SCIENTIFIC AMERICAN™

Permanent Address: http://blogs.scientificamerican.com/plugged-in/2012/06/19/california-jail-transforms-into-modern-microgrid/

California Jail Transformed into Modern Microgrid

By Melissa C. Lott | June 19, 2012

The Santa Rita jail can't afford to lose power. With the safety of thousands of inmates and facility staff at stake, the jail requires that large amounts of electricity be constantly available. This is why, over the past decade, the facility has teamed up with private and public organizations to successfully transform the 113-acre mega-jail into a modern microgrid.

The current Santa Rita jail opened in Dublin, California in 1989. Its campus-style design is laid out over a one-half mile long by one quarter-mile wide site with 18 separate housing units, and a handful of administration buildings used for booking, release, and administration as well as warehouses, laundry, commissary, and kitchen facilities. Each building is equipped with sophisticated monitoring and management technology, including a robotic cart system to deliver food and collect laundry from inmates.

Aerial View of Santa Rita Jail in Dublin, CA

This mega-jail is currently the fifth largest correctional facility in the United States, with the capacity to hold up to 4,000 inmates. The sophisticated technologies installed throughout the facility help officers to more effectively control inmate movement throughout the buildings, decreasing safety risks. But, the jail's size and suite of modern technologies come with a corresponding price tag – to the tune of a $3 million in utility bills each year.

Starting in the mid-1990's, the jail began making major energy efficiency upgrades to lighting systems and exhaust fans in the hope of decreasing the overall cost of operating the 1 million square foot facility. And, in the aftermath of the 2000-2001 California electricity crises, the local government began a major push to buffer the jail against rolling blackouts and spikes in electricity prices. To date, the jail has installed:

1. A 1.2-Megawatt (MW) peak-power solar PV array capable of meeting about 1/3 of the facility's peak power demand (installed in 2001)

Section of Solar Array Installed at Santa Rita Jail

2. A1 MW molten carbonate fuel cell power plant capable of meeting 50% of the jail's electricity needs and 18% of the facility's waste heat requirements (installed 2005).

Santa Rita Jail Fuel Cell System

Santa Rita Jail Fuel Cell System

3. Five small wind turbines, each generating about 2.3 kilowatts (kW) at peak (brought online in 2010)

Wind Turbines at Santa Rita Jail

4. A 4 MW battery pack, including 2 MW each in sodium-sulfur and lithium-ion phosphate batteries (installed in 2011/2012)

Crane Placing Battery Storage System at Santa Rita Jail

Looking at Battery Storage System Within Storage Container

5. 275 kW solar tracking system with 1100 solar panels, including Solaria solar panels and an Ideematec Azimuth tracker (installed 2011/2012)

For most of these projects, as well as an additional suite of energy efficiency retrofits that have taken place since 2000, the county government partnered with a group called Chevron Energy Solutions (CES). This division of the oil giant Chevron Corp works with private and public sector groups to help them reduce their utility bills.

This year, funded by almost $12 million in grants, primarily from the U.S. Department of Energy and California Energy Commission, the jail was able to make another huge leap as it successfully completed the integration of these electricity generation systems under its own microgrid. For this project, the jail again partnered with Chevron Energy Solutions to help manage the design and implementation of the system. Other project partners included Alameda County's General Services Agency, Pacific Gas and Electric Co., California Independent System Operator, Lawrence Berkeley National Laboratory, the National Renewable Energy Laboratory and the University of Wisconsin.

Static Disconnect Switch Allows the Jail to Isolate Itself from the Grid

Today, the Santa Rita jail can meet its own power needs in the event of a utility grid outage thanks to:

1. A static disconnect switch that allows the facility to isolate itself from the utility's grid
2. Its existing onsite generation capacity
3. An advanced energy storage/power conditioning system
4. Integration enabled by a CERTS compatible control and monitoring system

And, while the facility still maintains 2 back-up diesel generators in case of extreme, extended outages, it expects to be able to avoid using these generators in most (if not all) cases. It will be exciting to see what we learn over time from this operational microgrid system, which could someday be used for critical loads – from jails to hospitals to military bases – around the nation.

Photo Credit:

1. Aerial photos of Santa Rita jail by energy.ca.gov – found here and here in the RESCO 2011 project update.

2. 2nd photo of fuel cell system from RECO 2011 project update.
3. All other photos used in this post courtesy of Chevron Corp. and used with permission.

 **About the Author:** An engineer and researcher who works at the intersection of energy, environment, technology, and policy. Follow on Twitter @mclott.

The views expressed are those of the author and are not necessarily those of Scientific American.