

# DLC Advanced Lighting Technology Demonstration: Cree SmartCast

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 Con-Serv Inc., Cree Inc., EverSource, Energize CT, and Langlais Group Inc.

## Demonstration Site

The medical office facility located at 44 Dale Road in Avon, Connecticut houses multiple healthcare providers in three-stories of mixed use space including: offices, examination/procedure rooms, and testing laboratories. Constructed in 1985, this 30,500 ft<sup>2</sup> building was initially outfitted with fluorescent lighting. The building owner chose the recent LED lighting and controls retrofit to harvest extra savings and to improve lighting and control quality. The new LED system provides wireless communication, and advanced sensor options allowing for customization of light levels to meet application and occupant needs.

## Demonstration Technology

The Cree SmartCast technology, applied at the luminaire level, incorporates wireless controls which supports easy one-for-one replacement. The installed system offers area control applied to subgroups of fixtures based on room environments. This grouping and control activation was completed wirelessly using Cree's hand-held remote commissioning device. Onboard sensing including occupancy sensing and daylighting can be activated on an individual fixture and/or group basis. Final commissioning included activation of occupancy sensing for all fixtures and daylighting control for those next to windows. Building managers set light levels based on tenant preferences. The SmartCast technology allows tenants to change light settings as needed with available remotes, for this study access to lighting controls was limited to building managers and lighting installers to ensure data consistency.

## Project Savings

Pacific Northwest National Laboratory managed the measurement and verification component of the demonstration and the Cadmus Company completed the field measurements. Lighting system energy use was measured before and after the upgrade to capture the energy savings provided by the new LED system. In addition, power measurements of existing and retrofit LED fixtures were taken to confirm total savings without the advanced controls. The resultant analysis shows that replacement of older fluorescents with LEDs alone saved over 29% of the estimated annual lighting energy use at this site. Note that a significant portion of this is attributable to the reduction in light levels correcting previously overlit areas in the building.

With advanced occupancy sensing and daylighting controls, energy savings increased by an additional 33% for a total of 62% savings from baseline conditions. Estimated total annual savings is 69,000 kWh per year. The corresponding reduction in facility energy cost is approximately \$8,200 annually. The project cost for the chosen fixtures totaled \$92,500, with payback in 6.7 years after EverSource utility rebates of over \$37,950 are applied.

## Installation and Operation

The medical offices operate on a typical 9 AM to 5 PM, 5 days a week schedule. Lighting controls consisted of integrated occupancy and daylight harvesting sensors onboard each fixture. The commissioning process set base light levels to meet occupant needs, set occupancy shut off controls to match occupant space use,

MEDICAL FACILITY AT 44 DALE ROAD, AVON, CT



The building owner updated the building lighting for energy savings and improved lighting quality. Photo courtesy of Google Earth.

## Cree SmartCast Luminaire

Photo courtesy of Cree, Inc.



Advanced lighting control systems can incorporate a variety of options. The SmartCast system offers the following:

- Occupancy Sensing
- Daylight Harvesting
- High-End Trim/Task Tuning

## Occupant Lighting Satisfaction

### AFTER THE LED RETROFIT

A staff survey of 28 occupants found the following:

**79%** Satisfied with new light levels

**64%** Overall satisfied with lighting controls

**86%** Overall satisfaction with new lighting

and set up daylighting control in areas with windows to take advantage of sunlight. Some occupants declined to have daylighting control activated in their space.

PROJECT ENERGY SAVINGS		
Total Lighting System Savings*		
New LED Fixtures Only	New LED Fixtures with Controls	
29%	62%	
Lighting Control Savings**		
Light Level Task Tuning***	Occupancy Sensor Shutoff	Daylight Harvesting
8%	28%	10%

\* Installation of the more energy efficient LED fixtures along with reduced light levels in overlit spaces contributed to 29% of the savings. Remaining savings were due to advanced lighting controls.

\*\*The data also shows, that at this site the advanced controls alone, reduced the lighting energy use of the new LED fixtures by 46% (8% + 28% + 10%).

\*\*\*Task tuning was performed twice at this site. The final adjustments were made after the energy metering period started and resulted in the estimated reduction for this site. The light level trim was completed to adjust high initial LED fixture levels.

NOTE: Applications with different installed equipment, layouts, and occupant needs could see higher or lower savings.

### 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.

Note: 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 a given mix of space types and activities.

### Facility Acceptance

Con-Serv Inc., the contractor who installed the new fixtures, found the system easy to install, much like a standard fluorescent fixture. The control system programming was new to the installer, however instructions were sufficient to complete the commissioning process. Commissioning this system took approximately 10 minutes per fixture which included adjusting to the tenant’s preferences. Although making the adjustments to meet tenant needs required time, they were relatively easy to make.

Facility operations staff reported that the SmartCast interface and system was fairly easy to set up and operate using the provided remote control. The system was considered more involved, but easier to control than a standard fluorescent system. Staff noted the light quality of the new system was comparable to the old system.

Shortly after initial installation, issues were noticed with fixtures experiencing loss of control settings and shutoffs; issues were eventually attributed to faulty onboard drivers. All units were replaced in the facility resulting in no operational issues since replacement. In some cases, commissioning changes at the site including occupancy and daylighting settings to meet occupant desires, caused energy use to increase post retrofit.

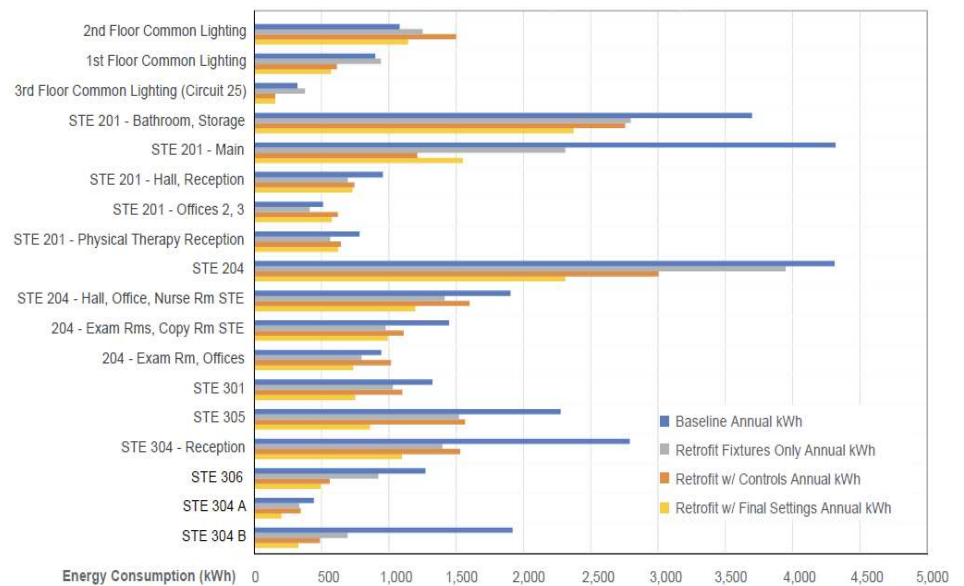
### Lighting System Performance

Lighting measurements were taken in selected open hallway areas with lighting layouts that were representative of the majority of the building to compare lighting performance before and after the retrofit.

Location	Before* (fc)	After* (fc)	% Change
Suite 304/ Eye Care	62.7	24.7	-61%
304/303/305/306 Hallway	56.1	14.8	-74%
Suite 204/ Healthcare	49.1	29.4	-40%

\*measurements taken at floor level for consistency, and listed in footcandles (fc). Light levels before the retrofit were mixed with some higher and some lower than Illuminating Engineering Society (IES) recommendations. The post-retrofit light levels in these areas all generally meet or exceed IES recommendations. This reduction in light levels accounts for a significant portion of the energy savings at this site which may or may not occur in other site projects.

### Annual Extrapolated Energy Consumption by Space Type



This technology demonstration is supported through a partnership of multiple organization including:

