

Commercial Lighting Issues

Conservation Resources Advisory Committee
January 28, 2015

Commercial Lighting Issues

- **New Federal GSFL standard: Savings or Not?**
- **Interior**
 - Proxy measures modeled
 - Equivalent lumens or not
 - Fixture turnover rate
 - Baseline estimates of sales penetration LED

Standards Freeze Date



Standards Issued 2014

Sector	Product
Commercial/Industrial	Automatic Commercial Ice Makers
Commercial/Industrial	Commercial Refrigeration Equipment
Commercial/Industrial	Electric Motors
Residential	External Power Supplies
Residential	Furnace Fans
Lighting	General Service Fluorescent Lamps
Lighting	Incandescent Reflector Lamps
Lighting	Metal Halide Lamp Fixtures
Commercial/Industrial	Walk-In Coolers and Freezers



General Service Fluorescent (Second Standard Since 6P)

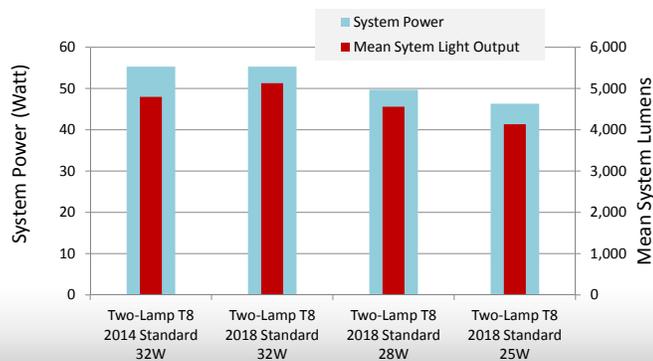
Fluorescent Standard	Lamp Lumens per Watt 4 foot medium Bi-Pin Instant Start
6P Baseline	75 ish
GSFL 1 (Effective 2012-2014)	89
GSFL 2 (Effective 2018)	93

Incandescent Reflector Standard	Lumens per Watt
6P Baseline	Incandescent
IRL1 (Effective 2012)	Halogen IR
IRL 2 (Effective 2018)	No Change

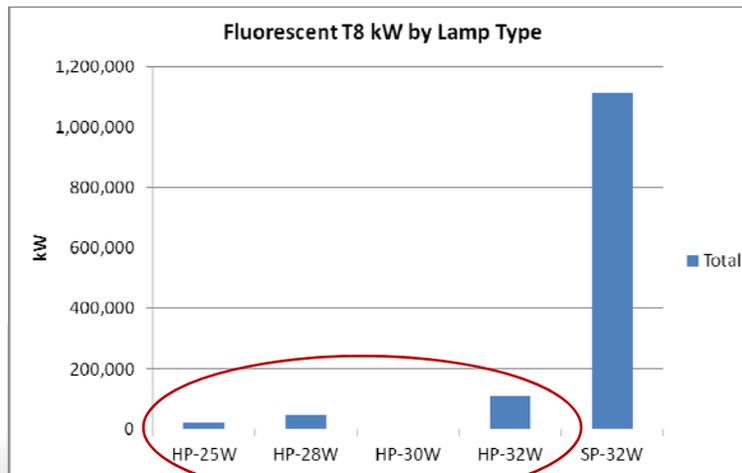
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GSFL 2 Impact

- Issue: Will there be savings?
 - Same power more light?
 - No savings unless shift to 25W and 28W lamps



Current Stock Mix of T8 Lamps



GSFL 2 Impact

- **Proposal: Forecast CBSA stock mix of HPT8**
 - 55% HP32W, 30% 28W, 15% 25W
- **Reduces load forecast beginning 2018**
- **About 4%-5% - lamp stock phase-in 7 years**
- **Total about 50 aMW**
- **Establishes more efficient baseline for remaining potential**
 - 89 lm/Watt T8 is obsolete beginning 2018
- **BUT: It's anybody's guess at market shift**



Feedback

- Some savings in forecast or not from GSFL?

Issue: Baseline Penetration for Annual LED Installs

		Sales Penetration Estimates for Solid State Lighting		
Type	Sub Type	DOE Forecast for 2015	NEEA/BPA Sales Estimates 2014	Council Forecast Baseline 2016
General Service	All	19%	?	30%
Decorative	All	3%	?	8%
Directional	All	13%	?	20%
Directional	PAR Lamp	25%	?	50%
Directional	MR Lamp	25%	?	30%
Directional	PAR Fixture	4%	?	5%
Directional	MR Fixture	4%	?	5%
Downlight	DL Lamp	5%	?	8%
Downlight	DL Luminaire	2%	?	5%
Linear Fluorescent Fixture	Commercial	8%	?	15%
Linear Fluorescent Fixture	Industrial	5%	?	10%
Low/High Bay	Commercial	4%	?	15%
Low/High Bay	Industrial	9%	?	20%
Street & Roadway	All	31%	?	50%
Parking	Lot	20%	?	30%
Parking	Garage	13%	?	20%
Exterior	All	17%	?	25%

Issue: Fixture Replacement Rate Turnover Rate Drives Annual Availability & Targets

Weighted by Floor Area

Data from
CBSA
Interviews

Proposal:
Use 5%
turnover
rate

	Assembly	Grocery	Lodging	Office	Other	Residential	Restaurant	Retail/Service	School K-12	Warehouse	Total
0	1%	0%	4%	2%	1%	3%	2%	1%	1%	0%	1%
1	11%	6%	17%	13%	4%	2%	5%	10%	1%	10%	10%
2	5%	14%	4%	13%	4%	1%	1%	5%	13%	0%	7%
3	5%	0%	2%	1%	5%	2%	3%	7%	0%	4%	3%
4	2%	0%	5%	4%	2%	5%	0%	4%	2%	0%	3%
5	3%	5%	3%	3%	7%	0%	7%	1%	5%	0%	3%
Average Over Years											
Year_18.2_Ago	8%	10%	11%	12%	9%	2%	3%	8%	7%	5%	8%
Year_18.26.1_Ago	7%	7%	8%	8%	7%	2%	3%	7%	5%	5%	7%
Year_1thru5_Ago	5%	5%	6%	6%	6%	2%	3%	6%	4%	3%	5%
Year_06.18.2_Ago	6%	7%	8%	9%	6%	2%	3%	5%	5%	3%	6%
Fixtures Impacted	70%	5%	5%	6%	6%	1%	2%	5%	3%	3%	5%

Buildings that renovated fixtures one, two or three years ago, renovated 71% of the fixtures.
From Building_Renovation_History

Buildings replace fixtures at 7% per year
About 70% of fixtures replaced at each replacement event

Feedback

- Baseline Penetration Estimates
- Fixture Turnover Rate

Commercial Interior Lighting Fixtures & Lamps Modeled

Base Fixture Types

LF	Linear Fluorescent
CAN	Recessed Can
DISP	Display or Track Lighting
HIGHBAY	High Bay >15 Feet
OTHER	Ceiling Mount, Wall Sconse, Table Lamp, Other

Base Fixture Lamps

LF2018	Linear fluorescent compliant with 2018 GSFL standard
CFL	Compact Fluorescent
INC_HAL	Halogen Incandescent
LED	Light Emitting Diode
HID	Metal Halide High Intensity Discharge
HID_CMH	Ceramic Metal Halide HID

Counts & Watts by type from CBSA

Proxy Fixture Replacement Measures

Fixture Measures

FIX_REPL_LF_from LF2018 to LED_FIX_KIT
FIX_REPL_LF_from LF2018 to LED_FIX_KIT_RDX
FIX_REPL_LF_from LF2018 to LF_FIX_KIT_RDX
FIX_REPL_CAN_from CFL to LED_FIX_KIT
FIX_REPL_CAN_from INC_HAL to LED_FIX_KIT
FIX_REPL_DISP_from CFL to LED_FIX_KIT
FIX_REPL_DISP_from INC_HAL to LED_FIX_KIT
FIX_REPL_DISP_from INC_HAL to HID_CMH
FIX_REPL_Highbay_from HID to LED_FIX_KIT
FIX_REPL_Highbay_from HID to HO_LF2018
FIX_REPL_Highbay_from LF2018 to LED_FIX_KIT
FIX_REPL_OTHER_from CFL to LED_FIX_KIT
FIX_REPL_OTHER_from INC_HAL to LED_FIX_KIT
FIX_REPL_OTHER_from HID to LED_FIX_KIT

3 Linear Fluorescent

2 Recessed Can

3 Display Track

3 High Bay

3 Other

Unique EE Measures Description

LED_FIX_KIT	LED fixture, fixture kit, or LED tube kit
LED_FIX_KIT_RDX	LED fixture, fixture kit, or LED tube kit with delamp (80% lumen)
LF_FIX_KIT_RDX	HP LF fixture or fixture kit with delamp (80% lumen) (eg 3L to 2L)

Proxy Lamp Replacement Measures

Lamp Measures

LAMP_REPL_LF_from LF2018 to LF_LOWWATT
 LAMP_REPL_LF_from LF2018 to TLED_PIN
 LAMP_REPL_LF_from LF2018 to LF_LOWWATT_RDX
 LAMP_REPL_LF_from LF2018 to TLED_PIN_RDX
 LAMP_REPL_CAN_from CFL to LED_CAN_LAMP
 LAMP_REPL_CAN_from INC_HAL to LED_CAN_LAMP
 LAMP_REPL_DISP_from CFL to LED_PAR_MR
 LAMP_REPL_DISP_from INC_HAL to LED_PAR_MR
 LAMP_REPL_DISP_from HID_CMH to LED_PAR_MR
 LAMP_REPL_OTHER_from CFL to LED_OMNI
 LAMP_REPL_OTHER_from INC_HAL to LED_OMNI
 LAMP_REPL_OTHER_from INC_HAL to CFL_OMNI

3 Linear Fluorescent

Limit to newer ballast

2 Recessed Can

3 Display Track

3 Other

LED Lamp replacements that use existing fluorescent ballast (LF and Recessed Can) are limited to fraction of stock with ballasts < five years old (20%)

Feedback

- Measure set
- Up to 20% lumen reduction in some applications? (Office)
- Treatment of LED tubes

Some Results

Exterior Building Lighting

- Mostly Parking, Façade and Walkway
- Power reductions 50% to 80%



Exterior Building Lighting

Parameter	Sixth Plan	Seventh Plan (draft)
Savings per Unit	30% 1 measure	50% to 80% 8 measures by applic & size
Levelized Cost (\$/MWh)	\$33	\$<0 to \$10
Levelized Cost (\$/MWh) (No NEB)		\$<0 to \$65
Baseline EE Saturation	Parking 1% Exterior 1%	Parking 30% Exterior 25%
Applicability	30%	70% More options on market
Number of Units (20 years)		New estimate of units from CBSA 2014
Achievable Technical Potential (aMW over 20 years)	142 aMW	147 aMW

Embedded Parking Garage Lighting

- **Embedded: Included inside a building**
 - About 6% of building floor area, most in office buildings
 - Measure: HID to LED with step dimming
 - Fraction HID per CBSA (~40%)
 - LED saturation 4% of fixtures
 - About 20% with occupancy sensor
 - No measure for fluorescent
 - Total use about 70 aMW
 - Savings potential <20 aMW

- **No data for count of dedicated parking structure**
 - Only 1 in CBSA – So potential estimate is partial



Street and Roadway Lighting

Parameter	Sixth Plan	Seventh Plan (draft)
Unit Savings at busbar (kWh)	190 to 280	340 to 3200
Levelized Cost (\$/MWh)	3 to 250 73 weighted average	(-100) to 16 (-39) weighted average
Levelized Cost (\$/MWh) Without maintenance savings	NA	(-5) to 34 18 weighted average
Baseline EE Saturation	<1%	22% by end 2015*
Number of Units (20 years)	1.5 million	1.3 million
Achievable Technical Potential (aMW over 20 years)	44 aMW	55 aMW

* Updated: Was 13%