

BY RAY CLARKE, PE, AND JOSHUA HANSEN

JOSHUA HANSEN IS AN AUTOMATION AND CONTROL SYSTEMS ENGINEER WITH AUSENCO. HE CAN BE REACHED AT JOSHUA.HANSEN@AUSENCO.COM.

RAY CLARKE, PE, IS A REGISTERED PROFESSIONAL ELECTRICAL ENGINEER (CALIFORNIA, HAWAII) WITH AUSENCO. HE CAN BE REACHED AT RAY.CLARKE@AUSENCO.COM.

Complex System Management

INTEGRATED CONTROL SYSTEMS ARE THE KEY TO MANAGING COMPLEX ENERGY-EFFICIENT BUILDINGS.

One of the trends in energy-efficient construction today is complexity. While some earlier heating and cooling systems could be managed with little more than a thermostat, energy-efficient buildings require the best available integrated control systems.

For example, The David & Lucile Packard Foundation's new headquarters in Los Altos, Calif., recently opened in July 2012 and uses a wide range of systems to reach its goal of net-zero energy use. These include:

- Rainwater harvesting with roof runoff draining to tanks that are used for irrigating roof vegetation and other landscaping, as well as for toilet flushing;
- Indoor and outdoor louvers adjusted automatically so that daylighting systems coordinate with artificial lighting to provide light without glare, reduce energy use and reduce unwanted heat gain;
- Rooftop-mounted solar arrays that pump power back into the grid, as well as provide power for the building itself;
- Electronic displays telling building users when it is appropriate (or not) to open windows;



IMAGE BY TERRY LORANT, COURTESY OF THE DAVID AND LUCILE PACKARD FOUNDATION

- A dashboard that allows employees to monitor in real time the amount of energy used by their actions, like charging devices and printing;
- An innovative heating and cooling system that includes chilled beams, heat pumps and cooling towers for greater efficiency.

These building features support the foundation's goal of being a positive example for other organizations, as well to provide a model that can



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be replicated, cost-efficiently, elsewhere in the country.

COMPLEX SYSTEMS NEED GOOD INTEGRATION

Not that it's easy. Some energy-efficient systems can include solar and wind generation onsite, geo-energy,

the louvers that regulate the amount of daylight entering the building, ventilation systems that move air between the sun-warmed side of a building and the shady side, and the use of collected rainwater, as well as traditional heating and cooling systems.

In the Packard Foundation building, sustainable aspects include rooftop solar panels, rainwater harvesting and automated shading systems, each of which requires controls to keep energy consumption down while also producing a pleasant indoor work environment. It can be a challenge for building managers to monitor and manage the many systems in which changes to one may require changes to another.

It all comes together with an Integrated Control System (ICS) like the one designed and configured by engineering firm Ausenco for the Packard Foundation building. This is an electronic system that combines the output received from each of the building's systems so that the whole can be run off one central screen.

Anyone involved in renewable energy systems for buildings needs to be aware of the growing capability of ICSSs and how they are increasingly important in meeting energy efficiency targets as well as organizational goals. Duties of the ICS at the Packard Foundation building include:

- Reducing power for IT systems: Having a virtualized environment, where one physical server runs several virtual servers, reduces the amount of power required to run the building.
- Gathering information to tweak performance: The data gathered by the ICS helps operators learn how to boost the building's efficiency, and data on every branch circuit helps to discover "problem areas" such as an electric space heater hidden under someone's desk.
- Supporting certification: The data collected also helps certify the building's net-zero status.

- Providing hard data: The detailed information gathered can translate "soft" benefits into hard data such as the energy savings involved in using rooftop runoff, rather than municipal water, for some purposes.
- Builds stakeholder relations: Hard data helps reassure employees and other stakeholders that the building is being efficiently run (which is particularly important for organizations that need to demonstrate "green" credentials to their customers).

GETTING GOOD RESULTS FROM AN ICS

Experience shows that the keys to efficiently managing this huge array of factors involve the right selection, customization and operation of an ICS. Building owners would do well to look to the Control System Integrators Association (CSIA), which provides certification and continuing education for its members.

Certified Control System Integrators have passed an independent audit of 76 criteria covering all aspects of business performance, including general management, financial management, project management, quality management, supporting systems and human resources.

The organization offers an online referral service that helps potential clients find a qualified professional.

It is particularly important to make sure that the organization or individual be experienced in a wide array of communications protocols since there may be a diverse range of devices and inputs to the system, each with its own language.

Net-zero energy buildings wanting to operate as efficiently as possible need the support of a qualified professional and the right ICS to help the complex systems. edc