



Gills Onions

600 kW Fuel Cell System

Site Description

Gills Onions in Oxnard, California has been in operation for more than 20 years and is the nation's largest supplier of prepared onion products. The facility has a base electrical load of 600 kW, and a peak load of 2,200 kW, primarily for process and refrigeration equipment.

Project Profile

The facility's "Advanced Energy Recovery System" utilizes two FuelCell Energy DFC300 molten carbonate fuel cell (MCFC) systems to take advantage of digester gas from 200,000–300,000 pounds of onion waste that is produced each day. The MCFC system provides 100% of base load power, and 33% of the peak load. By diverting these waste streams to anaerobic digesters, Gills Onions significantly reduces the waste discharged from the facility and the associated greenhouse gas emissions, and produces high-grade animal feed as a co-product.

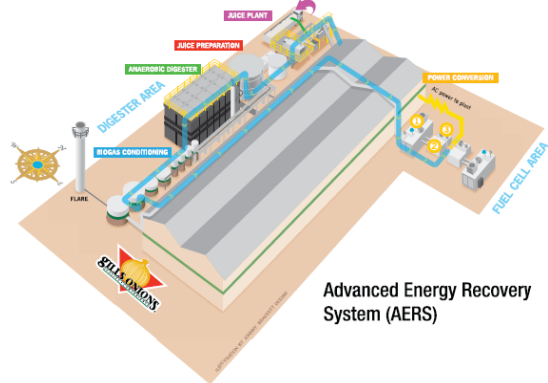
Currently, the waste heat from the system is not being utilized for any process at the plant as the anaerobic digesters are being heated using the waste heat from a compressor that is used in the processing facility. In the future, Gills Onions plans to utilize the MCFC system waste heat to produce Quercetin extract. Gills Onions is also investigating the feasibility of installing a flow battery in conjunction with the fuel cell system.

Quick Facts

LOCATION: Oxnard, California
MARKET SECTOR: Food & Beverage
TOTAL PROJECT COST: \$9.5 million
PAYBACK PERIOD: 5 years (incl. incentives and sale of co-products)
ANNUAL ENERGY BILL SAVINGS:
Approx. \$1 Million
EQUIPMENT: Two 300-kW FuelCell Energy DFC 300 molten carbonate fuel cells
FUEL: Natural gas and Biogas
USE OF THERMAL ENERGY: Process heat and Quercetin extraction (planned)
FACILITY SIZE: No Data
FACILITY PEAK LOAD: 2200 kW
FACILITY AVERAGE LOAD: No Data
CHP IN OPERATION SINCE: 2009

Project Planning & Financing

The full system was installed for \$9.5 million, or about \$16,000 per kilowatt installed capacity. The actual installation was performed under a third-party design-build agreement with HDR Engineering, Inc. with Deaton and Associates, LLC acting as the project manager. Gills Onions estimates that its power costs are approximately \$0.07–\$0.20 per kWh depending on the time of day. The payback period for the fuel cell project is estimated to be 5 years and represents funds saved due to avoided electricity purchases, avoided waste disposal fees, and the sale of co-products from processing onion waste for the anaerobic digesters. The system was funded by Gills Onions, a \$2.5 million dollar grant from the California Self Generation Incentive Program, and a 30% federal tax credit on the cost of the installation from the American Recovery and Reinvestment Act. The total cost of the installation does not include a \$500,000 grant provided by the California Energy Commission for an initial the study of biogas conditioning.



Gills Onions Advanced Energy Recovery System (Source: www.gillsonions.com)

Digester Gas Conditioning

To prevent damaging the fuel cell stack, the biogas from the anaerobic digesters must first be conditioned prior to use as a fuel. Sulfur compounds are particularly problematic, and must be limited to 100 parts-per-billion to avoid degrading cells. Due to the high sulfur content of onion waste, the digester gas may contain up to 5000 parts-per-million of hydrogen sulfide and other sulfur compounds. Currently available systems could not meet the necessary standards for the fuel cells so Gillsonions partnered with the Gas Technologies Institute to develop a new gas conditioning system with a \$500,000 dollar grant from the CEC. The conditioning system devised consists of multiple media in series to absorb inorganic and organic sulfur compounds from the gas, remove particulate matter, and dehydrate the gas. The media require routine maintenance due to saturation. Gas monitoring is installed to ensure proper operation of the conditioning units. As MCFs are tolerant of carbon monoxide (CO), no CO removal is required. In the event that the digester gas contains contaminants in concentrations outside design specifications, the facility control system is programmed to blend in or completely transition to pipeline natural gas, which has no conditioning requirements. The control system also blends in pipeline gas in the event that the digesters are unable to produce sufficient gas for the system to operate near capacity.

Unforeseen Project Issues

The FuelCell Energy DFC300 units were originally specified with an expected capacity factor of 90%, at an average electrical energy efficiency of 45%. Unforeseen issues with the units, however, resulted in an average capacity factor of 60% during the first year of operation of the facility. Two root causes of the decreased performance were identified as a malfunctioning DC-to-AC inverter, and limits to power output as a result of local grid voltages being out of specification. The inverter malfunctions were corrected and the units will become more tolerant of out-of-specification grid voltages when the first stack replacement is completed. As a result of the voltage issues, however, unit #1 required a stack replacement earlier than anticipated. Since the repairs have been completed, the capacity factor is increasing from 60% back to the design specification of 90%. Newer units produced by FuelCell Energy have been re-engineered to be more tolerant of voltage degradation and will be more robust in response to variations in grid voltage.

For More Information

Gills Onions:

<http://www.gillsonions.com>

FuelCell Energy:

<http://www.fuelcellenergy.com>

Additional CHP Pacific Projects Profiles:

<http://www.pacificcleanenergy.org>

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