DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Product: Lighting Efficiency - CO

Description:

Prescriptive rebates will be offered for replacement lighting equipment. ~~New Construction rebates will be offered for new facilities, spaces overhauled for a new purpose, spaces where new lighting is required for safety/code requirements and spaces with fixtures that are at the end of their useful life.~~ Custom rebates are available for lighting-related improvements that are not prescriptive.

Equations:

Fixtures and Lamps	
Electrical Demand Savings (Customer kW)	= (kW_Exist - kW_Prop) x Cooling_kW_Savings_Factor
Electrical Energy Savings (Customer kWh/yr)	= (kW_Exist - kW_Prop) x Hours x Cooling_kWh_Savings_Factor
Electrical Peak Coincident Demand Savings (Customer PCkW)	= (kW_Exist - kW_Prop) x Cooling_kW_Savings_Factor x CF
kW_Exist	= Qty_Existing_Equip x Existing_Model__kW
kW_Prop	= Qty_Prop_Equip x Equipment_Model__kW
Natural Gas Savings (Dth)	= (kW_Exist - kW_Prop) x Hours x Heating_Penalty_Factor
Lighting Controls	
Electrical Demand Savings (Customer kW)	= (kW_Connected) x % Savings x Cooling_kW_Savings_Factor
Electrical Energy Savings (Customer kWh/yr)	= (kW_Connected) x % Savings x Hours x Cooling_kWh_Savings_Factor
Electrical Peak Coincident Demand Savings (Customer PCkW)	= (kW_Connected) x % Savings x Cooling_kW_Savings_Factor x CF
Natural Gas Savings (Dth)	= (kW_Connected) x % Savings x Hours x Heating_Penalty_Factor

Variable ID:	**Value**	**Description**
Qty_Existing_Equip	Customer Input	Quantity of existing equipment, verified during M&V.
Qty_Prop_Equip	Customer Input	Quantity of proposed equipment, verified during M&V.
HVAC_Type	Customer Input	Type of heating or cooling, verified during M&V.
Facility_Type	Customer Input	Type of facility.
Existing_Model_kW	Customer Input	Existing equipment wattage determined from stipulated fixture or lamp wattage. Specific lighting product provided by customer and verified during M&V.

Equipment_Model_kW	Customer Input	Proposed equipment wattage of fixture or lamp. Specific lighting product provided by customer and verified during M&V.
kW_Connected	Customer Input	Total connected fixture load connected to lighting controls, provided by customer and verified during M&V.
Cooling_kW_Savings_Factor	Table 1	Cooling system secondary demand savings factor resulting from efficient lighting. Reduction in lighting demand results in a reduction in cooling demand, if the customer has air conditioning. Existence of air conditioning determined by HVAC_Type.
Cooling_kWh_Savings_Factor	Table 1	Cooling system secondary energy savings factor resulting from efficient lighting. Reduction in lighting energy results in a reduction in cooling energy, if the customer has air conditioning. Existence of air conditioning determined by HVAC_Type.
Heating_Penalty_Factor	Table 1	Heating system secondary energy penalty factor resulting from efficient lighting. Reduction in lighting demand results in an increase in heating usage, if the customer has gas heating. Existence of gas heating to be determined by HVAC_Type.
CF	Table 2	Coincidence Factor is the probability that the peak demand of the lights will coincide with the peak utility system demand, determined by Facility_Type.
Hours	Table 2	Annual operating hours, determined by Facility_Type.
% Savings	Table 3	Stipulated savings percentage based on control type.
NTG	74%	Net-to-gross. [9]
NTG	100%	Net-to-gross for Network Lighting Controls. [11]
Measure Life	Table 4	Length of time the lighting equipment will be operational. For lamps, the measure life equals the lifetime hours of the lamp divided by the estimated hours of use.
Baseline Cost	Customer Input from Picklist	Cost of the baseline technology. For Retrofit, the cost is $0.00 since the baseline is to continue to operate the existing system. ~~For New Construction, the cost is that of the lower efficiency option.~~ Costs are determined through market research and provided by vendors. [10]

High Efficiency Cost	Customer Input from Picklist	Cost of the High Efficiency technology. [10] Equipment and Labor costs are also collected on a per measure basis, data is used to evaluate and identify the need to update costs as needed throughout the year to account for the rapidly evolving market.

Tables:

Table 1: HVAC Interactive Factors [1, 2]

HVAC_Type	Cooling_kWh_ Savings_Factor	Cooling_kW_ Savings_Factor	Heating_Penalty_ Factor (Dth/kWh)
Heating Only	1.00	1.00	-0.000508
Heating and Cooling	1.13	1.33	-0.000508
Cooler Door Retrofit to LED	1.44	1.44	N/A
Freezer Door Retrofit to LED	1.70	1.70	N/A

Table 2: Coincident Peak Demand Factors and Annual Operating Hours by Facility Type [3]

Facility_Type	CF	Annual Operating Hours
24-Hour Facility	100%	8,760
Assisted Living	100%	7,862
College	63%	3,395
Elementary School	72%	3,038
Exterior - Dusk to Dawn	0%	4,380
Grocery/Convenience Store	75%	4,661
Healthcare Office/Outpatient	65%	3,890
Hospital	76%	7,616
Hotel/Motel Common Areas	73%	6,138
Hotel/Motel Guest Rooms	28%	2,390
Manufacturing	81%	4,618
Office - Low Rise	52%	2,698
Office - Mid Rise	52%	3,068
Office - High Rise	57%	2,886
Other/Misc.	58%	3,379
Religious Building	48%	2,085
Restaurant	68%	5,571
Retail - Department Store	95%	5,478
Retail - Strip Mall	71%	4,093
Safety or Code Required (Including Exit Signs)	100%	8,760
Secondary School	72%	3,038
Warehouse	68%	5,242

Table 3. Lighting Controls [4, 5]

Control Type	% Savings	Full Cost Per Watt	Rebate Per Watt
Standalone - Occupancy Sensor	24%	$0.61	$0.05
Standalone - Daylighting (Photocell) Sensor	28%	$0.61	$0.10
Standalone - Occupancy and Daylighting (Photocell) Sensor	38%	$0.61	$0.15
Networked Lighting Controls	47%	$1.57	$0.40

Table 4: Measure Lifetimes in Years [6, 7, 8]

Measure	Lifetime
LED Fixtures, Retrofit Kits and LED Linear Lamps - Type C	20.0
Lighting Sensors	8.0
Networked Lighting Controls	15.0

Eligibility Requirements and Methodologies:

The following represents the eligibility requirements and savings methodologies for lamps, retrofit kits, fixtures and controls.

Rebates:

LED fixture, retrofit kit and lamp rebates are determined on a dollar per unit basis. Rebates are available for equipment that is listed on the Design Lights Consortium Qualified Products List (DLC QPL) and ENERGY STAR rated lighting equipment. A tiered rebate is available for equipment that either does not qualify for ENERGY STAR or is not listed on the DLC QPL. Non-DLC and non-ENERGY STAR products must meet the DLC or ENERGY STAR product eligibility category definitions. Lighting Controls rebates are determined on a dollar per controlled watt basis. Networked lighting controls must meet the Design Lights Consortium specification and be included on the DLC QPL to qualify for a rebate.

Equipment Pairings Methodology:

Each replacement lighting fixture assumes equivalent lighting levels for the baseline and proposed (see sections below that discuss the case where a customer is over or under lit). ~~New construction fixtures are put in on a one-for-one basis instead of lower efficiency options, equipment pairings used produce equivalent lighting levels.~~

Fixture identity with "Over"

Applied for lighting technologies where there is a discrete set of fixture options which results in a non-continuous set of input wattages. Customer was initially over lit, and we have deemed that an intermediate step to reduce the over lit condition was made before the decision to reduce input wattage again with LED retrofit fixture. Baseline input wattage is adjusted to deemed value and the replacement fixture cost is subtracted from the LED fixture cost to determine the project incremental cost. Examples include HID wall packs which have a range of 35 to 400 watts or more but are available only in input wattages of 35, 45, 70, 100, 125, 150, 175, 250 and 400 Watts (nominal values meant to illustrate baseline wattages, other input wattages exist).

Fixture identity with “Under”

Applied for lighting technologies where there is a discrete set of fixture options which results in a non-continuous set of input wattages. Customer was initially under lit, and we have deemed that an intermediate step to increase the under lit condition was made before the decision to reduce input wattage with LED retrofit fixture. Baseline input wattage is adjusted to deemed value and the replacement fixture cost is subtracted from the LED fixture cost to determine the project incremental cost. Examples include HID wall packs which have a range of 35 to 400 watts or more but are available only in input wattages of 35, 45, 70, 100, 125, 150, 175, 250 and 400 Watts (nominal values meant to illustrate baseline wattages, other input wattages exist).

Fixture identity with “Not-On-the-List”

Applied for lighting technologies where the range of available input wattages for a technology is relatively narrow (as compared to HID fixtures) and can essentially be viewed as a continuous range (there are many possible of lamps and ballasts for example). This approach essentially allows all baseline choices to be considered whether or not they are listed in the choice list for any particular proposed input wattage. The deemed value for the “Not-On-the-List” identity is the average value derived from all choices extant for a particular proposed input wattage selection. In other words, the several baseline choices for a proposed input wattage of 32w for an LED fixture has the available baseline choices averaged and the baseline cost reduced to determine kW savings and incremental cost and adjusts for both the over or under conditions. This process allows any baseline to be considered for a particular proposed input wattage obviating the need for a custom preapproval.

Fixture identity with “Non-Functioning”

Applied for lighting technologies where the baseline equipment is burnt out or failing. Customer had lighting equipment that was failing or burnt out so we have deemed that an intermediate step to increase the under lit condition was made before the decision to reduce input wattage with a LED retrofit fixture. The deemed values for the "Non-functioning" equipment option wattage and cost is the average value derived from all choices extant for a particular proposed input wattage selection, excluding the "Over" and "Under" options. The baseline input wattage is adjusted to the deemed value and the replacement fixture cost is subtracted from the LED fixture cost to determine the project incremental cost.

Baseline Adjustments:

- Rebates are available for T12 baseline equipment. For T12 baseline equipment the T12 baseline is adjusted to a T8 baseline and the replacement fixture cost is subtracted from the LED fixture cost to determine the incremental cost.

References:

1. HVAC Interactive Factors developed based on the Rundquist Simplified HVAC Interaction Factor method for Colorado, ASHRAE Journal - "Calculating lighting and HVAC interactions".

2. COP values from the Deemed Savings for CO Commercial Refrigeration, 2019-2020. (Cooler and Freezer Door Interactive Factors).

3. State of Illinois Energy Efficiency Technical Reference Manual Final Technical Version as of February 8th, 2017. Effective January 1st, 2018. (Hours and CF)

4. Design Lights Consortium. (2017). Energy Savings from Networked Lighting Control (NLC) Systems. Medford: Design Lights Consortium. Retrieved 10 01, 2017, from https://www.designlights.org/lighting-controls/reports-tools-resources/nlc-energy-savings-report/

5. Lawrence Berkeley National Laboratory. (2011). A Meta-Analysis of Energy Savings from Lighting Controls in Commercial Buildings. Berkeley, CA: Lawrence Berkeley National Laboratory. Retrieved 10 01, 2017, from https://eta.lbl.gov/sites/default/files/publications/a_meta-analysis_of_energy_savings_from_lighting_controls_in_commercial_buildings_lbnl-5095e.pdf

6. Measure Life for automatically controlled measures from the Deemed Savings for CO Energy Management Systems, 2019-2020. (NLC Measure Life)

7. Design Lights Consortium (2018). Qualified Products List as of February 27, 2018. (Lamp Lifetime Hours)

8. Hours of Use to calculate measure life for lamps was determined using a weighted hours of operation from Xcel Energy 2017/2018 participation.
9. Net-to-Gross factor from Evaluation of Xcel Energy's Lighting Efficiency Program. Jan 21, 2018. EMI Consulting.
10. LED baseline and proposed costs come from previous Xcel Energy Custom Lighting Efficiency projects, as well as market research through ShineRetrofits.com, LightingAtlanta.org, 1000bulbs.com, grainger.com, Pro Lighting.com, and more.
11. The Unopposed Settlement Agreement in Proceeding No. 18A-0606EG.