White Paper Series

Building Sustainability through Building Automation

As a goal, sustainability may be driven by a number of factors such as environmental stewardship, the desire for green building certification, or the financial promises of lower operating costs. No matter what propels you toward the sustainability goal, building automation and control systems can contribute greatly to its achievement.

Here, we'll discuss some general benefits of control systems and some specific strategies for achieving your particular sustainability goals.

Benefits of Control Systems for Green Buildings

Building automation can benefit your green building in a number of ways. Let's look at four important benefit categories:

- Higher Energy Efficiency
- Lower Operating and Maintenance Costs
- Better Indoor Air Quality
- Greater Occupant Comfort and Productivity

Let's examine how each of these can be achieved.

Higher Energy Efficiency

A few control system practices stand out as most meaningful for energy efficiency.

An easy one is effective occupancy control through such common practices as occupancy sensing and schedules. Surprisingly, many pieces of equipment remain unscheduled, have their schedules overridden, or are programmed incorrectly. While there are no definitive numbers, it is generally estimated that 10-30% energy savings can be achieved through scheduled control alone. Add occupancy-based scheduling and still more savings can be achieved.

Another control practice with direct ties to energy efficiency is what has become known as demand control ventilation. Here, only the proper amount of outside air is introduced into the space by monitoring return or space CO_2 levels and controlling fresh air dampers. A great deal of money can be saved by NOT conditioning hot summer outside air or cold winter outside air.

On a related note, the proper implementation of advanced, demand-based zoning systems such VAV and chilled beam, can create a good deal of energy savings. Coupling these strategies with proper static pressure control of the supply air (such as with VFDs on the fans) results in further energy efficiencies.

Finally, consider practices that involve resetting the various air stream temperatures, supply water temperatures, and cooling tower condenser temperatures to optimum setpoints as the dynamic loads change.

A qualified controls provider can implement these and other strategies.

In general:

- Automation optimizes HVAC efficiency by methods such as resetting setpoints of boilers according to outside temperature, optimizing start/stop times for occupied periods, using economizers for free cooling, and maintaining ventilation at the most efficient flow rates.
- Motion sensors allow automatic setback override during unoccupied periods as well as adaptive occupancy scheduling.
- Lighting controls reduce unnecessary artificial lighting via motion sensors and schedules as well as by controlling daylight harvesting louvers.
- A control system saves water and energy by controlling rainwater harvesting and landscape irrigation.

Lower Operating and Maintenance Costs

Surely one definition of sustainability could be that we make decisions now that are intended to benefit, and not harm, the future.

For up-front building/system design, selection of an automation system based on an open communication protocol, and BACnet® in particular, offers future proofing benefits such that subsequent updating will always lead to interoperable devices and systems.

In terms of building operation, an interoperable control system can offer training-related synergies, thereby reducing or containing labor costs. With disparate systems in place, the cross-training of technicians and operators can be daunting. An interoperable system, on the other hand, means that technicians and operators can learn one front end or operator workstation while nicely managing the interoperating systems.

In addition, BACnet was built for integration of building systems. The notion of integration is central to LEED® certified or other green buildings. A&E professionals speak of an "integrated design" and contractors talk about "integrated project delivery." Integrated approaches to building systems can have a positive impact on transportation footprints, on training and cross training of employees, and, of course, on the most efficient operation of equipment. Integration of systems can have a distinct positive impact on initial costs and operating budgets.

Also:

- Trends and logs provide information for further optimization of the system as well as for documentation requirements for building certification.
- Individual room control allows set point adjustments only where needed.
- Based on sensor data, software alarms and notifications alert service personnel to issues before they cause discomfort to building occupants and escalate into bigger, more costly problems.
- Remote network monitoring and troubleshooting via the Internet reduces service calls.
- Sensors with data ports also allow quick network access and control to service personnel using a laptop computer and a network interface.
- Current sensors and power meters monitor energy consumption and electrical generation by wind turbine and/or photovoltaic arrays for credit from the utility company.

Better Indoor Air Quality (IAQ)

Can proper indoor air quality be achieved without sacrificing costs or comfort? Today's control systems can lead to a well-tuned building where energy performance, comfort, and sustainable factors all reside harmoniously. The difference between a building that does and a building that doesn't is most often tied to the design and installation of the control system. That's where qualifying your controls contractor, energy service provider, or system integrator really pays off.

In general:

- Temperature and humidity sensors monitor thermal comfort.
- Carbon dioxide (CO_2) and carbon monoxide (CO) sensors monitor pollutants, ensuring the required minimum fresh air ventilation.
- Control systems provide smoke control during a fire, maintaining breathable air zones for evacuation.
- The control system monitors and controls natural ventilation dampers.

Greater Occupant Comfort and Productivity

A control system can tie building access to the activation of HVAC and lighting for a particular space (such as an office or zone). This is good for both individual comfort control (an imperative for green buildings) as well as efficient use of equipment and power. By the same token, schedules can offer similar benefits while permitting some override capability to suit individual needs. Then, there is trended or historical data which can be used to both analyze and improve building performance.

Beyond occupant comfort, the control system also has a profound effect upon occupant productivity. This fits the greater intent of indoor environmental quality as defined by the LEED rating system for green buildings. As an example, a control system can monitor for CO_2 or other contaminants and initiate ventilation, alarms, or other remedial activities.

In particular:

- Controllers, based on sensor input, provide optimal zone ventilating, heating, and air conditioning.
- Sensors in each room sense temperature and allow occupant-controlled set points and overrides.
- Humidity sensors are used to control summer dehumidification and winter humidification of air.

Case Studies

Numerous examples exist for commercial and institutional facilities in achieving the above-stated results. You can find documented case studies on both the KMC web site (http://www.kmccontrols.com/products/projectshome.aspx) and on the web site of BACnet International of which KMC Controls is a founding member (http://www.bacnetinternational.net/success/stories.php).

Controls & LEED Certification

A properly designed and installed control system can lead to fulfilled credits worth up to 48 points in the LEED rating systems, especially with the controls provider or system integrator involved in the LEED team. Minimally, the control system can help you achieve 22 to 26 points depending on the rating system you use. When the minimum level for building certification is 40 points, you can begin to understand the power of a control system.

Building automation has the most impact on the Energy & Atmosphere (E&A) section of the LEED rating system. This section also carries the most potential for LEED points. But points are possible in the Indoor Environmental Quality and Water Efficiency sections, and even the Sustainable Sites section.

It is important to understand the difference between a contributory LEED credit and a compliance LEED credit. With rare exception, the use of a particular product or type of product cannot, in and of itself, lead to credit compliance. For the most part, products, of whatever type, CONTRIBUTE to the fulfillment of particular LEED credits. As an example, a building automation and control system can COMPLY with E&A Credit 3.1 in the LEED EB: O&M rating system. Elsewhere, for both rating systems, building automation and controls systems CONTRIBUTE to credit compliance.

Consider E&A Credit 1 in both rating systems. It calls for "Optimized Energy Performance." For LEED BD&C, it means performance simulation compared to the ASHRAE 90.1 standard. For LEED EB:O&M, it means actual measurements against the EPA Energy Star criteria. One to 19 points (1-18 for EB:O&M) are available for this credit alone. And, simply put, for a commercially viable facility, achieving the requisite level of performance is not possible without a control system.

Consider also the fundamental and additional commissioning requirements for LEED certified buildings. The automation and control system is the commissioning agent's primary tool. Therefore, credit achievement is nearly impossible without the contributory help of the control system.

For More Information

If building sustainability, for whatever reason, is your goal, turn to KMC Controls for answers. For more than 40 years, we have designed and manufactured control system hardware and software for flexible building automation. We remain the only privately held U.S. manufacturer to offer a complete line of components and digital automation systems.

Learn more at www.kmccontrols.com or follow us on your favorite social media: