



Applying the SEL-734 and SEL-300G for Waste-to-Energy Production

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INTRODUCTION

Interestingly, methane gas is over 20 times more effective in trapping heat in the atmosphere than carbon dioxide [1]. For those concerned about man-made climate change, reducing methane emissions is a critical step towards reducing greenhouse gases. For proponents of abundant energy, capturing and combusting methane gas is a step towards energy independence.



Figure 1 Generators Produce Energy With Surplus Methane

PROBLEM

Today, only a small fraction of methane produced during decomposition or oil exploration is converted into energy. The majority of this gas is released into the environment or simply ignited into the air. On a large scale, the United States releases about 27.5 tons of methane gas per year—enough to produce 370,000 TWh of energy per year. On a small scale, methane released by just one landfill can produce 5 MW of generation. In the past, this gas escaped into the environment, but new capture, generation, monitoring, and control methods allow this previously wasted gas to be converted into valuable energy.

SEL SOLUTIONS

The SEL-734 Advanced Metering System and SEL-300G Generator Protection Relay are two devices ideally suited for metering and protecting methane-powered generation. The SEL-734 meets monitoring and control requirements perfectly with instantaneous metering, energy reporting through MV-90[®], time-of-use, advanced communications, and standard power quality reporting. In addition, the DNP3 LAN/WAN capabilities of the SEL-734 help eliminate expensive RTUs, which cost \$3,000 to \$20,000. The SEL-300G provides integrated generator

protection, sequence of events reporting, event capture, and breaker and dc monitoring functions without the installation and maintenance expense of purchasing those components individually.

A typical metering and control cabinet includes the following equipment to meter and protect these sites:

- SEL-734
- SEL-300G
- Battery bank
- Battery charger
- Spread-spectrum Ethernet radio

SEL-734

The landfill owner, methane generator, and interconnection utility are often three separate entities. This makes accounting for energy and power quality disturbances very important to each party. With high-accuracy metering and advanced load profile recording, the SEL-734 provides watt-hour, VAR-hour, and ampere-hour energy produced every 15 minutes. The bidirectional capabilities of the SEL-734 record delivered, received, and net energy values. The difference between delivered and received energy, called net energy value, accounts for energy consumed when the landfill is not generating. The owner of the landfill generator receives compensation for the net energy produced. With instantaneous reporting over DNP3, the utility's SCADA (supervisory control and data acquisition) system monitors voltage, current, power flow direction, power factor, and harmonics. Thanks to these data, the utility instantaneously sees any system anomaly and is able to make corrective actions very rapidly.

SEL-300G

The SEL-300G protects both the generator and the electric grid by opening the breaker if an adverse condition occurs. Examples of this include over-/undervoltage and over-/underfrequency conditions due to local system islanding or a system-wide voltage and/or frequency disturbance.

The SEL-300G provides protection by monitoring the system voltages and currents. If the SEL-300G detects an abnormal condition, it sends a trip signal to the breaker, thereby isolating the generator from the electric grid. If required, the SEL-300G can send a separate shutdown signal to the engine control.

Once the generator has disconnected from the grid, the SEL-300G will not allow the generator to reconnect unless it detects that the utility supply and generator are within normal bounds (voltage, frequency, and phase angle). This protects both the generator and the grid from damage caused by a nonsynchronized close.

Battery Bank

A 48 Vdc battery bank continuously powers the SEL meter and relay. In the event of a loss of 120 V power, the system continues to operate and report data back to the utility. SEL Engineering Services can provide detailed battery bank analysis and recommendations based on site-specific needs to ensure long battery life, lower maintenance costs, and improved reliability.

SEL-9310 Power Supply Battery Charger

The purpose-built SEL-9310 provides a constant 48 Vdc source to the meter and relay. The built-in battery charger maintains the optimum charging voltage of the 48 Vdc battery bank. An alarm contact in the SEL-9310 is connected to an input on the SEL-734 that reports any battery issues to the utility's SCADA system over DNP3 protocol. In addition to supplying power and charging the batteries, the SEL-9310 provides battery protection by isolating the load from the batteries if the voltage drops below 40 V during cases of severe discharge.

References

- [1] United States Environmental Protection Agency. <<http://www.epa.gov/methane>>. June 10, 2009.

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