



CHP Engine Fuel-Blending

Fuel-Blending and Biogas Power



Michigan Cat is the premier dealer of heavy equipment and high horsepower natural gas and diesel engines in Michigan. Due to our experience in digester fuel-blending technologies, Michigan Cat called upon Peaker Services, Inc. to modify a genset to run on environmentally friendly biogas.



One of the largest breweries in Michigan, Bell's Brewery offers a wide variety of craft beers state and nationwide. Their passion for craft beer spills into a sustainability program aimed at limiting their impact on the environment by investing in lower and cleaner energy consumption and local recycling programs.

Location:

Bell's Brewery
Galesburg, Michigan

Type of Installation:

Fuel-Blending and Biogas Power

Power Source:

CAT G3408 genset

Unique Obstacle:

Using varying BTU biogas to fuel CHP for brewing process.

System/Products Used:

- Woodward E3 Rich Burn control system
- TecJet 52 Fuel Valve
- TecJet Harness
- ProAct Integrated Throttle Body
- PISC Harness
- Manifold Pressure Sensor
- MAP Sensor Harness
- Manifold Air Temperature Sensor
- Speed Sensor w/ Harness
- EG3P Blanking Plate

Results:

- Improved emissions and engine safety
- More efficient combustion
- Automated load adjustment for varying BTU gas

Bell's Brewery Solves Biogas BTU Issues With Advanced Fuel-Blending Controls

Customer Goal & Challenge:

Bell's Brewery has a wastewater treatment plant in Galesburg, Mich. that uses a CAT G3408 genset to provide the facility with power. This genset runs on biogas retrieved from digesters during treatment of waste solids. Additionally, the gen-set uses a CHP system to generate hot water and maintain the necessary temperature in the digesters.

Trouble with the CAT genset arose due to the variable BTU content of the biogas. Without a way for the governor to monitor these changes, this meant the air/fuel ratio (AFR) would become lean or rich, provoking the control system to shut the genset down to prevent damage. Remote control of the genset has meant the problem was manageable, allowing alarms to be cleared and the engine restarted without someone onsite, however, Bell's Brewery desired a more reliable solution.

Due to their expertise in



Bell's wastewater treatment plant.

biogas fuel-blending systems, Peaker Services, Inc. was chosen to propose and install a solution.



CAT G3408 genset and CHP system on-site at Bell's.

Solution:

A Woodward E3 Rich Burn control system was installed on the G3408. This system is comprised of an engine control unit (ECU), TecJet control valve, ProAct ISC actuator, kW sensor, and engine sensors. It is designed to handle the variable BTU content of landfill gases. It automatically adjusts the AFR to guarantee consistent and safe combustion, also controlling speed, load, and engine protection.

with the E3 control system, allowing it precise control over fuel and air intake. With thorough and automatic AFR control, misfires and detonation should prove to be greatly reduced, along with alarms and shutdowns.



Top: TecJet 52 installed, complete with ProAct ISC actuator. Bottom: ProAct integrated throttle.

Sensors were installed to provide the E3 with more information on speed and load, allowing for more complete and reliable engine protection.

Results:

After installation, the CAT G3408 was found to perform smoothly, running without shutdowns or alarms. The control system successfully allows for more efficient combustion of biogas, allowing for greater engine efficiency even with the variable BTU content. Due to the reduction of rich and lean burn, emissions have overall improved, including a reduction in methane slip.

The automatic nature of the E3 control system means lower maintenance costs and fewer



E3 control system installed on the G3408.

To allow the E3 better control over AFR, a TecJet 52 fuel valve and ProAct integrated throttle body were installed. Both parts are designed to work

emergency calls for Bell's facility. Longer life should be expected for the genset. Personnel costs to keep the genset online have been reduced, and the reliability of the new system means for smoother, less stressful production onsite. The genset is no longer a pain for Bell's to manage, but now is the green power generating asset they had initially hoped for.

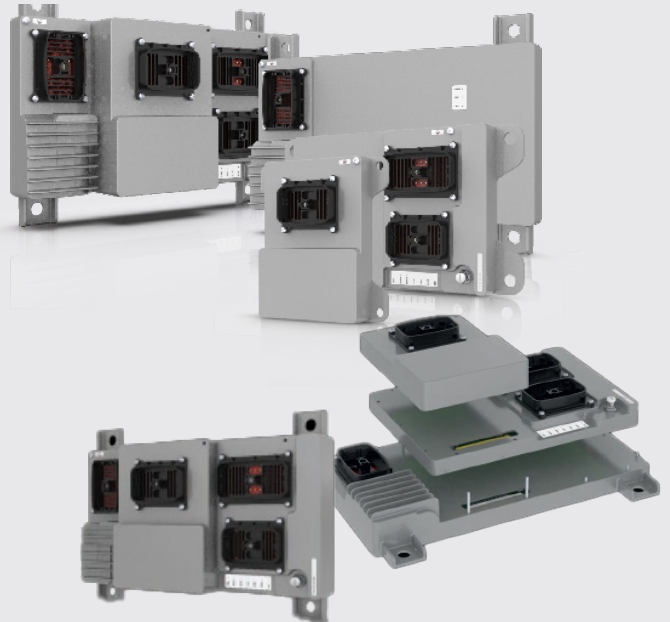
Advancements:

Years after this installation, Woodward has since released a series of improved ECUs designed for biogas applications. These are known as the E6 LECM (Large Engine Control Module). Improvements were made to the reliability of the system with the addition of the Gas Quality Closed Loop algorithm (GQCL). The GQCL allows the E6 to adjust fuel flow for varying BTU, but also allows emissions to be kept stable even as the methane content changes. Impressively, the GQCL allows for this without the use of O2 or NOx sensors, instead analyzing the load of the engine to calculate the fluctuations in BTU content, automatically adjusting AFR accordingly.

The E6 also allows for fuel blending with natural gas. As many biogas gensets cannot run continuously from collected biogas, this feature can prove useful for those needing their power generating asset to run more often or want to use biogas as a cost-cutting, supplemental fuel. Blending and transition from fuel types is seamless with the E6, with many who use it noting that not only is load unaffected, but that there is no audible change during the fuel switch.



After brewing, solid waste is separated, then sent to a digester to become burnable biogas.



The E6 LECM also marks the introduction of a modular, mix and match design to allow for a more customizable control module.



Peaker Services, Inc. is an innovator and recognized leader in high-horsepower engine repair and systems integration in North America.

Since its founding in 1971, Peaker Services has expanded beyond power grid applications, servicing rail, marine, and industrial power needs, creating custom solutions at the large and small scale.

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