

Going Digital

New Technologies Including Building Automation Promise Greater Energy Efficiency

By Brad Berton

Sustainable design is taking a turn to the technological as it advances into the future. Automated systems and other higher-grade products offer promise of greater efficiency and cost control, both in existing buildings and new construction. The bulk of near-term investment emphasis will be on increasingly sophisticated computer programs. These will drive comprehensive energy management systems striving to more accurately monitor, and more effectively optimize, a property's energy consumption. Essentially, this means the use of building automation systems under direct digital control—so-called DDC systems.

Predictably, the cutting-edge emphasis is on boosting the efficiency of building systems that consume the most energy: those that keep interior space air temperatures at comfortable levels. Energy efficiency efforts do also extend to the latest lighting technologies and strategies, as well as more effective management of water consumption—a factor expected to become more meaningful to competitiveness as water becomes a more costly resource. Still, lowering air-conditioning costs will be the most meaningful sustainability-related technological improvement building owners and operators will adopt in coming months.

Climate Control

With EnergyStar and LEED certifications playing increasingly important roles in occupants' site selection efforts, building owners will continue upgrading HVAC systems to comprehensive, automated energy management systems. Traditional, mostly pneumatic HVAC controls will be replaced by innovative DDC systems that suppliers are developing today.

Modern DDC systems monitor energy use on an ongoing basis in increasingly detailed fashion, while also controlling consumption through coordinated mechanisms, explained



Lucid Design Group Inc. (www.luciddesigngroup.com) pioneered the Building Dashboard, which allows users to view, compare and share building energy and water use information via the Internet.

Zorana Bosnic, sustainable design director with architecture firm HOK.

Building automation systems increasingly in use are programmed to generate extensive data, which is graphically displayed to managers and other parties via so-called “dashboards.” The near-term future will see continued efforts to develop more customized and sophisticated dashboards that help managers identify efficiency improvement opportunities and share this critical information with building occupants, Bosnic observed.

Monitoring and benchmarking tools owners are tapping into these days can even track how buildings consume energy, depending on time of day, outside weather conditions and numerous other factors, added George Plattenburg, senior vice president with energy efficiency consultant Servidyne Inc.

Indeed, the quality and quantity of monitoring and control systems continue to rise, agreed energy efficiency advisor Mark Stetz of Stetz

Consulting L.L.C. “Submeters, wireless meter and submeter communications, and software are all becoming more readily available,” he said.

Ted Spear, a senior consultant with sustainability specialist Green Building Services, expects more building owners to upgrade to sophisticated energy management systems including “economizer” mechanisms that automatically tap cold exterior air to cool interior spaces when weather allows.

Owners generally will continue increasing the number of sensor-driven control points that automatically direct HVAC systems installed around large buildings to adjust for optimal comfort at the lowest energy-use level, Spear continued. A system that automatically shuts off high-energy-use boilers, chillers and fans when they are not needed can save significant energy, Spear stressed, adding that modern office buildings might end up with 20 or more control points on every floor.

As for smaller properties, manufacturers have started making building-top heating and cooling units that can automatically adjust to optimize the amount of exterior air being used based on the temperatures of the outdoor and indoor air. While these units for the time being are more expensive than predecessor technologies, the approach is an economical improvement over traditional units that operate with a fixed amount of exterior air, Spear noted.

Not too far into the future, Bosnic suggested, systems may well automatically open windows to help condition interior air, under appropriate weather conditions.

Plattenburg even foresees building managers soon implementing “smart grid” and “load shed” strategies based on automated responses to real-time communications with power suppliers about ongoing variations in energy prices. When utilities signal that costs along the grid are about to jump sharply, building operators can program

various minor changes that might collectively reduce energy loads by meaningful amounts.

In such cases, controls might be programmed to automatically reduce consumption through temporary and scarcely noticeable measures, such as turning off fountains, dimming lights, cutting back on air exhaust rates and slightly raising interior temperatures.

“Smart grid-enabling a building,” Plattenburg noted, “offers the flexibility to make operating changes based on pricing signals and benchmarking data.”

Spear, for his part, thinks the industry will also see more automation systems that know who is in the building and adjust climate-control activities in corresponding offices accordingly. Bosnic anticipates more extensive use of under-floor and hydronic HVAC systems, which are more efficient than traditional alternatives.

And the experts near-uniformly predict greater prevalence of geexchange-type HVAC mechanisms that tap the constant temperature of water tables to help cool or heat buildings on a low-cost basis.

Lights, Water—Wind?

The experts also predicted ongoing efforts to improve the energy efficiency of commercial building lights and lighting systems—no surprise given that this sustainability upgrade generates the fastest payback period. More sophisticated and automated dimming capabilities will supplement the switch to more energy-efficient bulb technologies, including light-emitting diodes, or LEDs.

“LEDs are obviously big,” Stetz said, “and

look for dimmable models as the next area of improvement.” As for lighting’s role in automated energy management, the movement today is toward “motion sensors everywhere,” added Roy Cook, managing senior vice president of engineering with the Transwestern group of service companies.

Bosnic expects more efficiencies driven by technologies allowing managers to dim lights and break building floorplates into various lighting zones. Energy efficiency will improve as building systems synchronize the intensity of artificial lighting with automated operations of window blinds, she noted.

“Otherwise, we’re relying on occupants to draw blinds, and we know that doesn’t happen as often as it should,” Bosnic observed.

Building skins may fairly soon even supplement solar arrays through high-tech coatings that act as collectors of solar energy, Bosnic added. And more owners will opt for white reflective membrane roofs, applications of which do not cost a lot but receive significant LEED scoring credit, Cook noted. In addition, products are under development that will turn roofs and other surfaces light gray to reflect heat when the sun is shining and back to dark to absorb heat when it is not, Bosnic noted.

Sustainability pros also stressed that water management is bound to garner more attention going forward. Modern monitoring technologies will help owners and managers more accurately track water usage, while strategies such as rain-water and air-conditioning-related condensation retention, native-plant landscaping and low-flow fixtures will help them reduce consumption.

Water- and waste-management innovations seem certain to take greater prominence in the near-term future as building owners and managers respond to inevitable substantial increases in water costs, Cook stressed. “I think water will be the next electricity,” he predicted, adding that Transwestern now tracks water use nearly as intensely as energy use, since as costs rise more efficient water use will translate directly into more competitive lease rates.

Further out is widespread adoption of solar arrays and wind turbines on commercial buildings. Absent considerable subsidies, solar arrays are unlikely to pencil out effectively until emerging photosynthesis-driven technologies become more efficient, Bosnic related. That is especially the case in urban settings.

Likewise, technology will need to improve before building-top (or -side) wind turbines sprout up to a greater degree even in windy locales. However, they can make sense in select situations on smallish scales, such as the 12-paired array featured at a new HOK-designed parking structure in Chicago, Bosnic added.

Wide regional and state variations in energy costs and public policy will also play a role in which sustainable technologies get adopted in various markets, Cook noted. Western states that provide rebates, tax credits and the like for investments into sustainable systems are bound to see new technologies faster than those in most of the rest of the country, where pure market economics rule.

“The absence of consistency across the country is something we struggle with,” Cook concluded.

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