DLC Advanced Lighting Technology Demonstration: Philips SpaceWise

This demonstration is one in a series of advanced lighting demonstration projects being completed through a joint initiative between the DesignLights™ Consortium (DLC) and the U.S. Department of Energy. Additional partners for this site included National Grid plc, Philips, and Rise Engineering.

Demonstration Site
The Rhode Island Public Utility Commission (RIPUC) occupies a multi-story, 19,400 ft² office building constructed in 1980 in Warwick, Rhode Island. Although the facilities were lighted with standard T8 fluorescent technology, the LED lighting and intelligent controls retrofit completed in 2016 offered additional savings and better quality lighting and control. The RIPUC installed the new LED lighting and intelligent control system. The advanced software options allow for customization of light levels to meet application and occupant needs.

Demonstration Technology
The Philips SpaceWise technology is a fully integrated wireless control system applied at the luminaire level that provides plug and play lighting energy savings. It has application modes for open plan offices, private offices, meeting rooms, corridors, and emergency egress; on-board technology provides dimming in response to both occupancy sensing and daylight harvesting. Full light output is delivered only to occupied workstations with background settings typically at only 1/3 of full output. In addition, the system allows for task tuning to adjust lighting to desired levels and daylighting control requires no separate zoning or configuration. For this demonstration, the scope of the project included replacement of the existing luminaires with new Philips DuaLED luminaires with on-board controls.

Project Savings
The Cadmus company measured the lighting system energy use before and after the upgrade with and without lighting controls. The results of the measurements show that replacement of older fluorescents with LEDs alone saved 64% of the estimated annual lighting energy use. Along with this savings was a modest reduction in excessive pre-retrofit light levels in many areas. With advanced occupancy sensing and daylighting controls, an additional 3% of the baseline energy use was saved for a total of 67% estimated to be 39,500 kWh. The corresponding reduction in facility energy cost is approximately $4,700 annually. The total project cost is $110,900 and will pay for itself in just under 15 years after $41,000 in utility rebates from National Grid. A more basic fixture from the manufacturer with similar capabilities could have been applied at $83,300 for a payback of just over 9 years with the rebate.

The low energy savings (3%) from controls at this site are because of limited occupancy sensor savings. This includes enclosed offices and restrooms that already had occupancy sensors. The new embedded occupancy sensors were also set to "automatic-on" and gradually dim to off after the space is unoccupied for 25 minutes. While this configuration may provide occupant satisfaction benefits, it may increase energy use vs. traditional occupancy sensors that automatically turn lights off when unoccupied and use a "vacancy" control strategy requiring a manual switch to turn lights on.

Installation and Operation
RIPUC office hours are from 8 AM to 4 PM, 5 days a week. Pre-retrofit lighting controls were a combination of wall switches and some on-off occupancy sensors. The variety of departments with differing functions in the facility provide some occupancy variance creating energy harvesting opportunities for advanced controls.

### Advanced Lighting Control System
Advanced lighting control systems can incorporate a variety of options. The SpaceWise system offers the following:
- Occupancy Sensing
- Daylight Harvesting
- High-End Trim / Task Tuning

### Occupant Lighting Satisfaction

#### BEFORE THE LED RETROFIT
A staff survey of 38 occupants found the following:

- 89% Between Neutral and Very Satisfied with Overall Lighting Conditions
- 22% Lighting Too Bright At Times
- 78% Occupancy Sensor Control of Lighting is Acceptable or Satisfying

#### AFTER THE LED RETROFIT
A staff survey of 13 occupants found the following:

- 100% Very Satisfied or Neutral with Overall Lighting Conditions
- 15% Lighting Too Bright At Times
- 77% Occupancy Sensor Control of Lighting is Acceptable or Satisfying
- 62% Daylighting Controls of Lighting is Acceptable or Satisfying

*Before and after the retrofit 1 respondent found the light too dim.
**Facility Acceptance**

The installation contractor who installed the LED lighting found the process to be straightforward and generally similar to installing standard fluorescent fixtures. System controls commissioning was provided by the manufacturer and was relatively quick to implement in this mostly standard office facility. Facility operations staff reported that the system software required a learning curve, but found the system made it very easy to check the occupancy sensor operation (typically a cumbersome task). This system when initially installed did experience issues with proper programming and fixture operation. After exploring the issues, the system provider determined there was a manufacturing issue with the LED drivers. After the replacement of the drivers, the system is functioning as designed and operating well to meet the needs of the occupants.

**Application Determines Savings**

In most areas, the technology change from fluorescent to LED fixtures provided the majority of savings. Controls offered additional savings when they were not present before. Control savings can vary widely depending upon the type of activity and facility function.

**Lighting System Performance**

Pacific Northwest National Laboratory took measurements in selected open areas to compare lighting performance before and after the retrofit. These open areas provided clean comparison relative to typical office areas.

**Annual Extrapolated Energy Consumption by Space Type**

These results represent potential savings for one building type with representative space types and activities. It is important when choosing a lighting system and controls to determine the best fit for the given mix of space types and activities.