh of electricity. This is landfill gas that would have otherwise been destroyed with a candlestick flare, without contributing any energy to the electrical grid, or providing an environmental benefit through green power. As a greenhouse gas, methane is 21 times stronger than carbon

dioxide. The landfill gas destroyed by this engine annually has roughly the carbon reduction equivalent of eliminating over 9,000 passenger cars from the road. Therefore, this project not only reduces greenhouse gases through the destruction of the methane itself, but also by offsetting other carbon emitting forms of electricity production.

As well as providing a necessary and environmentally beneficial means of landfill gas destruction, the installation of the engine-generator also serves to provide additional revenue to the Madison County solid waste department through sales of landfill gas to the waste to energy facility as a fuel. These sales, along with additional potential revenue from energy sales, help to offset the costs of solid waste disposal and recycling programs, providing residents with a more economical and environmentally responsible solid waste management system.

With the relatively volatile nature of energy sales prices, the return on the investment for the facility is bound to vary dramatically from very high to very low, and sometimes even negative numbers. Many projects similar to this have been implemented throughout New York State and the rest of the country and have proven to be financially beneficial over the life of the project. Regardless of the financial implications of variations in energy sales, the environmental benefits of the project will continue to prove valid and unwavering.