A Caterpillar® publication for Power Professionals WINTER **2021**

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POWERING A SUSTAINABLE FUTURE

LANDFILL MAXIMIZES ECONOMIC VALUE, REDUCES CARBON FOOTPRINT

CUSTOMER PROFILE

Cumberland County Improvement Authority

Location: Millville, N.J.

Application: Landfill gas/waste-to-energy, cogeneration

Cat® Equipment: G3520 gas gensets (3)

Located 45 miles southeast of Philadelphia in southern New Jersey, the Cumberland County Improvement Authority's primary mission is to promote and develop the economic and environmental health of the region.

Nowhere is that approach more evident than at the county's 275-acre landfill in Millville, N.J., where it has developed a forward-looking Energy Hub that combines innovative, sustainable practices in one location. A microgrid powered by three Cat® G3520 generator sets is the backbone of the Energy Hub.

As a result of a public-private partnership, Allentown, Pennsylvania-based Energy Power Partners (EPP) owns and operates a 4.8 MW landfill gas-to-energy plant at The Authority's Solid Waste Complex. Three Cat G3520 gensets are fueled by methane gas from the landfill and produce approximately 20 million kilowatt-hours each year—enough electricity to power 1,600 homes. In operation since 2008, the project reduces annual emissions by 15,000 tons of carbon dioxide.

Electricity produced by the generators is primarily used to power all facilities at the Solid Waste Complex, as well as The

Authority's nearby offices. The remaining power from the waste-to-energy project is sold back to the local utility grid.

The Authority is the only landfill in New Jersey to operate a microgrid, maintaining and operating its own electrical infrastructure. The microgrid enables the Authority to more completely recycle on-site energy produced from its own landfill gas. The total annual economic impact for The Authority landfill microgrid is estimated at $13.5 million.

"We do not utilize taxpayer revenue; all of our operations are supported by fees that we collect," says Gerard Velazquez III, president and CEO of the Cumberland County Improvement Authority. "So the key is to be sustainable on the economic side, which is the tipping fees that we collect and other creative things that we do to generate the revenue that sustains us.

"The other part of the sustainability mix is how we can better accomplish our environmental goals," Velazquez says. "The ability to implement these programs while creating environmentally friendly and sustainable systems is integral to the ongoing operations of The Authority and its energy partners. So, sustainability is in our blood—it's what we do."

"Everything that we do here is designed to make landfill operations sustainable."

GERARD VELAZQUEZ, President and CEO, Cumberland County Improvement Authority

The Solid Waste Complex currently receives 540 tons of solid waste per day and operates 160 methane gas wells—this number will increase as the landfill expands. The greenhouse gas (GHG) impact of methane is up to 84 times worse than CO_2, so collecting and destroying this gas is important. Many landfills in the U.S. simply flare their landfill gas. The Authority saw the opportunity to use this gas beneficially to further reduce GHG emissions and simultaneously create economic value for the county.

"Trash is something that's going to be with us forever," Velazquez says. "So if you're in the trash business, the reality is you have to be a good environmental steward. For all of the things that we have going on here, there is zero impact. Not only are we all but eliminating greenhouse gas emissions, but there is virtually no odor coming from the landfill. When you pass the landfill and you don't notice the smell, that's a good day."

Cogeneration evaporates wastewater

In an effort to further maximize the efficiency of the microgrid, The Authority saw an opportunity to continue reducing GHG emissions while creating economic value. The waste heat

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from the generator sets is used to preheat the landfill leachate storage tanks and treat the leachate, which is the fluid that collects and is removed from the bottom of the landfill.

On average, the Solid Waste Complex treats 100,000 gallons of leachate per day (GPD) using a membrane technology called reverse osmosis (RO). However, the RO process creates 30,000 GPD of highly concentrated leachate that was trucked offsite to a location 40 miles away for disposal.

Working with Energy Power Partners, The Authority began a project three years ago to install a leachate evaporation system from Heartland Water Technology. Heartland's solution, called the Heartland Concentrator™, is a patented process that uses the hot exhaust from the power plant for evaporation, creating an energy-efficient cogeneration solution.

Before installation of the evaporation system, the exhaust heat from the generator sets was not beneficially used, notes Casey Cammann, a spokesman for Heartland Water Technology in Hudson, Mass.

"We were able to duct together exhaust from multiple engines and create a path of least resistance," Cammann says. "The system works on a negative pressure, so we're pulling the exhaust from the engines into the concentrator where it can evaporate the leachate."

By evaporating the leachate concentrate, The Authority eliminated GHG emissions and environmental risks associated with nearly 1,500 truckloads per year that were previously hauled offsite, saving the county thousands of dollars annually. Additionally, the combined reverse osmosis and evaporation system achieves a 98 percent reduction in raw leachate. Clean water derived from the process is collected in a large holding pond at the Solid Waste Complex.

Cat dealer Cleveland Brothers Equipment Co. played a key role in both the landfill gas-to-energy and evaporator projects. At the outset, the Cat generators and custom enclosures at Cumberland County were sourced through Cleveland Brothers during 2007.

The Cat dealer designed and built the hot gas duct system, new exhaust stack structure, as well as the containment pad. It also installed the Heartland Concentrator system.

Serving in the role of construction manager and general contractor, Cleveland Brothers also designed and built a jacket-water heat-recovery system, pump skid, and underground

pipeline that connects to the treatment plant. The heat exchanger uses heat from the Cat engines to keep the stored leachate warm enough to continue efficient water treatment throughout the winter by sustaining the biological process, and keeping the filtration process running at an optimum flow rate.

Controlling their destiny

The Authority's mission to sustain the environmental future of the county does not stop there. The Authority's Solid Waste Complex has an on-site public Compressed Natural Gas (CNG) fueling station and a fleet of eight CNG-fueled vehicles. CNG emits 50 percent less carbon dioxide than coal when burned. First opened in January 2019, the fueling station provides the opportunity for businesses who have made the switch to CNG to fuel their vehicles quickly and conveniently.

"The concept around the Energy Hub is taking everything that we do from an energy standpoint, bringing it in house, and essentially controlling our destiny," Velazquez says. "So, generating electricity with methane gas from the landfill and distributing it through our microgrid, along with treating the leachate and minimizing its environmental impact—everything that we do here is designed to make landfill operations sustainable."

Looking back, the original concept of waste-to-energy at the Cumberland County Solid Waste Complex utilizing landfill gas has evolved over time, and is likely to continue. Future plans call for creating an enterprise zone so that more businesses can use the power produced by the gensets. Another idea involves supplying energy to battery-charging power stations for electric vehicles.

"What was just a simple project focused on making electricity has today become a comprehensive energy hub for the residents of Cumberland County," says Steven Gabrielle, a partner with EPP. "The beneficial use at this complex has grown tremendously over the last decade under this partnership with The Authority."

ENERGY POWER PARTNERS

With about 50 projects from coast to coast in 17 states, Energy Power Partners (EPP) is utilizing more than 100 Cat® generator sets as part of its renewable energy portfolio. As is the case in many of its renewable power installations, EPP owns and operates the Cat power plant at the Cumberland County Solid Waste Complex.

"We've researched many different renewable technologies, especially when we started this business several decades ago. And clearly, Caterpillar was the premier engine then and remains so today," says Steve Gabrielle, a partner with EPP.

"Landfill gas is comprised of half methane and other constituents. And you need the right engine to properly destroy that gas and generate electricity. Through our research, we saw that Caterpillar had a very robust engine that could handle the biogas here at this landfill and other landfills where we have operations. There aren't a lot of manufacturers that have a product like that."

The president and CEO of the Cumberland County Improvement Authority concurs with that assessment.

"There are many landfills in New Jersey that are flaring their gas every day because their engines cannot hold up to carbon and the other elements that are part of landfill gas," says Gerard Velazquez III. "And those landfills are not utilizing Cat engines. When you take a look at what's happening throughout the state, the long-term performance of the Cat engines certainly stands out.

"We're very proud of our partnership with EPP, it's probably the best public-private partnership we have here," Velazquez adds. "It's a great way for us to utilize the strengths and capacity of a private entity to pull this project off. We benefit from the technical expertise and the operating knowledge of the private sector."

John Côté of EPP Service Company is the onsite plant operator at the Cumberland County Solid Waste Complex. He performs routine maintenance and conducts other tasks to keep the generators running 24/7/365.

"When I have an engine down for scheduled maintenance, our remaining units immediately come up to fill the gap," Côté says. "Overall, we have better than 98 percent uptime with these Cat generators."

Côté calls on the local Cat dealership when he requires additional technical assistance. He also utilizes Cat Electronic Technician (ET) software to diagnose existing and potential problems with the gensets.

"Cat ET makes things so much easier," Côté says. "I hook up my laptop, and the software tells me exactly what's wrong, and then I know what to do."