Lighting
Cal TF Tier 2 Presentation

CALIFORNIA
TECHNICAL FORUM

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APRIL 2018

Lighting
Measure Affirmation

"Cal TF affirms the subcommittee recommendations regarding 'Stage 1 Issues' for Lighting Measures."

- 4.19 LED, Troffer (2x4, 1x4, 2x2)
- 4.22 LED Landscape Lighting Fixtures
- 4.51 LED Pool & Spa Lighting

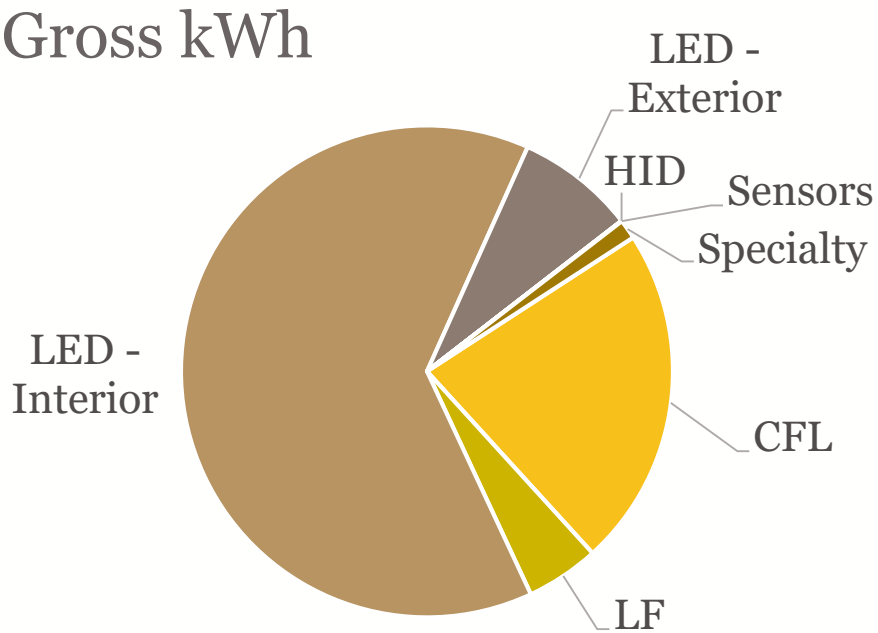
Not Included:

- 4.48 LED in Walk-in Coolers & Freezers (*On Hold*)

Agenda

- Discuss Final Items to Gain Cal TF Affirmation of Subcommittee Recommendations for Four Lighting Measures Consolidated in Q1 2018:
  - 4.19 LED Troffers
  - 4.22 LED Landscape
  - 4.48 LED Refrig Walk-in (On Hold)
  - 4.51 LED Pool and Spa Lighting
- Discuss Opportunities for Addressing Interactive Effects for Statewide Measures:
  - Current Approach, Intermediate Approach, Proposed Approach
- High Level Discussion of Future Topics:
  - Future Lighting Program Opportunities
  - Cost Methodologies and Update Process
  - Improving Hours of Operation Data

Deemed Lighting 2017 – Q1 – Q3



Lighting Total: 361.5M kWh (77%)
Deemed Portfolio: 471.2M kWh

Ref No	Category	Measrue Description	Gross kWh
4.01	CFL	CFL, Interior Fixture	342,231
4.02	CFL	CFL, Exterior Fixture	368,143
4.04	CFL	CFL, Integral/Screw-in	77,196,831
4.06	CFL	CFL, 3-Way	3,116,775
4.07	CFL	CFL, Spiral	-
4.09	CFL	CFL, Plug-In	-
4.10	LF	LF, 4' Replace Lamp	432,927
4.12	LF	LF, Ballast Retrofit	331,049
4.13	LF	LF, Replacement Fixture	15,157,034
4.14	LF	LF, HP Fixture	1,500,245
4.16	LED - Interior	LED, Interior Downlight	1,086,284
4.17	LED - Exterior	LED, Exterior Wallpack	129,869
4.18	LED - Interior	LED, High/Low Bay	15,918,225
4.19	**LED - Interior**	**LED, Troffer (2x4, 1x4, 2x2)**	7,535,133
4.20	LED - Exterior	LED, Street Light	20,600,706
4.21	LED - Interior	LED, Interior Common, Res	21,538,731
4.22	**LED - Exterior**	**LED, Landscape**	3,837
4.23	LED - Exterior	LED, Exterior with Motion	1,369,506
4.24	LED - Exterior	LED, Exterior, Res	5,436,898
4.25	LED - Exterior	LED, Exterior, Pole	484,168
4.26	LED - Interior	LED, MR-16	1,176,779
4.27	LED - Interior	LED, PAR20, 30, 38,	57,083,732
4.28	LED - Interior	LED, Candelabra	1,620,142
4.29	LED - Interior	LED, Globe	35,337
4.30	LED - Interior	LED, A-Lamp	59,934,779
4.31	LED - Interior	LED, Interior Downlight	4,636,357
4.32	LED - Interior	LED, R-BR	52,173,244
4.35	LED - Exterior	LED, Exterior Lamps	164,519
4.36	LED - Interior	LED, Tube LED	7,436,489
4.38	HID	HID, Exterior Fixture	58,425
4.40	Sensor	Sensor, Residential Occ	773
4.41	Sensor	Sensor, Wall or Ceiling Occ	-
4.42	Sensor	Sensor, Integrated Fixture	70,224
4.44	Specialty	LED, Open Sign	17,282
4.47	Specialty	LED, Refrig, Case Door	4,066,387
4.48	**Specialty**	**LED, Refrig, Walk-in**	-
4.49	Specialty	LED, Refrig, Reach-in	470,194
9.02	**Specialty**	**LED Pool and Spa Lighting**	83,537

Measure Consensus
4.19 LED, Troffer (2x4, 1x4, 2x2)

- Offering (WPs Reviewed: PGECOLTG179-R5, SCE17LG118-R0)
  - Replacement of linear fluorescent fixtures with LED Ambient Commercial Fixtures & Integrated Retrofit Kits (LED panel fixtures)
  - Cost, wattage and savings are all in units of kilolumen
  - Building Types: 24 NonRes (Not: OTR) / 1 Res (MFm-Common Area)
  - Measure Application Type: ROBNC (replace–on-burnout / new construction)
  - Vintage: Ex, New
  - Climate Zone: CZ01 – CZ16
  - Residential Area: Common (Not: In-Dwelling)
  - Delivery: PreRebDown, PreRebUp, NonUpStrm, DirInstall
- Stage 1 Issues
  - *Document source of Base and Measure Case kilolumen/watt (working with Energy Solutions)*
  - *Include supporting values and documentation for revised labor cost included in the most recent version of PG&E WP*
  - *Climate Zone specific claims to match across the state*
  - Included incremental items added by SCE in their “short form” WP, specifically adding common areas for the Multifamily (MFm) Building Type (and additional calc. template)
  - Using PG&E / SCE cost approach since PG&E has the lead workpaper – from distributor catalogs and web-scraping
    - SDG&E (short form) is using READi cost IDs, but cost fairly close

Black text = Current state of the consolidated measure
Blue text = Changing and / or first time item is mentioned
Italics text = Item that has not been completed

Measure Consensus
4.19 LED, Troffer (2x4, 1x4, 2x2)

- Measure Extension
  - Added measure for POUs (electric measure)
- Stage 2 Issues
  - *Should residential or commercial values apply to MF Common Area measure parameters (e.g. IE, HOU, NTG, EUL, GSIA, load shape)*
  - *Calculation: Review hours of use, interactive effects*
  - *Cost: Review variation due to CZ/Delivery/Offering, methodology for keeping costs up-to-date*
  - *Baseline: Existing conditions opportunity, document baselines*
  - *Permutation collapse*

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Input Consensus - 4.19 LED, Troffer (2x4, 1x4, 2x2)

- Measure Permutations

	eTRM Measure Value	PG&E	SCE	SDG&E	SCG
BldgType	Com,Sun,Asm,ECC,EPr,ERC,ESe,EUn,Gro,Gst,Hsp,Htl,MBT,MLI,Mtl,Nrs,OfL,OfS,RFF,RSD,Rt3,RtL,RtS,SCn,WRf,MFm	SUn,Asm,Com,ECC,EPr,ERC,ESe,EUn,Gro,Hsp,Htl,MBT,MLI,Mtl,Nrs,OfL,OfS,RFF,RSD,Rt3,RtL,RtS,SCn,WRf,MFm	EPr,ERC,ESe	SUn,Asm,Com,ECC,EUn,Gro,Hsp,Htl,MBT,MLI,Mtl,Nrs,OfL,OfS,RFF,RSD,Rt3,RtL,RtS,SCnWRf	No Value
BldgVintage	Ex,New	Ex,New	Any	Ex	No Value
BldgLoc	CZ01,CZ02,CZ03,CZ04,CZ05,CZ06,CZ07,CZ08,CZ09,CZ10,CZ11,CZ12,CZ13,CZ14,CZ15,CZ16, IOU	IOU	CZ06,CZ08,CZ09,CZ10,CZ13,CZ14,CZ15,CZ16	CZ06,CZ07,CZ08,CZ10,CZ14,CZ15,IOU	No Value
BldgHVAC	cWtd rWtd	cWtd rWtd	Any	Any	No Value

	eTRM Measure Value	PG&E	SCE	SDG&E	SCG
MeasureAppType	ROBNC	NC,ROB	RobNc,ER	No Value	No Value
NormUnit	KiloLumen	KiloLumen	Fixture	KiloLumen	No Value
EUL ID	ILtg-Com-LED-50000hr+16yr ILtg-Res-LED-50000hr+16yr	ILtg-Com-LED-50000hr+16yr ILtg-Res-LED-50000hr+16yr	ILtg-Com-LED-50000hr	ILtg-Com-LED-50000hr+16yr	No Value
NTGR	Com-Default>2yrs Res-Default>2	ET-Default All-Default<=2yrs Com-Default>2yrs Res-Default>2	ET-Default Com-Default>2yrs	No Value	No Value
DeliveryType	DirInstall PreRebDown PreRebUp NonUpStrm	DirInstall PreRebDown PreRebUp	DirInstall NonUpStrm	No Value	No Value
GSIA	Def-GSIA	Def-GSIA	Def-GSIA	No Value	No Value

Measure Consensus
4.22 LED Landscape Lighting Fixtures

- Offering (WPs Reviewed: SCE17LG105R0, SDGE1057R1)
  - The replacement of a low voltage JC bi-pin lamp halogen landscape lighting fixtures typically ranging from 10-75 watts with LED landscape lighting fixtures in commercial and residential sectors
  - Six measure offerings (3 measure wattage ranges, Commercial & Residential applic's)
    - ≤5W, >5W to ≤15W, >15W to ≤30W
  - Building Types: 24 NonRes / 4 Res (Note: Not OTR , Gst/not GsR)
  - Measure Application Type: ROBNC (replace–on-burnout / new construction)
  - Vintage: Ex, New
  - Climate Zone: CZ01 – CZ16
  - Delivery: PreRebDown, NonUpStrm
- Stage 1 Issues
  - How does recent (March 1, 2018) Outdoor Lighting Disposition affect the viability of this measure?
  - Check WRR used in WPs against recent dispositions – using 4.24 WRR

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Measure Consensus
4.22 LED Landscape Lighting Fixtures

- Measure Extension
  - Added measure for POUs (electric measure)
- Stage 2 Issues
  - *Calculation: Review savings methodology (WRR vs delta watts), hours of use, interactive effects*
  - *Cost: Review variation due to CZ/Delivery/Offering, methodology for keeping costs up-to-date*
  - *Baseline: Existing conditions opportunity, document baselines*
  - *Permutation collapse*

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Input Consensus - 4.22 LED Landscape Lighting Fixtures

- Measure Permutations

	eTRM Measure Value	PG&E	SCE	SDG&E	SCG
BldgType	Com,Sun,Asm,ECC,EPr,ERC,ESe,EUn,Gro,Gst,Hsp,Htl,MBT,MLI,Mtl,Nrs,OfL,OfS,RFF,RSD,Rt3,RtL,RtS,SCn,WRf,Res,DMo,MFm,SFm	No Value	SUn,Asm,DMo,ECC,EPr,ERC,ESe,EUn,Gro,Gst,Hsp,Htl,MBT,MFm,MLI,Mtl,Nrs,OfL,OfS,RFF,RSD,Rt3,RtL,RtS,SCn,SFm,WRf	Res	No Value
BldgVintage	Ex, New	No Value	Any	Ex	No Value
BldgLoc	CZ01,CZ02,CZ03,CZ04,CZ05,CZ06,CZ07,CZ08,CZ09,CZ10,CZ11,CZ12,CZ13,CZ14,CZ15,CZ16, IOU	No Value	CZ06,CZ08,CZ09,CZ10,CZ13,CZ14,CZ15,CZ16	Any	No Value
BldgHVAC	cWtd rWtd	No Value	Any	Any	No Value

	eTRM Measure Value	PG&E	SCE	SDG&E	SCG
MeasureAppType	ROBNC	No Value	RobNc	No Value	No Value
NormUnit	Fixture	No Value	Fixture	Lamp	No Value
EUL ID	OLtg-Com-LED-50000hr OLtg-Res-LED-50000hr	No Value	OLtg-Com-LED-50000hr OLtg-Res-LED-50000hr	OLtg-Res-LED-50000hr	No Value
NTGR	Com-Default>2yrs Res-Default>2	No Value	Com-Default>2yrs Res-Default>2	No Value	No Value
DeliveryType	PreRebDown NonUpStrm	No Value	PreRebDown NonUpStrm	No Value	No Value
GSIA	Def-GSIA	No Value	Def-GSIA	No Value	No Value

Measure Consensus
4.48 LED in Walk-in Coolers & Freezers

- Offering (WPs Reviewed: PGE3PLTG171R2)
  - Replacing fluorescent and incand lighting systems in refrigerated areas of a grocery store with LED luminaires
  - *Ten iterations of the measure to account for the range of existing lighting technologies and the impact of case temperature (i.e. cooler/freezer) on refrigeration system efficiency*
    - *32W to 24W, 60W to 38W, 75W to 38W, 100W to 38W, 220W to 80W*
    - *Each wattage analyzed separately for cooler or freezer savings to account for refrigeration system efficiency*
  - Building Types: Grocery (only)
    - *May also be applicable in small business, hospitality, and hospital sectors*
  - Measure Application Type: ROB (replace-on-burnout) / NR (normal replacement)
  - Vintage: Ex (Note: Not New)
  - Climate Zone: CZ01 – CZ16
  - Delivery: PreRebDown
- Stage 1 Issues
  - Measure didn't report savings in 2017 Q1-Q3. Confirmed to be moving forward.
  - *Text methodology for indirect savings does not match Ex Ante values in Rev.2.*
    - *The Rev.1 workpaper described savings linked to the refrigeration efficiencies that are documented in DOE2.2 (grocery prototype model).*
    - *The Rev.2 savings are calculated in the more traditional manner of using the interactive effects table. Because gas savings are included in this table, it seems unlikely that interactive effects are specific to walk-in coolers.*
    - *Rev.1 methodology seems more correct.*
  - EUL ID is correct, but confirm approach:
    - 50,000 hrs/yr @ 4,710 hrs/uyr (Grocery) = 10.6 yrs
    - EUL ID has 16 yrs
    - *Measure should claim the lessor of these values*
  - Change NormUnit from Each to Fixture
    - Workpaper use "luminaires"

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Measure Consensus
4.48 LED in Walk-in Coolers & Freezers

- Measure Extension
  - Added measure for POUs (electric measure)
- Stage 2 Issues
  - *Calculation: Review hours of use, interactive effects*
  - *Cost: Review variation due to CZ/Delivery/Offering, methodology for keeping costs up-to-date*
  - *Baseline: Existing conditions opportunity, document baselines*
  - *Permutation collapse*

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Input Consensus - 4.48 LED in Walk-in Coolers & Freezers

- Measure Permutations

	eTRM Measure Value	PG&E	SCE	SDG&E	SCG
BldgType	Gro	Gro	No Value	No Value	No Value
BldgVintage	Any	Any	No Value	No Value	No Value
BldgLoc	Any	Any	No Value	No Value	No Value
BldgHVAC	cWtd	cWtd	No Value	No Value	No Value

	eTRM Measure Value	PG&E	SCE	SDG&E	SCG
MeasureAppType	ROB	ROB	No Value	No Value	No Value
NormUnit	Fixture	Each	No Value	No Value	No Value
EUL ID	GrocDisp-FixtLtg-LED	GrocDisp-FixtLtg-LED	No Value	No Value	No Value
NTGR	Com-Default>2yrs	Com-Default>2yrs	No Value	No Value	No Value
DeliveryType	PreRebDown	PreRebDown	No Value	No Value	No Value
GSIA	Com-LED-PGE	Com-LED-PGE	No Value	No Value	No Value

Measure Consensus
4.51 LED Pool & Spa Lighting

- Offering (WPs Reviewed: SCE17LG071R0, SDGE0028R1)
  - Replacement of incandescent pool lamps or luminaires with LED pool lighting in commercial and residential swimming pools and spas
  - 32 measure offerings (4 wattages, 4 scenarios, lamps and luminaires)
  - Base case and measure wattages are the same for both lamps and luminaires
  - Building Types: Hotel / Motel and 3 Residential (SFm, MFm-Common, DMo-Common)
  - Measure Application Type: ROBNC (replace–on-burnout / new constr)~~, ER (Early Retirement)~~
  - Vintage: Ex
  - Climate Zone: CZ01 – CZ16
  - Delivery: PreRebDown, DirInstall
- Stage 1 Issues
  - Do recent lighting dispositions have any impact on the future of this measure?
  - Update Dusk-to-Dawn hours of operation to 4,100 hrs/yr
  - Confirm that two schedules Dusk-to-Dawn and Dusk-to-Close (1,460 hrs/yr) are applicable
  - Confirm that Spa Offerings should not exist for non-Res (Hotel / Motels)
  - Confirm that ROBNC should be used for fixtures; ROB should be used for lamps.
    - Is this a general rule that can be applied for lighting measures?

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Measure Consensus
4.51 LED Pool & Spa Lighting

- Measure Extension
  - Added measure for POUs (electric measure)
- Stage 2 Issues
  - *Calculation: Review hours of use- residential hours of use are low (pools 48 hrs/yr, spas 66 hrs/yr), interactive effects*
  - *Cost: Review variation due to CZ/Delivery/Offering, methodology for keeping costs up-to-date*
  - *Baseline: Existing conditions opportunity, document baselines*
  - *Permutation collapse*

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Input Consensus - 4.51 LED Pool & Spa Lighting

- Measure Permutations

	eTRM Measure Value	PG&E	SCE	SDG&E	SCG
BldgType	DMo,MFm,SFm,Htl,Mtl	No Value	Any	DMo,MFm,SFm,Htl,Mtl	No Value
BldgVintage	Ex	No Value	Any	Ex	No Value
BldgLoc	CZ01,CZ02,CZ03,CZ04,CZ05,CZ06,CZ07,CZ08,CZ09,CZ10,CZ11,CZ12,CZ13,CZ14,CZ15,CZ16, IOU	No Value	Any	IOU	No Value
BldgHVAC	cWtd rWtd	No Value	Any	Any	No Value

	eTRM Measure Value	PG&E	SCE	SDG&E	SCG
MeasureAppType	ER.ROBNC	No Value	ER.ROBNC	No Value	No Value
NormUnit	Fixture,Lamp	No Value	Fixture	Fixture,Lamp	No Value
EUL ID	OLtg-Com-LED-50000hr OLtg-Res-LED-20000hr	No Value	OLtg-Com-LED-20000hr OLtg-Com-LED-50000hr OLtg-Res-LED-20000hr OLtg-Res-LED-50000hr	OLtg-Com-LED-50000hr OLtg-Res-LED-20000hr	No Value
NTGR	Com-Default>2yrs Res-Default>2	No Value	ET-Default Com-Default>2yrs Res-Default>2	No Value	No Value
DeliveryType	DirInstall PreRebDown	No Value	DirInstall PreRebDown	No Value	No Value
GSIA	Def-GSIA	No Value	Def-GSIA Res-Default>2	No Value	No Value

Lighting
Measure Affirmation

"Cal TF affirms the subcommittee recommendations regarding 'Stage 1 Issues' for Lighting Measures."

- 4.19 LED, Troffer (2x4, 1x4, 2x2)
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Lighting – Location Value Change Summary

Lighting Interactive Effects

Specific Climate Zones

IOU (weighted average)

Impact of Specific CZ vs IOU (on Lighting)

- PG&E change in savings (examples):
  - 4.26, LED MR-16 (-1% kWh, -1% kW, +3% therms)
  - 4.30, LED A-Lamp (+1% kWh, +1% kW, +6% therms)
  - 4.31, LED Recessed Downlight Retrofit Kit (+2% kWh, +1% kW, +8% therms)
- Suspected to effect some other programs for SCE and SDG&E
- Conclusion
  - Minimal change due to using “CZxx” rather than “IOU”

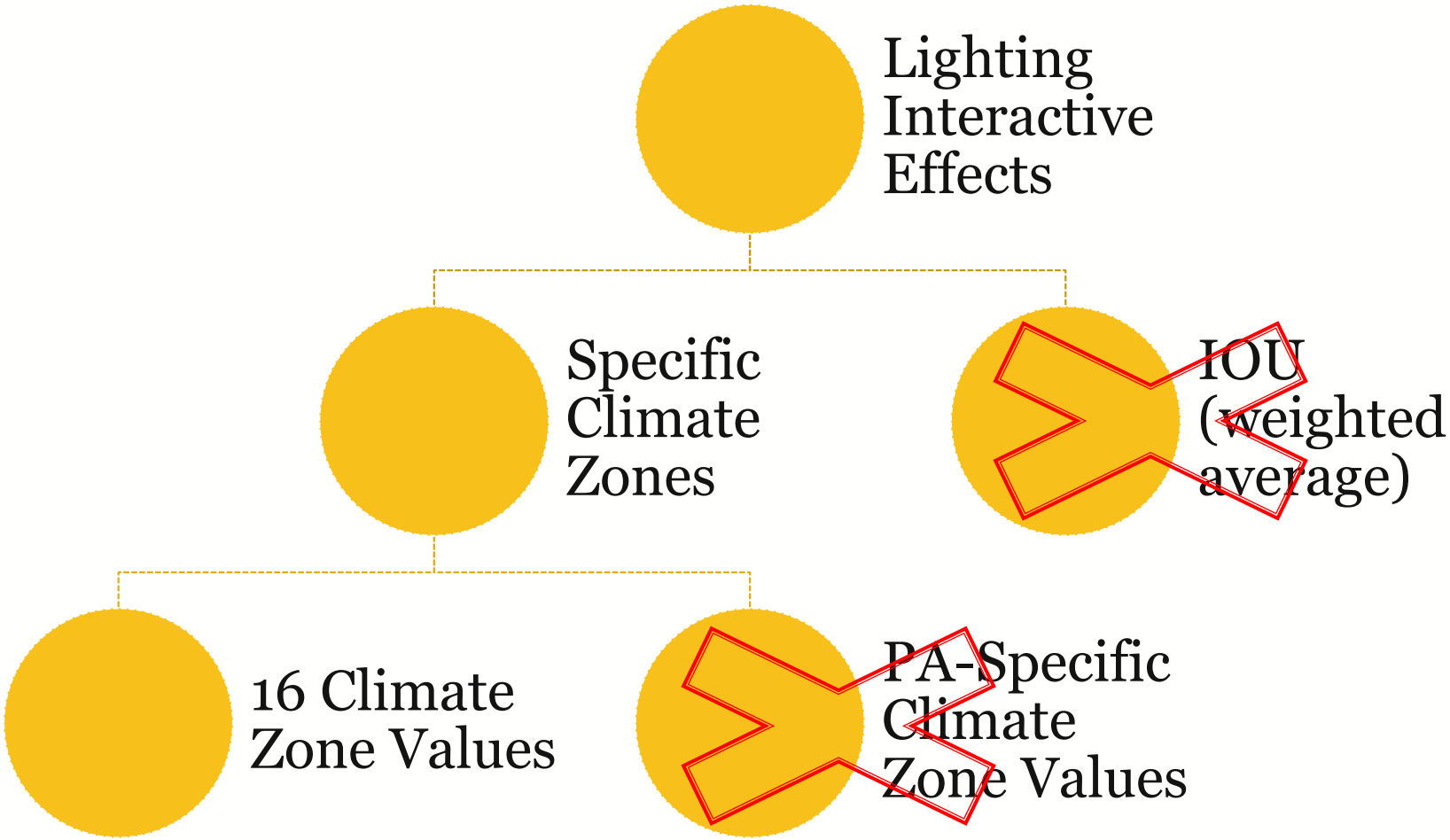
Lighting – Location Value Change Summary

Lighting Interactive Effects

Specific Climate Zones

~~IOU (weighted average)~~

Lighting – Location Value Change Summary



Impact of Removing PA Effects from CZ (on Lighting)

- Approach to follow…
- Effect
  - PG&E and SCE – much less than 1% shift
  - SDG&E – less than 1%
    - 4.32, LED R-BR (-0.5% kW, 0% kWh, -0.1% therms)

Approach

- Goal: Keep it simple
- Looked at Stock SqFt weighting data (from 2014)

Climate Zone	PGE	SCE	SCG	SDG	Action	Recommendation
CZ01	23.5138					
CZ02	152.9304					
CZ03	837.3043					
CZ04	366.6724					
CZ05	55.388	8.0326	8.0326			
CZ06		584.3908	659.2546	18.2303		
CZ07				409.5341		
CZ08		839.0039	989.3702	16.8964		
CZ09		387.6003	965.5512			
CZ10		485.3834	485.3834	134.6185		
CZ11	120.4384					
CZ12	467.2743					
CZ13	310.4741	60.6275	60.6275			
CZ14		80.4411	80.4411	2.7436		
CZ15		92.1954	92.1954	1.1765		
CZ16	16.3118	44.9486	44.9486			

Approach

- Goal: Keep it simple
- Looked at Stock SqFt weighting data (from 2014)

Climate Zone	PGE	SCE	SCG	SDG	Action	Recommendation
CZ01	23.5138				Only one PA	PG&E
CZ02	152.9304				Only one PA	PG&E
CZ03	837.3043				Only one PA	PG&E
CZ04	366.6724				Only one PA	PG&E
CZ05	55.388	8.0326	8.0326			
CZ06		584.3908	659.2546	18.2303		
CZ07				409.5341	Only one PA	SDG&E
CZ08		839.0039	989.3702	16.8964		
CZ09		387.6003	965.5512			
CZ10		485.3834	485.3834	134.6185		
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CZ04	366.6724				Only one PA	PG&E
CZ05	55.388	8.0326	8.0326		One IOU is much larger	PG&E
CZ06		584.3908	659.2546	18.2303		
CZ07				409.5341	Only one PA	SDG&E
CZ08		839.0039	989.3702	16.8964		
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CZ11	120.4384				Only one PA	PG&E
CZ12	467.2743				Only one PA	PG&E
CZ13	310.4741	60.6275	60.6275		One IOU is much larger	PG&E
CZ14		80.4411	80.4411	2.7436	One IOU is much larger	SCE
CZ15		92.1954	92.1954	1.1765	One IOU is much larger	SCE
CZ16	16.3118	44.9486	44.9486		One IOU is much larger	SCE

Approach

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CZ05	55.388	8.0326	8.0326		One IOU is much larger	PG&E
CZ06		584.3908	659.2546	18.2303	SCG missing values	SCE
CZ07				409.5341	Only one PA	SDG&E
CZ08		839.0039	989.3702	16.8964	SCG missing values	SCE
CZ09		387.6003	965.5512		SCG missing values	SCE
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CZ14		80.4411	80.4411	2.7436	One IOU is much larger	SCE
CZ15		92.1954	92.1954	1.1765	One IOU is much larger	SCE
CZ16	16.3118	44.9486	44.9486		One IOU is much larger	SCE

Impact of Removing PA Effects from CZ (on Lighting)

- Approach
  - Choose single IOU value to represent the area (no calculation)
  - Note that typically the values match
- Effect
  - PG&E and SCE – much less than 1% shift
  - SDG&E – less than 1%
    - 4.32, LED R-BR (-0.5% kW, 0% kWh, -0.1% therms)

Future Lighting Subcommittee Work

- High Level Discussion of Future Topics:
  - Future Lighting Program Opportunities:
    - Can Existing Baseline Resurrect Any Measures
    - Underserved Markets
    - Specialty Lamps
    - High Quality Lamps
    - Controls
  - Cost Methodologies and Update Process
  - Improving Hours of Operation Data