SCE DRET Findings
November 2011

ET11SCE1.05.02: Demand Response Tests of Lighting in a Typical College Corridor

OPPORTUNITY

What is the potential for DR Lighting in college corridors?

The typical college corridor is representative of an office space. According to the California Commercial Energy Use Survey (CEUS), offices are the single largest draw of commercial energy use in California. Offices represent 21% of the total commercial square footage and 25% of total commercial energy usage in California. In the SCE service territory, offices represent 18% of commercial square footage (385,110,000 sf), and have an interior lighting connected load of 1.16 Watts per square feet (W/sf).

TECHNOLOGY

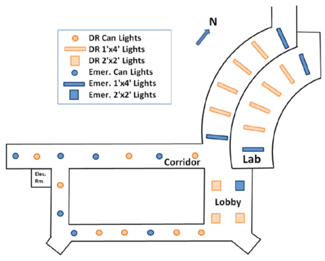
How does DR Lighting in corridors work?

The technology tested in this study is an advanced lighting control system (ALCS), which includes three types of LED fixtures, all which include DR control capability and an occupancy sensor. Lighting control system Redwood Systems RE64 (Redwood Engine) conducts reliable operation of the LED fixtures. It provides full dimming for LED fixtures that use 60W or fewer and uses Redwood occupancy sensors. Full dimming allows for optimization of light levels to accommodate the user's comfort while maintaining maximum energy savings.

M&V

Where did Measurement and Verification occur?

The ALCS was installed in the corridor and teaching lab lighting on the ground floor of the Natural Sciences 1 building at the University of California, Irvine (UCI). Data loggers were installed in each individual light fixture to collect electric load profile data during DR testing, and to measure demand reductions attributable to the ALCS.



RESULTS

How did DR Lighting in a typical college corridor perform in M&V?

Demand Response Test Days

DR testing was conducted for the same business hours over three separate days in November of 2011: Nov. 2, Nov. 3 and Nov. 8. During the test periods recording intervals were 1-minute. After the first two test days it was determined the tests should include periods with all the lights on. The occupancy timeout was increased from 6 seconds to 10 minutes. The third day of the test (Nov. 8) was not representative of typical operation because monitoring staff continually walked through the hall to turn on the lights. A fourth day (Nov. 16) was added to the test where the lights were programmed to stay on and run through an identical set of DR levels at a faster pace.

Demand Response Reduction

The average demand reductions from this study across all fixtures were as follows: 23 W (0.011 W/sf) at 10% DR level; 30 W (0.015 W/sf) at 15% DR level; 36 W (0.018 W/sf) at 20% DR level; 55 W (0.028 W/sf) at 25% DR level; and 62 W (0.031 W/sf) at 30% DR level. The maximum DR reduction of 62 W represents an approximately 43% reduction of average wattage. In an alternative analysis, the impact of dimming from the occupancy sensors was ignored. This resulted in a maximum DR reduction of 236 W (0.118 W/sf) or 54% of the commissioned wattage from the fixtures at the 30% DR level setting.

Space Type Important in Demand Savings

The occupancy sensor controls have a timeout of 6 seconds for individual corridor lights. The result is they are off most of the time, and no DR reduction is available if the lights are off. The teaching lab lights have a 10-minute timeout that controls all four of the fixtures in the lab. Almost all the DR reduction is attributable to the lights in the teaching lab because these lights are on for most of the day.

DEPLOYMENT

What are the recommendations moving forward regarding DR Lighting in a college corridor?

Additional recommended steps:

- This pilot only explored incremental DR settings up to 30%. Future studies that examine greater power reductions (for example, incremental DR settings up to 50%) could further the understanding of the power saving potential of this ALCS.
- Further study of the market impact of mass implementation of this ALCS would improve our understanding of factors related to easing the stress to the electric grid.