

City of Santa Cruz Advanced Building Controls

Brief Summary

The City of Santa Cruz's climate action plan (CAP) included 12 primary goals, one of which is to reduce energy use by 40 percent in municipal buildings by 2020. The City of Santa Cruz's Advanced Building Control project supported this goal and included the installation of a building automation system (BAS) at the City of Santa Cruz Police Station and City Hall Annex and connection to a newly installed variable refrigerant flow (VRF) system. The project also included the development of a Municipal Advanced Buildings Controls toolkit to aid other governments when pursuing similar retrofits.

The project started October of 2017 and ended March 31, 2021.

Main Activities included:

- Installing controls and connection to new VRF system at the City Hall Annex and Police Station
- Third-party commissioning and support
- Collecting pre-and post-project energy use data
- Verifying actualized energy savings by submetering the electrical use of each building before and after the project
- Developing and disseminating a municipal facility BAS toolkit for use by other municipalities
- Writing a final report

Major Project Measures included:

- Replacing Variable Air Volume (VAV) box controllers, VAV box actuators and thermostats
- Replacing mechanical equipment controllers
- Replacing motors and controllers, and installing sensors on boilers
- Balancing both the air and water systems
- Replacing broken Variable Frequency Drive (VFD) on indoor gun range
- Integrating hardware into new software platform

Lead Agency and Partnerships

The California Energy Commission (CEC) provided grant funding; City of Santa Cruz managed the project; and Facility Dynamics Engineering and Ecology Action acted as technical subcontractors.

Funding

- \$523,672 CEC Local Government Challenge Grant
- \$97,000 City of Santa Cruz

Climate Impact Area

This project supported the City of Santa Cruz's CAP milestone to "reduce energy use in municipal buildings 40 percent from 2008 by 2020."

Alignment with State Energy Goals

The project aligned with the state's goal to double energy efficiency savings (Senate Bill 350 (De León, Chapter 547, Statutes of 2015). Additionally, this project leveraged the requirements of Assembly Bill 802 (Williams, Chapter 590, Statutes of 2015) to identify energy usage patterns and periods of peak load.

Part 1. Identification of Building and Installation of Controls at City Hall Annex

The City of Santa Cruz Police Station and City Hall Annex analyzed the two prior years of building energy usage and benchmarking data to pinpoint candidates for retrofits. The installation of the controls at the two buildings and connection to a newly installed VRF system set up the backbone for both the BAS server and submetering network. This allowed the building managers to track trending temperatures and ultimately gain insight about the system's operations.

Air Handling Unit Control Panel



Source: City of Santa Cruz

The previous BAS control system prevented occupants from changing the thermostat settings. While this is a common practice, it led to complaints from occupants. For the City's new system, thermostats display temperatures, fan state, and other useful information while allowing the occupants to increase or decrease the temperature within four degrees of the established setting. The result is increased comfort and occupant control while still setting parameters that save energy.

Control System Outcomes and Benefits

Prior to the project, the building's baseload energy usage or minimal hourly power draw was approximately 40 kilowatts (kW). After the installation, baseload energy usage decreased by 5 kW or 12.5 percent to 35 kW. That represents a 43,500-kilowatt hours per year (kWh/year) savings or a 10 percent reduction in total energy use on an annual basis.

Over the course of the sample period for the newly installed devices, there was a 16 percent reduction in energy use. However, there are building energy demands not linked to this project which continued to draw energy, such as lighting and plug loads, thus limiting the amount of total savings. The benefits from installing advanced controls included energy savings, a better tuned system, and increased responsiveness to changing operating and weather conditions. Adjustments that used to take several minutes now take seconds.

Part 2. Development and dissemination of a control system toolkit

As part of the grant project, the City prepared a comprehensive toolkit that could be used by other municipal agencies to implement similar projects. The toolkit:

- Provides a prioritization guidance document and flow chart to identify buildings that consume the most energy and are good candidates for advanced controls system integration.
- Estimates potential energy and emissions reductions from an advanced building controls project.
- Utilizes step-by-step advanced building energy controls project development and implementation guide with ballpark cost estimates for each stage, permitting requirements, sample request for design-build proposals, and project evaluation guidance.
- Develops and execute a successful advanced controls project.

The toolkit has been promoted and sponsored by the Central Coast Climate Collaborative and Monterey Bay Economic Partnership.

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