PROJECT PROFILE

WESTERN CHP TECHNICAL ASSISTANCE PARTNERSHIPS

Alameda County Santa Rita Jail Microgrid

1.4-MW Fuel Cell CHP System

Photo coutesy of Paul Chinn, San Francisco Chronicle

Quick Facts

LOCATION: Dublin, CA (Alameda County)
MARKET SECTOR: Corrections Facility
FACILITY SIZE: 980,000 gross sq. ft.
FACILITY PEAK LOAD: 3 MW
EQUIPMENT: 1.4 MW molten carbonate CHP fuel cell; 1.2 MW photovoltaic system; 2 MW advanced energy storage system
CHP FUEL: Natural gas
USE OF THERMAL ENERGY: Hot water for laundry and food preparation; space heating
CHP TOTAL EFFICIENCY: 58%
ENVIRONMENTAL BENEFITS: 98.5% NO_X reduction
TOTAL CHP PROJECT COST: $6.1M
YEARLY ENERGY SAVINGS: $266,825
PAYBACK: 14 years with incentives
CHP IN OPERATION SINCE: 2006
FUEL CELL REPLACEMENT: 2016

Site Description

The current Santa Rita Jail facility was opened in 1989 in Dublin, California. It replaced the original Santa Rita Jail that opened in 1947 and is the third largest jail in the state (fifth largest in the country), and can house up to 4,000 inmates at a given time. The peak electricity demand in the jail is approximately 3MW. Some of this load is used to prepare over 12,000 meals per day, wash over 10,000 pounds of laundry per day, and power over 10,000 lighting fixtures.

The jail's pursuit of developing a smart microgrid began in 2001 in response to the California energy crisis. That year, Alameda County installed a 1.2 MW solar photovoltaic system on the jail's roof, one of the largest installations of its kind at the time, and reduced its energy usage through retrofits to the jail's central plant. In 2005, the jail installed a 1-MW fuel cell combined heat and power (CHP) system that provided waste heat recovery for pre-heating domestic hot water in addition to base load electricity. In 2010, five small wind turbines were installed, further adding to the jail's renewable energy capacity. In 2016, the original 1-MW fuel cell was replaced with a new 1.4-MW fuel cell (both by FuelCell Energy).

Over the past decade, Alameda County has installed a series of distributed energy resources (DER) to further reduce energy consumption at the site. These include a large 2 MW electricity battery storage system equipped with Consortium for Electric Reliability Technology Solutions (CERTS) Microgrid capability, which allows the Santa Rita Jail to disconnect from the grid and run islanded for extended periods. This capability allowed the Santa Rita Jail to remain operational in an area impacted by utility-mandated Public Safety Power Shutoffs (PSPS) in 2019, providing steady, reliable power to the site during a time when over 3 million Californians were generally affected by PSPS events.

CHP Equipment & Operation

Chevron Energy Solutions designed and managed the original CHP installation utilizing a 1-MW DFC1500 fuel cell manufactured by FuelCell Energy. The system consisted of a molten carbonate fuel cell (single module with four 400-cell internal stacks) used as baseload power in parallel with the utility grid, an on-site solar PV system, and an energy storage system. All utility interconnection points were integrated with the fuel cell and the rest of the jail's infrastructure. Maximum value from the fuel cell was assured by utilizing the fuel cell's thermal exhaust to heat hot water for laundry and dishwashing and to provide space heating.

1.4 MW single direct fuel cell module at Santa Rita Jail
(Photos courtesy of ENGIE Services U.S.)

In 2016, the 1-MW fuel cell was replaced with a newer 1.4-MW fuel cell. Under normal operations, the fuel cell plant has a continuous power output with a 45% electric efficiency rate. Overall efficiency of the system is 58% and NO_X emissions are reduced by 98.5% compared to standard power plants. The system also provides backup power in case of grid failure to ensure reliability and security at facility. When a disturbance to the utility grid occurs, the automatic disconnect switch enables the facility to island itself from the utility grid.

To mitigate the $6.1 million in capital costs, Alameda County received $1.4 million from CA's Self-Generation Incentive Program (SGIP) and $1 million from the U.S. Department of Defense's Climate Change Fuel Cell Program.

Reasons for CHP & a Microgrid

Reasons for installing CHP within a microgrid include:

- On-site CHP power generation solutions are ideal for installations requiring continuous 24/7 power such as hospitals, schools, and large businesses
- CHP is perfect for sites requiring high-quality heat for water heating and/or absorption chilling
- CHP enhances resiliency by allowing the site to operate in island mode

"We believe that this project will successfully exhibit the numerous advantages of microgrids and will be a model for both public agencies and private companies to emulate."

-Matt Muniz, P.E., Former Facilities Manager, Alameda County General Services Agency

For More Information

U.S. DOE WESTERN CHP TECHNICAL ASSISTANCE PARTNERSHIP (CHP TAP)

Alameda County
General Services Agency
Tim Wesig,
Energy Project Manager
510-208-9517
tim.wesig@acgov.org

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