

CASH for TRASH

LANDFILL WASTE-TO-ENERGY SYSTEM REDUCES EMISSIONS, AND SELLS POWER TO THE GRID

When the Mount Trashmore landfill in Cedar Rapids closed in 2006, waste from Iowa's second-largest city was diverted to an existing landfill in nearby Marion. While Mount Trashmore reopened in 2008 to accept 480,000 tons of waste generated by major flooding, today the city landfill is being converted to a recreational biking and hiking trail, with scenic vistas of downtown Cedar Rapids.

In addition to Mount Trashmore, the Cedar Rapids Linn County Solid Waste Agency operates the 75-acre landfill in Marion, which serves 17 communities

in the county. The facility includes a 44,000-square foot resource recovery building that is used for processing hazardous household materials and transferring recycled materials.

When it started accepting waste from the entire county, the landfill near Marion developed quickly, with four new cells added between 2007 and 2013. The landfill currently accepts about 180,000 tons of municipal waste annually. In 2009, the agency installed a system of wells to collect methane gas from the original 30-acre cell and a 13-acre plot.

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CUSTOMER PROFILE

Cedar Rapids Linn County Solid Waste Agency

Location: Marion, Iowa

Application: Waste to energy

Cat® Equipment: G3520C gas generator set

SolidWaste Agency
Cedar Rapids Linn County



Landfill gas is typically made up of 50 percent methane, 50 percent carbon dioxide, and trace amounts of various hazardous air pollutants known as non-methane organic compounds (NMOCs). The U.S. Environmental Protection Agency (EPA) requires large landfills that emit NMOCs from landfill gas in excess of 50 megagrams (Mg) per year to control emissions.

In general, controlling emissions involves drilling collection wells into the landfill, and routing the gas to a suitable energy recovery system or combustion device. Combusting the landfill gas destroys most of the NMOCs in the gas while oxidizing the methane gas to carbon dioxide. This process also reduces the landfill’s greenhouse gas footprint, since methane has a 25 times greater global warming potential compared to carbon dioxide.

Powerful solution

Five years ago, Cedar Rapids Linn County Solid Waste opted to install a Cat® G3520C gas generator set, which produces electricity using the methane as fuel to run the generator. The electric



power produced by the Cat generator is sold back to the local utility, Central Iowa Power Cooperative (CIPCO). Annual revenue generated from power production is more than \$500,000.

“Having a gas system in place that diverts landfill gas to a control device which burns it off is greatly beneficial to the environment and public health, because it reduces our emissions footprint,” says Garrett Prestegard, an

environmental engineer with the Cedar Rapids Linn County Solid Waste Agency. “To be able to collect landfill gas and not only burn it to help control our emissions, but have the added benefit of generating electricity and selling it to the grid is a very positive thing.”

About 500,000 cubic feet of gas is consumed daily by the agency’s Cat generator set. Condensation is removed from the landfill gas before it is combusted in the engine. Otherwise, the gas receives essentially no pretreatment. One of the strengths of the Cat G3520C is the ability to run on relatively low concentrations of methane. The concentration of methane at the Marion landfill averages about 50 percent.

“This Cat engine is a lean burning unit, which means it has additional inerts within the gas stream,” Prestegard says. “The inerts in the gas stream absorb heat during the combustion process, which reduces exhaust temperatures. This limits the formation of NO_x emissions, and helps us meet our air quality requirements.”

The 2,242 hp Cat G3520C advanced gaseous-fueled generator set features high-efficiency and long service life to support low-energy fuel from landfill applications. The G3520C 60 Hz generator set is specifically designed to protect engine components against landfill gas contaminants, thus eliminating the need for elaborate fuel-treatment systems and special maintenance and service

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GARRETT PRESTEGARD
Environmental Engineer
Cedar Rapids Linn County
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practices. The G3520C generator set also provides a lower installed cost per kW, with power densities as high as 100 kW per cylinder.

Many utilities are mandated to provide a certain percentage of their power from renewable sources. Utilization of landfill gas generator sets can result in both renewable energy credits and carbon reduction credits.

By purchasing renewable energy, CIPCO enables its member systems like East Central Iowa REC to offer green energy options. Nearly 60 percent of CIPCO's electricity is generated from emission- and carbon-free resources, minimizing the impact to the environment. All or some of the renewable energy credits associated with this generation may have been sold or will be sold in the future, to other parties, or may be used to comply with future regulatory requirements.

Heat capture

Waste heat generated from the power plant can be used directly by adjacent businesses. The Cedar Rapids Linn County Solid Waste Agency collects the excess heat from the Cat generator set to provide heating to its nearby 44,000 square-foot resource recovery building.

A heat exchanger unit rests on a skid adjacent to the Cat generator enclosure. There are two parallel coolant systems, one that runs through the engine and another one that runs through the heat exchanger to the resource recovery building. The heat is transferred from one coolant system to the other, and the heated coolant is piped back to the resource recovery building. At that point, it's sent through a radiant-heating floor system in the drive-thru aisle, and is also sent to a snow melt system adjacent to the truck bays outside. The generator waste heat is also used to provide heating through three makeup air units.

"Capturing the thermal energy and using it to heat our resource recovery building provide a nice added benefit," Prestegard says.

Dealer support

Cat dealer Altorfer provides all maintenance for the generator set through a 10-year Customer Support Agreement. That includes regularly scheduled maintenance, oil changes, spark plugs, top end in-frame overhauls and a major overhaul once the genset reaches 60,000 hours.

Altorfer technicians are available to troubleshoot and resolve issues if

they arise. On average, the generator operates 24/7, and uptime is high, averaging about 95 percent.

"Altorfer is good about getting out here on short notice when we're having a problem and helping us work through it," Prestegard says. "All of their technicians and service people are really knowledgeable, and just having them locally is fantastic. We count on their expertise to keep our Cat genset running.

"When I started out here, I didn't have a lot of experience in terms of landfill gas engines like the system we have," Prestegard says. "So I've relied on Altorfer's expertise quite a bit, and I've really learned a heck of a lot about this system in the two years that I have been here."

Within two years, the agency plans on expanding the gas collection system into the more recent phases of the landfill.

"We'll be at the point where we have enough waste depth to go out and drill wells into those areas," Prestegard says. "And when we do that, we certainly anticipate maxing out the capacity of our current engine. We'll probably be at a stage where we will be collecting enough methane to support the installation of another Cat genset." 

