April 16, 2019

REPORT # E19-381

LLLC Savings Methodology Review

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MEMO

TO: Meei Lum, Kathryn Bae, NEEA
FROM: Nicholas O'Neil, Energy 350
SUBJECT: LLLC Savings Methodology Review
DATE: April 16, 2019

1. Overview

Energy 350 was requested to review the approach for quantifying savings from Luminaire Level Lighting Controls (LLLCs) using the RTF's regionally accepted assumptions for Controls Savings Fractions (CSFs) and Hours of Use (HOU) and applying them to distributor sales data.

The RTF publishes savings methodologies for non-residential lighting retrofits as well as code compliant lighting installations. The RTF has separate documents (a standard protocol and an associated savings calculator) that outline the savings methodologies used for each application. Both applications rely on a single workbook that provides default values for hours of use and control savings fractions from a variety of sources available in the region. (NonResidentialLighting_CSFandHOU_v1_1.xlsx) Assumptions in this workbook serve as the basis for NEEA to estimate savings of LLLCs and applying it to distributor sales data.

2. Approach Review and Findings

Claiming savings from distributor data of LLLC fixture sales relies on three primary factors:

1. Careful cleaning of Distributor Sales data to ensure only products that are LLLCs are included,
2. Application of the RTF's HOU values based on various building types, and
3. Application of the RTF's default CSF values based on different control features.

The sample distributor data provided to us by NEEA appeared incomplete and therefore we did not attempt to validate savings calculations made off distributor data as part of this review. However our assumptions are that each line item will be validated by NEEA or its contractor as a viable LLLC product, and that quantities marked as returns will be netted out of the final savings calculations. Then the appropriate HOU estimate would be applied based on building type and the resulting CSF applied to arrive at a final savings.

2.1 Approach to establishing HOU estimates

In most cases distributor sales data does not specify the building type where the fixture will be installed and therefore an estimate of HOU must be made in order to calculate final savings. NEEA's approach to designating a building type when it is unknown appears sound, as most applications for LLLCs are either warehouse (which utilize specific fixtures)

or offices. Therefore we do not foresee a significant issue with over or underestimating savings by assigning Office HOU to unknown building types.

We do suggest using the RTF's most recent HOU estimates for each building type that is specified by distributor and only assigning the default HOU associated with Offices to unknown building types. For example, a Hospital building type was specified in the provided distributor sales data and should be assigned a value of 4,200 HOU in line with the RTF's most recent estimates rather than the Office HOU estimate. In the appendix below we have combined common building types (which are unlikely to be split out by distributor data) and recommend using the average HOU for that general building type category when more specific information about building size is unknown.

Additionally, any building type specified by distributor sales data that indicates a residential installation should be netted out of final savings estimates as the RTF default values are specifically for non-residential building types.

2.2 Approach to establishing CSF estimates

The fundamental equation used to establish savings for LLLCs in NEEA's approach memo is correct, but only when applied to retrofit installations. In these cases, the assumed replacement control is a manual switch, and therefore LLLC's should claim the full 50% CSF (in most building types) over the default manual switch (0%).

For new construction/major renovation installations however, the savings from controls must consider the counterfactual baseline control that a code compliant building would install. Therefore to accurately claim LLLC savings independent of code savings we suggest taking the LLLC CSF for each space and subtracting the CSF for the likely code compliant control strategy to arrive at a net CSF for LLLCs in new construction and major renovations projects. This would estimate savings for LLLCs over a current practice baseline, which is the underlying methodology the RTF uses in its savings methodology.

Both Washington and Oregon energy codes, as well as ASHRAE 90.1 require one or more lighting control strategies in most spaces. The accepted regional assumption to satisfy this code requirement has been an occupancy sensor due to the low cost of implementing this control strategy. However little data exists to support this assumption and therefore we recommend conducting market research to determine the likely control strategy used in commercial spaces to satisfy code requirements. In addition, since not all spaces in a building are required to utilize automated lighting controls, we also recommend conducting research to determine what fraction of the total floor area is required to have lighting controls and applying that fraction to the net LLLC CSF.

Absent the market data recommended above, a conservative approach to utilize in the near term is to assume an occupancy sensor is the default control strategy and net that CSF out of LLLC CSF. A column has been added in the Appendix to the RTF's CSF defaults that show the net CSF for new construction/major renovation installations assuming an occupancy sensor is the default code-compliant control strategy.

We recognize that gaining knowledge of where fixtures ultimately end up is problematic at the distributor sales data level. Absent obtaining these installation details from the distributor sales data or future market research, NEEA could look at the typical split in sales from each distributor (either through existing market data or through new market research) to determine what percent of high-end product sales (such as LLLCs) go towards new construction/major renovation versus retrofit. NEEA could then apply this split to total sales from that distributor to arrive at a weighted average CSF. We believe this will more accurately assign CSF savings to individual fixtures and would be more in line with the RTF's savings methodology.

3. Appendix

RTF Default Annual Hours of Use

Default hours of use under the control of a manual (on/off) switch

Building Types	Annual Hours of Use	Average Annual Hours of Use
Assembly	2,700	2,700
Automotive Repair	3,100	3,100
College or University	2,100	2,100
Exterior 24-Hour Operation	8,766	N/A
Hospital	4,200	4,200
Industrial Plant with One Shift	5,500	6,250
Industrial Plant with Three Shifts	7,000	
Industrial Plant with Two Shifts	5,500	
Library	3,000	3,000
Lodging	3,500	3,500
Manufacturing	5,500	5,500
Office <20,000 sf	2,600	2,950
Office >100,000 sf	3,300	
Office 20,000 to 100,000 sf	3,300	
Other Health, Nursing, Medical Clinic	4,300	4,300
Parking Garage	6,300	N/A
Restaurant	4,900	4,900
Retail 5,000 to 50,000 sf	3,900	5,133
Retail Anchor Store >50,000 sf Multistory	4,400	
Retail Big Box >50,000 sf One-Story	6,000	
Retail Boutique <5,000 sf	2,500	
Retail Mini Mart	7,200	
Retail Supermarket	6,800	
School K-12	2,500	2,500
Street & Area Lighting (Photo Sensor Controlled)	4,383	N/A
Warehouse	2,600	2,600
Other	3,800	3,800

Analysis is documented in the supporting document, NonResidentialLighting_CSFandHOU_v1_1.xlsx

RTF Default Control Savings Fractions (CSF) and assumed LLLC CSF using a common code baseline

SPACE TYPE	CONTROL TYPE							
	Manual switch (On/Off)	Bi-level switch/ personal tuning	Daylight control - On/Off	Daylight control - Multi-step and Continuous	Occ. sensor	Occ. sensor with daylighting control	LLLC Lighting Control	LLLC Savings w/ common code control strategy
Assembly	0%	15%	10%	30%	25%	25%	25%	0%
Break Room	0%	15%	10%	30%	25%	40%	50%	25%
Classroom	0%	10%	10%	30%	15%	25%	25%	10%
Computer Room	0%	15%	10%	30%	25%	40%	50%	25%
Conference	0%	15%	10%	30%	25%	40%	50%	25%
Dining	0%	15%	10%	30%	15%	40%	50%	35%
Gymnasium	0%	15%	10%	30%	25%	40%	50%	25%
Hallway	0%	15%	10%	30%	50%	50%	50%	0%
Hospital Room	0%	15%	10%	30%	25%	40%	50%	25%
Industrial	0%	15%	10%	30%	25%	40%	50%	50%*
Kitchen	0%	15%	10%	30%	25%	40%	50%	25%
Library	0%	15%	10%	30%	25%	40%	50%	25%
Lobby	0%	15%	10%	30%	25%	40%	50%	25%
Lodging (Guest Rooms)	0%	15%	10%	30%	25%	40%	50%	25%
Open Office	0%	15%	10%	30%	15%	40%	50%	35%
Parking Garage	0%	15%	10%	30%	25%	40%	50%	25%
Private Office	0%	20%	10%	30%	15%	40%	50%	35%
Process	0%	15%	10%	30%	25%	40%	50%	50%*
Public Assembly	0%	15%	10%	30%	25%	40%	50%	25%
Restroom	0%	15%	10%	30%	50%	50%	50%	0%
Retail	0%	15%	10%	30%	25%	40%	50%	25%
Stairs	0%	15%	10%	30%	25%	40%	50%	25%
Storage	0%	15%	10%	30%	50%	50%	50%	0%
Technical Area	0%	15%	10%	30%	25%	25%	25%	25%*
Warehouse Aisle	0%	15%	10%	30%	25%	60%	75%	50%
Other	0%	15%	10%	30%	25%	40%	50%	25%

** Space is not mandated by code to install lighting controls and therefore full LLLC saving can be applied.*