

Energy Efficiency through Advanced Diagnostics

Scientific Conservation Helps Santa Clara County's Green Initiative Get Into the Black

Santa Clara County (SCC), situated in the heart of Silicon Valley, has a long-standing commitment to energy efficiency and the adoption and enforcement of green environmental policies. Not only has SCC been among the earliest adopters to purchase [Energy Star](#)-rated devices and bio degradable materials for county-owned facilities, it has also been a leader in enforcing chemical restrictions to eliminate toxic substances.

Fast-forwarding to today, the county is actively preparing to comply with California Assembly Bill-32, better known as the [Global Warming Solutions Act](#), requiring California to reduce greenhouse gas emissions to 1990 levels by 2020. In addition, SCC has instituted a requirement that all new construction exceed Title 24 by 10 percent — including Part 6 of the [California Energy Code](#) containing energy conservation standards.

One of the key facilities that SCC is paying particular attention to is the East Wing building that serves as the headquarters for county government. This 16-story office building, constructed in 1973, contains 274,740 square feet and is the home of several departments and offices, including the county Board of Supervisors, County Executive Office, Office of Budget Analysis, County Counsel, Department of Revenue, the Clerk Recorder, Assessor and Planning Department. The East Wing has historically been one of the most energy-intensive facilities in SCC's real estate portfolio. Much of this was due to a lack of building systems tuning.

As a result of participating in [Pacific Gas & Electric's Energy Watch](#) program – a retro-commissioning initiative designed to improve the energy efficiency of facilities in order to qualify for utility rebates—SCC embarked on a discovery process that uncovered previously undetected system failures that were directly impacting energy consumption levels.

The Energy Watch program was carried out by the [Association of Bay Area Governments](#) (ABAG), of which SCC is a member. ABAG brought in engineers (Energy Solutions) to survey a sampling of the East Wing's mechanical and electrical systems to establish an “energy consumption baseline.” What they concluded from this survey is that the Variable Air Volume (VAV) boxes used to control the capacity of heating/ventilation/air conditioning (HVAC) systems needed recalibration and/or repair. The survey also suggested that the air economizers in the building should be readjusted to function as designed.

According to Lin Ortega, utilities engineer program manager with SCC, “While the sample survey results were helpful at a macro level, there was not enough detail about which individual VAVs needed attention or what specific programming settings we should have implemented on our economizers and HVAC systems.” Without this level of detail, SCC facilities staff could not pinpoint and prioritize which systems were most in need of attention. And because the Energy Watch program had a compliance deadline in order to qualify for the PG&E rebate, the clock was ticking to find a more precise solution.

Ortega and his team recognized that the East Wing’s energy management system (EMS), which supplied raw data on the facility’s mechanical and electrical systems were not enough to help meet PG&E’s compliance requirements. At this juncture, Ortega brought in specialists from [Scientific Conservation, Inc., \(SCI\)](#) an energy efficiency software company whose SCIwatch™ (pronounced “SKY-watch”) continuous commissioning system was used to identify individual system components that were non-responsive or were operating outside of acceptable tolerances.

Within just a two-week period, SCIwatch made a series of startling discoveries. First, and most revealing, was the actual number of VAV boxes that were failing. Of the 426 VAV boxes installed in the East Wing, over 120 were failing and this was contributing to significant inefficiencies in the building’s energy consumption.

SCIwatch also determined that a certain percentage of the VAV boxes could not communicate with controllers out in the field. In a number of cases, VAV boxes simply would not react to instructions, resulting in simultaneous heating and cooling of floors in the building. For a number of VAV boxes, SCIwatch discovered that dampers would not open or close properly. SCIwatch also identified a problem with the valve controlling the hot water flow to the air handler. And in a testament to SCIwatch’s detective skills, it was discovered that some of the VAV boxes were no longer even hooked up following a building remodeling in the late ‘90s.

“The speed with which SCIwatch discovered system problems is nothing short of remarkable,” Ortega said. “Not only did they locate the problem quickly, they also were able to pinpoint the source of these problems.”

Based on conclusions drawn from SCIwatch reports, ABAG presented findings to PG&E, which accepted the results once SCC initiated repairs on deficient systems. Based on these system corrections, the PG&E/ABAG/SCI collaboration is providing the East Wing facility with \$126,000 in energy savings a year. On top of this, SCC has received a \$93,000 rebate; another \$20,000 of rebates is expected shortly. And this is for a single building. SCC has over 250 facilities plus over 700 other structures comprising nearly 9 million square feet.

Reflecting on how SCC achieved such dramatic energy savings, Ortega points out the exceptional fault detection capabilities of SCIwatch. “ABAG’s initial analysis and recommendations were based on sampling a small percentage of the VAVs per floor. We brought in SCIwatch for more than sampling. Operating remotely with data supplied by our EMS, the system was able to quickly isolate problem areas down to individual devices. That is huge when it comes to troubleshooting and timely problem resolution.”

Ortega is also using SCIwatch for sensor diagnostics at another SCC facility called Berger Building 2. “Most EMS will not set flags to notify facility operators for sensors or actuators that are out of calibration until they actually fail,” explained Ortega. “As a result, we could go on for months or even years operating our buildings based on false readings. With SCIwatch, you can monitor a sensor’s accuracy and drift in addition to the other devices that are part of that system and draw correlations to identify abnormalities. These complex set of monitoring capabilities enable us to achieve significant energy efficiency which translate into monetary savings.”

At the Berger Building 2, SCIwatch has already uncovered a host of system anomalies that require attention. This includes everything from economizers operating with heating valves running at “full open” to stuck chilled water valves with room temperature levels far below normal to air units with clogged pre-filters.

At the end of the day, the ability to monetize and prioritize system faults is critical to SCC. “SCI’s ability to quantify potential losses is of key interest to us,” Ortega said. “For example, if the system issues a flag that something is not working properly or is beginning to drift (not sensing properly) it will quantify what that failure is costing the county. That helps us prioritize where to direct our attention.”

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