

Energy-saving Strategies for Luminaire-integrated Lighting Controls

The LRC conducted a study to determine how various parameters affect the energy savings from luminaire-level lighting controls (LLCs), also called luminaire-integrated controls, in an open office setting.

Laboratory measurements were made of five commercially available LLC motion sensors to determine the field of view of each when detecting medium motion. Field measurements were made in an open office with a drop ceiling that included 60 occupied cubicles. A photometric simulation was conducted to determine a simulated layout of 2 ft x 4 ft LED troffers that would provide an average illuminance of 323 lx (30 fc) on the work plane. At each location in the open office where a troffer would be in the simulated lighting layout, two data loggers with motion sensors, one with a wide field of view and one with a restricted field of view, recorded the occupancy over two days. The recorded data were used in a custom MATLAB program to determine when each



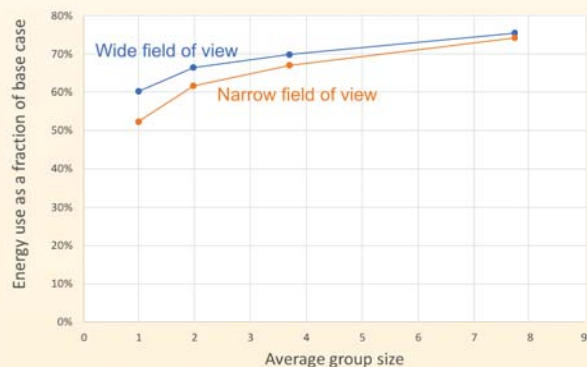
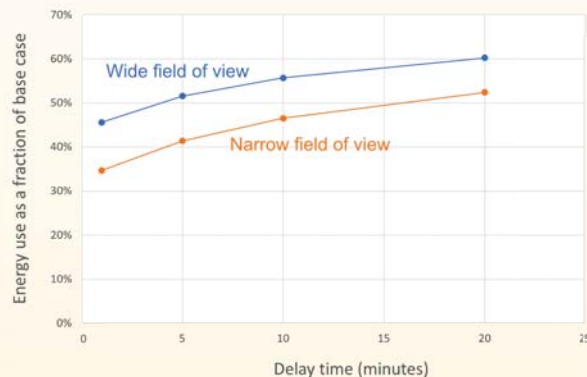
luminaire in a simulated installation would be on, dimmed, or off over the two-day period, and total energy use was calculated. Twenty-one simulations were conducted to determine how energy use varied with changes in the four investigated parameters.

The results illustrated that LLCs offer significant energy savings potential in open offices; the average energy use of the 21 simulations represented a 43% energy reduction compared with the calculated manual-control base case.

The results also showed that choices made during LLC selection (e.g. sensor field of view) and commissioning (e.g. delay time, grouping, dimming vs. turning off during vacancy) have an impact on potential energy savings. For example, in the monitored open office:

- Setting the delay time to 5 minutes reduces energy use by 21% compared with using the typical default of 20 minutes.
- Leaving troffers ungrouped reduces energy use up to 29% compared with connecting troffers into groups of eight.
- Selecting a narrow field of view sensor LLC reduces energy use by 18% compared with using a wide field of view sensor.
- Turning off troffers completely during vacancy reduces energy use up to 14% compared with dimming troffers to 20% light output when vacancy is detected under the troffer but there is occupancy elsewhere in the room.

Selecting LLC products and settings for maximum energy savings has the potential to adversely impact occupant satisfaction. Lighting specifiers and installers should balance energy savings with the needs of occupants.



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