



Compact Fluorescent Lamps, Screw-In

Table 6 Compact Fluorescent Lamps, Screw-In

Measure Description	ENERGY STAR-rated CFLs with lamp/ballast efficacy of ≥ 40 lumens per Watt. Measure applies only if incandescent or HID lamps are being replaced.
Units	Per lamp
Base Case Description	Incandescent or HID lamps.
Measure Savings	Source: KEMA
Measure Incremental Cost	Source: AEP Ohio Potential Study
Effective Useful Life	Source: DEER 2.5 years

This incentive applies to screw-in lamps and applies only if an incandescent or high-intensity discharge (HID) lamp is being replaced. All screw-in CFLs must be ENERGY STAR® rated. The lamp/ballast combination must have an efficacy ≥ 40 lumens per Watt (LPW). For screw-in CFLs, electronic ballasts are required for lamps ≥ 18 Watts.

Measure Savings

Baseline and retrofit equipment assumptions are presented in the next table. Most lighting retrofits assume an early replacement of existing technologies where the baseline represents the equipment removed. The table shows the wattages used for the savings calculations.



Table 7: Baseline and Retrofit Wattages

Measure	Base Wattage (Watts)	Retrofit Wattage (Watts)	kW Reductions (kW)
15 W or less	75	15	0.060
15 W or less	60	15	0.045
15 W or less	60	14	0.046
15 W or less	50	14	0.036
15 W or less	65	13	0.052
15 W or less	60	13	0.047
15 W or less	40	13	0.027
15 W or less	40	11	0.029
15 W or less	40	10	0.030
15 W or less	35	7	0.028
15 W or less	30	7	0.023
15 W or less	25	7	0.018
15 W or less	30	9	0.021
15 W or less	25	9	0.016
15 W or less	25	5	0.020
15 W or less	20	5	0.015
16W-25W	100	25	0.075
16W-25W	75	25	0.05
16W-25W	100	23	0.077
16W-25W	100	20	0.08
16W-25W	75	20	0.055
16W-25W	75	19	0.056
16W-25W	75	18	0.057
16W-25W	60	18	0.042
16W-25W	60	16	0.044
26W and Greater	150	40	0.11
26W and Greater	150	36	0.114
26W and Greater	100	30	0.07
26W and Greater	100	28	0.072
26W and Greater	100	26	0.074
26W and Greater	75	26	0.049



Table 8 Wattage Reduction

Wattage Category	Average Wattage Reduction
≤15	32
16 to 26	60
>26	76

The following tables provide the measure savings using the above wattage reduction assumptions.

Table 9 Measure Savings for 15 W or less

Annual Operating Hours	Demand Interactive Effects	Coincident Diversity Factors	Energy Interactive Effects	Peak kW Savings	kWh Savings
4,321	1.19	0.77	1.12	0.029	155

Table 10 Measure Savings for 16 – 26 W

Annual Operating Hours	Demand Interactive Effects	Coincident Diversity Factors	Energy Interactive Effects	Peak kW Savings	kWh Savings
4,321	1.19	0.77	1.12	0.054	290

Table 11 Measure Savings for > 26 W

Annual Operating Hours	Demand Interactive Effects	Coincident Diversity Factors	Energy Interactive Effects	Peak kW Savings	kWh Savings
4,321	1.19	0.77	1.12	0.069	368

Measure Savings Analysis

Annual energy savings and the peak coincident demand savings were calculated using the equations below.

$$\text{Noncoincident kW reduction} = \text{kW of existing equipment} - \text{kW of replacement equipment}$$

Energy savings are based on the difference between baseline and efficient equipment connected wattage and annual operating hours, according to the following formula:



$$\text{kWh Reduction} = (\text{kW of existing equipment} - \text{kW of replacement equipment}) * (\text{Annual operating hours}) * (\text{Energy Interactive Effects})$$

Coincident demand savings are calculated by applying the coincidence factor and the demand interactive effect, according to the following formula:

$$\text{Coincident kW savings} = \text{noncoincident kW savings} * \text{Coincidence Factor} * \text{Demand interactive effect}$$

Interactive factors account for savings that the measures achieve through avoided air conditioning load because of reduced internal heat gains from energy-efficient lighting.

The annual operating hours, the coincidence factors, and the interactive effect factors are all derived from DEER figures.³

Measure Life and Incremental Measure Cost

The following table provides the measure life and incremental measure cost (IMC) documented for this measure as well as the source of the data.

Incremental cost is the cost difference between the energy-efficient equipment and the less efficient option. For lighting measures, the IMC is equal to the full measure cost since the cost of the less efficient option, i.e., not conducting the retrofit, is \$0.

Table 12 Measure Life and Incremental Measure Cost

Wattage Category		Value	Source
All	Measure Life	2.5	DEER 2005
≤15W	Incremental Measure Cost	\$4.13	AEP Ohio Potential Study
16W-26W	Incremental Measure Cost	\$4.13	AEP Ohio Potential Study
> 26W	Incremental Measure Cost	\$4.13	AEP Ohio Potential Study

³ 2005 Database for Energy Efficiency Resources (DEER) Update Study Final Report - Residential and Commercial Non-Weather Sensitive Measures



T5 Lamp and Ballast

T5 Lamp and Ballast	
Measure Description	This measure consists of replacing 4 foot T12 lamps and magnetic ballasts with T5 lamps and electronic ballast. The T5 lamps must have a color rendering index (CRI) ≥ 80 . The electronic ballast must be high frequency (≥ 20 kHz), UL listed, and warranted against defects for 5 years. Ballasts must have a power factor (PF) ≥ 0.90 and a total harmonic distortion (THD) ≤ 20 percent at full light output.
Units	Per Lamp
Base Case Description	T12 lamps with magnetic ballasts.
Measure Savings	Source: KEMA
Measure Incremental Cost	Source: KEMA
Effective Useful Life	Source: DEER 11 years

This measure consists of replacing 4 foot T12 lamps and magnetic ballasts with T5 lamps and electronic ballast. The T5 lamps must have a color rendering index (CRI) ≥ 80 . The electronic ballast must be high frequency (≥ 20 kHz), UL listed, and warranted against defects for 5 years. Ballasts must have a power factor (PF) ≥ 0.90 and a total harmonic distortion (THD) ≤ 20 percent at full light output.

Measure Savings

The savings are presented in the following table. The annual operation hours, the coincidence factors, and the interactive effect factors are obtained from the DEER database.⁴ Since the AEP SmartGrid program does not vary savings by building type, the savings presented below are averages of savings calculated for these building types.

Table 13 T12 to T5 Fluorescent Fixtures per Watt Reduced

Annual Operating Hours	Demand Interactive Effects	Coincident Diversity Factors	Energy Interactive Effects	Peak Watt Savings	kWh Savings
4,389	1.19	0.77	1.12	0.012	65.1

Measure Savings Analysis

Annual energy savings and the peak coincident demand savings were calculated using the equations below.

⁴ 2005 Database for Energy Efficiency Resources (DEER) Update Study Final Report - Residential and Commercial Non-Weather Sensitive Measures



Non-coincident kW reduction = kW of existing equipment - kW of replacement equipment

Energy savings are calculated by applying the annual operating hours and the energy interactive effect, according to the following formula:

$$\text{kWh Reduction} = \text{Non-Coincident kW Savings} * \text{Annual Operating Hours} * \text{Energy Interactive Effect}$$

Coincident demand savings are calculated by applying the coincidence factor and the demand interactive effect, according to the following formula:

$$\text{Coincident kW savings} = \text{Non-Coincident kW Savings} * \text{Coincidence Factor} * \text{Demand Interactive Effect}$$

Baseline and retrofit equipment assumptions are listed in the table below.

Table 14 Baseline and Retrofit Wattages for T12 to T5 Fixture Retrofits

Baseline Configuration	Base Fixture Wattage	Retrofit Configuration	Retrofit Fixture Wattage	Demand Savings per lamp (kW)	Weight Percentages
4ft 4-lamp T12	270	4ft T5 4lamp HO	234	0.009	13%
4ft 4-lamp T12	164	4ft T5 4lamp	128	0.009	13%
4ft 3-lamp T12	230	4ft T5 3 Lamp HO	179	0.017	13%
4ft 3-lamp T12	133	4ft T5 3 Lamp	97	0.012	13%
4ft 2-lamp T12	145	4ft T5 2 Lamp HO	117	0.014	13%
4ft 2-lamp T12	82	4ft T5 2 Lamp	64	0.009	13%
4ft 1-lamp T12	80	4ft T5 1 Lamp HO	62	0.018	13%
4ft 1-lamp T12	51	4ft T5 1 Lamp	33	0.018	13%
Weighted Average				0.013	

Measure Life and Incremental Measure Cost

The following table provides the measure life and IMC documented for this measure as well as the source of the data.

Incremental cost is cost difference between the energy efficient equipment and the less efficient option. In this case, the IMC is equal to the full measure cost since the cost of the less efficient option, i.e., not conducting the retrofit, is \$0.

Table15 Measure Life and Incremental Measure Cost

	Value	Source
Measure Life	11	DEER
Incremental Measure Cost	\$18.54	KEMA



High Performance and Reduced Wattage 4-foot T8 Lamps and Ballast

High Performance and Reduced Wattage 4-foot T8 Lamps and Ballast	
Measure Description	This measure consists of replacing existing T12 4' lamps and magnetic ballasts with high performance 32W T8 lamps or reduced wattage 28W or 25W lamps and electronic ballasts. Both the lamp and ballast must meet the Consortium for Energy Efficiency (CEE) high performance or reduced wattage T8 specification (www.cee1.org) summarized below.
Units	Per lamp
Base Case Description	T12 lamp and magnetic ballasts
Measure Savings	Source: KEMA
Measure Incremental Cost	Source: AEP Ohio Potential Study
Effective Useful Life	Source: DEER 11 years

This measure consists of replacing existing T12 lamps and magnetic ballasts with high-performance T8 lamps or reduced wattage (28 or 25W) T8 lamps and electronic ballasts. This measure is based on the Consortium for Energy Efficiency (CEE) high-performance T8 or reduced wattage specification (www.cee1.org) and is summarized below. A list of qualified lamps and ballasts can be found at: <http://www.cee1.org>. Both the lamp and ballast must meet the specification to qualify for an incentive. The incentive is calculated based on the number of lamps installed. A manufacturer's specification sheet must accompany the application.

For reduced wattage 4-foot T8 lamps, the nominal wattage must be 28 W ($\geq 2,585$ Lumens) or 25 W ($\geq 2,400$ Lumens) to qualify. The mean system efficacy must be ≥ 90 MLPW, CRI ≥ 80 , and lumen maintenance at 94 percent. Other requirements can be found on the CEE website using the links above.

The table below provides the specification for high performance systems.



High-Performance T8 Specifications

Table 16 High-Performance T8 Specifications

Performance Characteristics for Systems					
Mean system efficacy	≥ 90 Mean Lumens per Watt (MLPW) for Instant Start Ballasts				
	≥ 88 MLPW for Programmed Rapid Start Ballasts				
Performance Characteristics for Lamps					
Color Rendering Index (CRI)	≥ 80				
Minimum initial lamp lumens	≥ 3100 Lumens ⁵				
Lamp life	≥ 24,000 hours				
Lumen maintenance or minimum mean lumens	≥ 90% or ≥ 2,900 Mean Lumens				
Performance Characteristics for Ballasts					
Ballast Efficacy Factor (BEF) BEF = (BF x 100) / Ballast Input Watts	Instant-Start Ballast (BEF)				
	Lamps	Low BF ≤ 0.85	Norm 0.85 < BF ≤ 1.0	High BF ≥ 1.01	
	1	> 3.08	> 3.11	NA	
	2	> 1.60	> 1.58	>1.55	
	3	≥ 1.04	≥ 1.05	≥ 1.04	
	4	≥ 0.79	≥ 0.80	≥ 0.77	
	Programmed Rapid Start Ballast (BEF)				
	1	≥ 2.84	≥ 2.84	NA	
	2	≥ 1.48	≥ 1.47	≥ 1.51	
	3	≥ 0.97	≥ 1.00	≥ 1.00	
	4	≥ 0.76	≥ 0.75	≥ 0.75	
	Ballast Frequency	20 to 33 kHz or ≥ 40 kHz			
	Power Factor	≥ 0.90			
Total Harmonic Distortion	≤ 20%				

Measure Savings

Savings are summarized by the following table:

Table 17 Measure Savings for High-Performance or Reduced Wattage 4-foot Lamp and Ballast (per lamp)

Coincident Demand Savings (kW)	Energy Savings (kWh)
0.012	62.0

⁵ For lamps with temperature ≥4500K, 2,950 minimum initial lamp lumens are specified.



Measure Savings Analysis

Annual energy savings and the peak coincident demand savings were calculated using the equations below. The annual operating hours, the coincidence factors, and the interactive effect factors were all derived from the DEER database and shown in the following table. However, DEER values by building type were averaged for the AEP Ohio Program.

Table 18 Factors used for Calculating Lighting Savings

Annual Operating Hours	Demand Interactive Effects	Coincident Diversity Factors	Energy Interactive Effects
4,389	1.19	0.77	1.12

Non-coincident kW reduction = kW of existing equipment - kW of replacement equipment

Energy savings are calculated by applying the annual operating hours and the energy interactive effect, according to the following formula:

$$\text{kWh Reduction} = \text{non-coincident kW savings} * \text{Annual operating hours} * \text{Energy interactive effect}$$

Coincident demand savings are calculated by applying the coincidence factor and the demand interactive effect, according to the following formula:

$$\text{Coincident kW savings} = \text{non-coincident kW savings} * \text{Coincidence Factor} * \text{Demand interactive effect}$$

Baseline and retrofit equipment assumptions are presented in the table below.



Table 19 Baseline and Retrofit Wattages for High-Performance or Reduced Wattage Fixture Retrofits

	T8, 4-foot Configuration	Base Fixture Wattage	Retrofit Lamp Wattage	Retrofit Fixture Wattage	Demand Savings per fixture (kW)	Demand Savings per lamp (kW)	Weight Percentages
High	4-lamp	144	32	108	0.036	0.009	9%
	3-lamp	103	32	83	0.02	0.007	4%
	2-lamp	72	32	54	0.018	0.009	8%
	1-lamp	43	32	28	0.015	0.015	4%
Med	4-lamp	144	28	96	0.048	0.012	15%
	3-lamp	103	28	72	0.031	0.010	10%
	2-lamp	72	28	48	0.024	0.012	15%
	1-lamp	43	28	25	0.018	0.018	10%
Low	4-lamp	144	25	85	0.059	0.015	9%
	3-lamp	103	25	66	0.037	0.012	4%
	2-lamp	72	25	44	0.028	0.014	8%
	1-lamp	43	25	22	0.021	0.021	4%
	Weighted Average					0.0126	

Measure Life and Incremental Measure Cost

The table below provides the measure life and IMC documented for this measure as well as the source of the data. Incremental cost is the cost difference between the energy-efficient equipment and the less efficient option. In this case, the IMC is equal to the full measure cost since cost of the less efficient option is 0.

Table 20 Measure Life and Incremental Measure Cost

	Measure Category	Value	Source
Measure Life	Lamp and Ballast	11	DEER
Incremental Measure Cost	4 Foot Lamp and Ballast	\$13.14	AEP Ohio Potential Study



Reduced Wattage 4-foot Lamp Only

Reduced Wattage 4-foot Lamp Only	
Measure Description	This measure consists of replacing existing standard T8 4' lamps and electronic ballasts with reduced wattage T8 lamps. The lamp must meet the Consortium for Energy Efficiency (CEE) reduced wattage T8 specification (www.cee1.org). The nominal wattage for 4 foot lamps must be 28W (≥ 2585 Lumens) or 25W (≥ 2400 Lumens) to qualify. The mean system efficacy must be ≥ 90 MLPW, CRI ≥ 80 , and lumen maintenance at 94%. A manufacturer's specification sheet must accompany the application.
Units	Per lamp
Base Case Description	Standard T8 fixtures.
Measure Savings	Source: KEMA
Measure Incremental Cost	Source: ICF Portfolio Plan
Effective Useful Life	Source: KEMA 3 years

Incentives are available when replacing standard 32-Watt T8 lamps with reduced-wattage T8 lamps when an electronic ballast is already present. The lamps must be reduced wattage in accordance with the Consortium for Energy Efficiency (CEE) specification (www.cee1.org). Qualified products can be found at <http://www.cee1.org>. The nominal wattage must be 28 W ($\geq 2,585$ Lumens) or 25 W ($\geq 2,400$ Lumens) to qualify. The mean system efficacy must be ≥ 90 MLPW, CRI ≥ 80 , and lumen maintenance at 94 percent. A manufacturer's specification sheet must accompany the application.

Measure Savings

Savings are summarized by the following table:

Table 21 Measure Savings for Reduced-Wattage 4-foot Lamp Only

Coincident Demand Savings (kW)	Energy Savings (kWh)
0.005	28.8

Measure Savings Analysis

Annual energy savings and the peak coincident demand savings were calculated using the equations below. The annual operating hours, the coincidence factors, and the interactive effect factors were all derived from the DEER database and shown in the next table. However, DEER values by building type were averaged for the AEP Ohio Program.



Table 22 Factors used for Calculating Lighting Savings

Annual Operating Hours	Demand Interactive Effects	Coincident Diversity Factors	Energy Interactive Effects
4,389	1.19	0.77	1.12

Non-coincident kW reduction = kW of existing equipment - kW of replacement equipment

Energy savings are calculated by applying the annual operating hours and the energy interactive effect, according to the following formula:

$$\text{kWh Reduction} = \text{non-coincident kW savings} * \text{Annual operating hours} * \text{Energy interactive effect}$$

Coincident demand savings are calculated by applying the coincidence factor and the demand interactive effect, according to the following formula:

$$\text{Coincident kW savings} = \text{non-coincident kW savings} * \text{Coincidence Factor} * \text{Demand interactive effect}$$

Baseline and retrofit equipment assumptions are presented in the next table.

Table 23 Baseline and Retrofit Wattages for 4-foot T8 Lamp Only

T8 Configuration	Base Lamp Wattage	Base Fixture Wattage	Retrofit Lamp Wattage	Retrofit Fixture Wattage	Demand Savings per fixture (kW)	Demand Savings per lamp (kW)	Weight Percentages
4 ft, 4-lamp	32	112	28	96	0.016	0.004	18%
4 ft, 3-lamp	32	85	28	72	0.013	0.004	13%
4 ft, 2-lamp	32	58	28	48	0.01	0.005	15%
4 ft, 1-lamp	32	32	28	25	0.007	0.007	5%
4 ft, 4-lamp	32	112	25	85	0.027	0.007	18%
4 ft, 3-lamp	32	85	25	66	0.019	0.006	13%
4 ft, 2-lamp	32	58	25	44	0.014	0.007	15%
4 ft, 1-lamp	32	32	25	22	0.01	0.010	5%
Weighted Average						0.006	

Measure Life and Incremental Measure Cost

The following table provides the measure life and IMC documented for this measure as well as the source of the data. Incremental cost is the cost difference between the energy-efficient equipment and the less efficient option. In this case, the IMC is equal to the full measure cost for



lamp and ballast retrofit and incremental for lamp only. The lamp and ballast retrofit is a change in technology.

Table 24 Measure Life and Incremental Measure Cost

	Measure Category	Value	Source
Measure Life	Lamp Only	3	KEMA
Incremental Measure Cost	4 Foot Lamp Only	\$2.10	ICF Portfolio Plan



Reduced Wattage 8-foot

Table 25 Reduced Wattage 8-foot

Measure Description	This measure consists of replacing existing T12 8' lamps and magnetic ballasts with reduced wattage T8 lamps and electronic ballasts. Both the lamp and ballast must meet the Consortium for Energy Efficiency (CEE) high performance or reduced wattage T8 specification (www.cee1.org). Eight foot lamps must have a minimum MLPW of 90 and must have a nominal wattage of less than 57W. A manufacturer's specification sheet must accompany the application. High wattage T8 (59W) can be replaced with reduced wattage lamps without replacing the ballast. The lamps must also meet CEE standards for reduced wattage.
Units	Per lamp
Base Case Description	T12 lamp and magnetic ballasts or high watt T8 fixtures (for reduced wattage lamp only replacements).
Measure Savings	Source: KEMA
Measure Incremental Cost	Source: DEER and ICF Portfolio Plan
Effective Useful Life	Source: KEMA and DEER

This measure consists of replacing existing T12 lamps and magnetic ballasts with reduced wattage lamp and electronic ballast systems. The lamps and ballasts must meet the Consortium for Energy Efficiency (CEE) specification (www.cee1.org). Qualified lamps and ballast products can be found at <http://www.cee1.org>. Incentives are also available when replacing 59-Watt T8 lamps with reduced-wattage T8 lamps when an electronic ballast is already present. Eight-foot lamps must have a minimum MLPW of 90 and must have a nominal wattage of less than 57 W. A manufacturer's specification sheet must accompany the application.

Measure Savings

Savings are summarized by the following table:

Table 26 Measure Savings for Reduced-Wattage 8-foot Lamp and Ballast

Coincident Demand Savings (kW)	Energy Savings (kWh)
0.016	78.7

Table 27 Measure Savings for Reduced-Wattage 8-foot Lamp Only



Coincident Demand Savings (kW)	Energy Savings (kWh)
0.005	24.6

Measure Savings Analysis

Annual energy savings and the peak coincident demand savings were calculated using the equations below. The annual operating hours, the coincidence factors, and the interactive effect factors were all derived from the DEER database and shown in the table below. DEER values by building type were averaged for the AEP Ohio Program.

Table 28 Factors used for Calculating Lighting Savings

Annual Operating Hours	Demand Interactive Effects	Coincident Diversity Factors	Energy Interactive Effects
4,389	1.19	0.77	1.12

Non-coincident kW reduction = kW of existing equipment - kW of replacement equipment

Energy savings are calculated by applying the annual operating hours and the energy interactive effect, according to the following formula:

$$\text{kWh Reduction} = \text{non-coincident kW savings} * \text{Annual operating hours} * \text{Energy interactive effect}$$

Coincident demand savings are calculated by applying the coincidence factor and the demand interactive effect, according to the following formula:

$$\text{Coincident kW savings} = \text{non-coincident kW savings} * \text{Coincidence Factor} * \text{Demand interactive effect}$$

Baseline and retrofit equipment assumptions are presented in the next table.



Table 29 Baseline and Retrofit Wattages for 8-foot

	Configuration	Base Lamp Wattage	Base Fixture Wattage	Retrofit Lamp Wattage	Retrofit Fixture Wattage	Demand Savings per fixture (kW)	Demand Savings per lamp (kW)	Weight Percentages
Lamp and Ballast	8ft, 2 lamp	60	132	57	102	0.030	0.015	50%
	8ft, 1-lamp	60	77	57	60	0.017	0.017	50%
	Weighted Average						0.016	
Lamp Only	8ft, 2 lamp	59	106	57	102	0.004	0.002	50%
	8ft, 1-lamp	59	68	57	60	0.008	0.008	50%
	Weighted Average						0.005	

Measure Life and Incremental Measure Cost

The following table provides the measure life and IMC documented for this measure as well as the source of the data. Incremental cost is the cost difference between the energy-efficient equipment and the less efficient option. In this case, the IMC is equal to the full measure cost for lamp and ballast retrofit and incremental for lamp only. The lamp and ballast retrofit is a change in technology.

Table 30 Measure Life and Incremental Measure Cost

	Measure Category	Value	Source
Measure Life	Lamp and Ballast	11	DEER
Measure Life	Lamp Only	3	KEMA
Incremental Measure Cost	8 Foot Lamp and Ballast	\$36.91	DEER
Incremental Measure Cost	8 Foot Lamp Only	\$5.50	ICF Portfolio Plan



U-Tube T8 Lamps and Ballast

Table 31 U-Tube T8 Lamps and Ballast

Measure Description	This measure consists of replacing existing T12 U-tube lamps and magnetic ballasts with T8 U-tube lamps and electronic ballasts.
Units	Per lamp
Base Case Description	U-tube T12 lamps and magnetic ballast
Measure Savings	Source: KEMA
Measure Incremental Cost	Source: AEP Ohio Potential Study
Effective Useful Life	Source: DEER 11 years

This measure consists of replacing existing U-tube T12 lamps and magnetic ballasts with U-tube T8 lamps and electronic ballasts. The lamp must have a color rendering index (CRI) ≥ 80 and the ballast must have a total harmonic distortion (THD) $\leq 20\%$ at full light output and power factor (PF) ≥ 90 . Ballasts must also be warranted against defect for 5 years. The incentive is calculated based on the number of lamps installed. A manufacturer's specification sheet must accompany the application.

Measure Savings

The coincident kW and kWh savings are in the following table.

Table 32 Measure Savings for U-tube Lamp and Ballast (per lamp)

Coincident Demand Savings (kW)	Energy Savings (kWh)
0.009	46.7

Measure Savings Analysis

Annual energy savings and the peak coincident demand savings were calculated using the equations below. The annual operating hours, the coincidence factors, and the interactive effect factors were all derived from the DEER database and shown in the following table.⁶

⁶ 2005 Database for Energy Efficiency Resources (DEER) Update Study Final Report - Residential and Commercial Non-Weather Sensitive Measures



Table 33 Factors used for Calculating Lighting Savings

Annual Operating Hours	Demand Interactive Effects	Coincident Diversity Factors	Energy Interactive Effects
4,389	1.19	0.77	1.12

Non-coincident kW reduction = kW of existing equipment - kW of replacement equipment

Energy savings are calculated by applying the annual operating hours and the energy interactive effect, according to the following formula:

$$\text{kWh Reduction} = \text{non-coincident kW savings} * \text{Annual operating hours} * \text{Energy interactive effect}$$

Coincident demand savings are calculated by applying the coincidence factor and the demand interactive effect, according to the following formula:

$$\text{Coincident kW savings} = \text{non-coincident kW savings} * \text{Coincidence Factor} * \text{Demand interactive effect}$$

Baseline and retrofit equipment assumptions are presented in the following table. The wattages were collected from PG&E's Non-residential retrofit standard wattages table.

Table 34 Baseline and Retrofit Wattages for U-tube lamps

T8 Configuration	Base Lamp Wattage	Base Fixture Wattage	Retrofit Lamp Wattage	Retrofit Fixture Wattage	Demand Savings per fixture (kW)	Demand Savings per lamp (kW)	Weight Percentages
U-tube, 2 lamp	35	72	32	59	0.013	0.007	50%
U-tube, 1 lamp	35	43	32	31	0.012	0.012	50%
Weighted Average						0.010	

Measure Life and Incremental Measure Cost

The table below provides the measure life and IMC documented for this measure as well as the source of the data. Incremental cost is cost difference between the energy-efficient equipment and the less efficient option. In this case, the IMC is equal to the full measure cost since cost of the less efficient option is \$0. For U-tubes, it is assumed that the cost is the same as a high performance 4-foot T8 lamp (DEER measure ID D03-852).



Table35 Measure Life and Incremental Measure Cost

	Measure Category	Value	Source
Measure Life	Lamp and Ballast	11	DEER
Measure Life	Lamp Only	3	KEMA
Incremental Measure Cost	U-Tube Lamp and Ballast	\$13.14	AEP Potential Study



2-foot & 3-foot T8 Lamps and Ballast

Table 36 2-foot & 3-foot T8 Lamps and Ballast

Measure Description	This measure consists of replacing existing T12 2-foot and 3-foot lamps and magnetic ballasts with 17W, 2-foot, and 25W, 3-foot, T8 lamps and electronic ballasts.
Units	Per lamp
Base Case Description	T12 lamps and magnetic ballast
Measure Savings	Source: KEMA
Measure Incremental Cost	Source: PG&E 2006 Work papers
Effective Useful Life	Source: DEER 11 years

This measure consists of replacing existing T12 lamps and magnetic ballasts with T8 lamps and electronic ballasts. The lamp must have a color rendering index (CRI) ≥ 80 and the ballast must have a total harmonic distortion (THD) $\leq 32\%$ at full light output and power factor (PF) ≥ 0.90 . Ballasts must also be warranted against defects for 5 years. The incentive is calculated based on the number of lamps installed. A manufacturer's specification sheet must accompany the application.

Measure Savings

The coincident kW and kWh savings are provided in the following table:

Table 37 Measure Savings for 2-foot and 3-foot Lamp and Ballast (per lamp)

2-foot Lamp fixtures		3-foot Lamp fixtures	
Coincident Demand Savings (kW)	Energy Savings (kWh)	Coincident Demand Savings (kW)	Energy Savings (kWh)
0.010	51.6	0.013	69.5

Measure Savings Analysis

Annual energy savings and the peak coincident demand savings were calculated using the equations below. The annual operating hours, the coincidence factors, and the interactive effect factors were all derived from the DEER database and shown in the following table.

Table 38 Factors used for Calculating Lighting Savings



Annual Operating Hours	Demand Interactive Effects	Coincident Diversity Factors	Energy Interactive Effects
4,389	1.19	0.77	1.12

Non-coincident kW reduction = kW of existing equipment - kW of replacement equipment

Energy savings are calculated by applying the annual operating hours and the energy interactive effect, according to the following formula:

$$\text{kWh Reduction} = \text{non-coincident kW savings} * \text{Annual operating hours} * \text{Energy interactive effect}$$

Coincident demand savings are calculated by applying the coincidence factor and the demand interactive effect, according to the following formula:

$$\text{Coincident kW savings} = \text{non-coincident kW savings} * \text{Coincidence Factor} * \text{Demand interactive effect}$$

Baseline and retrofit equipment assumptions are presented in the tables below. The fixture wattages were collected from PG&E's Non-residential Retrofit Program standard fixture wattage table.

Table 39 Baseline and Retrofit Wattages for 2-foot lamps

T8 Configuration	Base Lamp Wattage	Base Fixture Wattage	Retrofit Lamp Wattage	Retrofit Fixture Wattage	Demand Savings per fixture (kW)	Demand Savings per lamp (kW)	Weight Percentages
2 ft, 4-lamp	20	112	17	61	0.051	0.013	2.5%
2 ft, 3-lamp	20	84	17	47	0.037	0.012	2.5%
2 ft, 2-lamp	20	56	17	33	0.023	0.012	65%
2 ft, 1-lamp	20	28	17	20	0.008	0.008	30%
Weighted Average						0.011	

Table 40 Baseline and Retrofit Wattages for 3-foot lamps

T8 Configuration	Base Lamp Wattage	Base Fixture Wattage	Retrofit Lamp Wattage	Retrofit Fixture Wattage	Demand Savings per fixture (kW)	Demand Savings per lamp (kW)	Weight Percentages



3 ft, 4-lamp	30	152	25	87	0.065	0.0163	2.5%
3 ft, 3-lamp	30	114	25	67	0.047	0.0157	2.5%
3 ft, 2-lamp	30	76	25	46	0.030	0.0150	65%
3 ft, 1-lamp	30	38	25	26	0.012	0.0120	30%
Weighted Average						0.014	

Measure Life and Incremental Measure Cost

The table below provides the measure life and IMC documented for this measure as well as the source of the data. Incremental cost is cost difference between the energy-efficient equipment and the less efficient option. In this case, the IMC is equal to the full measure cost since cost of the less efficient option is \$0.

Table 41 Measure Life and Incremental Measure Cost

	Measure Category	Value	Source
Measure Life	Lamp and Ballast	11	DEER
Measure Life	Lamp Only	3	KEMA
Incremental Measure Cost	2 Foot Lamp and Ballast	\$10.50	PG&E 2006 Work Paper
Incremental Measure Cost	3 Foot Lamp and Ballast	\$21	PG&E 2006 Work Paper



Ceramic Metal Halides or Pulse Start Metal Halides

Table 42 Ceramic Metal Halides or Pulse Start Metal Halides

Measure Description	This measure applies to retrofits of high intensity discharge fixtures with either pulse start metal halide or ceramic metal halide fixtures. The new fixture must replace a higher wattage existing fixture.
Units	Per Fixture
Base Case Description	High wattage HID fixtures
Measure Savings	Source: KEMA
Measure Incremental Cost	Source: KEMA
Effective Useful Life	Source: DEER 16 years

This incentive applies to retrofits of high-intensity discharge fixtures with either pulse-start metal halide or ceramic metal halide fixtures. Total replacement wattage must be lower than existing wattage to ensure energy savings. This measure is subject to possible pre-inspection. Retrofit kits may be used on existing mercury vapor, standard metal halide or high-pressure sodium fixtures only.

Measure Savings

The table below provides the non-coincident savings.

Table 43 Wattage Reduction

Wattage Category	Average Wattage Reduction
100W or Less	48
101W-200W	65
201-350W	126

The savings are presented in the following table. The annual operation hours, the coincidence factors, and the interactive effect factors are obtained from the DEER database.⁷ Since the AEP SmartGrid program does not vary savings by building type, the savings presented below are averages of savings calculated for these building types.

⁷ 2005 Database for Energy Efficiency Resources (DEER) Update Study Final Report - Residential and Commercial Non-Weather Sensitive Measures



Table 44: Measure Savings for ≤100W MH

Annual Operating Hours	Peak kW Savings	kWh Savings
4,389	0.048	211

Table 45 : Measure Savings for 101W-200W MH

Annual Operating Hours	Peak kW Savings	kWh Savings
4,389	0.065	285

Table 46: Measure Savings for >200W-350W MH

Annual Operating Hours	Peak kW Savings	kWh Savings
4,389	0.126	553

Measure Savings Analysis

Annual energy savings and the peak coincident demand savings were calculated using the equations below. The annual operation hours, the coincidence factors, and the interactive effect factors were all obtained from the DEER database. The savings presented here are averages of those savings by building type.

Non-coincident kW reduction = kW of existing equipment - kW of replacement equipment

Energy savings are calculated by applying the annual operating hours and the energy interactive effect, according to the following formula:

kWh Reduction = non-coincident kW savings * Annual operating hours * Energy interactive effect

Coincident demand savings are calculated by applying the coincidence factor and the demand interactive effect, according to the following formula:

Coincident kW savings = non-coincident kW savings * Coincidence Factor * Demand interactive effect

For this measure, it is assumed that the lighting is placed in non-conditioned areas so the energy and demand interactive effects are 1.0.



Baseline and retrofit equipment assumptions are presented in the following table. Most lighting retrofits assume an early replacement of existing technologies where the baseline represents the equipment removed. The table shows the wattages used for the savings calculations.

Table 47: Baseline and Retrofit Wattages⁸

Measures	Base Wattage	Retrofit Wattage	Wattage Reduction
100W or Less			
Base case => Ceramic MH (20W lamp)	57	22	35
Base case => Ceramic MH (39W lamp)	83	46	37
Base case (100W) => Ceramic MH (25W lamp)	100	27	73
Average			48
101W-200W			
Base case (250W lamp) => Metal Halide (175W lamp)	295	208	87
Base case (175W lamp) => Metal Halide (150W lamp)	208	185	23
Metal Halide (250W) => Pulse Start Metal Halide (175W)			85
Average			65
201-350W			
Base case (400W lamp) => Metal Halide (320W lamp)	458	365	93
Mercury Vapor (400W) => Pulse Start Metal Halide (250W)			159
Average			126

Measure Life and Incremental Measure Cost

The next table provides the measure life and IMC documented for this measure as well as the source of the data. Incremental cost is cost difference between the energy-efficient equipment and the less efficient option. In this case, lighting measures, the IMC is equal to the full measure cost since the cost of the less efficient option, i.e., not conducting the retrofit, is \$0.

⁸2006 PG&E Interior Pulse Start Metal Halide Workpaper, PG&E Directional Lighting CMH Workpaper, SCE Ceramic Metal Halide Workpaper (WPSCNRLG0054.1), 2005 Database for Energy Efficiency Resources (DEER) Update Study Final Report - Residential and Commercial Non-Weather Sensitive Measures.



Table 48: Measure Life and Incremental Measure Cost

Wattage Category		Value	Source
All	Measure Life	16	DEER
100W or Less	Incremental Measure Cost	\$95	SCE WP ⁹
101W-200W	Incremental Measure Cost	\$170	PG&E WP ¹⁰
201-350W	Incremental Measure Cost	\$266	SCE WP ¹¹

⁹ WPSCNRLG0054.1 Ceramic Metal Halide Fixtures, Southern California Edison Workpaper, 2008.

¹⁰ 2006 PG&E Interior Pulse Start Metal Halide Workpaper

¹¹ WPSCNRLG0046.1 Interior Pulse Start Metal Halide Fixtures 251 -400W, Southern California Edison Workpaper, 2008.



New T5/T8 Fluorescent Fixtures

Table 49 New T5/T8 Fluorescent Fixtures

Measure Description	This measure consists of replacing one or more existing fixtures with new fixtures containing T8 or T5 lamps and electronic ballasts. The T8 or T5 lamps must have a color rendering index (CRI) ≥ 80 . The electronic ballast must be high frequency (≥ 20 kHz), UL listed, and warranted against defects for 5 years. Ballasts must have a power factor (PF) ≥ 0.90 . Ballasts for 4-foot lamps must have total harmonic distortion (THD) ≤ 20 percent at full light output. For 2- and 3-foot lamps, ballasts must have THD $\leq 32\%$ at full light output.
Units	Per Watt reduced
Base Case Description	Typically high wattage HID fixtures
Measure Savings	Source: KEMA
Measure Incremental Cost	Source: KEMA
Effective Useful Life	Source: DEER 11 years

This measure consists of replacing one or more existing fixtures with new fixtures containing T8 or T5 lamps and electronic ballasts. The T8 or T5 lamps must have a color rendering index (CRI) ≥ 80 . The electronic ballast must be high frequency (≥ 20 kHz), UL listed, and warranted against defects for 5 years. Ballasts must have a power factor (PF) ≥ 0.90 . Ballasts for 4-foot lamps must have total harmonic distortion (THD) ≤ 20 percent at full light output. For 2- and 3-foot lamps, ballasts must have THD ≤ 32 percent at full light output.

Measure Savings

The annual operating hours, the coincidence factors, and the interactive effect factors were all derived from the DEER database.¹²

Table 50: Measure Savings for New T8/T5 Fluorescent Fixtures per Watt Reduced

Annual Operating Hours	Demand Interactive Effects	Coincident Diversity Factors	Energy Interactive Effects	Peak kW Savings	kWh Savings
4,389	1.19	0.77	1.12	0.000916	4.9141

¹² 2005 Database for Energy Efficiency Resources (DEER) Update Study Final Report - Residential and Commercial Non-Weather Sensitive Measures



Measure Savings Analysis

Annual energy savings and the peak coincident demand savings were calculated using the equations below.

$$\text{Non-coincident kW reduction} = \text{kW of existing equipment} - \text{kW of replacement equipment}$$

Energy savings are calculated by applying the annual operating hours and the energy interactive effect, according to the following formula:

$$\text{kWh Reduction} = \text{non-coincident kW savings} * \text{Annual operating hours} * \text{Energy interactive effect}$$

Coincident demand savings are calculated by applying the coincidence factor and the demand interactive effect, according to the following formula:

$$\text{Coincident kW savings} = \text{non-coincident kW savings} * \text{Coincidence Factor} * \text{Demand interactive effect}$$

Baseline and retrofit equipment assumptions are variable. Because we define this measure with the number of watts reduced, the non-coincident demand savings will be one watt by definition.

Measure Life and Incremental Measure Cost

The following table provides the measure life and IMC documented for this measure as well as the source of the data.

Incremental cost is cost difference between the energy efficient equipment and the less efficient option. For lighting measures, the IMC is equal to the full measure cost since the cost of the less efficient option, i.e., not conducting the retrofit, is \$0.

Table 51: Measure Life and Incremental Measure Cost

	Value	Source
Measure Life	11	DEER
Incremental Measure Cost ¹³	\$0.75	KEMA



Exit Signs

Table 52 Exit Signs

Measure Description	High-efficiency exit signs must replace or retrofit an existing incandescent exit sign. Electroluminescent, photoluminescent, T1 and light-emitting diode (LED) exit signs are eligible under this category. Non-electrified and remote exit signs are not eligible. All new exit signs or retrofit exit signs must be UL or ETL listed, have a minimum lifetime of 10 years, and have an input wattage ≤ 5 Watts or be ENERGY STAR qualified.
Units	Per Sign
Base Case Description	Incandescent Exit Signs
Measure Savings	Source: ENERGY STAR
Measure Incremental Cost	Source: AEP Ohio Potential Study
Effective Useful Life	Source: DEER 16 years

High-efficiency exit signs must replace or retrofit an existing incandescent exit sign. Electroluminescent, photoluminescent, T1 and light-emitting diode (LED) exit signs are eligible under this category. Non-electrified and remote exit signs are not eligible. All new exit signs or retrofit exit signs must be UL or ETL listed, have a minimum lifetime of 10 years, and have an input wattage ≤ 5 Watts or be ENERGY STAR qualified.

Measure Savings

Baseline and retrofit equipment assumptions are presented in the next table. Most lighting retrofits assume an early replacement of existing technologies where the baseline represents the equipment removed. The table shows the wattages used for the savings calculations.

Table 53: Baseline and Retrofit Wattages

Measure	Base Wattage	Retrofit Wattage	Wattage Reduction
Two Incandescent Bulbs (20W each) -> LED EXIT Sign (5W)	40	5	35

The measure savings use the above non-coincident savings.



Table 54: Exit Sign Savings

Peak kW Savings	kWh Savings
0.042	343.4

Measure Savings Analysis

Annual energy savings and the peak coincident demand savings were calculated using the equations below. The coincident diversity factor is 1.0 since the sign is on all the time. The operating hours are 8,760 hours per year.¹⁴

Table 55: Factors used for Calculating Savings

Annual Operating Hours	Demand Interactive Effects	Coincident Diversity Factors	Energy Interactive Effects
8,760	1.19	1.00	1.12

Non-coincident kW reduction = kW of existing equipment - kW of replacement equipment

Energy savings are calculated by applying the annual operating hours and the energy interactive effect, according to the following formula:

$$\text{kWh Reduction} = \text{non-coincident kW savings} * \text{Annual operating hours} * \text{Energy interactive effect}$$

Coincident demand savings are calculated by applying the coincidence factor and the demand interactive effect, according to the following formula:

$$\text{Coincident kW savings} = \text{non-coincident kW savings} * \text{Coincidence Factor} * \text{Demand interactive effect}$$

Measure Life and Incremental Measure Cost

The following table provides the measure life and incremental measure cost (IMC) documented for this measure as well as the source of the data.

¹⁴ 2005 Database for Energy Efficiency Resources (DEER) Update Study Final Report - Residential and Commercial Non-Weather Sensitive Measures



Incremental cost is cost difference between the energy efficient equipment and the less efficient option. In this case, the IMC is equal to the full measure cost since the cost of the less efficient option, i.e., not conducting the retrofit, is \$0.

Table 56: Measure Life and Incremental Measure Cost

	Value	Source
Measure Life	16	DEER
Incremental Measure Cost	\$82.54	AEP Ohio Potential Study



LED Lamps

Table 57 LED Lamps

Measure Description	LED recessed down lamps or screw-in base lamps qualify. The LED recessed downlight must be ≤ 18 Watts and have a minimum efficacy of 35 lumens per Watt. The product must meet Energy Star Criteria. For screw-in base LED lamps, the wattage must be < 8 Watts.
Units	Per lamp
Base Case Description	100 Watt or less incandescent
Measure Savings	Source: KEMA
Measure Incremental Cost	Source: PG& E 2006 Work papers
Effective Useful Life	Source: PG& E 2006 Work papers 16 years

LED recessed down lamps or screw-in base lamps qualify. The LED recessed downlight must be ≤ 18 Watts and have a minimum efficacy of 35 lumens per Watt. The product must meet Energy Star Criteria. For screw-in base LED lamps, the wattage must be < 8 Watts.

Measure Savings

The coincident kW and kWh savings are provided in the following table.

Table 58: Measure Savings for LED (per lamp)

Coincident Demand Savings (kW)	Annual Energy Savings (kWh)
0.030	160.9

Measure Savings Analysis

Annual energy savings and the peak coincident demand savings were calculated using the equations below. The annual operation hours, the coincidence factors, and the interactive effect factors are obtained from the DEER database.¹⁵ Since the AEP SmartGrid program does not vary savings by building type, the savings presented below are averages of savings calculated for these building types.

¹⁵ 2005 Database for Energy Efficiency Resources (DEER) Update Study Final Report - Residential and Commercial Non-Weather Sensitive Measures



Table 59: Factors used for Calculating Lighting Savings

Annual Operating Hours	Demand Interactive Effects	Coincident Diversity Factors	Energy Interactive Effects
4,321	1.19	0.77	1.12

Non-coincident kW reduction = kW of existing equipment - kW of replacement equipment

Energy savings are calculated by applying the annual operating hours and the energy interactive effect, according to the following formula:

$$\text{kWh Reduction} = \text{non-coincident kW savings} * \text{Annual operating hours} * \text{Energy interactive effect}$$

Coincident demand savings are calculated by applying the coincidence factor and the demand interactive effect, according to the following formula:

$$\text{Coincident kW savings} = \text{non-coincident kW savings} * \text{Coincidence Factor} * \text{Demand interactive effect}$$

Baseline and retrofit equipment assumptions are presented in the table below. The fixture wattages were collected from PG&E's Non-residential Retrofit Program standard fixture wattage table.

Table 60: Baseline and Retrofit Wattages for LED Lamps

Base Case lamps	Base Lamp Wattage	Retrofit Lamp Wattage	Demand Savings per lamp (kW)	Weight Percentages
100 W incandescent	100	8	0.092	5%
75 W incandescent	75	8	0.067	15%
60 W incandescent	60	8	0.052	15%
40 W incandescent	40	8	0.032	15%
25 W incandescent	25	8	0.017	25%
15 W incandescent	15	8	0.007	25%
Weighted Average			0.033	

Measure Life and Incremental Measure Cost

The next table provides the measure life and IMC documented for this measure as well as the source of the data. Incremental cost is cost difference between the energy-efficient equipment and the less efficient option. In this case the lighting measures, the IMC is equal to the full



measure cost since cost of the less efficient option is \$0. For LED lighting, the IMC was calculated as the average price of 8 LED bulbs ranging from 0.85 to 4.7 W.

The measure life for the LED bulbs is taken from the PG&E work paper on LED open signs and is 16 years.

Table 61: Measure Life and Incremental Measure Cost

Measure Category	Lamp	Value	Source
Measure Life	LED	16 years	PG&E LED Open sign Work paper
Incremental Measure Cost	LED	\$30	Average of 8 LED bulbs sold at CCrane.com



LED Refrigerated Case Lighting

Table 62: LED Refrigerated Case Lighting

Measure Description	Replace fluorescent refrigerated case lighting with light emitting diode (LED) source illumination. Fluorescent lamps, ballasts, and associated hardware are typically replaced with pre-fabricated LED light bars and driver units.
Units	Per door
Base Case Description	Fluorescent refrigerated case lighting
Measure Savings	Source: PG&E LED Refrigerated Case Lighting Workpaper
Measure Incremental Cost	Source: PG&E LED Refrigerated Case Lighting Workpaper
Effective Useful Life	Source: PG&E LED Refrigerated Case Lighting Workpaper 16 years

Replace fluorescent refrigerated case lighting with light emitting diode (LED) source illumination. Fluorescent lamps, ballasts, and associated hardware are typically replaced with pre-fabricated LED light bars and LED driver units. The two LED lamp products, 5' light bars and 6' light bars are eligible.

Measure Savings Analysis

The coincident demand savings is 0.061KW per door and annual energy savings is 375 kWh per door.

Measure Savings Analysis

The energy and demand savings are derived from an Emerging Technologies (ET) study of the refrigerated case lighting done by PG&E.

The electricity use (kWh) savings and gross summer peak demand (kW) reduction comprises two factors: reduced lighting load and reduced refrigeration requirements due to reduced heat gain. Reductions in lighting load occur continuously over the expected annual operating period, which includes the summer peak period. Savings due to reduced heat gain are computed assuming those reduced effects occur during the period in which the lighting systems operate, in consideration of the refrigeration compressor COP and the reduced cooling load, under normal operation (i.e., doors closed). Baseline and retrofit equipment assumptions are presented in the next table.

Table 63: Baseline and Retrofit Wattages LED refrigeration Lighting (per door)

	Estimated Energy Savings kWh/yr/door	Estimated Demand Savings kW/door	Weight Percentages
5' LED Light Bar			
Premium Tier	341	0.055	25%
Standard Tier	292	0.047	25%
6' LED Light Bar			
Premium Tier	465	0.075	25%
Standard Tier	403	0.065	25%



Weighted Average	375	0.061	
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Measure Life and Incremental Measure Cost

The table below provides the measure life and IMC documented for this measure as well as the source of the data. Incremental cost is cost difference between the energy-efficient equipment and the less efficient option. In this case the lighting measures, the IMC is equal to the full measure cost since cost of the less efficient option is \$0.

The EUL for an LED exit sign or retrofit kit is estimated to be 16 years (over 140,000 hours), according to DEER. The core technology, LED sources and driver, are similar for both the established application (exit sign lighting) and the emerging technology (refrigeration case lighting). LED Power (LED equipment manufacturer) provided an expected life of 50,000 hours for the LED low-temperature case lighting, which is much less than the DEER estimate of 16 years for LED exit sign technology. It is well documented that LED life is extended in a low-temperature environment; therefore the expected useful life of 50,000 hours assumed for this application is probably conservative. Based on the fixture run-time of 6,205 hours annually for the facility in the study, the expected life calculates to 8 years.

Table 64: Measure Life and Incremental Measure Cost

	Measure Category	Value	Source
Measure Life	Fixture life	16	PG&E Work paper
Incremental Measure Cost	LED Refrigerated Case Lighting	\$266	PG&E Work paper



LED Open Signs

Table 65: LED Open Signs

Measure Description	Light-emitting diodes (LED) open signs are eligible under this category.
Units	Per Sign
Base Case Description	Neon open sign
Measure Savings	Source: PG&E work paper
Measure Incremental Cost	Source: PG&E work paper
Effective Useful Life	Source: PG&E work paper 16 years

LED open signs must replace an existing neon open sign. LED drivers can be either electronic switching or linear magnetic, with the electronic switching supplies being the most efficient. The on-off power switch may be found on either the power line or load side of the driver, with the line side location providing significantly lower standby losses when the sign is turned off and is not operating.

Measure Savings

The coincident kW and kWh savings are provided in the following table. Open signs are assumed to be on during the typical operating hours of these buildings.

Table 66: Measure Savings for LED Open Signs (per sign)

Coincident Demand Savings (kW)	Energy Savings (kWh)
0.145	776.7

Measure Savings Analysis

Annual energy savings and the peak coincident demand savings were calculated using the equations below. The annual operation hours, the coincidence factors, and the interactive effect factors are obtained from the DEER database.¹⁶ Since the AEP SmartGrid program does not vary savings by building type, the savings presented below are averages of savings calculated for these building types.

¹⁶ 2005 Database for Energy Efficiency Resources (DEER) Update Study Final Report - Residential and Commercial Non-Weather Sensitive Measures



Table 67: Factors used for Calculating Lighting Savings

Annual Operating Hours	Demand Interactive Effects	Coincident Diversity Factors	Energy Interactive Effects
4,389	1.19	0.77	1.12

Non-coincident kW reduction = kW of existing equipment - kW of replacement equipment

Energy savings are calculated by applying the annual operating hours and the energy interactive effect, according to the following formula:

$$\text{kWh Reduction} = \text{non-coincident kW savings} * \text{Annual operating hours} * \text{Energy interactive effect}$$

Coincident demand savings are calculated by applying the coincidence factor and the demand interactive effect, according to the following formula:

$$\text{Coincident kW savings} = \text{non-coincident kW savings} * \text{Coincidence Factor} * \text{Demand interactive effect}$$

The following table provides the sample retrofit options and demand reduction assumptions used.

Table 68: Demand Reduction for Open Signs

	Demand Savings per Sign	Weight Percentages
Replacement of Neon-Large Neon-Like Appearance	0.169	33%
Replacement of Neon-Small Dot Pattern	0.125	33%
Replacement of Neon-Large Oblong Dot Pattern	0.180	33%
Weighted Average	0.158	

Measure Life and Incremental Measure Cost

The following table provides the measure life and incremental measure cost (IMC) documented for this measure as well as the source of the data. The measure life is assumed to be the same as that of an LED exit sign.

Incremental cost is cost difference between the energy efficient equipment and the less efficient option. In this case the lighting measures, the IMC is equal to the full measure cost since cost of the less efficient option, i.e., of not conducting the retrofit is \$0.

The actual incremental cost of LED technology over new neon technology with electronic ballasts is about \$50 to 100 per sign, or \$75, on average.



Table 69: Measure Life and Incremental Measure Cost

	Value	Source
Measure Life	16	PG&E work paper
Incremental Measure Cost	\$75	PG&E work paper



LED Channel Signs, Indoor

Table 70 LED Channel Signs, Indoor

Measure Description	Retrofit and replacement of inefficient neon and argon-mercury channel letter signs with efficient LED channel letter signs.
Units	Per letter
Base Case Description	Existing signage– Neon (red) channel letter signs and argon-mercury (white) channel letter signs.
Measure Savings	Source: PG&E workpaper
Measure Incremental Cost	Source: PG&E workpaper
Effective Useful Life	16 years Source: PG&E workpaper

LED channel sign incentive is available for retrofitting or replacing incandescent, HID, argon-mercury or neon-lighted channel letter signs. Replacement signs cannot use more than 20% of the actual input power of the sign that is replaced.

Measure Savings¹⁷

The following table summarizes the savings for LED channel signs.

Table 71: Savings for LED Channel Signs

Location	Hours of Operation	Sign Height	Annual Energy Savings kWh/letter	Demand Savings kW/letter	Peak Demand Savings kW/letter
Indoor	4375	≤ 2 ft	147	0.034	0.034
		>2 ft	378	0.086	0.086

Measure Savings Analysis

The calculation methodology used by PG&E in the LED Channel Sign workpaper is outlined below. All the supporting documentation and spreadsheets are shown in the PG&E workpaper.

- (1) Collected letter schematics showing linear feet of tubing and number of LED modules for each letter of the alphabet, both uppercase and lowercase, for 24 inch high letters and 36 inch high letters.
- (2) The base case wattage (W/ft) and the energy efficient case wattage (W/module) input values were collected for each specific letter.

¹⁷ PGE LED Channel Sign work paper

- (3) A probability table, showing the frequency each letter appears in the English language, was integrated into the spreadsheet. By multiplying the wattage for each specific letter by the probability, a weighted average wattage per letter was obtained. This single value represents all 26 letters of that height and will be accurate over a range of signs with a weighted average watts/letter for red and white for uppercase and lowercase letters.
- (4) This spreadsheet was then modified to account for the average height of signs in each category. (According to sign industry sources, the average height of a sign in the 2 feet or less category is 21 inches. The average height of a sign in the greater than 2 feet high category is 27 inches).
- (5) The watts/letter values were then weighted assuming 70% of letters are uppercase and 30% of letters are lowercase, as well as 50% are red signs and 50% are white signs.

Measure Life and Incremental Measure Cost

Measure life is assumed to be 16 years for the signs. LEDs have a lifetime of 25,000 hours for LEDs. However, to be consistent, DEER uses 16 years for LED exit signs, hence all LEDs are assumed to have a 16 year life.

Incremental cost is cost difference between the energy efficient equipment and the less efficient option. The incremental cost for the retrofit case is the full cost of the LED-lighted sign because the retrofit case assumes the existing lighting is working properly and does not need to be replaced. The incremental cost for the replacement case is the difference between the base case and the energy-efficient alternative. The incremental costs were weighted assuming that 30% of the channel signs will be retrofit and 70% of the channel signs will be new or replacement. Therefore, the incremental cost for signs less than or equal to 2 ft. high is \$35/letter and the incremental cost for signs greater than 2 ft. high is \$154/letter.



Interior Induction Fixtures

Table 72: Interior Induction Fixtures

Measure Description	This measure consists of replacing Mercury Vapor, T12/High Output Fluorescent, T12/Very High Output Fluorescent, Standard Metal Halide, or High Pressure Sodium fixtures with induction fixtures.
Units	Per fixture
Base Case Description	Mercury Vapor, T12/High Output Fluorescent, T12/Very High Output Fluorescent, Standard Metal Halide, or High Pressure Sodium fixtures
Measure Savings	Source: PG&E 2006 Workpapers
Measure Incremental Cost	Source: PG&E 2006 Workpapers
Effective Useful Life	Source: PG&E 2006 Workpapers 16 years

Only new, hard-wired induction fixtures qualify. New fixtures must replace, one for one, existing Incandescent, Mercury Vapor, T12/High Output Fluorescent, T12/Very High Output Fluorescent, Standard Metal Halide, or High Pressure Sodium fixtures in interior installations. The new fixtures must not exceed the maximum Wattage listed in the table below for each range of lamp Wattage being replaced.

Table 73: Wattage Criteria for Induction Lighting Replacement

Basecase Wattage	Replacement Fixture Wattage (Maximum)
≥ 400 Watt	360W
176-399 Watt	180W
101-175 Watt	160W
≤100 Watt	95W

Measure Savings

The coincident kW and kWh savings are provided in the following table.

Table 74: Measure Savings for Induction Fixtures

Coincident Demand Savings (kW)	Energy Savings (kWh)
0.063	337.7

Measure Savings Analysis

Annual energy savings and the peak coincident demand savings were calculated using the equations below. The annual operation hours, the coincidence factors, and the interactive effect



factors are obtained from the DEER database.¹⁸ Since the AEP SmartGrid program does not vary savings by building type, the savings presented below are averages of savings calculated for these building types.

Table 75: Factors used for Calculating Lighting Savings

Annual Operating Hours	Demand Interactive Effects	Coincident Diversity Factors	Energy Interactive Effects
4,389	1.19	0.77	1.12

Non-coincident kW reduction = kW of existing equipment - kW of replacement equipment

Energy savings are calculated by applying the annual operating hours and the energy interactive effect, according to the following formula:

$$\text{kWh Reduction} = \text{non-coincident kW savings} * \text{Annual operating hours} * \text{Energy interactive effect}$$

Coincident demand savings are calculated by applying the coincidence factor and the demand interactive effect, according to the following formula:

$$\text{Coincident kW savings} = \text{non-coincident kW savings} * \text{Coincidence Factor} * \text{Demand interactive effect}$$

Baseline and retrofit equipment assumptions are presented in the table below.

¹⁸ 2005 Database for Energy Efficiency Resources (DEER) Update Study Final Report - Residential and Commercial Non-Weather Sensitive Measures



Table 76: Baseline and Retrofit Wattages for Induction Lighting

	Base Lamp Wattage	Base Fixture Wattage	Retrofit Lamp Wattage	Retrofit Fixture Wattage	Demand Savings per fixture	Weight Percentages
400 Watt lamp basecase, up to 360 Watt replacement fixture	400	458	330	354	0.104	40%
176-399 Watt lamp basecase, up to 180 Watt replacement fixture	250	295	165	177	0.118	10%
101-175 Watt lamp basecase, up to 160 Watt replacement fixture	150	190	150	160	0.030	40%
100 Watt lamp basecase, up to 95 Watt replacement fixture	100	128	85	95	0.033	10%
Weighted Average					0.069	

Measure Life and Incremental Measure Cost

The next table provides the measure life and IMC documented for this measure as well as the source of the data. The measure life is assumed to be the same as that for HID lighting. Incremental cost is cost difference between the energy-efficient equipment and the less efficient option. In this case the lighting measures, the IMC is equal to the full measure cost since cost of the less efficient option.

Table 77: Measure Life and Incremental Measure Cost

	Measure Category	Value	Source
Measure Life	All	16	PG&E Work paper
Incremental Measure Cost	All	\$290	PG&E Work paper



Compact Fluorescent Fixtures, Hardwired

Table 78: Compact Fluorescent Fixtures, Hardwired

Measure Description	New fixtures or modular retrofits with hardwired electronic ballasts qualify. The CFL ballast must be programmed start or programmed rapid start with a PF ≥ 90 and THD $\leq 20\%$.
Units	Per fixture
Base Case Description	Incandescent or HID lamps.
Measure Savings	Source: KEMA
Measure Incremental Cost	Source: KEMA
Effective Useful Life	Source: DEER 12 years

Hardwired CFL incentives apply only to complete new fixtures or modular (pin-based) retrofits with hardwired electronic ballasts. The CFL ballast must be programmed 'start' or programmed 'rapid start' with a PF ≥ 90 and THD ≤ 20 percent.

Measure Savings

Baseline and retrofit equipment assumptions are presented in the table below. Most lighting retrofits assume early replacement of existing technologies where the baseline represents the equipment removed. The following table shows the wattages used for the savings calculations.



Table 79 Baseline and Retrofit Wattages

Measure	Base Wattage	Retrofit Wattage	kW Reduction
29W or Less	100	28	0.072
29W or Less	125	27	0.098
29W or Less	110	27	0.083
29W or Less	100	26	0.074
29W or Less	75	26	0.049
29W or Less	100	25	0.075
29W or Less	75	25	0.05
29W or Less	100	23	0.077
29W or Less	75	20	0.055
29W or Less	75	19	0.056
29W or Less	75	18	0.057
29W or Less	60	18	0.042
29W or Less	60	16	0.044
29W or Less	60	15	0.045
29W or Less	60	14	0.046
29W or Less	60	13	0.047
29W or Less	40	13	0.027
29W or Less	40	9	0.031
30W or Greater	120	30	0.09
30W or Greater	120	40	0.08
30W or Greater	200	55	0.145
30W or Greater	200	65	0.135

Table 80: Wattage Reduction

Wattage Category	Average Wattage Reduction
≤29	57
≥30W	113

The following tables provide the measure savings using the above wattage reduction assumptions.

Table 81 Measure Savings for 29W or less

Annual Operating Hours	Demand Interactive Effects	Coincident Diversity Factors	Energy Interactive Effects	Peak kW Savings	kWh Savings
4,321	1.19	0.77	1.12	0.052	276



Table 82: Measure Savings for ≥30W

Annual Operating Hours	Demand Interactive Effects	Coincident Diversity Factors	Energy Interactive Effects	Peak kW Savings	kWh Savings
4,321	1.19	0.77	1.12	0.103	544

Measure Savings Analysis

Annual energy savings and the peak coincident demand savings were calculated using the equations below. The annual operation hours, the coincidence factors, and the interactive effect factors were all derived from the DEER database.¹⁹ DEER values by building type were averaged for the AEP Ohio Program.

Non-coincident kW reduction = kW of existing equipment - kW of replacement equipment

Energy savings are calculated by applying the annual operating hours and the energy interactive effect, according to the following formula:

kWh Reduction = non-coincident kW savings * Annual operating hours * Energy interactive effect

Coincident demand savings are calculated by applying the coincidence factor and the demand interactive effect, according to the following formula:

Coincident kW savings = non-coincident kW savings * Coincidence Factor * Demand interactive effect

Measure Life and Incremental Measure Cost

The table below provides the measure life and IMC documented for this measure as well as the source of the data.

Incremental cost is the cost difference between the energy-efficient equipment and the less efficient option. For lighting measures, the IMC is equal to the full measure cost since the cost of the less efficient option, i.e., not conducting the retrofit, is \$0.

¹⁹ 2005 Database for Energy Efficiency Resources (DEER) Update Study Final Report - Residential and Commercial Non-Weather Sensitive Measures



Table 83: Measure Life and Incremental Measure Cost

Wattage Category		Value	Source
All	Measure Life	12	DEER
≤29	Incremental Measure Cost	\$95	KEMA
≥30W	Incremental Measure Cost	\$132	KEMA



Cold Cathode

Table 84: Cold Cathode

Measure Description	All cold cathode fluorescent lamps (CCFLs) must replace incandescent lamps of at least 10 W and not greater than 40 W. Cold cathode lamps may be medium (Edison) or candelabra base. Product must be rated for at least 18,000 average life hours.
Units	Per lamp
Base Case Description	Incandescent
Measure Savings	Source: KEMA, SCE
Measure Incremental Cost	Source: PG&E
Effective Useful Life	Source: SCE 5 years

All cold cathode fluorescent lamps (CCFLs) must replace incandescent lamps of at least 10 W and not greater than 40 W. Cold cathode lamps may be medium (Edison) or candelabra base. The product must be rated for at least 18,000 average life hours.

Measure Savings

Baseline and retrofit equipment assumptions are presented in table below. Most lighting retrofits assume an early replacement of existing technologies where the baseline represents the equipment removed. The table shows the wattages used for the savings calculations from SCE and KEMA research of cold cathode manufacturers.

Table 85: Baseline and Retrofit Wattages

Measures ²⁰	Base Wattage (Watts)	Retrofit Wattage (Watts)	Wattage Reduction (Watt)
Incandescent (15W) -> Cold Cathode FL (5W)	15	5	10
Incandescent (30W) -> Cold Cathode FL (5W)	30	5	25
Incandescent (40W) -> Cold Cathode FL (8W)	40	8	32
Average			22

The following table provides the measure savings using the above non-coincident savings.

²⁰ Southern California Edison Company, Cold Cathode Fluorescent Lamp Workpaper WPSCNRLG0063. 2007.



Table 86: Measure Savings

Annual Operating Hours	Demand Interactive Effects	Coincident Diversity Factors	Energy Interactive Effects	Peak kW Savings	kWh Savings
4,321	1.19	0.77	1.12	0.020	108

Measure Savings Analysis

Annual energy savings and the peak coincident demand savings were calculated using the equations below. The annual operating hours, the coincidence factors, and the interactive effect factors were all derived from the DEER database.

Non-coincident kW reduction = kW of existing equipment - kW of replacement equipment

Energy savings are calculated by applying the annual operating hours and the energy interactive effect, according to the following formula:

kWh Reduction = non-coincident kW savings * Annual operating hours * Energy interactive effect

Coincident demand savings are calculated by applying the coincidence factor and the demand interactive effect, according to the following formula:

Coincident kW savings = non-coincident kW savings * Coincidence Factor * Demand interactive effect

Measure Life and Incremental Measure Cost

The following table provides the measure life and IMC documented for this measure as well as the source of the data.

Incremental cost is cost difference between the energy-efficient equipment and the less efficient option. In this case, the IMC is equal to the full measure cost since cost of the less efficient option is \$0.



Table 87: Measure Life and Incremental Measure Cost²¹

	Value	Source
Measure Life	5	SCE WP
Incremental Measure Cost	\$9.68	PG&E WP

²¹ Southern California Edison Company, Cold Cathode Fluorescent Lamp Workpaper WPCNRLG0063
2007, Pacific Gas & Electric, Lighting WP.doc, 2006.



Specialty Screw-In CFL

Table 88: Specialty Screw-In CFL

Measure Description	This measure consists of the replacement of a conventional incandescent lamp with a specialty CFL.
Units	Per lamp
Base Case Description	Conventional, incandescent bulb
Measure Savings	Source: KEMA
Measure Incremental Cost	Source: KEMA \$47
Effective Useful Life	Source: DEER 2008 2.5 years

This measure consists of the replacement of an existing incandescent, metal halide, or induction lamp with a specialty compact fluorescent lamp (CFL). These specialty applications typically include 3-way and dimmable lamps. These lamps must meet ENERGY STAR® criteria, if available for the type of lamp.

Measure Savings

Table 89: Baseline and Retrofit Wattages

Measures	Base Wattage	Retrofit Wattage	Wattage Reduction, kW	Weights
Incandescent (60W) -> CFL (14.5W)	60	14.5	0.046	50%
Incandescent (75W) -> CFL (20W)	75	20	0.055	25%
Incandescent (100W) -> CFL (26.5W)	100	26.5	0.074	25%
Weighted average			0.055	

The savings are presented in the following table. The annual operation hours, the coincidence factors, and the interactive effect factors are obtained from the DEER database.²² Since the AEP SmartGrid program does not vary savings by building type, the savings presented below are averages of savings calculated for these building types.

Table 90: Measure Savings, per lamp

Annual Operating Hours	Demand Interactive Effects	Coincident Diversity Factors	Energy Interactive Effects	Peak kW Savings	kWh Savings
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²² 2005 Database for Energy Efficiency Resources (DEER) Update Study Final Report - Residential and Commercial Non-Weather Sensitive Measures



4,321	1.19	0.77	1.12	0.050	266
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Measure Savings Analysis

Annual energy savings and the peak coincident demand savings were calculated using the equations below. The annual operation hours, the coincidence factors, and the interactive effect factors were all obtained from the DEER database.

Non-coincident kW reduction = kW of existing equipment - kW of replacement equipment

Energy savings are calculated by applying the annual operating hours and the energy interactive effect, according to the following formula:

$$\text{kWh Reduction} = \text{non-coincident kW savings} * \text{Annual operating hours} * \text{Energy interactive effect}$$

Coincident demand savings are calculated by applying the coincidence factor and the demand interactive effect, according to the following formula:

$$\text{Coincident kW savings} = \text{non-coincident kW savings} * \text{Coincidence Factor} * \text{Demand interactive effect}$$

Measure Life and Incremental Measure Cost

The following table provides the measure life and IMC documented for this measure as well as the source of the data. Incremental cost is cost difference between the energy efficient equipment and the less efficient option. In this case the IMC is equal to the full measure cost since the cost of the less efficient option, i.e., not conducting the retrofit, is \$0.

Table 91: Measure Life and Incremental Measure Cost

	Value	Source
Measure Life	2.5	DEER 2008
Incremental Measure Cost	\$47	KEMA



Permanent Lamp Removal

Table 92: Permanent Lamp Removal

Measure Description	Incentives are paid for the permanent removal of existing 8', 4', 3' and 2' fluorescent lamps. Unused lamps, lamp holders, and ballasts must be permanently removed from the fixture. This measure is applicable when retrofitting from T12 lamps to T8 lamps or simply removing lamps from a T8 fixture. Removing lamps from a T12 fixture that is not being retrofitted with T8 lamps are not eligible for this incentive.
Units	Per lamp
Base Case Description	Various configurations of fluorescent fixtures before removal of lamps.
Measure Savings	Source: KEMA
Measure Incremental Cost	Source: ICF Portfolio Plan
Effective Useful Life	Source: DEER 11 years

Incentives are paid for the permanent removal of existing fluorescent lamps resulting in a net reduction of the number of foot-lamps. Customers are responsible for determining whether or not to use reflectors in combination with lamp removal in order to maintain adequate lighting levels. Unused lamps, lamp holders, and ballasts must be permanently removed from the fixture. This measure is applicable when retrofitting from T12 lamps to T8 lamps or simply removing lamps from a T8 fixture. Removing lamps from a T12 fixture that is not being retrofitted with T8 lamps is not eligible for this incentive. A Pre-approval Application is required for lamp removal projects in order for KEMA to have the option of conducting a pre-retrofit inspection.

Measure Savings

Non-coincident demand savings are summarized by the following table:

Table 93: Wattage Reduction

Wattage Category	Average Wattage Reduction
8 Foot Lamp Removal	68
4 Foot Lamp Removal	35
2 Foot or 3 Foot Lamp Removal	24

Table 94: Measure Savings for 8-Foot Lamp Removal

Annual	Demand	Coinciden	Energy	8-foot	8-foot
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Operating Hours	Interactive Effects	t Diversity Factors	Interactive Effects	Lamp Peak Savings (kW)	Savings (kWh)
4,389	1.19	0.77	1.12	0.062	333.7

Table 95: Measure Savings for 4-Foot Lamp Removal

Annual Operating Hours	Demand Interactive Effects	Coincident Diversity Factors	Energy Interactive Effects	4-foot Lamp Peak Savings (kW)	4-foot Savings (kWh)
4,389	1.19	0.77	1.12	0.032	172.3

Table 96: Measure Savings for 2-Foot or 3-Foot Lamp Removal

Annual Operating Hours	Demand Interactive Effects	Coincident Diversity Factors	Energy Interactive Effects	2-foot or 3-foot Lamp Peak Savings (kW)	2-foot or 3-foot Savings (kWh)
4,389	1.19	0.77	1.12	0.022	119.3

Measure Savings Analysis

Annual energy savings and the peak coincident demand savings were calculated using the equations below. The annual operating hours, the coincidence factors, and the interactive effect factors were all derived from the DEER database.²³ However, DEER values by building type were averaged for the AEP Ohio Program.

Non-coincident kW reduction = kW of existing equipment - kW of replacement equipment

Energy savings are calculated by applying the annual operating hours and the energy interactive effect, according to the following formula:

²³ 2005 Database for Energy Efficiency Resources (DEER) Update Study Final Report - Residential and Commercial Non-Weather Sensitive Measures



$\text{kWh Reduction} = \text{non-coincident kW savings} * \text{Annual operating hours} * \text{Energy interactive effect}$

Coincident demand savings are calculated by applying the coincidence factor and the demand interactive effect, according to the following formula:

$\text{Coincident kW savings} = \text{non-coincident kW savings} * \text{Coincidence Factor} * \text{Demand interactive effect}$

Baseline assumptions are presented in the next table. Most lighting retrofits assume an early replacement of existing technologies where the baseline represents the equipment removed. The table shows the wattages used for the savings calculations. Weighted average savings values are used when determining deemed savings for each 8 foot or 4 foot lamp permanently removed.

Table 97: Wattages for Eight-foot Lamps

Baseline	Base Wattage	Lamp Removed Wattage	Weight Percentages
Two 8' T12 (60W/75W)	140	70	85%
Two 8' T8 (59W)	111	56	15%
Total Weighted Average		68	

Table 98: Wattages for Four-foot Lamps

Baseline	Base Wattage	Lamp Removed Wattage	Weight Percentages
Two 4' T8 (32W)	65	36	3%
Two 4' T12 (34W/40W)	72	36	8%
Three 4' T8 (32W)	92	31	7%
Three 4' T12 (34W/40W)	115	38	22%
Four 4' T8 (32W)	118	30	15%
Four 4' T12 (34W/40W)	144	36	45%
Total Weighted Average		35	

Table 99: Wattages for Two and Three-foot Lamps

Baseline	Base Wattage	Lamp Removed Wattage	Weight Percentages
Two 3' T12 (30W)	76	38	15%
Two 3' T8 (34W/40W)	48	24	15%
Two 2' T8 (17W)	31	15	30%
Two 2' T12 (20W)	56	28	30%
Three 2' T8 (17W)	46	16	2.5%



Three 2' T12 (20W)	62	21	2.5%
Four 2' T8 (17W)	60	15	2.5%
Four 2' T12 (20W)	112	28	2.5%
Total Weighted Average		24	

Measure Life and Incremental Measure Cost

The following table provides the measure life and incremental measure cost (IMC) documented for this measure as well as the source of the data.

Incremental cost is cost difference between the energy efficient equipment and the less efficient option. For lighting measures, the IMC is equal to the full measure cost since the cost of the less efficient option, i.e., not conducting the retrofit, is \$0.

Table 100: Measure Life and Incremental Measure Cost

Measure Category		Value	Source
All	Measure Life	11	DEER
8-Foot Lamp Removal	Incremental Measure Cost	\$25.91	ICF Portfolio Plan
4-Foot Lamp Removal	Incremental Measure Cost	\$25.70	ICF Portfolio Plan
2-Foot or 3-Foot Removal	Incremental Measure Cost	\$25.70	KEMA



Occupancy Sensors

Table 101: Occupancy Sensors

Measure Description	Passive infrared, ultrasonic detectors and fixture-integrated sensors or sensors with a combination thereof are eligible. All sensors must be hard-wired and control interior lighting fixtures. The incentive is per Watt controlled.
Units	Per Connected Watt
Base Case Description	No Sensor
Measure Savings	Source: DEER
Measure Incremental Cost	Source: DEER
Effective Useful Life	Source: DEER 8 years

Passive infrared, ultrasonic detectors and fixture-integrated sensors or sensors with a combination thereof are eligible. All sensors must be hard-wired and control interior lighting fixtures. The incentive is per Watt controlled.

Measure Savings

The annual operation hours, the coincidence factors, and the interactive effect factors were all derived from the DEER database.

Table 102: Measure Savings for Occupancy Sensor per Connected Watt

Annual Operating Hours	Demand Interactive Effects	Coincident Diversity Factors	Energy Interactive Effects	Peak Watt Savings	kWh Savings
4,389	1.19	0.77	1.12	0.0003	1,385

Measure Savings Analysis

Annual energy savings and the peak coincident demand savings were calculated using the equations below.

Energy savings are calculated by applying the annual operating hours and the energy interactive effect, according to the following formula:

$$\text{kWh Reduction} = \text{Connected wattage}/1000 * \text{Annual operating hours} * \text{Energy interactive effect} * \text{Occupancy Off Rate}$$

Coincident demand savings are calculated by applying the coincidence factor and the demand interactive effect, according to the following formula:



$$\text{Coincident kW savings} = \text{Connected wattage}/1000 * \text{Occupancy Off Rate} * \text{Coincidence Factor} \\ * \text{Demand interactive effect}$$

The baseline for this measure is fixtures that do not include any automatic controls, i.e., manual switches. Since the unit is defined as per connected Watt, the baseline demand is one watt. Demand savings depend on whether areas are high or low occupancy. DEER states that occupancy time off rates are at 20 percent for high-occupancy building types and 50 percent for low-occupancy building types.²⁴ The table below shows the assumed range of occupancy off rates. Calculations here are performed with the 28% average sensor off rate.

Table 103: Occupancy Off Rate

Average Grouping	Occupancy Sensor Off Rate
Office	20%
School (K-12)	20%
College/University	20%
Retail/Service	20%
Restaurant	20%
Hotel/Motel	20%
Medical	20%
Grocery	20%
Warehouse	50%
Light Industry	50%
Heavy Industry	50%
Average	28%

Measure Life and Incremental Measure Cost

The following table provides the measure life and IMC documented for this measure as well as the source of the data.

Incremental cost is cost difference between the energy efficient equipment and the less efficient option. For lighting measures, the IMC is equal to the full measure cost since the cost of the less efficient option, i.e., not conducting the retrofit, is \$0.

²⁴ 2005 Database for Energy Efficiency Resources (DEER) Update Study Final Report - Residential and Commercial Non-Weather Sensitive Measures



Table 104: Measure Life and Incremental Measure Cost

	Value	Source
Measure Life	8	DEER
Incremental Measure Cost	\$0.32	DEER



Plug Load Occupancy Sensors

Table 105 Plug Load Occupancy Sensors

Measure Description	Installation of an occupancy sensor on a plug load.
Units	Per sensor
Base Case Description	50W of task lighting and a computer monitor with no controls
Measure Savings	Source: DEER
Measure Incremental Cost	Source: DEER
Effective Useful Life	Source: DEER 8 years

This rebate applies to passive infrared and/or ultrasonic detectors only. Plug-load sensors must control electricity using equipment in offices or cubicles, including shared copiers and/or printers.

Measure Savings

The coincident demand savings is 0.091 kW and annual energy savings is 258 kWh per application. The savings are provided for the Office building type (interactive effects are included in the savings).

Measure Savings Analysis

Annual energy savings and the peak coincident demand savings were calculated using the equations below. The annual operation hours, the coincidence factors, and the interactive effect factor are obtained from the DEER database and shown in the following table. The occupancy sensor is assumed to turn off equipment for 2,450 hours/year. The factors used are for office building.

Table 106: Office Building Factors

Hours	Energy Interactive Effect	Demand Interactive Effects	Coincidence Factor
2,450	1.17	1.25	0.81

Energy savings are calculated by applying the annual operating hours and the energy interactive effect, according to the following formula:

$$\text{kWh Reduction} = \text{non-coincident kW savings} * \text{Annual operating hours} * \text{Energy interactive effect}$$

Coincident demand savings are calculated by applying the coincidence factor and the demand interactive effect, according to the following formula. The non-coincident demand reduction is 90W in this calculation.

$$\text{Coincident kW savings} = \text{non-coincident kW savings} * \text{Coincidence Factor} * \text{Demand interactive effect}$$



Measure Life and Incremental Measure Cost

The following table provides the measure life and incremental measure cost (IMC) documented for this measure as well as the source of the data. The full measure cost is the cost applicable for this measure.

Table 107: Measure Life and Incremental Measure Cost

	Value	Source
Measure Life	8	DEER
Incremental Measure Cost	\$20	DEER



Daylighting Controls

Table 108: Daylighting Controls

Measure Description	This measure consists of the installation of daylighting controls.
Units	Per square foot
Base Case Description	No lighting controls
Measure Savings	Source: KEMA, Michigan CI Technologies Workpaper FES-L12
Measure Incremental Cost	Source: Michigan CI Technologies Workpaper FES-L12
Effective Useful Life	Source: DEER 2008 8 years

This measure consists of the installation of daylighting controls. These systems use photoelectric controls to take advantage of available daylight in interior building spaces. These controls can be used to turn lights off/on, A-B switching, or continuous dimming.

Measure Savings

Installation of daylighting controls is assumed to result in 30% savings for most perimeter and open space applications. Assumed average lighting density is 1.3 watts per square foot.

$$\text{Annual kWh Savings} = \left(\frac{1.3 \text{ watts per square foot}}{1000 \text{ watts per kW}} \right) \times (30\% \text{ savings}) \times (\text{annual operating hours}) \times (\text{energy intera})$$

$$\text{Peak Savings} = (1.3 \text{ watts per square foot}) \times (1 \text{ square foot}) \times (\text{coincidence factor}) \times (\text{diversity factor})$$

The savings are presented in the following table. The annual operation hours, the coincidence factors, and the interactive effect factors are obtained from the DEER database.²⁵ Since the AEP SmartGrid program does not vary savings by building type, the savings presented below are averages of savings calculated for these building types.

²⁵ 2005 Database for Energy Efficiency Resources (DEER) Update Study Final Report - Residential and Commercial Non-Weather Sensitive Measures



Table 109: Measure Savings for Daylighting Controls, per sq ft

Annual Operating Hours	Demand Interactive Effects	Coincident Diversity Factors	Energy Interactive Effects	Peak kW Savings, W per sq ft	Peak kW Savings, kW per 10,000 sq ft	kWh Savings, sq ft
4,389	1.19	0.77	1.12	0.001	11.91	1.92

Measure Life and Incremental Measure Cost

The following table provides the measure life and IMC documented for this measure as well as the source of the data. Incremental cost is cost difference between the energy efficient equipment and the less efficient option. In this case the IMC is equal to the full measure cost since the cost of the less efficient option, i.e., not conducting the retrofit, is \$0.

The cost assumes a space of 3000 sq ft. Material cost is \$3,000, and installation cost is estimated at \$1,000.

Table 110: Measure Life and Incremental Measure Cost, per sq ft

	Value	Source
Measure Life	8	DEER 2008
Incremental Measure Cost	\$1.33	Michigan CI Technologies Workpaper FES-L12



Bi-level Stairwell/Hall/Garage Light Fixtures

Table 111: Bi-level Stairwell/Hall/Garage Light Fixtures

Measure Description	This measure consists of replacing 2-lamp T12 fixture (full level output only) with a 2-lamp T8 bi-level fixture.
Units	Fixture
Base Case Description	2-lamp T12 fixture (full level output only)
Measure Savings	Source: PG&E 2006 Work papers
Measure Incremental Cost	Source: PG&E 2006 Work papers and KEMA
Effective Useful Life	Source: DEER 11 years

Existing fixtures must be a two-lamp T12 fixture. Eligible fixtures are hardwired (including linear) two-lamp T8 fluorescent fixtures with electronic ballasts and manufacturer integrated occupancy sensors used in areas where code requires lighting 24 hours a day (such as stairwells, halls, and garages). Fixtures with manual on override are not eligible. During occupied periods, the fixture should operate at full light output. During unoccupied periods, the fixture should operate at lower light output and wattage. This measure is not also eligible for the occupancy sensor or T12 to T8 incentive.

Measure Savings

Average annual energy savings is 340 kWh and 0.039 kW savings. Peak demand savings are assumed to be zero. Fixtures are assumed to be in unconditioned spaces so interactive energy and demand effects are not claimed.

Measure Savings Analysis

This measure assumes that an existing 2-lamp T12 fixture (full level output only) will be replaced with a 2-lamp T8 bi-level fixture. At full level output, the existing is at 72 W/fixture and bi-level fixtures consume 58 W. Based on a survey of market-available bi-level fixtures, at low level output, the bi-level fixture would, on average, consume 22 W.

Based on the Final Report of Bi-level Stairwell Fixtures from a California Energy Commission Lighting Research Project, the percentage of time in the low output mode ranged from 62% to 82% on weekdays and 85% to 97% on weekends. Therefore, a conservative calculation of the percentage of time in the low output mode = $[(5)(62\%)+(2)(85\%)]/7 = 69\%$.

Average demand of the bi-level fixture is $(58 \text{ W})(0.31) + (22 \text{ W})(0.69) = 33 \text{ W}$, or 0.033 kW.
Average demand savings = $0.072 \text{ kW} - 0.033 \text{ kW} = 0.039 \text{ kW}$ per fixture.

Annual energy savings = $(0.039 \text{ kW per fixture})(8,760 \text{ hours per year}) = 340 \text{ kWh per fixture}$.

Measure Life and Incremental Measure Cost

The next table provides the measure life and IMC documented for this measure as well as the source of the data. Incremental cost is cost difference between the energy-efficient equipment



and the less efficient option. In this case the lighting measures, the IMC is equal to the full measure cost since cost of the less efficient option.

Table 112: Measure Life and Incremental Measure Cost

	Measure Category	Value	Source
Measure Life	Lamp and Ballast	11	DEER
Incremental Measure Cost	2 Lamp System	\$150	PG&E workpaper/ KEMA

Sensor-controlled LED Parking Lot Bi-Level Fixture

Table 113: Sensor-controlled LED Parking Lot Bi-Level Fixture

Measure Description	This measure consists of the replacement of a 150W Metal Halide fixture with a 60-lamp sensor-controlled LED Bi-Level Fixture
Units	Per fixture
Base Case Description	150W Metal Halide, (system wattage=190W)
Measure Savings	Source: CLTC, PG&E Workpaper – PGECOLTG101.1 – Bi-Level Light Fixture
Measure Incremental Cost	Source: California Lighting Technology Center (CLTC) http://cltc.ucdavis.edu/content/view/354/287/ , "UC / CSU case study: Bi-level Smart Parking Garage Fixture" \$975
Effective Useful Life	Source: DEER 2008 (same as occupancy sensors) 8 years

Fixture is integrated with occupancy sensor that allows the light to switch between high and low levels based on the presence of vehicle or pedestrian traffic. Switching between high and low light levels based on occupancy maintains sufficient light for security and way-finding while maximizing energy savings. New fixture must be pulse start metal halide, induction, or LED and have lower nominal wattage than existing fixture.

Measure Savings and Analysis

This measure assumes that an existing 150W Metal Halide fixture (190W connected) will be replaced by a 60-lamp Bi-Level SMART LED Fixture. At full output, the bi-level fixture is assumed to consume 110W, while at low light level the fixture consumes 35W. The bi-level fixtures are assumed to be in low output mode 50% of the time.

The demand savings are calculated as follows:

$$\Delta \text{Watts/unit} = \text{Pre-Retrofit Wattage} - \text{Bi-Level Fixture Wattage}$$

Bi-Level Fixture Wattage is calculated by a time-weighted average as follows:

$$(0.5 \times 35\text{W}) + (0.5 \times 110\text{W}) = 72.5\text{W}$$

$$\text{Demand Savings} = 190\text{W} - 72.5\text{W}$$



$$= \underline{117.5 \text{ W}}$$

$$\underline{\text{Energy Savings [kWh/Unit]}} = \frac{(\Delta \text{Watts/unit}) \times (\text{hours/day}) \times (\text{days/year})}{1,000 \text{ Watts / kW}}$$

$$= (117.5 \text{ W}) \times (4,100/\text{yr}) / (1,000 \text{ W/kW})$$

$$= \underline{482 \text{ kWh}}$$

Measure Life and Incremental Measure Cost

The following table provides the measure life and IMC documented for this measure as well as the source of the data. Incremental cost is the cost difference between the energy-efficient equipment and the less efficient option.

Table 114: Measure Life and Incremental Measure Cost

	Value	Source
Measure Life	8 (same as occupancy sensors)	DEER 2008
Full Measure Cost	\$975	CLTC
Incremental Measure Cost	\$975	CLTC

Sensor-controlled Wallpack Fixtures

Table 115: Sensor-controlled Wallpack Fixtures

Measure Description	This measure consists of the replacement of a 150W Metal Halide fixture with a 60-lamp sensor-controlled LED Bi-Level Fixture
Units	Per fixture
Base Case Description	150W Metal Halide, (system wattage=190W)
Measure Savings	Source: CLTC, PG&E Workpaper – PGECOLTG101 1 – Bi-Level Light Fixture
Measure Incremental Cost	Source: California Lighting Technology Center (CLTC) http://cltc.ucdavis.edu/content/view/354/287/ , "UC / CSU case study: Bi-level Smart Parking Garage Fixture" \$975
Effective Useful Life	Source: DEER 2008 (same as occupancy sensors) 8 years

Bi-level fixtures are typically found in hallways, stairwells, and garages. These fixtures are intended for use in levels where high lighting levels are required when occupied, but are actually unoccupied for the majority of the time. These fixtures employ a motion sensor-type lighting switch to provide lower levels of light while unoccupied, and full illumination while occupied.

These particular fixtures also feature LED lighting sources, which typically require less energy demand than typical HID sources. These fixtures can also incorporate a fully integrated LED night light for illumination during low-output mode.

Measure Savings and Analysis

This measure assumes that an existing 150W Metal Halide fixture (190W connected) will be replaced by a 60-lamp Bi-Level SMART LED Fixture. At full output, the bi-level fixture is assumed to consume 110W, while at low light level the fixture consumes 35W. The bi-level fixtures are assumed to be in low output mode 75% of the time.

The demand savings are calculated as follows:

$$\Delta \text{Watts/unit} = \text{Pre-Retrofit Wattage} - \text{Bi-Level Fixture Wattage}$$

Bi-Level Fixture Wattage is calculated by a time-weighted average as follows:

$$(0.75 \times 35\text{W}) + (0.25 \times 110\text{W}) = 53.75\text{W}$$



$$\text{Demand Savings} = 190\text{W} - 53.75\text{W}$$

$$= \underline{136.25 \text{ W}}$$

$$\text{Energy Savings [kWh/Unit]} = \frac{(\Delta \text{Watts/unit}) \times (\text{hours/day}) \times (\text{days/year})}{1,000 \text{ Watts / kW}}$$

$$= (136.25 \text{ W}) \times (8760/\text{yr}) / (1,000\text{W/kW})$$

$$= \underline{1194 \text{ kWh}}$$

Measure Life and Incremental Measure Cost

The following table provides the measure life and IMC documented for this measure as well as the source of the data. Incremental cost is the cost difference between the energy-efficient equipment and the less efficient option.

Table 116: Measure Life and Incremental Measure Cost

	Value	Source
Measure Life	8 (same as occupancy sensors)	DEER 2008
Incremental Measure Cost	\$975	CLTC

Exterior LED and Induction Lighting

Table 117 Exterior LED and Induction Lighting

Measure Description	Light emitting diodes and induction lighting can be use for street lighting, and parking lots with significant energy savings compared to HID fixtures. These technologies also have longer useful lives and lower maintenance costs when compared to HIDs.
Units	Per Fixture
Base Case Description	High wattage HID fixtures
Measure Savings	Source: KEMA
Measure Incremental Cost	Source: KEMA
Effective Useful Life	Source: DEER 2005 16 years

This measure applies to the retrofit of high wattage HID or incandescent outdoor light fixtures to LED or Inductions lamps. Both LED and induction lamps offer significant energy savings over their HID options and have longer life spans. The downside of this technology is cost. Prices for LED and induction are still high. Operating hours for exterior lighting may not as high as interior operating hours. There is also no benefit in heat reduction since there is no conditioned space to speak of. The payback period on this measure, as a result is also relatively high.

Measure Savings

The tables below provides the baseline and replacement wattages for induction and LED lamps.

Table 118: Exterior Induction Wattage Reduction

	Peak kW Reduction	Induction kWh Savings	LED kWh Savings	Average kWh Savings
250-400W HID	0	455	617	589
175-250W HID	0	205	344	484
≤175W HID	0	135	210	275

Table 119: Garage Induction Wattage Reduction

	Induction Peak kW Reduction	LED Peak kW Reduction	Induction kWh Savings	LED kWh Savings	Average kW Reduction	Average kWh Savings
250-400W HID	0.111	0.151	972	1319	0.131	1258
175-250W HID	0.050	0.084	438	736	0.067	1034
≤175W HID	0.033	0.051	289	449	0.042	587

There is no coincident kW savings in this case since lamps are assumed to be off during peak hour in both the base and retrofit conditions. Exterior kWh savings are calculated with annual operating hours of 4,100, equating to a 12 hour daily use during non-summer days and 9 hour use during summer days. Garage kWh savings are calculated with annual operating hours of 8760, assuming these are on all the time. No interactive effects are used.

Measure Savings Analysis

Energy savings are calculated by applying the annual operating hours and the energy interactive effect, according to the following formula:

$$\text{kWh Reduction} = \text{non-coincident kW savings} * \text{Annual operating hours} * \text{Energy interactive effect}$$

For this measure, it is assumed that the lighting is placed in non-conditioned areas so the energy and demand interactive effects are 1.0. Operating hours are 4,100 hours for exterior and 8760 hours for interior usage annually.

Exterior coincident kW savings are 0 since both baseline and retrofit lamps are off during peak hours. Interior garage lighting is on all the time and so coincident kW savings are calculated with a coincident factor of 1.

The following table shows the wattage reduction assumed for induction lighting retrofits.

Table 120: Induction Wattage Reduction

	Base Fixture Wattage	Retrofit Fixture Wattage	Non- Coincident kW Reduction
400W HID to Induction	458	354	0.104
250W HID to Induction	295	177	0.118
150W HID to Induction	210	160	0.050
100W HID to Induction	128	95	0.033

The following table summarizes exterior LED retrofits from 3 LED manufacturers.

Table 121 Manufacturer's LED Wattage Reduction²⁶

	Manufacturer	Base Fixture Wattage	Retrofit Fixture Wattage
100W HID to LED	Ledtronics	130	25
100W HID to LED	LuxBright	130	42
100W HID to LED	MoonCell	130	55

These figures suggest energy savings of 60– 80%. Forty percent energy savings is also often cited in various publications.

²⁶ "Technology Assessment of Light Emitting Diodes (LED) for Street and Parking Lot Lighting Applications"
Prepared for San Diego Regional Energy Office, Public Agency Energy Partnership Program. Prepared by Tetra Tech EM Inc. Aug 2003.



We will use the more conservative 40% here but note that savings may actually be greater depending on the application.

Table 122: LED Energy Reduction

	Base Fixture Wattage	kW Reduction
400W HID	458	183
250W HID	295	118
175W HID	210	84
100W HID	128	51

Measure Life and Incremental Measure Cost

The following table provides the measure life and IMC documented for this measure as well as the source of the data.

Table 123: Measure Life and Incremental Measure Cost

	Measure Category	Value	Source
Induction Measure Life	All	16	PG&E Lighting Work paper
Induction Incremental Measure Cost	All	\$290	PG&E Lighting Work paper
LED Measure Life	Incremental Measure Cost	16	DEER 2005 (LED Exit Signs)
LED Measure Cost	Incremental Measure Cost	\$265- \$799	KEMA



New T5/T8 Fluorescent Fixtures (Parking Garage)

Table 124: New T5/T8 Fluorescent Fixtures (Parking Garage)

Measure Description	This measure consists of replacing one or more existing fixtures with new fixtures containing T8 or T5 lamps and electronic ballasts specifically in interior and exterior garages. The T8 or T5 lamps must have a color rendering index (CRI) ≥ 80 . The electronic ballast must be high frequency (≥ 20 kHz), UL listed, and warranted against defects for 5 years. Ballasts must have a power factor (PF) ≥ 0.90 . Ballasts for 4-foot lamps must have total harmonic distortion (THD) ≤ 20 percent at full light output. For 2- and 3-foot lamps, ballasts must have THD $\leq 32\%$ at full light output.
Units	Per Watt reduced
Base Case Description	Typically high wattage HID fixtures at interior and exterior garages.
Measure Savings	Source: KEMA
Measure Incremental Cost	Source: KEMA
Effective Useful Life	Source: DEER 11 years

This measure consists of replacing one or more existing fixtures with new fixtures containing T8 or T5 lamps and electronic ballasts. The T8 or T5 lamps must have a color rendering index (CRI) ≥ 80 . The electronic ballast must be high frequency (≥ 20 kHz), UL listed, and warranted against defects for 5 years. Ballasts must have a power factor (PF) ≥ 0.90 . Ballasts for 4-foot lamps must have total harmonic distortion (THD) ≤ 20 percent at full light output. For 2- and 3-foot lamps, ballasts must have THD ≤ 32 percent at full light output.

This section only applies to interior and exterior parking garages and is presented separately from other building types due to the drastic difference in operating hours. We define interior as parking structures that are enclosed where it is reasonable to assume that all lighting fixtures operate 24 hours per day, 7 days a week.²⁷ This will include underground parking structures and also stand alone parking structures that may be semi-enclosed. Exterior parking structures are outdoor parking lots where light fixtures do not operate during the day. For other building types refer to savings numbers in the New T5/T8 fluorescent fixture section.

Measure Savings

The savings are provided for interior and exterior parking garages.

²⁷ PG&E Lighting WP 2006



Table 125: Parking Garage Savings for New T8/T5 Fluorescent Fixtures per Watt Reduced

Garage Types	Annual Operating Hours	Demand Interactive Effects	Coincident Diversity Factors	Energy Interactive Effects	Peak Watt Savings	kWh Savings
Interior	8,760	1.00	1	1.00	0.0010	8.7600
Exterior	4,100	1.00	0	1.00	0.0000	4.1000

Measure Savings Analysis

Annual energy savings and the peak coincident demand savings were calculated using the equations below.

Non-coincident kW reduction = kW of existing equipment - kW of replacement equipment

Energy savings are calculated by applying the annual operating hours and the energy interactive effect, according to the following formula:

kWh Reduction = non-coincident kW savings * Annual operating hours * Energy interactive effect

Coincident demand savings are calculated by applying the coincidence factor and the demand interactive effect, according to the following formula:

Coincident kW savings = non-coincident kW savings * Coincidence Factor * Demand interactive effect

Baseline and retrofit equipment assumptions are variable. Because we define this measure with the number of watts reduced, the non-coincident demand savings will be one watt by definition.

Operating hours vary depending on the parking structure type. Interior garages keep lights on at all times while exterior parking lots operate daily at 12 hours per day, except during the summer when lights are on 3 hours less. These operating hours imply that coincident factors are 1 for interior parking (lights are always in operation) and 0 for exterior parking (lights are only in operation at night). Since parking structures are not conditioned space, interactive effects are set to 1.

Measure Life and Incremental Measure Cost

The following table provides the measure life and IMC documented for this measure as well as the source of the data.

Incremental cost is cost difference between the energy efficient equipment and the less efficient option. In this case the IMC is equal to the full measure cost since the cost of the less efficient option, i.e., not conducting the retrofit, is \$0.

Table 126: Measure Life and Incremental Measure Cost

	Value	Source
Measure Life	11	DEER



Incremental Measure Cost ²⁸	\$0.75	KEMA
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²⁸ Based on the assessment of active projects in the 2008-09 ComEd Smart Ideas Program

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Case No(s). 10-1835-EL-EEC

Summary: Application (Part 2 of 3) of Pickaway Manor Care Ctr and Columbus Southern Power Company for approval of a special arrangement agreement with a mercantile customer electronically filed by Mr. Matthew J Satterwhite on behalf of Columbus Southern Power Company