DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Product: Lighting Efficiency

Description:

Prescriptive rebates will be offered for replacement lighting equipment. New Construction rebates will be offered for new facilities or spaces overhauled for a new purpose. Custom rebates are available for lighting-related improvements that are not prescriptive.

Algorithms:

Electrical Demand Savings (Customer kW)	= (kW_Base - kW_EE) x HVAC_cooling_kWsavings_factor
Electrical Energy Savings (Customer kWh/yr)	= (kW_Base - kW_EE) x Hrs x HVAC_cooling_kWhsavings_factor
Natural Gas Savings (Dth)	= (kW_Base - kW_EE) x Hrs x HVAC_heating_penalty_factor
Lighting Controls -Electrical Energy Savings (Customer kWh/yr)	= (kW connected) x ~~(1-PAF)~~ % Savings x Hrs x HVAC_cooling_kWhsavings_factor
Lighting Controls -Electrical Demand Savings (Customer kW)	= (kW connected) x ~~(1-PAF)~~ % Savings x HVAC_cooling_kWsavings_factor
Lighting Controls -Natural Gas Savings (Dth)	= (kW connected) x ~~(1-PAF)~~ % Savings x Hrs x HVAC_heating_penalty_factor
Electrical Energy Savings (Gross Generator kWh)	= Customer kWh / (1-TDLF)
Electrical Demand Savings (Gross Generator kW)	= Customer kW x CF / (1-TDLF)
Electrical Energy Savings (Net Generator kWh)	= Gross Generator kWh x NTG
Electrical Demand Savings (Net Generator kW)	= Gross Generator kW x NTG

Variables:

Hrs	= Annual Operating Hours. Hours to be obtained from Table 2. The type of facility is to be supplied by the customer.
kW_Base	= Baseline fixture wattage (kW per fixture) determined from stipulated fixture wattages from Standard Fixture information. Fixture type provided by customer. Table~~4 5~~ 5
kW_EE	= High Efficiency fixture wattage (kW per fixture) determined from stipulated fixture wattages from Standard Fixture information. Fixture type provided by customer. Table~~4-5~~ 5
HVAC_cooling_kWhsavings_factor	= Cooling system energy savings factor resulting from efficient lighting from Table 1. Reduction in lighting energy results in a reduction in cooling energy, if the customer has air conditioning. Existence of air conditioning to be provided by customer.
HVAC_cooling_kWsavings_factor	= Cooling system demand savings factor resulting from efficient lighting from Table 1. Reduction in lighting demand results in a reduction in cooling demand, if the customer has air conditioning. Existence of air conditioning to be provided by customer.
HVAC_heating_kWsavings_factor	= Heating system penalty factor resulting from efficient lighting. Reduction in lighting demand results in an increase in heating usage, if the customer has gas heating. A value of -0.000508 Dth/kWh given by (Reference 4).
CF	= Coincidence Factor, the probability that peak demand of the lights will coincide with peak utility system demand. CF will be determined based on customer provided building type in table 2.
Measure Life	= Length of time the lighting equipment will be operational, see Table 3 for Measure Lifetimes
Baseline Cost	= 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 by (Reference 4) and vendors.
High Efficiency Cost	= Cost of the High Efficiency technology. Costs given in tables~~4 6~~ 5 (Reference 4, 8) and vendors.
kW connected	Total ~~connected~~ fixture load connected to lighting controls, provided by customer~~, determined as the sum of stipulated fixture wattages from Deemed Fixture Table 6.~~
~~PAF~~ % Savings	Stipulated ~~power adjustment factor~~ savings based on control type from Table ~~7~~ 4.
TDLF	Transmission Distribution Loss Factor = 6.50%, the percentage loss of electricity as it flows from the power plant to the customer, calculated using factors from Enhanced DSM Filing SRD-2
NTG	Net-to-gross = 99.2% (Reference 5)
Incremental operation and maintenance cost	= Other annual savings or costs associated with the electrical savings. For Lighting, this consists of additional natural gas for heating. Methodology given by Reference 2.

Provided by Customer:	**Verified during M&V:**
Number of Fixtures	Yes
Lighting equipment type	Yes
Building type	Yes
Existence of air conditioning	Yes

Assumptions:

- Each replacement lighting fixture is going in on a one-for-one basis for existing fixtures. New construction fixtures are put in on a one-for-one basis instead of lower efficiency options.
- In the Technical Assumptions, one will note that the Operating Hours does not appear, but rather a modified version. The methodology defines kW Savings on the basis of difference in kW with the HVAC Cooling demand factor. The Annual Energy Savings takes into account any heating that has to be added.

Table 1: HVAC Interactive Factors (Reference 2)

HVAC system	HVAC Cooling kWh Savings Factor	HVAC Cooling kW Savings Factor	Heating Penalty	kW/Ton	COP
Heating only	1.00	1.00	-0.000508	-	-
Heating and cooling	1.13	1.33	-0.000508	-	-
Cooler Door Retrofit to LED Secondary Benefits Factor	1.44	1.44	0.000000	1.54	2.28
Freezer Door Retrofit to LED Secondary Benefits Factor	1.70	1.70	0.000000	2.46	1.43

Table 2: Coincident Peak Demand Factors and Annual Operating Hours by Building Type (Reference 1 and 3 and 13)

Building Type	CF	Annual Operating Hours
24-Hour Facility	100%	8760
College	81%	3540
Cooler Door Retrofit to LED	87%	8760
Elementary School	71%	2422
Secondary School	58%	4311
Freezer Door Retrofit to LED	87%	8760
Grocery (All) / Big Box Retail (larger than 50,000 SF)	90%	5802
Health	75%	5095
Hospital	75%	6038
Hotel/Motel	21%	3044
Manufacturing	92%	5200
Night Time Exterior	0%	4903
Office	70%	4439
Other/Misc.	66%	4576
Restaurant	80%	3673
Retail	83%	4719
Safety or Code Required (Including Exit Signs)	100%	8760
Traffic Signals	50%	4380
Warehouse	70%	4746
Company Owned Street Lights	0%	4140

Table 3: Measure Lifetimes in Years (Reference 4,6,7,~~14~~)

Measure	Lifetime
LED Interior Lamps	12.0
LED Interior Fixtures	20.0
LED Exterior Fixtures	20.0
~~Low Wattage T8 Lamps~~	~~8.0~~
~~Ballasted CFLs~~	~~20.0~~
~~Integrated 25W Ceramic Metal Halide~~	~~7.0~~
~~T8 Lighting Systems~~	~~20.0~~
~~T5 Lighting Systems~~	~~20.0~~
Stand-alone Lighting Controls	8.0
Networked Lighting Controls	15.0
~~Stairwell Fixtures with Occupancy Sensors~~	~~14.4~~
LED Tubes (Insta-fit type only)	10.0
~~HID Fixture~~	~~20.0~~
LED High-bay Lamps	9.6

Table 4: Lighting Controls (References 15, 16)

Lighting Control	% Savings	Full Cost Per Watt	Rebate Per Watt
Occupancy Sensor	24%	$0.61	$0.05
Photocell Sensor	28%	$0.61	$0.10
Occupancy & Photo Cell Sensor	38%	$0.61	$0.15
Networked Lighting Controls	47%	$1.57	$0.40

Tables ~~4 7~~ 5: Lighting Efficiency Technical Assumption Updates

The Company has historically filed an exhaustive list with specific lighting retrofit pairings for eligible equipment in the Lighting Efficiency rebate program (for example: CMH-GEN-20-1-Fixt-EB-XX-XX-XX, which is a xxx type of bulb with an xxx type of wattage). Given that LED pairing options are rapidly entering the marketplace and evolving at a fast pace, the Company is transitioning to providing the technical assumptions—bulb qualification criteria, rebate factors, preconditions, and others—rather than listing out each pairing in the Plan. This solution will provide continued transparency while allowing the program to evolve as new LED specifications enter the market. However, the Company will continue to maintain a full list of the pairings, updated on a quarterly basis, on our website~~http://www.xcelenergy.com/Save_Money_&_Energy/Rebates/Lighting_Efficiency_-_CO~~
https://www.xcelenergy.com/programs_and_rebates/business_programs_and_rebates/equipment_rebates/lighting_efficiency

Lighting Pairing Technical Assumptions for Lamps, Fixtures and Controls:

~~Fluorescent:~~

~~A. Low wattage T8 Fluorescent Lamps~~

~~Rebates are based on replacing 32W T8 lamps with 28W or 25W lamps.~~

~~B. Lighting Optimization~~

~~Rebates are based on the permanent removal of the equivalent of at least one 4-foot (T8) lamp from an 8-foot or 4-foot fixture as a result of a retrofit. Rebate amount is per fixture, based on the final quantity of lamps installed in each fixture. Reducing the quantity of fixtures does not qualify. In order to qualify, the fixture must be retrofitted such that the existing ballast(s) must be disconnected and removed, new lamp-quantity appropriate high-efficiency electronic ballast is installed, and the sockets for the eliminated lamps are removed. In addition, the customer may not remove more than 50% of the existing lamp quantity (e.g., replacing a 3-lamp system with a 1-lamp system is not allowed). High efficiency electronic ballasts are required for all 4-foot T8 optimization rebates. A list of qualified ballasts can be found at http://library.cee1.org/content/commercial-lighting-qualifying-products-listsh. Customer must sign the line below the optimization rebate on page 4 of the rebate application to verify that optimization has occurred. Although Xcel Energy recommends customer follow IES guidelines, the final light levels are the responsibility of the customer~~.

~~C. High-Efficiency Ballast~~

~~New fixtures that include high-efficiency electronic ballasts qualify for this rebate. Approved ballasts must be listed by CEE at http://library.cee1.org/content/commercial-lighting-qualifying-products-lists to qualify. The high-efficiency ballast cannot be in addition, or added to, the optimization rebates. The high-efficiency ballast is already incorporated into the optimization rebate~~.

~~D. High-Bay Fluorescent T8, T8VHO and T5HO Lamps with High-Efficiency Electronic Ballasts~~

~~Rebates are based on a one-for-one replacement of HID fixtures (including mercury vapor, high-pressure sodium, metal halide, or pulse-start metal halide) ranging in size from 175W to 1000W. Rebates are available for T8, T8VHO systems or T5HO systems. High-efficiency electronic ballasts are required for all fixtures using 4-foot, 4-lamp or less T8 ballasts. Other fixture configurations will be considered under the Custom Efficiency program~~.

~~E. Compact Fluorescent Fixtures~~

~~Rebates are based on one-for-one replacement of incandescent fixtures with new hard-wired (dedicated) or modular fixtures containing pin-based compact fluorescent lamps (CFLs). For fixtures that house more than one lamp, the rebate is based on the total fixture wattage (i.e., one fixture that houses two 18W CFLs would be rebated as one 36W CFL fixture). Screw-base (integral) CFLs do not qualify. Two-foot low-wattage CFL rebate is paid per lamp~~.

LED:

A tiered rebate is available for equipment that either does not qualify for ENERGY STAR or is not listed on the DLC QPL.

~~F~~A. LED and LEC Exit Signs

Rebates are based on one-for-one replacement of incandescent exit signs to LED or LEC exit signs. CFL and photoluminescent exit signs do not qualify for a rebate. LED Exit Signs do not need to follow the DLC requirement until a DLC category is created.

~~G~~B. LED Lamps and Luminaires (ENERGY STAR Rebates Available)

Rebates are based on one-for-one replacement of incandescent or halogen lamps with LED lamps (screw-based or pin-based). Rebates are based on wattage per lamp, not total fixture wattage. LED lamps and commercial downlight luminaires are required for prescriptive rebates. This is a midstream incentive implemented by a third-party and the incentive is paid directly to participating distributors.

~~H~~C. Commercial LED Downlight Luminaires (hardwired and screw in/retrofit) (ENERGY STAR Rebates Available)

Rebates are based on one-for-one full fixture replacement of incandescent fixtures with commercial LED hardwired and screw-in downlight luminaires. Rebates are based on HID lamp wattage and total fixture wattage (Fixture must be a commercial downlight; not all products listed qualify for rebates).

~~I~~D. Exterior LED Canopy, Soffit and Wall Pack Fixtures (DLC QPL Rebates Available)

Rebates are based on one-for-one replacement of HID canopy, soffit or wall pack fixtures with LED fixtures rated for exterior use. Rebates are based on total fixture wattage. Wall packs can be installed in parking garages, however parking garage ceiling fixtures do not qualify for this rebate, but can be analyzed through Custom Efficiency. Wall pack must include wall pack terminology on spec sheet to qualify for rebate.

~~J~~E. Refrigerated LED Case Lighting (DLC QPL Rebates Available)

Rebates are based on replacement of T12 or T8 linear 5 to 6 foot fluorescent refrigerated case door lighting with 5 to 6 foot LED refrigerated case door strip lighting. Rebates are per door, not per lamp. Linear LED tube lights do not qualify for this rebate, but can be analyzed through Custom Efficiency.

~~K~~F. LED Troffer Fixture & Retrofit Kits (DLC QPL Rebates Available)

Rebates are based on a one-for-one fixture and retrofit kit replacement of existing linear fluorescent troffer systems to qualify for rebates. Eligible LED fixture types are 2X2, 2X1, 2X4, 1X4, and retrofit kits. LED T8 tubes do not qualify for the retrofit kit, but can be analyzed through Custom Efficiency.

~~LG~~. LED Parking Garage Fixture (DLC QPL Rebates Available)

Eligible parking garage structures need to be either underground or semi-enclosed above ground. The lighting within the garage must operate 24 hours a day. Rebates are based on a one-for-one replacement of HID (including mercury vapor, high-pressure sodium, metal halide, or pulse-start metal halide) ranging in size from 100W–250W. LED retrofit kits are not available for prescriptive rebates, but can be analyzed through Custom Efficiency.

~~MH~~. Street and Area LED Lighting (DLC QPL Rebates Available)

Rebates are based on one-for-one replacement of HID fixture with LED fixtures rated for exterior use. Rebates are based on total fixture wattage.

~~NI~~. LED High Bay Fixtures or Retrofit Kits (DLC QPL Rebates Available)

Rebates are based on one-for-one replacement of HID fixture with an LED fixture in a high-bay interior space. Retrofit kits that work within the existing HID fixture but use LED lamps are included in this measure, but use separate cost and energy assumptions. New construction fixtures are also included, using separate assumptions.

~~OJ~~. LED Tubes (Linear lamps) (DLC QPL Rebates Available)

Rebates are based on one-for-one replacement of linear T8 fluorescent lamps with LED lamps in interior fixtures. Three different types of LED linear lamps are included using separate assumptions: insta-fit type lamps (require no re-wiring of fixture), direct-wired type lamps (requres re-wiring of fixture and removal of the ballasts), and external driver lamps (require removal of ballasts and installation of separate driver).

~~PK~~. LED Downlight Fixtures (ENERGY STAR Rebates Available)

Each replacement lighting fixture is going in on a one-for-one basis for existing fixtures. New construction fixtures are put in on a one-for-one basis instead of lower efficiency options These kits replace CFL downlights by entirely replacing the existing downlight fixture with an LED fixture.

~~QL~~. LED Plug Lamps (DLC QPL Rebates Available)

Each replacement lighting lamp is going in on a one-for-one basis for existing lamps. New construction lamps are put in on a one-for-one basis instead of lower efficiency options. These lamps replace 2-pin and 4-pin CFL lamps in a variety of fixtures.

~~RM~~. LED Direct Linear Ambient Luminaries (DLC QPL Rebates Available)

Suspended- or surface-mounted luminaires or recessed luminaires, no wider than 12", designed to provide direct lighting in indoor spaces. Products may be designed to be installed end-to-end to create long chains, and may be described as direct, indirect, semi-direct, semi-indirect, or general ambient, depending on intended lighting distribution. Utilitarian "strip" style fixtures are also eligible under this category. Products intended for cove lighting are not currently eligible under this category.

N. LED Stairwell Fixtures (DLC QPL Rebates Available)

Rebates are based on one-for-one replacement of a linear T8 fluorescent fixture with an LED fixture in a stairwell. Rebates are based on total fixture wattage.

~~SO~~. 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).

~~TP~~. 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).

~~UO~~. 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 a 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 32 watts 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.

Automatic Controls:

~~V~~R. Occupancy Sensors, Photocells and combined Occupany and Photocell Sensors~~Stairwell Fixtures~~

Rebate is based on ~~the type of sensor (wall vs. ceiling mount) as well as~~ the connected load of each sensor. ~~Stairwell fixtures may be 2-3 lamp T8 or 20W-30W LED and be controlled via an integrated occupancy sensor or step-dimming ballast. Fixture must operate in low-standby light level during vacancy and switch to full light output upon occupancy. The fixture cannot exceed 35% of full wattage during unoccupied periods. Low mode setting should be chosen so that the surface illumination levels are code compliant.~~ Occupancy sensors may be wall or ceiling mounted, and must be permanently installed; they can be passive infrared, ultrasonic or dual technology sensors. Photocells can only qualify for a rebate when controlling interior fixtures.

~~W. Standalone:~~

~~Occupancy sensors may be wall or ceiling mounted, and must be permanently installed; they can be passive infrared, ultrasonic or dual technology sensors. Photocells can only qualify for a rebate when controlling interior fixtures.~~

~~X. Integrated:~~

~~Automatic controls must be permanently integrated into the fixture to qualify for this rebate~~.

S. Networked Lighting Controls:

Rebate is based on the total load connected to the networked lighting control system. Networked lighting controls must meet the Design Lights Consortium specification and be included in the Qualified Products List (https://www.designlights.org/lighting-controls/download-the-qpl/). High level trim must be set to 80% of maximum fixture output. Occupancy sensing may be set to occupancy or vacancy mode, with a timeout period of 20 minutes or less. Daylight harvesting must be deployed where side and top lighting is available as defined by IECC 2015.

References:

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