PACIFIC

U.S. DOE

CHP TECHNICAL ASSISTANCE PARTNERSHIPS

PROJECT PROFILE

St. Helena Hospital

400-kW Fuel Cell System

Quick Facts

LOCATION: St. Helena, CA (Napa Valley)
MARKET SECTOR: Health Sector
FACILITY SIZE: 350,000 square feet
FACILITY PEAK LOAD: 1.2 MW
EQUIPMENT: 400-kW phosphoric acid fuel cell unit (PureCell Model 400)
FUEL: Natural gas
USE OF THERMAL ENERGY: Space heating, hot water and steam for a commercial kitchen, sterilization
CHP TOTAL EFFICIENCY: 55%
ENVIRONMENTAL BENEFITS: Offset 665 tonnes of CO_2 and 2.1 tonnes of NO_x annually; 500,713 gallons of water conserved per year
TOTAL PROJECT COST: $2.15 million
ANNUAL ENERGY SAVINGS: $170,000 per year
PAYBACK: 3 years (after state incentive and donation)
CHP IN OPERATION SINCE: 2010

Site Description

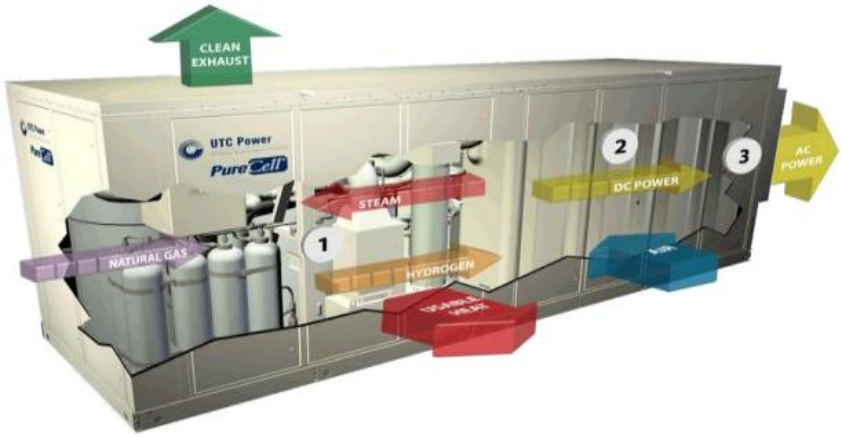
Opened in 1878, St. Helena Hospital in Napa Valley is renowned for its lifestyle and fitness medicine, state-of-the-art cardiac care, orthopedic joint replacement program and addiction rehabilitation. It is a 151-bed, full-service community hospital with comprehensive care programs and a 24,000-square-foot cancer treatment center. The hospital area is 350,000 square feet (excluding the cancer center), including the main hospital, auxiliary building, Lloyd office building and Crystal Spring building, a former dormitory now used to house guests.

Reasons for CHP

St. Helena Hospital's facility director explains, "The fuel cell system is a good fit for our facilities because we need power and thermal energy around the clock. Keeping the lights on and the rooms heated 24/7 is a big job that the fuel cell makes easier, cheaper and a lot cleaner. In traditional power generation, rejected heat and transmission losses result in a mere 30% efficiency." In contrast, the installed PureCell Model 400 fuel cell system captures waste heat that can be used for space heating and hot water, turning potential waste into useable energy. With maximum usage of the recovered heat, this type of fuel cell can achieve up to 62% efficiency. St. Helena's fuel cell produces 63% of the hospital's electricity and increases power production efficiency from about 30% to more than 55% by capturing and using the waste heat.

CHP Equipment & Operation

Since December 2010, St. Helena Hospital has powered its state-of-the-art medical facility with a 400-kilowatt (kW) PureCell Model 400 phosphoric acid fuel cell (PAFC) system. During the summer, the waste heat from the fuel cell provides 100% of on-site thermal loads. A lower percentage is provided during the winter when three "California Special" boilers, designed to meet California emission limits, provide supplemental heating. The plant also generates 400 kW of power for the facility and was installed feeding into the unit substation serving the hospital.



PureCell Model 400 Fuel Cell System

"Fuel cells are a great choice for businesses that have 24/7 operational needs and the capability to maximize utilization of both the power and the heat generated. They are very efficient with a potential to achieve 60%+ when all of the waste heat is utilized. The more we capture and use, the more money we save."

- Stan Tempchin, Director of Facilities

Although the fuel cell system has the capability to operate in grid island mode, the current configuration limits the fuel cell to operating in grid-connect mode. Hospital emergency power is provided by reciprocating diesel engines. Minimum power loads at the facility are about 560 kW, allowing the fuel cell to operate at capacity full time. The system has a 10-year stack life, a 20-year system life, and an electric efficiency of about 36%. The fuel cell provides on average 0.64MMBtu/hr of high-grade waste heat (250° F) or 0.88MMBtu/hr of lower-grade (140° F) waste heat to be used for hot water and space heating. Maximum efficiency of the CHP system, including the waste heat recovery component, is 62%.

Fuel cells operate like continuously discharging batteries, producing energy in the form of electricity and heat as long as a suitable fuel, such as hydrogen and an oxidant gas, is supplied. The illustration shows three major parts of the fuel cell system, which is based on medium-temperature PAFC technology. The first section is the "fuel processor", which converts natural gas to a hydrogen-rich stream that is fed into the second section of the fuel cell called the "fuel cell stack". The DC power generated by the stack is then converted to AC output in the "power conditioner."

Financial Incentives

The capital cost of the installation was $2.15 million, or $5,375/kW installed capacity. Additional funding was provided by a $1 million rebate from the Self-Generation Incentive Program (SGIP) and a donation of $500,000, which allowed for an effective payback period of three years. To hedge energy costs, St. Helena Hospital negotiated long-term natural gas and electricity prices. A sub-meter on the fuel cell allows the site to take advantage of special gas transmission tariffs for on-site generation. Despite the long-term energy contracts, the hospital is still subject to a $1,700 per month standby charge from PG&E. Annual avoided costs are approximately $110,000 for electricity and $60,000 for avoided heating fuel.

For More Information

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Date produced: July 2015