Conservation on Capitol Hill

By Scott Shapleigh and Andy Wakefield

While programs to create an environmentally-conscious workplace have long existed on Capitol Hill, these efforts have intensified in recent years in response to growing concerns about rising energy costs and the need to protect the environment. Circumstances today now place Congress in the unique position of having an opportunity to shape energy policy while establishing itself as a leader in the effort to conserve energy.

The Office of the Architect of the Capitol (AOC) has been aggressively working to reduce the Capitol complex's overall energy consumption for a number of years. In addition, AOC is fully committed to meeting congressionally-mandated energy reduction goals established by the *Energy Policy Act of 2005*, the *Energy Independence and Security Act of 2007* and the Greening of the Capitol initiatives set in 2007.

In 2008, AOC conducted energy audits; purchased renewable energy; and installed more than 14,000 compact fluorescent light bulbs, which resulted in Congress reducing its energy consumption by 10.7 percent, exceeding the FY08 requirement of a 9 percent reduction as compared to the FY03 baseline.

Spotlight on Senate Offices

Over the past several years, AOC has been proactive in implementing a comprehensive energy management program that targets the Senate office buildings. The program focuses on improvements and upgrades designed to impact both the supply and demand sides of the energy equation. Some of these efforts include upgrading HVAC systems with the most energy-efficient technologies. For example, new direct digital control capabilities allow facility managers to set temperature controls to predefined settings.

AOC also has implemented a building-wide metering system for Senate office buildings. The system currently meters all electricity and chilled water at the building level and will soon include sub-metering capabilities. This will allow AOC staff to view energy consumption of individual floors or wings of buildings for improved energy management. Steam meters will be installed in the near future to better monitor heating energy use.

On the demand side, strategies include implementing an energy awareness program as well as evaluating equipment and processes to determine where upgrades or changes can be made to reduce consumption. A key component in this strategy is AOC's lighting program. According to the Department of Energy, lights account for 39 percent of the electricity used in office buildings. Therefore, improvements in this one area can provide substantial savings in energy costs.

As lawmakers in Washington, D.C., work to guide the nation's future energy policy, their own office buildings are becoming increasingly efficient.

With an intelligent fluorescent dimming system like this one in the offices of the *New York Times*, lights automatically dim when daylight is available.

Defining the Strategy

Initial lighting projects undertaken by AOC include installation of the following technologies: compact fluorescent light bulbs; dimmable ballasts in offices; and night set-back of nonessential lighting. These projects are expected to reduce energy consumption by approximately 1.5-million-kWh annually, which equates to the annual consumption of 150 U.S. households.

While reducing energy costs is a fundamental goal of the program, also important is improving lighting control flexibility, which is scalable over time as needs change. The existing overhead fluorescent lights in the buildings were originally configured with on/off capability only, and offered limited control of individual rooms. Therefore, it was important that the retrofit would save energy as well as give occupants more control of their environment, with configurable illumination levels throughout each building and room.

Precision and Flexibility

At the center of AOC's new lighting management system is a network of digitally-addressable dimming ballasts that incorporate greater flexibility, from precise control of one's personal workspace to building-wide control from a central management system. The system also includes daylight sensors near windows, occupancy sensors and additional switch panels for individual control of conference rooms.

The technology allows light levels to be reduced on a per-fixture basis, with the highest available output preset at a maximum of 70 percent of full light. As a result, when anyone turns on a light, the system provides an automatic 30 percent savings in lighting costs. The system also saves energy through scheduled control strategies: Each night the system is programmed to turn off a select number of the lights on every floor. Lights within individual workspaces can be customized and preset based on occupant-requested illumination preferences or as needs change.

Because every element of the system is digitally designed, lighting scheme changes within rooms, floors, or an entire building can be accomplished with a programming menu and without rewiring. Therefore, as floor plans change or space is reconfigured or expanded, the lighting strategy can be easily adapted. This programming flexibility also allows AOC staff to set an optimum light level for each light in an area of the office. In walkways, for example, lights can be set to a maximum 60 percent output; in private offices, the light requirements range from 40 to 70 percent.

Leveraging Daylight

Because the buildings receive a significant amount of direct sunlight as well as reflective light, daylighting technology is an important component in AOC's lighting strategy. Using innovative daylight harvesting capabilities, the system allows AOC to dictate light levels centrally and locally throughout buildings, corridors and rooms as well as customize lighting schemes to each environment, even accounting for seasons and time of day.

The daylighting solution helps maintain appropriate, balanced levels of light throughout the day, utilizing sensors and controls to automatically and gradually tune the use of electric light in direct response to changes in available daylight. This ensures proper levels of light without manual intervention (such as removing bulbs), and also controls costs directly related to energy consumption. As the needs of a space change, wall controls, occupancy sensors, and daylight sensors can be reassigned to different fixtures or groups of fixtures. The system also is scalable and integrates with other energy saving devices for control in other lighting areas.

Centralized Control

The fluorescent dimming system is networked and controlled from a central computer, allowing AOC staff to control, monitor and report on all the lighting from one location. The lighting management system tracks usage and provides ongoing alerts regarding possible lamp outages, enabling maintenance staff to predict more accurately the life of a lamp. Previously, lamps were replaced based on a defined schedule whether or not they were near the end of their useful life. AOC staff can now better anticipate when a lamp needs replacement, helping to reduce maintenance costs, make more efficient use of staff time and take full advantage of the available life of the product.

One key advantage of the control system is its immediate demand-response capability. This allows AOC to shed a percentage of its lighting output at times of peak usage to avoid extra charges, blackouts, or brownouts. With the push of a few buttons, the system will instantly reduce the output of every light tied into the system by a specified percentage. This allows the AOC to quickly load-shed an entire facility or particular space as needed.

Reaping the Rewards

During the first year, AOC's lighting program saved approximately 150,000-kWh of electricity, enough to power about 15 U.S. households annually. To date, AOC has equipped 21 senatorial suites with the new lighting technology and will continue with the installation in all Senate offices over the next few years. Overall, the program has helped AOC achieve an average of 40 percent savings in lighting energy. Equally important, AOC has received positive feedback from staffers about the new lighting system. Many of their comments relate to the benefits of the softer lighting and the ability to customize individual lights to meet their specific environment or comfort preferences.

The lighting program has proven to be an important component in AOC's overall energy management strategy and provides a solid foundation for future implementations. With a program that reduces energy costs, improves lighting quality and controls flexibility while increasing the satisfaction levels of the occupants, AOC was able to create the framework of an ultimate win-win solution. TME

Scott Shapleigh is Facilities Project Manager, Senate Office Buildings, Office of the Architect of the Capitol; 202-224-6344, or sshaplei@aoc.gov.

Andy Wakefield is Government Business Development Director; 610-282-7361, or awakefield610@gmail.com.