

DLC Advanced Lighting Technology Demonstration: Daintree ControlScope®

This demonstration is one in a series of advanced lighting demonstration projects being completed through a joint initiative between the Design Lights™ Consortium (DLC) and the U.S. Department of Energy. Additional partners for this site included Opterra Energy Services, GE Current, Eversource, and Stop & Shop New England.

Demonstration Site

The Stop & Shop store in New Bedford, Massachusetts is a 73,000 ft² full-service grocery store with offices and a smaller mezzanine area upstairs. Originally, the building had fluorescent lighting and the building owners were interested in the savings potential offered by new LED technology and advanced controls. The task tuning ability was particularly of interest as it ensures quality lighting for the various products, consumers, employees, and tasks in each section.

Demonstration Technology

Current's Daintree ControlScope® Manager (CSM) is a lighting control software solution using Zigbee mesh networking. This networking system can set up fixture groups within the CSM to facilitate localized control. LED luminaires such as the Cooper Corelite™, Cooper Encounter™, and Precision Paragon™ were shipped with pre-installed Zigbee-enabled controls compatible with the Daintree Control System. All luminaires were set up with built-in occupancy and daylight harvesting sensors and can be task tuned with Daintree software.

The CSM software scheduling feature provides for light levels to be tuned to specified levels at specified times. Occupancy sensing was activated in certain areas, task tuning was enabled in fixture groups as suited to location and occupant use, and daylight harvesting was activated in the fixtures by the store front windows.

Project Savings

Pacific Northwest National Laboratory managed the measurement and verification component of the demonstration and the Cadmus Company completed field energy measurements of the lighting system before and after the upgrade to capture the energy savings of the new LED system. The results show that initial replacement of older fluorescents with LEDs saved 30% of the estimated annual lighting energy use.

Energy savings increased by an additional 36% with task tuning and occupancy and daylight sensing controls. Task tuning was used to set operating light levels according to store management requirements for optimum retail sales conditions. This resulted in post-upgrade light levels that were visually brighter to management but measured lower than pre-upgrade levels. Occupancy sensing was used to set reduced light levels rather than fully off in most spaces when not occupied, saving an estimated 18,000 kWh/yr.

Total annual energy savings is estimated to be 439,300 kWh, which is a 66% savings over the baseline energy use at this site. The corresponding reduction in facility energy cost is approximately \$65,985 annually and the total project cost, as installed was \$583,061. Project payback is calculated to be 7.5 years after the \$92,253 EverSource utility rebates are applied.

Installation and Operation

The Stop & Shop store departments operate on varied schedules ranging from 6 AM to 12 AM, Monday through Saturday, and 7 AM to 9 PM on Sunday. The new advanced LED Daintree control applied differing task tuning levels to accommodate the needs of each department.

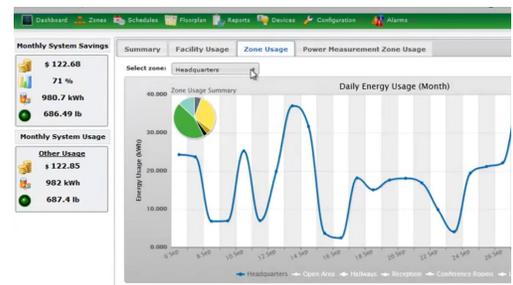
STOP & SHOP STORE, NEW BEDFORD, MA



The building owner updated the building lighting for energy savings and improved lighting quality. Photo courtesy of Google Earth 2017.

Daintree ControlScope Manager Advanced Lighting Control System

Photo courtesy of Current, powered by GE



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

- Occupancy Sensing
- Daylight Harvesting
- High-End Trim/Task-Tuning
- Scheduling On/Off Functionality

Cooper Corelite™

Photo courtesy of Cooper Lighting.



Building managers used the Daintree controls to customize lighting levels, such as setting the main sales floor lighting at 60% of full output from 7:00 AM to 10:30 PM, then at 40% from 10:31 PM until 6:59 AM.

PROJECT ENERGY SAVINGS

Total Lighting System Savings*

New LED Fixtures Only

New LED Fixtures with Controls

30%

66%

Lighting Control Savings**

Occupancy Sensor Shutoff

Daylight Harvesting

High-End Trim / Task Tuning***

4%

(~)

47%

*The 30% energy savings resulted from installing more efficient LED fixtures. The additional 36% resulted from tuning the new lighting down to preferred operational light levels in addition to occupancy and daylighting controls.

Data shows, at this site, the advanced controls alone reduced the energy use of the new LED fixtures by 51% (47%+ 4%). This includes significant task tuning with some occupancy-based and scheduled dimming. With few windows onsite, daylight harvesting and related savings were insignificant. *Task tuning was set as the first control stage after installation of the LED luminaires, and before occupancy sensors and daylight harvesting were activated.

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 a significant portion of the savings. A combination of task tuning and the new occupancy-based controls more than doubled the savings. Note that occupancy-based control savings were limited because of the general retail need for consistent light levels throughout sales areas during business hours.

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

The facility operator reported that the Daintree CSM advanced control system was easy to understand, set up, and configure. Once the system was completely commissioned, no further actions were needed. Set up time took about 16 hours to create control zones and configure settings to meet occupant needs.

The facility operator did comment that initially, a few fixtures lost communication once due to external issues, but each fixture was easily reset from full light output back down to the task-tuned level. Challenges such as short sensor delay times were minor and readily resolved. In comparison to the old fluorescent lighting, the facility operator found the new LED lighting improved lighting quality for staff and customers.

Lighting System Performance

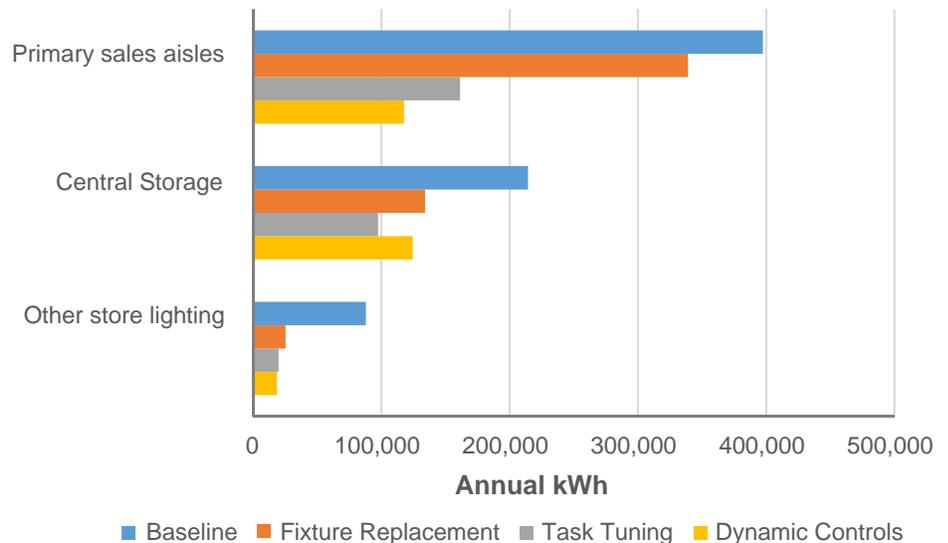
Lighting measurements were taken in selected areas that were representative of the majority of the building. Vertical measurements in a sales aisle were also taken to show the critical illumination of the face of products in the aisles.

Location	Before* (fc)	After* (fc)	% Change
Conf Rm /Lunchroom	23.3	17.9	-23
Floral Shop	63.7	32.7	-49
Central Storage	17.6	14.9	-15
Cracker/Juice Aisle	45.5	38.6	-15
Juice Shelves (Vertical)	38.1	40.9	7

* measurements taken at floor level (or at face of product for vertical) for consistency and listed in footcandles (fc)

Final Light levels after the retrofit were based on direction from store management to create optimum retail lighting conditions. Because of the perceived brightness of the new LED technology and some overlighting prior to the retrofit, the resulting measured floor light levels were found to be generally 15% - 49% lower than before. However, the critical vertical measurements were found to be 7% higher than before the retrofit.

Annual Extrapolated Energy Consumption by Space Type



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

