Occupancy Sensors

ENERGY SAVING – FACT SHEET

Opportunities for Occupancy Sensors in Lighting Systems

Occupancy sensors automatically turn off lighting in unoccupied spaces such as classrooms, conference rooms, public spaces, dormitories, and large offices.

The typical office spends 29% of its electrical energy costs for lighting.[1] Occupancy sensors can reduce these charges by 50% or more, at an energy savings of 5¢ - 20¢ per square foot.[2] These sensors, which are usually infrared and/or ultrasonic, are most effective in those areas which are often unoccupied, such as corridors and conference rooms.[3]

Technologies: Infrared and Ultrasonic

Two technologies dominate the occupancy sensor market: infrared and ultrasonic. Passive infrared sensors detect temperature changes in a room, and work well where the entire room is within the sensor's field of view. Ultrasonic sensors use high frequency sound, much like bats do, to detect motion (even around corners). Dual-technology sensors use both methods, increasing accuracy and flexibility, but at a higher price.

Choosing the Best Applications

Facility staff can determine the best areas to install occupancy sensors by using lighting loggers or random surveys about room/area occupancy. Lighting loggers can count lighting hours and can correlate lighting duration with detected occupancy. Recording ammeters document lighting energy use. See chart for potential energy savings for various types of building spaces.

Installation & Cost Information

Proper placement and orientation of occupancy sensors is essential. Placement of controls should take into account furniture placement as much as possible. Occupancy sensors must be able to sense all occupants to avoid turning off lights while the space is occupied. At the same time, the sensitivity of the sensors must be set to avoid "false-on" incidents triggered by passerbys in adjoining hallways. Occupancy sensors with their sensitivity set too high can fail to save energy, and occupancy sensors with too low a sensitivity or too short a delay time can be annoying to occupants. Commissioning and calibration of lighting controls are essential if energy savings are to be achieved and maintained.

Occupancy sensor costs range from approximately $30 to $130, depending on the type. Payback period of occupancy sensors retrofits range from 0.5 to 5 years, depending upon the level of occupancy and energy savings potential of the area controlled.

Successes with Occupancy Sensors

NCSU Facilities Staff is testing the use of occupancy sensors as a retrofit application in various classrooms in Dabney and Broughton Hall on the North Carolina State University campus. The sensors were installed by NCSU Facility Management staff and classroom energy consumption and occupancy has been monitored by the NCSU Industrial Assessment Center (IAC). Initial adjustments were made to sensor's sensitivity to reduce 'false triggers' by passerbys outside of the classrooms. IAC staff also recommend the use of dual sensing technologies for optimum performance. Sensors were installed in a drop acoustical tile ceiling.

IAC staff have measured an approximate reduction of 30% in lighting electrical load since the installation of the sensors. After the optimization of the sensors, students and instructors have been pleased with lighting control functions. For more information, contact Alan Daeke, Director of Utilities and Engineering Services, NCSU, (919) 513-5081 or e-mail: alan_daeke@ncsu.edu.

Estimating Potential Cost Savings from Occupancy Sensors

Square Footage Basis

_______sq.ft. area of application. x 3000 hrs of operation/year* x $\frac{\_\_\_\%}{100}$ time unoccupied** x 1.5 Watts/sq.ft. x $0.081/kWh*** x 0.001 = $__________ savings/year

Lighting Fixture Basis

_________# of fluorescent fixtures controlled by sensors x 3000 hrs. of operation/year* x $\frac{\_\_\_\%}{100}$ time unoccupied** x ____ Watts/fixture**** x $0.081/kWh*** x 0.001 = $ _________ savings/year

* typical annual hours for a one shift/office operation. Adjust for specific applications.
** Reference U.S. EPA Chart below
*** Assumes 1.5 watts per square foot of lighting energy density with an average commercial rate of 8.1¢ per kWh in NC.
**** Use 72 watts for a 4 foot, 2-lamp, T-12 system. Use 144 watts for 4-lamp, T-12 systems; 58 watts for 2-lamp T-8's; 94 watts for 3-lamp T-8's; and 112 watts for 4-lamp T-8 systems

Potential Energy Savings From Occupancy Sensors:[3]
(Estimated Time Unoccupied)

Type of Space	U.S. EPA Prediction	EPRI Prediction
Private Offices	13-50%	38%
Classrooms	40-46%	58%
Conference Rooms	22-65%	50%
Restrooms	30-90%	60%
Corridors	30-80%	-
Storage Areas	45-80%	-

Alternatives to Occupancy Sensors

Occupancy sensors are used in place of establishing the occupants' behavior to shut off lights upon exiting a room. For applications where the installation of occupancy sensors is cost prohibited, note the following options:

- raise awareness for building occupants with light switch stickers and educational materials,
- require custodial and security personnel to turn lights out, and
- consider controlling lights with timers or through existing energy management systems.

References & Resources:

1. Lighting Control Types, Federal Energy Management Program. http://www1.eere.energy.gov/femp/procurement/eep_light_controls.html
2. .Electric Power Research Institute (EPRI) Advanced Lighting Guidelines—Section 8 (Search for: Product ID: 1005992) http://my.epri.com/portal/server.pt?
3. Whole Building Design Guide http://www.wbdg.org/resources/electriclighting.php

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