

Food/Beverage Processing

Fuel Cells and Food/Beverage Processing

Many facilities, such as food/beverage processing facilities, wineries, breweries, dairies, large industrial factory farms and confined animal feeding operations (CAFOs), generate many tons of organic waste as a byproduct of daily operations, which can be expensive to remove and burdensome to store.

That waste can be turned into fuel via anaerobic digestion, generating methane gas, or anaerobic digester gas (ADG). Many sites dispose of that gas by combusting it or venting it into the atmosphere in an open flame which is often highly regulated and restricted, while others burn it as fuel in their boilers. Although ADG is considered carbon-neutral since it is derived from an organic (non-fossil) source, flaring or burning leads to releases of direct and indirect GHGs and other air pollutants.

Fuel cells are increasingly being adopted to utilize this ADG more efficiently and cleanly, providing significant saving for these businesses.

Benefits

Fuel cells generate electricity using an electrochemical reaction. Fuel cells can provide primary power, backup power or combined heat and power (CHP), and since they can be installed as part of the electric grid, or in parallel to it, fuel cells can provide reliable power without disruption due to grid failure or blackouts. The excess heat can be captured to provide hot water or space heating, and when installed as CHP systems, the fuel cells are achieving 85% efficiency and higher.

This excess heat from the fuel cell can be directed to the anaerobic digester to generate ADG, which can then be fed into a fuel cell, providing reliable and efficient electricity and, excess heat which continues the process. A fuel cell system running off ADG also leads to tremendous savings from eliminating the need for costly waste removal.

Many states consider fuel cells as a clean energy technology, and ADG, an organic waste product, as a renewable fuel source, under renewable portfolio standards (RPS) and utility green power programs. State agencies often encourage such resources and may offer grants, low-interest loans, or other assistance to encourage deployment of these technologies. California's Self Generation Incentive Program (SGIP), for example, provides facilities in the state \$4,500/kW for fuel cell systems that use a biogas feedstock, nearly double the subsidy for natural gas-powered fuel cells.

Fuel cells are scalable and can be constructed to satisfy any power need.



600 kW fuel cell system at Gills Onions in Oxnard, CA running off ADG generated from onion waste

Current Fuel Cell Customers

In 1998, Japanese beer companies Kirin, Asahi and Sapporo installed fuel cells at their respective breweries running off the ADG from the brewing effluent. Since then, several others have followed suit.

Sierra Nevada Brewing Co. – Installed four 250-kW (1 MW total) fuel cells at its Chico, California, brewery in 2005. Biogas is currently being collected and fed into Sierra Nevada’s boilers to offset the natural gas required to run the systems. The company’s long term goal is to have only the biogas running in the fuel cells.



Two 400 kW fuel cells systems installed at Coca-Cola Facility in Elmsford, New York

Gills Onions – Installed a 600 kW fuel cell system in 2009 at its processing plant in Oxnard, California, that runs off ADG generated from onion juice pressed from the skins and other waste. The company reported a two-year savings \$800,000 in electricity and labor costs associated with the disposal of onion remains while greatly reducing CO₂ emissions (2012-2014).

Kellogg Company Bakery – In 2013, Kellogg installed fuel cells at its San Jose, California Eggo Waffle bakery, reducing the facilities annual electricity consumption in half.

Napa Wine Company – In 2010, the Oakville, California, winery became the first to install a fuel cell, generating hydrogen using naturally-occurring bacteria and a small amount of electricity from the wastewater it generates from winemaking and other processes.

The Coca-Cola Company – Coca-Cola has deployed five 200 kW fuel cells at its American Canyon, California bottling facility, two 400 kW fuel cell systems at its East Hartford, Connecticut Bottling Plant, as well as two 400 kW systems at its Elmsford, New York production facility.

Sonoma County Farm to Fuel Project – Proposed project to generate power through the digestion of manure from nearly 2 million Sonoma County egg laying chickens. The plan includes a 1.4 MW fuel cell to convert some of the biogas to clean electricity while the remaining biogas will be sold for use elsewhere.

Other Fuel Cell ADG Applications

Fuel cells are also operating off ADG at wastewater treatment plants (WWTP) in California and New York, and a successful demonstration took place at the Orange County Sanitation District’s wastewater treatment plant located in Fountain Valley, California.

The project, which was supported by the DOE, California Air Resources Board, Orange County Sanitation District, academia, and private industry, used an ADG-powered fuel cell to generate not only power and heat, but also hydrogen, making it the world’s first demonstration of “tri-generation” at a WWTP. The hydrogen supplied an onsite hydrogen fueling station that is accessible to the public and sufficient to provide fuel for 25 to 50 fuel cell electric vehicles per day. This demonstration highlighted the potential for tri-generation systems to serve as a “bridge” technology in supporting the development of hydrogen vehicle refueling infrastructure.