Impact Evaluation of 2013-14 Upstream and Residential Downstream Lighting Programs

California Public Utilities Commission

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1 EXECUTIVE SUMMARY

This report presents an impact evaluation of the 2013-14 California investor-owned utilities' (IOU) upstream and residential downstream lighting programs. DNV GL conducted this work as part of the California Public Utilities Commission (CPUC) Energy Division (ED) Evaluation Measurement & Verification Work Order ED_I_LTG_4: 2013-2014 Lighting Impact Evaluation and Market Research Studies. This evaluation addresses all lighting measures associated with upstream delivery mechanisms across sectors and all downstream lighting measures targeted at the residential sector.

1.1 Program background

Together, upstream and residential downstream lighting measures account for between 9% and 18% of each IOU's reported ex ante net annual electric savings, and between 7% and 16% of each IOU's net peak demand reductions (Table 1). For comparison, during the 2010-12 program period, upstream and residential downstream lighting measures accounted for about a third of IOU-reported net energy savings and net peak demand impacts.

Table 1. Summary of IOU-reported ex ante net annual savings from upstream and residential downstream lighting measures, 2010-12 and 2013-14*

IOU	IOU Reported Net Annual Savings					
	Total Portfolio		Upstream / Residential Downstream Lighting		Upstream / Residential Downstream Lighting as Percent of Total Portfolio	
	Energy (GWh)	Peak Demand Reduction (MW)	Energy (GWh)	Peak Demand Reduction (MW)	Energy (GWh)	Peak Demand Reduction (MW)
PG&E	1,590	272	148	20	9%	7%
SCE	1,625	262	299	43	18%	16%
SDG&E	328	54	45	6	14%	11%
Statewide	**3,542**	**588**	**492**	**69**	**14%**	**12%**

* Ex ante data used in this table and throughout the report were finalized on November 2, 2015 and include the CPUC updates published in Commission Ex Ante Team, 2015.

Upstream lighting measures fall into 26 groups that consist of similar measures. For example, the light-emitting diode (LED) reflector measure group includes all LED reflector lamp wattages and styles, such as parabolic aluminized reflector (PAR) and multifaceted reflector (MR) lamps. While savings claims included within the IOU tracking data are based on assumptions tied to specific measure characteristics, the evaluation applies updates to savings at the measure group level.

This evaluation focuses on seven upstream lighting measure groups. Taken together, these measures account for over 90% of each IOU's ex ante net savings from upstream and residential downstream lighting measures. These include:

- Medium screw-base (MSB) compact fluorescent lamp (CFL) basic spiral[1] ≤ 30 W
- MSB CFL A-lamp ≤ 30 W

[1] The CPUC defines "basic spiral CFLs" as single-wattage, non-dimmable, bare spiral CFLs of up to (and including) 30 W. For the sake of clarity, we refer to these lamps as "basic spiral CFLs" throughout the report.

- MSB CFL reflector ≤ 30 W
- MSB CFL globe ≤ 30 W
- MSB CFL high-wattage (> 30 W)
- LED A-lamps of all wattages
- LED reflector lamps of all wattages[2]

Although each of these LED lamp measure groups accounts for less than 1% of the IOUs' combined 2013-14 reported portfolio-level ex ante net energy savings and/or demand reduction, we included them in the 2013-14 evaluation because of the uncertainty associated with some of the savings parameters for these measures.[3] We also include them because both measure groups are expected to increase their share of portfolio-level savings in subsequent program years. Table 2 shows the quantity of evaluated measures for which each IOU provided incentives through its 2013-14 upstream programs by measure group and IOU.

Table 2. Quantity of lamps in evaluated upstream lighting measure groups by IOU, 2013-14

Evaluated Upstream Lighting Measure	Quantity			Overall Quantity (Across IOUs)	
	PG&E	SCE	SDG&E	Total	% of Total
MSB CFL basic spiral ≤ 30 W	1,104,105	719,416	1,940,280	3,763,801	22%
MSB CFL A-lamp ≤ 30 W	659,960	2,063,196	488,529	3,211,685	19%
MSB CFL reflector ≤ 30 W	561,166	2,126,552	484,425	3,172,143	18%
MSB CFL globe ≤ 30 W	N/A	218,680	49,692	268,372	2%
MSB CFL high-wattage (> 30 W)	365,578	4,146,993	7,908	4,520,479	26%
LED A-lamp, all wattages	277,886	245,225	234,979	758,090	4%
LED reflector, all wattages	605,986	760,681	204,858	1,571,525	9%
Overall	**3,574,681**	**10,280,743**	**3,410,671**	**17,266,095**	**100%**

In addition to program-discounted measures shipped during the 2013-14 program period, PG&E and SCE also claimed savings for measures that were carried over from the previous program cycle in the 2013-14 tracking data. The CPUC allowed the IOUs to defer recognition of these measures due to a decision to discontinue an ongoing roll-over installation rate assumption under the 2010-12 upstream and residential downstream lighting evaluation.[4] Appendix K of the CPUC's 2010–12 Energy Efficiency Annual Progress Evaluation Report reviews this change, its impacts, and the allocation of carry-over lamps.[5] This evaluation recognizes savings for these carry-over lamps using impact parameters from the 2010-12 evaluation. The report refers only to 2013-14 measures unless explicitly stated otherwise. Table 3 shows the quantities of 2010-12 carry-over measures included in the 2013-14 evaluation. The primary ex post driver for different realization rates between cycles is due to an increase in delta Watts. Ex post HOU and peak CF did not change significantly, and ex post installation rates, res/non-res split, and interactive effects remained the same between the two evaluation cycles.

[2] Note that while the CFL measure groups include MSB lamps only, the LED lamp measure groups include all base types.

[3] For more details regarding uncertain measures, see CPUC ED, 2013.

[4] DNV GL, 2014c.

[5] CPUC ED, 2015c.

Table 3. Quantity of carry-over lamps in evaluated upstream lighting measure groups by IOU, 2010-12 measures recognized in 2013-14 program

Evaluated Upstream Lighting Measure Group	Quantity			Overall Quantity (Across IOUs)	
	PG&E	SCE	SDG&E	Total	% of Total
MSB CFL basic spiral ≤ 30 W	3,000,000	1,711,859	0	4,711,859	78%
MSB CFL A-lamp ≤ 30 W	560,000	117,000	0	677,000	11%
MSB CFL reflector ≤ 30 W	673,000	3,141	0	676,141	11%
Overall	**4,233,000**	**1,832,000**	**0**	**6,065,000**	**100%**

1.2 Program context

Through the upstream lighting program, California retailers offer incentives to lamp suppliers who then offer discounted lamps to consumers in retail stores. The program collects no information regarding the ultimate end-users of the discounted lamps, and program-discounted lamps compete with non-program lamps in retail settings. As such, it is important to understand the program in the broader context of California's residential lighting market. The market has changed rapidly over the past several years, and the upstream lighting program has also evolved. These changes affect consumer choices regarding lamp purchases and also influence our choice of evaluation approaches.

Key characteristics of the recent history of California's residential lighting market (between the conclusion of the 2010-12 program period and the conclusion of the 2013-14 program period) include:

- The share of total lamp stock comprised by efficient lamps (CFLs and LED lamps) remained steady at roughly one-third of the market between the end of 2012 and the end of 2014, but the share comprised by CFLs declined from slightly while the share of LED lamps increased. Among inefficient lamps (halogen lamps and traditional incandescent lamps), the share comprised by traditional incandescent lamps declined while the share comprised by halogen lamps increased.
- The average price gap between IOU-discounted CFLs and other CFLs widened for spirals, A-lamps, and globes and decreased for reflectors between the end of 2012 and the end of 2014.
- Average LED lamp prices decreased across the board for A-lamps and reflectors between periods, including IOU-discounted lamps and those not discounted through the program. Incandescent and halogen lamp prices increased between the two periods for A-lamps, reflectors, and globes.
- Program-discounted CFLs were the lowest-cost options within each replacement lamp category at the end of 2014. Without IOU discounts, incandescent and halogens were the lowest-cost options within each replacement lamp category at the end of 2014.

These characteristics and changes between periods affect consumer choices when shopping for replacement lamps. As California's retail market for replacement lamps changed over time, so too did the upstream lighting program. Key differences between the 2010-12 and 2013-14 upstream lighting programs include:

- The 2013-14 program provided incentives for roughly 17 million lamps (an average of just over 8 million per year) while the 2010-12 provided incentives for 70 million lamps (roughly 23 million per year.
- Basic spiral CFLs ≤ 30 W accounted for approximately two-thirds of lamps discounted through the 2010-12 program but only about one-fifth of lamps discounted by the 2013-14 program.
- MSB CFL high wattage (>30 W) accounted for the largest share of lamps discounted by the upstream program in 2013-14 (27%, or roughly 4.5 million lamps) but only 1% of lamps discounted by the 2010-12 program (just over 700,000 lamps).

- The quantity of discounted LED lamps increased from approximately 110,000 in the 2010-12 program to approximately 2.2 million in the 2013-14 program. The IOUs also added LED A-lamps to the 2013-14 program (as the only LED lamps in the 2010-12 program were reflectors)
- The share of incentive allocations to grocery channels (including both chain and independent grocery stores) declined between 2010-12 and 2013-14 while the share of allocations to the home improvement channel increased.

In addition to these changes, there were noteworthy differences in lamp shipments from quarter to quarter within the 2013-14 program in terms of the measure groups included. This further complicates the market from an evaluation perspective given the uptick in the quantity of incentives for LED lamps (adding another competing efficient lamp technology to the range of available options) during 2013-14 and the fact that several of these technologies are applicable in many of the same applications as one another (for example, CFL reflector lamps and LED reflector lamps). The differences described above are even more pronounced at the channel level and within specific retail stores. The stark differences in pricing between IOU-discounted lamps and lamps not discounted through the program becomes even more critical given that with the program discounts, efficient technologies are the least-cost option and without them, comparatively inefficient incandescent and halogen lamps become the least-cost option. The presence or absence of program-discounted lamps in a retail store alters the landscape for consumer decision-making.

1.3 Evaluation goals and approach

The overarching goal of the impact evaluation for the 2013-14 upstream and residential downstream lighting measures is to verify and validate the IOU reported energy savings and peak demand reduction estimates. The impact evaluation approach has three main components:

1. Develop measure quantity adjustments, which include program invoice and application verification, an assessment of the percentage of IOU-discounted products purchased by non-IOU customers (i.e., leakage), and an assessment of the percentage of IOU-discounted products purchased by residential versus nonresidential customers.
2. Develop gross savings inputs, which include an assessment of the percentage of IOU-discounted measures installed as well as estimates of the average daily hours-of-use (HOU), the average percent of measures operating at peak coincidence factor (CF), the wattage displaced by IOU-discounted measures (delta watts), unit energy savings (UES) in kWh/year and peak kW, and installation rate.
3. Develop net savings inputs, which include estimates of the net-to-gross ratio (NTGR).

In addition to these components, pursuant to direction from Commission staff, DNV GL developed an alternate method for estimating gross savings and NTGR in which the gross savings estimate removes savings from CFL-to-CFL replacements per direction in the 2015 CPUC memo titled "Ex Ante Update for Energy Savings Performance Incentive (ESPI) Uncertain Measures Compact Fluorescent Lamps 30 Watts and Less." While this evaluation report relies upon the methods for estimating gross savings and NTGR used previously (referenced herein as the conventional approach), we also developed gross savings and NTGR using the alternate approach.

This alternate approach was necessitated by regulatory and market changes. Given the differences between the 2010-12 and 2013-14 programs and shifts in California's residential lighting market over the past several years, the 2013-14 impact evaluation includes other changes and improvements to approaches applied in the 2010-12 evaluation – for example, improvements to estimating NTGR through use of an imputation factor and attempts to better reflect quarterly variations in program activity.

1.4 Evaluation results

Table 4 below provides an overview of the ex ante and ex post gross annual energy savings, demand reductions, and realization rates for 2013-14 evaluated upstream lighting measures across IOUs by evaluated upstream lighting measure group as well as for carry-over upstream lighting measures from 2010-12. Table 5 shows ex ante and ex post gross savings and realization rates for the same measures across IOUs. As shown, the IOUs achieved ex post gross annual energy savings of more than 741 GWh for 2013-14 measures (Table 4) and ex post net annual energy savings of more than 292 GWh for 2013-14 measures (Table 5).

Key drivers for these results include:

- **Difference in approach to estimating delta watts between ex ante and ex post for both CFLs and LED lamps.** Upstream measure groups other than high-wattage CFLs averaged approximately 11 to 17 W per measure group in 2013 and 13 to 18 W per group in 2014 for PG&E; from 16 to 20 W in 2013 and 17 to 21 W per group in 2014 for SCE; and from approximately 8 to 17 W in 2013 and 10 to 16 W per upstream measure group in 2014 for SDG&E. Because these average program-discounted upstream measure wattages are fairly low, the ex post approach to estimating delta watts ultimately yields higher energy savings than the ex ante approach. The ex ante approach to calculating delta watts yields lower deltas for lower-wattage lamps than for higher-wattage lamps based on a wattage reduction ratio, while the ex post approach yields higher deltas for lower-wattage lamps because we subtract the average program-discounted lamp wattages for each evaluated measure group from the average wattage of the installed baseline lamp wattages (with incandescent lamps as the baseline for CFL measure groups and incandescent and CFLs as the baseline for LED lamp measure groups).[6]
- **Installation rates for CFLs.** CFL installation rates are considerably higher in ex post than ex ante (97% versus a range of 67% to 81% depending on measure group and IOU), largely attributable to a change in the definition of installation rates that occurred before the 2013-14 program's launch.
- **Residential / nonresidential split for CFLs.** For all evaluated upstream CFL measure groups, the ex ante approach assumes a higher proportion of lamps installed in residential applications than ex post. Shifting a quantity of measures from the residential sector to the nonresidential sector increases the ex post gross energy savings associated with these measures.
- **Lower NTGR than in the 2010-12 evaluation.** The NTGR for evaluated upstream lighting measure groups are lower in the current evaluation than in the previous evaluations. This is a consequence of two effects:
  - **Cross-measure substitution effects within the program.** Incentives for one program-discounted upstream lighting measure group pull sales away one or more other program-discounted upstream lighting measure groups.
  - **Program / non-program substitution effects**. Program-discounted lamps also competed with non-program lamps. Unlike during the 2010-12 upstream lighting program, most channels stocked both program-discounted lamps and non-program lamps. Shifting sales between program and functionally non-program program lamps does not result in savings.

  These effects lead to (for example) incentives for CFLs shifting sales away from LED lamps. A markets-based approach requires crediting the program for additional efficient technology sales and debiting the program for sales movements away from efficient technologies.

[6] The average delta watts in the 2010-12 Upstream and Residential Downstream Impact Evaluation (DNV GL, 2014c) are lower than in 2013-14 for comparable CFL measure groups because the average program-discounted wattage was higher in the IOUs' 2010-12 upstream programs than in the in 2013-14 upstream programs.

For all residential downstream lighting measures, we passed through the ex ante gross savings estimates rather than developing separate ex post estimates. Ex post gross savings estimates for nonresidential upstream measures rely upon the ex ante gross UES estimates, but we adjusted the measure quantities based on an updated estimate for the share of lamps installed in residential versus nonresidential applications and updated the installation rates.

Table 4. Ex ante and ex post gross savings and realization rates by upstream measure group across all IOUs, 2013-14 and 2010-12 carry-over measures

All IOUs Evaluated Upstream Lighting Measure Group	Ex Ante Gross Savings			Ex Post Gross Savings			Gross Realization Rates		
	kWh	kW	therms	kWh	kW	therms	kWh	kW	therms
2013-14									
MSB CFL basic spiral ≤ 30 W	76,636,319	10,103	-1,156,843	124,905,835	17,190	-1,935,555	163%	170%	167%
MSB CFL A-lamp ≤ 30 W	84,213,269	11,661	-1,187,740	112,809,678	15,662	-1,672,663	134%	134%	141%
MSB CFL reflector ≤ 30 W	102,322,499	13,513	-1,532,846	128,971,184	17,848	-1,958,785	126%	132%	128%
MSB CFL globe ≤ 30 W	7,431,337	1,037	-95,815	6,387,100	1,091	-77,988	86%	105%	81%
MSB CFL high-wattage (> 30 W)	281,547,654	39,694	-3,798,880	289,311,812	41,414	-4,030,388	103%	104%	106%
LED A-lamp, all wattages	12,527,404	1,687	-195,434	20,021,949	2,695	-308,415	160%	160%	158%
LED reflector, all wattages	39,036,875	5,463	-612,664	58,723,767	7,691	-980,087	150%	141%	160%
Overall	**603,715,357**	**83,158**	**-8,580,222**	**741,131,324**	**103,590**	**-10,963,880**	**123%**	**125%**	**128%**
2010-12									
MSB CFL basic spiral ≤ 30 W	166,945,236	24,884	-2,521,894	165,113,186	24,765	-2,790,132	99%	100%	111%
MSB CFL A-lamp ≤ 30 W	15,865,522	2,247	-300,663	21,900,743	2,874	-415,988	138%	128%	138%
MSB CFL reflector ≤ 30 W	19,126,906	2,710	-503,314	27,227,392	3,690	-538,073	142%	136%	107%
Overall	**201,937,665**	**29,841**	**-3,325,871**	**214,241,320**	**31,329**	**-3,744,193**	**106%**	**105%**	**113%**

Table 5. Ex ante and ex post net savings and realization rates by evaluated upstream lighting measure group across all IOUs, 2013-14 and 2010-12 carry-over measures

All IOUs Evaluated Upstream Lighting Measure Group	Ex Ante Net Savings			Ex Post Net Savings			Net Realization Rates		
	kWh	kW	therms	kWh	kW	therms	kWh	kW	therms
2013-14									
MSB CFL basic spiral ≤ 30 W	41,383,612	5,456	-624,695	31,045,451	4,267	-469,230	75%	78%	75%
MSB CFL A-lamp ≤ 30 W	45,475,166	6,297	-641,380	71,691,649	9,968	-1,052,368	158%	158%	164%
MSB CFL reflector ≤ 30 W	55,254,150	7,297	-827,737	31,601,578	4,387	-472,647	57%	60%	57%
MSB CFL globe ≤ 30 W	4,012,922	560	-51,740	4,347,308	742	-53,074	108%	133%	103%
MSB CFL high-wattage (> 30 W)	152,035,735	21,435	-2,051,395	129,522,837	18,541	-1,806,719	85%	86%	88%
LED A-lamp, all wattages	9,604,546	1,294	-149,298	7,802,053	1,055	-120,138	81%	82%	80%
LED Reflector, all wattages	28,819,974	4,047	-452,553	16,142,601	2,115	-268,319	56%	52%	59%
Overall	**336,586,106**	**46,385**	**-4,798,799**	**292,153,478**	**41,076**	**-4,242,494**	**87%**	**89%**	**88%**
2010-12									
MSB CFL basic spiral ≤ 30 W	59,192,451	8,493	-1,513,136	59,277,253	8,760	-1,076,805	100%	103%	71%
MSB CFL A-lamp ≤ 30 W	54,472,293	8,410	-255,563	56,341,457	8,347	-911,712	103%	99%	357%
MSB CFL reflector ≤ 30 W	19,874,518	2,817	-427,722	18,542,026	2,511	-345,902	93%	89%	81%
Overall	**133,539,262**	**19,720**	**-2,196,421**	**134,160,737**	**19,617**	**-2,334,419**	**100%**	**99%**	**106%**

For PG&E, Table 6 shows the ex ante and ex post gross annual energy savings, demand reductions, and realization rates for 2013-14 evaluated upstream lighting measures across IOUs by evaluated upstream lighting measure group as well as for carry-over upstream lighting measures from 2010-12. Table 7 shows net savings results for PG&E.

Table 6. PG&E ex ante and ex post gross savings and realization rates by evaluated upstream lighting measure group, 2013-14 and 2010-12 carry-over measures

PG&E Evaluated Upstream Lighting Measure Group	Ex Ante Gross Savings			Ex Post Gross Savings			Gross Realization Rates		
	kWh	kW	therms	kWh	kW	therms	kWh	kW	therms
2013-14									
MSB CFL basic spiral ≤ 30 W	20,711,778	2,790	-392,265	37,003,332	5,131	-729,891	179%	184%	186%
MSB CFL A-lamp ≤ 30 W	13,175,709	1,778	-248,840	20,436,379	2,797	-388,209	155%	157%	156%
MSB CFL reflector ≤ 30 W	13,574,272	1,773	-267,741	22,233,870	2,991	-446,288	164%	169%	167%
MSB CFL globe ≤ 30 W	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MSB CFL high-wattage (> 30 W)	15,880,886	2,160	-296,331	23,316,926	3,332	-435,453	147%	154%	147%
LED A-lamp, all wattages	4,475,565	596	-85,677	7,260,604	991	-136,812	162%	166%	160%
LED reflector, all wattages	15,456,205	2,054	-297,841	24,824,151	3,183	-509,617	161%	155%	171%
Overall	**83,274,414**	**11,153**	**-1,588,694**	**135,075,262**	**18,425**	**-2,646,270**	**162%**	**165%**	**167%**
2010-12									
MSB CFL basic spiral ≤ 30 W	98,654,086	14,155	-2,521,894	98,795,422	14,600	-1,794,676	100%	103%	71%
MSB CFL A-lamp ≤ 30 W	11,291,209	1,597	-300,663	17,460,306	2,275	-353,757	155%	142%	118%
MSB CFL reflector ≤ 30 W	18,988,335	2,690	-503,314	27,092,488	3,671	-536,133	143%	136%	107%
Overall	**128,933,631**	**18,442**	**-3,325,871**	**143,348,217**	**20,546**	**-2,684,565**	**111%**	**111%**	**81%**

Table 7. PG&E ex ante and ex post net savings and realization rates by evaluated upstream lighting group, 2013-14 and 2010-12 carry-over measures

PG&E Evaluated Upstream Lighting Measure Group	Ex Ante Net Savings			Ex Post Net Savings			Net Realization Rates		
	kWh	kW	therms	kWh	kW	therms	kWh	kW	therms
2013-14									
MSB CFL basic spiral ≤ 30 W	11,184,360	1,507	-211,823	7,255,507	1,006	-143,115	65%	67%	68%
MSB CFL A-lamp ≤ 30 W	7,114,883	960	-134,374	10,800,725	1,478	-205,170	152%	154%	153%
MSB CFL reflector ≤ 30 W	7,330,107	958	-144,580	3,977,300	535	-79,834	54%	56%	55%
MSB CFL globe ≤ 30 W	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MSB CFL high-wattage (> 30 W)	8,575,678	1,166	-160,018	10,890,684	1,556	-203,388	127%	133%	127%
LED A-lamp, all wattages	3,480,121	463	-66,714	2,900,051	396	-54,646	83%	85%	82%
LED Reflector, all wattages	12,514,162	1,665	-241,047	6,658,075	854	-136,684	53%	51%	57%
Overall	**50,199,311**	**6,719**	**-958,556**	**42,482,342**	**5,825**	**-822,837**	**85%**	**87%**	**86%**
2010-12									
MSB CFL basic spiral ≤ 30 W	59,192,451	8,493	-1,513,136	59,277,253	8,760	-1,076,805	100%	103%	71%
MSB CFL A-lamp ≤ 30 W	9,597,528	1,358	-255,563	12,571,421	1,638	-254,705	131%	121%	100%
MSB CFL reflector ≤ 30 W	16,123,581	2,284	-427,722	14,900,868	2,019	-294,873	92%	88%	69%
Overall	**84,913,560**	**12,134**	**-2,196,421**	**86,749,542**	**12,417**	**-1,626,383**	**102%**	**102%**	**74%**

For SCE, Table 8 shows the ex ante and ex post gross annual energy savings, demand reductions, and realization rates for 2013-14 evaluated upstream lighting measures across IOUs by evaluated upstream lighting measure group as well as for carry-over upstream lighting measures from 2010-12. Table 9 shows net savings results for SCE.

Table 8. SCE ex ante and ex post gross savings and realization rates by evaluated upstream lighting measure group, 2013-14 and 2010-12 carry-over measures

SCE Evaluated Upstream Lighting Measure Group	Ex Ante Gross Savings			Ex Post Gross Savings			Gross Realization Rates		
	kWh	kW	therms	kWh	kW	therms	kWh	kW	therms
2013-14									
MSB CFL basic spiral ≤ 30 W	16,262,089	2,296	-220,311	30,192,785	4,332	-429,913	186%	189%	195%
MSB CFL A-lamp ≤ 30 W	62,525,537	8,839	-817,782	78,470,521	10,988	-1,094,330	126%	124%	134%
MSB CFL reflector ≤ 30 W	77,704,815	10,588	-1,082,370	92,614,983	12,971	-1,327,741	119%	123%	123%
MSB CFL globe ≤ 30 W	6,575,077	925	-84,509	5,559,175	959	-67,370	85%	104%	80%
MSB CFL high-wattage (> 30 W)	265,352,333	37,501	-3,497,441	265,503,839	38,015	-3,588,500	100%	101%	103%
LED A-lamp, all wattages	3,810,172	524	-54,717	6,499,145	938	-81,062	171%	179%	148%
LED reflector, all wattages	15,865,484	2,250	-230,501	26,059,257	3,533	-359,249	164%	157%	156%
Overall	**448,095,506**	**62,922**	**-5,987,632**	**504,899,705**	**71,737**	**-6,948,166**	**113%**	**114%**	**116%**
2010-12									
MSB CFL basic spiral ≤ 30 W	68,291,151	10,729	0	66,318,238	10,165	-995,464	97%	95%	N/A
MSB CFL A-lamp ≤ 30 W	4,574,313	650	0	4,440,436	599	-62,231	97%	92%	N/A
MSB CFL reflector ≤ 30 W	138,571	20	0	134,904	19	-1,940	97%	93%	N/A
Overall	**73,004,034**	**11,399**	**0**	**70,893,577**	**10,783**	**-1,059,636**	**97%**	**95%**	**N/A**

Table 9. SCE ex ante and ex post net savings and realization rates by evaluated upstream lighting measure group, 2013-14 and 2010-12 carry-over measures

SCE Evaluated Upstream Lighting Measure Group	Ex Ante Net Savings			Ex Post Net Savings			Net Realization Rates		
	kWh	kW	therms	kWh	kW	therms	kWh	kW	therms
2013-14									
MSB CFL basic spiral ≤ 30 W	8,781,528	1,240	-118,968	7,938,256	1,139	-113,032	90%	92%	95%
MSB CFL A-lamp ≤ 30 W	33,763,791	4,773	-441,602	53,600,393	7,506	-747,498	159%	157%	169%
MSB CFL reflector ≤ 30 W	41,960,601	5,718	-584,480	25,061,657	3,510	-359,287	60%	61%	61%
MSB CFL globe ≤ 30 W	3,550,542	499	-45,635	3,794,758	655	-45,987	107%	131%	101%
MSB CFL high-wattage (> 30 W)	143,290,262	20,250	-1,888,618	118,439,374	16,958	-1,600,804	83%	84%	85%
LED A-lamp, all wattages	2,519,008	349	-35,800	2,710,799	391	-33,811	108%	112%	94%
LED Reflector, all wattages	9,747,903	1,397	-139,833	7,278,037	987	-100,334	75%	71%	72%
Overall	**243,613,634**	**34,226**	**-3,254,937**	**218,823,275**	**31,146**	**-3,000,754**	**90%**	**91%**	**92%**
2010-12									
MSB CFL basic spiral ≤ 30 W	44,874,765	7,053	0	43,770,037	6,709	-657,006	98%	95%	N/A
MSB CFL A-lamp ≤ 30 W	3,750,937	533	0	3,641,158	492	-51,029	97%	92%	N/A
MSB CFL reflector ≤ 30 W	85,914	12	0	83,640	12	-1,203	97%	93%	N/A
Overall	**48,711,616**	**7,598**	**0**	**47,494,835**	**7,212**	**-709,239**	**98%**	**95%**	**N/A**

For SDG&E, Table 10 shows the ex ante and ex post gross annual energy savings, demand reductions, and realization rates for 2013-14 evaluated upstream lighting measures across IOUs by evaluated upstream lighting measure group as well as for carry-over upstream lighting measures from 2010-12. Table 11 shows net savings results for SDG&E.

Table 10. SDG&E ex ante and ex post gross savings and realization by evaluated upstream lighting measure group, 2013-14[1]

SDG&E Evaluated Upstream Lighting Measure Group	Ex Ante			Ex Post			Gross Realization Rates		
	kWh	kW	therms	kWh	kW	therms	kWh	kW	therms
2013-14									
MSB CFL basic spiral ≤ 30 W	39,662,451	5,017	-544,267	57,709,717	7,727	-775,752	146%	154%	143%
MSB CFL A-lamp ≤ 30 W	8,512,024	1,044	-121,118	13,902,778	1,876	-190,123	163%	180%	157%
MSB CFL reflector ≤ 30 W	11,043,412	1,151	-182,735	14,122,331	1,886	-184,756	128%	164%	101%
MSB CFL globe ≤ 30 W	856,260	112	-11,306	827,926	132	-10,618	97%	118%	94%
MSB CFL high-wattage (> 30 W)	314,435	33	-5,109	491,047	67	-6,435	156%	201%	126%
LED A-lamp, all wattages	4,241,667	567	-55,040	6,262,200	765	-90,540	148%	135%	164%
LED reflector, all wattages	7,715,187	1,159	-84,322	7,840,359	974	-111,221	102%	84%	132%
Overall	**72,345,436**	**9,083**	**-1,003,897**	**101,156,358**	**13,428**	**-1,369,444**	**140%**	**148%**	**136%**

[1] SDG&E had no 2010-2012 carry-over measures for upstream lighting in 2013-14

Table 11. SDG&E ex ante and ex post net savings and realization by evaluated upstream lighting measure group, 2013-14[1]

SDG&E Evaluated Upstream Lighting Measure Group	Ex Ante			Ex Post			Net Realization Rates		
	kWh	kW	therms	kWh	kW	therms	kWh	kW	therms
2013-14									
MSB CFL basic spiral ≤ 30 W	21,417,724	2,709	-293,904	15,851,689	2,122	-213,083	74%	78%	73%
MSB CFL A-lamp ≤ 30 W	4,596,493	564	-65,404	7,290,530	984	-99,699	159%	175%	152%
MSB CFL reflector ≤ 30 W	5,963,442	622	-98,677	2,562,621	342	-33,526	43%	55%	34%
MSB CFL globe ≤ 30 W	462,380	60	-6,105	552,550	88	-7,087	120%	145%	116%
MSB CFL high-wattage (> 30 W)	169,795	18	-2,759	192,779	26	-2,526	114%	146%	92%
LED A-lamp, all wattages	3,605,417	482	-46,784	2,191,204	268	-31,681	61%	56%	68%
LED Reflector, all wattages	6,557,909	986	-71,673	2,206,489	274	-31,301	34%	28%	44%
Overall	**42,773,161**	**5,440**	**-585,306**	**30,847,862**	**4,105**	**-418,902**	**72%**	**75%**	**72%**

[1] SDG&E had no 2010-2012 carry-over measures for upstream lighting in 2013-14

1.5 Recommendations

Our over-arching recommendation is that projections for future programs must recognize that California's market for residential replacement lamps is evolving rapidly. As described in Section 2.3, there were changes in lamp availability and pricing even during the 2013-14 program period, and more substantial changes over the longer-term. In this swiftly-changing landscape, planning projections based directly on 2013-14 program results could already be outdated.

Given this, the evaluation team has the following recommendations:

1. **Refine targeting for LED lamp incentives.** In big box channels such as large home improvement, mass merchandise, and membership club, NTGR are relatively low in the current evaluation and were relatively low in prior evaluations for most measure groups. The presence of LED lamps in these channels has increased rapidly while pricing has declined at the market level. The IOUs should review the cost-effectiveness of offering incentives for LED lamps in big box channels and (if not cost-effective) consider directing incentives for these lamps toward the non- big box channels. The cost-effectiveness review should consider not only the NTGR determined for the 2013-14 program, but also the likelihood that even without program discounts LED lamps will increase in availability at lower prices in big box channels.
2. **Refine targeting for CFL incentives.** The NTGR for CFLs are somewhat lower than in the prior evaluation, but still potentially represent cost-effective investments. The IOUs should examine the cost-effectiveness of offering incentives for CFLs of the different measure groups in each retail channel and consider discontinuing incentive offerings in channels where incentives are not cost-effective, or are borderline cost-effective.
3. **Examine projections of lamp pricing and market conditions.** DNV GL recommends that the IOUs conduct scenario analyses to represent current market conditions regarding lamp availability and pricing as of 2016, and to project changing conditions into the future. The IOUs can then apply the results of these analyses to adjust ex ante assumptions for key impact parameters. The lamp choice model developed for this evaluation could support such analysis with scenarios representing more current market conditions.
    - **Review baselines.** This evaluation characterized the baseline for CFLs and as the mix of installed incandescent lamp stock in IOU customer households as of 2012 and the baseline for LED lamps as the mix of installed CFLs and incandescent lamps during the same timeframe. Another perspective on baseline would be to identify the mix of lamp technologies that consumers would purchase in the absence of program discounts—in other words, the purchases displaced by program-discounted lamps. The mix of displaced lamps represents the net baseline condition, and could be estimated using the lamp choice model. This became apparent during the course of the 2013-14 impact evaluation.
    - **Explore the effectiveness of offering discounts on multiple competing technologies.** Evaluation results indicate that there is competition among program-discounted measure groups within the same replacement lamp category when more than one is offered in a retail store at the same time. At the same time, when the program provides incentives for only one measure group within a replacement lamp category (say, basic spiral CFLs) and the other is available without program discounts (say, CFL A-lamps), sales of the program-discounted lamp may come at the expense of sales of the similarly-efficient non-program alternative. Assessment of program cost-effectiveness needs to explore these substitution effects. Again, the lamp choice model developed for this work could support such exploration. The goal is to clarify how best to allocate discounts among multiple efficient technologies

within a replacement lamp category for specific combinations of measure groups and retail channels.

4. **If more up-to-date estimates are not developed through prospective work, use the results of this evaluation to true up ex ante assumptions for key impact parameters.** If the IOUs are unable to generate projections of lamp pricing and changing market conditions as suggested above, the DNV GL recommends that the IOUs use the results of this evaluation to revise current ex ante assumptions for key impact evaluation parameters. While these results are already somewhat dated at the time of this report's publication, these results are still more current than those used to generate their ex ante savings estimates for 2013-14.

2 INTRODUCTION

2.1 Program overview

During the 2013-14 program period, each California IOU that provides electric service – including PG&E, SCE, and SDG&E – implemented a Statewide Lighting Program designed to promote energy-efficient lighting across all market sectors. The program included three subprograms: Lighting Market Transformation; Lighting Innovation; and Primary Lighting. The IOUs intended the Primary Lighting subprogram to support lighting measures that had already proven their market viability (versus emerging technologies) and to facilitate rapid adoption of these measures through upstream, downstream, and midstream incentives. The 2013-14 Primary Lighting subprogram was a resource-acquisition program that included non-resource and market transformation activities. A key component of the Primary Lighting subprogram during this period was the upstream mechanism, which provided incentives to lamp manufacturers in exchange for providing discounted lamps to consumers in retail stores.

The upstream delivery mechanism has been a core part of the California IOUs' CFL program activities for many years, but the 2013-14 period marked the beginning of a shift away from CFLs and toward LED lamps. Starting in January 2014, the CPUC ED required that the IOUs demonstrate that the LED lamps for which they offered incentives met the performance requirements outlined in the California Quality LED Specification developed by the California Energy Commission (CEC).[7] The requirements in the specification go beyond ENERGY STAR for lamp attributes such as color, dimmability, light distribution, and warranty, with the intent of meeting or exceeding customer expectations regarding lamp performance and light quality. The IOUs began introducing LED lamps into the upstream program in relatively small quantities during 2013 and in somewhat greater quantities in 2014. The IOUs also varied in the extent to which they concurrently decreased incentives for CFLs.

2.2 Evaluation overview

This impact evaluation is designed to include all lighting measures associated with the upstream delivery mechanism as well as all downstream lighting measures targeted at the residential sector by PG&E, SCE, and SDG&E. Together, upstream and residential downstream lighting measures account for between 9% and 19% of each IOU's reported ex ante net annual electric savings, and between 8% and 17% of each IOU's net peak demand reductions (Table 12). For comparison, during the 2010-12 program period, upstream and residential downstream lighting measures accounted for about a third of IOU-reported net energy savings and net peak demand impacts.

[7] CEC, 2012.

Table 12. Summary of IOU-reported ex ante net annual savings from upstream and residential downstream lighting measures, 2013-14*

IOU	IOU Reported Net Annual Savings					
	Total Portfolio		Upstream / Residential Downstream Lighting		Upstream / Residential Downstream Lighting as Percent of Total Portfolio	
	Energy (GWh)	Peak Demand Reduction (MW)	Energy (GWh)	Peak Demand Reduction (MW)	Energy (GWh)	Peak Demand Reduction (MW)
PG&E	1,590	272	148	20	9%	7%
SCE	1,625	262	299	43	18%	16%
SDG&E	328	54	45	6	14%	11%
Statewide	**3,542**	**588**	**492**	**69**	**14%**	**12%**

* Ex ante data used in this table and throughout the report were finalized on November 2, 2015 and include the CPUC updates published in Commission Ex Ante Team, 2015.

Upstream lighting measures comprised the vast majority of the combined total upstream and residential downstream lighting measures during the 2013-14 program period (Table 13). As such, the remainder of this report focuses on upstream lighting measures and in particular, the measures identified as part of the ESPI uncertain measure list[8] and that account for the majority of ex ante savings within the upstream program. For residential downstream measures, we are passing through the ex ante estimates for energy savings (kWh), demand reductions (kW), and gas impacts (therms) and for all upstream measures not included in the seven evaluated upstream lighting measure groups described below.[9]

[8] CPUC, 2013.

[9] "Pass-through" measures are those for which we rely on ex ante assumptions in the evaluation.

Table 13. Summary of IOU-reported ex ante upstream and residential downstream lighting measure savings for evaluated and passed-through measure groups, 2013-14

IOU / Lighting Measure Category	Ex Ante Upstream and Residential Downstream Lighting Savings					
	Energy		Demand		Gas Impacts	
	GWh	% of GWh	MW	% of MW	Therms	% of Therms
PG&E						
Upstream - Evaluated	135.1	91%	18.9	93%	-3.2	93%
Upstream - Passed Through	9.0	6%	1.2	6%	-0.2	5%
Downstream - Passed Through	3.7	3%	0.3	1%	-0.1	2%
Subtotal – PG&E	**147.9**	**100%**	**20.4**	**100%**	**-3.4**	**100%**
SCE						
Upstream - Evaluated	292.3	98%	41.8	97%	-3.3	98%
Upstream - Passed Through	2.5	1%	0.4	1%	0.0	1%
Downstream - Passed Through	4.5	2%	0.7	2%	0.0	1%
Subtotal – SCE	**299.4**	**100%**	**42.9**	**100%**	**-3.3**	**100%**
SDG&E						
Upstream - Evaluated	42.8	95%	5.4	96%	-0.6	95%
Upstream - Passed Through	1.3	3%	0.2	3%	0.0	3%
Downstream - Passed Through	1.0	2%	0.1	1%	0.0	2%
Subtotal – SDG&E	**45.1**	**100%**	**5.7**	**100%**	**-0.6**	**100%**
All IOUs						
Upstream - Evaluated	470.2	96%	66.1	96%	-7.0	95%
Upstream - Passed Through	12.9	3%	1.8	3%	-0.2	3%
Downstream - Passed Through	9.2	2%	1.1	2%	**-0.1**	2%
Grand Total – All IOUs	**492.4**	**100%**	**69.0**	**100%**	**-7.3**	**100%**

* Value is less than 0 but greater than -0.1.

Upstream lighting measures fall into 26 groups that consist of similar measures. For example, the LED reflector measure group includes all LED reflector lamp wattages and styles, such as parabolic aluminized reflector (PAR) and multifaceted reflector (MR) lamps. While savings claims included within the IOU tracking data are based on assumptions tied to specific measure characteristics, the evaluation applies updates to savings at the measure group level.

This evaluation focuses on seven upstream lighting measure groups. Taken together, these measures account for over 90% of each IOU's ex ante net savings from upstream and residential downstream lighting measures. The 2010-12 upstream and residential downstream lighting impact evaluation addressed four measure groups: basic spiral CFLs ≤ 30 Watts (W),[10] CFL A-lamps ≤ 30 W, CFL reflector lamps ≤ 30 W, and CFL globe lamps ≤ 30 W.[11] All of these were medium screw-base (MSB) lamps. While there were few CFLs of greater than 30 W in the 2010-12 program, high-wattage CFLs represented a noteworthy percentage of reported portfolio-level annual energy savings and demand reductions in the 2013-14 program for SCE (Table 14). The 2013-14 evaluation thus separates CFLs of all shapes that are greater than 30 W into a new measure group called CFL high-wattage (> 30 W). As such, the five upstream CFL measure groups addressed by this evaluation include the following:

[10] The CPUC defines "basic spiral CFLs" as single-wattage, non-dimmable, bare spiral CFLs of up to (and including) 30 W. For the sake of clarity, we refer to these lamps as "basic spiral CFLs" throughout the report.

[11] DNV GL, 2014c. Note that the 2010-12 impact evaluation report does not explicitly use the "≤ 30 W" label for the CFL A-lamp, reflector, and globe measure groups but none of these measure groups included CFLs > 30 W during the 2010-2012 program. As such, we have included the "≤ 30 W" label for 2010-12 measures in this report for consistency with nomenclature used in the 2013-14 report.

- MSB CFL basic spiral ≤ 30 W
- MSB CFL A-lamp ≤ 30 W
- MSB CFL reflector ≤ 30 W
- MSB CFL globe ≤ 30 W
- MSB CFL high-wattage (> 30 W)

The 2013-14 evaluation also addresses two new upstream measure groups for LED lamps:

- LED A-lamps of all wattages
- LED reflector lamps of all wattages[12]

Although each of these LED lamp measure groups accounts for less than 1% of the IOUs' combined 2013-14 reported portfolio-level ex ante net energy savings and/or demand reduction, we include them in the 2013-14 evaluation because of the uncertainty associated with some of the savings parameters for these measures.[13] We also include them because both measure groups are expected to increase their share of portfolio-level savings in subsequent program years.

Table 14 lists the percent of IOU-reported portfolio-level net annual energy savings and peak demand reductions by evaluated upstream lighting measure for residential and nonresidential programs. For savings estimates from all other measure groups, including residential downstream lighting measures and upstream lighting measures not included above, we rely on deemed assumptions and since these measure groups comprise insignificant savings, are not evaluable, and/or represent measures unlikely to persist in future cycles. As shown, CFL A-lamps ≤ 30 W and high-wattage (> 30 W) CFLs provided the majority of annual energy savings and peak demand reductions portfolio-wide. SCE's programs provided greater annual savings and demand reductions compared with the other two IOUs. Specifically, the savings from SCE's high-wattage CFL measure group accounted for 4.0% of the overall IOU portfolio savings.

[12] Note that while the CFL measure groups include MSB lamps only, the LED lamp measure groups include all base types.

[13] For more details regarding uncertain measures, see CPUC ED, 2013.

Table 14. Percent of reported portfolio-level ex ante net annual energy savings and peak demand reductions by upstream lighting measure group for residential and nonresidential measures, 2013-14

Evaluated Upstream Lighting Measure Group	Ex Ante Net Annual Energy Savings				Ex Ante Net Peak Demand Reductions			
	Overall	PG&E	SCE	SDG&E	Overall	PG&E	SCE	SDG&E
MSB CFL basic spiral ≤ 30 W	1.7%	0.5%	1.1%	0.1%	1.4%	0.4%	0.9%	0.1%
MSB CFL A-lamp ≤ 30 W	4.1%	2.0%	1.5%	0.6%	3.6%	1.7%	1.4%	0.5%
MSB CFL reflector ≤ 30 W	2.0%	0.7%	1.2%	0.2%	1.6%	0.6%	1.0%	0.1%
MSB CFL globe ≤ 30 W	0.1%	<0.1%	0.1%	<0.1%	0.1%	<0.1%	0.1%	<0.1%
MSB CFL high-wattage (> 30 W)	4.3%	0.2%	4.0%	<0.1%	3.6%	0.2%	3.4%	<0.1%
LED A-lamp, all wattages	0.3%	0.1%	0.1%	0.1%	0.2%	0.1%	0.1%	<0.1%
LED reflector, all wattages	0.8%	0.4%	0.3%	0.2%	0.7%	0.3%	0.2%	0.2%
Pass-through lighting measures	0.6%	0.4%	0.2%	0.1%	0.5%	0.3%	0.2%	0.0%
Overall	**13.9%**	**4.2%**	**8.5%**	**1.3%**	**11.7%**	**3.5%**	**7.3%**	**1.0%**

Table 15 shows the quantity of evaluated measures for which each IOU provided incentives through its 2013-14 upstream programs by measure group and IOU. As shown, SCE allocated a large number of incentives toward MSB high-wattage CFLs > 30 W. this measure group thus accounted for the largest share of upstream program-discounted measures across IOUs (accounting for 26% of the evaluated measures). The high-wattage CFLs for which SCE provided incentives accounted for more than 90% of all high-wattage CFLs in the 2013-14 programs and represented the largest share of measures in SCE's upstream lighting program.

MSB basic spiral CFLs ≤ 30 W also accounted for a large share of program-discounted measures across the IOUs' upstream programs at 22% of all measures in evaluated measure groups, followed by MSB CFL A-lamps ≤ 30 W, which accounted for 19% and MSB CFL reflectors ≤ 30 W, which accounted for 18%. For PG&E and SDG&E, MSB basic spiral CFLs ≤ 30 W accounted for the largest share of program-discounted measures at 53% and 57% percent, respectively, while this measure group accounted for only 20% of SCE's upstream measures during the 2013-14 period.

Table 15. Quantity of lamps by evaluated upstream lighting measure group and IOU, 2013-14

Evaluated Upstream Lighting Measure Group	Quantity			Overall Quantity (Across IOUs)	
	PG&E	SCE	SDG&E	Total	% of Total
MSB CFL basic spiral ≤ 30 W	1,103,983	719,416	1,940,280	3,763,679	22%
MSB CFL A-lamp ≤ 30 W	659,959	2,063,196	488,529	3,211,684	19%
MSB CFL reflector ≤ 30 W	561,157	2,126,552	484,425	3,172,134	18%
MSB CFL globe ≤ 30 W	0	218,680	49,692	268,372	2%
MSB CFL high-wattage (> 30 W)	365,578	4,146,993	7,908	4,520,479	26%
LED A-lamp, all wattages	277,886	245,225	234,979	758,090	4%
LED reflector, all wattages	605,986	760,681	204,858	1,571,525	9%
Overall	**3,574,549**	**10,280,743**	**3,410,671**	**17,265,963**	**100%**

Table 16 below shows the average incentive amount per lamp for lamps in each evaluated upstream lighting measure group by IOU weighted by the lamp quantities shown in Table 15 above. As shown, the lowest overall average incentive was for MSB CFL basic spiral ≤ 30 W (with discounts of roughly $0.49 per lamp, on average) and the highest was for LED A-lamps (roughly $6.59 per lamp). The table also shows that the IOUs' incentive amounts vary not only from measure group to measure group but also from IOU to IOU within measure groups. Of the three IOUs, SCE had the highest average incentive per lamp for all evaluated upstream lighting measure groups with the exception of MSB basic spiral CFLs ≤ 30 W, for which SDG&E offered the highest average incentive per lamp.

Table 16. Average incentive amount per lamp by evaluated upstream lighting measure group and IOU, 2013-14

Evaluated Upstream Lighting Measure Group	Average Incentive Amount			Overall
	PG&E	SCE	SDG&E	
MSB CFL basic spiral ≤ 30 W	$0.34	$0.48	$0.61	$0.49
MSB CFL A-lamp ≤ 30 W	$2.05	$2.32	$1.20	$2.08
MSB CFL reflector ≤ 30 W	$1.45	$2.52	$1.43	$2.14
MSB CFL globe ≤ 30 W	N/A	$2.77	$1.47	$2.53
MSB CFL high-wattage (> 30 W)	$2.65	$2.92	$1.13	$2.89
LED A-lamp, all wattages	$6.16	$8.59	$5.00	$6.59
LED reflector, all wattages	$3.56	$6.04	$3.47	$4.75
Overall	**$2.04**	**$3.70**	**$1.19**	**$2.41**

Note: average incentive amounts are weighted by the lamp quantities shown in Table 15

In addition to program-discounted measures shipped during the 2013-14 program period, PG&E and SCE also claimed savings for measures that were carried over from the previous program cycle in the 2013-14 tracking data. The CPUC allowed the IOUs to defer recognition of these measures due to a decision to discontinue an ongoing roll-over installation rate assumption under the 2010-12 upstream and residential downstream lighting evaluation.[14] Appendix K of the CPUC's 2010–12 Energy Efficiency Annual Progress Evaluation Report reviews this change, its impacts, and the allocation of carry-over lamps.[15] This evaluation recognizes savings for these carry-over lamps using impact parameters from the 2010-12 evaluation. Table 17 shows the quantities of 2010-12 carry-over measures. All discussion from this point forward in the report refers only to 2013-14 measures unless explicitly stated otherwise.

Table 17. Quantity of carry-over lamps in evaluated upstream lighting measure groups by IOU, 2010-12 measures recognized in 2013-14 program

Evaluated Upstream Lighting Measure Group	Quantity			Overall Quantity (Across IOUs)	
	PG&E	SCE	SDG&E	Total	% of Total
MSB CFL basic spiral ≤ 30 W	3,000,121	1,711,859	0	4,711,980	78%
MSB CFL A-lamp ≤ 30 W	560,001	117,000	0	677,001	11%
MSB CFL reflector ≤ 30 W	673,008	3,141	0	676,149	11%
Overall	**4,233,131**	**1,832,000**	**0**	**6,065,131**	100%

2.3 Program Context

Through the upstream lighting program, California retailers offer discounted lamps to consumers. The program collects no information regarding the ultimate end-users of the discounted lamps, and program-

14 DNV GL, 2014c.

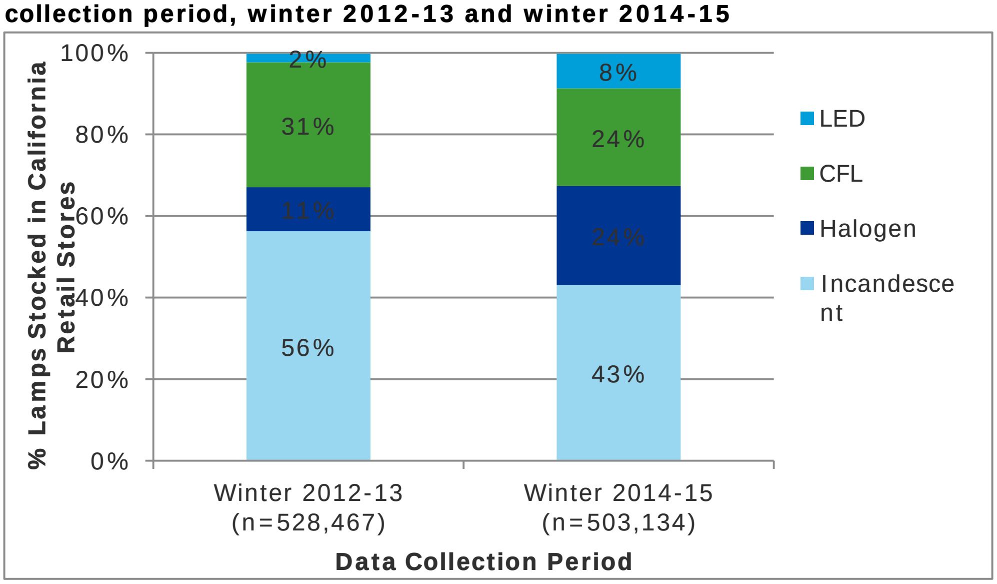
15 CPUC ED, 2015c.

discounted lamps compete with non-program lamps in retail settings. As such, it is important to understand the program in the broader context of California's residential lighting market. The market has changed rapidly over the past several years, and the upstream lighting program has also evolved. These changes affect consumer choices regarding lamp purchases and also influence our choice of evaluation approaches. We describe key changes in the market and in program strategies below, and review our evaluation approaches in Section 2.4.

2.3.1 California's residential lighting market

California's retail market for replacement lamps is changing rapidly in terms of lamp availability and pricing. DNV GL staff conducted complete inventories of replacement lamps for sale in California retail stores at the conclusion of the 2010-12 upstream lighting program period (winter 2012-13) and again at the conclusion of the 2013-14 program period (winter 2014-15).[16] During this timeframe, the overall share of total lamp stock comprised by efficient lamps (CFLs and LED lamps) remained steady at roughly one-third of the market, but the share comprised by CFLs declined from 31% to 24% while the share comprised by LED lamps increased from 2% to 8% (Figure 1). The share comprised by inefficient lamps (halogen lamps and traditional incandescent lamps) held steady at roughly two-thirds of lamp stock at the end of 2012 and 2014, but the share comprised by traditional incandescent lamps among California retailers declined from 56% to 43% while the share comprised by halogen lamps increased from 11% to 24%. There are a number of reasons that could explain this change, but because this was not a research priority for this report, we will not speculate on these influences here. Additional insight may be given in the upcoming markets report later in 2016. Regardless of the drivers, these shifts altered the retail landscape for consumers.

Figure 1. Share of retail lamp stock across all retail channels by technology and shelf survey data collection period, winter 2012-13 and winter 2014-15



Source: DNV GL retail store shelf surveys

During the shelf survey visits, DNV GL staff also gathered detailed information regarding lamp pricing in the stores, including whether or not the lamps in stock were discounted by the California IOUs. These details

[16] Please refer to APPENDIX D for an overview of the shelf survey sampling approach and to APPENDIX J for the data collection instrument.

enabled the calculation of the average prices for IOU-discounted lamps in the stores as well as for lamps not discounted by the IOUs as shown in Table 18. Note that in all cases, these prices reflect the final prices that consumers would pay the cash register after any discounts. Key findings include:

- **IOU-discounted lamp prices were typically lower than non-program prices.** The average CFL and LED lamp prices were lower for IOU-discounted lamps than for comparable lamps not discounted through the program in most cases. The final prices for CFLs not discounted by the program were roughly three to six times as expensive as IOU-discounted CFLs during the winter of 2014-15, and LED lamps not discounted by the program were roughly twice as expensive as program-discounted lamps.[17]
- The average price gap between IOU-discounted CFLs and other CFLs widened for spirals, A-lamps, and globes and decreased for reflectors between periods.
- **Average LED lamp prices decreased across the board for A-lamps and reflectors** between periods, including IOU-discounted lamps and those not discounted through the program.
- **Incandescent and halogen lamp prices increased** between the two data collection periods for A-lamps, reflectors, and globes.
- **Program-discounted CFLs were the lowest-cost options** within each replacement lamp category during the winter 2014-15 data collection period.
- **Without IOU discounts, incandescent and halogens were the lowest-cost options** within each replacement lamp category. Non-program incandescent and halogen lamp prices were lower than CFL and LED lamp prices during the winter 2014-15 data collection period by roughly \$1 to \$9 among A-lamp replacements, \$1 to \$13 among reflector lamp replacements, and roughly \$3 among globe replacements.

[17] Prices in this table reflect the overall averages for lamps stocked in California retail stores by evaluated upstream lighting measure group. Readers should use caution in interpreting these results. For example, the gap between the average program-discounted lamp price and non-program lamp price should not be viewed as the average IOU incentive amount because non-program lamps include a wide range of models that may not be directly comparable to program-discounted lamps beyond their wattage category. Table 16 above shows the average incentive amounts per lamp by evaluated upstream lighting measure group and IOU.

Table 18. Average IOU-discounted and non- IOU-discounted price per lamp across retail stores by replacement lamp category, evaluated upstream lighting measure group, and shelf survey data collection period, winter 2102-13 and winter 2014-15

Replacement Lamp Category and Measure Group	Winter 2012-13		Winter 2014-15	
	IOU-Discounted Lamps	Non-IOU Lamps	IOU-Discounted Lamps	Non-IOU Lamps
A-lamp Replacements				
MSB CFL basic spiral ≤ 30 W	$0.80	$3.15	$0.59	$3.27
MSB CFL A-lamp ≤ 30 W	$0.50	$4.92	$0.93	$5.45
Incandescent A-lamp*	N/A	$1.17	N/A	$1.90
Halogen A-lamp†	N/A	$1.86	N/A	$2.14
LED A-lamp, all wattages	$18.39	$19.09	$6.92	$11.16
Reflector Lamp Replacements				
MSB CFL reflector ≤ 30 W	$1.08	$6.84	$1.77	$5.79
Incandescent reflector*	N/A	$4.51	N/A	$4.59
LED reflector, all wattages	$15.10	$27.85	$7.84	$18.70
Globe Lamp Replacements				
MSB CFL globe ≤ 30 W	$0.95	$4.76	$1.32	$5.50
Incandescent globe*	N/A	$2.17	N/A	$2.36

Source: DNV GL retail store shelf surveys
* Includes lamps ≤ 100 W
† Includes lamps ≤ 72 W

2.3.2 Recent upstream lighting program activity

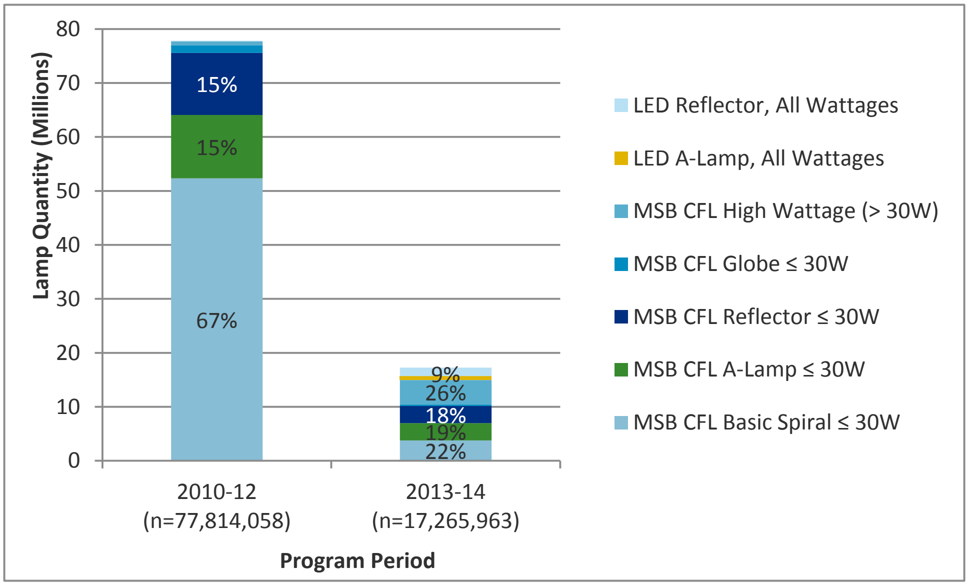
As California's retail market for replacement lamps changed over time, so too did the upstream lighting program. Figure 2 shows the total quantity of lamps for which the IOUs provided upstream incentives during the 2010-12 and 2013-14 program periods by the upstream lighting measure groups evaluated in 2013-14. As shown, key differences include:

- **Dramatically smaller program in 2013-14.** There were nearly 70 million lamps in these measure groups during the 2010-12 program compared to less than 17 million during the 2013-14 period. The three-year 2010-12 program period averaged roughly 23 million IOU-discounted lamps per year while the two-year 2013-14 period averaged just over 8 million lamps per year.
- **Decreased focus on basic spiral CFLs between periods.** MSB CFL basic spirals ≤ 30 W accounted for approximately two-thirds of lamps discounted through the 2010-12 program but only about one-fifth of lamps discounted by the 2013-14 program.
- **Increased focus on high-wattage CFLs (>30 W).** MSB CFL high wattage (>30 W) accounted for the largest share of lamps discounted by the upstream program in 2013-14 (27%, or roughly 4.5 million lamps) but only 1% of lamps discounted by the 2010-12 program (just over 700,000 lamps).
- **Increased focus on LED lamps.** The quantity of discounted LED lamps increased from approximately 110,000 in the 2010-12 program to approximately 2.2 million in the 2013-14 program. The IOUs also added LED A-lamps to the 2013-14 program (as the only LED lamps in the 2010-12 program were reflectors).

Not shown in the figure is how the size of the upstream lighting program in 2010-12 and 2013-2014 compared with the overall size of California's residential replacement lamp market. Shelf survey data suggest that overall retail lamp stock declined by approximately 10% to 15% between the winters of 2012-

13 and 2014-15. Even despite this shrinkage in the market as a whole, the upstream lighting program represented a smaller share of California's replacement lamp stock during the 2013-14 program period than during the 2010-2012 program period.

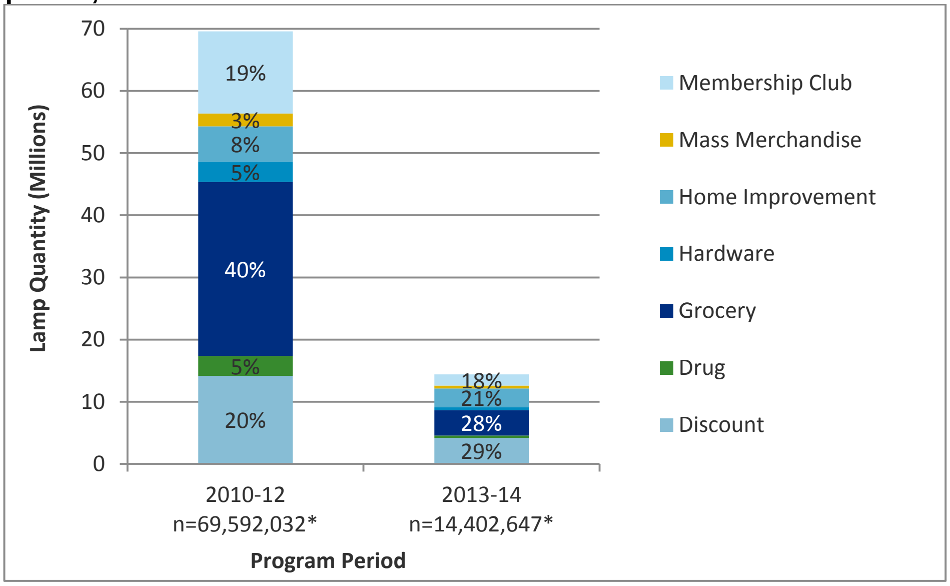
Figure 2. Quantity and share of IOU-discounted lamp shipments by evaluated upstream lighting measure group and program period, 2010-12 and 2013-14



Source: program tracking data
Note: 2010-12 lamp quantity includes carry-over measures from this period reported in 2013-14.

In addition to the dramatic differences in lamp quantities, another key difference between the 2010-12 and 2013-14 upstream lighting programs was in lamp allocations by lamp technology and retail channel. While fairly consistent in terms of the retail channels to which they allocated LED lamps between program periods—largely to the membership club, home improvement, and hardware channels), there were some noteworthy shifts in the share of CFL incentives allocated by retail channel between periods. Figure 3 shows the quantity and share of CFLs allocated by retail channel in 2010-12 and 2013-14. These include a decline in the share of allocations to grocery channels (including both chain and independent grocery stores) and an increase in the share of allocations to the home improvement channel. While these shifts are substantial in terms of the share of total program lamps, the figure again highlights that the absolute quantities of CFLs were far lower in the 2013-14 than in the 2010-12 program (for example, the IOUs shipped more than more than 28 million CFLs to grocery stores during 2010-12 compared to just over 4 million in 2013-14).

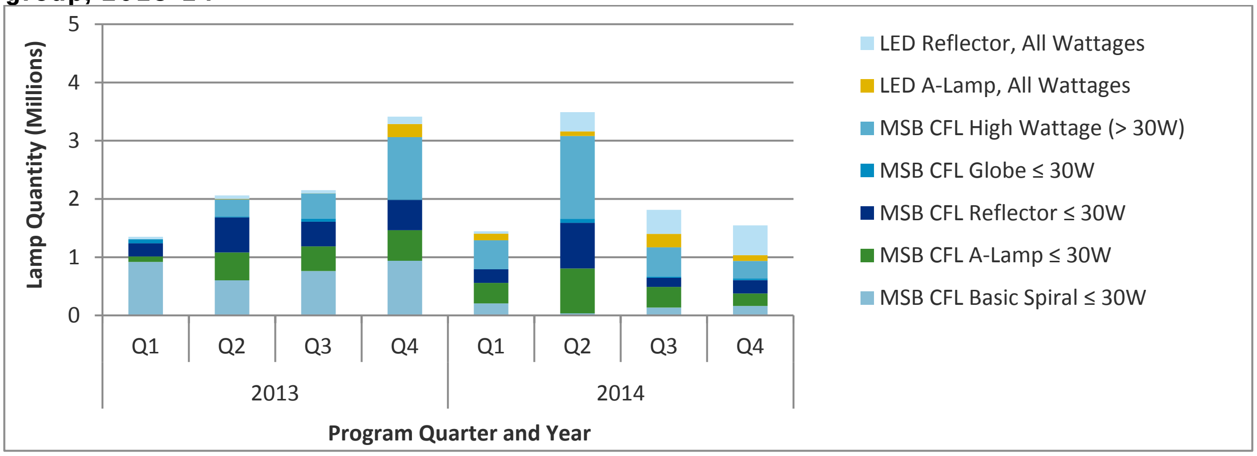
Figure 3. Share of upstream lighting program CFL shipments by retail channel and program period, 2010-12 and 2013-14



Source: program tracking data
* Total quantities reflect the shipments from the channels included in the figure, not across all channels. 2010-12 lamp quantity includes carry-over measures from this period reported in 2013-14

Finally, while program quantities and the share of program lamps allocated by channel differed substantially between the 2010-12 and 2013-14 program periods, there were noteworthy differences in lamp shipments from quarter to quarter within the 2013-14 program alone. As shown in Figure 4 below, across all IOUs, program shipments varied in terms of the quantities of lamps shipped within each evaluated upstream lighting program measure group. The quantity of LED lamp shipments increased between the third and fourth quarters of 2013, and the quantity of CFL reflector lamp shipments decreased between the second and third quarter of 2014.

Figure 4. Quarterly lamp shipments across retail channels by upstream lighting program measure group, 2013-14

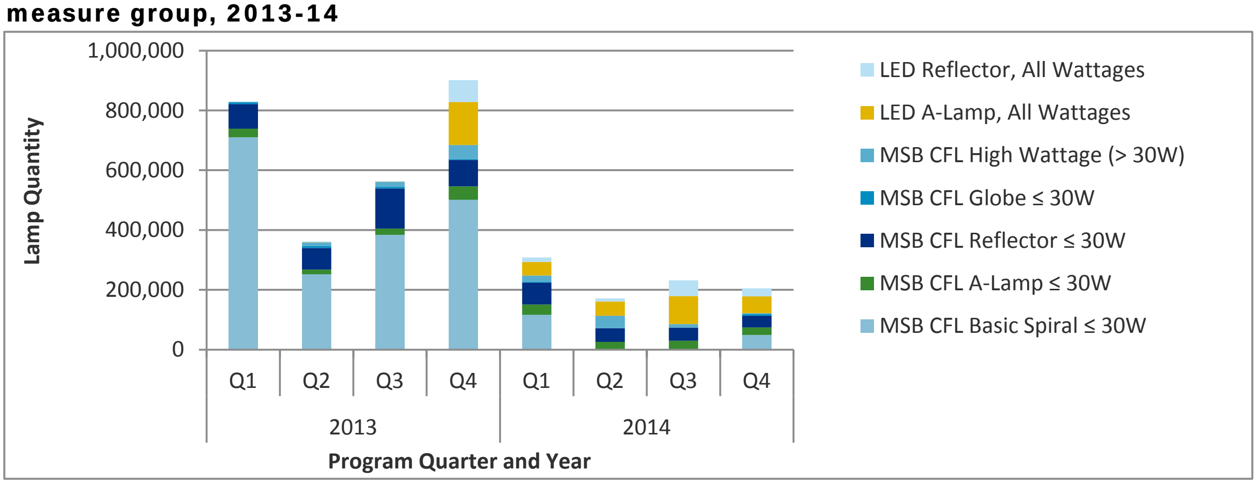


Source: program tracking data

These differences are even more pronounced at the channel level. The program shipped only CFLs to the drug channel, for example, but in other cases shipped the full mix of technologies and measure groups. The home improvement channel is one of the latter cases. Participating manufacturers shipped few IOU-discounted LED lamps to home improvement stores before the fourth quarter of 2013 (Figure 5). The program also had high shipments of MSB CFL basic spirals ≤ 30 W in all four quarters of 2013 but dramatically fewer in 2014 (and almost none during the second and third quarters of 2014). IOU-discounted high-wattage and globe CFL shipments also varied dramatically between quarters within the home improvement channel.

Differences in shipment quantities and timing by retail channel and evaluated upstream lighting measure group also varied dramatically by IOU. As such, even if (for example) program-discounted CFL and LED A-lamps were both available at the same time for part of the year, it's possible that only one or the other were available at other times within the same retail store. It's thus likely that shoppers encountered a varying mix of IOU-discounted CFL and LED styles in different channels depending on when they shopped for replacement lamps during 2013 and 2014. The pricing information shown above in Table 18 becomes even more critical in this regard because average prices for lamps without program discounts were dramatically higher than lamps with program discounts.

Figure 5. Quarterly lamp shipments to home improvement stores by upstream lighting program measure group, 2013-14



Source: program tracking data

2.4 Evaluation goals and approach

The overarching goal of the impact evaluation for the 2013-14 upstream and residential downstream lighting measures is to verify and validate the IOU reported energy savings and peak demand reduction estimates. The impact evaluation approach has three main goals:

1. Develop measure quantity adjustments, which include program invoice and application verification, an assessment of the percentage of IOU-discounted products purchased by non-IOU customers (i.e., leakage), and an assessment of the percentage of IOU-discounted products purchased by residential versus nonresidential customers.

2. Develop gross savings inputs, which include an assessment of the percentage of IOU-discounted measures installed as well as estimates of the average daily hours-of-use (HOU), the average

percent of measures operating at peak coincidence factor (CF), the wattage displaced by IOU-discounted measures (delta watts), unit energy savings (UES) in kWh/year and peak kW, and installation rate.

3. Develop net savings inputs, which include estimates of the net-to-gross ratio (NTGR).

In addition to these components, pursuant to direction from Commission staff, DNV GL developed an alternate method for estimating gross savings and NTGR in which the gross savings estimate removes savings from CFL-to-CFL replacements per direction in the 2015 CPUC memo titled "Ex Ante Update for ESPI Uncertain measures Compact Fluorescent Lamps 30 Watts and Less." While this report relies upon the methods for estimating gross savings and NTGR used previously (referenced herein as the conventional approach), we provide an overview of the alternate approach and results in Section 7 of this report.

This alternate approach was necessitated by regulatory and market changes. Given the dramatic differences between the 2010-12 and 2013-14 programs and dramatic shifts in California's residential lighting market over the past several years, the 2013-14 impact evaluation includes other changes and improvements to approaches applied in the 2010-12 evaluation – for example, improvements to estimating NTGR through use of an imputation factor (described in Section 5.3.2) and attempts to better reflect the quarterly variations in program activity shown in Figure 4 and Figure 5 above (further described in Section 5.2.1.2).

2.5 Report overview

The remainder of the report is organized as follows:

- Section 3 summarizes adjustments to measure quantities based on evaluation activities.
- Section 4 summarizes the gross savings approach and results by parameter and measure group for the conventional savings approach.
- Section 5 describes our approach to estimating the NTGR and resulting NTGR for the IOUs' 2013-14 upstream and residential downstream lighting programs.
- Section 6 reviews the net savings results.
- Section 7 reviews the alternate approach to calculating gross savings and NTGR, and provides these results.
- Section 8 provides the evaluation team's conclusions and recommendations.
- Section 9 provides complete references for all sources cited in this report.
- APPENDIX A provides the ex ante and ex post first year and lifecycle savings tables per the CPUC ED Impact Evaluation Standard Reporting (IESR) Guidelines.[18]
- APPENDIX B provides the ex post first year, annual, and lifecycle savings and effective useful life (EUL) per the CPUC ED IESR Guidelines.
- APPENDIX C provides standardized recommendations per the CPUC ED IESR Guidelines.
- APPENDIX D summarizes the methods and sampling approach for the retail lighting shelf surveys and in-store shopper intercept surveys.
- APPENDIX E summarizes the methods and sampling approach for the 2015 consumer telephone survey.
- APPENDIX F summarizes sample sizes in the 2006-08 residential lighting metering study.
- APPENDIX G reviews the sampling approach for the 2012 California Lighting and Appliance Saturation Survey (CLASS).[19]

[18] CPUC ED, 2015a.
[19] DNV GL, 2014b.

- APPENDIX H provides details regarding the lamp choice model methodology.
- APPENDIX I provides additional data tables to illustrate our approach to developing NTGR.
- APPENDIX J provides the data collection instruments used in support of this evaluation.
- APPENDIX K provides the evaluators' response to public comments on the draft Impact Evaluation of 2013-2014 Upstream and Residential Downstream Lighting Programs.

3 MEASURE QUANTITY ADJUSTMENTS

The 2010-12 Upstream and Downstream Residential Lighting Impact Evaluation[20] applied three adjustments to the quantity of rebated measures claimed by the IOUs as having been sold to their residential and nonresidential customers during the program period. This evaluation maintains the values associated with each of these three adjustments, which include:

1. Quantity of IOU-discounted products shipped by participating manufacturers to retailers as determined through the verification of a sample of program invoices/applications
2. Percent of IOU-discounted products purchased by residential versus nonresidential customers
3. Percent of IOU-discounted products purchased by non-IOU customers (i.e., leakage)

We provide more detail regarding measure quantity adjustments below.

3.1 Invoice verification

The 2010-12 residential and upstream lighting impact evaluation report describes the results of the evaluation team's invoice verification. Evaluators verified the quantity of IOU-discounted products shipped by participating manufacturers to retailers based on their review of a sample of program invoices and applications. The evaluation estimated an ultimate verification rate of 100% for all IOUs and retail channels. As such, we have applied the 100% verification rate in this report.

3.2 Residential versus nonresidential

To estimate the portion of upstream CFLs that are installed in nonresidential applications, the 2010-12 evaluation relied on the results of two onsite survey studies conducted during the 2010-12 period—the CLASS[21] and the Commercial Market Share Tracking Study.[22] These efforts yielded the residential versus nonresidential shares of total upstream lighting program measures shown in Table 19. We have applied these estimates in this report.

Table 19. Ex post share of residential vs. nonresidential upstream lighting measures by IOU, 2013-14

IOU	Ex Post	
	Nonresidential	Residential
PG&E	7%	93%
SCE	6%	94%
SDG&E	6%	94%
Overall	**7%**	**93%**

Table 20 compares ex ante and ex post estimates for the split between upstream measures installed in residential versus nonresidential applications by measure group and IOU. As shown, ex post assumptions

[20] DNV GL, 2014c.
[21] DNV GL, 2014a. Please refer to APPENDIX G for details regarding the CLASS sampling approach.
[22] Itron, Inc., 2014.

indicate that the share of lamps installed in nonresidential applications is greater than or equal to ex ante assumptions for all CFL measure groups. The same is true for the two LED lamp measure groups.

Table 20. Ex ante and ex post residential and nonresidential split by upstream lighting measure group and IOU, 2013-14

Upstream Lighting Measure Group / IOU	Ex Ante		Ex Post	
	Residential	Nonresidential	Residential	Nonresidential
MSB CFL basic spiral ≤ 30 W				
PG&E	94%	6%	93%	7%
SCE	94%	6%	94%	6%
SDG&E	95%	5%	94%	6%
MSB CFL A-lamp ≤ 30 W				
PG&E	94%	6%	93%	7%
SCE	94%	6%	94%	6%
SDG&E	96%	4%	94%	6%
MSB CFL reflector ≤ 30 W				
PG&E	94%	6%	93%	7%
SCE	94%	6%	94%	6%
SDG&E	97%	3%	94%	6%
MSB CFL globe ≤ 30 W				
PG&E	N/A	N/A	N/A	N/A
SCE	96%	4%	94%	6%
SDG&E	95%	5%	94%	6%
MSB CFL high-wattage (> 30 W)				
PG&E	94%	6%	93%	7%
SCE	94%	6%	94%	6%
SDG&E	97%	3%	94%	6%
LED A-lamp, all wattages				
PG&E	94%	6%	93%	7%
SCE	94%	6%	94%	6%
SDG&E	94%	6%	94%	6%
LED reflector, all wattages				
PG&E	94%	6%	93%	7%
SCE	94%	6%	94%	6%
SDG&E	94%	6%	94%	6%

Table 21 shows how the ex ante and ex post shares of residential versus nonresidential lamps from Table 20 affect ex ante and ex post residential and nonresidential lamp quantities in each of the IOUs' 2013-14 upstream lighting programs by measure group.

Table 21. Ex post and ex ante quantities of residential and nonresidential lamps by upstream lighting measure group, 2013-14

Evaluated Upstream Lighting Measure Group / IOU	Residential		Nonresidential	
	Ex Ante	Ex Post	Ex Ante	Ex Post
MSB CFL basic spiral ≤ 30 W				
PG&E	1,037,859	1,026,818	66,246	77,287
SCE	676,644	676,251	42,772	43,165
SDG&E	1,846,090	1,823,863	94,190	116,417
Overall	**3,560,593**	**3,526,932**	**203,208**	**236,869**
MSB CFL A-lamp ≤ 30 W				
PG&E	620,362	613,763	39,598	46,197
SCE	1,940,047	1,939,404	123,149	123,792
SDG&E	469,255	459,217	19,274	29,312
Overall	**3,029,664**	**3,012,384**	**182,021**	**199,301**
MSB CFL reflector ≤ 30 W				
PG&E	527,496	521,884	33,670	39,282
SCE	2,001,504	1,998,959	125,048	127,593
SDG&E	469,254	455,359	15,171	29,066
Overall	**2,998,254**	**2,976,203**	**173,889**	**195,940**
MSB CFL globe ≤ 30 W				
PG&E	N/A	N/A	N/A	N/A
SCE	205,618	205,559	13,062	13,121
SDG&E	47,048	46,710	2,644	2,982
Overall	**252,666**	**252,270**	**15,706**	**16,102**
MSB CFL high-wattage (> 30 W)				
PG&E	343,643	339,988	21,935	25,590
SCE	3,898,799	3,898,173	248,194	248,820
SDG&E	7,698	7,433	210	474
Overall	**4,250,140**	**4,245,594**	**270,339**	**274,885**
LED A-lamp, all wattages				
PG&E	261,213	258,434	16,673	19,452
SCE	231,577	230,512	13,648	14,714
SDG&E	220,639	220,880	14,339	14,099
Overall	**713,429**	**709,825**	**44,661**	**48,264**
LED reflector, all wattages				
PG&E	569,292	563,567	36,694	42,419
SCE	716,701	715,040	43,980	45,641
SDG&E	193,290	192,567	11,568	12,291
Overall	**1,479,283**	**1,471,174**	**92,242**	**100,351**

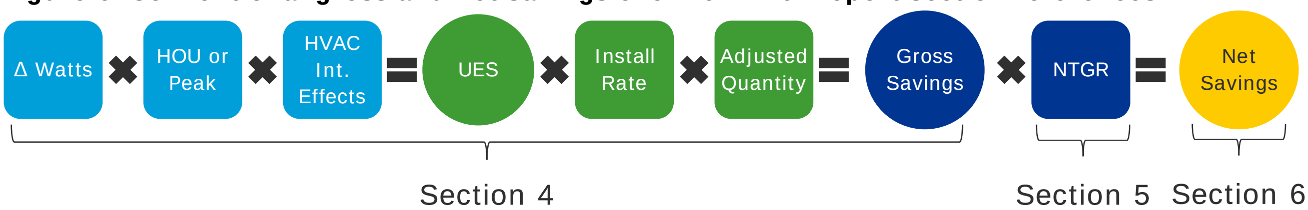
3.3 Leakage

Leakage is defined as the quantity of program-discounted upstream lamps that “leak” out of the collective IOU service territories. Due to the lack of strong data supporting leakage, no adjustment to quantity was applied for the 2010-2012 evaluation. Therefore, we have applied the same 0% leakage rate in this report.

4 GROSS SAVINGS

This section of the report focuses on the conventional gross savings methods and results for the 2013-14 upstream and residential downstream lighting programs. Figure 6, below, displays the components used in this section as well as where these parameters fit in the broader context of the evaluation (along with references to the related sections of this report). As indicated in Section 2.3, this evaluation also presents an alternative methodology for calculating gross savings that excludes CFLs replacing CFLs. Section 7 of the report provides an overview of the alternate methods and results.

Figure 6. Conventional gross and net savings overview with report section references



4.1 Overview

Gross savings are calculated using an estimate for unit energy savings (UES) and an evaluated installation rate. The UES is defined per measure group and includes delta watts (Δ watts), hours of use (HOU), peak coincidence factor (CF), and factor to account for HVAC interactive effects (IE). We show the equations for these estimates below in Equation 1 through Where:

ΔW_L = average displaced (delta) wattage for IOU-discounted lamp measure group, L, in watts (W)

CF_L = average percent on at peak for IOU-discounted lamp measure group, L

IE_L = HVAC interactive effects in kilowatts (kW)

Equation 4 Where:

ΔW_L = average displaced (delta) wattage for IOU-discounted lamp measure group, L, in watts (W)

CF_L = average percent on at peak for IOU-discounted lamp measure group, L

IE_L = HVAC interactive effects in kilowatts (kW).

Equation 1. Conventional gross energy unit energy savings

$$UES_L\left[\frac{kWh}{year}\right] = \Delta Watts_L[W] \ast HOU_L[h] \ast \frac{1\,kWh}{1000\,Wh} \ast \frac{365\,days}{1\,year} \ast IE_L[kWh]$$

Where:

$\Delta Watts_L$ = average displaced (delta) wattage for IOU-discounted lamp measure group, L, in watts (W)

HOU_L = annual average HOU for IOU-discounted lamp measure group, L, in hours (h)

IE_L = HVAC interactive effects in kilowatt-hours (kWh)

Equation 2. Conventional gross savings

$$Gross\ savings_L[kWh] = UES_L[kWh] * IR_L * Q_L$$

Where:

UES = unit energy savings for lamp measure group, L (see Section 4.6)

IR_L = installation rate for lamp measure group, L

Q_L = rebated measure quantity for lamp measure group, L

Equation 3. Conventional gross peak unit energy savings

$$UES_L\left[\frac{kW}{year}\right] = \Delta Watts_L[W] * CF_L * \frac{1\ kW}{1000\ W} * IE_L[kW]$$

Where:

ΔW_L = average displaced (delta) wattage for IOU-discounted lamp measure group, L, in watts (W)

CF_L = average percent on at peak for IOU-discounted lamp measure group, L

IE_L = HVAC interactive effects in kilowatts (kW)

Equation 4. Conventional gross peak savings

$$Gross\ savings_L[kW] = UES_L[kW] * IR_L * Q_L$$

4.2 HOU

The average daily HOU is used to calculate the unit energy savings based on the operating hours for each relevant lamp type. For this evaluation, as in the 2010-12 impact evaluation, we estimated population-level average daily HOU by measure group using an ANCOVA model for residential savings estimates. We applied the ex ante UES for nonresidential savings estimates, and so this section applies only to residential savings estimates. For the 2013-14 evaluation, we made a few significant changes to HOU estimates:

- We created a high-wattage CFL (> 30 W) measure group as well as an overall LED measure group.
- To account for changes in the lower-wattage CFL measure groups with the removal of the high-wattage lamps, we developed HOU estimates for basic spiral CFLs ≤ 30 W, A-lamp CFLs ≤ 30 W, reflector CFLs ≤ 30 W, and globe CFLs ≤ 30 W.

The ANCOVA model used the 2010 Residential Lighting Metering Study[23, 24] logger data HOU profiles and the 2012 CLASS residential lamp inventory data for lamp installation locations.[25] HOU estimates by measure group take into account lamp types as well as room location and usage within the population. For example,

[23] KEMA, Inc. and Cadmus Group, 2010. The study included 1,200 households recruited randomly throughout California over three overlapping waves of data collection from July 2008 through December 2009. Please refer to APPENDIX F for more details regarding metering study sample sizes.

[24] While more current metering data would certainly be preferable, these data are not available. In the absence of more current data, DNV GL believes that adjustments to the 2010 study's metering results based on updated lamp disposition (by installation location) from the CLASS study provide the most accurate representation available for residential lamp usage in California. Commission staff are currently engaged in scoping efforts for an updated residential lighting metering study.

[25] DNV GL, 2014b.

for a reflector CFL ≤ 30 W located in a dining room, we applied the usage profile generated for CFL reflectors in dining rooms that were less than or equal to 30 W.

Sample sizes in the 2010 metering study were insufficient to model LED A-lamp and LED reflector lamp usage profiles, and DNV GL is aware of no other sources that estimate LED lamp hours of use in California. Lamp usage varies by installation location, so we applied the CFL usage profiles from the 2010 metering study to the LED lamps in the 2012 CLASS inventory based on installation locations to yield LED lamp usage profiles.

The model produced both IOU estimates and statewide estimates. For all MSB CFL measure groups ≤ 30 W, we applied HOU estimates at the IOU level. Because LED lamps and high-wattage CFLs >30 W were present in lesser quantities in the 2012 CLASS data than lower-wattage CFLs, confidence intervals were too broad to support IOU-specific estimates for LED lamps and high-wattage CFLs >30 W. Also, as a result of small sample sizes, the data do not support reporting on LED lamps by lamp shape. Table 22 provides an overview of the HOU results, including confidence intervals (CI).

Table 22. Residential lighting HOU estimates by evaluated upstream lighting measure group and IOU, 2013-14

Evaluated Upstream Lighting Measure Group	PG&E		SCE		SDG&E		Overall	
	HOU	90% CI	HOU	90% CI	HOU	90% CI	HOU	90% CI
MSB CFL basic spiral ≤ 30 W	1.6	±0.1	1.9	±0.2	1.4	±0.2	1.7	±0.1
MSB CFL A-lamp ≤ 30 W	1.5	±0.2	1.9	±0.2	1.3	±0.3	1.6	±0.2
MSB CFL reflector ≤ 30 W	1.7	±0.3	1.9	±0.2	1.2	±0.4	1.7	±0.2
MSB CFL globe ≤ 30 W	N/A	N/A	1.6	±0.2	1.0	±0.3	1.4	±0.2
MSB CFL high-wattage (> 30 W)*	**	**	**	**	**	**	1.9	±0.2
LED A-lamp, all wattages*	**	**	**	**	**	**	2.1	±0.2
LED reflector, all wattages*	**	**	**	**	**	**	2.1	±0.2

* The table presents high-wattage CFL, LED A-lamp, and LED reflector lamp measure groups across all IOUs as a result of small sample sizes in the 2010 metering study for measures in these groups. Please refer to APPENDIX F for more details regarding metering study sample sizes.
** Sample sizes were too small to produce IOU-specific estimates. We applied the overall estimates in calculating impacts.

4.3 Peak coincidence factor

Peak CF represents the average percent of time that a lamp is used during the peak period. Peak periods vary by climate zone. Similar to our approach for HOU estimates, we derived CF estimates for LED lamps and high-wattage CFLs from the logger data collected for the 2010 metering study and applied these estimates to the lighting inventory data collected during CLASS 2012. Again, high-wattage CFL, LED A-lamp, and LED reflector lamp inventories were too small to create valid estimates by lamp shape or by IOU, so we applied the overall estimates (across IOUs) in calculating impacts. Table 23 shows the final peak CF values for 2013-14.[26]

[26] Please refer to APPENDIX F for more details regarding metering study sample sizes.

Table 23. Residential lighting peak CF by evaluated upstream lighting measure group and IOU, 2013-14

Evaluated Upstream Lighting Measure Group	PG&E		SCE		SDG&E		Overall	
	Peak CF	90% CI	Peak CF	90% CI	Peak CF	90% CI	Peak CF	90% CI
MSB CFL basic spiral ≤ 30 W	0.05	±0.01	0.07	±0.01	0.04	±0.02	0.06	±0.01
MSB CFL A-lamp ≤ 30 W	0.05	±0.02	0.06	±0.02	0.04	±0.02	0.05	±0.01
MSB CFL reflector ≤ 30 W	0.05	±0.02	0.06	±0.02	0.04	±0.03	0.06	±0.02
MSB CFL globe ≤ 30 W	N/A	N/A	0.07	±0.02	0.04	±0.02	0.06	±0.02
MSB CFL high-wattage (> 30 W)*	**	**	**	**	**	**	0.06	±0.01
LED A-lamp, all wattages*	**	**	**	**	**	**	0.06	±0.02
LED reflector, all wattages*	**	**	**	**	**	**	0.06	±0.02

* The table presents high-wattage CFL, LED A-lamp, and LED reflector lamp measure groups across all IOUs as a result of small sample sizes in the 2010 metering study. Please refer to APPENDIX F for more details regarding metering study sample sizes.
** Sample sizes were too small to produce IOU-specific estimates. We applied the overall estimates in calculating impacts.

4.4 Delta watts

The conventional estimate for delta watts is the difference between the program-discounted lamp wattage and the baseline lamp wattage (Equation 5).

Equation 5. Conventional delta watts

$$\Delta\text{Watts}_{L,yr} = kW_{IOU\ Discounted} - kW_{Base}$$

We calculated average program-discounted lamp wattages for each evaluated measure group for each program year based on program tracking data. For baseline lamp wattage, the 2010-12 evaluation applied the average wattage of incandescent lamps used in similar applications as the baseline wattage. The method for calculating delta watts in the 2013-14 evaluation contains four sets of assumptions:

1. **All evaluated upstream lighting measure groups.** In the 2010-12 impact evaluation report, we compared the average lamp wattages from the 2010 residential lighting metering study with those from the 2012 CLASS study. We assumed a constant annual rate of change in average lamp wattage between 2008 and 2012 and developed average lamp wattages for each year between (and including) 2008 and 2012.[27] We used these estimates as the average baseline lamp wattages for 2010, 2011, and 2012 in the 2010-12 impact evaluation. Pursuant to direction from Commission staff, given that we have no updated estimates of lamp wattage to leverage in continuing this extrapolation beyond 2012, we have assumed the same baseline lamp wattages in this report as we did for 2012 in the 2010-2012 impact evaluation report.

2. **All non-pass-through CFLs ≤ 30 W**. We assumed the baseline for non-high-wattage CFLs was equal to the incandescent baseline reported in the 2010-12 impact evaluation report, which included incandescent lamps of all wattages.

3. **High-wattage CFLs (> 30 W).** For this evaluation report, we created a separate high-wattage CFL measure group which required developing a baseline wattage estimate. The evaluation team is unaware of any studies that specifically address consumer behavior when installing high-wattage

[27] As mentioned above, the 2010 metering study reported on data collected between July 2008 and December 2009.

CFLs, and as such, we must rely on assumptions regarding these behaviors. Given the brightness and wattage of high-wattage CFLs compared with lower-wattage incandescent lamps, it seems unlikely that many consumers would, for instance, replace a 40 W or 60 W incandescent lamp with a 32 W CFL. This seems reasonable given that a 32 W CFL would likely be three to four times as bright as a 40 W traditional incandescent lamp, and at least twice as bright as a typical 60 W incandescent lamp. Additionally, energy savings would seem to be a poor motivation for installing a high-wattage CFL to replace lower-wattage incandescent lamps. As such, for the 2013-14 impact evaluation, we have assumed that the minimum wattage for incandescent lamps replaced by high-wattage CFLs is 75 W.

4. **LED lamps.** This evaluation report addresses savings for LED A-lamps and LED reflector lamps while the 2010-12 evaluation did not. Results from the 2014 California Residential Replacement Lamp Market Status Report[28] and other sources suggest that consumers are installing LED lamps to replace both efficient and inefficient lamps, so the baseline for LED lamps in the 2013-14 evaluation is defined as the average of the incandescent lamp and CFL wattages in the 2012 CLASS inventory by lamp shape (A-lamp and reflector) and IOU, weighted by the relative quantities of each lamp technology in the inventory.[29]

Table 24 shows the results for delta watts using the approach described above.

[28] DNV GL, 2014b.

[29] Pursuant to direction from Commission staff, the evaluation does not include halogen lamps in the baseline..

Table 24. Average lamp wattages and ex post delta watts by upstream lighting measure group and IOU (2013 and 2014)

Measure Group / IOU	2013 Average Baseline Wattage[1]	2013 Average Program Lamp Wattage*[2]	2013 Delta Watts	2014 Average Equivalent Wattage[1]	2014 Average Program Lamp Wattage*[2]	2014 Delta Watts
MSB CFL Basic Spiral ≤ 30 W (baseline: incandescent A-lamps, all wattages)						
PG&E	61	15	45	N/A	N/A	N/A
SCE	61	14	46	N/A	N/A	N/A
SDG&E	62	16	46	62	16	46
MSB CFL A-Lamp ≤ 30 W (baseline: incandescent A-lamps, all wattages)						
PG&E	61	17	44	61	16	45
SCE	61	19	41	61	19	42
SDG&E	62	15	47	62	14	48
MSB CFL Reflector ≤ 30 W (baseline: incandescent reflector lamps, all wattages)						
PG&E	71	17	54	71	18	53
SCE	68	19	49	68	21	48
SDG&E	66	17	49	66	16	50
MSB CFL Globe ≤ 30 W (baseline: incandescent globe lamps, all wattages)						
PG&E	N/A	N/A	N/A	N/A	N/A	N/A
SCE	46	19	27	46	19	27
SDG&E	46	13	33	46	13	33
MSB CFL High-Wattage (> 30 W) (baseline: > 75W incandescent A-lamps)						
PG&E	104	33	71	104	37	67
SCE	103	38	64	103	34	68
SDG&E	102	35	67	102	37	65
LED A-Lamp (baseline: incandescent A-lamps and MSB CFL A-lamps, all wattages)						
PG&E	38	11	27	38	13	25
SCE	39	16	23	39	17	22
SDG&E	38	8	30	38	10	28
LED Reflector (baseline: incandescent reflectors and MSB CFL reflectors, all wattages)						
PG&E	60	17	43	60	14	45
SCE	53	20	33	53	19	33
SDG&E	55	15	40	55	13	41

* IOU tracking data includes wattage ranges for some line items rather than point estimates of wattage (e.g., 0-7 W LED versus 3.5 W LED). In these instances, we assume the highest wattage in the range for the total quantity of lamps reflected in the tracking data for those line items.
Note: Differences between delta watts and the value generated by subtracting the rebated wattage from the baseline wattage may exist due to rounding
[1] Source: CLASS 2012
[2] Source: program tracking data

It should be noted that the California Database for Energy Efficient Resources[30] uses a wattage reduction ratio to estimate energy savings related to efficient lamp replacements. The IOUs apply these estimates in their ex ante savings calculations. Using the wattage reduction ratio yields energy savings results that differ from those described above, particularly when the discounted lamp wattages are fairly high or low. The conventional delta watts methodology used in this report relies upon a baseline of all MSB incandescent lamps in use by PG&E, SCE, and SDG&E residential electric customers per the 2012 CLASS inventory. For low-wattage CFLs, this approach ultimately yields higher energy savings than those generated by applying the wattage reduction ratio.

To show how these methodologies differ at the upper and lower lamp wattages, Table 25 shows two examples. Using the ex ante methodology, a 13 W MSB basic spiral CFL generates a delta of 32 W, while the ex post approach generates a delta of 49 W. For a high-wattage CFL of 35 W, ex ante methodology yields a delta of 86 W and the ex post approach yields a delta of 67 W. As shown, lower and higher wattage lamps demonstrate this divergence in results most notably.

Table 25. Example of ex ante and ex post delta Watts methodologies

Delta Watts Inputs and Outputs	MSB Basic Spiral CFL - 13 W		MSB High Wattage CFL - 35 W	
	Ex Ante	Ex Post	Ex Ante	Ex Post
1. Program Lamp Wattage	13	13	35	35
2. Wattage Reduction Ratio[31]	3.47	N/A	3.47	N/A
3. Baseline Wattage	45	62	121	102
4. Delta Watts	32	49	86	67

4.5 HVAC interactive effects

HVAC interactive effects account for the changes in heating and cooling energy requirements due to changes in lamp wattages and efficiency. Generally, lower-wattage efficient lamps release less heat than higher-wattage, less-efficient lamps resulting in air conditioning energy savings and increased space heating requirements. DEER reports the estimated kWh, kW, and therm savings factors for indoor CFL and LED measures. In this evaluation, we applied the IOU-weighted residential and commercial multipliers reported in DEER 2011 (Table 26). The same ratios apply to both CFL and LED lamps as the interactive effects very by wattage reduction and not lamp technology. Our evaluation team applied these savings factors to the direct impacts as a multiplier for both kWh and kW and a decrement factor of therm/kWh for therm impacts.

[30] DEER is a California Energy Commission (CEC) and CPUC-sponsored database designed to provide well-documented estimates of energy and peak demand savings values, measure costs, and effective useful life (EUL) all with one data source: http://www.energy.ca.gov/deer/.

[31] CPUC ED, 2015b

Table 26. CFL and LED HVAC interactive effect factors by IOU

Building Type	Units	IOU		
		PG&E	SCE	SDG&E
Residential	kWh	1.02	1.07	1.03
	kW	1.33	1.40	1.23
	Therms	-0.025	-0.019	-0.018
Commercial	kWh	1.06	1.12	1.12
	kW	1.21	1.24	1.23
	Therms	-0.0061	-0.0032	-0.0028

4.6 Unit energy savings

UES estimates are the average gross energy and peak demand impacts per measure in kWh per year and kW, respectively. DNV GL calculated UES values for each of the evaluated measure groups using the same approach described in the 2010-12 impact evaluation. As in the 2010-12 impact evaluation, this report focuses on the parameters necessary for calculating the residential UES. For measures installed in nonresidential settings, we applied the approved weighted commercial UES value from DEER to the average wattage of IOU-discounted measures for each program year. Because DEER does not distinguish between different lamp shapes, all CFL measure groups of interest thus have the same per-Watt values. The same is true for both LED measure groups. We show the equations for estimating the residential UES below (Equation 6 and Equation 7). We apply the respective nonresidential interactive effect factor to the UES defined for each measure by DEER.

Equation 6. Unit energy savings

$$UES_L\left[\frac{kWh}{year}\right] = \Delta\, Watts_L[W] * HOU_L[h] * \frac{1\ kWh}{1000\ Wh} * \frac{365\ days}{1\ year} * IE_L[kWh]$$

Where:

$\Delta Watts_L$ = average displaced (delta) wattage for IOU-discounted lamp measure group, L, in watts (W)

HOU_L = annual average HOU for IOU-discounted lamp measure group, L, in hours (h)

IE_L = HVAC interactive effects in kilowatt-hours (kWh)

Equation 7. Peak demand reduction

$$UES_L\left[\frac{kW}{year}\right] = \Delta Watts_L[W] * CF_L * \frac{1\ kW}{1000\ W} * IE_L[kW]$$

Where:

ΔW_L = average displaced (delta) wattage for IOU-discounted lamp measure group, L, in watts (W)

CF_L = average percent on at peak for IOU-discounted lamp measure group, L

IE_L = HVAC interactive effects in kilowatts (kW)

Below we present 2013-14 residential and nonresidential UES results by IOU and measure group for the seven upstream lighting measure groups of interest for this report.

4.6.1 MSB CFL basic spiral ≤ 30 W

Table 27 shows the UES values for MSB basic spiral CFLs ≤ 30 W. As shown, all three IOUs offered upstream incentives for CFLs in this measure group in 2013, but only SDG&E offered incentives for basic spiral CFLs ≤ 30 W in 2014. In 2013, residential UES-kWh values ranged from 23.8 for SDG&E to 35.2 for SCE, while nonresidential UES-kWh values ranged from 125.5 for PG&E to 170.3 for SCE. For residential downstream MSB basic spiral CFLs ≤ 30 W, we passed through the ex ante estimates for energy savings (kWh), demand reductions (kW), and gas impacts (therms).

Table 27. Residential and nonresidential UES values – upstream MSB CFL basic spiral ≤ 30 W, 2013-14

MSB CFL Basic Spiral ≤ 30 W	2013			2014		
	PG&E	SCE	SDG&E	PG&E	SCE	SDG&E
Residential						
UES-kWh	27.7	35.2	23.8	N/A	N/A	23.8
UES-kW	0.003	0.004	0.003	N/A	N/A	0.003
UES-therms	-0.7	-0.6	-0.4	N/A	N/A	-0.4
Nonresidential						
kWh/W	8.2	8.7	8.7	N/A	N/A	8.7
kW/W	1.6	1.8	1.8	N/A	N/A	1.8
Average rebated wattage	15.4	19.6	15.8	N/A	N/A	15.9
UES-kWh	125.5	170.3	137.7	N/A	N/A	138.1
UES-kW	0.03	0.04	0.03	N/A	N/A	0.03
UES-therms	-0.7	-0.5	-0.3	N/A	N/A	-0.3

4.6.2 MSB CFL A-lamp ≤ 30 W

All three IOUs offered upstream incentives for MSB CFL A-lamps ≤ 30 W in both 2013 and 2014. Table 28 shows the UES values. For each of the three IOUs, the average rebated wattage decreased from 2013 to 2014, resulting in slightly higher delta watts in 2014. As a result, residential UES-kWh savings were slightly higher in 2014 as well. For residential downstream measures in this measure group, we passed through the ex ante estimates for energy savings, demand reductions, and gas impacts.

Table 28. Residential and nonresidential UES values – upstream MSB CFL A-lamp ≤ 30 W, 2013-14

MSB CFL A-Lamp ≤ 30 W	2013			2014		
	PG&E	SCE	SDG&E	PG&E	SCE	SDG&E
Residential						
UES-kWh	24.0	30.9	23.2	24.6	31.1	23.7
UES-kW	0.003	0.004	0.003	0.003	0.004	0.003
UES-therms	-0.6	-0.5	-0.4	-0.6	-0.6	-0.4
Nonresidential						
kWh/W	8.2	8.7	8.7	8.2	8.7	8.7
kW/W	1.6	1.8	1.8	1.6	1.8	1.8
Average rebated wattage	16.8	19.5	14.6	15.8	19.0	12.8
UES-kWh	137.0	170.0	127.1	129.1	165.7	111.4
UES-kW	0.03	0.04	0.03	0.03	0.04	0.02
UES-therms	-0.8	-0.5	-0.3	-0.7	-0.5	-0.3

4.6.3 MSB CFL reflector ≤ 30 W

All three IOUs offered upstream incentives for MSB CFL reflector lamps ≤ 30 W in both 2013 and 2014. As shown in Table 29, residential UES-kWh values for PG&E and SCE declined slightly between 2013 and 2014 while SDG&E's residential UES-kWh value increased slightly between years. These changes were driven by a decline of one watt or more in delta watts values between 2013 and 2014 for PG&E and SCE within this measure group and an increase of one watt for SDG&E in the same timeframe. We passed through the ex ante estimates for energy savings, demand reductions, and gas impacts for residential downstream measures in this measure group.

Table 29. Residential and nonresidential UES values – upstream MSB CFL reflector ≤ 30 W, 2013-14

MSB CFL Reflector ≤ 30 W	2013			2014		
	PG&E	SCE	SDG&E	PG&E	SCE	SDG&E
Residential						
UES-kWh	33.7	37.3	22.4	33.1	36.3	23.0
UES-kW	0.004	0.004	0.002	0.004	0.004	0.002
UES-therms	-0.8	-0.7	-0.4	-0.8	-0.6	-0.4
Nonresidential						
kWh/W	8.2	8.7	8.7	8.2	8.7	8.7
kW/W	1.6	1.8	1.8	1.6	1.8	1.8
Average rebated wattage	16.6	18.9	17.2	17.6	20.5	16.2
UES-kWh	136.0	164.4	149.8	143.9	178.3	140.6
UES-kW	0.03	0.03	0.03	0.03	0.04	0.03
UES-therms	-0.8	-0.5	-0.4	-0.8	-0.5	-0.4

4.6.4 MSB CFL globe ≤ 30 W

Table 30 shows the UES values for MSB CFL globe lamps ≤ 30 W in 2013 and 2014. As shown, SCE and SDG&E both offered upstream incentives for this measure group in both years while PG&E did not offer incentives for MSB CFL globes ≤ 30 W in either year. For residential downstream MSB CFL globe lamps ≤ 30 W, we passed through the ex ante estimates for energy savings, demand reductions, and gas impacts.

Table 30. Residential and nonresidential UES values – upstream MSB CFL globe ≤ 30 W, 2013-14

MSB CFL Globe ≤ 30 W	2013			2014		
	PG&E	SCE	SDG&E	PG&E	SCE	SDG&E
Residential						
UES-kWh	N/A	17.4	12.6	N/A	17.3	12.6
UES-kW	N/A	0.003	0.002	N/A	0.003	0.002
UES-therms	N/A	-0.3	-0.2	N/A	-0.3	-0.2
Nonresidential						
kWh/W	N/A	8.7	8.7	N/A	8.7	8.7
kW/W	N/A	1.8	1.8	N/A	1.8	1.8
Average rebated wattage	N/A	19.0	10.4	N/A	19.0	9.9
UES-kWh	N/A	165.4	90.3	N/A	165.4	86.3
UES-kW	N/A	0.03	0.02	N/A	0.03	0.02
UES-therms	N/A	-0.5	-0.2	N/A	-0.5	-0.2

4.6.5 MSB CFL high-wattage (> 30 W)

Table 31 shows the 2013 and 2014 UES values for MSB high-wattage CFLs (> 30 W). All three IOUs offered incentives for CFLs in this measure group in both years. As shown, residential UES-kWh values were at least 47 kWh for each IOU in each year, with a slight increase between years for SCE and slight decreases for PG&E and SDG&E between years, driven by changes in residential delta watts values. High-wattage CFLs had the highest residential UES values across all CFL measure groups. Per-unit UES values for nonresidential MSB high-wattage CFLs (> 30 W) are comparatively low because all CFLs use a wattage reduction ratio per DEER in the ex ante estimates. For residential downstream MSB high-wattage CFLs (> 30 W), we passed through the ex ante estimates for energy savings, demand reductions, and gas impacts.

Table 31. Residential and nonresidential UES values – upstream MSB CFL high-wattage (> 30 W), 2013-14

MSB CFL High-Wattage (> 30 W)	2013			2014		
	PG&E	SCE	SDG&E	PG&E	SCE	SDG&E
Residential						
UES-kwh	51.0	48.4	48.6	48.0	51.5	47.1
UES-kW	0.006	0.006	0.005	0.006	0.006	0.005
UES-therms	-1.3	-0.9	-0.9	-1.2	-0.9	-0.8
Nonresidential						
kWh/W	8.2	8.7	8.7	8.2	8.7	8.7
kW/W	1.6	1.8	1.8	1.6	1.8	1.8
Average rebated wattage	32.5	38.5	35.2	36.8	34.3	37.4
UES-kwh	265.6	334.8	306.5	300.4	298.2	325.3
UES-kW	0.05	0.07	0.06	0.06	0.06	0.07
UES-therms	-1.5	-1.0	-0.8	-1.7	-0.9	-0.8

4.6.6 LED A-lamps, all wattages

Table 32 shows the UES values for LED A-lamps of all wattages in 2013 and 2014. All three IOUs offered upstream incentives for LED A-lamps in both program years, with residential delta watts declining by roughly 2 W between years for each IOU. Similarly, residential UES-kWh also declined slightly between years for each IOU. For residential downstream LED A-lamps, we passed through the ex ante estimates for energy savings, demand reductions, and gas impacts.

Table 32. Residential and nonresidential UES values – upstream LED A-lamps of all wattages, 2013-14

LED A-Lamp, All Wattages	2013			2014		
	PG&E	SCE	SDG&E	PG&E	SCE	SDG&E
Residential						
UES-kwh	20.8	19.0	23.8	19.3	18.2	22.4
UES-kW	0.002	0.002	0.002	0.002	0.002	0.002
UES-therms	-0.5	-0.3	-0.4	-0.5	-0.3	-0.4
Nonresidential						
kWh per Watt	9.6	10.2	10.2	9.6	10.2	10.2
kW per Watt	1.9	2.1	2.2	1.9	2.1	2.2
Average rebated wattage	10.2	14.5	7.7	12.8	15.9	9.5
UES-kwh	97.5	147.8	78.2	122.6	161.6	96.5
UES-kW	0.02	0.03	0.02	0.02	0.03	0.02
UES-therms	-0.6	-0.4	-0.2	-0.7	-0.5	-0.2

4.6.7 LED reflector lamps, all wattages

Table 33 shows the UES values for LED reflector lamps of all wattages in 2013 and 2014. As shown, all three IOUs offered incentives for LED lamps in this measure group in both program years. Residential UES-kWh values increased slightly between 2013 and 2014 for each IOU. For residential downstream LED reflector lamps, we passed through the ex ante estimates for energy savings, demand reductions, and gas impacts.

Table 33. Residential and nonresidential UES values – upstream LED reflector lamps of all wattages, 2013-14

LED Reflector, All Wattages	2013			2014		
	PG&E	SCE	SDG&E	PG&E	SCE	SDG&E
Residential						
UES-kwh	33.5	26.7	31.0	35.4	27.1	32.5
UES-kW	0.004	0.003	0.003	0.004	0.003	0.003
UES-therms	-0.8	-0.5	-0.5	-0.9	-0.5	-0.6
Nonresidential						
kWh per Watt	9.6	10.2	10.2	9.6	10.2	10.2
kW per Watt	1.9	2.1	2.2	1.9	2.1	2.2
Average rebated wattage	15.2	14.1	15.3	12.7	15.3	13.4
UES-kwh	145.5	143.6	155.4	121.4	155.9	136.8
UES-kW	0.03	0.03	0.03	0.02	0.03	0.03
UES-therms	-0.8	-0.4	-0.4	-0.7	-0.4	-0.3

4.7 Installation rate

For this evaluation, we applied installation rates that generate savings for all lamps purchased within the 2013-14 program period regardless of whether the lamps were installed during the program period. We first adopted this methodology, which eliminates the need for an installation-based carry-over analysis, in the 2010-12 evaluation.

Because of the uncertainty associated with CFL and LED lamp installation rates identified in the 2013 CPUC Decision Adopting ESPI Mechanism,[32] DNV GL addressed CFL and LED lamp installation rates in its 2015 consumer telephone surveys.[33] Specifically, we attempted to quantify the percentage of lamps that will never be installed. We subtract this value from 100% to yield the installation rate. Interviewers asked respondents about the quantity of CFLs that they have installed, the quantity in storage, and how many will or will not be installed in the future, and repeated a similar series of questions for LED lamps.

Survey results indicate that 97% of CFLs in homes within PG&E, SCE, and SDG&E's residential electric service territories are or will eventually be installed (Table 34). These results align with those from the 2010-12 program period.

32 CPUC ED, 2014.

33 Please refer to APPENDIX E for details regarding the consumer telephone survey approach and APPENDIX J for the data collection instrument.

Table 34. Residential upstream CFL installation rates (2015 consumer telephone survey)

CFL Classification	CFLs in Household	
	Weighted Lamp Count*	Percent
Installed	72,097,479	69%
In storage, will be installed	29,300,321	28%
In storage, will never be installed	2,634,142	3%
Total CFLs in Household	**104,031,943**	**100%**

* Weighted estimate of lamps installed and in storage based on survey respondents. We excluded respondents who reported 100 or more CFLs installed or in storage from this calculation.

For LED lamps, survey results indicate that 99% of lamps were installed at the time of the survey or will be installed in the future (Table 35). We applied these installation rates to calculate gross savings.[34]

Table 35. Residential upstream LED lamp installation rates (2015 consumer telephone survey)

LED Lamp Classification	LED Lamps in Household	
	Weighted Lamp Count*	Percent
Installed	34,648,469	84%
In storage, will be installed	6,448,633	16%
In storage, will never be installed	239,030	1%
Total LED Lamps in Household	**41,336,132**	**100%**

* Weighted estimate of lamps installed and in storage based on survey respondents. We excluded respondents who reported 100 or more CFLs installed or in storage from this calculation.

We also applied these installation rates to nonresidential upstream CFLs and LED lamps. For residential downstream lighting measures, we passed through the ex ante installation rates.

Table 36 shows ex ante and ex post installation rates for 2013-14 upstream lighting measures by IOU and sector for each measure group. For CFL measure groups, ex ante installation rates varied by IOU and CFL measure group but ranged from 67% to 81% for CFL measures. Because we applied installation rates that generate savings for all lamps purchased within the 2013-14 program period regardless of when they will be installed, ex post installation rate estimates for CFL measure groups were higher than ex ante estimates for 2013-14. For all LED lamp measure groups, installation rate estimates were 1 percentage point lower for ex post versus ex ante (99% versus 100%, respectively).

[34] Note that we applied the CFL installation rate across all five CFL measure groups and the LED lamp installation rate across both LED measure groups.

Table 36. Ex ante and ex post residential and nonresidential installation rates by IOU and upstream lighting measure group, 2013-14

IOU	Evaluated Upstream Lighting Measure Group	Residential		Nonresidential	
		Ex Ante	Ex Post	Ex Ante	Ex Post
PG&E	MSB CFL basic spiral ≤ 30 W	67%	97%	73%	97%
	MSB CFL A-lamp ≤ 30 W	67%	97%	73%	97%
	MSB CFL globe ≤ 30 W	N/A	N/A	N/A	N/A
	MSB CFL reflector ≤ 30 W	67%	97%	73%	97%
	MSB CFL high-wattage (> 30 W)	67%	97%	73%	97%
	LED A-lamp, all wattages	100%	99%	100%	99%
	LED reflector, all wattages	100%	99%	100%	99%
SCE	MSB CFL basic spiral ≤ 30 W	77%	97%	81%	97%
	MSB CFL A-lamp ≤ 30 W	77%	97%	81%	97%
	MSB CFL globe ≤ 30 W	N/A	N/A	N/A	N/A
	MSB CFL reflector ≤ 30 W	77%	97%	81%	97%
	MSB CFL high-wattage (> 30 W)	77%	97%	81%	97%
	LED A-lamp, all wattages	100%	99%	100%	99%
	LED reflector, all wattages	100%	99%	100%	99%
SDG&E	MSB CFL basic spiral ≤ 30 W	76%	97%	76%	97%
	MSB CFL A-lamp ≤ 30 W	73%	97%	71%	97%
	MSB CFL globe ≤ 30 W	77%	97%	78%	97%
	MSB CFL reflector ≤ 30 W	76%	97%	74%	97%
	MSB CFL high-wattage (> 30 W)	76%	97%	79%	97%
	LED A-lamp, all wattages	100%	99%	100%	99%
	LED reflector, all wattages	100%	99%	100%	99%

4.8 Gross savings results

Table 37 provides an overview of the ex ante and ex post gross annual energy savings, demand reductions, and realization rates for 2013-14 evaluated upstream lighting measures and measure group across IOUs as well as for carry-over upstream lighting measures from 2010-12. As shown, realization rates exceeded 100% for nearly all combinations of IOU and measure group. The primary reasons for this include:

- **Difference in approach to estimating delta watts between ex ante and ex post for both CFLs and LED lamps.** Upstream measure groups other than high-wattage CFLs averaged approximately 11 to 17 W per measure group in 2013 and 13 to 18 W per group in 2014 for PG&E; from 16 to 20 W in 2013 and 17 to 21 W per group in 2014 for SCE; and from approximately 8 to 17 W in 2013 and 10 to 16 W per upstream measure group in 2014 for SDG&E. Because these average program-discounted upstream measure wattages are fairly low, the ex post approach to estimating delta watts ultimately yields higher energy savings than the ex ante approach. The ex ante approach to calculating delta watts yields lower deltas for lower-wattage lamps than for higher-wattage lamps based on a wattage reduction ratio, while the ex post approach yields higher deltas for lower-wattage lamps because we subtract the average program-discounted lamp wattages for each evaluated measure group from the average wattage of the installed baseline lamp wattages (with incandescent lamps as the baseline for CFL measure groups and incandescent and CFLs as the baseline for LED lamp measure groups).[35]

- **Installation rates for CFLs.** CFL installation rates are considerably higher in ex post than ex ante (97% versus a range of 67% to 81% depending on measure group and IOU)), largely attributable to a change in the definition of installation rates that occurred before the 2013-14 program's launch.

For all residential downstream lighting measures, we passed through the ex ante gross savings estimates. Ex post gross savings estimates for nonresidential upstream measures rely upon the ex ante gross UES estimates, but we adjusted the measure quantities based on an updated estimate for the share of lamps installed in residential versus nonresidential applications and updated the installation rates.

[35] The average delta watts in the 2010-12 Upstream and Residential Downstream Impact Evaluation (DNV GL, 2014c) are lower than in 2013-14 for comparable CFL measure groups because the average program-discounted wattage was higher in the IOUs' 2010-12 upstream programs than in the in 2013-14 upstream programs.

Table 37. Ex ante and ex post gross savings and gross realization rates by upstream measure group across all IOUs, 2013-14 and 2010-12 carry-over measures

All IOUs Evaluated Upstream Lighting Measure Group	Ex Ante			Ex Post			Gross Realization Rates		
	kWh	kW	therms	kWh	kW	therms	kWh	kW	therms
2013-14									
MSB CFL basic spiral ≤ 30 W	76,636,319	10,103	-1,156,843	124,905,835	17,190	-1,935,555	163%	170%	167%
MSB CFL A-lamp ≤ 30 W	84,213,269	11,661	-1,187,740	112,809,678	15,662	-1,672,663	134%	134%	141%
MSB CFL reflector ≤ 30 W	102,322,499	13,513	-1,532,846	128,971,184	17,848	-1,958,785	126%	132%	128%
MSB CFL globe ≤ 30 W	7,431,337	1,037	-95,815	6,387,100	1,091	-77,988	86%	105%	81%
MSB CFL high-wattage (> 30 W)	281,547,654	39,694	-3,798,880	289,311,812	41,414	-4,030,388	103%	104%	106%
LED A-lamp, all wattages	12,527,404	1,687	-195,434	20,021,949	2,695	-308,415	160%	160%	158%
LED reflector, all wattages	39,036,875	5,463	-612,664	58,723,767	7,691	-980,087	150%	141%	160%
Overall	**603,715,357**	**83,158**	**-8,580,222**	**741,131,324**	**103,590**	**-10,963,880**	**123%**	**125%**	**128%**
2010-12									
MSB CFL basic spiral ≤ 30 W	166,945,236	24,884	-2,521,894	165,113,186	24,765	-2,790,132	99%	100%	111%
MSB CFL A-lamp ≤ 30 W	15,865,522	2,247	-300,663	21,900,743	2,874	-415,988	138%	128%	138%
MSB CFL reflector ≤ 30 W	19,126,906	2,710	-503,314	27,227,392	3,690	-538,073	142%	136%	107%
Overall	**201,937,665**	**29,841**	**-3,325,871**	**214,241,320**	**31,329**	**-3,744,193**	**106%**	**105%**	**113%**

4.8.1 PG&E

Table 38 shows the ex ante and ex post gross annual energy savings, demand reductions, gas impacts, and realization rates for PG&E by upstream lighting measure group. The table includes savings from evaluated upstream CFL and LED measure groups for 2013-14 and carry-over CFL measure groups from 2010-12. Table 39 provides PG&E's ex post gross savings results for the residential and nonresidential sectors.

Table 38. PG&E ex ante and ex post gross savings and gross realization rates by evaluated upstream lighting measure group, 2013-14 and 2010-12 carry-over measures

PG&E Evaluated Upstream Lighting Measure Group	Ex Ante			Ex Post			Gross Realization Rates		
	kWh	kW	therms	kWh	kW	therms	kWh	kW	therms
2013-14									
MSB CFL basic spiral ≤ 30 W	20,711,778	2,790	-392,265	37,003,332	5,131	-729,891	179%	184%	186%
MSB CFL A-lamp ≤ 30 W	13,175,709	1,778	-248,840	20,436,379	2,797	-388,209	155%	157%	156%
MSB CFL reflector ≤ 30 W	13,574,272	1,773	-267,741	22,233,870	2,991	-446,288	164%	169%	167%
MSB CFL globe ≤ 30 W	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MSB CFL high-wattage (> 30 W)	15,880,886	2,160	-296,331	23,316,926	3,332	-435,453	147%	154%	147%
LED A-lamp, all wattages	4,475,565	596	-85,677	7,260,604	991	-136,812	162%	166%	160%
LED reflector, all wattages	15,456,205	2,054	-297,841	24,824,151	3,183	-509,617	161%	155%	171%
Overall	**83,274,414**	**11,153**	**-1,588,694**	**135,075,262**	**18,425**	**-2,646,270**	**162%**	**165%**	**167%**
2010-12									
MSB CFL basic spiral ≤ 30 W	98,654,086	14,155	-2,521,894	98,795,422	14,600	-1,794,676	100%	103%	71%
MSB CFL A-lamp ≤ 30 W	11,291,209	1,597	-300,663	17,460,306	2,275	-353,757	155%	142%	118%
MSB CFL reflector ≤ 30 W	18,988,335	2,690	-503,314	27,092,488	3,671	-536,133	143%	136%	107%
Overall	**128,933,631**	**18,442**	**-3,325,871**	**143,348,217**	**20,546**	**-2,684,565**	**111%**	**111%**	**81%**

Table 39. PG&E ex post gross savings by evaluated upstream lighting measure group and sector, 2013-14

PG&E Evaluated Upstream Lighting Measure Group	Annual Energy Savings (kWh)		Peak Demand Reductions (kW)		Gas Impact (Therms)	
	Residential	Nonresidential	Residential	Nonresidential	Residential	Nonresidential
MSB CFL basic spiral ≤ 30 W	27,592,193	9,411,139	3,240	1,891	(676,279)	-53,611
MSB CFL A-lamp ≤ 30 W	14,446,844	5,989,534	1,594	1,203	(354,089)	-34,120
MSB CFL reflector ≤ 30 W	16,989,700	5,244,170	1,937	1,054	(416,414)	-29,874
MSB CFL globe ≤ 30 W	N/A	N/A	N/A	N/A	N/A	N/A
MSB CFL high-wattage (> 30 W)	16,085,825	7,231,101	1,879	1,453	(394,260)	-41,193
LED A-lamp, all wattages	5,073,646	2,186,958	552	439	(124,354)	-12,458
LED reflector, all wattages	19,571,542	5,252,609	2,128	1,055	(479,695)	-29,922

4.8.2 SCE

Table 40 shows the ex ante and ex post gross annual energy savings, demand reductions, gas impacts, and realization rates by upstream lighting measure group for SCE. The table includes savings from evaluated upstream CFL and LED measure groups for 2013-14 and carry-over CFL measure groups from 2010-12. Table 41 shows the ex post gross savings results for the residential and nonresidential sectors.

Table 40. SCE ex ante and ex post gross savings and gross realization rates by evaluated upstream lighting measure group, 2013-14 and 2010-12 carry-over measures

SCE Evaluated Upstream Lighting Measure Group	Ex Ante			Ex Post			Gross Realization Rates		
	kWh	kW	therms	kWh	kW	therms	kWh	kW	therms
2013-14									
MSB CFL basic spiral ≤ 30 W	16,262,089	2,296	-220,311	30,192,785	4,332	-429,913	186%	189%	195%
MSB CFL A-lamp ≤ 30 W	62,525,537	8,839	-817,782	78,470,521	10,988	-1,094,330	126%	124%	134%
MSB CFL reflector ≤ 30 W	77,704,815	10,588	-1,082,370	92,614,983	12,971	-1,327,741	119%	123%	123%
MSB CFL globe ≤ 30 W	6,575,077	925	-84,509	5,559,175	959	-67,370	85%	104%	80%
MSB CFL high-wattage (> 30 W)	265,352,333	37,501	-3,497,441	265,503,839	38,015	-3,588,500	100%	101%	103%
LED A-lamp, all wattages	3,810,172	524	-54,717	6,499,145	938	-81,062	171%	179%	148%
LED reflector, all wattages	15,865,484	2,250	-230,501	26,059,257	3,533	-359,249	164%	157%	156%
Overall	**448,095,506**	**62,922**	**-5,987,632**	**504,899,705**	**71,737**	**-6,948,166**	**113%**	**114%**	**116%**
2010-12									
MSB CFL basic spiral ≤ 30 W	68,291,151	10,729	0	66,318,238	10,165	-995,464	97%	95%	N/A
MSB CFL A-lamp ≤ 30 W	4,574,313	650	0	4,440,436	599	-62,231	97%	92%	N/A
MSB CFL reflector ≤ 30 W	138,571	20	0	134,904	19	-1,940	97%	93%	N/A
Overall	**73,004,034**	**11,399**	**0**	**70,893,577**	**10,783**	**-1,059,636**	**97%**	**95%**	**N/A**

Table 41. SCE ex post gross energy savings by evaluated upstream lighting measure group and sector, 2013-14

SCE Evaluated Upstream Lighting Measure Group	Annual Energy Savings (kWh)		Peak Demand Reductions (kW)		Gas Impact (Therms)	
	Residential	Nonresidential	Residential	Nonresidential	Residential	Nonresidential
MSB CFL basic spiral ≤ 30 W	23,060,837	7,131,949	2,846	1,487	-409,491	-20,421
MSB CFL A-lamp ≤ 30 W	58,390,048	20,080,474	6,803	4,185	-1,036,833	-57,498
MSB CFL reflector ≤ 30 W	71,342,549	21,272,434	8,537	4,434	-1,266,830	-60,911
MSB CFL globe ≤ 30 W	3,454,599	2,104,576	520	439	-61,343	-6,026
MSB CFL high-wattage (> 30 W)	189,897,467	75,606,372	22,257	15,759	-3,372,011	-216,489
LED A-lamp, all wattages	4,193,232	2,305,913	457	481	-74,459	-6,603
LED reflector, all wattages	19,110,971	6,948,286	2,085	1,448	-339,354	-19,896

4.8.3 SDG&E

Table 42 shows SDG&E's ex ante and ex post gross annual energy savings, demand reductions, gas impacts, and realization rates by upstream lighting measure group for 2013-14. The table includes savings from evaluated 2013-14 upstream CFL and LED measure groups. Unlike PG&E and SCE, SDG&E reported no carry-over CFL measures from 2010-12. Table 43 shows SDG&E's ex post gross savings results for the residential and nonresidential sectors.

Table 42. SDG&E ex ante and ex post gross savings and gross realization rates by evaluated upstream lighting measure group, 2013-14[1]

SDG&E Evaluated Upstream Lighting Measure Group	Ex Ante			Ex Post			Gross Realization Rates		
	kWh	kW	therms	kWh	kW	therms	kWh	kW	therms
2013-14									
MSB CFL basic spiral ≤ 30 W	39,662,451	5,017	-544,267	57,709,717	7,727	-775,752	146%	154%	143%
MSB CFL A-lamp ≤ 30 W	8,512,024	1,044	-121,118	13,902,778	1,876	-190,123	163%	180%	157%
MSB CFL reflector ≤ 30 W	11,043,412	1,151	-182,735	14,122,331	1,886	-184,756	128%	164%	101%
MSB CFL globe ≤ 30 W	856,260	112	-11,306	827,926	132	-10,618	97%	118%	94%
MSB CFL high-wattage (> 30 W)	314,435	33	-5,109	491,047	67	-6,435	156%	201%	126%
LED A-lamp, all wattages	4,241,667	567	-55,040	6,262,200	765	-90,540	148%	135%	164%
LED reflector, all wattages	7,715,187	1,159	-84,322	7,840,359	974	-111,221	102%	84%	132%
Overall	**72,345,436**	**9,083**	**-1,003,897**	**101,156,358**	**13,428**	**-1,369,444**	**140%**	**148%**	**136%**

[1] SDG&E had no 2010-2012 carry-over measures for upstream lighting in 2013-14.

Table 43. SDG&E ex post gross energy savings by evaluated upstream lighting measure group and sector, 2013-14

SDG&E Evaluated Upstream Lighting Measure Group	Annual Energy Savings (kWh)		Peak Demand Reductions (kW)		Gas Impact (Therms)	
	Residential	Nonresidential	Residential	Nonresidential	Residential	Nonresidential
MSB CFL basic spiral ≤ 30 W	42,145,571	15,564,146	4,428	3,298	-736,525	-39,227
MSB CFL A-lamp ≤ 30 W	10,369,719	3,533,059	1,128	749	-181,218	-8,905
MSB CFL reflector ≤ 30 W	9,973,828	4,148,504	1,007	879	-174,300	-10,456
MSB CFL globe ≤ 30 W	570,479	257,447	77	55	-9,970	-649
MSB CFL high-wattage (> 30 W)	347,493	143,554	37	30	-6,073	-362
LED A-lamp, all wattages	4,998,696	1,263,504	498	268	-87,356	-3,184
LED reflector, all wattages	6,115,548	1,724,811	609	366	-106,874	-4,347

5 NTGR

In this section, we present how the conventional NTGR were developed. Because the program is delivered upstream, we are unable to identify participants. Thus, rather than assessing the program's impact on individuals, we must instead understand the program's impacts on the market. We developed two separate estimates of NTGR for each combination of retail channel and evaluated upstream lighting measure group. We then weighted and combined these estimates to yield the final NTGR. For further context and detail on NTGR for each measure group by IOU and channel, refer to Table 106 through Table 112 in APPENDIX I.

We have organized the remainder of Section 5 around the main steps involved in generating the NTGR:

- **Develop supplier-based NTGR.** Section 5.1 describes how we developed suppler-based NTGR using the results of in-depth interviews with supplier representatives (manufacturers and retail buyers)[36] and lamp shipment estimates from the program tracking data.
- **Estimate model-based NTGR.** Section 5.2 discusses how we developed model-based NTGR based on lighting retail shelf surveys and shopper intercept surveys[37] from two time periods[38] and applying decision criteria to identify the best model scenario for estimating NTGR.
- **Weight the supplier and model-based NTGR.** Section 5.3.1 describes how we applied a 70% weight to model-based NTGR results and a 30% weight to supplier-based results.
- **Calculate imputed NGTR when model-based NTGR not available.** Section 5.3.2 explains how we calculated the final NTGR by applying imputation factors to supplier NTGR where model results were insufficient.
- **Calculate final NTGR.** Section 5.3.4 describes the methodology used to calculate IOU-specific NTGR for each measure group based on shipment distributions.

The remaining subsections describe these steps in greater detail.

5.1 Supplier-based NTGR

5.1.1 Overview of approach

DNV GL used interview responses from lighting manufacturers and retail buyers to estimate the percent by which their sales would decline in the absence of the program (NTGR). Our interviews included:

- 16 representatives of participating lighting manufacturers (which accounted for approximately 99% of 2013-14 program-discounted lamps)
- 6 lighting buyers for large retail chains (which accounted for approximately 30% of 2013-14 program-discounted lamps)

The evaluation team completed these in-depth interviews in the third quarter of 2015. For these interviews, we classified lamps into four categories: basic spiral CFLs, specialty CFLs, LED A-lamps, and LED reflector lamps. The specialty CFL category included CFL A-lamps, globes, reflectors, and high-wattage lamps.

To estimate the NTGR, we asked a series of questions. First, we asked interview participants whether they would have sold any CFLs in absence of the program and asked the same question about LED lamps.[39] If the manufacturers identified any combinations of lamp types and retail channels through which they would not

[36] Please refer to APPENDIX J for all data collection instruments used in support of this evaluation.

[37] APPENDIX D provides details regarding our approaches to the shelf surveys and shopper intercept surveys.

[38] Summer 2013 and winter 2014-15.

[39] These questions (6-3 and 6-4) can be found in the retailer and manufacturer interview guides in APPENDIX J.

have sold any CFL or LED lamps without the program, we flagged these as program-reliant. Similarly, if the retail buyers identified any lamp types that they would not have sold without the program, we flagged the share of program-discounted lamp type(s) as program-reliant in the relevant channel. We use details regarding program reliance as part of the lamp choice modelling efforts described below in Section 5.1.3.

If the lighting manufacturers or retail lighting buyers said they would have sold some volume of lamps for a given lamp type without the program, we asked a series of follow-up questions.[40] These probed for the directionality of their sales without the program (e.g., same, lower, or higher) and the percentage change in their sales absent the program.[41, 42] Once again, we asked the manufacturers to provide estimates for each combination of lamp type and retail channel to which they supplied program-discounted lamps and asked the retail buyers to provide estimates for each lamp type their company sold through the program.

For the purposes of these questions, we collapsed the CFL measure groups into two as described above (with basic spiral CFLs in one group and all other CFLs in a “specialty CFLs” group).[43] We also asked the manufacturers and retail buyers to provide state-level estimates rather than estimates at the IOU level. This was mainly to avoid respondent fatigue. The majority of manufacturers sold program-discounted lamps through multiple retail channels. Therefore they had to answer NTG question batteries for multiple combinations of lamp types and retail channels. Adding the additional dimension of IOU-specific estimates would have tripled the length of these batteries in many cases.

The interviews yielded state-level NTGR estimates from manufacturers for the four measure categories (basic spiral CFL, specialty CFL, LED A-lamp, and LED reflector) by retail channel. For some channels and lamp categories, the interviews also generated NTGR estimates from retail buyers. For example, we asked each supplier, “Do you think your company would have been selling CFL products during this 2013-2014 program period if the discounts from this program had not been available?” If the respondent replied “No,” we assigned a NTGR of 100%. If the respondent answered “Yes,” we then asked, “If these manufacturer buydown discounts and program promotional materials had not been available during this 2013-2014 period, do you think your sales of these types of basic or general purpose CFL bulbs would have been about the same, lower, or higher?” If the respondent said “lower,” we asked: “By what percentage do you estimate your sales of basic or general purpose CFL bulbs through [the relevant retail channel] would be lower during this 2013-14 period if these manufacturer buydowns and program promotional materials for basic or general purpose CFLs had not been available?” We repeated respondents’ answers to this question back to each respondent, and once verified, served as the supplier-based NTGR. This approach is consistent with the approach used in impact evaluations of the IOUs’ 2010-12 and 2006-08 upstream lighting programs in California.[44]

We only obtained retail buyer NTGR estimates for four of the retail channels: discount, home improvement, mass merchandise, and membership club. However, for two of these four channels (mass merchandise and membership club), the retail buyers represented nearly all of the program lamp sales through those

40 These questions (6-3b and 6-3b_i) can be found in the retailer and manufacturer interview guides in APPENDIX J.

41 Note that these percentages always represented declines in sales; none of the respondents reported that their sales would be higher without the program.

42 For example, for basic spiral CFLs, we asked, “By what percentage do you estimate your sales of basic or general purpose Energy Star CFL lamps through [retail channel] would be lower during this 2013-2014 period if these manufacturer buydowns and program promotional materials for basic or general purpose CFLs had not been available?”

43 We asked separate questions about LED A-lamps and LED reflector lamps.

44 DNV GL, 2014b and KEMA, Inc. and Cadmus Group, 2010.

channels. Retailer interviews also represented over a quarter of the discount channel program sales (27%) and four percent of home improvement channel sales.

We aggregated the manufacturer NTGR estimates and the retailer NTGR estimates to the more detailed measure type (high-wattage CFL versus specialty CFL) and channel level using the percentage of measure and channel shipments attributed to the manufacturer or retailer which is shown in Equation 8 and Equation 9 below. Then, to determine the most appropriate NTGR estimate for use in subsequent calculations, we developed and applied weights to the manufacturer and retail buyer estimates to generate combined NTGR by evaluated upstream lighting measure group and retail channel (see Equation 10). While the interviews asked for only one NTGR estimate from each supplier for specialty CFLs in each channel, we applied different weights to manufacturer and retail buyer responses at the measure group level to reflect differences in shipment patterns by evaluated upstream measure group and channel. As such, the final recommended supplier-based NTGR estimates by retail channel vary among specialty CFL types (CFL A-lamps ≤ 30 W, CFL reflectors ≤ 30 W, CFL globes ≤ 30 W, and high-wattage CFLs [> 30 W]).

Equation 8. Retailer NTGR weighting by channel and measure group

$$\sum_{r}^{i} rNTGR_{i,C,L} * \frac{Q_{i,C,L}}{Q_{C,L}} = rNTGR_{C,L}$$

Where:

$rNTGR_{i,C,L}$ = net to gross ratio for each retailer, i, by channel, C, and measure type, L.

$Q_{i,C,L}$ = lamp shipment quantity by retailer, i, by channel, C, and lamp measure group, L.

$Q_{C,L}$ = lamp shipment quantity by by channel, C, and lamp measure group, L.

$rNTGR_{C,L}$ = retailer weighted net to gross ratio by channel, C, and measure type, L.

Equation 9. Manufacturer NTGR weighting by channel and measure group

$$\sum_{m}^{i} mNTGR_{i,C,L} * \frac{Q_{i,C,L}}{Q_{C,L}} = mNTGR_{C,L}$$

Where:

$mNTGR_{i,C,L}$ = net to gross ratio for each manufacturer, i, by channel, C, and measure type, L.

$Q_{i,C,L}$ = lamp shipment quantity by manufacturer, i, by channel, C, and lamp measure group, L.

$Q_{C,L}$ = lamp shipment quantity by by channel, C, and lamp measure group, L.

$mNTGR_{C,L}$ = manufacturer weighted net to gross ratio by channel, C, and measure type, L.

Equation 10. Supplier NTGR weighting by channel and measure group

$$rNTGR_{C,L} * rW_{C,L} + mNTGR_{C,L} * \ mW_{C,L} = sNTGR_{C,L}$$

Where:

$rNTGR_{C,L}$ = retailer weighted net to gross ratio by channel, C, and measure type, L.

rW = assigned retailer net to gross ratio weight.

$mNTGR_{C,L}$ = manufacturer weighted net to gross ratio by channel, C, and measure type, L.

mW = assigned manufacturer net to gross ratio weight.

$sNTGR_{C,L}$ = supplier weighted net to gross ratio by channel, C, and measure type, L.

5.1.2 Results of supplier-based approach

Below we present the supplier-based NTGR by evaluated upstream lighting measure group and channel.

5.1.2.1 **MSB CFL basic spiral ≤ 30 W**

Table 44 presents NTGR estimates by retail channel for basic spiral CFLs ≤ 30 W. The recommended NTGR estimates by channel from the supplier retail self-report method appears in the final column.

We completed interviews with manufacturers who accounted for nearly all the basic spiral CFLs ≤ 30 W sold through the program during the 2013-14 period. The retailer estimates accounted for all of the mass merchandise program lamps and nearly all of the membership club basic spiral CFL program lamps (98%). Additionally, the retailer interviews accounted for over half of the discount program basic spiral CFLs (57%) and less than one percent of the home improvement shipments.

To weight the manufacturer and retail buyer NTGR estimates across a given channel, our starting point was their relative sales. We then made adjustments based on other factors to develop the weights for the final supplier-based NTGR estimation. For example, for mass merchandise and membership clubs, the sales weights of the manufacturers and retail buyers were equal, but we gave the manufacturer estimate a slightly higher weight (55%) because it represented a larger sample size and therefore a broader range of lighting market actor perspectives.

The NTGR estimates vary widely across channels, with similar patterns to what we have found when we used this methodology for past evaluations of the upstream lighting program as well as more recent evaluations of upstream lighting programs in other states.[45] These patterns include higher estimates for hard-to-reach channels such as discount and independent grocery (suggesting greater program influence on sales through these channels) and lower estimates for “big box” channels such as large home improvement, mass merchandise, and membership club (suggesting lower program influence on sales through these channels).

The one anomaly was the low NTGR estimate in chain grocery for basic spiral CFLs ≤ 30 W (12%). When we looked more closely at this result, we found that it was mostly due to a single manufacturer estimating that

[45] Such variation in the NTGR estimates, and low NTGR estimates for some channels, does indicate that gaming of the NTGR estimates may be minimal. If many of the manufacturers were subject to the “don’t kill the golden goose” bias discussed above and had provided very inflated estimates, one would expect that, across the retail channels, the NTGR estimates would be much higher and more uniform.

their sales would decrease by only 5% to 10% absent the program. This manufacturer accounted for a large percentage of the program-discounted lamps in this channel and so this low estimate had the effect of greatly reducing the NTGR estimate for the channel as a whole. However, since the program only sold a small quantity of basic spiral CFLs through the chain grocery channel, this low NTGR estimate had very little impact on the overall supplier-based estimate for this measure group.

Table 44. Supplier self-reported NTGR estimates for MSB basic spiral CFLs ≤ 30 W, 2013-14

Retail Channel	Manufacturers			Retail Buyers			Final Supplier NTGR Estimate
	NTGR Estimate	% of Program Lamps Represented by Respondents	Weight	NTGR Estimate	% of Program Lamps Represented by Respondents	Weight	
Discount	78%	100%	70%	100%	57%	30%	84%
Drug	63%	90%	100%	*	*	N/A	63%
Grocery - chain	12%	100%	100%	*	*	N/A	12%
Grocery - independent	100%	71%	100%	*	*	N/A	100%
Hardware	54%	100%	100%	*	*	N/A	54%
Home improvement	53%	99%	100%	100%	0%	N/A	53%
Mass merchandise	46%	100%	55%	75%	100%	45%	59%
Membership club	64%	100%	55%	12%	98%	45%	41%

* We did not interview retail buyers representing this channel for this measure group.

5.1.2.2 MSB CFL A-lamp ≤ 30 W

Table 45 presents the supplier-based NTGR estimates by retail channel for CFL A-lamps ≤ 30 W. Once again, the recommended NTGR estimate for the supplier retail self-report method appears in the final column.

As was the case for the basic spiral CFLs ≤ 30 W, we completed interviews with manufacturers who accounted for the majority of CFL A-lamps ≤ 30 W sold through the program during the 2013-14 program period. However, once again, we only obtained retail buyer estimates for four of the retail channels. For two of these channels – home improvement and membership club – the retail buyers accounted for less than a fifth of the program lamp sales through those channels.

To weight the manufacturer and retail buyer NTG results across a given channel, we used the same method as described in 5.1.2.1 above. We started with their relative sales weights and then increased the weights of the manufacturer estimates slightly because they had larger sample sizes and therefore represented a broader range of light market actor perspectives.

The NTGR estimates in the final column show a similar pattern as was shown for basic spiral CFLs ≤ 30 W. Once again, the hard-to-reach channels such as discount and independent grocery had higher estimates while the big box channels such as home improvement, mass merchandise, and membership club have lower estimates. Additionally, recall that while the interviews asked for only one NTGR estimate from each supplier for specialty CFLs in each channel, we applied different weights to manufacturer and retail buyer responses at the measure group level to reflect differences in shipment patterns by evaluated upstream measure group and channel. As such, the final recommended supplier-based NTGR estimates by retail channel vary among specialty CFL types (including CFL A-lamps ≤ 30 W).

One notable difference is that the NTGR estimate for the chain grocery channel is much higher than it was for the basic spiral CFLs ≤ 30 W (94% versus 12%, respectively). This is mainly a result of the absence of the one anomalous NTGR estimate that we described in the previous subsection. For all of the big box channels, the CFL A-lamps ≤ 30 W NTGR are higher than for the basic spiral CFLs ≤ 30 W.

Table 45. Supplier self-reported NTGR estimates for MSB CFL A-lamps ≤ 30 W, 2013-14

Retail Channel	Manufacturers			Retail Buyers			Final Supplier NTGR Estimate
	NTGR Estimate	% of Program Lamps Represented by Respondents	Weight	NTGR Estimate	% of Program Lamps Represented by Respondents	Weight	
Discount	79%	100%	70%	100%	49%	30%	86%
Drug	62%	100%	100%	*	*	N/A	62%
Grocery - chain	94%	100%	100%	*	*	N/A	94%
Grocery - independent	85%	99%	100%	*	*	N/A	85%
Hardware	66%	99%	100%	*	*	N/A	66%
Home improvement	62%	96%	90%	100%	14%	10%	65%
Mass merchandise	60%	100%	55%	75%	91%	45%	67%
Membership club	45%	100%	90%	15%	17%	10%	42%

* We did not interview retail buyers representing this channel for this measure group.

5.1.2.3 MSB CFL reflector lamps ≤ 30 W

Table 46 presents the supplier-based NTGR estimates by retail channel for CFL reflector lamps ≤ 30 W. As was the case for the other CFL types, the table shows that we completed interviews with manufacturers who accounted for the majority of reflector CFLs ≤ 30 W sold through the program during the 2013-14 program period.

Once again, the table shows that we obtained retail buyer estimates for only four of the eight retail channels. In two of these channels – mass merchandise and membership club – the retail buyers accounted for all or nearly all of program-discounted lamp sales in 2013-14 (87% and 100%, respectively) but a negligible share of sales in the other two channels (3% in discount and 2% in home improvement). As such, we assigned low weights to retail buyer results in the discount and home improvement channels and higher weights in the mass merchandise and membership club channels. Again, recall that while the interviews asked for only one NTGR estimate from each supplier for specialty lamps in each channel, we applied different weights to manufacturer and retail buyer responses at the measure group level to reflect differences in shipment patterns by evaluated upstream measure group and channel. As such, the final recommended supplier-based NTGR estimates by retail channel vary among specialty CFL types (including CFL reflectors ≤ 30 W).

Results suggest that the program's influence was greatest highest in chain and independent grocery stores and (with NTGR of 94% and 85%, respectively) lowest in membership clubs (31%).

Table 46. Supplier self-reported NTGR estimates for MSB reflector CFLs ≤ 30 W, 2013-14

Retail Channel	Manufacturers			Retail Buyers			Final Supplier NTGR Estimate
	NTGR Estimate	% of Program Lamps Represented by Respondents	Weight	NTGR Estimate	% of Program Lamps Represented by Respondents	Weight	
Discount	79%	98%	97%	100%	3%	3%	80%
Drug	62%	99%	100%	*	*	N/A	62%
Grocery - chain	94%	99%	100%	*	*	N/A	94%
Grocery - independent	85%	95%	100%	*	*	N/A	85%
Hardware	66%	94%	100%	*	*	N/A	66%
Home improvement	62%	99%	98%	95%	2%	2%	62%
Mass merchandise	60%	100%	55%	75%	87%	45%	67%
Membership club	45%	100%	55%	15%	100%	45%	31%

* We did not interview retail buyers representing this channel for this measure group.

5.1.2.4 MSB CFL globe ≤ 30 W

Table 47 presents the supplier-based NTGR estimates by retail channel for globe CFLs ≤ 30 W. As shown, we completed interviews with manufacturers who accounted for 100% of globe CFLs ≤ 30 W sold through the program in 2013 and 2014. Note that the IOUs did not provide incentives for globe CFLs ≤ 30 W in the membership club channel during this period.

We obtained retail buyer estimates for only one of the eight retail channels (mass merchandise). This buyer accounted for 100% of sales in the mass merchandise channel. We assigned a 55% weight to mass merchandise manufacturer estimates and 45% to the buyer estimates. In all other channels we assigned 100% weights to the manufacturer estimates. Again, recall that while the interviews asked for only one NTGR estimate from each supplier for specialty lamps in each channel, we applied different weights to manufacturer and retail buyer responses at the measure group level to reflect differences in shipment patterns by evaluated upstream measure group and channel. As such, the final recommended supplier-based NTGR estimates by retail channel vary among specialty CFL types (including CFL globes ≤ 30 W).

As with reflector CFLs, results suggest that the program’s influence was again highest in chain and independent grocery stores. Results are the same for these two measure groups in these channels because the same manufacturers shipped program-discounted specialty CFLs to grocery retailers in 2013-2014. The NTGR was lowest in the home improvement (62%) and drug channels (62%).

Table 47. Supplier self-reported NTGR estimates for MSB globe CFLs ≤ 30 W, 2013-14

Retail Channel	Manufacturers			Retail Buyers			Final Supplier NTGR Estimate
	NTGR Estimate	% of Program Lamps Represented by Respondents	Weight	NTGR Estimate	% of Program Lamps Represented by Respondents	Weight	
Discount	79%	100%	100%	*	*	N/A	79%
Drug	62%	100%	100%	*	*	N/A	62%
Grocery - chain	94%	100%	100%	*	*	N/A	94%
Grocery - independent	85%	100%	100%	*	*	N/A	85%
Hardware	66%	100%	100%	*	*	N/A	66%
Home improvement	62%	100%	100%	*	*	N/A	62%
Mass merchandise	60%	100%	55%	75%	100%	45%	67%
Membership club	**	**	N/A	**	**	N/A	N/A

* We did not interview retail buyers representing this channel for this measure group.
** The program provided no globe CFL incentives in this channel.

5.1.2.5 MSB CFL high-wattage (> 30 W)

Table 48 presents the supplier-based NTGR estimates by retail channel for MSB high-wattage CFLs (< 30 W). As shown, we completed interviews with manufacturers who accounted for the majority of high-wattage CFL sales through the 2013-14 program.

We obtained retail buyer estimates for four of the retail channels. In the membership club channel, the retail store was responsible for 100% of program sales through that channel. In two additional channels (home improvement and mass merchandise), the retail buyers we interviewed represented nearly half of lamp sales. The fourth represented only 9% of sales in the discount channel. These differences are again reflected in the weights assigned to manufacturer and retail buyer NTGR estimates. Again, recall that while the interviews asked for only one NTGR estimate from each supplier for specialty lamps in each channel, we applied different weights to manufacturer and retail buyer responses at the measure group level to reflect differences in shipment patterns by evaluated upstream measure group and channel. As such, the final recommended supplier-based NTGR estimates by retail channel vary among specialty CFL types (including high-wattage CFLs).

As with reflector and globe CFLs, results suggest that the program's influence was highest in chain and independent grocery stores. Results are the same for these three measure groups in these channels because the same manufacturers shipped program-discounted specialty CFLs to grocery retailers in 2013-2014. The NTGR was lowest in the membership club channel at 47%.

Table 48. Supplier self-reported NTGR estimates for MSB high-wattage CFLs (> 30 W), 2013-14

Retail Channel	Manufacturers			Retail Buyers			Final Supplier NTGR Estimate
	NTGR Estimate	% of Program Lamps Represented by Respondents	Weight	NTGR Estimate	% of Program Lamps Represented by Respondents	Weight	
Discount	79%	98%	95%	100%	9%	5%	80%
Drug	62%	74%	100%	*	*	N/A	62%
Grocery - chain	94%	100%	100%	*	*	N/A	94%
Grocery - independent	85%	94%	100%	*	*	N/A	85%
Hardware	66%	91%	100%	*	*	N/A	66%
Home improvement	62%	100%	70%	99%	47%	30%	73%
Mass merchandise	60%	100%	70%	75%	45%	30%	65%
Membership club	45%	100%	55%	50%	100%	45%	47%

* We did not interview retail buyers representing this channel for this measure group.

5.1.2.6 LED A-lamps of all wattages

Table 49 presents NTGR estimates by supplier type and retail channel for LED A-lamps of all wattages. The table shows that we completed interviews with manufacturers who accounted for nearly all of the LED A-lamps sold through the program during the 2013-14 program period. While we only obtained NTGR estimates from two retail buyers, the retail interviews accounted for all of the home improvement LED A-lamps sold through the program during the 2013-14 period.

To weight the manufacturer and retail buyer results across a given channel, we used the same method as we described in the previous subsections. The NTGR estimates in the final column are higher in the hard-to-reach channels and lower in the big box channels. For grocery stores (chains and independent), suppliers suggested that 100% of the sales of these lamps were attributable to the program.

Table 49. Supplier self-reported NTGR estimates for LED A-lamps of all wattages, 2013-14

Retail Channel	Manufacturers			Retail Buyers			Final Supplier NTGR Estimate
	NTGR Estimate	% of Program Lamps Represented by Respondents	Weight	NTGR Estimate	% of Program Lamps Represented by Respondents	Weight	
Discount	69%	100%	100%	*	*	N/A	69%
Drug	**	**	N/A	**	**	N/A	N/A
Grocery - chain	100%	100%	100%	*	*	N/A	100%
Grocery - independent	100%	75%	100%	*	*	N/A	100%
Hardware	56%	100%	100%	*	*	N/A	56%
Home improvement	43%	100%	95%	60%	6%	5%	44%
Mass merchandise	*	*	N/A	*	*	N/A	N/A
Membership club	78%	100%	55%	50%	100%	45%	65%

* We did not interview suppliers representing this channel for this measure group because the 2013-14 provided incentives for only 15 LED A-lamps in mass merchandise stores. We relied upon the ex ante estimate for this combination of measure group and channel.
** The program provided no LED reflector lamp incentives in this channel.

5.1.2.7 LED reflector lamps of all wattages

Table 50 presents NTGR estimates by supplier type and retail channel for LED reflector lamps of all wattages. The IOUs offered fewer than one thousand incentives for LED reflector lamps in the discount and mass merchandise channels during the 2013-14 program period.

For LED reflector lamps, we only obtained NTGR estimates from one retail buyer which accounted for a small portion of program-discounted LED reflector lamp sales in the home improvement channel (5%). As such, we assigned a correspondingly low weight (5%) to the retail buyer NTGR estimate in the home improvement channel but 100% to the manufacturer NTGR for all other retail channels. Consistent with results for LED A-lamps, supplier-based results suggest greater program influence on LED reflector lamp sales in the hard-to-reach channels and lower program influence in the big box channels. Also consistent with LED A-lamp results are the 100% NTGR estimates from manufacturers in the two grocery channels (chain and independent).

Table 50. Supplier self-reported NTGR estimates for LED reflector lamps of all wattages, 2013-14

Retail Channel	Manufacturers			Retail Buyers			Final Supplier NTGR Estimate
	NTGR Estimate	% of Program Lamps Represented by Respondents	Weight	NTGR Estimate	% of Program Lamps Represented by Respondents	Weight	
Discount	**	**	N/A	**	**	N/A	N/A
Drug	**	**	N/A	**	**	N/A	N/A
Grocery - chain	100%	100%	100%	*	*	N/A	100%
Grocery - independent	100%	56%	100%	*	*	N/A	100%
Hardware	97%	99%	100%	*	*	N/A	97%
Home improvement	44%	96%	95%	80%	5%	5%	46%
Mass merchandise	*	*	N/A	*	*	N/A	N/A
Membership club	72%	100%	100%	*	*	N/A	72%

* We did not interview suppliers representing this channel for this measure group because the 2013-14 provided incentives for only 2 LED reflector lamps in mass merchandise stores. We relied upon the ex ante estimate for this combination of measure group and channel.
** The program provided no LED reflector lamp incentives in this channel.

5.1.3 Strengths and weaknesses of supplier-based approach

Like all activities feeding NTGR estimations, the supplier and retailer self-report methodology has strengths and weaknesses, which we present in Table 51. The interview guide attempted to mitigate the disadvantages posed by this approach by including questions that we used as consistency checks for their responses to the primary questions regarding NTGR. These included questions about the magnitude and nature of any non-program lamps sales and what happened to the respondents' lamp sales when program discounts were not available.[46]

[46] For additional detail on these consistency checks, please refer to section 8.8.3 (Consistency Checks and Quality Control) in the impact evaluation of the 2006-08 upstream and residential downstream programs (KEMA, Inc. and Cadmus Group, 2010).

Table 51. Strengths and weaknesses of the supplier-based NTGR approach, 2013-14

Strengths	Weaknesses
• *Can develop NTGR estimates for a large proportion of program shipments/sales:* For example, for the 2013-14 program period, the lamp manufacturers providing NTGR estimates accounted for approximately 99% of program sales. • *Can develop NTGR estimates for channels/products that might be difficult to access/capture via shopper intercept surveys.* For example, this method can develop NTGR estimates for lamp sales in hard-to-reach retailers like ethnic grocery stores or stores with low-volume lighting sales like drug stores. • *Suppliers have market knowledge that consumers lack:* For example, a shopper in a dollar store may not be aware that since the production cost of an Energy Star CFL is over a dollar, such a lamp would not be available for sale without program discounts. • *Estimating the program impacts on sales of energy-efficient lamps is not an academic exercise for suppliers:* Every year, lighting manufacturers submit proposals to the IOUs indicating how many CFLs and LED lamps they think they can sell of what lamp type and through which retail channels. If they overestimate or underestimate the sales effects of these rebates, they must deal with unhappy retail partners and upstream lighting program managers. Many manufacturers are also aware of program sales impacts through retailer restock requests and routine store visits. • *Supplier estimates provide the "why" for NTGR:* The in-depth interviews with manufacturers and retailers provide qualitative explanations of why the NTGR varies for different lamp types and retail channels.	• *Lighting suppliers have biases that may cause them to provide estimates of the program's influences or effects that are higher or lower than the program deserves.* These include: o <u>Gaming bias</u> (or "don't kill the golden goose" bias). This occurs when market actors purposely overestimate how much their lamp sales would drop in the absence of the program. Their motivations for doing this may be to ensure that they continue receiving the program discounts. o <u>Green retailer bias</u>. This occurs when suppliers underestimate how much their sales would drop in the absence of the program. Their motivations for doing so may be because they have exaggerated confidence in their company's ability to market environmentally-friendly products without program discounts. Since these biases work in opposite directions, the supplier self-report method tries to mitigate these biases by getting both manufacturer and retailer NTGR estimates. Yet since manufacturers may benefit more directly from upstream lighting programs than the retailers, they tend to be more willing to complete interviews. Manufacturers may also be are more likely to exhibit the gaming bias since they receive the vast majority of program discounts. • *Channel shift effects:* The program may create some impacts in terms of shifting sales of energy-efficient lamps between different retail channels. The supplier self-report method tries to account for these channel shifts by talking to suppliers for the full range of retail channels. For example, if the program is creating a shift in energy-efficient lamp sales from mass merchandise stores to discount stores, talking to suppliers from both of these channels would hopefully capture both the positive and negative program effects. However, it is possible that the method may not be fully capturing these channel shift effects.

5.2 Model-based NTGR

5.2.1 Overview of approach

The IOUs designed the upstream lighting program to shift consumer choices away from inefficient lamps and toward energy-efficient lamps. These shopping decisions occur within a complicated residential lighting market that consists of multiple lamp choices. The underlying theory is that providing program discounts for a CFL or LED lamp makes them more attractive choices than the alternatives. The question behind the impact evaluation is: what choice would the consumer have made in the absence of the incentive? Discrete choice models are the analytical framework designed for this class of problem. Discrete choice models combine the relevant information about each possible choice—for example, lamp price and shopper characteristics—and assign a probability to each of the choices. To answer the impact evaluation question, we apply the model scenarios with and without the program incentives and calculate the percent difference in market shares.

In Section 5.1 above we describe the supplier-based approach to generating NTGR. We employed a second approach using a discrete choice logit model (dubbed the Lamp Choice Model [lamp choice model]) to estimate NTGR.[47] We prefer model-based estimates of NTGR to the supplier-based estimates as the lamp choice model is able to capture substitution patterns that suppliers are not able to easily quantify. Quantifying the extent that consumers make substitutions between program-discounted lamps, other energy- efficient lamps, and with functionally equivalent non-program lamps is essential to evaluating upstream program impacts in a complicated market.

The lamp choice model predicts the probability with which a consumer would choose different lamps within a replacement lamp category. For the purposes of the model, replacement lamp categories include:

- **A-lamp replacements**, which include traditional incandescent A-lamps, EISA-compliant halogen A-lamps, CFL A-lamps, basic spiral CFLs, and LED A-lamps
- **Reflector lamp replacements**, which include incandescent reflector lamps, reflector CFLs, and LED reflector lamps
- **Globe lamp replacements**, which include globe CFLs and incandescent globe lamps

There is one additional replacement lamp category: high-wattage lamps. However, during the shopper intercept surveys, we did not encounter enough shoppers purchasing lamps of this type to generate model-based estimates of market shift for the related measure group (CFL high-wattage [>30 W]). We estimated the model using shopper characteristic and preference data gathered during two waves of in-store shopper intercept surveys (summer 2013 and winter 2014-15).[48] Concurrently with the shopper intercept surveys, DNV GL staff also collected information on the lamps stocked by the retail stores in which we conducted intercept surveys.

For each replacement lamp category, DNV GL ran the model against three scenarios:

1. **With-program scenario**. This scenario reflects the lamp prices and availability that DNV GL observed in retail stores during the shelf survey visits in 2013 and 2014. This scenario results in an estimate of the share of program lamp sales for each modelled technology.

[47] Please refer to APPENDIX H for more details regarding the lamp choice model methodology.

[48] For ease of reference, the remainder of this section refers to the summer 2013 data collection period as 2013 and the winter 2014-15 data collection period as 2014. APPENDIX D describes the sampling approach for the shelf and shopper intercept surveys.

2. **No-discount scenario**. This scenario reflects the lamp prices that consumers would have seen in California retail stores in 2013 and 2014 in the absence of IOU discounts. DNV GL estimated price differences based on clearly-labeled IOU discounts in the stores or by matching lamps to program tracking data. This scenario results in a counterfactual estimate of market shares that would have occurred if only prices on program-discounted lamps changed due no program activity. This scenario represents the first of two “no program” scenarios.

3. **Constrained scenario.** In addition to the price effects described in the no-discount scenario, the constrained scenario reflects stocking changes that would have occurred in the absence of the program. As described in Section 5.1 above, when a manufacturer indicated that they would not have sold a lamp through a channel in the absence of the program, we consider those lamps to be program-reliant. This scenario results in a counterfactual estimate of market shares if program-reliant lamps were not in stores and if the IOUs did not discount lamps. This scenario represents the second “no program” scenario.

We applied the model for each replacement lamp category to a series of choices under the three scenarios described above. This results in estimates of the market share of lamp sales by measure group within each replacement category. The percent change in a measure group’s market share is the program-attributable sales for that measure group. We define the ratio in Equation 11 below.

Equation 11. NTGR calculation

$$NTGR = \frac{Program\ Market\ Share - No\ Program\ Market\ Share}{Program\ Market\ Share}$$

Because we have two “no program” scenarios, we must decide which counterfactual market shift estimate is most accurate for each combination of measure group and retail channel.

To ensure that the model results were robust enough and representative of the program at large, we implemented three steps:

- **Review respondent count.** First, we determined the measure group-channel combinations for which we could consider a modelled NTGR based on a review of shopper intercept survey respondent counts and the accuracy of the model’s interpretation of program activity.
- **Calculate activity type weighting**. Second, we weighted segmented iterations of the model so that choice sets accurately represented program activity.
- **Determine most appropriate model scenario.** Third, we considered supplier perspectives regarding the program’s influence on lamp sales to determine which model scenario to apply in generating model-based NTGR.

For all combinations of replacement lamp category and retail channel in which we had sufficient shopper intercept survey sample sizes and in which the program activity types matched between the modelled scenarios and the program tracking data, we applied the program activity weights to the selected model scenario to generate model-based NTGR. We also used these results to generate imputation factors to apply to modelled results for cases in which we had insufficient shopper intercept survey sample sizes and/or program activity types did not match well. Section 5.2.1.1 explains the process for determining sufficient modeling sample size. Section 5.3.2 describes the calculation of program activity weighting, imputation factors and shows final NTGR for cases in which we relied upon supplier-based estimates as imputed based on modeled results. The remainder of this section describes the steps used in generating the model-based NTGR.

5.2.1.1 Review respondent count

Like any model, the lamp choice model performs most reliably when it has a large volume of input data to generate a stable result. Given this, we considered the number of respondents that informed model estimation. We only considered model results where we conducted shopper intercept surveys with at least 15 respondents in a given channel. Additionally, we also required that the simulation data were robust enough to accurately represent the program's activity. In other words, even if the sample size was large for a given channel, it was also essential that the sample included discounts that were representative of the larger program. We discuss this consideration in more detail in Section 5.2.1.2.

Table 52 displays the respondent counts where program-discounted lamps were available at the time of the shopper intercept surveys for A-lamp, reflector, and globe replacements. Within the A-lamp replacement category, where we had 15 or more observations, we considered model-based estimates of NTGR. As shown, this allowed us to consider all channels for A-lamp replacements. For reflector replacements, this allowed us to consider the hardware, home improvement, and mass merchandise, and membership club channels, and for globe replacements, the home improvement and mass merchandise channels. We have highlighted these combinations of replacement lamp categories and retail channels in the table below. In each of these instances, we moved forward to the next step in calculating model-based NTGR. In all other cases—those not highlighted in the table below—we imputed NTGR from supplier-based estimates (as we will describe in Section 5.3.2).

As mentioned above, we did not generate model-based NTGR for MSB CFL high-wattage (> 30 W) because we completed only a small number of shopper intercept surveys with respondents who purchased lamps in this replacement lamp category.

Table 52. Respondent counts for considering model-based NTGR by retail channel, replacement lamp category, and evaluated upstream lighting measure group, 2013-14

Channel	Replacement Lamp Category		
	A-Lamp Replacements	Reflector Replacements	Globe Replacement
Discount	82	1	11
Drug	53	10	0
Grocery - chain	17	5	0
Grocery - independent	20	0	0
Hardware	90	60	7
Home improvement	281	189	23
Mass merchandise	126	65	63
Membership club	93	85	0

Note: Respondent counts represent the number of respondents who completed shopper intercept surveys for each lamp type in stores offering program discount for those lamps at the time of the surveys

5.2.1.2 **Calculate activity type weighting**

As described in Section 2.3.2 above, the distribution of IOU-discounted lamps varied substantially from quarter to quarter. Some stores received IOU-discounted lamps of only one measure group while others received various combinations of IOU-discounted lamps. For example, one store may have received only basic spiral CFLs ≤ 30 W program lamps and another may have received IOU-discounted MSB CFLs ≤ 30 W, MSB CFL A-lamps ≤ 30 W, and LED A-lamps of all wattages. The lamp choice model can simulate these differences and estimate their impacts, but it is important to consider the relative frequency of each combination of program offerings. We refer to these program lamp combinations as “activity types” and developed a weighting approach to reflect the relative presence of these activities in retail stores throughout the program period.

We assigned quarterly activity types to each store in the tracking data based on the measure groups that participating manufacturers shipped to each store within a given quarter. For instance, if a store received both MSB CFL basic spiral ≤ 30 W and MSB CFL A-lamp ≤ 30 W within a quarter, we assigned that store (and all of the program-discounted lamps shipped to that store) a “basic spiral CFL + CFL A-lamp” activity type for that quarter. [49] To calculate each activity type’s weight, we divided the number of program lamps within a respective measure group, activity type, and channel by the number of program lamps within that measure group and channel.

For example, in the discount channel, we classified 119,693 MSB CFL basic spiral ≤ 30 W as “basic spiral” and 130,642 MSB CFL basic spiral ≤ 30 W as “basic spiral CFL + A-lamp CFL” based on the program shipments that occurred during each relevant timeframe. The “basic spiral” activity type thus accounted for 48 percent of program basic spiral CFLs shipped to discount stores while the “basic spiral CFL + CFL A-lamp” activity type accounted for 52 percent.

We then classified our model simulations in the same way as the program tracking data. If a simulation presented both a program-discounted MSB CFL basic spiral ≤ 30 W and an MSB CFL A-lamp ≤ 30 W, then we classified the simulation as the activity type “basic spiral CFL + A-lamp CFL.” We then compared the tracking activity types with simulation activity types. For all cases in which we had robust sample sizes for the shopper intercept surveys (15 or more respondents for a combination of channel and replacement lamp category) and in which program activity types aligned between the modelled data and program-discounted lamp shipments, we applied the program activity weights to the activity type NTGR.[50] In cases where program activity types lacked sufficient respondents for modeling, we did not attempt to weight the model and rather imputed NTGR from supplier-based estimates (as described in Section 5.3.2 below).

Returning to our example, we applied the 52 percent activity weight for the "basic spiral CFL + A-Lamp CFL" to the MSB CFL basic spiral ≤ 30 W NTGR in the discount channel. Then, we weighted the modeled NTGR for the other activity types. The sum of these estimates represented the NTGR for the discount channel MSB CFL basic spiral ≤ 30 W. Table 99 though Table 103 in APPENDIX I provide additional detail on the program activity type segmentation and weighting. We describe the program activity weights for each replacement lamp category below.

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[49] When referring to activity types, we assume all CFLs are ≤ 30 W, as there were not sufficient MSB CFL high wattage (> 30 W) shopper intercept surveys to estimate a model for high-wattage replacement lamps.

[50] Note, for simplicity, we have not considered alternate model scenarios in this example. In Section 5.2.1.3 we will introduce the two model scenarios and how the final model NTGR was selected for each channel and lamp type

A-lamp replacement category

Table 53 displays the number of shopper intercept survey respondents and the number of program lamps shipped by channel and program activity type for lamps in the A-lamp replacement category when program activity types aligned between the modelled data and program-discounted lamp shipments. For example, in the discount channel there were a sufficient number of intercept surveys aligning with the tracking data shipments to utilize the model results. We thus moved forward to the next step in calculating model-based NTGR for this channel. Table 99 in APPENDIX I reviews the results for cases in which program activity types did not align between modelled data and program-discounted lamp shipments within the A-lamp replacement category. For example, in the independent grocery channel, we had 16 intercept survey respondents who reflected the “basic spiral CFL + CFL A-lamp” activity type, but the bulk of program shipments occurred in the “CFL A-lamp” activity type, for which we had no respondents. We thus did not use model results in generating NTGR for the independent grocery channel. As shown in the table, we had sufficient data to move forward to the next step in generating model-based NTGR for A-lamp replacements the discount, chain grocery, home improvement, and hardware channels. We had insufficient data to move forward with model-based NTGR for A-lamp replacements in the drug, independent grocery, mass merchandise, and membership club channels.

Table 53. Respondent counts and program-discounted lamp quantities for the A-lamp replacement category by retail channel and program activity type, 2013-14

Channel	Activity Type	Respondent Count	Quantity of Program-Discounted Lamps			
			Total A-Lamp Replacements	Basic Spiral CFL	CFL A-Lamp	LED A-Lamp
Discount	Basic spiral CFL	32	119,693	119,693		
	CFL A-lamp	30	1,374,190		1,374,190	
	LED A-lamp	6	1,758			1,758
	Basic spiral CFL + CFL A-lamp	14	263,888	130,642	133,246	
Drug	*	*	*	*	*	*
Grocery - chain	Basic spiral CFL	9	15,852	15,852		
	CFL A-lamp	8	415,220		415,220	
Grocery - independent	*	*	*	*	*	*
Hardware	CFL A-lamp	19	34,352		34,352.00	
	LED A-lamp	60	55,668			55,668
	Basic spiral CFL + CFL A-lamp**	10	149,530	86,216	62,594	720
Home improvement	Basic spiral CFL	95	30,432	30,432		
	CFL A-lamp	53	33,787		33,787	
	LED A-lamp	110	138,306			138,306
	CFL A-lamp + LED A-lamp	4	190,626		68,879	121,747
	Basic spiral CFL + CFL A-lamp	16	1,653,242	1,575,757	77,486	
Mass merchandise	*	*	*	*	*	*
Membership club	*	*	*	*	*	*

* Field data did not accurately represent program activity types for this channel. See Table 99 in APPENDIX I for details.
** This activity type includes 720 LED A-Lamps, and was considered to be a Basic spiral CFL + A-Lamp activity type

As shown in the table above, we had robust sample sizes for the shopper intercept surveys and the model generated accurate representations of program activity in the discount, chain grocery, hardware, and home improvement channels for program-discounted lamps in the A-lamp replacement category. Table 54 below displays the weighting applied to each modeled NTGR activity type for each combination of channel and evaluated upstream lighting measure group for these channels. Note that in the hardware channel, a shipment of 720 LED lamps alongside 43,962 basic spiral CFLs and 60,480 CFL A-lamps generated a program activity type of “basic spiral CFL + CFL A-lamp + LED A-lamp.” However, because the quantity of 720 LED A-lamps of all wattages was so small relative to the CFL shipments, we reclassified this activity type to “basic spiral CFL + CFL A-lamp.”

Table 54. Activity type weights by retail channel for the A-lamp replacement category, 2013-14

Channel*	Activity Type	Model Respondent Count	Total Program Lamps	Activity Type Weights		
				Basic Spiral CFL	CFL A-Lamp	LED A-Lamp
Discount	Basic spiral CFL	32	119,693	48%	0%	0%
	CFL A-lamp	30	1,374,190	0%	91%	0%
	LED A-lamp	6	1,758	0%	0%	100%
	Basic spiral CFL + CFL A-lamp	14	263,888	52%	9%	0%
	Overall	**82**	**1,759,529**	**100%**	**100%**	**100%**
Grocery - chain	Basic spiral CFL	9	15,852	100%	0%	0%
	CFL A-lamp	8	415,220	0%	100%	0%
	Overall	**17**	**431,072**	**100%**	**100%**	**0%**
Hardware	CFL A-lamp	20	34,352	0%	35%	0%
	LED A-lamp	60	55,668	0%	0%	99%
	Basic spiral CFL + CFL A-lamp	10	149,530	100%	65%	1%
	Overall	**90**	**239,550**	**100%**	**100%**	**100%**
Home improvement	Basic spiral CFL	95	30,432	2%	0%	0%
	CFL A-lamp	54	33,787	0%	19%	0%
	LED A-lamp	111	138,306	0%	0%	53%
	CFL A-lamp + LED A-lamp	4	190,626	0%	38%	47%
	Basic spiral CFL + CFL A-lamp	17	1,653,242	98%	43%	0%
	Overall	**281**	**2,046,393**	**100%**	**100%**	**100%**

*The quantities of the basic spiral CFL + CFL A-lamp + LED A-lamp activity type in the hardware channel was reclassified to basic spiral CFL + CFL A-lamp due to minimal presence of LED lamps within the category. We present the methodology for these changes in APPENDIX I.

Reflector lamp replacement category

For the reflector replacement lamp category, we had sufficient counts of shopper intercept survey respondents in the hardware, home improvement, mass merchandise, and membership club channels (as shown in Table 52 above) to move to the next step in generating model-based NTGR for these channels. However, when considering the program activity types reflected, data for the hardware and membership club channel intercepts did not represent the key activity types (see Table 100 in APPENDIX I). Table 55 shows that for lamps in the reflector lamp replacement category, we had good matches for program activity types in the home improvement and mass merchandise channels and thus moved forward to the next step in generating model-based NTGR for IOU-discounted reflector replacement lamps in these channels. (As described above, for cases in which program activity types did not match well, we imputed NTGR from supplier-based estimates as described in Section 5.3.2 below).

Table 55. Respondent counts and program-discounted lamp quantities for the reflector replacement category by retail channel and program activity type, 2013-14

Channel	Activity Type	Respondent Count	Quantity of Program-Discounted Lamps		
			Total Reflector Replacements	CFL Reflector	LED Reflector
Discount	**	**	**	**	**
Drug	**	**	**	**	**
Grocery - chain	**	**	**	**	**
Grocery – independent	**	**	**	**	**
Hardware	*	*	*	*	*
Home improvement	CFL reflector	100	263,322	263,322	
	LED reflector	49	68,615		68,615
	CFL reflector + LED reflector	40	427,853	315,542	112,311
Mass merchandise	CFL reflector***	65	21,227	21,225	2
Membership club	*	*	*	*	*

* Field data did not accurately represent program activity types for this channel. See Table 100 in APPENDIX I for details.
** Insufficient respondent count to generate model-based NTGR
***This activity type includes 2 LED reflector lamps, and was considered to be a CFL reflector activity type

As shown above, we had good alignment of program activity types in the home improvement and mass merchandise channels for lamps in the reflector lamp replacement category. We developed program activity weights for reflector lamp replacements in these channels as shown in Table 56.

Table 56. Activity type weights by retail channel for the reflector replacement category, 2013-14

Channel	Activity Type	Model Respondent Count	Total Program Lamps	Activity Type Weights	
				CFL Reflector	LED Reflector
Home improvement	CFL reflector	10	263,322	45%	0%
	LED reflector	4	68,615	0%	38%
	CFL reflector + LED reflector	4	427,853	55%	62%
	Overall	**18**	**759,790**	**100%**	**100%**
Mass merchandise	CFL reflector	65	21,227	100%	100%
	Overall	**65**	**21,227**	**100%**	**100%**

Globe and High Wattage lamp replacement category

Because no LED globes were discounted, there was only the MSB CFL globe ≤ 30 W activity type and so activity weights were not needed. Based on our criteria for sample size, model results were leveraged to generate NTGR for the home improvement and mass merchandise channels. As mentioned in

Section 5.2.1.1, not enough data was available to model the MSB CFL high-wattage (> 30 W) measure group, so no weighting was necessary.

5.2.1.3 Determine most appropriate model scenario

For all combinations of evaluated upstream lighting measure group and retail channel in which we had sufficient shopper intercept survey sample sizes and in which the program activity types matched between the modelled scenarios and the program tracking data, the next step in calculating model-based NTGR involves selecting the most appropriate model scenario. We then apply the program-activity weights presented in Section 5.2.1.2 to the model NTGR to generate the final model-based NTGR.

For a given combination of evaluated upstream lighting measure groups and retail channels, the difference between the appropriate “no program” market share and the modelled with-program market share divided by the with program market share is the percent attributable to the program, also known as the NTGR. The model considers two scenarios to estimate non-program market shares:

- **Constrained scenario.** In cases where suppliers indicate some lamps were dependent on the program, and it is likely that the channel would not receive non-program lamps as alternatives, we rely upon modelled NTGR from the constrained scenario. For these estimates, the model removes choice sets for which manufacturers reported they would have sold no lamps of a specific measure group in a specific channel without the program.
- **No-discount scenario.** Where suppliers did not indicate program dependence, or in cases where program lamps may have been dependent, but other non-program lamps would likely exist in their absence (such as the home improvement channel) we apply the no-discount scenario. In these scenarios, we did not constrain choices, but did remove the program discounts from lamp prices so that prices available in consumer choice sets reflected the full retail prices.

Table 57 shows our chosen “no program” scenario to apply in estimating NTGR for each combination of evaluated upstream lighting measure group and retail channel for lamps in the A-lamp replacement category. Not all channel and evaluated upstream lighting measure groups have selected scenarios as discussed in Sections 5.2.1.1 and 5.2.1.2.

Table 57. Modelled scenario for A-lamp replacements by evaluated upstream lighting measure group and retail channel, 2013-14

Evaluated Upstream Lighting Measure Group	Channel	Scenario Used
MSB CFL basic spiral ≤ 30 W	Discount	Constrained
	Drug	*
	Grocery - chain	*
	Grocery - independent	*
	Hardware	No-Discount
	Home improvement	No-Discount
	Mass merchandise	*
	Membership club	No-Discount
MSB CFL A-lamp ≤ 30 W	Discount	Constrained
	Drug	*
	Grocery - chain	Constrained
	Grocery - independent	*
	Hardware	Constrained
	Home improvement	No-Discount
	Mass merchandise	*
	Membership club	*
LED A-lamp, all wattages	Discount	No-Discount
	Drug	*
	Grocery - chain	*
	Grocery - independent	*
	Hardware	No-Discount
	Home improvement	No-Discount
	Mass merchandise	*
	Membership club	Constrained

* We did not rely on model-based NTGR directly for this channel and as such, it was not necessary to choose an appropriate model scenario.

Table 58 shows that the “no program” scenario was applied to estimate NTGR for each combination of evaluated upstream lighting measure group and retail channel for reflector lamp replacements.

Table 58. Modelled scenario for reflector lamp replacements by evaluated upstream lighting measure group and retail channel, 2013-14

Evaluated Upstream Lighting Measure Group	Channel	Scenario Used
MSB CFL reflector ≤ 30 W	Discount	*
	Drug	*
	Grocery - chain	*
	Grocery - independent	*
	Hardware	*
	Home improvement	No-Discount
	Mass merchandise	No-Discount
	Membership club	*
LED reflector, all wattages	Discount	*
	Drug	*
	Grocery - chain	*
	Grocery - independent	*
	Hardware	*
	Home improvement	No-Discount
	Mass merchandise	*
	Membership club	*

* We did not rely on model-based NTGR directly for this channel and as such, it was not necessary to choose an appropriate model scenario.

Table 59 shows the "no program" scenario was also applied to estimate NTGR for each combination of evaluated upstream lighting measure group and retail channel for globe lamp replacements.

Table 59. Modelled scenario for globe lamp replacements by evaluated upstream lighting measure group and retail channel, 2013-14

Evaluated Upstream Lighting Measure Group	Channel	Scenario Used
MSB CFL Globe ≤ 30 W	Discount	*
	Drug	*
	Grocery - chain	*
	Grocery - independent	*
	Hardware	*
	Home improvement	No-Discount
	Mass merchandise	No-Discount
	Membership club	*

* We did not rely on model-based NTGR directly for this channel and as such, it was not necessary to choose an appropriate model scenario.

As mentioned in Section 5.2.1.1, not enough data was available to model the MSB CFL high-wattage (> 30 W) measure group, so it was not necessary to choose a scenario for this evaluated upstream lighting measure group.

5.2.2 Model-based NTGR Results

This section presents the modelled NTGR by measure group and channel where model data was robust. We first discuss model-based results in Section 5.2.1.1. The results shown here will later be weighted with supplier estimates in Section 5.3.1 and Section 5.3.2.

Table 60, below, shows that the model finds relatively high NTGR for A-lamp replacement measure groups in the discount and grocery retail channels (ranging from 45%-100%). The hardware, home improvement, and membership club retail channels had NTGR ranging from 8% to 75%.

Table 60. Modelled NTGR for A-lamp replacements by evaluated upstream lighting measure group and retail channel, 2013-14

Evaluated Upstream Lighting Measure Group	Channel	Scenario Used	Modelled NTGR
MSB CFL basic spiral ≤ 30 W	Discount	Constrained	57%
	Drug	*	*
	Grocery - chain	*	*
	Grocery - independent	*	*
	Hardware	No-Discount	14%
	Home improvement	No-Discount	8%
	Mass merchandise	*	*
	Membership club	No-Discount	5%
MSB CFL A-lamp ≤ 30 W	Discount	Constrained	45%
	Drug	*	*
	Grocery - chain	Constrained	100%
	Grocery - independent	*	*
	Hardware	Constrained	75%
	Home improvement	No-Discount	8%
	Mass merchandise	*	*
	Membership club	*	*
LED A-lamp, all wattages	Discount	No-Discount	30%
	Drug	*	*
	Grocery - chain	*	*
	Grocery - independent	*	*
	Hardware	No-Discount	41%
	Home improvement	No-Discount	42%
	Mass merchandise	*	*
	Membership club	Constrained	16%

Table 61, below, displays the modelled NTGR for reflector lamp replacement lamps. The model predicts very low NTGR for these two measure groups, ranging from 2% to 31%.

Table 61. Modelled NTGR for reflector lamp replacements by evaluated upstream lighting measure group and retail channel, 2013-14

Evaluated Upstream Lighting Measure Group	Channel	Scenario Used	Modelled NTGR
MSB CFL reflector ≤ 30 W	Discount	*	*
	Drug	*	*
	Grocery - chain	*	*
	Grocery - independent	*	*
	Hardware	*	*
	Home improvement	No-Discount	2%
	Mass merchandise	No-Discount	10%
	Membership club	*	*
LED reflector, all wattages	Discount	*	*
	Drug	*	*
	Grocery – chain	*	*
	Grocery - independent	*	*
	Hardware	*	*
	Home improvement	No-Discount	31%
	Mass merchandise	*	*
	Membership club	*	*

NTGR for MSB CFL Globes ≤ 30 W are shown in Table 62. The model found that these NTGR were high relative to other measures, ranging from 46% to 85%.

Table 62. Modelled NTGR for globe lamp replacements by evaluated upstream lighting measure group and retail channel, 2013-14

Evaluated Upstream Lighting Measure Group	Channel	Scenario Used	Modelled NTGR
MSB CFL Globe ≤ 30 W	Discount	*	*
	Drug	*	*
	Grocery – chain	*	*
	Grocery - independent	*	*
	Hardware	*	*
	Home improvement	No-Discount	86%
	Mass merchandise	No-Discount	46%
	Membership club	*	*

5.2.3 Strengths and weaknesses of the model-based approach

Our model-based approach to generating NTGR used a logit model to predict consumer choice. We used preference data to estimate the logit models. We then used shelf survey data to simulate the choices consumers make. There are inherent strengths and weakness in the underlying data, the logit model, and the simulation process. We describe these in Table 63.

Table 63. Strengths and weaknesses of the model-based NTGR approach, 2013-14

Strengths	Weaknesses
• *Intercept surveys inform the model estimation:* We used information from consumers making purchasing decisions in California retail stores to estimate the model. This information is as close to real-time consumer purchasing decisions as possible. • *Directly models consumer choices:* Upstream programs attempt to influence consumer choices. Logit models are the preferred analytical method for quantifying how a program signal moves consumers from one lamp technology to another. • *Captures differences in shopper populations by retail channel:* The model specification captures differences in choice-making among consumers by income group, homeowner versus renter status, and planned versus impulse purchasing decisions. The model specification is sensitive to differences in the population that shops in retail stores from channel to channel (capturing, for example, differences among shoppers the discount channel versus the home improvement channel). • *Simulation based on up-to-date retail stocking information:* We built the simulation using shelf survey data from a representative sample of California retail stores that sold replacement lamps during the 2013-14 program period. These data record the distribution of lamp models and prices at each store, and these ground our analyses in the choices facing consumers during the program period.	• *Preference data may reflect biases that would not be present in sales data:* The evaluation team is unaware of a comprehensive data source representing retail lamp sales from all of California's major lighting retailers. As such, we cannot confirm the extent to which survey respondents' stated choices under different conditions (e.g., whether they still would have purchased the same lamp when we altered their available options in our choice sets) reflect actual retail sales volumes. • *The model does not explicitly represent sales volume:* The model predicts market shares. As such, the model does not endogenously account for the different volumes program shipments. • *The model does not comprehensively address substitution between program and non-program lamps:* Some stores (such as those in the home improvement channel) have more non-program lamps than program-discounted lamps. The model does not handle this market situation as well as situations in which the volume differences are less skewed. • *The shelf survey visits capture a point in time:* Although our shelf survey data represent the best-available information regarding lamp stock available to consumers among California retailers during the 2013-14 program, the data still reflect the points in time during which the data is collected. Our store visits may not always coincide with all of the different types of program activity and thus cannot completely reflect all of the program's shipments of the various evaluated upstream lighting measure groups to different channels (and to individual stores within each channel) at different times throughout the two-year program period.

5.3 Final NTGR

In this section we combine the model and supplier NTGR results and present the final NTGR estimates for evaluated upstream lighting measure groups by retail channel across IOUs, and by measure group for each IOU. APPENDIX I includes modelled NTGR and confidence intervals. In addition, the appendix includes tables for each evaluated upstream lighting measure group by channel along with the respective quantities of program-discounted lamp shipments by IOU (Table 106 through Table 112 in APPENDIX I).

5.3.1 Weighted model and supplier NTGR

Where modelled NTGR estimates were available, we calculated combined NTGR as a weighted average by applying a 70% weight to modelled results and a 30% weight to supplier results. The modeling approach is based on a richer data set, less subject to respondent bias, and better able to account for varying price and substitution between technologies. At the same time, supplier responses account for nearly all program-discounted lamps and capture some effects not reflected in the model-based estimates. Thus we assigned a higher weight to the model-based NTGR results compared to the supplier-based NTGR results. Table 64 shows the modelled, supplier, and combined NTGR for lamps in the A-lamp replacement category where we applied model-based results directly (as opposed to imputing model-based results). The modelled results shown are calculated from either the Constrained or No-Discount model scenario as determined in Section 5.2.1.3.

Table 64. NTGR for A-lamp replacements by retail channel and evaluated upstream lighting measure group, 2013-14

Evaluated Upstream Lighting Measure Group	Channel	Scenario Used	Modelled NTGR	Supplier NTGR	Combined NTGR
MSB CFL basic spiral ≤ 30 W	Discount	Constrained	57%	84%	66%
	Drug	*	*	*	*
	Grocery - chain	*	*	*	*
	Grocery - independent	*	*	*	*
	Hardware	No-Discount	14%	54%	26%
	Home improvement	No-Discount	8%	53%	22%
	Mass merchandise	*	*	*	*
	Membership club	No-Discount	5%	41%	15%
MSB CFL A-lamp ≤ 30 W	Discount	Constrained	45%	86%	57%
	Drug	*	*	*	*
	Grocery - chain	Constrained	100%	94%	98%
	Grocery - independent	*	*	*	*
	Hardware	Constrained	75%	66%	72%
	Home improvement	No-Discount	8%	65%	25%
	Mass merchandise	*	*	*	*
	Membership club	*	*	*	*
LED A-lamp, all wattages	Discount	No-Discount	30%	69%	42%
	Drug	*	*	*	*
	Grocery - chain	*	*	*	*
	Grocery - independent	*	*	*	*
	Hardware	No-Discount	41%	56%	45%
	Home improvement	No-Discount	42%	44%	43%
	Mass merchandise	*	*	*	*
	Membership club	Constrained	16%	65%	31%

* We did not rely on model-based NTGR directly for this channel

Table 65 shows the modelled, supplier, and combined NTGR for lamps in the reflector lamp replacement category where we had model-based results to draw from directly (as opposed to imputing model-based results).

Table 65. NTGR for reflector lamp replacements by retail channel and evaluated upstream lighting measure group, 2013-14

Evaluated Upstream Lighting Measure Group	Channel	Scenario Used	Modelled NTGR	Supplier NTGR	Combined NTGR
MSB CFL reflector ≤ 30 W	Discount	*	*	*	*
	Drug	*	*	*	*
	Grocery - chain	*	*	*	*
	Grocery - independent	*	*	*	*
	Hardware	*	*	*	*
	Home improvement	No-Discount	2%	62%	20%
	Mass merchandise	No-Discount	10%	67%	27%
	Membership club	*	*	*	*
LED reflector, all wattages	Discount	*	*	*	*
	Drug	*	*	*	*
	Grocery – chain	*	*	*	*
	Grocery - independent	*	*	*	*
	Hardware	*	*	*	*
	Home improvement	No-Discount	31%	46%	36%
	Mass merchandise	*	*	*	*
	Membership club	*	*	*	*

* We did not rely on model-based NTGR directly for this channel

Table 66 shows the modelled, supplier, and final NTGR for lamps in the reflector lamp replacement category where we relied upon model-based results directly (as opposed to imputing model-based results).

Table 66. NTGR for globe lamp replacements by retail channel and evaluated upstream lighting measure group, 2013-14

Evaluated Upstream Lighting Measure Group	Channel	Scenario Used	Modelled NTGR	Supplier NTGR	Combined NTGR
MSB CFL Globe ≤ 30 W	Discount	*	*	*	*
	Drug	*	*	*	*
	Grocery – chain	*	*	*	*
	Grocery - independent	*	*	*	*
	Hardware	*	*	*	*
	Home improvement	No-Discount	86%	62%	79%
	Mass merchandise	No-Discount	46%	67%	52%
	Membership club	*	*	*	*

* We did not rely on model-based NTGR directly for this channel

As mentioned in Section 5.2.1.1, not enough data was available to model the MSB CFL high-wattage (> 30 W) measure group, so we did not calculate model-based NTGR for lamps in this measure group.

5.3.2 Imputed NTGR

The model-based NTGR shown in Section 5.2.3 represent the combined estimates for the upstream lighting measure groups and retail channels shown in the table. For the others, we used the model outputs to estimate the relationship between the supplier-based NTGR and the combined NTGR. We divided the average combined NTGR by the average supplier NTGR from Section 5.1.2 for each evaluated upstream lighting measure group. We used this factor to impute a combined NTGR by applying it to the supplier estimate for each combination of evaluated upstream lighting measure group and retail channel for which model-based results were not rigorous enough to use.

For example, for MSB CFL basic spiral ≤ 30 W, we averaged the combined NTGR across the discount, hardware, home improvement, and membership club channels (because we relied upon the no-discount scenario to generate market shift estimates in each of these channels – so, 66% + 26%+ 22% + 15% divided by 4) and divided this by the average of the supplier NTGR estimates for the same four channels (84% + 54% +53% + 41% divided by 4) to yield the imputation factor of 0.55. Where we had less than two usable model-based NTGR, we used a comparable measure group for the imputation factor. With this approach, we applied the CFL reflector imputation factor of 0.36 to LED reflectors. For CFL globes, we applied the CFL A-lamp imputation factor, as these lamps are the most comparable. Because the majority of the high-wattage CFLs were basic spiral CFLs, DNV GL considered the most representative lamp for a high-wattage CFL to be a basic spiral CFL. The basic spiral CFL imputation factor high rigor. Table 67 shows the imputation factors by retail channel, replacement lamp category, and evaluated upstream lighting measure group.

Table 67. Imputation factors by retail channel, replacement lamp category, and evaluated upstream lighting measure group, 2013-14

Evaluated Upstream Lighting Measure Group	Channel	Combined NTGR	Supplier NTGR	Imputation Factor
A-lamp Replacement Category				
MSB CFL basic spiral ≤ 30 W	Discount	66%	84%	0.55
	Hardware	26%	54%	
	Home improvement	22%	53%	
	Membership club	15%	41%	
MSB CFL A-lamp ≤ 30 W	Discount	57%	86%	0.81
	Grocery - chain	98%	94%	
	Hardware	72%	66%	
	Home improvement	25%	65%	
LED A-lamp, all wattages*	Discount	42%	69%	0.69
	Hardware	45%	56%	
	Home improvement	43%	44%	
	Membership club	31%	65%	
Reflector Lamp Replacement Category				
MSB CFL reflector	Home improvement	20%	62%	0.36
	Mass merchandise	27%	67%	
LED reflector	Home improvement	36%	46%	0.36
Globe Lamp Replacement Category				
MSB CFL globe ≤ 30 W	Home improvement	79%	62%	0.81
	Mass merchandise	52%	67%	

As explained, for each combination of evaluated upstream lighting measure group and retail channel for which shopper intercept survey sample sizes were too small or where program activity types in the model did not represent activity types in the tracking data, we applied the imputation factor to supplier-based results to yield a combined NTGR. Within a measure group, we applied these factors at the retail channel level. Table 68 shows the final imputation factors for each measure group. We present the combined NTGR for all evaluated upstream lighting measure groups by retail channel in Section 5.3.3.

Table 68. Final imputation factors by evaluated upstream lighting measure group, 2013-14

Evaluated Upstream Lighting Measure Group	Imputation Factor
MSB CFL basic spiral ≤ 30 W	0.55
MSB CFL A-lamp ≤ 30 W	0.81
LED A-lamp, all wattages	0.69
MSB CFL reflector ≤ 30 W	0.36
LED reflector, all wattages	0.36
MSB CFL globe ≤ 30 W	0.81
MSB CFL high-wattage (> 30 W)	0.55

5.3.3 Combined NTGR estimates by measure group and channel

Table 69 below shows all NTGR for evaluated upstream lighting measure groups by channel in the A-lamp replacement category.

Table 69. NTGR for A-lamp replacement category by evaluated upstream lighting measure group and retail channel, 2013-14

Evaluated Upstream Lighting Measure Group	Channel	Applied Method	Total Program Lamps	Model + Supplier NTGR	Supplier NTGR	Imputation Factor	Combined NTGR
MSB CFL basic spiral ≤ 30 W	Discount	Modelled	250,335	66%	N/A	N/A	66%
	Drug Store	Imputed	38,202	N/A	63%	55%	35%
	Grocery - chain	Imputed	16,652	N/A	12%	55%	7%**
	Grocery - independent	Imputed	2,104	N/A	100%	55%	55%
	Hardware	Modelled	86,217	26%	N/A	N/A	26%
	Home improvement	Modelled	2,013,107	22%	N/A	N/A	22%
	Mass merchandise	Imputed	406,343	N/A	59%	55%	33%
	Membership club	Modelled	751,655	15%	N/A	N/A	15%
MSB CFL A-lamp ≤ 30 W	Discount	Modelled	1,508,936	57%	N/A	N/A	57%
	Drug Store	Imputed	189,043	N/A	62%	81%	50%
	Grocery - chain	Modelled	417,570	98%	N/A	N/A	98%
	Grocery - independent	Imputed	588,398	N/A	85%	81%	69%
	Hardware	Modelled	105,986	72%	N/A	N/A	72%
	Home improvement	Modelled	225,009	25%	N/A	N/A	25%
	Mass merchandise	Imputed	33,384	N/A	67%	81%	54%
	Membership club	Imputed	363	N/A	42%	81%	34%
LED A-lamps, all wattages	Discount	Modelled	2,538	42%	N/A	N/A	42%
	Drug Store*	N/A					
	Grocery - chain	Imputed	3,720	N/A	100%	69%	69%
	Grocery - independent	Imputed	3,066	N/A	100%	69%	69%
	Hardware	Modelled	57,957	45%	N/A	N/A	45%
	Home improvement	Modelled	388,653	43%	N/A	N/A	43%
	Mass merchandise*	Ex Ante	15	N/A	N/A	N/A	85%
	Membership club	Modelled	214,985	31%	N/A	N/A	31%

* Drug stores had no shipments of LED lamps and mass merchandise only received a quantity of 15 LED lamps, so ex ante values were used for these combinations of retail channel and evaluated upstream lighting measure groups.
** The final NTGR of 7% in the chain grocery channel was an anomalous finding that was driven by low supplier estimates and low model results. There were no apparent reasons to reject the result, but it is worth noting its status as an outlier.

Below, Table 70 displays the NTGR for the reflector, globe, and high-wattage CFL measure groups.

Table 70. NTGR for reflector, globe, and high wattage CFL lamp replacement categories by evaluated upstream lighting measure group and retail channel, 2013-14

Evaluated Upstream Lighting Measure Group	Channel	Applied Method	Total Program Lamps	Model + Supplier NTGR	Supplier NTGR	Imputation Factor	Combined NTGR
MSB CFL reflector ≤ 30 W	Discount	Imputed	808,394	N/A	80%	36%	29%
	Drug Store	Imputed	131,766	N/A	62%	36%	22%
	Grocery - chain	Imputed	263,263	N/A	94%	36%	34%
	Grocery - independent	Imputed	507,410	N/A	85%	36%	31%
	Hardware	Imputed	124,968	N/A	66%	36%	24%
	Home improvement	Modelled	578,865	20%	N/A	N/A	20%
	Mass merchandise	Modelled	21,225	27%	N/A	N/A	27%
	Membership club	Imputed	601,208	N/A	31%	36%	11%
LED reflector, all wattages	Discount*	Ex Ante	813	N/A	N/A	N/A	69%
	Drug Store**	N/A	N/A	N/A	N/A	N/A	N/A
	Grocery - chain	Imputed	3,240	N/A	100%	36%	36%
	Grocery - independent	Imputed	2,348	N/A	100%	36%	36%
	Hardware	Imputed	49,100	N/A	97%	36%	35%
	Home improvement	Modelled	180,926	36%	N/A	N/A	36%
	Mass merchandise*	Ex Ante	2	N/A	N/A	N/A	85%
	Membership club	Imputed	1,312,320	N/A	72%	36%	26%
MSB CFL globe ≤ 30 W	Discount	Imputed	59,646	N/A	79%	81%	64%
	Drug Store	Imputed	400	N/A	62%	81%	50%
	Grocery - chain	Imputed	25,628	N/A	94%	81%	76%
	Grocery - independent	Imputed	112,550	N/A	85%	81%	69%
	Hardware	Imputed	10,950	N/A	66%	81%	54%
	Home improvement	Modelled	30,150	79%	N/A	N/A	79%
	Mass merchandise	Modelled	21,073	52%	N/A	N/A	52%
	Membership club**	N/A	N/A	N/A	N/A	N/A	N/A
MSB CFL High-wattage (> 30 W)	Discount	Imputed	1,550,204	N/A	80%	55%	45%
	Drug Store	Imputed	21,677	N/A	62%	55%	34%
	Grocery - chain	Imputed	1,108,106	N/A	94%	55%	52%
	Grocery - independent	Imputed	1,052,306	N/A	85%	55%	47%
	Hardware	Imputed	140,842	N/A	66%	55%	37%
	Home improvement	Imputed	154,524	N/A	73%	55%	40%
	Mass merchandise	Imputed	4,350	N/A	65%	55%	36%
	Membership club**	N/A	N/A	N/A	N/A	N/A	N/A

*Discount and mass merchandise channels had minimal shipments of LED reflectors and no supplier or model data were available. We used ex ante values in these instances.
**The drug channel did not have any LED reflector lamps and the membership club had no MSB CFL globe ≤ 30 W or MSB CFL high-wattage (> 30 W) so we calculated no NTGR in these instances.

5.3.4 Final NTGR by measure group and IOU

The NTGR results presented thus far are specific to each measure group and retail channel. To create an IOU-specific NTGR, we consider each measure group separately for each IOU. To calculate an IOU-specific NTGR for a given measure group, we weighted each retail-channel NTGR for that measure group to reflect the respective IOU's channel distribution for that measure group. Table 106 through Table 112 in Appendix I present these quantities for each measure group by IOU and retail channel. Table 71 shows the final 2013-14 NTGR for each evaluated upstream lighting measure group IOU by IOU. Across all IOUs, CFL A-lamps ≤ 30 W and LED A-lamps of all wattages exhibited the highest NTGR and CFL reflectors exhibited the lowest NTGR. As mentioned previously, PG&E did not offer incentives for CFL globe lamps ≤ 30 W through its 2013-14 program, but the other two IOUs did.

These results should be considered in the context of this evaluation. Many of the drivers behind them are specific to this program cycle and change over time. For example, program activity types, retail and program pricing heavily influence NTGR, varied throughout the program, and will continue to do so moving forward.

Table 71. Final overall NTGR by IOU and evaluated upstream lighting measure group, 2013-14

Evaluated Upstream Lighting Measure Group	IOU		
	PG&E	SCE	SDG&E
MSB CFL basic spiral ≤ 30 W	20%	26%	27%
MSB CFL A-lamp ≤ 30 W	53%	68%	52%
LED A-lamp, all wattages	40%	42%	35%
MSB CFL reflector ≤ 30 W	18%	27%	18%
LED Reflector, all wattages	27%	28%	28%
MSB CFL globe ≤ 30 W*	N/A	68%	67%
MSB CFL high-wattage (> 30 W)	47%	45%	39%

* PG&E included no measures from this measure group in its 2014-14 upstream lighting program.

The NTGR in Table 71 are lower than for similar evaluated upstream lighting measure groups in previous evaluations. This is a consequence of two effects:

- **Cross-measure substitution effects within the program.** The basic program theory is that providing incentives for a lamp will pull sales away from non-discounted lamps and toward program-discounted lamps. The upstream lighting program provided discounts for lamps in multiple measure groups in many retail channels and as such, incentives for one program-discounted upstream lighting measure group pull sales away one or more other program-discounted upstream lighting measure groups.
- **Program / non-program substitution effects.** The program also competed with non-program lamps. Unlike during the 2010-12 upstream lighting program, most channels stocked both program and non-program lamps. Shifting sales between program and functionally non-program program lamps does not result in savings.

These effects lead to (for example) incentives for CFLs shifting sales away from LED lamps. A sales-based approach requires crediting the program for additional efficient technology sales and debiting the program for sales movements away from efficient technologies.

It is important to note that channels-level program impact depends not just on the NTGR but also on the costs of operating in these channels compared to others. At the same time, the fact that a large proportion of lighting product moves through these channels doesn't by itself make it worthwhile to offer a lot of program lamps there if the discounts aren't having much effect, regardless of market transformation goals. For example, the results from this evaluation suggest that even though substantial CFL sales occur in the home improvement channel, many of these sales would have occurred in the absence of the program. Alternatively, despite fewer total lamp sales occurring in the discount channel, the NTGR suggests that the program was more likely to increase CFL sales.

Table 72 shows the final NTGR for 2010-12 carry-over measures included in the IOUs' 2013-14 upstream lighting program savings claims. As mentioned previously, SDG&E reported no 2010-12 carry-over measures in its 2013-14 program claims. In all instances, between the final NTGR for PG&E and SCE, SCE's NTGR were higher in each of the three evaluated upstream lighting measure groups carried over from 2010-12.

Table 72. Carry-over 2010-12 NTGR by IOU and evaluated upstream lighting measure group, 2013-14

Evaluated Upstream Lighting Measure Group	IOU		
	PG&E	SCE	SDG&E
MSB CFL basic spiral ≤ 30 W	60%	66%	*
MSB CFL A-lamp ≤ 30 W	72%	82%	*
MSB CFL reflector ≤ 30 W	55%	62%	*

* SDG&E reported no 2010-12 carry-over measures in its 2013-14 savings claims.

6 NET SAVINGS

This section describes the results of the net impacts assessment for the California IOUs' 2013-14 upstream lighting programs. We determined net impacts by applying the NTGR discussed in Section 5 (which reflect the portion of IOU-discounted lamps that would not have been sold, purchased or installed had it not been for the program) to estimates of gross savings from Section 4. Table 73 shows the ante and ex post net savings and net realization rates by evaluated upstream lighting measure group across all IOUs for the 2013-14 period including 2010-12 carry-over measures.

Net savings realization rates differ by measure group and IOU for many of the same reasons that gross savings realization rates differ. These include differences in ex ante and ex post methodologies in calculating delta watts, installation rate, and residential/non-residential split (Section 4.8). Additionally, the IOU-specific blend of channel and measure group NTGR will vary depending on each IOU's respective channel distribution of lamp shipments. Table 106 through Table 112 in Appendix I present these quantities for each measure group by IOU and retail channel.

Table 73. Ex ante and ex post net savings and realization rates by evaluated upstream lighting measure group across all IOUs, 2013-14 and 2010-12 carry-over measures

All IOUs Evaluated Upstream Lighting Measure Group	Ex Ante			Ex Post			Net Realization Rates		
	kWh	kW	therms	kWh	kW	therms	kWh	kW	therms
2013-14									
MSB CFL basic spiral ≤ 30 W	41,383,612	5,456	-624,695	31,045,451	4,267	-469,230	75%	78%	75%
MSB CFL A-lamp ≤ 30 W	45,475,166	6,297	-641,380	71,691,649	9,968	-1,052,368	158%	158%	164%
MSB CFL reflector ≤ 30 W	55,254,150	7,297	-827,737	31,601,578	4,387	-472,647	57%	60%	57%
MSB CFL globe ≤ 30 W	4,012,922	560	-51,740	4,347,308	742	-53,074	108%	133%	103%
MSB CFL high-wattage (> 30 W)	152,035,735	21,435	-2,051,395	129,522,837	18,541	-1,806,719	85%	86%	88%
LED A-lamp, all wattages	9,604,546	1,294	-149,298	7,802,053	1,055	-120,138	81%	82%	80%
LED reflector, all-wattages	28,819,974	4,047	-452,553	16,142,601	2,115	-268,319	56%	52%	59%
Overall	**336,586,106**	**46,385**	**-4,798,799**	**292,153,478**	**41,076**	**-4,242,494**	**87%**	**89%**	**88%**
2010-12									
MSB CFL basic spiral ≤ 30 W	59,192,451	8,493	-1,513,136	59,277,253	8,760	-1,076,805	100%	103%	71%
MSB CFL A-lamp ≤ 30 W	54,472,293	8,410	-255,563	56,341,457	8,347	-911,712	103%	99%	357%
MSB CFL reflector ≤ 30 W	19,874,518	2,817	-427,722	18,542,026	2,511	-345,902	93%	89%	81%
Overall	**133,539,262**	**19,720**	**-2,196,421**	**134,160,737**	**19,617**	**-2,334,419**	**100%**	**99%**	**106%**

6.1.1 PG&E

Table 74 shows PG&E's ante and ex post net savings and net realization rates by evaluated upstream lighting measure group across all IOUs for the 2013-14 period including 2010-12 carry-over measures. Table 75 shows PG&E's 2013-14 ex post net savings and realization rates by measure group and sector (residential and nonresidential).

Table 74. PG&E ex ante and ex post net savings and realization rates by evaluated upstream lighting group, 2013-14 and 2010-12 carry-over measures

PG&E Evaluated Upstream Lighting Measure Group	Ex Ante			Ex Post			Net Realization Rates		
	kWh	kW	therms	kWh	kW	therms	kWh	kW	therms
2013-14									
MSB CFL basic spiral ≤ 30 W	11,184,360	1,507	-211,823	7,255,507	1,006	-143,115	65%	67%	68%
MSB CFL A-lamp ≤ 30 W	7,114,883	960	-134,374	10,800,725	1,478	-205,170	152%	154%	153%
MSB CFL reflector ≤ 30 W	7,330,107	958	-144,580	3,977,300	535	-79,834	54%	56%	55%
MSB CFL globe ≤ 30 W	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MSB CFL high-wattage (> 30 W)	8,575,678	1,166	-160,018	10,890,684	1,556	-203,388	127%	133%	127%
LED A-lamp, all wattages	3,480,121	463	-66,714	2,900,051	396	-54,646	83%	85%	82%
LED Reflector, all wattages	12,514,162	1,665	-241,047	6,658,075	854	-136,684	53%	51%	57%
Overall	**50,199,311**	**6,719**	**-958,556**	**42,482,342**	**5,825**	**-822,837**	**85%**	**87%**	**86%**
2010-12									
MSB CFL basic spiral ≤ 30 W	59,192,451	8,493	-1,513,136	59,277,253	8,760	-1,076,805	100%	103%	71%
MSB CFL A-lamp ≤ 30 W	9,597,528	1,358	-255,563	12,571,421	1,638	-254,705	131%	121%	100%
MSB CFL reflector ≤ 30 W	16,123,581	2,284	-427,722	14,900,868	2,019	-294,873	92%	88%	69%
Overall	**84,913,560**	**12,134**	**-2,196,421**	**86,749,542**	**12,417**	**-1,626,383**	**102%**	**102%**	**74%**

Table 75. PG&E ex post net savings by evaluated upstream lighting measure group and sector, 2013-14

PG&E Evaluated Upstream Lighting Measure Group	Annual Energy Savings (kWh)		Peak Demand Reductions (kW)		Gas Impact (Therms)	
	Residential	Nonresidential	Residential	Nonresidential	Residential	Nonresidential
MSB CFL basic spiral ≤ 30 W	5,410,198	1,845,309	635	371	-132,603	-10,512
MSB CFL A-lamp ≤ 30 W	7,635,227	3,165,498	842	636	-187,138	-18,033
MSB CFL reflector ≤ 30 W	3,039,198	938,102	347	188	-74,490	-5,344
MSB CFL globe ≤ 30 W	N/A	N/A	N/A	N/A	N/A	N/A
MSB CFL high-wattage (> 30 W)	7,513,239	3,377,445	878	679	-184,148	-19,240
LED A-lamp, all wattages	2,026,530	873,521	220	176	-49,670	-4,976
LED Reflector, all wattages	5,249,275	1,408,800	571	283	-128,659	-8,025
Overall	**30,873,667**	**11,608,675**	**3,493**	**2,333**	**-756,708**	**-66,130**

6.1.2 SCE

Table 76 shows SCE's ante and ex post net savings and net realization rates by evaluated upstream lighting measure group across all IOUs for the 2013-14 period including 2010-12 carry-over measures. Table 77 shows SCE's 2013-14 ex post net savings and realization rates by measure group and sector (residential and nonresidential).

Table 76. SCE ex ante and ex post net savings and realization rates by evaluated upstream lighting measure group, 2013-14 and 2010-12 carry-over measures

SCE Evaluated Upstream Lighting Measure Group	Ex Ante			Ex Post			Net Realization Rates		
	kWh	kW	therms	kWh	kW	therms	kWh	kW	therms
2013-14									
MSB CFL basic spiral ≤ 30 W	8,781,528	1,240	-118,968	7,938,256	1,139	-113,032	90%	92%	95%
MSB CFL A-lamp ≤ 30 W	33,763,791	4,773	-441,602	53,600,393	7,506	-747,498	159%	157%	169%
MSB CFL reflector ≤ 30 W	41,960,601	5,718	-584,480	25,061,657	3,510	-359,287	60%	61%	61%
MSB CFL globe ≤ 30 W	3,550,542	499	-45,635	3,794,758	655	-45,987	107%	131%	101%
MSB CFL high-wattage (> 30 W)	143,290,262	20,250	-1,888,618	118,439,374	16,958	-1,600,804	83%	84%	85%
LED A-lamp, all wattages	2,519,008	349	-35,800	2,710,799	391	-33,811	108%	112%	94%
LED reflector, all wattages	9,747,903	1,397	-139,833	7,278,037	987	-100,334	75%	71%	72%
Overall	**243,613,634**	**34,226**	**-3,254,937**	**218,823,275**	**31,146**	**-3,000,754**	**90%**	**91%**	**92%**
2010-12									
MSB CFL basic spiral ≤ 30 W	44,874,765	7,053	0	43,770,037	6,709	-657,006	98%	95%	N/A
MSB CFL A-lamp ≤ 30 W	3,750,937	533	0	3,641,158	492	-51,029	97%	92%	N/A
MSB CFL reflector ≤ 30 W	85,914	12	0	83,640	12	-1,203	97%	93%	N/A
Overall	**48,711,616**	**7,598**	**0**	**47,494,835**	**7,212**	**-709,239**	**98%**	**95%**	**N/A**

Table 77. SCE ex post net savings by evaluated upstream lighting upstream measure group and sector, 2013-14

SCE Evaluated Upstream Lighting Measure Group	Annual Energy Savings (kWh)		Peak Demand Reductions (kW)		Gas Impact (Therms)	
	Residential	Nonresidential	Residential	Nonresidential	Residential	Nonresidential
MSB CFL basic spiral ≤ 30 W	6,063,132	1,875,125	748	391	-107,663	-5,369
MSB CFL A-lamp ≤ 30 W	39,884,143	13,716,250	4,647	2,859	-708,223	-39,275
MSB CFL reflector ≤ 30 W	19,305,326	5,756,330	2,310	1,200	-342,805	-16,483
MSB CFL globe ≤ 30 W	2,358,150	1,436,608	355	299	-41,874	-4,114
MSB CFL high-wattage (> 30 W)	84,711,909	33,727,465	9,928	7,030	-1,504,230	-96,574
LED A-lamp, all wattages	1,749,000	961,798	191	200	-31,057	-2,754
LED reflector, all wattages	5,337,464	1,940,573	582	404	-94,777	-5,557
Overall	**159,409,125**	**59,414,149**	**18,762**	**12,384**	**-2,830,629**	**-170,125**

6.1.3 SDG&E

Table 78 shows SDG&E's ante and ex post net savings and net realization rates by evaluated upstream lighting measure group across all IOUs for the 2013-14 period (note that SDG&E did not have any 2010-12 carry-over measures). Table 79 shows SDG&E's 2013-14 ex post net savings and realization rates by measure group and sector (residential and nonresidential).

Table 78. SDG&E ex ante and ex post net savings and realization rates by evaluated upstream lighting measure group, 2013-14 and 2010-12 carry-over measures[1]

SDG&E Evaluated Upstream Lighting Measure Group	Ex Ante			Ex Post			Net Realization Rates		
	kWh	kW	therms	kWh	kW	therms	kWh	kW	therms
2013-14									
MSB CFL basic spiral ≤ 30 W	21,417,724	2,709	-293,904	15,851,689	2,122	-213,083	74%	78%	73%
MSB CFL A-lamp ≤ 30 W	4,596,493	564	-65,404	7,290,530	984	-99,699	159%	175%	152%
MSB CFL reflector ≤ 30 W	5,963,442	622	-98,677	2,562,621	342	-33,526	43%	55%	34%
MSB CFL globe ≤ 30 W	462,380	60	-6,105	552,550	88	-7,087	120%	145%	116%
MSB CFL high-wattage (> 30 W)	169,795	18	-2,759	192,779	26	-2,526	114%	146%	92%
LED A-lamp, all wattages	3,605,417	482	-46,784	2,191,204	268	-31,681	61%	56%	68%
LED reflector, all wattages	6,557,909	986	-71,673	2,206,489	274	-31,301	34%	28%	44%
Overall	**42,773,161**	**5,440**	**-585,306**	**30,847,862**	**4,105**	**-418,902**	**72%**	**75%**	**72%**

[1] SDG&E had no 2010-2012 carry-over measures for upstream lighting in 2013-14

Table 79. SDG&E ex post net savings by evaluated upstream lighting measure group and sector, 2013-14

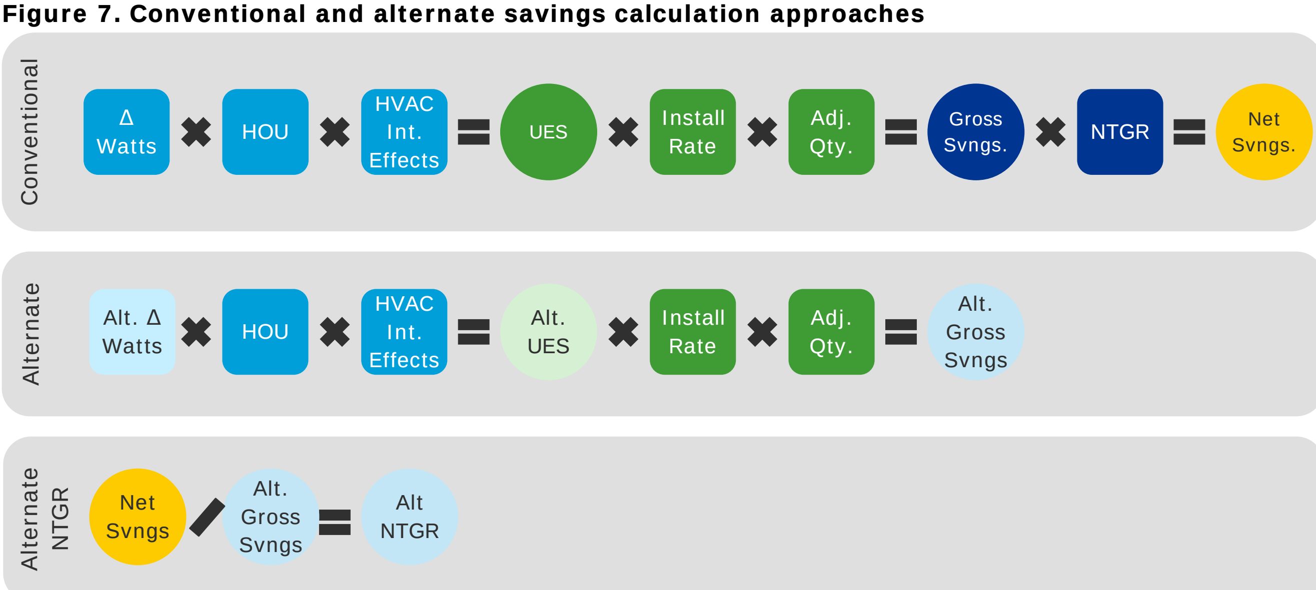
SDG&E Evaluated Upstream Lighting Measure Group	Annual Energy Savings (kWh)		Peak Demand Reductions (kW)		Gas Impact (Therms)	
	Residential	Nonresidential	Residential	Nonresidential	Residential	Nonresidential
MSB CFL basic spiral ≤ 30 W	11,576,533	4,275,155	1,216	906	-202,308	-10,775
MSB CFL A-lamp ≤ 30 W	5,437,816	1,852,714	591	393	-95,030	-4,669
MSB CFL reflector ≤ 30 W	1,809,839	752,783	183	160	-31,628	-1,897
MSB CFL globe ≤ 30 W	380,733	171,817	52	36	-6,654	-433
MSB CFL high-wattage (> 30 W)	136,422	56,357	14	12	-2,384	-142
LED A-lamp, all wattages	1,749,092	442,112	174	94	-30,567	-1,114
LED reflector, all wattages	1,721,081	485,408	171	103	-30,077	-1,223
Overall	**22,811,514**	**8,036,347**	**2,402**	**1,703**	**-398,648**	**-20,254**

7 ALTERNATE SAVINGS ESTIMATION APPROACH

An ongoing challenge in planning and evaluating California's residential and upstream lighting programs is uncertainty regarding the lamp technologies replaced by program-discounted lamps. Sections 1 though 6 of this report focus on the methodology and results associated with the conventional approach to estimating gross savings, the NTGR, and net savings. The alternate approach assumes that the IOUs should not claim energy savings for energy-efficient lamps that replace other energy-efficient lamps (e.g., CFLs that replace other CFLs) because there is unlikely to be any efficiency gain in those cases. In 2015, the CPUC ED issued a decision that removed the CFL-to-CFL savings from the ex ante gross savings estimate.[51] Under direction of Commission staff, DNV GL worked with the CPUC's upstream and residential downstream program evaluation project manager, its lighting program evaluation consultant, and the ex ante team to develop a savings estimation methodology that accommodates this change. This section of the report provides a preview of the approach that will be utilized in subsequent impact evaluations in place of the conventional approaches described in previous report sections.

The overall approach to estimating the alternate gross savings and NTGR for 2013-14 relies upon one key assumption: that total net savings stay the same regardless of whether CFL-to-CFL replacements are captured in gross savings or in the NTGR. We use this assumption because the conventional method for calculating the NTGR implicitly captures the issue of whether or not CFL-to-CFL replacements would have regressed to incandescent lamps in the absence of the program. Because there is no existing method for calculating a NTGR that does not include CFL-to-CFL replacements, the alternate method algebraically backs out the NTGR (Figure 7).

Figure 7. Conventional and alternate savings calculation approaches



51 CPUC ED, 2015b.

7.1 Gross savings – alternate approach

The approach to calculating alternate ex post gross savings is the same as the conventional ex post gross savings described in Section 4.1. The alternate approach relies on a different calculation for estimating delta watts than the conventional approach, which alters the UES.

7.1.1 HOU – alternate approach

The alternate approach relies upon the HOU estimates described in Section 4.2 above.

7.1.2 Delta watts – alternate approach

The alternate ex post methodology uses an adjusted kW_{base} estimate for each evaluated measure group. The alternate baseline wattage takes into account the efficient lamps that are replacing other efficient lamps by raising the baseline wattage. We considered CFL-to-CFL replacements and CFL-to-LED replacements as efficient-to-efficient lamp replacements.

DNV GL estimated the ratio of efficient lamps replacing efficient lamps based on the results of the 2015 consumer telephone survey. The conventional approach for calculating delta watts for LED lamps already accounts for LED lamps replacing CFLs, as the baseline wattage is an average of all incandescent lamps and CFLs. Therefore, an alternate estimate for LED lamps would only be necessary if there were concern regarding frequent LED-to-LED replacements. Because LED lamps are relatively new in the market, we did not calculate an alternate estimate to account for LED-to-LED replacements. We subsequently used the alternate delta watts estimate to calculate an alternate UES and alternate ex post gross savings.

To remove efficient-to-efficient lamp replacements in the alternate ex post approach, we adjusted the baseline wattage to include some efficient lamps. The 2015 consumer telephone survey provided information regarding the extent of efficient-to-efficient lamp replacement as well as the specific types of measures involved. While consumer telephone survey data is not an ideal source of measure-specific replacement estimates due to the difficulty of obtaining exact technology and quantity information from respondents, the need to address this issue was not raised until after the evaluation was in progress. Lacking another source for this information, and given the robust sample size for this source, we applied the survey-based estimates as indicators of lamp replacement behavior in this evaluation for the alternate approach.

Table 80 shows consumer telephone survey results for respondents who reported that they installed at least one CFL during 2013 and/or 2014 and who were able to identify the replaced lamp technologies and quantities (415 respondents). As shown, consumers reported that 24% of CFLs purchased in this timeframe replaced other CFLs and 8% replaced LED lamps resulting in a combined 33% efficient-to-efficient lamp replacement rate between 2013 and 2014.

In addition, according to the ex ante update that addressed CFL-to-CFL replacements, 40% of CFL-to-CFL replacements are likely to revert to incandescent lamps in the absence of support from IOU programs.[52] Thus, an additional 40% of the 33% efficient-to-efficient replacements are considered to part of the inefficient baseline under the alternate methodology (13.2%). If 13.2% of CFLs replaced efficient lamps but would have replaced inefficient lamps in the absence of the program, we can subtract 13.2% from the 33% of CFLs replacing CFLs to arrive at 19.8%. In other words, 19.8% of CFLs replaced efficient lamps and would have done so in the absence of the program. Conversely, we can add 13.2% to the estimate of CFLs that replaced inefficient lamps (67%), which would yield 80.2%. This calculation leads to a blended baseline of

[52] CPUC ED, 2015b

80.2% efficient-to-inefficient lamps and 19.8% efficient-to-efficient lamps. We calculated the 2013-14 alternate baseline wattage for CFLs as the average of the incandescent and CFL wattages from the 2012 CLASS weighted at 80.2% and 19.8%, respectively based on these survey results.[53]

Table 80. Previously installed lamps (and empty/new sockets) as a percentage of CFLs installed in 2013-14 (2015 consumer telephone survey)

Lamp Technology Replaced	Percent of CFLs Installed in 2013-2014 (n = 4,295)
Incandescent	49%
Halogen	14%
Empty socket	3%
New socket	1%
Other technology	<1%
CFL	24%
LED	8%
Total	**100%**

Note: Column values may not sum to total because of rounding.
The number of respondents is 415. These respondents represented 4,295 lamps.

Table 81 shows the values used to calculate the alternate baselines by measure group. Consider the MSB basic spiral CFL ≤ 30 W for PG&E: based on the CLASS residential lighting inventory,[54] the average installed wattage of inefficient lamps (which includes halogen lamps and incandescent lamps) is 60 W. The average installed wattage of efficient lamps (which includes CFLs and LED lamps) is 17 W. As shown in the table, we applied a weight of 80.2% to the average inefficient lamp wattage and a weight of 19.8% to the average efficient lamp wattage to produce an alternate baseline estimate of 51 W. Because we use ex ante UES values for nonresidential measures, and ex ante UES values rely on a wattage-reduction ratio, we did not modify nonresidential gross savings in the alternate methodology.

[53] Note that we did not incorporate the 2012 CLASS inventory data for LED lamps into the alternate CFL baseline approach because of the relatively small sample size for LED lamps in the 2012 CLASS data and to keep the calculation straightforward. Please refer to APPENDIX G for details regarding the CLASS sampling approach.

[54] DNV GL, 2014a. Please refer to APPENDIX G for details regarding the CLASS sampling approach.

Table 81. Values used in developing the alternate baseline, 2013-14

Evaluated Upstream Lighting Measure Group / IOU	Inefficient Lamp Baseline	Efficient Lamp Baseline (W)	Inefficient Lamp Weight	Efficient Lamp Weight	Alternate Baseline (W)
MSB CFL basic spiral ≤ 30 W (baseline: CFL and incandescent A-lamps and basic spiral CFLs, all wattages)					
PG&E	60	17	80.2%	19.8%	51
SCE	61	17	80.2%	19.8%	52
SDG&E	61	17	80.2%	19.8%	53
MSB CFL A-lamp ≤ 30 W (baseline: CFL and incandescent A-lamps and basic spiral, all wattages)					
PG&E	60	17	80.2%	19.8%	51
SCE	61	17	80.2%	19.8%	52
SDG&E	61	17	80.2%	19.8%	53
MSB CFL reflector ≤ 30 W (baseline: CFL and Incandescent reflector lamps, all wattages)					
PG&E	69	16	80.2%	19.8%	59
SCE	71	17	80.2%	19.8%	60
SDG&E	66	16	80.2%	19.8%	56
MSB CFL globe ≤ 30 W (baseline: CFL and Incandescent globe lamps, all wattages)					
PG&E	N/A	N/A	N/A	N/A	N/A
SCE	46	12	80.2%	19.8%	39
SDG&E	46	13	80.2%	19.8%	39
MSB CFL > 30 W (baseline: > 75 W incandescent and > 30 W CFL A-lamps and basic spiral CFLs)					
PG&E	104	42	80.2%	19.8%	92
SCE	109	39	80.2%	19.8%	95
SDG&E	103	47	80.2%	19.8%	92

We used the alternate baseline wattages to calculate new delta watts estimates using the same average rebated wattage as calculated in the conventional delta watts section of this report (Section 4.4 above). Table 82 shows a summary of the alternate delta watts results by evaluated upstream lighting measure group, IOU, and program year. Continuing to examine PG&E's basic spiral CFL ≤ 30 W measure group as an example, we subtract the average program-discounted wattage of 15.4 W from the alternate baseline wattage of 51 W to produce a delta watts estimate of 36 W. We did not modify nonresidential gross savings in the alternate methodology; instead we used the nonresidential ex ante UES factors, which rely on a wattage reduction ratio.

Table 82. Alternate baselines and delta watts for evaluated upstream CFL measure groups by measure group, IOU, and program year, 2013-2014

Evaluated Upstream Lighting Measure Group / IOU	2013			2014		
	Mixed Baseline Wattage[1]	Average Program Lamp Wattage*[2]	Alternate Delta Watts†	Mixed Baseline Wattage[1]	Average Program Lamp Wattage*[2]	Alternate Delta Watts†
MSB CFL basic spiral ≤ 30 W (baseline: CFL and Incandescent A-lamps and basic spiral CFLs, all wattages)						
PG&E	51	15	36	N/A	N/A	N/A
SCE	52	14	38	N/A	N/A	N/A
SDG&E	53	16	37	53	16	37
MSB CFL A-lamp ≤ 30 W (baseline: CFL and Incandescent A-lamps and basic spiral, all wattages)						
PG&E	51	17	35	51	16	36
SCE	52	19	33	52	19	33
SDG&E	53	15	38	53	14	39
MSB CFL reflector ≤ 30 W (baseline: CFL and Incandescent reflector lamps, all wattages)						
PG&E	59	17	42	59	18	41
SCE	60	19	41	60	21	40
SDG&E	56	17	39	56	16	40
MSB CFL globe ≤ 30 W (baseline: CFL and Incandescent globe lamps, all wattages)						
PG&E	N/A	N/A	N/A	N/A	N/A	N/A
SCE	39	19	20	39	19	20
SDG&E	39	13	26	39	13	26
MSB CFL > 30 W (baseline: > 75 W incandescent and > 30 W CFL A-lamps and basic spiral CFLs)						
PG&E	92	33	59	92	37	55
SCE	95	38	57	95	34	61
SDG&E	92	35	57	92	37	55

* IOU tracking data includes wattage ranges for some line items rather than point estimates of wattage (e.g., 0-7 W LED versus 3.5 W LED). In these instances, we assume the highest wattage in the range for the total quantity of lamps reflected in the tracking data for those line items.
† Differences between delta watts and the value calculated by subtracting the rebated wattage from the baseline are due to rounding.
[1] Source: CLASS 2012
[2] Source: program tracking data

7.1.3 HVAC interactive effects– alternate approach

The alternate approach relies upon the HVAC interactive effects estimates for CFLs and LED lamps as described in Section 4.5 of this report.

7.1.4 Unit energy savings – alternate approach

We calculated the alternate ex post UES following the same methodology described in Section 4.6 above—however, the resultant UES values are different because the alternate delta watts calculation includes efficient lamps in the baseline.

Table 83 displays the alternate UES values for evaluated 2013 and 2014 upstream CFL measures. By applying the same HOU and peak CF estimates as in the conventional approach, the same interactive effects factors as in the conventional approach, and the alternate delta Watts calculation, we generated the alternate UES values. These values are lower than their conventional counterparts, which aligns with the expectation that the alternate approach removes savings CFL-to-CFL replacements that were not driven by the program. After applying the respective parameters, our example of PG&E's basic spiral CFL receives an alternate UES of 21.7 kWh.

Table 83. Alternate ex-post UES values for evaluated upstream lighting measures by measure group, IOU, and program year, 2013-14

Evaluated Upstream Lighting Measure Group / IOU	2013			2014		
	UES kWh	UES kW	UES therms	UES kWh	UES kW	UES therms
MSB CFL basic spiral ≤ 30 W (baseline: CFL and Incandescent A-lamps and basic spiral, all wattages)						
PG&E	21.7	0.003	-0.5	N/A	N/A	N/A
SCE	28.7	0.004	-0.5	N/A	N/A	N/A
SDG&E	19.0	0.002	-0.3	19.0	0.002	-0.3
MSB CFL A-lamp ≤ 30 W (baseline: CFL and Incandescent A-lamps and basic spiral, all wattages)						
PG&E	19.1	0.002	-0.5	19.7	0.002	-0.5
SCE	24.6	0.003	-0.4	24.8	0.003	-0.4
SDG&E	18.6	0.002	-0.3	19.1	0.002	-0.3
MSB CFL reflector ≤ 30 W (baseline: CFL and Incandescent reflector lamps, all wattages)						
PG&E	26.3	0.003	-0.6	25.7	0.003	-0.6
SCE	31.2	0.004	-0.6	30.2	0.004	-0.5
SDG&E	17.8	0.002	-0.3	18.3	0.002	-0.3
MSB CFL globe ≤ 30 W (baseline: CFL and Incandescent globe lamps, all wattages)						
PG&E	N/A	N/A	N/A	N/A	N/A	N/A
SCE	13.0	0.002	-0.2	12.9	0.002	-0.2
SDG&E	10.0	0.001	-0.2	10.1	0.001	-0.2
MSB CFL > 30 W (baseline: > 75 W incandescent and > 30 W CFL A-lamps and basic spiral CFLs)						
PG&E	42.4	0.005	-1.0	39.4	0.005	-1.0
SCE	42.6	0.005	-0.8	45.8	0.005	-0.8
SDG&E	41.2	0.004	-0.7	39.6	0.004	-0.7

7.1.5 Installation rate – alternate approach

We used the same installation rates presented in Section 4.7 to calculate the alternate ex post gross savings.

7.1.6 Alternate gross savings

We calculated gross savings using Equation 12 below for both the conventional and alternate methods. However, the alternate gross savings are lower because the alternate delta watts approach incorporates efficient-to-efficient lamp replacement in the UES calculation. Table 84 shows the alternate gross savings by evaluated upstream lighting measure group and IOU for 2013-2014. Note that because the 2010-12 carry-over lamps were simply an agreed-upon deferred recognition of savings, we did not include those measures in the alternate estimates. Again, because we use ex ante nonresidential UES values, we did not modify nonresidential gross savings in the alternate methodology.

Equation 12. Gross savings

$$gross\ savings_L[kWh] = UES_L[kWh] * IR_L * Q_L$$

Where:

UES = unit energy savings for lamp measure group, L (see Section 4.6)

IR_L = installation rate for lamp measure group, L

Q_L = rebated measure quantity for lamp measure group, L

Table 84 provides ex ante and alternate ex post gross savings estimates by evaluated upstream lighting measure group and IOU.

Table 84. Ex Ante and alternate ex post gross savings estimates by evaluated upstream lighting measure group and IOU, 2013-2014

IOU/Evaluated Upstream Lighting Measure Group	Ex Ante Gross Savings			Alternate Ex Post Gross Savings			Alternate Ex Post Gross Realization Rates		
	kWh	kW	therms	kWh	kW	therms	kWh	kW	therms
PG&E									
MSB CFL basic spiral ≤ 30 W	20,711,778	2,790	-392,265	23,289,853	2,771	-570,830	112%	99%	146%
MSB CFL A-lamp ≤ 30 W	13,175,709	1,778	-248,840	12,403,291	1,364	-304,002	94%	77%	122%
MSB CFL reflector ≤ 30 W	13,574,272	1,773	-267,741	14,261,667	1,622	-349,551	105%	91%	131%
MSB CFL globe ≤ 30 W	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
MSB CFL high-wattage (> 30 W)	15,880,886	2,160	-296,331	14,246,255	1,664	-349,173	90%	77%	118%
LED A-lamp, all wattages	4,475,565	596	-85,677	8,289,843	901	-203,182	185%	151%	237%
LED reflector, all wattages	15,456,205	2,054	-297,841	20,452,644	2,223	-501,290	132%	108%	168%
SCE									
MSB CFL basic spiral ≤ 30 W	16,262,089	2,296	-220,311	20,050,183	2,474	-356,031	123%	108%	162%
MSB CFL A-lamp ≤ 30 W	62,525,537	8,839	-817,782	49,479,449	5,765	-878,607	79%	65%	107%
MSB CFL reflector ≤ 30 W	77,704,815	10,588	-1,082,370	63,313,341	7,576	-1,124,256	81%	72%	104%
MSB CFL globe ≤ 30 W	6,575,077	925	-84,509	2,750,304	414	-48,837	42%	45%	58%
MSB CFL high-wattage (> 30 W)	265,352,333	37,501	-3,497,441	179,027,206	20,983	-3,178,988	67%	56%	91%
LED A-lamp, all wattages	3,810,172	524	-54,717	7,120,444	777	-126,438	187%	148%	231%
LED reflector, all wattages	15,865,484	2,250	-230,501	25,125,651	2,741	-446,156	158%	122%	194%
SDG&E									
MSB CFL basic spiral ≤ 30 W	39,662,451	5,017	-544,267	35,813,491	3,763	-625,867	90%	75%	115%
MSB CFL A-lamp ≤ 30 W	8,512,024	1,044	-121,118	8,867,948	964	-154,974	104%	92%	128%
MSB CFL reflector ≤ 30 W	11,043,412	1,151	-182,735	8,430,092	851	-147,322	76%	74%	81%
MSB CFL globe ≤ 30 W	856,260	112	-11,306	484,805	66	-8,472	57%	59%	75%
MSB CFL high-wattage (> 30 W)	314,435	33	-5,109	312,368	33	-5,459	99%	99%	107%
LED A-lamp, all wattages	4,241,667	567	-55,040	7,961,242	793	-139,128	188%	140%	253%
LED reflector, all wattages	7,715,187	1,159	-84,322	6,745,766	672	-117,887	87%	58%	140%

7.2 NTGR – alternate approach

As there is no existing method for calculating a net to gross ratio that does not include efficient-to-efficient lamp replacements, the alternate method algebraically backs out the alternate NTGR. This calculation is broken into two separate equations (Equation 13 and Equation 14 below). Equation 15 shows the conventional net savings equation.

Equation 13. Gross and net savings – conventional approach

$$Gross\ Savings_L[kWh] \times NTGR_L = Net\ Savings_L[kWh]$$

Equation 14. Gross and net savings – alternate approach

$$Gross\ Savings^o{}_L[kWh] \times NTGR^o{}_L = Net\ Savings^o{}_L[kWh]$$

Equation 15. Net savings – conventional approach

$$Net\ savings_L[kWh] = Gross\ savings_L[kWh] * NTGR_L$$

Where:

Gross savings_L = conventional gross savings for lamp measure group, L

NTGR_L = conventional net to gross ratio for lamp measure group, L

Net Savings_L = conventional net savings for lamp measure group, L

Gross $\text{savings}^o{}_L$ = alternate gross savings for lamp measure group, L

$\text{NTGR}^o{}_L$ = alternate net to gross ratio for lamp measure group, L

Net $\text{Savings}^o{}_L$ = alternate net savings for lamp measure group, L

There is no existing method for calculating a stand-alone estimate for $NTGR^o$. We thus leverage the assumption that the net savings ultimately yielded by the conventional and alternate approaches will be equal (as shown in Equation 16).

Equation 16. Assumed substitution

$$Net\ Savings_L[kWh] = Net\ Savings^o{}_L[kWh]$$

With this assumption, we can substitute *Net Savings*^{o} with the conventional *Net Savings* to arrive at Equation 17.

Equation 17. NTGR calculation – alternate approach

$$NTGR^o{}_L = \frac{Net\ Savings_L[kWh]}{Gross\ Savings^o{}_L[kWh]}$$

7.3 Net savings – alternate approach

Table 85 shows the final ex post net savings, alternate ex post gross savings, and alternate ex post NTGR by IOU and evaluated upstream lighting measure group for the 2013-14 period.

Table 85. Ex post net savings, alternate ex post gross savings, and alternate ex post NTGR by IOU and evaluated upstream lighting measure group, 2013-14

Evaluated Upstream Lighting Measure Group / IOU	kWh		
	Net Savings	Gross Alternate	Alternate NTGR
PG&E			
MSB CFL basic spiral ≤ 30 W	7,255,507	23,289,853	31%
MSB CFL A-lamp ≤ 30 W	10,800,725	12,403,291	87%
MSB CFL reflector ≤ 30 W	3,977,300	14,261,667	28%
MSB CFL globe ≤ 30 W	N/A	N/A	N/A
MSB CFL high-wattage (> 30 W)	10,890,684	14,246,255	76%
LED A-lamp, all wattages	2,900,051	8,289,843	35%
LED reflector, all wattages	6,658,075	20,452,644	33%
SCE			
MSB CFL basic spiral ≤ 30 W	7,938,256	20,050,183	40%
MSB CFL A-lamp ≤ 30 W	53,600,393	49,479,449	108%
MSB CFL reflector ≤ 30 W	25,061,657	63,313,341	40%
MSB CFL globe ≤ 30 W	3,794,758	2,750,304	138%
MSB CFL high-wattage (> 30 W)	118,439,374	179,027,206	66%
LED A-lamp, all wattages	2,710,799	7,120,444	38%
LED reflector, all wattages	7,278,037	25,125,651	29%
SDG&E			
MSB CFL basic spiral ≤ 30 W	15,851,689	35,813,491	44%
MSB CFL A-lamp ≤ 30 W	7,290,530	8,867,948	82%
MSB CFL reflector ≤ 30 W	2,562,621	8,430,092	30%
MSB CFL globe ≤ 30 W	552,550	484,805	114%
MSB CFL high-wattage (> 30 W)	192,779	312,368	62%
LED A-lamp, all wattages	2,191,204	7,961,242	28%
LED reflector, all wattages	2,206,489	6,745,766	33%

8 RECOMMENDATIONS

Our over-arching recommendation is that projections for future programs must recognize that California's market for residential replacement lamps is evolving rapidly. As described in Section 2.3, there were changes in lamp availability and pricing even during the 2013-14 program period, and more substantial changes over the longer-term. In this swiftly-changing landscape, planning projections based directly on 2013-14 program results could already be outdated.

Given this, the evaluation team has the following recommendations:

1. **Refine targeting for LED lamp incentives.** In big box channels, NTGR are relatively low in the current evaluation and were relatively low in prior evaluations for most measure groups. The presence of LED lamps in these channels has increased rapidly while pricing has declined at the market level. The IOUs should review the cost-effectiveness of offering incentives for LED lamps in big box channels and (if not cost-effective) consider directing incentives for these lamps toward the non- big box channels. The cost-effectiveness review should consider not only the NTGR determined for the 2013-14 program, but also the likelihood that even without program discounts LED lamps will increase in availability at lower prices in big box channels.
2. **Refine targeting for CFL incentives.** The NTGR for CFLs are somewhat lower than in the prior evaluation, but still potentially represent cost-effective investments. The IOUs should examine the cost-effectiveness of offering incentives for CFLs of the different measure groups in each retail channel and consider discontinuing incentive offerings in channels where incentives are not cost-effective, or are borderline cost-effective.
3. **Examine projections of lamp pricing and market conditions.** DNV GL recommends that the IOUs conduct scenario analyses to represent current market conditions regarding lamp availability and pricing as of 2016, and to project changing conditions into the future. The IOUs can then apply the results of these analyses to adjust ex ante assumptions for key impact parameters. The lamp choice model developed for this evaluation could support such analysis with scenarios representing more current market conditions.
   - **Review baselines.** This evaluation characterized the baseline for CFLs and as the mix of installed incandescent lamp stock in IOU customer households as of 2012 and the baseline for LED lamps as the mix of installed CFLs and incandescent lamps during the same timeframe. Another perspective on baseline would be to identify the mix of lamp technologies that consumers would purchase in the absence of program discounts—in other words, the purchases displaced by program-discounted lamps. The mix of displaced lamps represents the net baseline condition, and could be estimated using the lamp choice model. This became apparent during the course of the 2013-14 impact evaluation.
   - **Explore the effectiveness of offering discounts on multiple competing technologies.** Evaluation results indicate that there is competition among program-discounted measure groups within the same replacement lamp category when more than one is offered in a retail store at the same time. At the same time, when the program provides incentives for only one measure group within a replacement lamp category (say, basic spiral CFLs) and the other is available without program discounts (say, CFL A-lamps), sales of the program-discounted lamp may come at the expense of sales of the similarly-efficient non-program alternative. Assessment of program cost-effectiveness needs to explore these substitution effects. Again, the lamp choice model developed for this work could support such exploration. The goal is to clarify how best to allocate discounts among multiple efficient technologies within a replacement lamp category for specific combinations of measure groups and retail channels.

4. **If more up-to-date estimates are not developed through prospective work, use the results of this evaluation to true up ex ante assumptions for key impact parameters.** If the IOUs are unable to generate projections of lamp pricing and changing market conditions as suggested above, the DNV GL recommends that the IOUs use the results of this evaluation to revise current ex ante assumptions for key impact evaluation parameters. While these results are already somewhat dated at the time of this report's publication, these results are still more current than those used to generate their ex ante savings estimates for 2013-14.

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APPENDIX A. STANDARDIZED HIGH LEVEL SAVINGS

The tables in Appendix AA summarizing natural gas savings make use of the unit MTherms – 1,000 Therms – rather than MMTherms – 1,000,000 Therms – for formatting purposes.

Gross Lifecycle Savings (MWh)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
PGE	NonRes Upst LTG IND CFL > 30 W	15,672	24,244	1.55	0.0%	1.55
PGE	NonRes Upst LTG IND CFL A LAMP	12,904	32,849	2.55	0.0%	2.55
PGE	NonRes Upst LTG IND CFL BASIC	44,428	190,632	4.29	0.0%	4.29
PGE	NonRes Upst LTG IND CFL REF	11,713	41,625	3.55	0.0%	3.55
PGE	NonRes Upst LTG IND LED LAMP	8,008	14,518	1.81	0.0%	1.81
PGE	NonRes Upst LTG IND LED REF	32,632	40,857	1.25	0.0%	1.25
PGE	PassThrough Res Downstream	54,709	54,709	1.00	100.0%	
PGE	PassThrough Upstream	208,485	208,485	1.00	100.0%	
PGE	Res Upst LTG IND CFL > 30 W	103,269	148,283	1.44	0.0%	1.44
PGE	Res Upst LTG IND CFL A LAMP	144,980	204,498	1.41	0.0%	1.41
PGE	Res Upst LTG IND CFL BASIC	749,581	684,964	0.91	0.0%	0.91
PGE	Res Upst LTG IND CFL REF	193,063	263,646	1.37	0.0%	1.37
PGE	Res Upst LTG IND LED LAMP	52,297	81,176	1.55	0.0%	1.55
PGE	Res Upst LTG IND LED REF	179,625	313,093	1.74	0.0%	1.74
PGE	**Total**	**1,811,367**	**2,303,579**	**1.27**	**14.5%**	**1.32**
SCE	NonRes Upst LTG IND CFL > 30 W	238,186	196,090	0.82	0.0%	0.82
SCE	NonRes Upst LTG IND CFL A LAMP	57,236	56,086	0.98	0.0%	0.98
SCE	NonRes Upst LTG IND CFL BASIC	13,721	48,401	3.53	0.0%	3.53
SCE	NonRes Upst LTG IND CFL GLOBE	6,024	5,619	0.93	0.0%	0.93
SCE	NonRes Upst LTG IND CFL REF	59,228	55,078	0.93	0.0%	0.93
SCE	NonRes Upst LTG IND LED LAMP	6,318	13,617	2.16	0.0%	2.16
SCE	NonRes Upst LTG IND LED REF	27,711	42,068	1.52	0.0%	1.52
SCE	PassThrough Res Downstream	82,614	82,614	1.00	100.0%	
SCE	PassThrough Upstream	34,081	34,081	1.00	100.0%	
SCE	Res Upst LTG IND CFL > 30 W	1,679,056	1,842,005	1.10	0.0%	1.10
SCE	Res Upst LTG IND CFL A LAMP	426,016	588,327	1.38	0.0%	1.38
SCE	Res Upst LTG IND CFL BASIC	555,228	580,682	1.05	0.0%	1.05
SCE	Res Upst LTG IND CFL GLOBE	41,913	33,510	0.80	0.0%	0.80
SCE	Res Upst LTG IND CFL REF	532,068	692,711	1.30	0.0%	1.30
SCE	Res Upst LTG IND LED LAMP	43,048	67,092	1.56	0.0%	1.56
SCE	Res Upst LTG IND LED REF	181,813	305,776	1.68	0.0%	1.68
SCE	**Total**	**3,984,260**	**4,643,757**	**1.17**	**2.9%**	**1.17**
SDGE	NonRes Upst LTG IND CFL > 30 W	58	501	8.64	0.0%	8.64
SDGE	NonRes Upst LTG IND CFL A LAMP	5,553	11,997	2.16	0.0%	2.16
SDGE	NonRes Upst LTG IND CFL BASIC	31,320	57,733	1.84	0.0%	1.84
SDGE	NonRes Upst LTG IND CFL GLOBE	804	892	1.11	0.0%	1.11
SDGE	NonRes Upst LTG IND CFL REF	3,127	33,781	10.80	0.0%	10.80
SDGE	NonRes Upst LTG IND LED LAMP	8,290	9,194	1.11	0.0%	1.11
SDGE	NonRes Upst LTG IND LED REF	11,424	12,205	1.07	0.0%	1.07
SDGE	PassThrough Res Downstream	11,883	11,883	1.00	100.0%	
SDGE	PassThrough Upstream	22,248	22,248	1.00	100.0%	

Gross Lifecycle Savings (MWh)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
SDGE	Res Upst LTG IND CFL > 30 W	2,885	3,360	1.16	0.0%	1.16
SDGE	Res Upst LTG IND CFL A LAMP	66,458	100,275	1.51	0.0%	1.51
SDGE	Res Upst LTG IND CFL BASIC	294,939	407,548	1.38	0.0%	1.38
SDGE	Res Upst LTG IND CFL GLOBE	6,080	5,517	0.91	0.0%	0.91
SDGE	Res Upst LTG IND CFL REF	101,588	96,447	0.95	0.0%	0.95
SDGE	Res Upst LTG IND LED LAMP	48,509	79,231	1.63	0.0%	1.63
SDGE	Res Upst LTG IND LED REF	82,563	91,240	1.11	0.0%	1.11
SDGE	**Total**	**697,729**	**944,052**	**1.35**	**4.9%**	**1.37**
	Statewide	***6,493,356***	***7,891,388***	***1.22***	***6.4%***	***1.23***

Net Lifecycle Savings (MWh)

PA	Standard Report Group	Ex-Ante Net	Ex-Post Net	NRR	% Ex-Ante Net Pass Through	Ex-Ante NTG	Ex-Post NTG	Eval Ex-Ante NTG	Eval Ex-Post NTG
PGE	NonRes Upst LTG IND CFL > 30 W	8,463	11,324	1.34	0.0%	0.54	0.47	0.54	0.47
PGE	NonRes Upst LTG IND CFL A LAMP	6,968	19,863	2.85	0.0%	0.54	0.60	0.54	0.60
PGE	NonRes Upst LTG IND CFL BASIC	25,442	101,873	4.00	0.0%	0.57	0.53	0.57	0.53
PGE	NonRes Upst LTG IND CFL REF	6,392	16,472	2.58	0.0%	0.55	0.40	0.55	0.40
PGE	NonRes Upst LTG IND LED LAMP	6,226	5,799	0.93	0.0%	0.78	0.40	0.78	0.40
PGE	NonRes Upst LTG IND LED REF	26,763	10,958	0.41	0.0%	0.82	0.27	0.82	0.27
PGE	PassThrough Res Downstream	40,615	40,615	1.00	100.0%	0.74	0.74		
PGE	PassThrough Upstream	133,324	133,324	1.00	100.0%	0.64	0.64		
PGE	Res Upst LTG IND CFL > 30 W	55,765	69,259	1.24	0.0%	0.54	0.47	0.54	0.47
PGE	Res Upst LTG IND CFL A LAMP	96,701	121,690	1.26	0.0%	0.67	0.60	0.67	0.60
PGE	Res Upst LTG IND CFL BASIC	441,677	307,997	0.70	0.0%	0.59	0.45	0.59	0.45
PGE	Res Upst LTG IND CFL REF	135,037	86,766	0.64	0.0%	0.70	0.33	0.70	0.33
PGE	Res Upst LTG IND LED LAMP	40,654	32,423	0.80	0.0%	0.78	0.40	0.78	0.40
PGE	Res Upst LTG IND LED REF	145,031	83,975	0.58	0.0%	0.81	0.27	0.81	0.27
PGE	**Total**	**1,169,058**	**1,042,337**	**0.89**	**14.9%**	**0.65**	**0.45**	**0.64**	**0.43**
SCE	NonRes Upst LTG IND CFL > 30 W	128,620	87,474	0.68	0.0%	0.54	0.45	0.54	0.45
SCE	NonRes Upst LTG IND CFL A LAMP	30,908	38,725	1.25	0.0%	0.54	0.69	0.54	0.69
SCE	NonRes Upst LTG IND CFL BASIC	7,409	24,865	3.36	0.0%	0.54	0.51	0.54	0.51
SCE	NonRes Upst LTG IND CFL GLOBE	3,253	3,836	1.18	0.0%	0.54	0.68	0.54	0.68
SCE	NonRes Upst LTG IND CFL REF	31,983	14,933	0.47	0.0%	0.54	0.27	0.54	0.27
SCE	NonRes Upst LTG IND LED LAMP	4,262	5,680	1.33	0.0%	0.67	0.42	0.67	0.42
SCE	NonRes Upst LTG IND LED REF	17,587	11,749	0.67	0.0%	0.63	0.28	0.63	0.28
SCE	PassThrough Res Downstream	47,089	47,089	1.00	100.0%	0.57	0.57		
SCE	PassThrough Upstream	18,404	18,404	1.00	100.0%	0.54	0.54		
SCE	Res Upst LTG IND CFL > 30 W	906,690	821,706	0.91	0.0%	0.54	0.45	0.54	0.45
SCE	Res Upst LTG IND CFL A LAMP	238,500	404,870	1.70	0.0%	0.56	0.69	0.56	0.69
SCE	Res Upst LTG IND CFL BASIC	352,607	294,427	0.84	0.0%	0.64	0.51	0.64	0.51
SCE	Res Upst LTG IND CFL GLOBE	22,633	22,874	1.01	0.0%	0.54	0.68	0.54	0.68
SCE	Res Upst LTG IND CFL REF	287,390	187,689	0.65	0.0%	0.54	0.27	0.54	0.27

Net Lifecycle Savings (MWh)

PA	Standard Report Group	Ex-Ante Net	Ex-Post Net	NRR	% Ex-Ante Net Pass Through	Ex-Ante NTG	Ex-Post NTG	Eval Ex-Ante NTG	Eval Ex-Post NTG
SCE	Res Upst LTG IND LED LAMP	28,076	27,984	1.00	0.0%	0.65	0.42	0.65	0.42
SCE	Res Upst LTG IND LED REF	110,003	85,399	0.78	0.0%	0.61	0.28	0.61	0.28
SCE	**Total**	**2,235,414**	**2,097,702**	**0.94**	**2.9%**	**0.56**	**0.45**	**0.56**	**0.45**
SDGE	NonRes Upst LTG IND CFL > 30 W	31	197	6.28	0.0%	0.54	0.39	0.54	0.39
SDGE	NonRes Upst LTG IND CFL A LAMP	2,999	6,291	2.10	0.0%	0.54	0.52	0.54	0.52
SDGE	NonRes Upst LTG IND CFL BASIC	16,913	15,858	0.94	0.0%	0.54	0.27	0.54	0.27
SDGE	NonRes Upst LTG IND CFL GLOBE	434	595	1.37	0.0%	0.54	0.67	0.54	0.67
SDGE	NonRes Upst LTG IND CFL REF	1,689	6,130	3.63	0.0%	0.54	0.18	0.54	0.18
SDGE	NonRes Upst LTG IND LED LAMP	7,047	3,217	0.46	0.0%	0.85	0.35	0.85	0.35
SDGE	NonRes Upst LTG IND LED REF	9,711	3,435	0.35	0.0%	0.85	0.28	0.85	0.28
SDGE	PassThrough Res Downstream	10,154	10,154	1.00	100.0%	0.85	0.85		
SDGE	PassThrough Upstream	18,887	18,887	1.00	100.0%	0.85	0.85		
SDGE	Res Upst LTG IND CFL > 30 W	1,558	1,319	0.85	0.0%	0.54	0.39	0.54	0.39
SDGE	Res Upst LTG IND CFL A LAMP	35,887	52,584	1.47	0.0%	0.54	0.52	0.54	0.52
SDGE	Res Upst LTG IND CFL BASIC	159,267	111,945	0.70	0.0%	0.54	0.27	0.54	0.27
SDGE	Res Upst LTG IND CFL GLOBE	3,283	3,682	1.12	0.0%	0.54	0.67	0.54	0.67
SDGE	Res Upst LTG IND CFL REF	54,858	17,501	0.32	0.0%	0.54	0.18	0.54	0.18
SDGE	Res Upst LTG IND LED LAMP	41,233	27,724	0.67	0.0%	0.85	0.35	0.85	0.35
SDGE	Res Upst LTG IND LED REF	70,178	25,677	0.37	0.0%	0.85	0.28	0.85	0.28
SDGE	**Total**	**434,127**	**305,195**	**0.70**	**6.7%**	**0.62**	**0.32**	**0.61**	**0.30**
	Statewide	***3,838,599***	***3,445,235***	***0.90***	***7.0%***	***0.59***	***0.44***	***0.59***	***0.42***

Gross Lifecycle Savings (MW)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
PGE	NonRes Upst LTG IND CFL > 30 W	3.2	4.9	1.51	0.0%	1.51
PGE	NonRes Upst LTG IND CFL A LAMP	2.6	6.6	2.52	0.0%	2.52
PGE	NonRes Upst LTG IND CFL BASIC	8.5	38.3	4.53	0.0%	4.53
PGE	NonRes Upst LTG IND CFL REF	2.4	8.4	3.54	0.0%	3.54
PGE	NonRes Upst LTG IND LED LAMP	1.6	2.9	1.78	0.0%	1.78
PGE	NonRes Upst LTG IND LED REF	6.6	8.2	1.24	0.0%	1.24
PGE	PassThrough Res Downstream	4.3	4.3	1.00	100.0%	
PGE	PassThrough Upstream	26.7	26.7	1.00	100.0%	
PGE	Res Upst LTG IND CFL > 30 W	11.0	17.3	1.57	0.0%	1.57
PGE	Res Upst LTG IND CFL A LAMP	17.5	22.5	1.29	0.0%	1.29
PGE	Res Upst LTG IND CFL BASIC	101.3	81.8	0.81	0.0%	0.81
PGE	Res Upst LTG IND CFL REF	24.0	30.0	1.25	0.0%	1.25
PGE	Res Upst LTG IND LED LAMP	5.6	8.8	1.58	0.0%	1.58
PGE	Res Upst LTG IND LED REF	19.1	34.0	1.78	0.0%	1.78
PGE	**Total**	**234.6**	**294.8**	**1.26**	**13.2%**	**1.30**
SCE	NonRes Upst LTG IND CFL > 30 W	48.9	40.9	0.84	0.0%	0.84
SCE	NonRes Upst LTG IND CFL A LAMP	11.7	11.6	0.99	0.0%	0.99
SCE	NonRes Upst LTG IND CFL BASIC	2.8	9.5	3.36	0.0%	3.36
SCE	NonRes Upst LTG IND CFL GLOBE	1.2	1.2	0.95	0.0%	0.95
SCE	NonRes Upst LTG IND CFL REF	12.1	11.5	0.95	0.0%	0.95
SCE	NonRes Upst LTG IND LED LAMP	1.4	2.8	2.09	0.0%	2.09
SCE	NonRes Upst LTG IND LED REF	6.4	8.8	1.37	0.0%	1.37
SCE	PassThrough Res Downstream	9.6	9.6	1.00	100.0%	
SCE	PassThrough Upstream	4.4	4.4	1.00	100.0%	
SCE	Res Upst LTG IND CFL > 30 W	179.8	215.9	1.20	0.0%	1.20
SCE	Res Upst LTG IND CFL A LAMP	46.8	68.6	1.46	0.0%	1.46
SCE	Res Upst LTG IND CFL BASIC	82.1	79.5	0.97	0.0%	0.97
SCE	Res Upst LTG IND CFL GLOBE	4.5	5.0	1.12	0.0%	1.12
SCE	Res Upst LTG IND CFL REF	57.2	82.9	1.45	0.0%	1.45
SCE	Res Upst LTG IND LED LAMP	4.6	7.3	1.60	0.0%	1.60
SCE	Res Upst LTG IND LED REF	19.3	33.4	1.73	0.0%	1.73
SCE	**Total**	**492.9**	**592.8**	**1.20**	**2.8%**	**1.21**
SDGE	NonRes Upst LTG IND CFL > 30 W	0.0	0.1	8.50	0.0%	8.50
SDGE	NonRes Upst LTG IND CFL A LAMP	1.2	2.5	2.13	0.0%	2.13
SDGE	NonRes Upst LTG IND CFL BASIC	6.6	12.2	1.85	0.0%	1.85
SDGE	NonRes Upst LTG IND CFL GLOBE	0.2	0.2	1.09	0.0%	1.09
SDGE	NonRes Upst LTG IND CFL REF	0.5	7.2	15.68	0.0%	15.68
SDGE	NonRes Upst LTG IND LED LAMP	1.7	1.9	1.11	0.0%	1.11
SDGE	NonRes Upst LTG IND LED REF	2.4	2.6	1.06	0.0%	1.06
SDGE	PassThrough Res Downstream	1.1	1.1	1.00	100.0%	
SDGE	PassThrough Upstream	2.5	2.5	1.00	100.0%	

Gross Lifecycle Savings (MW)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
SDGE	Res Upst LTG IND CFL > 30 W	0.3	0.4	1.23	0.0%	1.23
SDGE	Res Upst LTG IND CFL A LAMP	6.7	10.9	1.63	0.0%	1.63
SDGE	Res Upst LTG IND CFL BASIC	29.6	42.8	1.45	0.0%	1.45
SDGE	Res Upst LTG IND CFL GLOBE	0.6	0.7	1.22	0.0%	1.22
SDGE	Res Upst LTG IND CFL REF	10.2	9.7	0.95	0.0%	0.95
SDGE	Res Upst LTG IND LED LAMP	4.9	7.9	1.60	0.0%	1.60
SDGE	Res Upst LTG IND LED REF	9.7	9.1	0.93	0.0%	0.93
SDGE	**Total**	**78.2**	**111.9**	**1.43**	**4.5%**	**1.45**
	Statewide	***805.7***	***999.4***	***1.24***	***6.0%***	***1.26***

Net Lifecycle Savings (MW)

PA	Standard Report Group	Ex-Ante Net	Ex-Post Net	NRR	% Ex-Ante Net Pass Through	Ex-Ante NTG	Ex-Post NTG	Eval Ex-Ante NTG	Eval Ex-Post NTG
PGE	NonRes Upst LTG IND CFL > 30 W	1.7	2.3	1.31	0.0%	0.54	0.47	0.54	0.47
PGE	NonRes Upst LTG IND CFL A LAMP	1.4	4.0	2.83	0.0%	0.54	0.60	0.54	0.60
PGE	NonRes Upst LTG IND CFL BASIC	4.8	20.5	4.24	0.0%	0.57	0.53	0.57	0.53
PGE	NonRes Upst LTG IND CFL REF	1.3	3.3	2.57	0.0%	0.55	0.40	0.55	0.40
PGE	NonRes Upst LTG IND LED LAMP	1.3	1.2	0.91	0.0%	0.78	0.40	0.78	0.40
PGE	NonRes Upst LTG IND LED REF	5.4	2.2	0.41	0.0%	0.82	0.27	0.82	0.27
PGE	PassThrough Res Downstream	3.1	3.1	1.00	100.0%	0.73	0.73		
PGE	PassThrough Upstream	17.2	17.2	1.00	100.0%	0.64	0.64		
PGE	Res Upst LTG IND CFL > 30 W	6.0	8.1	1.36	0.0%	0.54	0.47	0.54	0.47
PGE	Res Upst LTG IND CFL A LAMP	12.1	13.4	1.11	0.0%	0.69	0.59	0.69	0.59
PGE	Res Upst LTG IND CFL BASIC	59.9	37.0	0.62	0.0%	0.59	0.45	0.59	0.45
PGE	Res Upst LTG IND CFL REF	17.3	9.9	0.57	0.0%	0.72	0.33	0.72	0.33
PGE	Res Upst LTG IND LED LAMP	4.3	3.5	0.81	0.0%	0.78	0.40	0.78	0.40
PGE	Res Upst LTG IND LED REF	15.4	9.1	0.59	0.0%	0.81	0.27	0.81	0.27
PGE	**Total**	**151.3**	**134.7**	**0.89**	**13.4%**	**0.65**	**0.46**	**0.64**	**0.43**
SCE	NonRes Upst LTG IND CFL > 30 W	26.4	18.2	0.69	0.0%	0.54	0.45	0.54	0.45
SCE	NonRes Upst LTG IND CFL A LAMP	6.3	8.0	1.27	0.0%	0.54	0.69	0.54	0.69
SCE	NonRes Upst LTG IND CFL BASIC	1.5	4.8	3.14	0.0%	0.54	0.50	0.54	0.50
SCE	NonRes Upst LTG IND CFL GLOBE	0.7	0.8	1.21	0.0%	0.54	0.68	0.54	0.68
SCE	NonRes Upst LTG IND CFL REF	6.6	3.1	0.47	0.0%	0.54	0.27	0.54	0.27
SCE	NonRes Upst LTG IND LED LAMP	0.9	1.2	1.30	0.0%	0.67	0.42	0.67	0.42
SCE	NonRes Upst LTG IND LED REF	4.1	2.4	0.60	0.0%	0.64	0.28	0.64	0.28
SCE	PassThrough Res Downstream	5.3	5.3	1.00	100.0%	0.55	0.55		
SCE	PassThrough Upstream	2.4	2.4	1.00	100.0%	0.54	0.54		
SCE	Res Upst LTG IND CFL > 30 W	97.1	96.3	0.99	0.0%	0.54	0.45	0.54	0.45
SCE	Res Upst LTG IND CFL A LAMP	26.5	47.2	1.78	0.0%	0.57	0.69	0.57	0.69
SCE	Res Upst LTG IND CFL BASIC	52.7	41.5	0.79	0.0%	0.64	0.52	0.64	0.52
SCE	Res Upst LTG IND CFL GLOBE	2.4	3.4	1.42	0.0%	0.54	0.68	0.54	0.68
SCE	Res Upst LTG IND CFL REF	30.9	22.5	0.73	0.0%	0.54	0.27	0.54	0.27

Net Lifecycle Savings (MW)

PA	Standard Report Group	Ex-Ante Net	Ex-Post Net	NRR	% Ex-Ante Net Pass Through	Ex-Ante NTG	Ex-Post NTG	Eval Ex-Ante NTG	Eval Ex-Post NTG
SCE	Res Upst LTG IND LED LAMP	3.0	3.1	1.03	0.0%	0.65	0.42	0.65	0.42
SCE	Res Upst LTG IND LED REF	11.7	9.3	0.80	0.0%	0.61	0.28	0.61	0.28
SCE	**Total**	**278.4**	**269.5**	**0.97**	**2.8%**	**0.56**	**0.45**	**0.57**	**0.45**
SDGE	NonRes Upst LTG IND CFL > 30 W	0.0	0.0	6.18	0.0%	0.54	0.39	0.54	0.39
SDGE	NonRes Upst LTG IND CFL A LAMP	0.6	1.3	2.07	0.0%	0.54	0.52	0.54	0.52
SDGE	NonRes Upst LTG IND CFL BASIC	3.6	3.4	0.94	0.0%	0.54	0.27	0.54	0.27
SDGE	NonRes Upst LTG IND CFL GLOBE	0.1	0.1	1.35	0.0%	0.54	0.67	0.54	0.67
SDGE	NonRes Upst LTG IND CFL REF	0.2	1.3	5.27	0.0%	0.54	0.18	0.54	0.18
SDGE	NonRes Upst LTG IND LED LAMP	1.5	0.7	0.46	0.0%	0.85	0.35	0.85	0.35
SDGE	NonRes Upst LTG IND LED REF	2.1	0.7	0.35	0.0%	0.85	0.28	0.85	0.28
SDGE	PassThrough Res Downstream	0.9	0.9	1.00	100.0%	0.86	0.86		
SDGE	PassThrough Upstream	2.1	2.1	1.00	100.0%	0.85	0.85		
SDGE	Res Upst LTG IND CFL > 30 W	0.2	0.1	0.89	0.0%	0.54	0.39	0.54	0.39
SDGE	Res Upst LTG IND CFL A LAMP	3.6	5.7	1.58	0.0%	0.54	0.52	0.54	0.52
SDGE	Res Upst LTG IND CFL BASIC	16.0	11.8	0.74	0.0%	0.54	0.27	0.54	0.27
SDGE	Res Upst LTG IND CFL GLOBE	0.3	0.5	1.51	0.0%	0.54	0.67	0.54	0.67
SDGE	Res Upst LTG IND CFL REF	5.5	1.8	0.32	0.0%	0.54	0.18	0.54	0.18
SDGE	Res Upst LTG IND LED LAMP	4.2	2.8	0.66	0.0%	0.85	0.35	0.85	0.35
SDGE	Res Upst LTG IND LED REF	8.3	2.6	0.31	0.0%	0.85	0.28	0.85	0.28
SDGE	**Total**	**49.2**	**35.8**	**0.73**	**6.2%**	**0.63**	**0.32**	**0.62**	**0.30**
	Statewide	***478.9***	***440.0***	***0.92***	***6.5%***	***0.59***	***0.44***	***0.59***	***0.43***

Gross Lifecycle Savings (MTherms)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
PGE	NonRes Upst LTG IND CFL > 30 W	-94	-138	1.46	0.0%	1.46
PGE	NonRes Upst LTG IND CFL A LAMP	-75	-187	2.50	0.0%	2.50
PGE	NonRes Upst LTG IND CFL BASIC	-256	-1,089	4.24	0.0%	4.24
PGE	NonRes Upst LTG IND CFL REF	-68	-238	3.50	0.0%	3.50
PGE	NonRes Upst LTG IND LED LAMP	-48	-83	1.73	0.0%	1.73
PGE	NonRes Upst LTG IND LED REF	-190	-233	1.23	0.0%	1.23
PGE	PassThrough Res Downstream	-1,102	-1,102	1.00	100.0%	
PGE	PassThrough Upstream	-4,199	-4,199	1.00	100.0%	
PGE	Res Upst LTG IND CFL > 30 W	-2,472	-3,634	1.47	0.0%	1.47
PGE	Res Upst LTG IND CFL A LAMP	-3,670	-5,012	1.37	0.0%	1.37
PGE	Res Upst LTG IND CFL BASIC	-19,675	-16,788	0.85	0.0%	0.85
PGE	Res Upst LTG IND CFL REF	-4,934	-6,462	1.31	0.0%	1.31
PGE	Res Upst LTG IND LED LAMP	-1,256	-1,990	1.58	0.0%	1.58
PGE	Res Upst LTG IND LED REF	-4,372	-7,674	1.76	0.0%	1.76
PGE	**Total**	**-42,410**	**-48,828**	**1.15**	**12.5%**	**1.17**
SCE	NonRes Upst LTG IND CFL > 30 W	-574	-561	0.98	0.0%	0.98
SCE	NonRes Upst LTG IND CFL A LAMP	-136	-161	1.18	0.0%	1.18
SCE	NonRes Upst LTG IND CFL BASIC	-34	-139	4.03	0.0%	4.03
SCE	NonRes Upst LTG IND CFL GLOBE	-14	-16	1.18	0.0%	1.18
SCE	NonRes Upst LTG IND CFL REF	-139	-158	1.14	0.0%	1.14
SCE	NonRes Upst LTG IND LED LAMP	-18	-39	2.21	0.0%	2.21
SCE	NonRes Upst LTG IND LED REF	-84	-120	1.43	0.0%	1.43
SCE	PassThrough Res Downstream	-961	-961	1.00	100.0%	
SCE	PassThrough Upstream	-578	-578	1.00	100.0%	
SCE	Res Upst LTG IND CFL > 30 W	-31,771	-32,709	1.03	0.0%	1.03
SCE	Res Upst LTG IND CFL A LAMP	-7,432	-10,447	1.41	0.0%	1.41
SCE	Res Upst LTG IND CFL BASIC	-2,004	-10,311	5.15	0.0%	5.15
SCE	Res Upst LTG IND CFL GLOBE	-770	-595	0.77	0.0%	0.77
SCE	Res Upst LTG IND CFL REF	-9,978	-12,300	1.23	0.0%	1.23
SCE	Res Upst LTG IND LED LAMP	-827	-1,191	1.44	0.0%	1.44
SCE	Res Upst LTG IND LED REF	-3,471	-5,430	1.56	0.0%	1.56
SCE	**Total**	**-58,791**	**-75,717**	**1.29**	**2.6%**	**1.30**
SDGE	NonRes Upst LTG IND CFL > 30 W	0	-1	7.63	0.0%	7.63
SDGE	NonRes Upst LTG IND CFL A LAMP	-16	-30	1.92	0.0%	1.92
SDGE	NonRes Upst LTG IND CFL BASIC	-103	-146	1.41	0.0%	1.41
SDGE	NonRes Upst LTG IND CFL GLOBE	-2	-2	0.98	0.0%	0.98
SDGE	NonRes Upst LTG IND CFL REF	-35	-85	2.40	0.0%	2.40
SDGE	NonRes Upst LTG IND LED LAMP	-29	-23	0.81	0.0%	0.81
SDGE	NonRes Upst LTG IND LED REF	-34	-31	0.90	0.0%	0.90
SDGE	PassThrough Res Downstream	-107	-107	1.00	100.0%	
SDGE	PassThrough Upstream	-346	-346	1.00	100.0%	

Gross Lifecycle Savings (MTherms)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
SDGE	Res Upst LTG IND CFL > 30 W	-49	-59	1.20	0.0%	1.20
SDGE	Res Upst LTG IND CFL A LAMP	-1,126	-1,752	1.56	0.0%	1.56
SDGE	Res Upst LTG IND CFL BASIC	-4,997	-7,122	1.43	0.0%	1.43
SDGE	Res Upst LTG IND CFL GLOBE	-103	-96	0.94	0.0%	0.94
SDGE	Res Upst LTG IND CFL REF	-1,726	-1,685	0.98	0.0%	0.98
SDGE	Res Upst LTG IND LED LAMP	-821	-1,385	1.69	0.0%	1.69
SDGE	Res Upst LTG IND LED REF	-1,231	-1,594	1.29	0.0%	1.29
SDGE	**Total**	**-10,727**	**-14,466**	**1.35**	**4.2%**	**1.36**
	Statewide	***-111,929***	***-139,010***	***1.24***	***6.5%***	***1.26***

Net Lifecycle Savings (MTherms)

PA	Standard Report Group	Ex-Ante Net	Ex-Post Net	NRR	% Ex-Ante Net Pass Through	Ex-Ante NTG	Ex-Post NTG	Eval Ex-Ante NTG	Eval Ex-Post NTG
PGE	NonRes Upst LTG IND CFL > 30 W	-51	-65	1.27	0.0%	0.54	0.47	0.54	0.47
PGE	NonRes Upst LTG IND CFL A LAMP	-40	-113	2.80	0.0%	0.54	0.60	0.54	0.60
PGE	NonRes Upst LTG IND CFL BASIC	-147	-582	3.96	0.0%	0.57	0.53	0.57	0.53
PGE	NonRes Upst LTG IND CFL REF	-37	-94	2.54	0.0%	0.55	0.40	0.55	0.40
PGE	NonRes Upst LTG IND LED LAMP	-37	-33	0.89	0.0%	0.77	0.40	0.77	0.40
PGE	NonRes Upst LTG IND LED REF	-155	-62	0.40	0.0%	0.82	0.27	0.82	0.27
PGE	PassThrough Res Downstream	-817	-817	1.00	100.0%	0.74	0.74		
PGE	PassThrough Upstream	-2,677	-2,677	1.00	100.0%	0.64	0.64		
PGE	Res Upst LTG IND CFL > 30 W	-1,335	-1,698	1.27	0.0%	0.54	0.47	0.54	0.47
PGE	Res Upst LTG IND CFL A LAMP	-2,472	-2,983	1.21	0.0%	0.67	0.60	0.67	0.60
PGE	Res Upst LTG IND CFL BASIC	-11,607	-7,549	0.65	0.0%	0.59	0.45	0.59	0.45
PGE	Res Upst LTG IND CFL REF	-3,484	-2,127	0.61	0.0%	0.71	0.33	0.71	0.33
PGE	Res Upst LTG IND LED LAMP	-978	-795	0.81	0.0%	0.78	0.40	0.78	0.40
PGE	Res Upst LTG IND LED REF	-3,537	-2,058	0.58	0.0%	0.81	0.27	0.81	0.27
PGE	**Total**	**-27,374**	**-21,652**	**0.79**	**12.8%**	**0.65**	**0.44**	**0.64**	**0.42**
SCE	NonRes Upst LTG IND CFL > 30 W	-310	-250	0.81	0.0%	0.54	0.45	0.54	0.45
SCE	NonRes Upst LTG IND CFL A LAMP	-74	-111	1.51	0.0%	0.54	0.69	0.54	0.69
SCE	NonRes Upst LTG IND CFL BASIC	-19	-71	3.84	0.0%	0.54	0.51	0.54	0.51
SCE	NonRes Upst LTG IND CFL GLOBE	-7	-11	1.49	0.0%	0.54	0.68	0.54	0.68
SCE	NonRes Upst LTG IND CFL REF	-75	-43	0.57	0.0%	0.54	0.27	0.54	0.27
SCE	NonRes Upst LTG IND LED LAMP	-12	-16	1.39	0.0%	0.66	0.42	0.66	0.42
SCE	NonRes Upst LTG IND LED REF	-53	-34	0.64	0.0%	0.63	0.28	0.63	0.28
SCE	PassThrough Res Downstream	-547	-547	1.00	100.0%	0.57	0.57		
SCE	PassThrough Upstream	-312	-312	1.00	100.0%	0.54	0.54		
SCE	Res Upst LTG IND CFL > 30 W	-17,156	-14,591	0.85	0.0%	0.54	0.45	0.54	0.45
SCE	Res Upst LTG IND CFL A LAMP	-4,013	-7,189	1.79	0.0%	0.54	0.69	0.54	0.69
SCE	Res Upst LTG IND CFL BASIC	-1,082	-5,228	4.83	0.0%	0.54	0.51	0.54	0.51
SCE	Res Upst LTG IND CFL GLOBE	-416	-406	0.98	0.0%	0.54	0.68	0.54	0.68
SCE	Res Upst LTG IND CFL REF	-5,388	-3,333	0.62	0.0%	0.54	0.27	0.54	0.27

Net Lifecycle Savings (MTherms)

PA	Standard Report Group	Ex-Ante Net	Ex-Post Net	NRR	% Ex-Ante Net Pass Through	Ex-Ante NTG	Ex-Post NTG	Eval Ex-Ante NTG	Eval Ex-Post NTG
SCE	Res Upst LTG IND LED LAMP	-540	-497	0.92	0.0%	0.65	0.42	0.65	0.42
SCE	Res Upst LTG IND LED REF	-2,101	-1,516	0.72	0.0%	0.61	0.28	0.61	0.28
SCE	**Total**	**-32,105**	**-34,156**	**1.06**	**2.7%**	**0.55**	**0.45**	**0.55**	**0.45**
SDGE	NonRes Upst LTG IND CFL > 30 W	0	0	5.55	0.0%	0.54	0.39	0.54	0.39
SDGE	NonRes Upst LTG IND CFL A LAMP	-8	-16	1.87	0.0%	0.54	0.52	0.54	0.52
SDGE	NonRes Upst LTG IND CFL BASIC	-56	-40	0.72	0.0%	0.54	0.27	0.54	0.27
SDGE	NonRes Upst LTG IND CFL GLOBE	-1	-2	1.21	0.0%	0.54	0.67	0.54	0.67
SDGE	NonRes Upst LTG IND CFL REF	-19	-15	0.81	0.0%	0.54	0.18	0.54	0.18
SDGE	NonRes Upst LTG IND LED LAMP	-24	-8	0.33	0.0%	0.85	0.35	0.85	0.35
SDGE	NonRes Upst LTG IND LED REF	-29	-9	0.30	0.0%	0.85	0.28	0.85	0.28
SDGE	PassThrough Res Downstream	-91	-91	1.00	100.0%	0.85	0.85		
SDGE	PassThrough Upstream	-294	-294	1.00	100.0%	0.85	0.85		
SDGE	Res Upst LTG IND CFL > 30 W	-26	-23	0.87	0.0%	0.54	0.39	0.54	0.39
SDGE	Res Upst LTG IND CFL A LAMP	-608	-919	1.51	0.0%	0.54	0.52	0.54	0.52
SDGE	Res Upst LTG IND CFL BASIC	-2,699	-1,956	0.72	0.0%	0.54	0.27	0.54	0.27
SDGE	Res Upst LTG IND CFL GLOBE	-56	-64	1.16	0.0%	0.54	0.67	0.54	0.67
SDGE	Res Upst LTG IND CFL REF	-932	-306	0.33	0.0%	0.54	0.18	0.54	0.18
SDGE	Res Upst LTG IND LED LAMP	-698	-484	0.69	0.0%	0.85	0.35	0.85	0.35
SDGE	Res Upst LTG IND LED REF	-1,047	-449	0.43	0.0%	0.85	0.28	0.85	0.28
SDGE	**Total**	**-6,589**	**-4,677**	**0.71**	**5.8%**	**0.61**	**0.32**	**0.60**	**0.31**
	Statewide	***-66,068***	***-60,485***	***0.92***	***7.2%***	***0.59***	***0.44***	***0.59***	***0.42***

Gross First Year Savings (MWh)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
PGE	NonRes Upst LTG IND CFL > 30 W	4,678	7,231	1.55	0.0%	1.55
PGE	NonRes Upst LTG IND CFL A LAMP	3,909	9,937	2.54	0.0%	2.54
PGE	NonRes Upst LTG IND CFL BASIC	11,191	42,756	3.82	0.0%	3.82
PGE	NonRes Upst LTG IND CFL REF	3,533	12,048	3.41	0.0%	3.41
PGE	NonRes Upst LTG IND LED LAMP	1,207	2,187	1.81	0.0%	1.81
PGE	NonRes Upst LTG IND LED REF	4,218	5,253	1.25	0.0%	1.25
PGE	PassThrough Res Downstream	5,065	5,065	1.00	100.0%	
PGE	PassThrough Upstream	14,102	14,102	1.00	100.0%	
PGE	Res Upst LTG IND CFL > 30 W	11,203	16,086	1.44	0.0%	1.44
PGE	Res Upst LTG IND CFL A LAMP	20,558	27,960	1.36	0.0%	1.36
PGE	Res Upst LTG IND CFL BASIC	108,175	93,043	0.86	0.0%	0.86
PGE	Res Upst LTG IND CFL REF	29,030	37,278	1.28	0.0%	1.28
PGE	Res Upst LTG IND LED LAMP	3,269	5,074	1.55	0.0%	1.55
PGE	Res Upst LTG IND LED REF	11,238	19,572	1.74	0.0%	1.74
PGE	**Total**	**231,375**	**297,590**	**1.29**	**8.3%**	**1.31**
SCE	NonRes Upst LTG IND CFL > 30 W	92,254	75,606	0.82	0.0%	0.82
SCE	NonRes Upst LTG IND CFL A LAMP	21,719	21,196	0.98	0.0%	0.98
SCE	NonRes Upst LTG IND CFL BASIC	5,488	19,360	3.53	0.0%	3.53
SCE	NonRes Upst LTG IND CFL GLOBE	2,254	2,105	0.93	0.0%	0.93
SCE	NonRes Upst LTG IND CFL REF	22,947	21,303	0.93	0.0%	0.93
SCE	NonRes Upst LTG IND LED LAMP	1,120	2,306	2.06	0.0%	2.06
SCE	NonRes Upst LTG IND LED REF	4,502	6,948	1.54	0.0%	1.54
SCE	PassThrough Res Downstream	8,023	8,023	1.00	100.0%	
SCE	PassThrough Upstream	4,696	4,696	1.00	100.0%	
SCE	Res Upst LTG IND CFL > 30 W	173,099	189,897	1.10	0.0%	1.10
SCE	Res Upst LTG IND CFL A LAMP	45,381	61,715	1.36	0.0%	1.36
SCE	Res Upst LTG IND CFL BASIC	79,065	77,151	0.98	0.0%	0.98
SCE	Res Upst LTG IND CFL GLOBE	4,321	3,455	0.80	0.0%	0.80
SCE	Res Upst LTG IND CFL REF	54,897	71,447	1.30	0.0%	1.30
SCE	Res Upst LTG IND LED LAMP	2,690	4,193	1.56	0.0%	1.56
SCE	Res Upst LTG IND LED REF	11,363	19,111	1.68	0.0%	1.68
SCE	**Total**	**533,818**	**588,512**	**1.10**	**2.4%**	**1.10**
SDGE	NonRes Upst LTG IND CFL > 30 W	16	144	8.94	0.0%	8.94
SDGE	NonRes Upst LTG IND CFL A LAMP	1,639	3,533	2.16	0.0%	2.16
SDGE	NonRes Upst LTG IND CFL BASIC	9,162	15,564	1.70	0.0%	1.70
SDGE	NonRes Upst LTG IND CFL GLOBE	228	257	1.13	0.0%	1.13
SDGE	NonRes Upst LTG IND CFL REF	538	4,149	7.71	0.0%	7.71
SDGE	NonRes Upst LTG IND LED LAMP	1,210	1,264	1.04	0.0%	1.04
SDGE	NonRes Upst LTG IND LED REF	1,667	1,725	1.03	0.0%	1.03
SDGE	PassThrough Res Downstream	1,148	1,148	1.00	100.0%	
SDGE	PassThrough Upstream	1,572	1,572	1.00	100.0%	

Gross First Year Savings (MWh)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
SDGE	Res Upst LTG IND CFL > 30 W	298	347	1.16	0.0%	1.16
SDGE	Res Upst LTG IND CFL A LAMP	6,873	10,370	1.51	0.0%	1.51
SDGE	Res Upst LTG IND CFL BASIC	30,500	42,146	1.38	0.0%	1.38
SDGE	Res Upst LTG IND CFL GLOBE	629	570	0.91	0.0%	0.91
SDGE	Res Upst LTG IND CFL REF	10,505	9,974	0.95	0.0%	0.95
SDGE	Res Upst LTG IND LED LAMP	3,032	4,999	1.65	0.0%	1.65
SDGE	Res Upst LTG IND LED REF	6,048	6,116	1.01	0.0%	1.01
SDGE	**Total**	**75,066**	**103,876**	**1.38**	**3.6%**	**1.40**
	Statewide	***840,258***	***989,978***	***1.18***	***4.1%***	***1.19***

Net First Year Savings (MWh)

PA	Standard Report Group	Ex-Ante Net	Ex-Post Net	NRR	% Ex-Ante Net Pass Through	Ex-Ante NTG	Ex-Post NTG	Eval Ex-Ante NTG	Eval Ex-Post NTG
PGE	NonRes Upst LTG IND CFL > 30 W	2,526	3,377	1.34	0.0%	0.54	0.47	0.54	0.47
PGE	NonRes Upst LTG IND CFL A LAMP	2,111	6,007	2.85	0.0%	0.54	0.60	0.54	0.60
PGE	NonRes Upst LTG IND CFL BASIC	6,346	21,852	3.44	0.0%	0.57	0.51	0.57	0.51
PGE	NonRes Upst LTG IND CFL REF	1,925	4,680	2.43	0.0%	0.54	0.39	0.54	0.39
PGE	NonRes Upst LTG IND LED LAMP	939	874	0.93	0.0%	0.78	0.40	0.78	0.40
PGE	NonRes Upst LTG IND LED REF	3,440	1,409	0.41	0.0%	0.82	0.27	0.82	0.27
PGE	PassThrough Res Downstream	3,732	3,732	1.00	100.0%	0.74	0.74		
PGE	PassThrough Upstream	9,041	9,041	1.00	100.0%	0.64	0.64		
PGE	Res Upst LTG IND CFL > 30 W	6,050	7,513	1.24	0.0%	0.54	0.47	0.54	0.47
PGE	Res Upst LTG IND CFL A LAMP	14,602	17,365	1.19	0.0%	0.71	0.62	0.71	0.62
PGE	Res Upst LTG IND CFL BASIC	64,031	44,681	0.70	0.0%	0.59	0.48	0.59	0.48
PGE	Res Upst LTG IND CFL REF	21,528	14,198	0.66	0.0%	0.74	0.38	0.74	0.38
PGE	Res Upst LTG IND LED LAMP	2,541	2,027	0.80	0.0%	0.78	0.40	0.78	0.40
PGE	Res Upst LTG IND LED REF	9,074	5,249	0.58	0.0%	0.81	0.27	0.81	0.27
PGE	**Total**	**147,886**	**142,005**	**0.96**	**8.6%**	**0.64**	**0.48**	**0.64**	**0.46**
SCE	NonRes Upst LTG IND CFL > 30 W	49,817	33,727	0.68	0.0%	0.54	0.45	0.54	0.45
SCE	NonRes Upst LTG IND CFL A LAMP	11,729	14,631	1.25	0.0%	0.54	0.69	0.54	0.69
SCE	NonRes Upst LTG IND CFL BASIC	2,964	9,946	3.36	0.0%	0.54	0.51	0.54	0.51
SCE	NonRes Upst LTG IND CFL GLOBE	1,217	1,437	1.18	0.0%	0.54	0.68	0.54	0.68
SCE	NonRes Upst LTG IND CFL REF	12,391	5,775	0.47	0.0%	0.54	0.27	0.54	0.27
SCE	NonRes Upst LTG IND LED LAMP	764	962	1.26	0.0%	0.68	0.42	0.68	0.42
SCE	NonRes Upst LTG IND LED REF	2,873	1,941	0.68	0.0%	0.64	0.28	0.64	0.28
SCE	PassThrough Res Downstream	4,533	4,533	1.00	100.0%	0.56	0.56		
SCE	PassThrough Upstream	2,536	2,536	1.00	100.0%	0.54	0.54		
SCE	Res Upst LTG IND CFL > 30 W	93,473	84,712	0.91	0.0%	0.54	0.45	0.54	0.45
SCE	Res Upst LTG IND CFL A LAMP	25,786	42,610	1.65	0.0%	0.57	0.69	0.57	0.69
SCE	Res Upst LTG IND CFL BASIC	50,692	41,762	0.82	0.0%	0.64	0.54	0.64	0.54
SCE	Res Upst LTG IND CFL GLOBE	2,333	2,358	1.01	0.0%	0.54	0.68	0.54	0.68
SCE	Res Upst LTG IND CFL REF	29,655	19,370	0.65	0.0%	0.54	0.27	0.54	0.27

Net First Year Savings (MWh)

PA	Standard Report Group	Ex-Ante Net	Ex-Post Net	NRR	% Ex-Ante Net Pass Through	Ex-Ante NTG	Ex-Post NTG	Eval Ex-Ante NTG	Eval Ex-Post NTG
SCE	Res Upst LTG IND LED LAMP	1,755	1,749	1.00	0.0%	0.65	0.42	0.65	0.42
SCE	Res Upst LTG IND LED REF	6,875	5,337	0.78	0.0%	0.61	0.28	0.61	0.28
SCE	**Total**	**299,394**	**273,386**	**0.91**	**2.4%**	**0.56**	**0.46**	**0.56**	**0.46**
SDGE	NonRes Upst LTG IND CFL > 30 W	9	56	6.50	0.0%	0.54	0.39	0.54	0.39
SDGE	NonRes Upst LTG IND CFL A LAMP	885	1,853	2.09	0.0%	0.54	0.52	0.54	0.52
SDGE	NonRes Upst LTG IND CFL BASIC	4,948	4,275	0.86	0.0%	0.54	0.27	0.54	0.27
SDGE	NonRes Upst LTG IND CFL GLOBE	123	172	1.40	0.0%	0.54	0.67	0.54	0.67
SDGE	NonRes Upst LTG IND CFL REF	290	753	2.59	0.0%	0.54	0.18	0.54	0.18
SDGE	NonRes Upst LTG IND LED LAMP	1,028	442	0.43	0.0%	0.85	0.35	0.85	0.35
SDGE	NonRes Upst LTG IND LED REF	1,417	485	0.34	0.0%	0.85	0.28	0.85	0.28
SDGE	PassThrough Res Downstream	978	978	1.00	100.0%	0.85	0.85		
SDGE	PassThrough Upstream	1,333	1,333	1.00	100.0%	0.85	0.85		
SDGE	Res Upst LTG IND CFL > 30 W	161	136	0.85	0.0%	0.54	0.39	0.54	0.39
SDGE	Res Upst LTG IND CFL A LAMP	3,711	5,438	1.47	0.0%	0.54	0.52	0.54	0.52
SDGE	Res Upst LTG IND CFL BASIC	16,470	11,577	0.70	0.0%	0.54	0.27	0.54	0.27
SDGE	Res Upst LTG IND CFL GLOBE	340	381	1.12	0.0%	0.54	0.67	0.54	0.67
SDGE	Res Upst LTG IND CFL REF	5,673	1,810	0.32	0.0%	0.54	0.18	0.54	0.18
SDGE	Res Upst LTG IND LED LAMP	2,577	1,749	0.68	0.0%	0.85	0.35	0.85	0.35
SDGE	Res Upst LTG IND LED REF	5,141	1,721	0.33	0.0%	0.85	0.28	0.85	0.28
SDGE	**Total**	**45,084**	**33,159**	**0.74**	**5.1%**	**0.60**	**0.32**	**0.59**	**0.30**
	Statewide	***492,364***	***448,550***	***0.91***	***4.5%***	***0.59***	***0.45***	***0.58***	***0.45***

Gross First Year Savings (MW)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
PGE	NonRes Upst LTG IND CFL > 30 W	1.0	1.5	1.51	0.0%	1.51
PGE	NonRes Upst LTG IND CFL A LAMP	0.8	2.0	2.52	0.0%	2.52
PGE	NonRes Upst LTG IND CFL BASIC	2.2	8.6	3.99	0.0%	3.99
PGE	NonRes Upst LTG IND CFL REF	0.7	2.4	3.40	0.0%	3.40
PGE	NonRes Upst LTG IND LED LAMP	0.2	0.4	1.78	0.0%	1.78
PGE	NonRes Upst LTG IND LED REF	0.9	1.1	1.23	0.0%	1.23
PGE	PassThrough Res Downstream	0.4	0.4	1.00	100.0%	
PGE	PassThrough Upstream	1.9	1.9	1.00	100.0%	
PGE	Res Upst LTG IND CFL > 30 W	1.2	1.9	1.57	0.0%	1.57
PGE	Res Upst LTG IND CFL A LAMP	2.6	3.1	1.19	0.0%	1.19
PGE	Res Upst LTG IND CFL BASIC	14.8	11.1	0.75	0.0%	0.75
PGE	Res Upst LTG IND CFL REF	3.8	4.2	1.13	0.0%	1.13
PGE	Res Upst LTG IND LED LAMP	0.3	0.6	1.58	0.0%	1.58
PGE	Res Upst LTG IND LED REF	1.2	2.1	1.78	0.0%	1.78
PGE	**Total**	**31.9**	**41.3**	**1.29**	**7.2%**	**1.32**
SCE	NonRes Upst LTG IND CFL > 30 W	19.0	15.8	0.83	0.0%	0.83
SCE	NonRes Upst LTG IND CFL A LAMP	4.5	4.4	0.99	0.0%	0.99
SCE	NonRes Upst LTG IND CFL BASIC	1.1	3.8	3.36	0.0%	3.36
SCE	NonRes Upst LTG IND CFL GLOBE	0.5	0.4	0.95	0.0%	0.95
SCE	NonRes Upst LTG IND CFL REF	4.7	4.4	0.94	0.0%	0.94
SCE	NonRes Upst LTG IND LED LAMP	0.2	0.5	2.01	0.0%	2.01
SCE	NonRes Upst LTG IND LED REF	1.0	1.4	1.39	0.0%	1.39
SCE	PassThrough Res Downstream	1.2	1.2	1.00	100.0%	
SCE	PassThrough Upstream	0.7	0.7	1.00	100.0%	
SCE	Res Upst LTG IND CFL > 30 W	18.5	22.3	1.20	0.0%	1.20
SCE	Res Upst LTG IND CFL A LAMP	5.0	7.2	1.43	0.0%	1.43
SCE	Res Upst LTG IND CFL BASIC	11.9	10.7	0.90	0.0%	0.90
SCE	Res Upst LTG IND CFL GLOBE	0.5	0.5	1.12	0.0%	1.12
SCE	Res Upst LTG IND CFL REF	5.9	8.5	1.45	0.0%	1.45
SCE	Res Upst LTG IND LED LAMP	0.3	0.5	1.60	0.0%	1.60
SCE	Res Upst LTG IND LED REF	1.2	2.1	1.73	0.0%	1.73
SCE	**Total**	**76.3**	**84.5**	**1.11**	**2.6%**	**1.11**
SDGE	NonRes Upst LTG IND CFL > 30 W	0.0	0.0	8.80	0.0%	8.80
SDGE	NonRes Upst LTG IND CFL A LAMP	0.4	0.7	2.13	0.0%	2.13
SDGE	NonRes Upst LTG IND CFL BASIC	2.0	3.3	1.69	0.0%	1.69
SDGE	NonRes Upst LTG IND CFL GLOBE	0.0	0.1	1.11	0.0%	1.11
SDGE	NonRes Upst LTG IND CFL REF	0.1	0.9	9.42	0.0%	9.42
SDGE	NonRes Upst LTG IND LED LAMP	0.3	0.3	1.03	0.0%	1.03
SDGE	NonRes Upst LTG IND LED REF	0.4	0.4	1.02	0.0%	1.02
SDGE	PassThrough Res Downstream	0.1	0.1	1.00	100.0%	
SDGE	PassThrough Upstream	0.2	0.2	1.00	100.0%	

Gross First Year Savings (MW)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
SDGE	Res Upst LTG IND CFL > 30 W	0.0	0.0	1.23	0.0%	1.23
SDGE	Res Upst LTG IND CFL A LAMP	0.7	1.1	1.63	0.0%	1.63
SDGE	Res Upst LTG IND CFL BASIC	3.1	4.4	1.45	0.0%	1.45
SDGE	Res Upst LTG IND CFL GLOBE	0.1	0.1	1.22	0.0%	1.22
SDGE	Res Upst LTG IND CFL REF	1.1	1.0	0.95	0.0%	0.95
SDGE	Res Upst LTG IND LED LAMP	0.3	0.5	1.62	0.0%	1.62
SDGE	Res Upst LTG IND LED REF	0.8	0.6	0.76	0.0%	0.76
SDGE	**Total**	**9.4**	**13.7**	**1.46**	**3.1%**	**1.48**
	Statewide	***117.6***	***139.5***	***1.19***	***3.9%***	***1.19***

Net First Year Savings (MW)

PA	Standard Report Group	Ex-Ante Net	Ex-Post Net	NRR	% Ex-Ante Net Pass Through	Ex-Ante NTG	Ex-Post NTG	Eval Ex-Ante NTG	Eval Ex-Post NTG
PGE	NonRes Upst LTG IND CFL > 30 W	0.5	0.7	1.31	0.0%	0.54	0.47	0.54	0.47
PGE	NonRes Upst LTG IND CFL A LAMP	0.4	1.2	2.82	0.0%	0.54	0.60	0.54	0.60
PGE	NonRes Upst LTG IND CFL BASIC	1.2	4.4	3.61	0.0%	0.57	0.51	0.57	0.51
PGE	NonRes Upst LTG IND CFL REF	0.4	0.9	2.42	0.0%	0.54	0.39	0.54	0.39
PGE	NonRes Upst LTG IND LED LAMP	0.2	0.2	0.91	0.0%	0.78	0.40	0.78	0.40
PGE	NonRes Upst LTG IND LED REF	0.7	0.3	0.41	0.0%	0.81	0.27	0.81	0.27
PGE	PassThrough Res Downstream	0.3	0.3	1.00	100.0%	0.73	0.73		
PGE	PassThrough Upstream	1.2	1.2	1.00	100.0%	0.64	0.64		
PGE	Res Upst LTG IND CFL > 30 W	0.6	0.9	1.36	0.0%	0.54	0.47	0.54	0.47
PGE	Res Upst LTG IND CFL A LAMP	1.9	1.9	1.01	0.0%	0.73	0.62	0.73	0.62
PGE	Res Upst LTG IND CFL BASIC	8.8	5.4	0.61	0.0%	0.59	0.48	0.59	0.48
PGE	Res Upst LTG IND CFL REF	2.9	1.6	0.57	0.0%	0.76	0.38	0.76	0.38
PGE	Res Upst LTG IND LED LAMP	0.3	0.2	0.81	0.0%	0.78	0.40	0.78	0.40
PGE	Res Upst LTG IND LED REF	1.0	0.6	0.59	0.0%	0.81	0.27	0.81	0.27
PGE	**Total**	**20.4**	**19.8**	**0.97**	**7.4%**	**0.64**	**0.48**	**0.64**	**0.47**
SCE	NonRes Upst LTG IND CFL > 30 W	10.2	7.0	0.69	0.0%	0.54	0.45	0.54	0.45
SCE	NonRes Upst LTG IND CFL A LAMP	2.4	3.0	1.26	0.0%	0.54	0.69	0.54	0.69
SCE	NonRes Upst LTG IND CFL BASIC	0.6	1.9	3.14	0.0%	0.54	0.50	0.54	0.50
SCE	NonRes Upst LTG IND CFL GLOBE	0.2	0.3	1.20	0.0%	0.54	0.68	0.54	0.68
SCE	NonRes Upst LTG IND CFL REF	2.5	1.2	0.47	0.0%	0.54	0.27	0.54	0.27
SCE	NonRes Upst LTG IND LED LAMP	0.2	0.2	1.23	0.0%	0.68	0.42	0.68	0.42
SCE	NonRes Upst LTG IND LED REF	0.7	0.4	0.61	0.0%	0.64	0.28	0.64	0.28
SCE	PassThrough Res Downstream	0.7	0.7	1.00	100.0%	0.55	0.55		
SCE	PassThrough Upstream	0.4	0.4	1.00	100.0%	0.54	0.54		
SCE	Res Upst LTG IND CFL > 30 W	10.0	9.9	0.99	0.0%	0.54	0.45	0.54	0.45
SCE	Res Upst LTG IND CFL A LAMP	2.9	5.0	1.71	0.0%	0.58	0.69	0.58	0.69
SCE	Res Upst LTG IND CFL BASIC	7.7	5.9	0.77	0.0%	0.65	0.55	0.65	0.55
SCE	Res Upst LTG IND CFL GLOBE	0.3	0.4	1.42	0.0%	0.54	0.68	0.54	0.68
SCE	Res Upst LTG IND CFL REF	3.2	2.3	0.73	0.0%	0.54	0.27	0.54	0.27

Net First Year Savings (MW)

PA	Standard Report Group	Ex-Ante Net	Ex-Post Net	NRR	% Ex-Ante Net Pass Through	Ex-Ante NTG	Ex-Post NTG	Eval Ex-Ante NTG	Eval Ex-Post NTG
SCE	Res Upst LTG IND LED LAMP	0.2	0.2	1.03	0.0%	0.65	0.42	0.65	0.42
SCE	Res Upst LTG IND LED REF	0.7	0.6	0.80	0.0%	0.61	0.28	0.61	0.28
SCE	**Total**	**42.9**	**39.4**	**0.92**	**2.5%**	**0.56**	**0.47**	**0.56**	**0.46**
SDGE	NonRes Upst LTG IND CFL > 30 W	0.0	0.0	6.40	0.0%	0.54	0.39	0.54	0.39
SDGE	NonRes Upst LTG IND CFL A LAMP	0.2	0.4	2.07	0.0%	0.54	0.52	0.54	0.52
SDGE	NonRes Upst LTG IND CFL BASIC	1.1	0.9	0.86	0.0%	0.54	0.27	0.54	0.27
SDGE	NonRes Upst LTG IND CFL GLOBE	0.0	0.0	1.38	0.0%	0.54	0.67	0.54	0.67
SDGE	NonRes Upst LTG IND CFL REF	0.1	0.2	3.17	0.0%	0.54	0.18	0.54	0.18
SDGE	NonRes Upst LTG IND LED LAMP	0.2	0.1	0.43	0.0%	0.85	0.35	0.85	0.35
SDGE	NonRes Upst LTG IND LED REF	0.3	0.1	0.34	0.0%	0.85	0.28	0.85	0.28
SDGE	PassThrough Res Downstream	0.1	0.1	1.00	100.0%	0.86	0.86		
SDGE	PassThrough Upstream	0.2	0.2	1.00	100.0%	0.85	0.85		
SDGE	Res Upst LTG IND CFL > 30 W	0.0	0.0	0.89	0.0%	0.54	0.39	0.54	0.39
SDGE	Res Upst LTG IND CFL A LAMP	0.4	0.6	1.58	0.0%	0.54	0.52	0.54	0.52
SDGE	Res Upst LTG IND CFL BASIC	1.7	1.2	0.74	0.0%	0.54	0.27	0.54	0.27
SDGE	Res Upst LTG IND CFL GLOBE	0.0	0.1	1.51	0.0%	0.54	0.67	0.54	0.67
SDGE	Res Upst LTG IND CFL REF	0.6	0.2	0.32	0.0%	0.54	0.18	0.54	0.18
SDGE	Res Upst LTG IND LED LAMP	0.3	0.2	0.67	0.0%	0.85	0.35	0.85	0.35
SDGE	Res Upst LTG IND LED REF	0.7	0.2	0.25	0.0%	0.85	0.28	0.85	0.28
SDGE	**Total**	**5.7**	**4.4**	**0.77**	**4.4%**	**0.61**	**0.32**	**0.60**	**0.31**
	Statewide	***69.0***	***63.6***	***0.92***	***4.1%***	***0.59***	***0.46***	***0.59***	***0.45***

Gross First Year Savings (MTherms)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
PGE	NonRes Upst LTG IND CFL > 30 W	-28	-41	1.46	0.0%	1.46
PGE	NonRes Upst LTG IND CFL A LAMP	-23	-57	2.50	0.0%	2.50
PGE	NonRes Upst LTG IND CFL BASIC	-65	-244	3.78	0.0%	3.78
PGE	NonRes Upst LTG IND CFL REF	-20	-69	3.36	0.0%	3.36
PGE	NonRes Upst LTG IND LED LAMP	-7	-12	1.73	0.0%	1.73
PGE	NonRes Upst LTG IND LED REF	-25	-30	1.22	0.0%	1.22
PGE	PassThrough Res Downstream	-101	-101	1.00	100.0%	
PGE	PassThrough Upstream	-270	-270	1.00	100.0%	
PGE	Res Upst LTG IND CFL > 30 W	-268	-394	1.47	0.0%	1.47
PGE	Res Upst LTG IND CFL A LAMP	-527	-685	1.30	0.0%	1.30
PGE	Res Upst LTG IND CFL BASIC	-2,850	-2,280	0.80	0.0%	0.80
PGE	Res Upst LTG IND CFL REF	-751	-914	1.22	0.0%	1.22
PGE	Res Upst LTG IND LED LAMP	-78	-124	1.58	0.0%	1.58
PGE	Res Upst LTG IND LED REF	-273	-480	1.76	0.0%	1.76
PGE	**Total**	**-5,285**	**-5,702**	**1.08**	**7.0%**	**1.08**
SCE	NonRes Upst LTG IND CFL > 30 W	-222	-216	0.97	0.0%	0.97
SCE	NonRes Upst LTG IND CFL A LAMP	-52	-61	1.18	0.0%	1.18
SCE	NonRes Upst LTG IND CFL BASIC	-14	-55	4.03	0.0%	4.03
SCE	NonRes Upst LTG IND CFL GLOBE	-5	-6	1.17	0.0%	1.17
SCE	NonRes Upst LTG IND CFL REF	-54	-61	1.14	0.0%	1.14
SCE	NonRes Upst LTG IND LED LAMP	-3	-7	2.17	0.0%	2.17
SCE	NonRes Upst LTG IND LED REF	-14	-20	1.47	0.0%	1.47
SCE	PassThrough Res Downstream	-70	-70	1.00	100.0%	
SCE	PassThrough Upstream	-63	-63	1.00	100.0%	
SCE	Res Upst LTG IND CFL > 30 W	-3,275	-3,372	1.03	0.0%	1.03
SCE	Res Upst LTG IND CFL A LAMP	-766	-1,096	1.43	0.0%	1.43
SCE	Res Upst LTG IND CFL BASIC	-207	-1,370	6.63	0.0%	6.63
SCE	Res Upst LTG IND CFL GLOBE	-79	-61	0.77	0.0%	0.77
SCE	Res Upst LTG IND CFL REF	-1,029	-1,269	1.23	0.0%	1.23
SCE	Res Upst LTG IND LED LAMP	-52	-74	1.44	0.0%	1.44
SCE	Res Upst LTG IND LED REF	-217	-339	1.56	0.0%	1.56
SCE	**Total**	**-6,120**	**-8,141**	**1.33**	**2.2%**	**1.34**
SDGE	NonRes Upst LTG IND CFL > 30 W	0	0	7.91	0.0%	7.91
SDGE	NonRes Upst LTG IND CFL A LAMP	-5	-9	1.92	0.0%	1.92
SDGE	NonRes Upst LTG IND CFL BASIC	-27	-39	1.43	0.0%	1.43
SDGE	NonRes Upst LTG IND CFL GLOBE	-1	-1	1.00	0.0%	1.00
SDGE	NonRes Upst LTG IND CFL REF	-4	-10	2.44	0.0%	2.44
SDGE	NonRes Upst LTG IND LED LAMP	-4	-3	0.86	0.0%	0.86
SDGE	NonRes Upst LTG IND LED REF	-5	-4	0.92	0.0%	0.92
SDGE	PassThrough Res Downstream	-11	-11	1.00	100.0%	
SDGE	PassThrough Upstream	-22	-22	1.00	100.0%	

Gross First Year Savings (MTherms)

PA	Standard Report Group	Ex-Ante Gross	Ex-Post Gross	GRR	% Ex-Ante Gross Pass Through	Eval GRR
SDGE	Res Upst LTG IND CFL > 30 W	-5	-6	1.20	0.0%	1.20
SDGE	Res Upst LTG IND CFL A LAMP	-116	-181	1.56	0.0%	1.56
SDGE	Res Upst LTG IND CFL BASIC	-517	-737	1.43	0.0%	1.43
SDGE	Res Upst LTG IND CFL GLOBE	-11	-10	0.94	0.0%	0.94
SDGE	Res Upst LTG IND CFL REF	-178	-174	0.98	0.0%	0.98
SDGE	Res Upst LTG IND LED LAMP	-51	-87	1.70	0.0%	1.70
SDGE	Res Upst LTG IND LED REF	-80	-107	1.34	0.0%	1.34
SDGE	**Total**	**-1,037**	**-1,403**	**1.35**	**3.2%**	**1.36**
	Statewide	***-12,443***	***-15,245***	***1.23***	***4.3%***	***1.24***

Net First Year Savings (MTherms)

PA	Standard Report Group	Ex-Ante Net	Ex-Post Net	NRR	% Ex-Ante Net Pass Through	Ex-Ante NTG	Ex-Post NTG	Eval Ex-Ante NTG	Eval Ex-Post NTG
PGE	NonRes Upst LTG IND CFL > 30 W	-15	-19	1.27	0.0%	0.54	0.47	0.54	0.47
PGE	NonRes Upst LTG IND CFL A LAMP	-12	-34	2.80	0.0%	0.54	0.60	0.54	0.60
PGE	NonRes Upst LTG IND CFL BASIC	-37	-125	3.41	0.0%	0.57	0.51	0.57	0.51
PGE	NonRes Upst LTG IND CFL REF	-11	-27	2.40	0.0%	0.54	0.39	0.54	0.39
PGE	NonRes Upst LTG IND LED LAMP	-6	-5	0.89	0.0%	0.78	0.40	0.78	0.40
PGE	NonRes Upst LTG IND LED REF	-20	-8	0.40	0.0%	0.81	0.27	0.81	0.27
PGE	PassThrough Res Downstream	-74	-74	1.00	100.0%	0.74	0.74		
PGE	PassThrough Upstream	-172	-172	1.00	100.0%	0.64	0.64		
PGE	Res Upst LTG IND CFL > 30 W	-145	-184	1.27	0.0%	0.54	0.47	0.54	0.47
PGE	Res Upst LTG IND CFL A LAMP	-378	-426	1.13	0.0%	0.72	0.62	0.72	0.62
PGE	Res Upst LTG IND CFL BASIC	-1,688	-1,095	0.65	0.0%	0.59	0.48	0.59	0.48
PGE	Res Upst LTG IND CFL REF	-561	-348	0.62	0.0%	0.75	0.38	0.75	0.38
PGE	Res Upst LTG IND LED LAMP	-61	-50	0.81	0.0%	0.78	0.40	0.78	0.40
PGE	Res Upst LTG IND LED REF	-221	-129	0.58	0.0%	0.81	0.27	0.81	0.27
PGE	**Total**	**-3,402**	**-2,696**	**0.79**	**7.3%**	**0.64**	**0.47**	**0.64**	**0.46**
SCE	NonRes Upst LTG IND CFL > 30 W	-120	-97	0.81	0.0%	0.54	0.45	0.54	0.45
SCE	NonRes Upst LTG IND CFL A LAMP	-28	-42	1.50	0.0%	0.54	0.69	0.54	0.69
SCE	NonRes Upst LTG IND CFL BASIC	-7	-28	3.84	0.0%	0.54	0.51	0.54	0.51
SCE	NonRes Upst LTG IND CFL GLOBE	-3	-4	1.47	0.0%	0.54	0.68	0.54	0.68
SCE	NonRes Upst LTG IND CFL REF	-29	-17	0.57	0.0%	0.54	0.27	0.54	0.27
SCE	NonRes Upst LTG IND LED LAMP	-2	-3	1.35	0.0%	0.67	0.42	0.67	0.42
SCE	NonRes Upst LTG IND LED REF	-9	-6	0.65	0.0%	0.63	0.28	0.63	0.28
SCE	PassThrough Res Downstream	-40	-40	1.00	100.0%	0.57	0.57		
SCE	PassThrough Upstream	-34	-34	1.00	100.0%	0.54	0.54		
SCE	Res Upst LTG IND CFL > 30 W	-1,769	-1,504	0.85	0.0%	0.54	0.45	0.54	0.45
SCE	Res Upst LTG IND CFL A LAMP	-414	-757	1.83	0.0%	0.54	0.69	0.54	0.69
SCE	Res Upst LTG IND CFL BASIC	-112	-742	6.65	0.0%	0.54	0.54	0.54	0.54
SCE	Res Upst LTG IND CFL GLOBE	-43	-42	0.98	0.0%	0.54	0.68	0.54	0.68
SCE	Res Upst LTG IND CFL REF	-555	-344	0.62	0.0%	0.54	0.27	0.54	0.27

Net First Year Savings (MTherms)

PA	Standard Report Group	Ex-Ante Net	Ex-Post Net	NRR	% Ex-Ante Net Pass Through	Ex-Ante NTG	Ex-Post NTG	Eval Ex-Ante NTG	Eval Ex-Post NTG
SCE	Res Upst LTG IND LED LAMP	-34	-31	0.92	0.0%	0.65	0.42	0.65	0.42
SCE	Res Upst LTG IND LED REF	-131	-95	0.72	0.0%	0.61	0.28	0.61	0.28
SCE	**Total**	**-3,329**	**-3,784**	**1.14**	**2.2%**	**0.54**	**0.46**	**0.54**	**0.46**
SDGE	NonRes Upst LTG IND CFL > 30 W	0	0	5.75	0.0%	0.54	0.39	0.54	0.39
SDGE	NonRes Upst LTG IND CFL A LAMP	-3	-5	1.86	0.0%	0.54	0.52	0.54	0.52
SDGE	NonRes Upst LTG IND CFL BASIC	-15	-11	0.73	0.0%	0.54	0.27	0.54	0.27
SDGE	NonRes Upst LTG IND CFL GLOBE	0	0	1.24	0.0%	0.54	0.67	0.54	0.67
SDGE	NonRes Upst LTG IND CFL REF	-2	-2	0.82	0.0%	0.54	0.18	0.54	0.18
SDGE	NonRes Upst LTG IND LED LAMP	-3	-1	0.35	0.0%	0.85	0.35	0.85	0.35
SDGE	NonRes Upst LTG IND LED REF	-4	-1	0.31	0.0%	0.85	0.28	0.85	0.28
SDGE	PassThrough Res Downstream	-9	-9	1.00	100.0%	0.85	0.85		
SDGE	PassThrough Upstream	-19	-19	1.00	100.0%	0.85	0.85		
SDGE	Res Upst LTG IND CFL > 30 W	-3	-2	0.87	0.0%	0.54	0.39	0.54	0.39
SDGE	Res Upst LTG IND CFL A LAMP	-63	-95	1.51	0.0%	0.54	0.52	0.54	0.52
SDGE	Res Upst LTG IND CFL BASIC	-279	-202	0.72	0.0%	0.54	0.27	0.54	0.27
SDGE	Res Upst LTG IND CFL GLOBE	-6	-7	1.16	0.0%	0.54	0.67	0.54	0.67
SDGE	Res Upst LTG IND CFL REF	-96	-32	0.33	0.0%	0.54	0.18	0.54	0.18
SDGE	Res Upst LTG IND LED LAMP	-44	-31	0.70	0.0%	0.85	0.35	0.85	0.35
SDGE	Res Upst LTG IND LED REF	-68	-30	0.44	0.0%	0.85	0.28	0.85	0.28
SDGE	**Total**	**-613**	**-447**	**0.73**	**4.6%**	**0.59**	**0.32**	**0.58**	**0.31**
	Statewide	***-7,344***	***-6,927***	***0.94***	***4.7%***	***0.59***	***0.45***	***0.59***	***0.45***

APPENDIX B. STANDARDIZED PER UNIT SAVINGS

Per Unit (Quantity) Gross Energy Savings (kWh)

PA	Standard Report Group	Pass Through	% ER Ex-Ante	% ER Ex-Post	Average EUL (yr)	Ex-Post Lifecycle	Ex-Post First Year	Ex-Post Annualized
PGE	NonRes Upst LTG IND CFL > 30 W	0	0.0%	0.0%	3.4	947.4	282.6	282.6
PGE	NonRes Upst LTG IND CFL A LAMP	0	0.0%	0.0%	3.3	384.7	116.4	116.4
PGE	NonRes Upst LTG IND CFL BASIC	0	0.0%	0.0%	4.4	663.6	148.8	148.8
PGE	NonRes Upst LTG IND CFL REF	0	0.0%	0.0%	3.4	481.8	139.5	139.5
PGE	NonRes Upst LTG IND LED LAMP	0	0.0%	0.0%	6.6	746.3	112.4	112.4
PGE	NonRes Upst LTG IND LED REF	0	0.0%	0.0%	7.8	963.2	123.8	123.8
PGE	Res Upst LTG IND CFL > 30 W	0	0.0%	0.0%	9.2	436.1	47.3	47.3
PGE	Res Upst LTG IND CFL A LAMP	0	0.0%	0.0%	7.4	180.2	24.6	24.6
PGE	Res Upst LTG IND CFL BASIC	0	0.0%	0.0%	7.3	179.5	24.4	24.4
PGE	Res Upst LTG IND CFL REF	0	0.0%	0.0%	7.1	229.7	32.5	32.5
PGE	Res Upst LTG IND LED LAMP	0	0.0%	0.0%	16.0	314.1	19.6	19.6
PGE	Res Upst LTG IND LED REF	0	0.0%	0.0%	16.0	555.6	34.7	34.7
PGE	PassThrough Res Downstream	1	0.0%		8.9	242.3	22.4	22.4
PGE	PassThrough Upstream	1	0.0%		15.6	437.9	29.6	29.6
SCE	NonRes Upst LTG IND CFL > 30 W	0	0.0%	0.0%	2.6	788.1	303.9	303.9
SCE	NonRes Upst LTG IND CFL A LAMP	0	0.0%	0.0%	2.6	428.8	162.0	162.0
SCE	NonRes Upst LTG IND CFL BASIC	0	0.0%	0.0%	2.5	331.8	132.7	132.7
SCE	NonRes Upst LTG IND CFL GLOBE	0	0.0%	0.0%	2.7	428.3	160.4	160.4
SCE	NonRes Upst LTG IND CFL REF	0	0.0%	0.0%	2.6	431.0	166.7	166.7
SCE	NonRes Upst LTG IND LED LAMP	0	0.0%	0.0%	5.9	925.5	156.7	156.7
SCE	NonRes Upst LTG IND LED REF	0	0.0%	0.0%	6.0	921.7	152.2	152.2
SCE	Res Upst LTG IND CFL > 30 W	0	0.0%	0.0%	9.7	472.5	48.7	48.7
SCE	Res Upst LTG IND CFL A LAMP	0	0.0%	0.0%	9.5	287.1	30.1	30.1
SCE	Res Upst LTG IND CFL BASIC	0	0.0%	0.0%	7.5	254.1	33.8	33.8
SCE	Res Upst LTG IND CFL GLOBE	0	0.0%	0.0%	9.7	163.0	16.8	16.8
SCE	Res Upst LTG IND CFL REF	0	0.0%	0.0%	9.7	346.0	35.7	35.7
SCE	Res Upst LTG IND LED LAMP	0	0.0%	0.0%	16.0	291.1	18.2	18.2
SCE	Res Upst LTG IND LED REF	0	0.0%	0.0%	16.0	427.6	26.7	26.7
SCE	PassThrough Res Downstream	1	6.6%		11.8	472.9	45.9	45.9
SCE	PassThrough Upstream	1	0.0%		9.3	213.9	29.5	29.5

Per Unit (Quantity) Gross Energy Savings (kWh)

PA	Standard Report Group	Pass Through	% ER Ex-Ante	% ER Ex-Post	Average EUL (yr)	Ex-Post Lifecycle	Ex-Post First Year	Ex-Post Annualized
SDGE	NonRes Upst LTG IND CFL > 30 W	0	0.0%	0.0%	3.5	1,055.9	302.6	302.6
SDGE	NonRes Upst LTG IND CFL A LAMP	0	0.0%	0.0%	3.4	409.3	120.5	120.5
SDGE	NonRes Upst LTG IND CFL BASIC	0	0.0%	0.0%	3.7	495.9	133.7	133.7
SDGE	NonRes Upst LTG IND CFL GLOBE	0	0.0%	0.0%	3.5	299.2	86.3	86.3
SDGE	NonRes Upst LTG IND CFL REF	0	0.0%	0.0%	8.1	1,162.2	142.7	142.7
SDGE	NonRes Upst LTG IND LED LAMP	0	0.0%	0.0%	7.2	652.2	89.6	89.6
SDGE	NonRes Upst LTG IND LED REF	0	0.0%	0.0%	7.1	993.0	140.3	140.3
SDGE	Res Upst LTG IND CFL > 30 W	0	0.0%	0.0%	9.7	452.0	46.7	46.7
SDGE	Res Upst LTG IND CFL A LAMP	0	0.0%	0.0%	9.7	218.4	22.6	22.6
SDGE	Res Upst LTG IND CFL BASIC	0	0.0%	0.0%	9.7	223.5	23.1	23.1
SDGE	Res Upst LTG IND CFL GLOBE	0	0.0%	0.0%	9.7	118.1	12.2	12.2
SDGE	Res Upst LTG IND CFL REF	0	0.0%	0.0%	9.7	211.8	21.9	21.9
SDGE	Res Upst LTG IND LED LAMP	0	0.0%	0.0%	15.8	358.7	22.6	22.6
SDGE	Res Upst LTG IND LED REF	0	0.0%	0.0%	14.9	473.8	31.8	31.8
SDGE	PassThrough Res Downstream	1	0.0%		10.4	490.0	47.3	47.3
SDGE	PassThrough Upstream	1	0.0%		0.0	0.4	0.0	0.0

Per Unit (Quantity) Gross Energy Savings (Therms)

PA	Standard Report Group	Pass Through	% ER Ex-Ante	% ER Ex-Post	Average EUL (yr)	Ex-Post Lifecycle	Ex-Post First Year	Ex-Post Annualized
PGE	NonRes Upst LTG IND CFL > 30 W	0	0.0%	0.0%	3.4	-5.4	-1.6	-1.6
PGE	NonRes Upst LTG IND CFL A LAMP	0	0.0%	0.0%	3.3	-2.2	-0.7	-0.7
PGE	NonRes Upst LTG IND CFL BASIC	0	0.0%	0.0%	4.4	-3.8	-0.8	-0.8
PGE	NonRes Upst LTG IND CFL REF	0	0.0%	0.0%	3.4	-2.7	-0.8	-0.8
PGE	NonRes Upst LTG IND LED LAMP	0	0.0%	0.0%	6.6	-4.3	-0.6	-0.6
PGE	NonRes Upst LTG IND LED REF	0	0.0%	0.0%	7.8	-5.5	-0.7	-0.7
PGE	Res Upst LTG IND CFL > 30 W	0	0.0%	0.0%	9.2	-10.7	-1.2	-1.2
PGE	Res Upst LTG IND CFL A LAMP	0	0.0%	0.0%	7.4	-4.4	-0.6	-0.6
PGE	Res Upst LTG IND CFL BASIC	0	0.0%	0.0%	7.3	-4.4	-0.6	-0.6
PGE	Res Upst LTG IND CFL REF	0	0.0%	0.0%	7.1	-5.6	-0.8	-0.8
PGE	Res Upst LTG IND LED LAMP	0	0.0%	0.0%	16.0	-7.7	-0.5	-0.5
PGE	Res Upst LTG IND LED REF	0	0.0%	0.0%	16.0	-13.6	-0.9	-0.9
PGE	PassThrough Res Downstream	1	0.0%		8.9	-4.9	-0.4	-0.4
PGE	PassThrough Upstream	1	0.0%		15.6	-8.8	-0.6	-0.6
SCE	NonRes Upst LTG IND CFL > 30 W	0	0.0%	0.0%	2.6	-2.3	-0.9	-0.9
SCE	NonRes Upst LTG IND CFL A LAMP	0	0.0%	0.0%	2.6	-1.2	-0.5	-0.5
SCE	NonRes Upst LTG IND CFL BASIC	0	0.0%	0.0%	2.5	-0.9	-0.4	-0.4
SCE	NonRes Upst LTG IND CFL GLOBE	0	0.0%	0.0%	2.7	-1.2	-0.5	-0.5
SCE	NonRes Upst LTG IND CFL REF	0	0.0%	0.0%	2.6	-1.2	-0.5	-0.5
SCE	NonRes Upst LTG IND LED LAMP	0	0.0%	0.0%	5.9	-2.6	-0.4	-0.4
SCE	NonRes Upst LTG IND LED REF	0	0.0%	0.0%	6.0	-2.6	-0.4	-0.4
SCE	Res Upst LTG IND CFL > 30 W	0	0.0%	0.0%	9.7	-8.4	-0.9	-0.9
SCE	Res Upst LTG IND CFL A LAMP	0	0.0%	0.0%	9.5	-5.1	-0.5	-0.5
SCE	Res Upst LTG IND CFL BASIC	0	0.0%	0.0%	7.5	-4.5	-0.6	-0.6
SCE	Res Upst LTG IND CFL GLOBE	0	0.0%	0.0%	9.7	-2.9	-0.3	-0.3
SCE	Res Upst LTG IND CFL REF	0	0.0%	0.0%	9.7	-6.1	-0.6	-0.6
SCE	Res Upst LTG IND LED LAMP	0	0.0%	0.0%	16.0	-5.2	-0.3	-0.3
SCE	Res Upst LTG IND LED REF	0	0.0%	0.0%	16.0	-7.6	-0.5	-0.5
SCE	PassThrough Res Downstream	1	6.6%		11.8	-5.5	-0.4	-0.4
SCE	PassThrough Upstream	1	0.0%		9.3	-3.6	-0.4	-0.4

Per Unit (Quantity) Gross Energy Savings (Therms)

PA	Standard Report Group	Pass Through	% ER Ex-Ante	% ER Ex-Post	Average EUL (yr)	Ex-Post Lifecycle	Ex-Post First Year	Ex-Post Annualized
SDGE	NonRes Upst LTG IND CFL > 30 W	0	0.0%	0.0%	3.5	-2.7	-0.8	-0.8
SDGE	NonRes Upst LTG IND CFL A LAMP	0	0.0%	0.0%	3.4	-1.0	-0.3	-0.3
SDGE	NonRes Upst LTG IND CFL BASIC	0	0.0%	0.0%	3.7	-1.2	-0.3	-0.3
SDGE	NonRes Upst LTG IND CFL GLOBE	0	0.0%	0.0%	3.5	-0.8	-0.2	-0.2
SDGE	NonRes Upst LTG IND CFL REF	0	0.0%	0.0%	8.1	-2.9	-0.4	-0.4
SDGE	NonRes Upst LTG IND LED LAMP	0	0.0%	0.0%	7.2	-1.6	-0.2	-0.2
SDGE	NonRes Upst LTG IND LED REF	0	0.0%	0.0%	7.1	-2.5	-0.4	-0.4
SDGE	Res Upst LTG IND CFL > 30 W	0	0.0%	0.0%	9.7	-7.9	-0.8	-0.8
SDGE	Res Upst LTG IND CFL A LAMP	0	0.0%	0.0%	9.7	-3.8	-0.4	-0.4
SDGE	Res Upst LTG IND CFL BASIC	0	0.0%	0.0%	9.7	-3.9	-0.4	-0.4
SDGE	Res Upst LTG IND CFL GLOBE	0	0.0%	0.0%	9.7	-2.1	-0.2	-0.2
SDGE	Res Upst LTG IND CFL REF	0	0.0%	0.0%	9.7	-3.7	-0.4	-0.4
SDGE	Res Upst LTG IND LED LAMP	0	0.0%	0.0%	15.8	-6.3	-0.4	-0.4
SDGE	Res Upst LTG IND LED REF	0	0.0%	0.0%	14.9	-8.3	-0.6	-0.6
SDGE	PassThrough Res Downstream	1	0.0%		10.4	-4.4	-0.5	-0.5
SDGE	PassThrough Upstream	1	0.0%		0.0	0.0	0.0	0.0

Per Unit (Quantity) Net Energy Savings (kWh)

PA	Standard Report Group	Pass Through	% ER Ex-Ante	% ER Ex-Post	Average EUL (yr)	Ex-Post Lifecycle	Ex-Post First Year	Ex-Post Annualized
PGE	NonRes Upst LTG IND CFL > 30 W	0	0.0%	0.0%	3.4	442.5	132.0	132.0
PGE	NonRes Upst LTG IND CFL A LAMP	0	0.0%	0.0%	3.3	232.6	70.3	70.3
PGE	NonRes Upst LTG IND CFL BASIC	0	0.0%	0.0%	4.4	354.6	76.1	76.1
PGE	NonRes Upst LTG IND CFL REF	0	0.0%	0.0%	3.4	190.7	54.2	54.2
PGE	NonRes Upst LTG IND LED LAMP	0	0.0%	0.0%	6.6	298.1	44.9	44.9
PGE	NonRes Upst LTG IND LED REF	0	0.0%	0.0%	7.8	258.3	33.2	33.2
PGE	Res Upst LTG IND CFL > 30 W	0	0.0%	0.0%	9.2	203.7	22.1	22.1
PGE	Res Upst LTG IND CFL A LAMP	0	0.0%	0.0%	7.4	107.3	15.3	15.3
PGE	Res Upst LTG IND CFL BASIC	0	0.0%	0.0%	7.3	80.7	11.7	11.7
PGE	Res Upst LTG IND CFL REF	0	0.0%	0.0%	7.1	75.6	12.4	12.4
PGE	Res Upst LTG IND LED LAMP	0	0.0%	0.0%	16.0	125.5	7.8	7.8
PGE	Res Upst LTG IND LED REF	0	0.0%	0.0%	16.0	149.0	9.3	9.3
PGE	PassThrough Res Downstream	1	0.0%		8.9	179.9	16.5	16.5
PGE	PassThrough Upstream	1	0.0%		15.6	280.1	19.0	19.0
SCE	NonRes Upst LTG IND CFL > 30 W	0	0.0%	0.0%	2.6	351.6	135.5	135.5
SCE	NonRes Upst LTG IND CFL A LAMP	0	0.0%	0.0%	2.6	296.0	111.8	111.8
SCE	NonRes Upst LTG IND CFL BASIC	0	0.0%	0.0%	2.5	170.5	68.2	68.2
SCE	NonRes Upst LTG IND CFL GLOBE	0	0.0%	0.0%	2.7	292.3	109.5	109.5
SCE	NonRes Upst LTG IND CFL REF	0	0.0%	0.0%	2.6	116.9	45.2	45.2
SCE	NonRes Upst LTG IND LED LAMP	0	0.0%	0.0%	5.9	386.0	65.4	65.4
SCE	NonRes Upst LTG IND LED REF	0	0.0%	0.0%	6.0	257.4	42.5	42.5
SCE	Res Upst LTG IND CFL > 30 W	0	0.0%	0.0%	9.7	210.8	21.7	21.7
SCE	Res Upst LTG IND CFL A LAMP	0	0.0%	0.0%	9.5	197.6	20.8	20.8
SCE	Res Upst LTG IND CFL BASIC	0	0.0%	0.0%	7.5	128.8	18.3	18.3
SCE	Res Upst LTG IND CFL GLOBE	0	0.0%	0.0%	9.7	111.3	11.5	11.5
SCE	Res Upst LTG IND CFL REF	0	0.0%	0.0%	9.7	93.8	9.7	9.7
SCE	Res Upst LTG IND LED LAMP	0	0.0%	0.0%	16.0	121.4	7.6	7.6
SCE	Res Upst LTG IND LED REF	0	0.0%	0.0%	16.0	119.4	7.5	7.5
SCE	PassThrough Res Downstream	1	6.6%		11.8	269.5	25.9	25.9
SCE	PassThrough Upstream	1	0.0%		9.3	115.5	15.9	15.9

Per Unit (Quantity) Net Energy Savings (kWh)

PA	Standard Report Group	Pass Through	% ER Ex-Ante	% ER Ex-Post	Average EUL (yr)	Ex-Post Lifecycle	Ex-Post First Year	Ex-Post Annualized
SDGE	NonRes Upst LTG IND CFL > 30 W	0	0.0%	0.0%	3.5	414.5	118.8	118.8
SDGE	NonRes Upst LTG IND CFL A LAMP	0	0.0%	0.0%	3.4	214.6	63.2	63.2
SDGE	NonRes Upst LTG IND CFL BASIC	0	0.0%	0.0%	3.7	136.2	36.7	36.7
SDGE	NonRes Upst LTG IND CFL GLOBE	0	0.0%	0.0%	3.5	199.7	57.6	57.6
SDGE	NonRes Upst LTG IND CFL REF	0	0.0%	0.0%	8.1	210.9	25.9	25.9
SDGE	NonRes Upst LTG IND LED LAMP	0	0.0%	0.0%	7.2	228.2	31.4	31.4
SDGE	NonRes Upst LTG IND LED REF	0	0.0%	0.0%	7.1	279.5	39.5	39.5
SDGE	Res Upst LTG IND CFL > 30 W	0	0.0%	0.0%	9.7	177.5	18.4	18.4
SDGE	Res Upst LTG IND CFL A LAMP	0	0.0%	0.0%	9.7	114.5	11.8	11.8
SDGE	Res Upst LTG IND CFL BASIC	0	0.0%	0.0%	9.7	61.4	6.3	6.3
SDGE	Res Upst LTG IND CFL GLOBE	0	0.0%	0.0%	9.7	78.8	8.2	8.2
SDGE	Res Upst LTG IND CFL REF	0	0.0%	0.0%	9.7	38.4	4.0	4.0
SDGE	Res Upst LTG IND LED LAMP	0	0.0%	0.0%	15.8	125.5	7.9	7.9
SDGE	Res Upst LTG IND LED REF	0	0.0%	0.0%	14.9	133.3	8.9	8.9
SDGE	PassThrough Res Downstream	1	0.0%		10.4	418.7	40.3	40.3
SDGE	PassThrough Upstream	1	0.0%		0.0	0.3	0.0	0.0

Per Unit (Quantity) Net Energy Savings (Therms)

PA	Standard Report Group	Pass Through	% ER Ex-Ante	% ER Ex-Post	Average EUL (yr)	Ex-Post Lifecycle	Ex-Post First Year	Ex-Post Annualized
PGE	NonRes Upst LTG IND CFL > 30 W	0	0.0%	0.0%	3.4	-2.5	-0.8	-0.8
PGE	NonRes Upst LTG IND CFL A LAMP	0	0.0%	0.0%	3.3	-1.3	-0.4	-0.4
PGE	NonRes Upst LTG IND CFL BASIC	0	0.0%	0.0%	4.4	-2.0	-0.4	-0.4
PGE	NonRes Upst LTG IND CFL REF	0	0.0%	0.0%	3.4	-1.1	-0.3	-0.3
PGE	NonRes Upst LTG IND LED LAMP	0	0.0%	0.0%	6.6	-1.7	-0.3	-0.3
PGE	NonRes Upst LTG IND LED REF	0	0.0%	0.0%	7.8	-1.5	-0.2	-0.2
PGE	Res Upst LTG IND CFL > 30 W	0	0.0%	0.0%	9.2	-5.0	-0.5	-0.5
PGE	Res Upst LTG IND CFL A LAMP	0	0.0%	0.0%	7.4	-2.6	-0.4	-0.4
PGE	Res Upst LTG IND CFL BASIC	0	0.0%	0.0%	7.3	-2.0	-0.3	-0.3
PGE	Res Upst LTG IND CFL REF	0	0.0%	0.0%	7.1	-1.9	-0.3	-0.3
PGE	Res Upst LTG IND LED LAMP	0	0.0%	0.0%	16.0	-3.1	-0.2	-0.2
PGE	Res Upst LTG IND LED REF	0	0.0%	0.0%	16.0	-3.7	-0.2	-0.2
PGE	PassThrough Res Downstream	1	0.0%		8.9	-3.6	-0.3	-0.3
PGE	PassThrough Upstream	1	0.0%		15.6	-5.6	-0.4	-0.4
SCE	NonRes Upst LTG IND CFL > 30 W	0	0.0%	0.0%	2.6	-1.0	-0.4	-0.4
SCE	NonRes Upst LTG IND CFL A LAMP	0	0.0%	0.0%	2.6	-0.8	-0.3	-0.3
SCE	NonRes Upst LTG IND CFL BASIC	0	0.0%	0.0%	2.5	-0.5	-0.2	-0.2
SCE	NonRes Upst LTG IND CFL GLOBE	0	0.0%	0.0%	2.7	-0.8	-0.3	-0.3
SCE	NonRes Upst LTG IND CFL REF	0	0.0%	0.0%	2.6	-0.3	-0.1	-0.1
SCE	NonRes Upst LTG IND LED LAMP	0	0.0%	0.0%	5.9	-1.1	-0.2	-0.2
SCE	NonRes Upst LTG IND LED REF	0	0.0%	0.0%	6.0	-0.7	-0.1	-0.1
SCE	Res Upst LTG IND CFL > 30 W	0	0.0%	0.0%	9.7	-3.7	-0.4	-0.4
SCE	Res Upst LTG IND CFL A LAMP	0	0.0%	0.0%	9.5	-3.5	-0.4	-0.4
SCE	Res Upst LTG IND CFL BASIC	0	0.0%	0.0%	7.5	-2.3	-0.3	-0.3
SCE	Res Upst LTG IND CFL GLOBE	0	0.0%	0.0%	9.7	-2.0	-0.2	-0.2
SCE	Res Upst LTG IND CFL REF	0	0.0%	0.0%	9.7	-1.7	-0.2	-0.2
SCE	Res Upst LTG IND LED LAMP	0	0.0%	0.0%	16.0	-2.2	-0.1	-0.1
SCE	Res Upst LTG IND LED REF	0	0.0%	0.0%	16.0	-2.1	-0.1	-0.1
SCE	PassThrough Res Downstream	1	6.6%		11.8	-3.1	-0.2	-0.2
SCE	PassThrough Upstream	1	0.0%		9.3	-2.0	-0.2	-0.2

Per Unit (Quantity) Net Energy Savings (Therms)

PA	Standard Report Group	Pass Through	% ER Ex-Ante	% ER Ex-Post	Average EUL (yr)	Ex-Post Lifecycle	Ex-Post First Year	Ex-Post Annualized
SDGE	NonRes Upst LTG IND CFL > 30 W	0	0.0%	0.0%	3.5	-1.0	-0.3	-0.3
SDGE	NonRes Upst LTG IND CFL A LAMP	0	0.0%	0.0%	3.4	-0.5	-0.2	-0.2
SDGE	NonRes Upst LTG IND CFL BASIC	0	0.0%	0.0%	3.7	-0.3	-0.1	-0.1
SDGE	NonRes Upst LTG IND CFL GLOBE	0	0.0%	0.0%	3.5	-0.5	-0.1	-0.1
SDGE	NonRes Upst LTG IND CFL REF	0	0.0%	0.0%	8.1	-0.5	-0.1	-0.1
SDGE	NonRes Upst LTG IND LED LAMP	0	0.0%	0.0%	7.2	-0.6	-0.1	-0.1
SDGE	NonRes Upst LTG IND LED REF	0	0.0%	0.0%	7.1	-0.7	-0.1	-0.1
SDGE	Res Upst LTG IND CFL > 30 W	0	0.0%	0.0%	9.7	-3.1	-0.3	-0.3
SDGE	Res Upst LTG IND CFL A LAMP	0	0.0%	0.0%	9.7	-2.0	-0.2	-0.2
SDGE	Res Upst LTG IND CFL BASIC	0	0.0%	0.0%	9.7	-1.1	-0.1	-0.1
SDGE	Res Upst LTG IND CFL GLOBE	0	0.0%	0.0%	9.7	-1.4	-0.1	-0.1
SDGE	Res Upst LTG IND CFL REF	0	0.0%	0.0%	9.7	-0.7	-0.1	-0.1
SDGE	Res Upst LTG IND LED LAMP	0	0.0%	0.0%	15.8	-2.2	-0.1	-0.1
SDGE	Res Upst LTG IND LED REF	0	0.0%	0.0%	14.9	-2.3	-0.2	-0.2
SDGE	PassThrough Res Downstream	1	0.0%		10.4	-3.8	-0.4	-0.4
SDGE	PassThrough Upstream	1	0.0%		0.0	0.0	0.0	0.0

APPENDIX C. RECOMMENDATIONS

Study ID	Study Type	Study Title	Study Manager
ED_I_LTG_4	Impact Evaluation	Impact Evaluation of 2013-14 Upstream and Residential Downstream Lighting Programs	CPUC ED

Rec. #	Program or Database	Summary of Findings	Additional Supporting Information	Best Practice / Recommendations	Recipient	Affected Workpaper or DEER
1	Upstream lighting programs	NTGR are relatively low in the current evaluation and were relatively low in prior evaluations for most measure groups. The presence of LED lamps in these channels has increased rapidly while pricing has declined at the market level.	NTGR tables in Section 5.3; 2010-12 California Upstream and Residential Lighting Impact Evaluation Work Order 28 (WO28) Final Report.[55]	Refine targeting for LED lamp incentives. Review the cost-effectiveness of LED lamp incentives in big box channels and consider not only the NTGR determined for the 2013-14 program, but also the likelihood that even without program discounts. LED lamps will increase in availability at lower prices in big box channels.	All IOUs	
2	Upstream lighting programs	The NTGR for CFLs are somewhat lower than in the prior evaluation, but still potentially represent cost-effective investments.	NTGR tables in Section 5.3. 2010-12 California Upstream and Residential Lighting Impact Evaluation Work Order 28 (WO28) Final Report.[56]	Refine targeting for CFL incentives. Examine the cost-effectiveness of offering incentives for CFLs of the different measure groups in each retail channel and consider discontinuing incentive offerings in channels where incentives are not cost-effective, or are borderline cost-effective.	All IOUs	
3	Upstream lighting programs	The mix of replacement lamps and lamp pricing in California retail stores has changed in recent history, and the market has increased in complexity.	Details regarding changing residential market conditions in Section 2.3.1.	Examine projections of lamp pricing and market conditions, conduct scenario analyses to represent these conditions, and apply results of these analyses to adjust ex ante savings inputs.	All IOUs	
3a	Upstream lighting programs	Another perspective on baseline may be to identify the mix of lamp technologies that consumers would purchase in the absence of program discounts—in other words, the purchases displaced by program-discounted lamps.	Baseline discussions in Section 4.2 and Section 7.1.1.	Review baselines and consider that the net baseline condition (mix of displaced lamps represents) could be estimated using the lamp choice model.	All IOUs	

55 DNV GL, 2014c.

56 *Ibid.*

Rec. #	Program or Database	Summary of Findings	Additional Supporting Information	Best Practice / Recommendations	Recipient	Affected Workpaper or DEER
3b	Upstream lighting programs	Evaluation results indicate that there is competition among program-discounted measure groups within the same replacement lamp category when more than one is offered in a retail store at the same time.	Program activity type weighting discussion in Section 5.2.1.2; NTGR discussion in Section 5.3.	Explore how best to allocate discounts among multiple efficient technologies within a replacement lamp category for specific combinations of measure groups and retail channels. An assessment of program cost-effectiveness should explore these substitution effects. Again, the lamp choice model developed for this work could support such exploration.	All IOUs	
4	Upstream lighting programs	Given the rapidly-changing market, these evaluation results are already somewhat dated at the time of this report's publication. However, they are still more current than those used to generate their ex ante savings estimates for 2013-14.	Details regarding changing residential market conditions in Section 2.3.1.	If more up-to-date estimates are not developed through prospective work, use the results of this evaluation to true up ex ante assumptions for key impact parameters.	All IOUs	

APPENDIX D. SHELF SURVEY AND SHOPPER INTERCEPT SURVEY APPROACH

Overview

Field researchers conducted complete inventories (shelf surveys) of all screw-base and pin-based lamps[57] for sale in California retail stores throughout PG&E, SCE, and SDG&E service territories. At the same time, field staff conducted shopper intercept surveys with consumers who were shopping for lamps. This report draws on shelf survey and shopper intercept survey data collected during three periods: November 2012 through February 2013 (Winter 2012-2013), May through July 2013 (Summer 2013), and November 2014 through February 2015 (Winter 2014-2015). DNV GL field researchers conducted both shelf surveys and shopper intercept surveys during all three phases of data collection.

The shelf surveys gathered detailed information regarding all residential replacement lamps stocked in the stores other than linear fluorescent lamps, while the shopper intercept surveys focused on shopper purchasing decisions and installation intentions for newly-purchased lamps.

Below we provide a brief description of the data collection process and the sampling approach for the shelf surveys and shopper intercept surveys analyzed in support of the 2013-2014 Upstream and Residential Downstream Lighting Programs Impact Evaluation Report. For additional details regarding data cleaning protocols and field work procedures, protocols, and training, please refer to Appendix C of the California Upstream and Residential Lighting Impact Evaluation Work Order 28 (WO28) Final Report.[58]

Data Collection

During the shelf surveys, field staff recorded key information for every store visited such as the retail channel, store name, IOU service territory, and store address. They also recorded information specific to each package of lamps in the store, including model number, lamp type, base type, lamp shape, manufacturer, wattage, and number of lamps in each package. Additionally, field staff recorded the number of packages, whether or not the lamps were 3-way or dimmable, full price, discounted price and discount provider (if relevant), rated life, color temperature, lamp coating, lumens, wattages, and whether each model was 3-way, dimmable, and/or Energy Star labeled for each package of lamps. Field staff recorded most of this information into a tablet computer using a handheld scanner. The barcode for each scanned lamp packages linked to a reference database that contained key lamp specifications such as lamp technology, style, wattage, lumens, and number of lamps per package. The tablet computer would then auto-populate the lamp characteristics into fields in a database, which the researcher would verify. DNV GL staff compiled all shelf survey results into a comprehensive database[59] for analysis.

During the shopper intercept surveys, field researchers conducted on-the-spot interviews with shoppers who were planning to purchase common replacement lamps across four major lamp technologies: CFLs, LED

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[57] This includes all CFLs, LED lamps, halogen lamps, incandescent lamps, high-intensity discharge (HID) lamps, and cold cathode lamps regardless of base type but does not include linear lamps (e.g., T8).

[58] DNV GL, 2015.

[59] DNV GL staff has created a California lighting retail shelf survey searchable online database that contains California retail shelf survey data from research dating back to 2008. To access the database and learn more about the online tool's capabilities, please visit https://www.lampstockdata.com.

lamps, incandescent lamps, and halogen lamps (including EISA-compliant lamps). For all intercepted lamp purchasers, field researchers used the same barcode scanner that they used to conduct shelf surveys to scan the lamp packages in purchasers' shopping carts or baskets. From there, the field researchers would proceed with conducting the intercept surveys, which obtained information from lamp purchasers regarding their installation plans for the lamp(s) they were purchasing as well as details regarding the influence of price on their purchasing decisions to serve lamp choice modeling efforts.APPENDIX H provides additional detail regarding construction of the choice sets for the intercept survey and their application in the lamp choice model.[60]

Sampling Approach

Appendix C of the 2010-2012 California Upstream and Residential Lighting Impact Evaluation Report[61] describes the approach for developing the sample frame used during the Winter 2012-2013 and Summer 2013 periods. Our field staff conducted surveys in chain and independent retail stores, including stores that participated in the IOUs' 2010-2012 upstream lighting program as well as non-participating stores. Field staff spent a minimum of four hours in each store completing the shelf surveys and attempting to intercept shoppers. Field staff spent approximately 2,200 hours in the stores across the three data collection periods. Field staff completed surveys opportunistically—that is, with individuals who were shopping during the time periods in which we conducted intercept surveys in specific stores. As such, results from the intercept surveys may not represent the broader population of shoppers purchasing replacement lamps at various stores throughout the year. Nonetheless, given the range in timeframes and store types in which we conducted these surveys, results provide general indications of shopper preferences, price sensitivity, lamp installation intentions, and so on.

We targeted approximately 200 store visits during each data collection period. We stratified the sample by retail channel and IOU service territory (for PG&E, SCE, and SDG&E territories) and designed the sample to represent the retail market for residential replacement lamps in these areas. We included stores that had IOU-discounted lamps in stock at the time of our store visits; stores that stocked IOU-discounted lamps but did not have any in stock at the time of our visits; stores that stocked IOU-discounted lamps in the past but not during the program cycle in which we conducted our visits; and stores that have never stocked IOU-discounted lamps. The sample design targeted roughly equal numbers of stores in each retail channel to ensure enough sample points per channel to enable channel-to-channel comparisons. For store visits conducted during the Winter 2014-2015 period, DNV GL staff attempted to revisit the stores included in the Summer 2013 data collection period to enable time-series comparisons of un-weighted lamp stocking volumes across the retail stores for market characterization purposes.

[60] DNV GL, 2015.
[61] *Ibid.*

Table 86 below provides details regarding the number of targeted and completed store visits during each of the three shelf survey phases by retail channel and IOU. Each store visit represents one completed shelf survey. Across all three phases, field researchers conducted more than 600 shelf surveys in seven retail channels. In a small number of cases, field researchers had to substitute stores in other channels for planned visits (for example, because a store had closed, or because they were refused permission to conduct the research by store personnel); the table highlights cases in which the number of targeted and completed visits differ.

Table 86. Number of targeted and completed shelf surveys conducted by survey phase, retail channel, and IOU

Retail Channel	Winter 2012-2013				Summer 2013				Winter 2014-2015				Overall			
	PG&E	SCE	SDG&E	Total	PG&E	SCE	SDG&E	Total	PG&E	SCE	SDG&E	Total	PG&E	SCE	SDG&E	Total
Targeted Shelf Surveys																
Discount	11	11	7	29	11	11	7	29	11	11	7	29	33	33	21	87
Drug	11	11	7	29	11	11	7	29	11	11	7	29	33	33	21	87
Grocery	10	11	7	28	10	11	7	28	10	11	7	28	30	33	21	84
Hardware	11	11	7	29	11	11	7	29	11	11	7	29	33	33	21	87
Home improvement	11	10	7	28	11	10	7	28	11	10	7	28	33	30	21	84
Mass merchandise	10	11	8	29	10	11	8	29	10	11	8	29	30	33	24	87
Membership club	11	10	7	28	11	10	7	28	11	10	7	28	33	30	21	84
Total Targeted	**75**	**75**	**50**	**200**	**75**	**75**	**50**	**200**	**75**	**75**	**50**	**200**	**225**	**225**	**150**	**600**
Completed Shelf Surveys																
Discount	11	11	7	29	11	11	7	29	11	11	7	29	33	33	21	87
Drug	11	11	7	29	11	11	7	29	11	11	7	29	33	33	21	87
Grocery	10	11	7	28	10	11	7	28	10	11	7	28	30	33	21	84
Hardware	11	11	7	29	11	11	7	29	11	11	7	29	33	33	21	87
Home improvement	11	10	7	28	12	10	7	29	11	10	7	28	34	30	21	85
Mass merchandise	10	11	8	29	10	11	8	29	10	11	8	29	30	33	24	87
Membership club	11	10	7	28	11	10	7	28	11	10	7	28	33	30	21	84
Total Completed	**75**	**75**	**50**	**200**	**76**	**75**	**50**	**201**	**75**	**75**	**50**	**200**	**226**	**225**	**150**	**601**

Below, Table 87 shows the number of sites that were targeted, visited, and dropped due to refusals, store closures, and lack of lamps present.

Table 87. Shelf survey disposition by survey phase and retail channel

Phase	Retail Channel	Number of Store Visits			Number of Incomplete Store Visits	
		Targeted	Completed	Refused	Closed	No Lamps Present
Winter 2012-2013	Discount	29	29	4	1	0
	Drug	29	29	3	0	1
	Grocery	28	28	2	2	1
	Hardware	29	29	7	1	0
	Home improvement	28	28	3	0	0
	Mass merchandise	29	29	6	0	0
	Membership club	28	28	2	0	0
	Total	**200**	**200**	**27**	**4**	**2**
Summer 2013	Discount	29	29	2	3	1
	Drug	29	29	1	3	0
	Grocery	28	28	0	2	0
	Hardware	29	29	3	1	0
	Home improvement	28	29	2	2	0
	Mass merchandise	29	29	5	1	0
	Membership club	28	28	2	0	0
	Total	**200**	**201**	**15**	**12**	**1**
Winter 2014-2015	Discount	29	29	2	0	0
	Drug	29	29	1	0	0
	Grocery	28	28	9	2	5
	Hardware	29	29	2	0	1
	Home improvement	28	28	2	0	0
	Mass merchandise	29	29	1	1	0
	Membership club	28	28	2	0	0
	Total	**200**	**200**	**19**	**3**	**6**

Table 88 displays the number of intercept surveys completed with lamp purchasers during the same three data collection periods by retail channel and IOU. Field staff completed shopper intercept surveys with nearly 1,300 lamp purchasers across the three phases of data collection.

Table 88. Number of intercept surveys completed with lamp purchasers by survey phase, retail channel, and IOU

Channel	Winter 2012-2013				Summer 2013				Winter 2014-2015				Overall			
	PG&E	SCE	SDG&E	Total	PG&E	SCE	SDG&E	Total	PG&E	SCE	SDG&E	Total	PG&E	SCE	SDG&E	Total
Discount	15	22	5	42	11	9	5	25	10	8	10	28	36	39	20	95
Drug	5	2	6	13	6	4	1	11	6	10	3	19	17	16	10	43
Grocery	3	2	0	5	2	5	1	8	3	4	2	9	8	11	3	22
Hardware	38	12	11	61	19	10	4	33	17	6	15	38	74	28	30	132
Home improvement	63	31	31	125	41	43	27	111	47	38	56	141	151	112	114	377
Mass merchandise	56	43	23	122	29	30	12	71	31	42	29	102	116	115	64	295
Membership club	38	46	20	104	31	34	26	91	55	45	31	131	124	125	77	326
Total Surveys	**218**	**158**	**96**	**472**	**139**	**135**	**76**	**350**	**169**	**153**	**146**	**468**	**526**	**446**	**318**	**1,290**

APPENDIX E. CONSUMER TELEPHONE SURVEY METHODS

During the third quarter of 2015, DNV GL conducted telephone surveys with residential electric customers of PG&E, SCE, and SDG&E to support continued monitoring of purchase, installation, and storage rates for CFLs and LED lamps. Below we provide an overview of the data collection instrument and sampling approach associated with these surveys.

Data Collection Instrument

DNV GL modelled the survey instrument on components of the consumer telephone survey fielded in support of the 2010-2012 California Upstream and Residential Lighting Impact Evaluation[62] and the 2014 California Residential Replacement Lamp Market Status Report.[63] 0 provides the data collection instrument.

The survey instrument identifies CFL and LED lamp purchasers and queries them regarding their installation, storage, use of, and satisfaction with these lamp technologies. The survey also identifies respondents who purchased CFLs and LED lamps during the program period (2013 and/or 2014). Next, the survey reviews consumer awareness and use of so-called “energy-efficient” (EISA-compliant) halogen lamps and their purchasing habits as a result of the declining availability of traditional incandescent lamps in California. For each technology, the survey asks respondents about their purchasing patterns (including details regarding online retail channels and online purchases).The survey closes with a section on respondent demographics.

Sampling Approach

DNV GL designed the 2015 telephone survey sampling approach to be as consistent as possible with the approach used for the 2012 and 2013 consumer telephone surveys in support of the 2010-2012 California Upstream and Residential Lighting Impact Evaluation,[64] the other major IOU evaluation studies, and the 2012 CLASS study.[65] Below we provide an overview of how we leveraged the CLASS sampling approach to the 2015 consumer telephone surveys.

Stratification

For the 2015 surveys, we applied the same stratification approach that was used for the 2012 and 2013 consumer telephone surveys to the IOUs’ 2014 billing data. There were 42 strata defined by:

- IOU
- Climate zone groups
- California Alternate Rates for Energy (CARE)[66]/Family Electric Rate Assistance (FERA)[67] participation status
- Average daily kWh

[62] DNV GL, 2014c.
[63] DNV GL, 2014b.
[64] DNV GL, 2014c.
[65] DNV GL, 2014a. Please refer to APPENDIX G for details regarding the CLASS sampling approach.
[66] CARE provides a monthly discount on energy bills for income-qualified households and housing facilities. Qualifications are based on the number of persons living in the home and the total annual household income.
[67] FERA provides a monthly discount on electric bills for income-qualified households of three or more persons.

We summarize these stratification variables in greater detail below.[68]

Climate Zone Groups

KEMA leveraged the cooling degree days (CDD) analyses performed for the 2009 Residential Appliance Saturation Study (RASS) to group CEC Title 24 climate zones into climate groups. We then stratified the IOUs' 2014 residential accounts by these climate zones.

Table 89 shows the climate zone groups used for sample stratification and the associated heating degree days (HDD) and CDD. As shown, the Desert climate group includes only climate zone 15 (which had more than twice the CDD of the other zones). The Inland climate group includes climate zones 8 through 14, and the third group ("Mild") includes the remaining zones (1 through 7 and 16).

Table 89. Climate zone groups for sample stratification (sorted by descending CDD)

Climate Zone Group	Title 24 Climate Zone	2009 HDD (65°F Base)	2009 CDD (65°F Base)
Desert	15	950	4,015
Inland	13	2,355	1,930
	14	3,107	1,769
	11	2,841	1,325
	10	1,799	1,268
	9	1,487	948
	12	2,812	792
	8	1,551	720
Mild	7	1,430	470
	2	3,232	426
	6	1,669	321
	4	2,512	283
	16	5,593	255
	3	2,792	38
	5	2,704	34
	1	4,149	0

CARE/FERA Participation Status

For the 2012 and 2013 surveys, Commission staff and IOU staff expressed interest in obtaining a representation of customers that participate in the CARE and FERA programs. The sample stratification approach for those surveys incorporated CARE/FERA participation status by coding utility customers that participated in CARE and/or FERA in 2010 as Yes (participants) and coding all other customers as No (nonparticipants). We applied the same stratification approach for CARE/FERA participation status to the IOUs' 2014 billing data in support of the 2015 consumer telephone surveys (Table 90).

When looking at CARE/FERA status, the proportion of energy used per stratum closely follows the proportion of customers in the stratum, as shown in the pairs of Columns D/G or E/H, based on the 2014 data utilized in this sampling frame. In PG&E service territory, 26% of customers had CARE/FERA status, and they used

[68] For further detail on the approach used in the 2012 CLASS, please refer to APPENDIX G.

26 percent of the energy consumed by PG&E customers in 2014. The corresponding proportions are 30% of customers and 27% of energy for SCE, and 22% of customers and 20% of energy for SDG&E.

Table 90. CARE/FERA participation status by IOU, 2014

A	B	C	D	E	G	H	I
IOU	CARE/FERA Participant	Number of Customers	% of Customers		2014 Daily kWh	% of Avg Daily kWh	
			Overall (Across IOUs)	By IOU		Overall (Across IOUs)	By IOU
PG&E	No	3,451,210	34%	74%	58,614,159	33%	74%
	Yes	1,193,448	12%	26%	21,029,875	12%	26%
SCE	No	3,028,665	30%	70%	57,902,992	32%	73%
	Yes	1,301,952	13%	30%	21,721,378	12%	27%
SDG&E	No	975,991	10%	78%	15,690,118	9%	80%
	Yes	279,095	3%	22%	3,856,702	2%	20%
Total		**10,230,361**	**100%**	**-**	**19,546,820**	**100%**	**-**

Daily kWh

For each customer, DNV GL summed all of the 2014 billed kWh and divided by the sum of the number of billed days in 2014. This produced average daily kWh for each customer that can be compared to other customers even if a customer did not have billing data available for all months in 2014.[69]

Within each stratum, identified by the variables described above, we: (a) sorted customers by their average daily consumption, (b) calculated the total average daily consumption in the stratum, and (c) calculated the individual daily average kWh cut-off points that would place approximately one third of the energy in three usage strata within each stratum. These cut-off points define the daily average kWh strata. This approach is consistent with the approach used for the 2012 and 2013 consumer telephone surveys in support of the 2010-2012 California Upstream and Residential Lighting Impact Evaluation.[70]

Sampling Frame

The stratification approach described above results in 42 strata. Table 91 below present the strata, the number of customers in the 2014 billing data, and the average daily kWh associated with each stratum.

69 As acknowledged in the 2010-2012 impact evaluation report, DNV GL recognizes that this is an imperfect way of comparing consumption across all customers. For example, if a customer has only the summer months available, he/she is likely to have a higher daily average than if the only months available are in the winter. However, in the absence of complete annual consumption for some customers, daily average kWh provides a better way to compare consumption among customers than total annual usage.

70 DNV GL, 2014c.

Table 91. Sampling frame – PG&E (based on 2014 billing data)

Stratum / IOU	Climate Zone Group	CARE / FERA Participant	Daily kWh	Number of Customers	% of Customers	Average Daily kWh	% of Average Daily kWh	Standard Deviation from Avg Daily kWh
PG&E								
1	Inland	N	<=20.9	733,635	16%	11.9	1%	5.8
2	Inland	N	<=33	354,919	8%	26.1	2%	3.4
3	Inland	N	>33	208,840	4%	46.0	4%	19.3
4	Inland	Y	<=20.6	354,681	8%	13.3	1%	4.6
5	Inland	Y	<=32.7	209,029	5%	25.8	2%	3.4
6	Inland	Y	>32.7	88,135	2%	41.8	4%	14.3
7	Mild	N	<=14.9	1,389,405	30%	8.2	1%	3.9
8	Mild	N	<=25.4	528,223	11%	19.1	2%	2.9
9	Mild	N	>25.4	236,188	5%	40.5	4%	33.0
10	Mild	Y	<=15.2	369,927	8%	8.9	1%	3.5
11	Mild	Y	<=28	141,969	3%	19.9	2%	3.4
12	Mild	Y	>28	29,707	1%	38.5	4%	23.3
13	Desert	N	<=29.2	62,867	1%	15.1	1%	7.8
SCE								
14	Desert	N	<=48.6	25,284	1%	37.5	4%	5.4
15	Desert	N	>48.6	12,776	0%	74.1	7%	44.1
16	Desert	Y	<=24.1	16,274	0%	15.9	2%	5.3
17	Desert	Y	<=34.4	9,089	0%	28.9	3%	2.9
18	Desert	Y	>34.4	5,912	0%	43.9	4%	11.5
19	Inland	N	<=19.4	1,241,716	30%	11.4	1%	4.9
20	Inland	N	<=30.9	585,409	12%	24.3	2%	3.2
21	Inland	N	>30.9	326,789	7%	43.5	4%	21.6
22	Inland	Y	<=16.3	597,071	15%	10.4	1%	3.6
23	Inland	Y	<=24.9	309,121	7%	20.1	2%	2.4
24	Inland	Y	>24.9	193,648	4%	32.2	3%	7.9
25	Mild	N	<=15.4	473,609	11%	8.7	1%	3.9
26	Mild	N	<=27.3	205,451	4%	20.2	2%	3.3
27	Mild	N	>27.3	94,764	2%	43.6	4%	43.2
28	Mild	Y	<=12.6	95,128	2%	7.9	1%	2.8
29	Mild	Y	<=20.0	47,615	1%	15.8	2%	2.1
30	Mild	Y	>20.0	28,094	1%	27.0	3%	9.8
31	Inland	N	<=17.3	199,751	14%	10.2	1%	4.5
SDG&E								
32	Inland	N	<=28.4	103,279	5%	22.0	2%	3.1
33	Inland	N	>28.4	58,043	3%	41.3	4%	18.0
34	Inland	Y	<=19.3	77,339	4%	11.2	1%	4.2
35	Inland	Y	<=29.7	19,699	2%	23.5	2%	2.9
36	Inland	Y	>29.7	9,625	1%	40.0	4%	12.1
37	Mild	N	<=13.5	353,295	35%	7.8	1%	3.4
38	Mild	N	<=22.8	170,513	14%	17.4	2%	2.6
39	Mild	N	>22.8	91,110	7%	35.9	3%	26.0
40	Mild	Y	<=15.2	125,827	9%	8.8	1%	3.4
41	Mild	Y	<=22.5	30,527	4%	18.2	2%	2.0
42	Mild	Y	>22.5	16,078	2%	29.8	3%	8.3

Sample Allocation

For consistency with the sample allocation approach used in the 2010-2012 California Upstream and Residential Lighting Impact Evaluation,[71] DNV GL allocated 40% of the overall sample for PG&E, 40% for SCE, and 20% to SDG&E, and then allocated the sample proportionally to the average daily kWh in each stratum.[72]

Survey Implementation

DNV GL hired an experienced survey research firm to conduct telephone surveys with residential electric customers of PG&E, SCE, and SDG&E using a Computer-Aided Telephone Interviewing (CATI) approach. The survey firm completed 1,016 surveys in July and August of 2015. These efforts yielded the results shown in Table 92. As shown, there are four strata for SDG&E in which the number of completed surveys fell short of targets (33, 37, 39, and 41, highlighted in blue in the table). In these cases, the number of targeted completes was similar to the overall number of customers in each relevant stratum, and telephone interviewers were not able to complete surveys with such a high proportion of respondents in these strata. Table 93 provides the sample disposition. With a final eligible sample of 13,353, the response rate was 8% based on the American Association of Public Opinion Research's (AAPOR) Response Rate 3 calculation approach.[73]

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[71] DNV GL, 2014c.

[72] For the 2012 and 2013 surveys, DNV GL estimated the statistical precision of four different allocation methods: (1) proportional to the number of customers in each stratum; (2) proportional to the average daily kWh in each stratum; (3) 40% of the sample for each of PG&E and SCE, and 20% to SDG&E, then proportional to the number of customers in each stratum; and (4) 40% of the sample for each of PG&E and SCE, and 20% to SDG&E, then proportional to the average daily kWh in each stratum. All methods produced high statistical precision at the statewide level, but the 40/40/20 methods improved precision in SDG&E's service territory with very little impact on precision for PG&E's and SCE's service territories. We thus adopted method 4 for the 2012 and 2013 consumer telephone surveys (40/40/20 with allocation proportional to kWh within each utility). We used the same method for the 2015 consumer telephone surveys.

[73] For more details regarding this approach, please refer to the discussion of response rates on AAPOR's website at http://www.aapor.org/Education-Resources/For-Researchers/Poll-Survey-FAQ/Response-Rates-An-Overview.aspx.

Table 92. Consumer telephone survey targets and completed surveys by stratum, 2015

IOU	Stratum	Targeted Number of Completed Surveys	Number of Completed Surveys
PG&E	1	42	43
	2	43	43
	3	43	43
	4	25	25
	5	25	25
	6	25	25
	7	50	51
	8	50	50
	9	50	50
	10	18	18
	11	18	18
	12	18	18
SCE	13	5	5
	14	5	5
	15	5	5
	16	2	2
	17	2	2
	18	2	2
	19	67	67
	20	68	70
	21	68	68
	22	36	36
	23	36	37
	24	37	38
	25	20	20
	26	20	20
	27	20	20
	28	5	5
	29	5	5
	30	5	6
SDG&E	31	19	19
	32	19	19
	33	19	17
	34	6	6
	35	6	6
	36	6	6
	37	34	32
	38	34	34
	39	35	29
	40	9	9
	41	10	7
	42	10	10
Total		**1,022**	**1,016**

Table 93. Consumer telephone survey disposition, 2015

Disposition Category	Total
QUOTA	1,022
COMPLETES	1,016
TOTAL SAMPLE	17,503
NO ANSWER	1,121
BUSY	56
SCHEDULED CALLBACK	241
UNSPEC. CALLBACK	282
ANSWERING MACHINE	1,143
6+ ATTEMPTS NO INTERVIEW	6,058
NON-WORKING NUMBER	2,604
NON-RESIDENTIAL	531
LANGUAGE BARRIER	787
OTHER PHONE PROBLEMS - FAX/MODEM	527
CLAIMS PREVIOUS INTERVIEW	67
HARD REFUSALS	1,971
BREAK-OFFS - SCREENER	43
QUALIFIED REFUSALS	43
DON'T KNOW / REFUSED IF LANDLINE OR WIRELESS	82
NOT CORRECT COMPANY	53
DON'T KNOW / REFUSED COMPANY	26

APPENDIX F. 2006-2008 RESIDENTIAL LIGHTING METERING STUDY SAMPLE SIZES

The 2006-2008 Residential Lighting Metering Study utilized a sample stratified by IOU and geographic region. Within each region, we selected a simple random sample. Essentially, every residential account in the IOU records had an equal probability of selection into the sample.

Within each home, we obtained a complete inventory of all lamps in use and of all CFLs in storage. We targeted four CFL fixture groups and three non-CFL fixture groups for metering in each home, taking a systematic sample from the full inventory.

Table 94 shows 2006-2008 residential lighting metering study sample sizes by month and year.

Table 94. 2006-2008 residential lighting metering study resident sample sizes by month and year*

Wave and Quantity Details	2008									2009								
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wave 1																		
# Sites	26	191	92				-26	-191	-92									
# Meters	174	1,280	622				-174	-1,280	-622									
Wave 2																		
# Sites				118	181	15					-118	-181	-15					
# Meters				814	1,249	104					-814	-1,249	-104					
Wave 3																		
# Sites									188	76	213	133		-24	-231		-155	-200
# Meters									1,297	524	1,470	918				-524	-1,470	-2,570
# Downloads														291	64			
Active # Sites	**26**	**217**	**309**	**427**	**608**	**623**	**597**	**406**	**502**	**578**	**673**	**625**	**610**	**586**	**355**	**355**	**200**	**0**
Cumulative # Meters	**174**	**1,454**	**2,076**	**2,890**	**4,139**	**4,243**	**4,069**	**2,789**	**3,464**	**3,988**	**4,644**	**4,313**	**4,209**	**4,500**	**4,564**	**4,040**	**2,570**	**0**

*Negative sample size indicates removed meters and associated follow-up site visits

Initially, we estimated the required metering sample size for achieving 90/10 precision for coincidence peak use at approximately 2,700 homes with summer metering. This sample size was several times the size of any previous study, and would have been impractical to achieve within the timeframe available for this evaluation. Instead, we set the metering sample size at 1,200 homes including a minimum of 600 during the summer. The projected statewide precision at 90 percent confidence for this design was +/- 7 percent for average daily HOU and +/- 19 percent for percent on at peak.

We developed estimates of average daily HOU and peak use from the metering data in two ways. The first was a direct expansion using the sampling weights. The second was a leveraged expansion, which first estimated HOU and peak use for each lamp in the inventory based on a model fit to the metered data and then applied sample expansion weights to produce averages from the full inventory data set. For the direct expansion, statistical confidence intervals are based on the estimated sampling error for the metering sample. For the leveraged estimates, statistical confidence intervals combine the modeling error with the inventory sampling error.

The leveraged expansion can provide more robust estimates for subdivisions of the data across multiple dimensions, particularly if the subdivision results in small sample sizes for direct expansion. For larger subgroups, the direct expansion generally provides better precision.

Achieved precision using direct estimation for HOU was +/- 3 percent for the state as a whole, and +/- 8 percent or better for each IOU. Achieved precision for peak was +/- 8.7 percent for the state as a whole and +/- 21 percent or better for each IOU.

APPENDIX G. CLASS SAMPLING APPROACH

This appendix is the CLASS sampling design memo that DNV GL distributed on May 25, 2012 under WO 21. This provides full background regarding how we designed the CLASS sample.

memo

To:	IOUs, CPUC Energy Division and their Consultants	Date:	May 25, 2012
From:	Claire Palmgren, Paula Ham-Su, Jarred Metoyer, - DNV KEMA		
Copy:	Dina Mackin, Carmen Best		
Subject:	Final Sample Design for WO21: California Lighting and Appliance Saturation Study (CLASS)		

The approved research plan for the California Lighting and Appliance Saturation Study (CLASS) discussed the possible sampling dimensions for the study. This memo defines the final stratification that will be used in the sample design for the 2012 CLASS study.

Background

The previous (2005) CLASS study utilized a sample design with stratification by rate classes known as "long rates" that contained information such as baseline territory, low income status and electric heat. By stratifying along these older rate classes, the sample was implicitly stratified along the attributes contained in the rates.

The current IOU CIS systems have some of this information contained in separate variables, so the individual variables need to be included separately into the sample design to include this information. The approved research plan also listed several dimensions that would be considered in the development of the sampling plan beyond the characteristics embedded in the 2005 sample design: multi-family dwellings, manufactured homes, and new construction. These dimensions were not consistently available in the data received from the IOUs, so were not incorporated in the sample design.

Proposed Stratification

The stratification for the current 2012 CLASS study consists of 42 strata defined by:

1. Utility (PG&E, SCE, SDG&E)
2. Climate zone groups (Mild, Inland, Desert)
3. CARE/FERA status (Yes or No)
4. Daily kWh (Average daily kWh for 2010)

The stratification variables are explained in greater detail below.

Climate Zone Groups

KEMA analyzed the climate zone Cooling Degree Days that are associated with the 2009 RASS to group T24 climate zones into climate zone groups. These CDDs are presented in Column D of Table 1.

Table 1 shows that there is a substantial difference in Cooling Degree Days between Climate Zone 15 and the other zones.

- CZ 15 has over twice the amount of CDDs than the second highest zone, CZ 13. Because of this, CZ 15 was placed in its own group ("Desert").
- The second group, "Inland", groups CZs 8 through 14. These CZs have CDDs between 700 and 2,000 approximately.
- The third group, "Mild", groups the remainder of the climate zones: CZs 1 through 7 and CZ 16. These range between 0 and 470 CDDs.

Table 1: Climate Zone Groups for CLASS Stratification Sorted by Descending Cooling Degree Days

A	B	C	D
Climate Zone Group	T24 Climate Zone	2009 HDD (65°F Base)	2009 CDD (65°F Base)
Desert	15	950	4,015
Inland	13	2,355	1,930
Inland	14	3,107	1,769
Inland	11	2,841	1,325
Inland	10	1,799	1,268
Inland	9	1,487	948
Inland	12	2,812	792
Inland	8	1,551	720
Mild	7	1,430	470
Mild	2	3,232	426
Mild	6	1,669	321
Mild	4	2,512	283
Mild	16	5,593	255
Mild	3	2,792	38
Mild	5	2,704	34
Mild	1	4,149	0

CARE / FERA[1] Status

The Energy Division and the IOUs have expressed interest in obtaining a representation of customers that participate in the CARE and FERA programs. The sample stratification has incorporated the CARE/FERA status by coding utility customers that participated in CARE and/or FERA in 2010 as Yes and coding all other customers as No.

When looking at CARE/FERA status, the proportion of energy used per stratum closely follows the proportion of customers in the stratum, as shown in the pairs of Columns D/G or E/H , based on the 2010 data utilized in this sampling frame. In the PG&E service territory, 28 percent of customers have CARE/FERA status, and they use 31 percent of the energy. These proportions are 32 percent and 31 percent for SCE, and 23 percent and 22 percent for SDG&E.

Table 2: CARE/FERA Status by IOU

A	B	C	D	E	F	G	H
IOU	CARE FERA Status	Number of Customers	Percent Customers Overall	Percent Customers IOU	Average Daily kWh	Percent Daily kWh Overall	Percent Daily kWh IOU
PGE	N	4,017,574	32%	72%	66,439,652	32%	69%
PGE	Y	1,573,317	13%	28%	30,507,941	15%	31%
SCE	N	3,640,787	29%	68%	60,350,520	29%	69%
SCE	Y	1,703,287	14%	32%	27,575,663	13%	31%
SDGE	N	1,253,097	10%	77%	18,046,401	9%	78%
SDGE	Y	368,341	3%	23%	4,985,869	2%	22%
TOTAL		12,556,403	100%		207,906,045	100%	

Daily Average kWh

For each customer, KEMA summed all of the 2010 kWh and divided by the sum of the number of days in 2010. This produced average daily kWh for each customer that can be compared to other customers even if a customer does not have all of the billing months available in 2010[2].

Within each stratum identified by the variables described above, we: (a) sorted customers by their average daily consumption, (b) calculated the total average daily consumption in the stratum, and (c) calculated the individual daily average kWh cutoff points that would place approximately one third of the energy in three usage strata within each stratum. These cutoff points define the daily average kWh strata.

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[1] CARE, the California Alternate Rates for Energy program, provides a monthly discount on energy bills for income-qualified households and housing facilities. Qualifications are based on the number of persons living in the home and the total annual household income. FERA, the Family Electric Rate Assistance program, provides a monthly discount on electric bills for income-qualified households of three or more persons.

[2] KEMA recognizes that this is an imperfect way of comparing consumption across all customers. For example, if a customer has only the summer months available, it is likely to have a higher daily average than if the only months available are in the winter. However, in the absence of complete annual consumption for some customers, daily average kWh provides a better way to compare consumption among customers than total annual usage.

Sampling Frame

The stratification described above results in 42 strata. The strata, the number of customers and the average daily kWh associated with each stratum are provided in Table 3.

Table 3: Sampling Frame (Based on 2010 Billing Data)

A	B	C	D	E	F	G	H	I	J	K
Stratum	IOU	Climate Zone Group	CARE FERA	Daily kWh	Number of Customers	Percent Customers Overall	Percent Customers IOU	Average Daily kWh	Percent Daily kWh	Std Dev Daily kWh
1	PGE	I	N	<= 20.9	939,212	7.5%	16.8%	9,979,587	4.8%	6.1
2	PGE	I	N	<= 33	388,491	3.1%	6.9%	10,177,432	4.9%	3.4
3	PGE	I	N	> 33	224,254	1.8%	4.0%	10,177,563	4.9%	21.3
4	PGE	I	Y	<= 20.6	467,446	3.7%	8.4%	5,946,164	2.9%	4.8
5	PGE	I	Y	<= 32.7	232,332	1.9%	4.2%	5,991,679	2.9%	3.4
6	PGE	I	Y	> 32.7	123,785	1.0%	2.2%	6,005,512	2.9%	91.9
7	PGE	M	N	<= 14.9	1,533,933	12.2%	27.4%	11,910,622	5.7%	4.1
8	PGE	M	N	<= 25.4	627,322	5.0%	11.2%	12,075,995	5.8%	2.9
9	PGE	M	N	> 25.4	304,362	2.4%	5.4%	12,118,454	5.8%	39.2
10	PGE	M	Y	<= 15.2	465,218	3.7%	8.3%	4,127,128	2.0%	3.5
11	PGE	M	Y	<= 28	209,521	1.7%	3.7%	4,226,823	2.0%	3.5
12	PGE	M	Y	> 28	75,015	0.6%	1.3%	4,210,634	2.0%	166.9
13	SCE	D	N	<= 27.1	79,399	0.6%	1.5%	954,642	0.5%	7.7
14	SCE	D	N	<= 48.1	26,808	0.2%	0.5%	961,120	0.5%	5.9
15	SCE	D	N	> 48.1	12,976	0.1%	0.2%	962,392	0.5%	46.4
16	SCE	D	Y	<= 24.2	24,353	0.2%	0.5%	362,100	0.2%	5.8
17	SCE	D	Y	<= 36.9	12,295	0.1%	0.2%	367,191	0.2%	3.6
18	SCE	D	Y	> 36.9	7,600	0.1%	0.1%	369,300	0.2%	12.5
19	SCE	I	N	<= 18.2	1,612,167	12.8%	30.2%	14,696,925	7.1%	5.4
20	SCE	I	N	<= 29.7	640,260	5.1%	12.0%	14,791,400	7.1%	3.2
21	SCE	I	N	> 29.7	352,762	2.8%	6.6%	14,872,178	7.2%	21.4
22	SCE	I	Y	<= 15.6	800,106	6.4%	15.0%	7,763,625	3.7%	3.5
23	SCE	I	Y	<= 24.8	400,663	3.2%	7.5%	7,843,450	3.8%	2.6
24	SCE	I	Y	> 24.8	234,996	1.9%	4.4%	7,914,104	3.8%	9.9
25	SCE	M	N	<= 14.8	575,692	4.6%	10.8%	4,320,386	2.1%	4.2
26	SCE	M	N	<= 25.5	228,303	1.8%	4.3%	4,385,988	2.1%	3
27	SCE	M	N	> 25.5	112,420	0.9%	2.1%	4,405,490	2.1%	25.6
28	SCE	M	Y	<= 12.5	126,138	1.0%	2.4%	969,106	0.5%	2.8
29	SCE	M	Y	<= 20.5	62,214	0.5%	1.2%	988,140	0.5%	2.3
30	SCE	M	Y	> 20.5	34,922	0.3%	0.7%	998,648	0.5%	9.7
31	SDGE	I	N	<= 18.4	219,329	1.7%	13.5%	2,090,941	1.0%	5.2
32	SDGE	I	N	<= 31.1	88,816	0.7%	5.5%	2,104,734	1.0%	3.6
33	SDGE	I	N	> 31.1	47,423	0.4%	2.9%	2,119,819	1.0%	17.9
34	SDGE	I	Y	<= 14.8	63,893	0.5%	3.9%	603,105	0.3%	3.2
35	SDGE	I	Y	<= 25.2	32,483	0.3%	2.0%	619,430	0.3%	2.9
36	SDGE	I	Y	> 25.2	16,766	0.1%	1.0%	615,817	0.3%	13.7
37	SDGE	M	N	<= 13.5	565,791	4.5%	34.9%	3,886,287	1.9%	3.7
38	SDGE	M	N	<= 23.5	221,662	1.8%	13.7%	3,901,656	1.9%	2.8

A	B	C	D	E	F	G	H	I	J	K
Stratum	IOU	Climate Zone Group	CARE FERA	Daily kWh	Number of Customers	Percent Customers Overall	Percent Customers IOU	Average Daily kWh	Percent Daily kWh	Std Dev Daily kWh
39	**SDGE**	**M**	**N**	**> 23.5**	110,076	0.9%	6.8%	3,942,963	1.9%	20.3
40	**SDGE**	**M**	**Y**	**<= 11.5**	143,281	1.1%	8.8%	1,035,485	0.5%	2.5
41	**SDGE**	**M**	**Y**	**<= 18.9**	72,179	0.6%	4.5%	1,055,179	0.5%	2.1
42	**SDGE**	**M**	**Y**	**> 18.9**	39,739	0.3%	2.5%	1,056,853	0.5%	9.4
TOTAL					12,556,403	100.0%		207,906,045	100.0%	

Sample Allocation and Estimated Precision

Given a sample size of 2,000 on site surveys, KEMA tested the precision of four different allocation methods:

1. Proportional to the number of customers in each stratum (Column B in tables below)
2. Proportional to the average daily kWh in each stratum (Column D in tables below)
3. Forty percent of the sample for each of PG&E and SCE, and 20 percent to SDG&E, then proportional to the number of customers in each stratum (Column F in tables below)
4. Forty percent of the sample for each of PG&E and SCE, and 20 percent to SDG&E, then proportional to the average daily kWh in each stratum (Column H in tables below)

These four methods of allocation are presented in Table 4 through 6.

Overall and IOU Estimated Precisions

All four methods of sample allocation will produce the same Overall Precision, as shown in Table 3.

The 40/40/20 allocation method improves precision for SDG&E, while maintaining a similar level of precision for PG&E and SCE. This is accomplished by allocating SDG&E a larger number of sample points relative to the number that would be allocated if strict proportions by stratum were allocated. The number of sample points allocated to PG&E and SCE is large enough that the decrease of sample size results in less than a 1% change in precision.

Table 4: Sample Allocation and Precision by IOU[3]

A	B	C	D	E	F	G	H	I
IOU	Proportional Allocation (Customers)	Estimated Precision at 90% Confidence	Proportional Allocation (kWh)	Estimated Precision at 90% Confidence	40/40/20 Allocation (Customers)	Estimated Precision at 90% Confidence	40/40/20 Allocation (kWh)	Estimated Precision at 90% Confidence
TOTAL	2,000	2%	2,001	2%	2,001	2%	1,999	2%
PG&E	890	3%	935	3%	801	3%	800	3%
SCE	851	3%	845	3%	800	3%	800	3%
SDG&E	259	5%	221	6%	400	4%	399	4%

[3] Stratum Precision is based on a 50% proportion.

CARE/FERA Program Estimated Precision

Precision for CARE/FERA participants from SDG&E is improved from 11% or 12% to 9% when the 40/40/20 allocation method is applied, while keeping the precision the same for participants from SCE and PG&E. Precision for non-participants from SDG&E is also improved by 1%, while decreasing precision for PG&E and SCE non-participants by 1% or less. This is illustrated in Table 5.

Table 5: Sample Allocation and Stratum Precision[4] by IOU and CARE/FERA Status

	A	B	C	D	E	F	G	H	I
IOU	CARE FERA Status	Proportional Allocation (Customers)	Estimated Precision at 90% Confidence	Proportional Allocation (kWh)	Estimated Precision at 90% Confidence	40/40/20 Allocation (Customers)	Estimated Precision at 90% Confidence	40/40/20 Allocation (kWh)	Estimated Precision at 90% Confidence
PGE	N	640	3%	640	3%	575	3%	548	4%
PGE	Y	250	5%	295	5%	226	5%	252	5%
SCE	N	580	3%	579	3%	545	4%	550	4%
SCE	Y	271	5%	266	5%	255	5%	250	5%
SDGE	N	200	6%	173	6%	309	5%	313	5%
SDGE	Y	59	11%	48	12%	91	9%	86	9%
Total		2,000	2%	2,001	2%	2,001	2%	1,999	2%

Stratum Estimated Precisions

The allocation method will affect the strata precisions, as shown in Table 6.

Table 6: Sample Allocation and Stratum Precision[5]

A	B	C	D	E	F	G	H	I
Stratum	Proportional Allocation (Customers)	Estimated Precision at 90% Confidence	Proportional Allocation (kWh)	Estimated Precision at 90% Confidence	40/40/20 Allocation (Customers)	Estimated Precision at 90% Confidence	40/40/20 Allocation (kWh)	Estimated Precision at 90% Confidence
1	150	7%	96	8%	134	7%	82	9%
2	62	10%	98	8%	56	11%	84	9%
3	36	14%	98	8%	32	15%	84	9%
4	74	10%	57	11%	67	10%	49	12%
5	37	14%	58	11%	33	14%	49	12%
6	20	18%	58	11%	18	19%	50	12%
7	244	5%	115	8%	219	6%	98	8%
8	100	8%	116	8%	90	9%	100	8%
9	48	12%	117	8%	44	12%	100	8%
10	74	10%	40	13%	67	10%	34	14%
11	33	14%	41	13%	30	15%	35	14%
12	12	24%	41	13%	11	25%	35	14%

[4] Stratum Precision is based on a 50% proportion.
[5] Stratum Precision is based on a 50% proportion

A	B	C	D	E	F	G	H	I
Stratum	**Proportional Allocation (Customers)**	Estimated Precision at 90% Confidence	**Proportional Allocation (kWh)**	Estimated Precision at 90% Confidence	**40/40/20 Allocation (Customers)**	Estimated Precision at 90% Confidence	**40/40/20 Allocation (kWh)**	Estimated Precision at 90% Confidence
13	13	23%	9	27%	12	24%	9	27%
14	4	41%	9	27%	4	41%	9	27%
15	2	58%	9	27%	2	58%	9	27%
16	4	41%	3	47%	4	41%	3	47%
17	2	58%	4	41%	2	58%	3	47%
18	1	82%	4	41%	1	82%	3	47%
19	257	5%	141	7%	241	5%	134	7%
20	102	8%	142	7%	96	8%	135	7%
21	56	11%	143	7%	53	11%	135	7%
22	127	7%	75	9%	120	8%	71	10%
23	64	10%	75	9%	60	11%	71	10%
24	37	14%	76	9%	35	14%	72	10%
25	92	9%	42	13%	86	9%	39	13%
26	36	14%	42	13%	34	14%	40	13%
27	18	19%	42	13%	17	20%	40	13%
28	20	18%	9	27%	19	19%	9	27%
29	10	26%	10	26%	9	27%	9	27%
30	6	34%	10	26%	5	37%	9	27%
31	35	14%	20	18%	54	11%	36	14%
32	14	22%	20	18%	22	18%	37	14%
33	8	29%	20	18%	12	24%	37	14%
34	10	26%	6	34%	16	21%	10	26%
35	5	37%	6	34%	8	29%	11	25%
36	3	47%	6	34%	4	41%	11	25%
37	90	9%	37	14%	140	7%	67	10%
38	35	14%	38	13%	55	11%	68	10%
39	18	19%	38	13%	27	16%	68	10%
40	23	17%	10	26%	35	14%	18	19%
41	11	25%	10	26%	18	19%	18	19%
42	6	34%	10	26%	10	26%	18	19%

Gas Service

The CLASS study has a unique focus on electric end-uses by the nature of the lighting inventory, appliances, and consumer electronics included in the scope. The study also includes heating and water heating systems which typically comprise a majority of gas consumption. The stratification for the sample design is based on electric service provider and electric consumption to avoid unnecessary complexity.

Although the sample frame is defined by electric accounts, the sample is expected to include customers with gas accounts with the IOUs along the proportions occurring within the population for each stratum. Since the sample is based on electric accounts, customers who purchase gas from an IOU but not electric from an IOU are precluded from the sample. Likewise, customers who purchase electric from an IOU may have gas service from another provider. Equipment saturations will be collected for all customers with gas service regardless of service provider. Reporting for SoCalGas will be included based on the sample of customers with IOU electric accounts.

Table 7 presents the sample frame with the number of customers with gas service accounts with IOUs.

Table 7: Sampling Frame with Gas Service

A	B	C	D	E	F	G	H	I	J	K	L
Stratum	IOU	T24 Climate Zone Group	CARE FERA	Daily kWh	Number of Customers	Number of Customers with Gas Account	Proportion with Gas Accounts	Average Daily Therms	Std Dev Daily Therms	Percent Daily kWh	Percent Daily Therms
1	PGE	I	N	<= 20.9	939,212	719,074	77%	677,504	1.1	5%	6%
2	PGE	I	N	<= 33	388,491	303,553	78%	443,018	0.8	5%	4%
3	PGE	I	N	> 33	224,254	144,026	64%	284,951	2.2	5%	3%
4	PGE	I	Y	<= 20.6	467,446	389,599	83%	393,510	0.7	3%	4%
5	PGE	I	Y	<= 32.7	232,332	188,696	81%	254,629	0.7	3%	2%
6	PGE	I	Y	> 32.7	123,785	80,505	65%	153,863	8.0	3%	1%
7	PGE	M	N	<= 14.9	1,533,933	1,123,368	73%	1,109,650	2.3	6%	10%
8	PGE	M	N	<= 25.4	627,322	520,179	83%	823,176	1.8	6%	8%
9	PGE	M	N	> 25.4	304,362	225,950	74%	552,879	5.4	6%	5%
10	PGE	M	Y	<= 15.2	465,218	366,882	79%	350,730	1.1	2%	3%
11	PGE	M	Y	<= 28	209,521	168,805	81%	244,930	0.8	2%	2%
12	PGE	M	Y	> 28	75,015	47,172	63%	142,022	17.8	2%	1%
13	SCE	D	N	<= 27.1	79,399	46,949	59%	31,606	0.7	0%	0%
14	SCE	D	N	<= 48.1	26,808	21,484	80%	27,707	1.1	0%	0%
15	SCE	D	N	> 48.1	12,976	11,137	86%	32,102	3.1	0%	0%
16	SCE	D	Y	<= 24.2	24,353	14,487	59%	9,716	0.5	0%	0%
17	SCE	D	Y	<= 36.9	12,295	8,551	70%	7,895	0.6	0%	0%
18	SCE	D	Y	> 36.9	7,600	5,604	74%	7,260	1.0	0%	0%
19	SCE	I	N	<= 18.2	1,612,167	1,052,084	65%	966,509	0.7	7%	9%
20	SCE	I	N	<= 29.7	640,260	518,182	81%	701,992	0.7	7%	6%
21	SCE	I	N	> 29.7	352,762	286,409	81%	575,221	1.5	7%	5%
22	SCE	I	Y	<= 15.6	800,106	560,824	70%	479,021	0.6	4%	4%
23	SCE	I	Y	<= 24.8	400,663	295,355	74%	374,334	0.6	4%	3%
24	SCE	I	Y	> 24.8	234,996	168,752	72%	274,079	0.9	4%	3%
25	SCE	M	N	<= 14.8	575,692	284,352	49%	253,913	0.7	2%	2%
26	SCE	M	N	<= 25.5	228,303	150,842	66%	209,485	0.8	2%	2%
27	SCE	M	N	> 25.5	112,420	79,243	70%	188,935	2.2	2%	2%
28	SCE	M	Y	<= 12.5	126,138	58,196	46%	46,487	0.6	0%	0%
29	SCE	M	Y	<= 20.5	62,214	31,568	51%	39,036	0.7	0%	0%
30	SCE	M	Y	> 20.5	34,922	17,466	50%	29,021	0.9	0%	0%
31	SDGE	I	N	<= 18.4	219,329	143,777	66%	134,208	3.3	1%	1%
32	SDGE	I	N	<= 31.1	88,816	65,282	74%	81,175	2.4	1%	1%
33	SDGE	I	N	> 31.1	47,423	28,458	60%	61,868	4.2	1%	1%
34	SDGE	I	Y	<= 14.8	63,893	37,053	58%	26,356	1.3	0%	0%
35	SDGE	I	Y	<= 25.2	32,483	20,446	63%	20,928	0.6	0%	0%
36	SDGE	I	Y	> 25.2	16,766	8,996	54%	12,756	2.1	0%	0%

A	B	C	D	E	F	G	H	I	J	K	L
Stratum	IOU	T24 Climate Zone Group	CARE FERA	Daily kWh	Number of Customers	Number of Customers with Gas Account	Proportion with Gas Accounts	Average Daily Therms	Std Dev Daily Therms	Percent Daily kWh	Percent Daily Therms
37	**SDGE**	**M**	**N**	**<= 13.5**	565,791	360,336	64%	268,337	2.8	2%	2%
38	**SDGE**	**M**	**N**	**<= 23.5**	221,662	182,343	82%	196,314	2.1	2%	2%
39	**SDGE**	**M**	**N**	**> 23.5**	110,076	97,407	88%	179,464	3.1	2%	2%
40	**SDGE**	**M**	**Y**	**<= 11.5**	143,281	98,044	68%	61,381	1.6	0%	1%
41	**SDGE**	**M**	**Y**	**<= 18.9**	72,179	54,452	75%	50,267	0.7	1%	0%
42	**SDGE**	**M**	**Y**	**> 18.9**	39,739	32,839	83%	40,538	0.7	1%	0%
TOTAL					12,556,403	9,018,727		10,818,770		100%	100%

Recommended Sample Allocation

KEMA believes allocating the sample by utilizing the 40/40/20 by kWh method will produce the best overall balance of study objectives. The columns have been shaded in Tables 4 through 6 to highlight the final sample allocation.

Table 4: Columns H and I
Table 5: Columns I and J
Table 6: Columns H and I

APPENDIX H. LAMP CHOICE MODEL METHODOLOGY

Overview

Upstream lighting programs use incentives to influence consumer decision-making. The underlying theory is that providing discounts for a CFL or LED lamp makes that CFL or LED lamp a more attractive choice. The question behind this impact evaluation is: what choice would the consumer have made in the absence of the incentive? The program's effects include providing lower-priced lamps in retail stores than would be available without the program, enabling specific retail stores (such as those in the discount channel) to stock lamps that they otherwise would meet their price point requirements. Discrete choice models are the analytical framework designed to address these types of effects. Discrete choice models combine the relevant information about each possible choice— for example, the lamp price and consumer characteristics—and assign a probability to each of the choices. To answer the impact evaluation question, we use the model to estimate the mix of lamp choices with and without the program in place. The difference is the movement of lamp purchases attributable to the program.

This section presents a summary of the data available for estimation and the estimation results for each of the three lamp replacement categories (A-lamp replacements, reflector lamp replacements, and globe lamp replacements) as described in Section 5.2.1. For additional background on logit models details on how we developed the lamp choice model, please refer to the CPUC ED 2010-12 California Upstream and Residential Lighting Impact Evaluation Work Order 28 (WO28) Final Report.[74]

Data

Estimating a discrete choice model requires data regarding consumer preferences and their characteristics. DNV GL collected these data with in-store shopper intercept surveys (please refer to APPENDIX J for the data collection instrument). The goal of the data collection was to capture the relationships between the choices that consumers make, the prices of lamps available to consumers, and consumer characteristics. Consumers' ranked preferences regarding their lamp choices form he dependent variables of the logit model. The prices, the retail channels, and customer characteristics are the independent variables.

We collected data regarding characteristics of the intercepted shoppers, the lamp(s) they purchased, and their lamp installation intentions as we expected there would be some correlation between these characteristics and lamp technology preferences. The specific elements we used to construct the lamp choice model include:

- **Replaced lamp technology.** Our expectation was that technology of the lamp the consumer is replacing can influence the purchase decisions. A consumer who is replacing a CFL, for example, may be more likely to purchase a CFL than a consumer who is replacing an incandescent lamp.
- **Annual household income.** Our expectation was that price sensitivity would vary by income level. We settled on three household income categories for constructing the lamp choice model: high income ($100,000 or greater), middle or low income (less than $100,000), and unknown/refused.
- **Rent versus own.** Our expectation was that consumer preferences regarding lamp technologies vary with homeowner status. For example, LED lamps have longer expected lifetimes compared to other

[74] DNV GL, 2014c.

technologies as well as higher retail prices. Consumers who are more transient (such as renters versus homeowners) may not realize an energy savings payback from LED lamps.

- **Planned purchased versus impulse purchase.** Our expectation was that the price of the lamp would have greater influence on the decisions of impulse purchasers than on the decisions of shoppers who entered the store planning to purchase a lamp or lamps on the day of the shopper intercept survey.

Estimation approach and results

We estimated separate models for each replacement lamp category (A-lamp replacements, reflector lamp replacements, and globe replacements) following the same general approach. We started with simple models and incrementally added complexity to increase the explanatory power of the model and/or to improve the relationships among the model parameters. The general approach is as follows:

1. **Establish the fundamental relationship.** We designed the model primarily to capture the effect of program price incentives on consumer choice. This model specification, shown in Table 95, has alternative-specific constants and generic coefficient on price. The alternative-specific constants force the model the predict market shares that are consistent with market shares in the survey data. The generic price coefficient constrains consumers to have the same price sensitivity toward each alternative technology.

   These results meet our *a priori* expectation that the price coefficient is negative. Consumers prefer lower prices, all other things being equal. Further, we see that consumers are more price-sensitive when shopping for A-lamp replacements than when shopping for reflector lamp replacements. This is consistent with our observation that A-lamps are more of a commodity good than reflector lamps. Manufacturers of reflector lamps compete through a combination of price and unique features. In comparison, A-lamp replacements have fewer distinguishing features and compete mostly on price.

   Technical note: we need to fix the value of one alternative-specific constant. (This is due to utility values being relative.) We have fixed the value of the CFL alternative (the CFL spiral in the case of the A-lamp replacements model) to zero.

Table 95. Initial estimation results of the A-Lamp replacement, reflector lamp replacement, and globe lamp replacement models, 2013-14

Coefficient	A-lamp Replacements		Reflector Lamp Replacements		Globe Lamp Replacements	
	Estimate	T-Stat	Estimate	T-Stat	Estimate	T-Stat
Alternative-specific constants (CFL spiral, CFL reflector, CFL globes are the respective reference levels)						
Incandescent A-lamp	-1.22	-13.24	0.53	3.9	3.53	3.9
Halogen A-lamp	-1.25	-12.57	N/A	N/A	N/A	N/A
CFL spiral						
CFL A-lamp	-1.1	-8.72	N/A	N/A	N/A	N/A
LED A-lamp	1.45	7.94	1.63	7.09	4.53	2.71
Price	**-0.25**	**-15.76**	**-0.12**	**-8.34**	**-0.29**	**-4.31**
Pseudo R2	**0.19**		**0.28**		**0.32**	

2. **Refine the model specification.** The refinements include:

   – **Differentiate price-sensitivity by alternative**. We let the price coefficients vary by technology. Incandescent, CFL, and LED lamps are not perfect substitutes for each other. LED, for example, have a much longer expected life. Our expectation was that consumers would be most price-sensitive toward incandescent lamps and the least price sensitive toward LED lamps because of differences in the technologies. The result was consistent with our *a priori* expectations for each model.

- **Constrain to channel targets.** We constrained the model to match the observed market shares for each alternative by channel. This constraint accounts for the unobserved differences between channels.
- **Include customer characteristics.** We included customer characteristics in the model to reflect that each retail channel serves different populations. We included four customer characteristics in the models:
  - **Income.** We stratified the price variable by income level to reflect that consumers with a household income of $100,000 or greater (high income) are less price sensitive than other consumer groups.
  - **Planned versus impulse purchases.** For the A-lamp replacements model, we were stratified the price variable by planned versus impulse purchase. The result was consistent with our expectation that planned purchasers would be less price-sensitive than impulse purchasers. Consumer who visited a store to buy a particular lamp tended to be less price-sensitive than a consumer who decided to buy a lamp when at the store.
  - **Replacement lamp technology.** The model results supported our expectation that consumers tend not to switch technologies when replacing a lamp.

Rent versus own. LED lamps save consumers money over time. However, they have a high initial cost than other technologies. Consumers who own their homes tend to make longer-term decisions than consumers in rental units. Results suggested that renters were less likely to buy LED lamps than homeowners. Table 96, Table 97, and Table 98 show the final model estimations results for A-Lamp replacements, reflector lamp replacements, and globe lamp replacements, respectively. The table groups related variables:

- **Alternative-specific constants.** These constants ensure that the total market share for each technology is consistent between model predictions and survey responses.
- **Channel constants.** These constants ensure that the total market share for each technology is consistent between the model predictions and survey responses by retail channel.

The key differences between the models for the three replacement lamp categories are:

- **Channel constants**. Reflectors and globes are not widely available in every retail channel. We were able to estimate channel constants only for the channels in which these technologies were more plentiful.
- **Price-income interaction.** We were able to quantify that high-income consumers are less price sensitive than consumers in other groups in the model results for A-lamp replacements and reflector replacements.
- **Price-planned purchase interaction.** The results matched our expectation that impulse purchasers are more price-sensitive. We stratified the results by technology within the A-lamp replacement category. However, we were not able estimate this parameter for the globe replacement model.
- **Pseudo R^2.** For each replacement lamp category, the overall fit of the final model shows improvement over the initial results shown in Table 95. Pseudo R^2 values tend to decrease as the number of alternatives in the model increases. As there are five alternatives in the A-lamp Replacements model, we expected a relatively lower pseudo R^2 value.

Table 96. Model estimation results for A-lamp replacements, 2013-14

Variable	Estimate	T-Statistic
Alternative-specific constants		
Incandescent A-lamp	-1.67	-7.05
Halogen A-lamp	-1.91	-8.00
CFL spiral		
CFL A-lamp	-1.06	-3.38
LED A-lamp	0.04	0.15
Channel constants for incandescent A-lamps		
Discount	0.78	2.85
Drug	-0.27	-0.74
Grocery	1.46	2.84
Hardware	0.26	0.95
Mass merchandise	-0.20	-0.91
Channel constants for halogen A-Lamps		
Drug	0.23	0.48
Grocery	2.43	4.33
Hardware	0.64	2.17
Mass merchandise	0.40	1.91
Channel constants for CFL A-Lamps		
Discount	-0.44	-1.04
Hardware	-0.11	-0.29
Mass merchandise	-0.23	-0.81
Channel constants for LED A-lamps		
Hardware	-0.66	-1.49
Mass merchandise	-1.32	-4.60
Price by technology		
Incandescent A-lamp	-0.77	-7.36
Halogen A-lamp	-0.64	-5.25
CFL spiral	-0.46	-10.50
CFL A-lamp	-0.31	-5.55
LED A-lamp	-0.16	-6.41
Price / income interactions		
High income	0.08	4.92
Unknown income	0.01	0.24
Price / planned purchase interactions by technology		
Incandescent A-lamp	0.36	3.30
Halogen A-lamp	0.29	2.57
CFL spiral	0.08	1.70
CFL A-lamp	-0.05	-0.85
LED A-lamp	0.00	-0.20
Pseudo R^2	**0.25**	

Table 97. Model estimation results for reflector lamp replacements, 2013-14

Variable	Estimate	T-Statistic
Alternative-specific constants		
Incandescent reflector	0.82	0.78
LED reflector	1.31	4.19
Channel constants for incandescent reflectors		
Hardware	0.32	0.29
Home improvement	-0.37	-0.36
Mass merchandise	0.02	0.02
Channel constants for LED reflectors		
Hardware	-2.38	-3.26
Home improvement	-1.32	-3.89
Mass merchandise	-2.01	-3.22
Price by technology		
Incandescent reflector	-0.29	-6.97
CFL reflector	-0.24	-5.94
LED reflector	-0.13	-4.26
Price/income interactions		
High income	0.02	1.15
Unknown income	0.00	0.00
Price/planned purchase interaction		
Overall	0.06	2.06
Pseudo R^2	**0.33**	

Table 98. Model estimation results for globe lamp replacements, 2013-14

Variable	Estimate	T-Statistic
Alternative-specific constants		
Incandescent globe	3.53	3.9
CFL globe		
LED globe	4.53	2.71
Channel constants for incandescent globes		
Hardware	-2.55	-2.93
Home improvement	-4.22	-6.03
Channel constants for LED globes		
Hardware	0.17	0.1
Home improvement	-1.26	-1.21
Price by technology		
Incandescent globe	-0.62	-2.17
CFL globe	-0.25	-2.95
LED globe	-0.61	-2.56
Pseudo R^2	**0.55**	

After obtaining the final model coefficients indicated in Table 96, Table 97, and Table 98, DNV GL applied these fitted models to three scenarios:

- **With-program.** This scenario reflects the lamp prices and availability that DNV GL observed in retail stores in 2012 and 2013. This scenario results in an estimate of observed market shares.
- **No-Discount.** This scenario reflects the lamp prices that consumers would have seen without IOU discounts. DNV GL estimated price differences based on clearly labelled IOU discounts in the stores or by matching lamps to program tracking data. This scenario results in a counterfactual estimate of market shares that would have occurred if only prices on CFLs and LED lamps changed due no program activity.
- **Constrained**. In addition to “no-discount”, this scenario reflects stocking that would have occurred in the absence of the upstream lighting program. When a manufacturer stated that they would not have shipped any CFLs or LED lamps to the California market without the program incentives, DNV GL flagged that manufacturer’s lighting products as “program-reliant.” This scenario results in a counterfactual estimate of market shares where we constrain the shelf to match to have only the lamps that do not depend on the program.

The lamp choice model estimates “program” and “no program” market shares that feed directly into the NTGR calculation (Equation 18).

Equation 18. Model-based NTGR

$$NTGR = \frac{Program\ Share - No - Program\ Share}{Program\ Share}$$

The NTGR is the percentage change in market share due to the influence of program activity—that is, the difference between the observed and counterfactual market shares divided by the program market share. For each combination of channel and lamp technology, we evaluated the differences between the program observed scenarios and the no-discount and the constrained counterfactual scenarios.

APPENDIX I. ADDITIONAL TABLES - NTGR

Table 99 and Table 100 show the model respondent counts and quantities of lamps associated with each activity for the A-lamp replacement and reflector replacement categories respectively.

Table 99. Program lamp shipments and model respondent counts by activity type and channel for A-lamp replacement category, 2013-14

Channel	Activity Type	Respondent Count	Quantity of Program-Discounted Lamps		
			Basic Spiral CFL	CFL A-Lamp	LED A-Lamp
Drug	CFL A-lamp	6	0	13,878	0
	Basic spiral CFL + CFL A-lamp	7	37,352	175,165	0
	Basic spiral CFL	41	850	0	0
Grocery – independent	CFL A-lamp	0	0	582,048	0
	Basic spiral CFL + CFL A-lamp	16	1,500	3,400	0
	CFL A-lamp + LED A-lamp	0	0	2,950	1,000
	Basic spiral CFL	4	604	0	0
	LED A-lamp	0	0	0	2,066
Mass merchandise	CFL A-lamp	41	0	3,175	0
	Basic spiral CFL + CFL A-lamp	3	339,980	26,626	0
	Basic spiral CFL + CFL A-lamp + LED A-lamp	0	63,622	3,583	15
	Basic spiral CFL	82	2,740	0	0
Membership club	Basic spiral CFL + CFL A-lamp	0	1,708	363	0
	Basic spiral CFL	65	616,549	0	0
	Basic spiral CFL + LED A-lamp	0	133,286	0	100,424
	LED A-lamp	28	0	0	114,561

Table 100. Program lamp shipments and model respondent counts by activity type and channel for reflector replacement category, 2013-14

Channel	Activity Type	Respondent Count	Quantity of Program-Discounted Lamps	
			CFL Reflector	LED Reflector
Hardware	CFL reflector	28	47,296	0
	LED reflector	32	0	44,498
	CFL reflector + LED reflector	0	77,672	4,708
Membership club	CFL reflector	0	98,228	0
	LED reflector	0	0	822,038
	CFL reflector + LED reflector	85	502,980	490,282

Table 101 and Table 102 display instances where respondent counts and program activity according to the tracking data were not in close alignment related to the A-lamp replacement category. In these cases, the modified or dropped activity type is noted and a description is provided.

Table 101. Adjustments to activity type classification for A-lamp replacement category, 2013-14

Channel	Activity type	Modified activity Type	Respondent Count	Basic spiral CFLs	CFL A-lamps	LED A-lamps	Description of Change
Discount	CFL A-lamp		30	0	1,374,190	0	
	Basic spiral CFL + CFL A-lamp		14	130,642	133,246	0	
	CFL A-lamp + LED A-lamp	DROP	0	0	1,500	780	Small quantity with no model representation
	Basic spiral CFL		32	119,693	0	0	
	LED A-lamp		6	0	0	1,758	
Drug	CFL A-lamp		5	0	13,878	0	
	Basic spiral CFL + CFL A-lamp		6	37,352	175,165	0	
	Basic spiral CFL		41	850	0	0	
Grocery - chain	CFL A-lamp		8	0	415,220	0	
	Basic spiral CFL + CFL A-lamp	DROP	0	800	1,800	0	Small quantity with no model representation
	CFL A-lamp + LED A-lamp	DROP	0	0	550	200	Small quantity with no model representation
	Basic spiral CFL		9	15,852	0	0	
	LED A-lamp	DROP	0	0	0	3,520	Small quantity with no model representation
Grocery - independent	CFL A-lamp		0	0	582,048	0	
	Basic spiral CFL + CFL A-lamp		16	1,500	3,400	0	
	CFL A-lamp + LED A-lamp		0	0	2,950	1,000	
	Basic spiral CFL		4	604	0	0	
	LED A-lamp		0	0	0	2,066	

Table 102. Adjustments to activity type classification for A-lamp replacement category, 2013-14 (Continued)

Channel	Activity Type	Modified Activity Type	Respondent Count	Basic spiral CFLs	CFL A-lamps	LED A-lamps	Description of Change
Hardware	CFL A-lamp		19	0	34,352	0	
	Basic spiral CFL + CFL A-lamp		10	42,254	2,114	0	
	Basic spiral CFL + CFL A-lamp + LED A-lamp	Basic spiral CFL + CFL A-lamp	0	43,962	60,480	720	Less than 1,000 LEDs against 100,000 other lamp types, and no model available to represent. Consider a CFL basic, A-lamp
	CFL A-lamp + LED A-lamp	DROP	0	0	9,040	2,776	Small quantity with no model representation
	LED A-lamp		60	0	0	55,668	
Home improvement	CFL A-lamp		53	0	33,787	0	
	Basic spiral CFL + CFL A-lamp		16	1,575,757	77,486	0	
	Basic spiral CFL + CFL A-lamp + LED A-lamp	DROP	1	395,314	44,857	126,056	Small simulation count for this one category so cannot consider viable
	CFL A-lamp + LED A-lamp		4	0	68,879	121,747	
	Basic spiral CFL		95	30,432	0	0	
	Basic spiral CFL + LED A-lamp	DROP	0	11,596	0	2,544	Small quantity with no model representation
	LED A-lamp		110	0	0	138,306	
Mass merchandise	CFL A-lamp		41	0	3,175	0	
	Basic spiral CFL + CFL A-lamp		2	339,980	26,626	0	
	Basic spiral CFL + CFL A-lamp + LED A-lamp	Basic spiral CFL + CFL A-lamp	0	63,622	3,583	15	Only 15 LED lamps; consider this a CFL basic, A-lamp
	Basic spiral CFL		82	2,740	0	0	
Membership club	Basic spiral CFL + CFL A-lamp	DROP	0	1,708	363	0	Small quantity with no model representation
	Basic spiral CFL		65	616,549	0	0	
	Basic spiral CFL + LED A-lamp	DROP	0	133,286	0	100,424	Small quantity with no model representation
	LED A-lamp		28	0	0	114,561	

Table 103 displays instances in which respondent counts and program activity according to the tracking data were not in close alignment related to the reflector replacement category. In these cases, modified or dropped activity types are noted with descriptions.

Table 103. Adjustments to activity type classification for reflector replacement category, 2013-14

Channel	Activity Type	Modified Activity Type	Simulation Count	CFL Reflectors	LED Reflectors	Description of Change
Discount	CFL reflector		10	807,655	0	
	LED reflector	DROP	0	0	262	Small quantity with no model representation
	CFL reflector + LED reflector	DROP	0	739	551	Small quantity with no model representation
Drug	CFL reflector		100	131,766	0	
	LED reflector		0	0	0	
	CFL reflector + LED reflector		0	0	0	
Grocery - chain	CFL reflector		50	262,813	0	
	LED reflector	DROP	0	0	3,120	Small quantity with no model representation
	CFL reflector + LED reflector	DROP	0	450	120	Small quantity with no model representation
Grocery - independent	CFL reflector	DROP	0	505,160	0	No simulation data
	LED reflector	DROP	0	0	1,304	No simulation data
	CFL reflector + LED reflector	DROP	0	2,250	1,044	No simulation data
Hardware	CFL reflector		280	47,296	0	
	LED reflector	LED A-lamp	320	0	44,498	
	CFL reflector + LED reflector	DROP	0	77,672	4,708	Moderate quantity but no model results
Home improvement	CFL reflector		1,000	263,322	0	
	LED reflector	LED A-lamp	490	0	68,615	
	CFL reflector + LED reflector		400	315,542	112,311	
Mass merchandise	CFL reflector		650	16,614	0	
	LED reflector		0	0	0	
	CFL reflector + LED reflector	CFL reflector	0	4,611	2	Only 2 LED lamps; consider this a CFL reflector

Table 103. Adjustments to activity type classification for reflector replacement category, 2013-14 (Continued)

Channel	Activity Type	Modified Activity Type	Simulation Count	CFL Reflectors	LED Reflectors	Description of Change
Membership club	CFL reflector	DROP	0	98,228	0	Reasonable quantity but only model estimates for combined techs, cannot use channel
	LED reflector	DROP	0	0	822,038	Reasonable quantity but only model estimates for combined techs, cannot use channel
	CFL reflector + LED reflector	DROP	850	502,980	490,282	Reasonable quantity but only model estimates for combined techs, cannot use channel

The NTGR contains at least three potential sources of uncertainty: supper interviews, shelf survey data, and the estimation of the Lamp Choice Model. As we surveyed nearly every manufacturer, we do not believe that the supplier interviews are a significant source of uncertainty. More, the information that we gathered in the supplier interview is qualitative and less easily translated into errors. Likewise, we lack good information to categorize the uncertainty in the shelf surveys. Instead, we concentrate our uncertainty analysis on the NTGR from the model-based approach.

The NTGR from the model-based approach result from applying the LCM to shelf data. The parameters in the LCM depend on survey responses. The estimation results depend on the sample of purchasers that we intercepted. We can calculate this uncertainty using the following jackknife procedure:

1. Pull a pseudo random 90% sample from the estimation data.
2. Re-estimate the LCM model parameters.
3. Run the simulation and record the NTGR by channel and program activity.
4. Repeat steps 1 to 3 until the maximum, average NTGR by channel and program activity is less than 0.001% difference from the maximum, averaged NTGR by channel and program activity from the previous iteration.

Table 104 and Table 105 show the standard errors and confidence intervals for A-lamp replacements, reflector lamp replacements, and globe lamp replacements. DNV GL notes that these calculations relate to the modelled NTGR. The supplier NTGR estimates are based on interview results, so there is no objective way to calculate uncertainty, except to consider representation of the population. We completed 16 manufacturer interviews, which accounted for roughly 99% of all program lamps.

Table 104. Modelled NTGR estimates for evaluated upstream lighting measure groups by channel for A-lamp replacements, 2013-14

Channel	Evaluated Upstream Lighting Measure Group	Activity Type	Weight	By Activity Type		By Measure Group				
				NTGR	SE	NTG	SE	CI	Lower	Upper
A-Lamp Replacement Category										
Discount	MSB CFL basic spiral ≤ 30 W	Basic CFL	48%	50%	2%	57%	1%	2%	55%	60%
		Basic CFL + CFL A-lamp	52%	64%	1%					
	MSB CFL A-lamp ≤ 30 W	CFL A-lamp	91%	44%	1%	45%	1%	2%	43%	47%
		Basic CFL + CFL A-lamp	9%	58%	1%					
	LED A-lamp, all wattages	LED A-lamp	100%	30%	3%	30%	3%	5%	25%	35%
Grocery - chain	MSB CFL A-lamp ≤ 30 W	CFL A-lamp	100%	100%	0%	100%	0%	0%	100%	100%
Hardware	MSB CFL basic spiral ≤ 30 W	Basic CFL + CFL A-lamp	100%	14%	2%	14%	2%	3%	10%	17%
	MSB CFL A-lamp ≤ 30 W	CFL A-lamp	35%	32%	1%	75%	1%	1%	74%	76%
		Basic CFL + CFL A-lamp	65%	99%	0%					
	LED A-lamp, all wattages	LED A-lamp	99%	43%	3%	41%	5%	8%	33%	48%
		Basic CFL + CFL A-lamp	1%	-103%	28%					
Home improvement	MSB CFL basic spiral ≤ 30 W	Basic CFL	2%	9%	1%	8%	1%	1%	7%	10%
		Basic CFL + CFL A-lamp	98%	9%	1%					
	MSB CFL A-lamp ≤ 30 W	CFL A-lamp	19%	10%	1%	8%	3%	5%	3%	13%
		Basic CFL + CFL A-lamp	43%	1%	1%					
		CFL A-lamp + LED A-lamp	38%	16%	5%					
	LED A-lamp, all wattages	LED A-lamp	53%	38%	3%	42%	3%	5%	37%	47%
		CFL A-lamp + LED A-lamp	47%	47%	4%					
Membership club	LED A-lamp, all wattages	LED A-lamp	100%	16%	1%	16%	1%	2%	14%	19%

Table 105. Modelled NTGR estimates for evaluated upstream lighting measure groups by channel for reflector and globe replacements, 2013-14

Channel	Evaluated Upstream Lighting Measure Group	Activity Type	Weight	By Activity Type		By Measure Group				
				NTGR	SE	NTG	SE	CI	Lower	Upper
Reflector Lamp Replacement Category										
Home improvement	MSB CFL reflector ≤ 30 W	CFL reflector	45%	24%	1%	12%	2%	3%	9%	14%
		CFL reflector + LED reflector	55%	2%	2%					
	LED reflector, all wattages	LED A-lamp	38%	35%	2%	30%	2%	3%	27%	34%
		CFL reflector + LED reflector	62%	28%	2%					
Mass merchandise	MSB CFL reflector ≤ 30 W	CFL reflector	100%	17%	1%	17%	1%	2%	15%	18%
Globe Lamp Replacement Category										
Home improvement	MSB CFL globe ≤ 30 W	CFL globe	100%	31%	5%	31%	5%	7%	24%	39%
Mass merchandise	MSB CFL globe ≤ 30 W	CFL globe	100%	30%	4%	30%	4%	7%	23%	37%

Table 106 through Table 112 provide the channel-level NTGR for each measure group, along with the respective program-discounted lamp quantities for each IOU.

Table 106. Final NTGR and program lamp shipments for CFL basic spiral ≤ 30 W, 2013-14

Retail Channel	Channel NTGR	Shipments			
		Total Program Lamps	PG&E	SCE	SDG&E
Discount	66%	250,335	0	61,952	188,383
Drug	35%	38,202	2,612	34,240	1,350
Grocery - chain	7%	16,652	0	800	15,852
Grocery - independent	55%	2,104	0	2,104	0
Hardware	26%	86,216	86,116	100	0
Home improvement	22%	2,013,099	541,868	586,862	884,369
Mass merchandise	33%	406,342	861	0	405,482
Membership club	15%	751,543	410,712	10,638	330,193
Total shipments		**3,564,493**	**1,042,169**	**696,696**	**1,825,628**
Overall NTGR			**20%**	**26%**	**27%**

Table 107. Final NTGR and program lamp shipments for CFL A-lamps ≤ 30 W, 2013-14

Retail Channel	Channel NTGR	Shipments			
		Total Program Lamps	PG&E	SCE	SDG&E
Discount	57%	1,508,936	402,464	755,530	350,942
Drug	50%	189,043	90,098	98,918	27
Grocery - chain	98%	417,570	0	417,570	0
Grocery - independent	69%	588,398	0	588,398	0
Hardware	72%	105,986	62,394	43,592	0
Home improvement	25%	225,008	96,429	67,788	60,791
Mass merchandise	54%	33,383	6,771	2,840	23,773
Membership club	34%	363	363	0	0
Total Shipments		**3,068,687**	**658,519**	**1,974,636**	**435,533**
Overall NTG			**53%**	**68%**	**52%**

Table 108. Final NTGR and program lamp shipments for LED A-lamps, all wattages, 2013-14

Retail Channel	Channel NTGR	Shipments			
		Total Program Lamps	PG&E	SCE	SDG&E
Discount	42%	2,538	0	2,538	0
Drug*	100%	0	0	0	0
Grocery - chain	69%	3,720	0	3,720	0
Grocery - independent	69%	3,066	264	2,802	0
Hardware	45%	59,164	13,140	43,426	2,598
Home improvement	43%	388,653	193,179	147,308	48,166
Mass merchandise*	100%	15	0	0	15
Membership club	31%	214,985	68,841	45,263	100,881
Total Shipments		**672,141**	**275,424**	**245,057**	**151,660**
Overall NTGR			**40%**	**42%**	**35%**

* Due to small quantity of total program lamps, our shelf surveys did not capture enough data for the model to evaluate this lamp type channel combination

Table 109. Final NTGR and program lamp shipments for CFL reflector lamps ≤ 30 W, 2013-14

Retail Channel	Channel NTGR	Shipments			
		Total Program Lamps	PG&E	SCE	SDG&E
Discount	29%	808,394	9,720	738,322	60,352
Drug	22%	131,766	70,000	61,766	0
Grocery - chain	34%	263,263	0	262,896	367
Grocery - independent	31%	507,410	0	507,410	0
Hardware	24%	124,967	70,691	54,276	0
Home improvement	20%	578,864	204,322	190,554	183,988
Mass merchandise	27%	21,225	2,493	2,696	16,036
Membership club	11%	601,201	202,492	229,152	169,558
Total Shipments		**3,037,090**	**559,717**	**2,047,072**	**430,301**
Overall NTGR			**18%**	**27%**	**18%**

Table 110. Final NTGR and program lamp shipments for LED reflector lamps, 2013-14

Retail Channel	Channel NTGR	shipments			
		Total Program Lamps	PG&E	SCE	SDG&E
Discount*	69%	813	0	811	2
Drug	100%	0	0	0	0
Grocery - chain	36%	3,240	0	3,240	0
Grocery - independent	36%	2,348	264	2,084	0
Hardware	35%	49,206	14,281	33,791	1,134
Home improvement	36%	180,926	33,447	107,405	40,074
Mass merchandise*	100%	2	0	0	2
Membership club	26%	1,312,320	555,548	608,122	148,650
Total Shipments		**1,548,855**	**603,540**	**755,453**	**189,862**
Overall NTGR			**27%**	**28%**	**28%**

* Due to small quantity of total program lamps, our in-store inventories did not capture enough data for the model to evaluate this lamp type channel combination

Table 111. Final NTGR and program lamp shipments for CFL globe lamps ≤ 30 W, 2013-14

Retail Channel	Channel NTGR	shipments			
		Total Program Lamps	PG&E	SCE	SDG&E
Discount	64%	59,646	N/A	59,000	646
Drug	50%	400	N/A	400	0
Grocery - chain	76%	25,628	N/A	25,480	148
Grocery - independent	69%	112,550	N/A	112,550	0
Hardware	54%	10,950	N/A	10,950	0
Home improvement	79%	30,150	N/A	4,800	25,350
Mass merchandise	52%	21,073	N/A	0	21,073
Membership club	100%	0	N/A	0	0
Total Shipments		**260,396**	N/A	**213,180**	**47,216**
Overall NTGR			N/A	**68%**	**67%**

Table 112. Final NTGR and program lamp shipments for high wattage CFLs (>30 watts), 2013-14

Retail Channel	Channel NTGR	shipments			
		Total Program Lamps	PG&E	SCE	SDG&E
Discount	45%	1,550,204	201,182	1,349,020	2
Drug	34%	21,677	0	21,677	0
Grocery - chain	52%	1,108,106	93,048	1,015,058	0
Grocery - independent	47%	1,052,306	58,000	994,306	0
Hardware	37%	140,842	0	140,842	0
Home improvement	40%	154,524	13,348	135,258	5,918
Mass merchandise	36%	4,350	0	2,400	1,950
Membership club	26%	439,971	0	439,971	0
Total Shipments		**4,471,979**	**365,578**	**4,098,532**	**7,869**
Overall NTGR			**47%**	**45%**	**39%**

APPENDIX J. DATA COLLECTION INSTRUMENTS

This appendix includes:

- 2015 consumer telephone survey instrument
- 2015 manufacturer in-depth interview guide
- 2015 retail buyer in-depth interview guide
- Winter 2014-15 shelf survey instrument
- Winter 2014-15 shopper intercept survey instrument

2015 consumer telephone survey instrument

2015 California Public Utilities Commission Consumer Lighting Survey
---------- DRAFT 06/24/2015 ----------

[RED BRACKETS DENOTE SURVEY QUESTIONS THAT HAVE BEEN ADDED, MODIFIED, OR MOVED FOR THE 2015 SURVEY]

0 INTRODUCTION

DIALSCR Hello, my name is [interviewer name], and I'm helping evaluate California's energy efficiency programs. This is not a sales call. We're calling on behalf of the California Public Utilities Commission and [IOU] to talk about light bulbs. Do you purchase light bulbs for your household?
[EXPLAIN IF THERE IS MORE THAN ONE PURCHASER WE ONLY NEED TO TALK TO ONE PERSON. ARRANGE CALL BACK IF RESPONDENT NOT AVAILABLE]

[**INTERVIEWER: If asked where caller is from:** I'm calling from Pacific Market Research, an independent research firm that the California Public Utilities Commission hired to conduct this survey.]
[INTERVIEWER: If asked who provided their number: We're calling customers randomly from your electric and gas utility.]
[**INTERVIEWER: If asked who is sponsoring this study:** We are conducting this study on behalf of the California Public Utilities Commission to help them improve their energy-efficiency programs.]
[**INTERVIEWER: If asked why you are conducting this study:** Studies like this help the California Public Utilities Commission better understand California utility customers' need for and interest in energy programs and services.]
[INTERVIEWER: If asked about survey length: This call should take about 30 minutes of your time. Is this a good time for us to speak with you? IF NOT, SET UP CALL BACK APPOINTMENT.]
[**INTERVIEWER: If respondent expresses sales concern:** I am not selling anything, and your responses will be kept confidential. If you would like to talk with someone from the California Public Utilities Commission about this study, please call Jeorge Tagnipes (pronounced Tag-neep-ez) at (415) 703-2451.]

S0 Are you taking this call on a cell phone or a landline?
[NEW]
1 Cell phone
2 Landline [SKIP TO S1]
-88 Don't Know [SKIP TO CLOSE]
-99 Refused [SKIP TO CLOSE]

S0A Are you taking this call while driving a car or doing something that requires your attention?
[NEW]
1 Yes [ARRANGE FOR CALLBACK]
[Due to safety reasons we will need to call you back at a more convenient time. Thank you very much.]
2 No
-88 Don't Know [SKIP TO CLOSE]
-99 Refused [SKIP TO CLOSE]

S1 Before we get started, can you confirm that [IOU] provides electricity to your home?
1 Yes
2 No [SKIP TO CLOSE_IOU]
-88 Don't know [SKIP TO CLOSE_IOU]
-99 Refused [SKIP TO CLOSE_IOU]

1 CFL AWARENESS

S2 [MOD] Great! Can you start by telling me what kinds of energy-efficient light bulbs you've heard of? [DO NOT READ THE CHOICES BELOW]
[ACCEPT MULTIPLE RESPONSES]
[If respondent says "Fluorescents," ASK: Did you mean the longer fluorescent tubes or Compact Fluorescent Lamps also known as CFLs?]
1 Compact Fluorescent Lamps (CFLs)
2 LEDs
3 Regular/standard Incandescents
4 Energy Efficient Incandescents
5 Halogens
6 Energy Efficient Halogens
7 Fluorescent Tubes
-77 Other [SPECIFY]
-88 Don't know
-99 Refused

S3 [IF S2 = 1, SKIP TO S4] Compact fluorescent light bulbs – also known as CFLs – come in many shapes and sizes. The most common type of CFL is made with a glass tube bent into a spiral and fits in a regular light bulb socket. Have you ever heard of them?
1 Yes
2 No
-88 Don't know
-99 Refused

S4 [IF S2 ≠ 1 AND S3 ≠ 1, SKIP TO S6] I'm going to read you a list of different types of CFLs, and ask you whether or not you've heard of them.
[READ IF NECESSARY WITH EACH ITEM] Before today, have you heard of…? [S4A—S4D]

S4A Spiral or twister shape CFLs? These are the most common type of CFLs. [IF NECESSARY: Have you heard of these before today?]
1 Yes
2 No
-88 Don't know
-99 Refused

[RANDOMIZE ORDER OF S4B THROUGH S4D]

S4B [MOD] A-shaped CFLs? These are CFLs that look like regular incandescent light bulbs with the spiral shape hidden inside.

1 Yes
2 No
-88 Don't know
-99 Refused

S4C Flood light or reflector CFLs? These look like regular flood lights with a spiral shape hidden inside. They're often used in recessed fixtures or in outdoor security fixtures.

1 Yes
2 No
-88 Don't know
-99 Refused

S4D Globe CFLs? These are round bulbs with the spiral shape hidden inside. They're sometimes used in bathroom vanity fixtures.

1 Yes
2 No
-88 Don't know
-99 Refused

2 CFL PURCHASER SECTION

2.1 CFL PURCHASER

G0 [NEW] [IF S2 or S3 = 1] Have you ever purchased any CFLs?

1 Yes
2 No [SKIP TO ATT4]
-88 Don't know [SKIP TO ATT4]
-99 Refused [SKIP TO ATT4]

G1 [MOD] Approximately how many CFLs are currently installed at your home, either indoors or outdoors? [RECORD # OF CFLs]

_____ Number of CFLs installed
[PROMPT FOR BEST GUESS OR ESTIMATE]
0 None
-88 Don't Know
-99 Refused

G2 [MOD] And, approximately how many CFLs are you currently storing in your home? [RECORD # OF CFLs]

_____ Number of CFLs stored
[PROMPT FOR BEST GUESS OR ESTIMATE]
0 None
-88 Don't Know
-99 Refused

G3 [IF G2 > 0] Why are you storing extra CFLs at your home? [DO NOT READ LIST] [ACCEPT MULTIPLE RESPONES]

1 So that I have them on hand if a bulb burns out
2 Purchased more CFLs than I needed (more were in the package than I Needed or left over from a package)
3 Bought them in bulk
4 Bought them on sale
5 Can't use them in certain rooms
6 Can't use them in certain applications (e.g. dimmer switch)
7 Didn't like the way they looked when installed
-77 Other (SPECIFY)
-88 Don't Know
-99 Refused

G4 [NEW] [IF G2 > 0] What do you expect to do with the [G2] CFLs you currently have in storage? would you say that you'll use them to replace bulbs that are currently working, use them to replace bulbs that burn out, throw or give them away, or keep them but probably not use them? [ACCEPT MULTIPLE RESPONSES]

1 Replace working bulbs
2 Replace burned-out bulbs
3 Throw or give them away
4 Keep but probably not use them
5 Other [SPECIFY]
-88 Don't know
-99 Refused

G6
[IF ONLY ONE RESPONSE GIVEN TO G4 AND G4 = -88 OR 5, ASK G6 OTHEWISE SKIP TO Q1]
[IF MORE THAN ONE RESPONSE GIVEN TO G4 AND INCLUDES G4 = 4 OR 5 OR -88, ASK G6. OTHERWISE SKIP TO Q1]How many of these [G2] CFLs do you think you'll never install?

[NEW] _____ RECORD NUMBER OF CFLs
[PROMPT FOR BEST GUESS OR ESTIMATE]
0 None
-88 Don't Know
-99 Refused

2.2 2013-2014 CFL PURCHASER

Q1 [IF S2 ≠ 1 AND S3 ≠ 1, SKIP TO ATT4] Let's talk a little more about CFLs. Have you purchased any CFLs since January 1st, 2013 to use at your home, either indoors or outdoors?

1 Yes
2 No [SKIP TO ATT4]
-88 Don't know [SKIP TO ATT4]

-99 Refused [SKIP TO ATT4]

Q2 How many have you purchased since then? [IF NECESSARY: Since Jan 1st, 2013]
_____ Number of CFLs [RECORD # CFLS]
[PROMPT FOR BEST GUESS OR ESTIMATE]
-88 Don't know [SKIP TO Q11]
-99 Refused [SKIP TO Q11]

Q3 [IF Q2 = 1] Was it a…
[IF Q2 > 1] How many were…

a.	Spiral or twister CFL(s)?	____ [Number purchased]
b.	A-shaped CFL(s)?	____ [Number purchased]
c.	Flood light or reflector CFL(s)?	____ [Number purchased]
d.	Globe CFL(s)?	____ [Number purchased]
-88	Don't know	
-99	Refused	

Q8 [IF Q1 = 2] At what store did you purchase that CFL?
[MOD] [IF Q1 > 2] At what stores did you purchase those CFLs?
[IF NECESSARY: The CFL(s) you purchased since January 1st, 2013]
[DO NOT READ LIST, ACCEPT MULTIPLE RESPONSES]

1 99 Cent Only Store
2 Albertsons
3 Ace Hardware
4 Costco
5 CVS
6 Dixieline Lumber Co.
7 Food 4 Less
8 HD Supply
9 Home Depot
10 Longs Drugs
11 Lowes
12 Orchard Supply
13 Ralphs
14 Rite Aid
15 Sam's Club
16 Stater Brothers
17 Target
18 True Value Hardware
19 Walgreens
20 Wal-Mart
-77 Other [SPECIFY]
-88 Don't know
-99 Refused

Q8A [MOD] [IF Q8 ≠ -77 or -88 or -99, SKIP TO Q11C]: Was it a...?
[READ LIST UNTIL THE RIGHT CATEGORY IS MENTIONED]
[ACCEPT MULTIPLE RESPONSES; RANDOMIZE ORDER OF LIST]

1 Discount store, such as 99 Cent or Dollar Store
2 Grocery store
3 Small hardware store
4 Lighting or electronics store
5 Drug store
6 Large home improvement store, such as Home Depot, Lowe's or Orchard Supply
7 Mass merchandise store, such as Wal-Mart or Target
8 Membership club store, such as Costco or Sam's Club, or
-77 Some other type of store? [SPECIFY]
-88 Don't Know
-99 Refused

Q11 [MOD] Of all the CFLs you purchased since January 1st, 2013, how many did you install in your home, either indoors or outdoors?

_____ Number of CFLs installed
[PROMPT FOR BEST GUESS OR ESTIMATE]
-88 Don't know [SKIP TO ATT4]
-99 Refused [SKIP TO ATT4]

Q11C [MOD] [IF Q11 = 1] Thinking of the CFL you installed since January 1st 2013, what type of bulb did it replace? [ACCEPT ONLY ONE RESPONSE]
[IF Q11 > 1] Thinking of the CFLs you installed since January 1st 2013, how many of them were... [ACCEPT MULTIPLE RESPONSES]

[RANDOMIZE ORDER OF LIST 1—4; STOP READING LIST WHEN TOTAL FOR Q11C = Q11]
[RECORD # OF BULBS]

1 replaced regular Incandescent bulbs?
2 replaced other CFLs?
3 replaced LED bulbs?
4 replaced Halogen bulbs?
5 went into empty sockets?
6 went into new lamps or fixtures?
-77 replaced other types of light bulbs? [SPECIFY]
-88 Don't know
-99 Refused

3 CFL DISPOSAL

ATT4 Have you ever had any CFLs that you needed to dispose of?
1 Yes
2 No [SKIP TO ATT6]
-88 Don't know [SKIP TO ATT6]
-99 Refused [SKIP TO ATT6]

ATT5 How did you dispose of them most recently? [DO NOT READ RESPONSES] [ACCEPT MULTIPLE RESPONSES]
1 Threw them away/threw them in the trash
2 Returned them to the store
3 Took them to a recycling center
4 Gave them away
5 Community hazardous waste disposal
6 Haven't disposed of them yet
-77 Other [SPECIFY]
-88 Don't know
-99 Refused

ATT6 Have you seen or heard anything about how you should dispose of CFLs?
1 Yes
2 No [SKIP TO S6]
-88 Don't know [SKIP TO S6]
-99 Refused [SKIP TO S6]

ATT7 What information have you seen or heard? [IF NEEDED: …about how you should dispose of CFLs?] [ACCEPT MULTIPLE RESPONSES. DO NOT READ RESPONSES]
1 CFLs need to be recycled
2 CFLs need to be wrapped in plastic/paper before being thrown in trash
3 CFLs contain mercury
4 CFLs contain harmful/dangerous materials
5 Return them to a retail store
-77 Other [SPECIFY]
-88 Don't know
-99 Refused

4 LED PURCHASER

LED AWARENESS

S6 [IF S2 = 2, SKIP TO S7] Have you heard of LEDs? They are also known as Light Emitting Diodes and are the most efficient light bulbs available today.
1 Yes
2 No [SKIP TO NL1]
-88 Don't know [SKIP TO NL1]
-99 Refused [SKIP TO NL1]

S7 [MOD] [IF S2 = 2, READ: You mentioned earlier that you've heard of LEDs.] What types of LEDs have you heard of?
[DO NOT READ. SELECT ALL THAT APPLY. PROBE ONCE FOR ADDITIONAL RESPONSES]
1 Holiday/Christmas Lights
2 Automobile lights (car or truck)
3 Task/Desk Lamps
4 Under-cabinet or under-counter Lighting
5 Light Bulbs (flood/spot/recessed, globe, candelabra)
6 Night Lights
7 Flashlights
8 Street lights or Stop lights
9 Appliances and electronics (TVs, monitors, computers, etc.)
10 Solar / Garden / Landscape
-77 Other [SPECIFY]
-88 Don't know
-99 Refused

4.1 LED PURCHASER

LE0 [LED1A] [MOD] Have you ever purchased any **LED bulbs**? Please count only LED bulbs, **not lamps or fixtures that use LED light sources. Do not count holiday lights or Christmas lights.**
1 Yes [SKIP TO LED2]
2 No
-88 Don't know [SKIP TO NL1]
-99 Refused [SKIP TO NL1]

LE1 [LED0] What is the main reason why you have not purchased any LED bulbs?
0 Don't need them [SKIP TO NL1]
1 Too expensive [SKIP TO NL1]
2 Not sure where to buy them [SKIP TO NL1]
3 Cannot find them in stores [SKIP TO NL1]
4 Not sure about how well they will work [SKIP TO NL1]
5 Don't like the way they look [SKIP TO NL1]
6 Better products may be available soon [SKIP TO NL1]
7 Only bought lamps/fixtures/holiday lights or Christmas LEDs [SKIP TO NL1]
-77 Other [SPECIFY] [SKIP TO NL1]
-88 Don't Know [SKIP TO NL1]
-99 Refused [SKIP TO NL1]

LE2 Approximately how many LED bulbs are currently installed at your home, either indoors or outdoors? [RECORD # OF LED BULBS]
_____ Number of LEDs installed
[PROMPT FOR BEST GUESS OR ESTIMATE]
0 None
-88 Don't Know
-99 Refused

LE3 [LEDX7]
Approximately how many total LED bulbs are you currently storing in your home? [RECORD # OF LED BULBS]
_____ Number of LED bulbs stored
[PROMPT FOR BEST GUESS OR ESTIMATE]
0 None [SKIP TO LE4]
-88 Don't Know [SKIP TO LE4]
-99 Refused [SKIP TO LE4]

LE3A [LEDX8]
Why are you storing extra LED bulbs at your home? [DO NOT READ LIST] [ACCEPT MULTIPLE RESPONES]
1 So that I have them on hand if a bulb burns out
2 Purchased more bulbs than I needed (more in package than I needed)
3 Bought them in bulk
4 Bought them on sale
5 Can't use them in certain rooms
6 Can't use them in certain applications (e.g. dimmer switch)
7 Didn't like having them installed
-77 Other (SPECIFY)
-88 Don't Know
-99 Refused

LE3B [NEW]
[IF LE3 > 0] What do you expect to do with the [LE3] LED bulbs you currently have in storage? Would you say that you'll use them to replace bulbs that are currently working, use them to replace bulbs that burn out, throw or give them away, or keep them but probably not use them? [ACCEPT MULTIPLE RESPONSES]
1 Replace working bulbs
2 Replace burned-out bulbs
3 Throw or give them away
4 Keep but probably not use them
5 Other [SPECIFY]
-88 Don't know
-99 Refused

LE3D
[IF ONLY ONE RESPONSE GIVEN TO LE3B AND LE3B = -88 OR 5, ASK LE3D OTHEWISE SKIP TO LE4]
[IF MORE THAN ONE RESPONSE GIVEN TO LE3B AND INCLUDES LE3B = 4 OR 5 OR -88, ASK LE3D.
OTHERWISE SKIP TO LE4][How many of these [LE3] LED bulbs do you think you'll
[NEW] never install?
_____ RECORD NUMBER OF LED BULBS
[PROMPT FOR BEST GUESS OR ESTIMATE]
0 None
-88 Don't Know
-99 Refused

LE4 [NEW]
Have you had any LED bulbs that you installed but later removed and did not use elsewhere in your home?

1 Yes
2 No [SKIP TO LE6]
-88 Don't know [SKIP TO LE6]
-99 Refused [SKIP TO LE6]

LE4A [NEW] And, approximately how many total LED bulbs did you remove? [RECORD # OF LEDs]
_____ Number of LED bulbs removed
[PROMPT FOR BEST GUESS OR ESTIMATE]
-88 Don't Know
-99 Refused

LE5 [NEW] Why did you remove these LED bulbs? [ACCEPT MULTIPLE RESPONSES
1 They burned out
2 Using them in another home
3 Storing them in another home
4 Using them at office/work/other nonresidential location
5 Storing them in office/work/other nonresidential location
6 Gave them away
7 Misplaced them
8 They broke
9 Returned them to the store
-77 Other [SPECIFY]
-88 Don't know
-99 Refused

4.2 2013-2014 LED PURCHASER

LE6 [OTH1] [IF S2 = 2 or S6 = 1] Let's talk a little more about LEDs. Have you purchased any LED bulbs since January 1st, 2013 to use at your home, either indoors or outdoors?
1 Yes
2 No [SKIP TO NL1]
-88 Don't know [SKIP TO NL1]
-99 Refused [SKIP TO NL1]

LE7 [OTH2] How many LED bulbs did you buy since January 1st, 2013 to use inside or outside your home? [ENTER # OF LEDs]
_____ Number of LED bulbs
[PROMPT FOR BEST GUESS OR ESTIMATE]
-88 Don't know
-99 Refused

LE8 [OTH3] [MOD] [IF LE7 = 1] At what store did you purchase that LED bulb? [IF NECESSARY: Since January 1st, 2013] [DO NOT READ LIST, ACCEPT ONLY ONE RESPONSE]
[IF LE7 > 1] At what stores did you purchase those LED bulbs? [IF NECESSARY: Since January 1st, 2013?] [DO NOT READ LIST, ACCEPT MULTIPLE RESPONSES]
1 99 Cent Only Store
2 Albertsons
3 Ace Hardware
4 Costco

5 CVS
6 Dixieline Lumber Co.
7 Food 4 Less
8 HD Supply
9 Home Depot
10 Longs Drugs
11 Lowes
12 Orchard Supply
13 Ralphs
14 Rite Aid
15 Sam's Club
16 Stater Brothers
17 Target
18 True Value Hardware
19 Walgreens
20 Wal-Mart
-77 Other [SPECIFY]
-88 Don't know
-99 Refused

LE8A [IF Q8 ≠ -77 or -88 or -99, SKIP TO LE9]: Was it a…?
[OTH3A] [READ LIST UNTIL THE RIGHT CATEGORY IS MENTIONED]
[MOD] [ACCEPT MULTIPLE RESPONSES; RANDOMIZE ORDER OF LIST]
1 Discount store, such as 99 Cent or Dollar Store
2 Grocery store
3 Small hardware store
4 Lighting or electronics store
5 Drug store
6 Large home improvement store, such as Home Depot, Lowe's or Orchard Supply
7 Mass merchandise store, such as Wal-Mart or Target
8 Membership club store, such as Costco or Sam's Club
-77 Some other type of store? [SPECIFY]
-88 Don't Know
-99 Refused

LE9 Of all the LEDs you purchased since January 1st, 2013, how many did you install inside or
[NEW] outside your home?
_____ Number of LEDs installed
[PROMPT FOR BEST GUESS OR ESTIMATE]
-88 Don't know [SKIP TO LE12]
-99 Refused [SKIP TO LE12]

LE10 [IF LE9 = 1] Where did you install that LED bulb?
[NEW] [IF LE9 > 1] Where did you install those [LE9] LED bulbs?
[IF NECESSARY: What room or location inside or outside of your home?]
[DO NOT READ LIST. ACCEPT MULTIPLE RESPONSES]
1 Living Room
2 Family Room/Den
3 Kitchen
4 Dining Room

5	Bedroom
6	Bathroom
7	Hallway/Entry
8	Office
9	Laundry
10	Basement
11	Garage
12	Closet
13	Outside – porch/patio
14	Outside – entry
15	Outside – other
-77	Other [SPECIFY]
-88	Don't know
-99	Refused

LE11 [NEW] [IF LE9 = 1] Thinking of the LED you installed since January 1st 2013, what type of bulb did it replace? [ACCEPT ONLY ONE RESPONSE]
[IF LE9 > 1] Thinking of the LEDs you installed since January 1st 2013, how many of them… [ACCEPT MULTIPLE RESPONSES]
[RANDOMIZE ORDER OF LIST 1—4; STOP READING LIST WHEN TOTAL FOR LE9 = LE10]
[RECORD # OF BULBS]

1	replaced regular incandescent bulbs? [SKIP TO LE12]
2	replaced CFLs?
3	replaced other LEDs? [SKIP TO LE12]
4	replaced Halogen bulbs? [SKIP TO LE12]
5	went into empty sockets? [SKIP TO LE12]
6	went into new lamps or fixtures? [SKIP TO LE12]
-77	replaced other types of light bulbs? [SPECIFY] [SKIP TO LE12]
-88	Don't know [SKIP TO LE12]
-99	Refused [SKIP TO LE12]

LE11A [NEW] Of the CFLs that you removed, were any of them still working?

1	Yes
2	No
-88	Don't know
-99	Refused [SKIP TO LE12]

LE11B What did you do with the CFL or CFLs you removed? [ACCEPT MULTIPLE RESPONSES]
[NEW]
1 Put back into storage/closet [SKIP TO LE12]
2 Replaced another light bulb
3 Threw away [SKIP TO LE12]
4 Recycled [SKIP TO LE12]
5 Gave away [SKIP TO LE12]
-77 Other [SPECIFY] [SKIP TO LE12]
-88 Don't know [SKIP TO LE12]
-99 Refused [SKIP TO LE12]

LE11C What type of bulb did you replace with the CFL or CFLs you removed and reinstalled?
[NEW]
1 Regular incandescent bulbs
2 CFLs
3 LEDs
4 Halogen bulbs
5 Energy Efficient incandescent
6 Energy Efficient halogen bulbs
7 Empty sockets
-77 Other [SPECIFY]
-88 Don't know
-99 Refused

LE12 [IF LED2 < 1, SKIP TO NL1] On a scale of 1 to 10 where 1 means very unsatisfied and 10 means very satisfied: How satisfied are you with the performance of the LED bulbs installed in your home?
[LED5]
_______ [ENTER 1 – 10]
-88 Don't know
-99 Refused

5 PLUG-IN LED NIGHT LIGHTS

NL1 Now I'm going to ask you about LED night lights. These can come as plug-in fixtures with built-in LED bulbs or stand-alone LED night light bulbs that screw into fixtures. Have you heard of these? [ACCEPT MULTIPLE RESPONSES]
[NEW]
[IF RESPONDENT MENTIONS ONLY 1 OR 2, PROMPT FOR THE OTHER]
1 Yes, plug-in LED night light fixtures
2 Yes, stand-alone LED night light bulbs [SKIP TO S5]
3 Have not heard of either [SKIP TO S5]
-88 Don't know [SKIP TO S5]
-99 Refused [SKIP TO S5]

NL2 I'd like you to focus **only** on the plug-in fixtures with built-in LED bulbs, not the stand-alone bulbs. Have you ever purchased any of these plug-in LED night lights?
[NEW]
1 Yes
2 No [SKIP TO S5]
-88 Don't know [SKIP TO S5]
-99 Refused [SKIP TO S5]

NL2A How many total plug-in LED night lights do you have installed in your home?
[NEW]
_____ Number of plug-in LED night lights installed
[PROMPT FOR BEST GUESS OR ESTIMATE]
0 None [SKIP TO S5]
-88 Don't Know [SKIP TO S5]
-99 Refused [SKIP TO S5]

NL3 Of the plug-in LED night lights you currently have installed in your home, how many were installed to replace other plug-in night light fixtures and how many were new night lights that didn't replace any other night lights?
[NEW]
[RECORD # of night lights]
[PROMPT FOR BEST GUESS OR ESTIMATE]
_____ Number that replaced other night lights
_____ Number that were new (not replacements)
-88 Don't Know
-99 Refused

NL4 [IF NL2A = 1] What room is the plug inLED night light being used in?
[NEW] [IF NL2A > 1] What rooms are the plug in LED night lights being used in?
[DO NOT READ LIST. ACCEPT MULTIPLE RESPONSES]
1 Living Room
2 Family Room/Den
3 Kitchen
4 Dining Room
5 Bedroom
6 Bathroom
7 Hallway/Entry
8 Office
9 Laundry
10 Basement
11 Garage
12 Closet
13 Outside – porch/patio
14 Outside – entry
15 Outside – other
-77 Other [SPECIFY]
-88 Don't know
-99 Refused

NL5 [IF NL2A = 1] Does the LED night light you have installed turn on and off automatically with a light sensor or do you have turn it on and off manually?
[NEW]
[IF NL2A > 1] Do the LED night lights you have installed turn on and off automatically with a light sensor or do you have to turn them on and off manually?
[ACCEPT MULTIPLE RESPSONES]
1 Light Sensor (or Photo Cell)
2 Manual operation
-88 Don't know
-99 Refused

NL6 [NEW] [IF NL5 = 2] And, approximately how many hours per day do you use the night light(s)? [IF NEEDED: On a typical day.]

_____ Hours of operation per day
-88 Don't know
-99 Refused

NL6A [NEW] [IF NL6 = -88] Would you say…
[READ LIST UNTIL THE RIGHT CATEGORY IS MENTIONED]

1 Less than 1 hour?
2 1 – 2 hours?
3 3 – 4 hours?
4 5 – 8 hours?
5 9 - 12 hours?
6 More than 12 hours?
-88 Don't know
-99 Refused

6 ENERGY-EFFICIENT INCANDESCENT AND EE HALOGEN LAMPS

S5 [MOD] [IF S2 = 4 or 6, SKIP TO EEI0] Have you ever heard of energy efficient incandescent or energy efficient halogen bulbs? These bulbs look like traditional incandescent bulbs and give off the same amount of light using less energy. They come in wattages like 43, 53, or 72 Watts instead of 60, 75 or 100 Watts like traditional incandescent or halogen bulbs. Have you ever heard of these more efficient incandescent or halogen bulbs?

1 Yes
2 No [SKIP TO OTH8]
-88 Don't know [SKIP TO OTH8]
-99 Refused [SKIP TO OTH8]

EEI0 [NEW] Have you ever purchased any energy efficient incandescent or energy efficient halogen bulbs?

1 Yes
2 No [SKIP TO OTH8]
-88 Don't know [SKIP TO OTH8]
-99 Refused [SKIP TO OTH8]

EEI1 [MOD] Approximately how many total energy efficient incandescent or energy efficient halogen bulbs are currently installed at your home, either indoors or outdoors?

_____ Number of energy efficient incandescent or halogen bulbs installed
0 None
-88 Don't Know
-99 Refused

EEI2 [MOD] And, approximately how many total energy efficient incandescent or halogen bulbs are you currently storing in your home?

_____ Number of Energy efficient incandescent or halogen bulbs stored
0 None
-88 Don't Know
-99 Refused

EEI3 Why are you storing extra energy efficient incandescent or halogen bulbs at your home?
[DO NOT READ LIST]
[ACCEPT MULTIPLE RESPONES]
1 So that I have them on hand if a bulb burns out
2 Purchased more bulbs than I needed (more in package than I needed)
3 Bought them in bulk
4 Bought them on sale
5 Can't use them in certain rooms
6 Can't use them in certain applications (e.g. dimmer switch)
7 Didn't like the way they looked when installed
8 They were given away by someone else
-77 Other [SPECIFY]
-88 Don't Know
-99 Refused

6.1 2013-2014 ENERGY EFFICIENT INCANDESCENT/HALOGEN PURCHASER

EEI4 [OTH4] [MOD] [IF S2 = 4 or 6 or S5 = 1] Have you or anyone else in your household purchased any Energy Efficient Incandescent or Energy Efficient Halogen bulbs since January 1st, 2013 to use in a home?
1 Yes
2 No [SKIP TO OTH8]
-88 Don't know [SKIP TO OTH8]
-99 Refused [SKIP TO OTH8]

EEI5 [OTH5] How many Energy Efficient Incandescent or halogen bulbs – in total – did you buy since January 1st, 2013 to use inside or outside of your home? [ENTER # OF ENERGY EFFICIENT INCANDESCENTs]
_____ Number of Energy Efficient Incandescents or halogens
[PROMPT FOR BEST GUESS OR ESTIMATE]
-88 Don't know [SKIP TO OTH8]
-99 Refused [SKIP TO OTH8]

EEI6 [OTH6] [MOD] [IF EEI5 = 1] At what store did you purchase that Energy Efficient Incandescent or halogen bulb? [IF NECESSARY: Since January 1st, 2013] [DO NOT READ LIST]
[IF EEI5 > 1] At what stores did you purchase those Energy Efficient Incandescent or halogen bulbs? [IF NECESSARY: Since January 1st, 2013?] [DO NOT READ LIST, ACCEPT MULTIPLE RESPONSES]
1 99 Cent Only Store
2 Albertsons
3 Ace Hardware
4 Costco
5 CVS
6 Dixieline Lumber Co.
7 Food 4 Less
8 HD Supply
9 Home Depot

10 Longs Drugs
11 Lowes
12 Orchard Supply
13 Ralphs
14 Rite Aid
15 Sam's Club
16 Stater Brothers
17 Target
18 True Value Hardware
19 Walgreens
20 Wal-Mart
-77 Other [SPECIFY]
-88 Don't know
-99 Refused

EEI6A [IF EEI6 ≠ -77 or -88 or -99, SKIP TO OTH8]: Was it a...?
[OTH6A] [READ LIST UNTIL THE RIGHT CATEGORY IS MENTIONED]
[MOD] [ACCEPT MULTIPLE RESPONSES; RANDOMIZE ORDER OF LIST]
1 Discount store, such as 99 Cent or Dollar Store
2 Grocery store
3 Small hardware store
4 Lighting or electronics store
5 Drug store
6 Large home improvement store, such as Home Depot, Lowe's or Orchard Supply
7 Mass merchandise store, such as Wal-Mart or Target
8 Membership club store, such as Costco or Sam's Club, or
-77 Some other type of store? [SPECIFY]
-88 Don't Know
-99 Refused

7 ONLINE PURCHASES

OTH8 Have you purchased any light bulbs **online** since January 1st, 2013? [IF NECESSARY: Have you purchased any light bulbs on the internet since January 1st, 2013?]
1 Yes
2 No [SKIP TO EISA3]
-88 Don't know [SKIP TO EISA3]
-99 Refused [SKIP TO EISA3]

OTH9 What types of bulbs did you purchase online? [ACCEPT MULTIPLE RESPONSES. PROMPT IF NEEDED]
[MOD]
1 Compact Fluorescent Lamps (CFLs)
2 LEDs
3 Regular/standard Incandescents
4 Energy Efficient Incandescents
5 Halogens
6 Energy Efficient Halogens
7 Fluorescent Tubes
-77 Other [SPECIFY]

-88 Don't know [SKIP TO EISA1]
-99 Refused [SKIP TO EISA1]

OTH10 Where did you buy them online? [DO NOT READ LIST] [ACCEPT MULTIPLE RESPONSES]

1 Amazon.com
2 1000Bulbs.com
3 Bulbs.com
4 Homedepot.com
5 Lowes.com
6 Walmart.com
7 Costco.com
-77 Other [SPECIFY]
-88 Don't know
-99 Refused

8 EISA/AB 1109 AWARENESS SECTION

EISA3 [MOD] California has also adopted legislation that phased out most traditional incandescent bulbs from retail stores by 2013. Before today, were you aware of this legislation?

1 Yes
2 No
-88 Don't know
-99 Refused

EISA4 [MOD] As part of this legislation, California began phasing traditional 60-Watt incandescent light bulbs out of retail stores at the beginning of 2013. Before today, were you aware that traditional 60-Watt incandescent bulbs are being phased out in California?

1 Yes
2 No
-88 Don't know
-99 Refused

EISA5 [MOD] Did you shop for any traditional 60-Watt incandescent bulbs in California since 2013?

1 Yes
2 No [SKIP TO EISA7]
-88 Don't know [SKIP TO EISA7]
-99 Refused [SKIP TO EISA7]

EISA6 [MOD] Did you end up purchasing any 60-Watt incandescent bulbs [IF NECESSARY: "...since 2013 when you went shopping for them in California"]?

1 Yes [SKIP TO EISA9]
2 No [SKIP TO EISA7]
-88 Don't know [SKIP TO EISA7]
-99 Refused [SKIP TO EISA7]

EISA7 Why not?
[DO NOT READ]
[MOD]

1 Could not find them
2 Did not need any bulbs

-77 Other [SPECIFY]
-88 Don't know [SKIP TO EISA9]
-99 Refused [SKIP TO EISA9]

EISA8 [ASK IF: EISA5=1 AND EISA6=NO, OTHERWISE SKIP] What type of light bulb did you end up purchasing instead? [ACCEPT MULTIPLE RESPONSES]

0 Did not purchase any light bulbs
1 Other incandescent bulb
2 CFL [
3 LED
4 Halogen bulb
-77 Other [SPECIFY]
-88 Don't know
-99 Refused

EISA9 [MOD] When traditional 60-Watt bulbs are no longer available, which of the following things are you most likely to do? Will you switch to a new type of bulb, keep using traditional bulbs but switch to a lower wattage, or something else? [ACCEPT MULTIPLE RESPONSES] [IF RESPONDENT MENTIONS A NEW TYPE OF LIGHT BULB, ENTER 1 AND CODE EISA10 ACCORDINGLY]

1 Switch to a new type of light bulb
2 Keep using traditional light bulbs but switch to a lower wattage [SKIP TO DIntro]
-77 Something else [SPECIFY] [SKIP TO DIntro]
-88 Don't know [SKIP TO DIntro]
-99 Refused [SKIP TO DIntro]

EISA10 Which type of light bulb are you most likely to switch to? Would you say… [ROTATE RESPONSE OPTIONS 1 THROUGH 4] [ACCEPT MULTIPLE RESPONSES]

1 LEDs
2 Halogens
3 CFLs
4 Energy efficient incandescents
5 Traditional incandescents of a different wattage
-77 Or something else [SPECIFY]
-88 Don't know
-99 Refused

9 DEMOGRAPHICS - ALL

DIntro We're almost finished. I just have a few questions about your household to make sure we're getting a representative sample of [IOU] customers.

D1 Do you or members of your household own this home or do you rent?

1 Own/Buying
2 Rent/Lease
3 Occupied without payment of rent

-77 Other [SPECIFY]

D2 Which of the following housing types would you say best describes your home? Is it a… [READ LIST]

1 Single-family detached house
2 Single-family attached house, such as a townhouse or row house
3 Duplex
4 Building with 2-4 living units
5 Building with 5 or more living units
6 Mobile home or house trailer, or
-77 Something else? [SPECIFY]

D3 About when was this building first built? [READ LIST IF NEEDED]

1 Before the 1970's
2 1970-1979
3 1980-1989
4 1990-1994
5 1995-1999
6 During or after 2000
-88 Don't know
-99 Refused

D4 How many square feet of living space are there in your residence, including bathrooms, foyers and hallways? (Exclude garages, basements and unheated porches.)
[IF "DON'T KNOW," PROMPT FOR BEST GUESS]

1 Less than 500
2 501–1000
3 1001–1500
4 1501–2000
5 2001–2500
6 2501–3000
7 Greater than 3000
-88 Don't know
-99 Refused

D5 How many full bathrooms do you have in your home? How many half bathrooms do you have in your home? [IF NECESSARY: A full bathroom is one that has a sink with running water, and a toilet, and either a bathtub or shower. A half bathroom has a sink and either a toilet, bathtub or shower.]

_____ [Record Number of full bathrooms]
_____ [Record Number of half bathrooms]
-88 Refused
-99 Don't know

D6 How many bedrooms do you have in your home? [ENTER # OF BEDROOMS]

_____ [Record Number]
[0 = studio, one-room apartment]
-88 Don't know
-99 Refused

D7 Including yourself, how many people currently live in your home year-round? [ENTER # OF PEOPLE]

_____ [Record Number]
-88 Don't know
-99 Refused

D8 [IF D7 > 1, SKIP TO D9] which of the following best describes your age? Would you say… [READ LIST]

1 Less than 18 years old,
2 18-24 years old,
3 25-34 years old,
4 35-44 years old,
5 45-54 years old,
6 55-64 years old, or
7 65 or older?
-88 Don't know
-99 Refused

D9 [SKIP IF D7 = 1] Including yourself, how many of the [D7] people currently living in your home year-round are in the following age groups? [TOTAL SHOULD EQUAL D7]

1	Less than 18 years old	_____ [Record Number]
2	18-24	_____ [Record Number]
3	25-34	_____ [Record Number]
4	35-44	_____ [Record Number]
5	45-54	_____ [Record Number]
6	55-64	_____ [Record Number]
7	65 or older	_____ [Record Number]
-88	Don't know	
-99	Refused	

D10 What is the highest level of education you have completed?

1 No schooling
2 Less than high school
3 Some high school
4 High school graduate or equivalent (e.g., GED)
5 Trade or technical school
6 Some college
7 College degree
8 Some graduate school
9 Graduate degree/professional degree
10 Post graduate
-77 Other [SPECIFY]
-88 Don't know
-99 Refused

D11 What was your annual household income from all sources in 2014, before taxes? Please stop me when I reach the category that best describes your household's income. [IF NECESSARY: This information is confidential and will only be used for the purpose of characterizing study respondents.]

[READ LIST]
1 Less than $20,000 per year
2 20 to less than $30,000
3 30 to less than $40,000
4 40 to less than $50,000
5 50 to less than $60,000
6 60 to less than $75,000
7 75 to less than $100,000
8 100 to less than $150,000
9 150 to less than $200,000
10 $200,000 or more
-88 Don't know
-99 Refused

D12 Are you Spanish/Hispanic/Latino?
1 Yes
2 No
-88 Don't know
-99 Refused

D13 How would you describe your race? [ACCEPT MULTIPLE RESPONSES]
1 White
2 Black or African American
3 American Indian or Alaska Native
4 Asian Indian
5 Chinese
6 Japanese
7 Korean
8 Vietnamese
9 Filipino
10 Native Hawaiian
11 Guamanian or Chamorro
12 Samoan
13 Other Asian
14 Other Pacific Islander
15 Hispanic or Latin
-77 Other [SPECIFY]
-88 Don't know
-99 Refused

D14 What is the primary language spoken in your home? [DO NOT READ LIST]
1 English
2 Spanish
3 Mandarin
4 Cantonese
5 Tagalog
6 Korean
7 Vietnamese
8 Russian
9 Japanese

- -77 Other [SPECIFY]
- -88 Don’t know
- -99 Refused

D15 Record gender [DO NOT READ QUESTION]

- 1 Male
- 2 Female
- -88 Don’t know

[CLOSE]

Those are all of the questions I have for you today. Thank you for your time, and have a great [day/evening].

[CLOSE_IOU]

Okay, for this study we’re trying specifically to reach [IOU] customers, so those are all of the questions I have for you today. Thank you for your time, and have a great [day/evening].

2015 manufacturer in-depth interview guide

Interview Guide for Manufacturers Participating in the 2013-2014 California Upstream Lighting Programs

Introduction

Contact Protocol

1. Send email interview invitation to appropriate interviewee. This invitation will include:
   a) Explanation of purpose and scope of interview.
   b) Explanation of time frame within which the interview will need to be completed.
   c) Instructions to propose a convenient interview time.
   d) Contact information for interviewers.
   e) Assurances of confidentiality.
   f) A letter attachment from the CPUC explaining the importance of the interview.
2. If target interviewee does not respond to the email invitation within a week, a follow-up call will be made to try to schedule an interview time, find an alternate interview target, or determine reasons for refusal.
3. Once an interview time has been arranged, the interviewee will be emailed, a couple days in advance of the interview, a copy of a summary of the interview guide as well as a customized data table similar to Table 1 below. The email will contain additional assurances of confidentiality.

At the beginning of the interview, collect information on interviewee's position and overall responsibilities, and experience with the program.

Key:

Participants Previously Interviewed (PPI): Manufacturers participating in the 2013-2014 CA ULP that were interviewed in 2014

Participants Not Previously Interviewed (PNPI): Manufacturers participating in the 2013-2014 CA ULP that were not interviewed in 2014

Section 1: Program Participation Confirmation and Reasons for Participation [Participants Only]

1-1. Pacific Gas and Electric, Southern California Edison, and San Diego Gas and Electric jointly participate in an Upstream Lighting Program which provides per bulb financial incentives to buy down the cost of energy efficient lighting products. According to our information your company has receiving these manufacturer buydown incentives from this California Upstream Lighting Program during the 2013-2014 program period. Are you aware of your company's participation in this program? [IF UNAWARE, FIND SOMEONE WITH THE COMPANY WHO IS AWARE. IF THEY RECOGNIZE THIS PROGRAM BY A DIFFERENT NAME, EXPLAIN THAT FOR THE SAKE OF SIMPLICITY YOU'LL HENCEFORTH REFER TO THE PROGRAM AS "THE CALIFORNIA UPSTREAM LIGHTING PROGRAM."]

1-2. **[PPI Only]** Has your company's participation or involvement in the CA Upstream Lighting Program changed since you were last interviewed in 2014?

a) [IF YES] How has this participation changed?

Section 2: 2013-2014 Standard CFL Product Sales and California Upstream Lighting Program Trends

2-1. My next questions concern which lighting products you sell in California and what retail channels you sell them through. Is this a topic that you are familiar with? [IF INTERVIEWEE IS FAMILIAR, PROCEED. IF NOT FAMILIAR, GET ALTERNATIVE CONTACT NAME AND SKIP TO NEXT SECTION]

2-2. First I'm going to ask you some questions about your sales of basic or general purpose and specialty CFL and LED bulbs in California.

By basic or general purpose CFLs I mean basic spiral CFLs that fit into a medium-base socket.

By "specialty" CFL or LED bulbs I mean bulbs that have special functions or features such as three-way bulbs, or reflectors; or bulbs that have non-spiral shapes such as A-lamps or globes or bulbs with smaller sockets like candelabra; or CFLs which have greater than 30 watts.

Earlier I emailed you a table showing CFL and LED bulbs that your company sold through the California Upstream Lighting Program in 2013-2014, according to our records. Were you able to complete your non-program CFL and LED bulb sales in this table? [REPEAT ASSURANCES OF CONFIDENTIALITY]

Table 1
Sample Data Table

Product Type	# Bulbs Sold Through Upstream Lighting Program			# Bulbs Sold in California Not Through Upstream Lighting Program		
	2013	2014	Total 2013-2014	2013	2014	Total 2013-2014
CFLs						
Basic or General Purpose CFL Bulbs of Type Sold Through Upstream Lighting Program						
Other Basic or General Purpose ENERGY STAR CFLs Sold in California But Not Through Upstream Lighting Program						
LEDs						
Basic or General Purpose LEDs Sold in California Through Upstream Lighting Program						
Other Basic or General Purpose ENERGY STAR LEDs Sold in California But Not Through Upstream Lighting Program						
Other Basic or General Purpose Non-ENERGY STAR LEDs Sold in California But Not Through Upstream Lighting Program						

2-3. Does the table I sent to you seem correct in terms of the types and volume of CFLs and LEDs you sold through the California Upstream Lighting Program in 2013-2014?

a) [IF NO] [Record any corrections to the table]

2-4. Why did you choose to sell these particular products and packages through the California Upstream Lighting Program?

2-5. [IF THEY DIDN'T FILL IN NON-ULP DATA INTO TABLE] During the 2013-2014 period did you sell CFL or LED bulbs in California that **did not** receive discounts from the Upstream Lighting Program?

a) [IF YES] Are the bulb types and packages different from those you sell through the California Upstream Lighting Program?

i. [IF YES] How so?

b) [IF YES] Why didn't you sell these bulbs through the California Upstream Lighting Program?

2-6. [IF YES] What sorts of distribution channels did you sell these ENERGY STAR CFLs or LED bulbs through? [SEE TABLE 2 FOR RETAIL CHANNELS AND

EXAMPLE STORES. [MAKE SURE TO DISTINGUISH RESPONSES WHICH APPLY TO CFLS ONLY FROM THOSE WHICH APPLY TO LEDS ONLY]

Table 2

Mass Merchandise	Walmart, Target,
Membership Club	Sam's Club, Costco
Home Improvement	Lowes, Home Depot, Do-it Center
Discount	Dollar Stores, Family dollar, 99cent
Drug	CVS, Longs, Rite Aid, Walgreens
Grocery	Ralphs, Albertson's, Vons, Safeway
Hardware	True-value, Ace Hardware
Other	7-11, convenience stores

2-7. In the past 12 months did you experience any periods where program-discounted CFLs or LED bulbs were not available due to delays in program startup or because product allocations for program-discounted bulbs ran out?

2-8. [IF ANSWERED YES TO QUESTION 2-7] When discounts from the Upstream Lighting Program were not available, did you sell Energy Star CFL or LED bulbs in California? [MAKE SURE TO DISTINGUISH RESPONSES WHICH APPLY TO CFLS ONLY FROM THOSE WHICH APPLY TO LEDS ONLY]

a) [IF YES] Were the bulb types and packages different from those you sell through the California Upstream Lighting Program?

i. [IF YES] How so?

b) [IF YES] What sorts of distribution channels did you use to sell these non-program ENERGY STAR CFLs or LEDs?

2-9. [IF THEY SOLD BASIC OR GENERAL PURPOSE CFLS THROUGH THE PROGRAM] Now I am going to ask you what percentage of your California sales of basic or general purpose CFLs are through the Program. As a reminder, by basic or general purpose CFLs I mean basic spiral CFLs that fit into a medium-base socket. Please provide your best estimate of what % of basic or general purpose CFL bulbs that you sold in California during the 2013-2014 period fit into the following categories:

First consider the basic or general purpose CFL bulbs that were discounted by the California Upstream Lighting Program. About	__%

what % basic or general purpose CFL bulbs that you sold in California during the 2013-2014 period were discounted by the program?	
Next consider the basic or general purpose CFL bulbs that met Energy Star specifications but were not discounted by the program. About what % of basic or general purpose CFL bulbs that you sold in California during the 2013-2014 period were not discounted by the program?	__%
Total basic or general purpose CFL bulbs sold in California during the 2013-2014 period	**100%**

Section 3: 2013-2014 Specialty CFL Product Sales and California Upstream Lighting Program Trends

Now I'm going to ask you some questions about your sales of specialty CFL bulbs sold during 2013-2014.

[IF NEEDED] By "specialty" CFL bulbs I mean bulbs that have special functions or features such as reflectors, high wattage (greater than 30 watts), three-way light levels, or flood lighting.

3-1. [IF THEY DIDN'T COMPLETE THE TABLE] Now I am going to ask you what percentage of your California sales of specialty CFLs are through the program. By specialty CFLs I mean bulbs that have special functions or features such as three-way bulbs, high wattage (greater than 30 watts) or reflectors or CFLs that have non-spiral shapes such as A-lamps or globes or bulbs with smaller base types like candelabra. Please provide your best estimate of what % of specialty CFL bulbs that you sold in California during the 2013-2014 period fit into the following categories:

First consider the specialty CFL bulbs that were discounted by the California Upstream Lighting Program. About what % specialty CFL bulbs that you sold in California during the 2013-2014 period were discounted by the program?	__%
Next consider the specialty CFL bulbs that met Energy Star specifications but were not discounted by the program. About what % specialty CFL bulbs that you sold in California during the 2013-2014 period were not discounted by the program?	__%
Total specialty CFL bulbs sold in California during the 2013-2014 period	**100%**

3-2. We would like to know a little more about the types and distribution of CFL specialty bulbs you sold in California during 2013-2014. Please provide your best estimate of the percent of all [LAMP TYPE] you sold that were CFLs.

Lamp Type	% of All Sales that are CFLs
Reflectors/Flood	__%
A-Lamp/Globe	__%
High Wattage (greater than 30 watts)	__%

3-3. Now I'd like you to think about the percentage of CFL sales that went through the Upstream Lighting Program during 2013-2014 for each of these lamp types. What percentage of CFL [LAMP TYPE] sales went through the program? (If all, record 100%)

Lamp Type	% of CFL Sales that are through the Upstream Lighting Program (All=100%)
Reflectors/Flood	__%
A-Lamp/Globe	__%
High Wattage (greater than 30 watts)	__%

Section 4: 2013-2014 LED Product Sales and California Upstream Lighting Program Trends [LED Parts Only]

Now I'm going to ask you some questions about your sales of LED bulbs sold during 2013-2014.

4-1. Now I am going to ask you what percentage of your California sales of LED basic or general purpose bulbs are sold through the Upstream Lighting Program By LED basic or general purpose I mean bulbs that fit into a medium base socket. Please provide your best estimate of what % of basic or general purpose LED bulbs that you sold in California during the 2013-2014 period fit into the following categories:

First consider the LED basic or general purpose bulbs that were discounted by the California Upstream Lighting Program. About what % of LED basic or general purpose bulbs that you sold in California during the 2013-2014 periodwere discounted by the program ?	__%
Next consider the LED basic or general purpose bulbs that met ENERGY STAR specifications and were **not** discounted by the program. About what % of the LED basic or general purpose bulbs that you sold in California during the 2013-2014 period were not discounted by the program?	__%
Next, consider the LED basic or general purpose bulbs that did **not** meet ENERGY STAR specifications and were **not** discounted by the program. About what % of LED basic or general purpose bulbs that you sold in California during the 2013-2014 period were **not** discounted by the program and did **not** meet ENERGY STAR specifications?	__%
Total LED basic or general purpose bulbs sold in California during the 2013-2014 period	**100%**

4-2. We would like to know a little more about the types and distribution of basic or general purpose bulbs you sold in California during 2013-2014. Please provide your best estimate of the percent of all A-lamps you sold that were LEDs.

Lamp Type	% of All Sales that are LEDs
A-Lamps	__%

4-3. Next, what percent of these LED A-lamps were sold through the California Upstream Lighting Program?

Lamp Type	% of LED Sales that are through ULP (All=100%)
A-Lamps	__%

4-4. Now I am going to ask you what percentage of your California sales of LED specialty bulbs are through the program. By LED specialty bulbs I mean bulbs that have special functions or features such as dimmable bulbs, three-way bulbs, or reflectors. Please provide your best estimate of what % of specialty LED bulbs that you sold in California during the 2013-2014 period fit into the following categories:

First consider the LED specialty bulbs that were discounted by the California Upstream Lighting Program and met ENERGY STAR specifications. About what % of LED specialty bulbs that you sold in California during the 2013-2014 period were discounted by the	__%

program?	
Next consider the LED specialty bulbs that met ENERGY STAR specifications and were **not** discounted by the program. About what % of these ENERGY STAR LED specialty bulbs that you sold in California during the 2013-2014 period were not discounted by the program ?	__%
Next, consider the LED specialty bulbs that did **not** meet ENERGY STAR specifications and were **not** discounted by the program. About what % of LED specialty bulbs that you sold in California during the 2013-2014 period were not discounted by the program and did not meet ENERGY STAR specifications?	__%
Total LED specialty bulbs sold in California during the 2013-2014 period	**100%**

4-5. We would like to know a little more about the types and distribution of specialty bulbs you sold in California during 2013-2014. Please provide your best estimate of the percent of all reflectors you sold that were LEDs.

Lamp Type	% of All Reflector Sales that are LEDs
Reflectors	__%

4-6. Next, what percent of these LED reflectors were sold through the California Upstream Lighting Program?
[IF NEEDED: Reflector bulbs give off broad beamed light and can be used indoors or outdoors.].

Lamp Type	% of LED Reflector Sales that are through ULP (All=100%)
Reflectors	__%

Section 5: Recent Trends & Policies for the California Upstream Lighting Program

5-1. In the past year have there been certain types of CFL or LED bulbs that the California Upstream Lighting Program has been encouraging your company to sell more than others?

a) [IF YES] Which products are these?

b) [IF YES] Have there been differences between the California investor-owned utilities [IF NEEDED: PG&E, SCE, and, SDG&E] involved in this program in terms of which lighting products they have been encouraging?

i. [IF YES] What are these differences?

5-2. Are there certain types of the energy-efficient lighting products that you think the California Upstream Lighting Program should be promoting that they are currently not promoting?

a) [IF YES] Which products are these?

Section 6: Free Ridership and In-State Spillover

My next questions are about the impact that the 2013-2014 California Upstream Lighting Program may have had on your California CFL product sales

6-1. Do you think your company would have been selling CFL products during this 2013-2014 program period if the discounts of $0.20 to $6 per bulb from this program had not been available?

a) [IF YES] Through which retailers or retailer categories would you have sold CFL products during 2013-2014 if the program discounts had not been available? [CATEGORIZE PER LIST BELOW; PROBE FOR AS MANY AS POSSIBLE]?

Mass Merchandise	Walmart, Target,
Membership Club	Sam's Club, Costco
Home Improvement	Lowes, Home Depot, Do-it Center
Discount	Dollar Stores, Family dollar, 99cent
Drug	CVS, Longs, Rite Aid, Walgreens
Grocery	Ralphs, Albertson's, Vons, Safeway
Hardware	True-value, Ace Hardware
Other	7-11, convenience stores

b) [IF YES] Are there any retailers or retailer categories that you worked with though the 2013-2014 Upstream Lighting Program that you think would have been selling a different assortment of CFL bulbs than they are now if the discounts of $0.20 to $6 per bulb from this program had not been available

i. [IF YES] Which retailers/retail categories and which products?

Free Ridership

[INSTRUCTIONS TO SURVEYOR: ASK QUESTIONS IN THIS ORDER:

1. FIRST ASK THE MANUFACTURER THE FREE RIDERSHIP QUESTION SEQUENCE FOR **QUESTION 6-3** (IF NOT APPLICABLE, ASK FOR QUESTION 6-4) FOR THE RETAILER CATEGORY THROUGH WHICH THEY SOLD THE MOST CFLS THROUGH THE PROGRAM (SEE MATRIX). EXCLUDE ANY RETAILER CATEGORIES THAT THEY IDENTIFIED IN QUESTION 6-1 AS NOT SELLING ANY CFL PRODUCTS AT ALL WITHOUT THE BUYDOWNS]

2. SECOND ASK THE MANUFACTURER THE FREE RIDERSHIP QUESTION SEQUENCES **QUESTION 6-3** (IF NOT APPLICABLE, ASK QUESTION 6-4) ONLY FOR THE RETAILER CATEGORY THROUGH WHICH THEY SOLD THE SECOND MOST CFLS THROUGH THE PROGRAM (SEE MATRIX). HOWEVER, AS BEFORE, EXCLUDE ANY RETAILER CATEGORIES THAT THEY IDENTIFIED IN QUESTION 6-1 AS NOT SELLING ANY CFL PRODUCTS AT ALL WITHOUT THE BUYDOWNS]

3. [IF THEY SOLD DISCOUNTED CFLS THROUGH MORE THAN TWO RETAILER CATEGORIES, THEN SAY: “You also sold CFL products through [LIST OTHER RETAILER CATEGORIES, IF ANY, BESIDES THE TWO ALREADY IDENTIFIED], AND ASK QUESTION 6-2 BELOW

6-2. Would your responses regarding the effect of the manufacturer buydowns on CFL product sales in these types of retailers be significantly different than for the retailer categories we already discussed?

a) [IF YES, OR THEY RESPOND IN A WAY THAT WOULD INDICATE SOME NON-TRIVIAL DIFFERENCE (THIS IS A JUDGEMENT CALL)] For which types of retailers would your responses be different?

i. ASK A NEW FREE RIDERSHIP QUESTION SEQUENCE FOR EACH ADDITIONAL RETAILER CATEGORY THAT THEY IDENTIFY ABOVE.

4. THEN, REPEAT STEPS #1 TO #4 ABOVE FOR QUESTION 6-4 ON SPECIALTY BULBS, IF APPLICABLE

CFLs

[ASK THE QUESTIONS IN THIS BATTERY IF THEY SELL CFL BASIC/GENERAL PURPOSE AND/OR SPECIALTY BULBS ELSE SKIP TO 6-5]

Basic or General Purpose CFLs

[ASK THE QUESTIONS IN THIS BATTERY IF THEY SELL BASIC OR GENERAL PURPOSE CFL BULBS ELSE SKIP TO 6-4.]

6-3. According to our records in the 2013-2014 period you received California Upstream Lighting Program manufacturer buydown discounts of $0.20 to $2.83 per bulb for the sale of basic or general purpose ENERGY STAR CFL bulbs through [RETAILER CATEGORY] such as [NAME RETAILER EXAMPLE]. If these manufacturer buydown discounts and program promotional materials had not been available during this 2013-2014 period, do you think your sales of these types of basic or general purpose Energy Star CFL bulbs would have been about the same, lower, or higher?

a) [IF THE SAME OR HIGHER] Why do you say this? [RECORD RESPONSE AND THEN SKIP TO 6-4]

b) [IF LOWER] By what percentage do you estimate your sales of basic or general purpose Energy Star CFL bulbs through [RETAILER CATEGORY] would be lower during this 2013-2014 period if these manufacturer buydowns and program promotional materials for basic or general purpose CFLs had not been available? [RECORD % DECREASE]

i. I want to make sure I understand you correctly. You estimate that your sales would have been [PERCENTAGE FROM QUESTION b)] % lower without the manufacturer buydowns. So if you actually sold 100 basic or general purpose CFLs in a given week, you think you'd have sold only about [100 – (PERCENTAGE FROM QUESTION b). * 100)] in that period if the manufacturer buydowns hadn't been available? [IF RESPONSE IS ≠ YES THEN CLARIFY ESTIMATED SALES DECREASE]

Specialty CFLs

[ASK THE QUESTIONS IN THIS BATTERY IF THEY SELL SPECIALTY CFL BULBS ELSE SKIP TO 6-5.]

6-4. According to our records in the 2013-2014 period you received California Upstream Lighting Program manufacturer buydown discounts of $0.20 - $6 per bulb for the sale of specialty CFL bulbs. If these manufacturer buydown discounts and program promotional materials had not been available during this 2013-2014 period, do you think your sales of these types of specialty Energy Star CFL bulbs would have been about the same, lower, or higher?

a) [IF THE SAME OR HIGHER] Why do you say this? [RECORD RESPONSE AND THEN SKIP TO 6-4c)]

b) [IF LOWER] By what percentage do you estimate your sales of specialty Energy Star CFL bulbs would be lower during the 2013-2014 period if these manufacturer buydowns and program promotional materials for specialty CFLs had not been available? [RECORD % DECREASE]

i. I want to make sure I understand you correctly. You estimate that your sales would have been [PERCENTAGE FROM QUESTION b] % lower without the manufacturer buydowns. So if you actually sold 100 basic or general purpose CFLs in a given week, you think you'd have sold only about [100 – (PERCENTAGE FROM QUESTION b. * 100)] in that period if the manufacturer buydowns hadn't been available? [IF RESPONSE IS ≠ YES THEN CLARIFY ESTIMATED SALES DECREASE]

c) Does this estimate vary by the type of specialty bulb? For example, would you have sold more globes, but fewer high wattage (greater than 30 watts) bulbs without program influence? [ONLY ASK FOR TYPES THEY SELL]

d) [IF YES, FILL OUT TABLE]

Type of Bulb	**Would your sales have been about the same, lower, or higher?**	**Percent Higher/ Lower?**
Reflectors/Flood	(Same/Lower/Higher)	__%
A-Lamp	(Same/Lower/Higher)	__%
Globe	(Same/Lower/Higher)	__%
Decorative (flame or similar shape)	(Same/Lower/Higher)	__%
High Wattage (>30 watts)	(Same/Lower/Higher)	__%

Three-way	(Same/Lower/Higher)	__%
Other	(Same/Lower/Higher)	__%

LEDs

[ASK THE QUESTIONS IN THIS BATTERY IF THEY SELL LED BASIC/GENERAL PURPOSE AND/OR SPECIALTY BULBS ELSE SKIP TO 6-7]

My next questions are about the impact that the 2013-2014 California Upstream Lighting Program may have had on your California LED product sales

6-5. Do you think your company would have been selling LED products during this 2013-2014 program period if the discounts of $1.50 to $20 per bulb from this program had not been available?

a) [IF YES] Through which retailers or retailer categories would you have sold LED products during 2013-2014 if the program discounts had not been available? [CATEGORIZE PER LIST BELOW; PROBE FOR AS MANY AS POSSIBLE]?

Mass Merchandise	Walmart, Target,
Membership Club	Sam's Club, Costco
Home Improvement	Lowes, Home Depot, Do-it Center
Discount	Dollar Stores, Family dollar, 99cent
Drug	CVS, Longs, Rite Aid, Walgreens
Grocery	Ralphs, Albertson's, Vons, Safeway
Hardware	True-value, Ace Hardware
Other	7-11, convenience stores

b) [IF YES] Are there any retailers or retailer categories that you worked with though the 2013-2014 Upstream Lighting Program that you think would have been selling a different assortment of LED bulbs than they are now if the discounts of $1.50 to $20 per bulb from this program had not been available

i. [IF YES] Which retailers/retail categories and which products?

LED Basic/General Purpose Bulbs

[ASK THE QUESTIONS IN THIS BATTERY IF THEY SELL LED BASIC/GENERAL PURPOSE BULBS ELSE SKIP TO 6-7]

6-6. According to our records in the 2013-2014 period you received California Upstream Lighting Program manufacturer buydown discounts of $1.50 to $15 per bulb for the sale of LED basic/general purpose bulbs through [RETAILER CATEGORY] such as [NAME RETAILER EXAMPLE]. If these manufacturer buydown discounts and program promotional materials had not been available during this 2013-2014 period, do you think your sales of these types of LED basic/general purpose bulbs would have been about the same, lower, or higher?

a) [IF THE SAME OR HIGHER] Why do you say this? [RECORD RESPONSE AND THEN SKIP TO 6-7.]

b) [IF LOWER] By what percentage do you estimate your sales of LED basic/general purpose bulbs through [RETAILER CATEGORY] would be lower during this 2013-2014 period if these manufacturer buydowns and program promotional materials for LED basic/general purpose bulbs had not been available? [RECORD % DECREASE]

i. I want to make sure I understand you correctly. You estimate that your sales would have been [PERCENTAGE FROM QUESTION b)] % lower without the manufacturer buydowns. So if you actually sold 100 LED basic/general purpose bulbs in a given week, you think you'd have sold only about [100 – (PERCENTAGE FROM QUESTION b). * 100)] in that period if the manufacturer buydowns hadn't been available? [IF RESPONSE IS ≠ YES THEN CLARIFY ESTIMATED SALES DECREASE]

[REPEAT QUESTION 6-6 FOR ADDITIONAL RETAILER CATEGORY THAT HAD SIGNIFICANT PROGRAM–DISCOUNTED GENERAL PURPOSE LED SHIPMENTS]

LED Specialty Bulbs

[ASK QUESTION 6-7 IF THEY SELL LED SPECIALTY BULBS ELSE SKIP TO 6-8]

6-7. According to our records in the 2013-2014 period you received California Upstream Lighting Program manufacturer buydown discounts of $1.50 to $20 per bulb for the sale of LED specialty bulbs through [RETAILER CATEGORY] such as [NAME RETAILER EXAMPLE]. If these manufacturer buydown discounts and program promotional materials had not been available during this 2013-2014 period, do you think your sales of these types of LED specialty bulbs would have been about the same, lower, or higher

a) [IF THE SAME OR HIGHER] Why do you say this? [RECORD RESPONSE AND THEN SKIP TO 6-8.]

b) [IF LOWER] By what percentage do you estimate your sales of LED specialty bulbs through [RETAILER CATEGORY] would be lower during this 2013-2014 period if these manufacturer buydowns and program promotional materials for LED specialty bulbs had not been available? [RECORD % DECREASE]

i. I want to make sure I understand you correctly. You estimate that your sales would have been [PERCENTAGE FROM QUESTION b)] % lower without the manufacturer buydowns. So if you actually sold 100 LED specialty bulbs in a given week, you think you'd have sold only about [100 – (PERCENTAGE FROM QUESTION b). * 100)] in that period if the manufacturer buydowns hadn't been available? [IF RESPONSE IS ≠ YES THEN CLARIFY ESTIMATED SALES DECREASE]

[REPEAT QUESTION 6-7 FOR ADDITIONAL RETAILER CATEGORY THAT HAD SIGNIFICANT PROGRAM–DISCOUNTED LED SPECIALTY BULB SHIPMENTS]

Spillover

6-8. **[PART/NONPART: ASK OF ALL MANUFACTURERS, EVEN THE ONES THAT ONLY SELL PROGRAM BULBS]** Thinking in terms of the California lighting market in general, do you think the California Upstream Lighting Program has any impact on the sales of high-efficiency bulbs in California outside the program? And just to be clear, when I say sales of bulbs in California sold outside the program, I don't just mean bulbs that your company may sell in California outside the program, but non-program bulbs sold by any manufacturer in California.

a) [IF YES] How are the program bulbs affecting the sales of non-program bulbs in California?

i. [IF NOT MENTIONED, PROBE FOR WHETHER THE PROGRAM BULBS ARE INCREASING OR DECREASING THE NON-PROGRAM BULB SALES.]

ii. [IF EFFECT(S) REPORTED] What do you attribute this to? [PROBE FOR MECHANISM E.G., IS THE PROGRAM HELPING CONSUMERS OVERCOME PERCEPTION BARRIERS TO LED BULBS? IS THE PROGRAM BRINGING MORE FOOT TRAFFIC INTO THE RETAIL LIGHTING SECTIONS? ETC.)

[NOTE TO INTERVIEWER: IF THEY INDICATED EARLIER THAT THEY SELL BOTH PROGRAM AND NON-PROGRAM CFLS/LEDS IN CA, READ QUESTIONS 6-9 TO 6-11 FOR EACH NON-PROGRAM BULB TECHNOLOGY SOLD:]

<TECHNOLOGY> =

1. <CFL basic or standard spiral>
2. <CFL specialty>
3. <LED basic or general purpose>
4. <LED specialty>

6-9. Now I would like you to think in terms of **your own** sales. Do the retailers you supply sell program-discounted <TECHNOLOGY> bulbs at the same time as non-program-discounted <TECHNOLOGY> bulbs?

a) [IF YES] Do you see any change in sales of non-program-discounted <TECHNOLOGY> bulbs when they are sold alongside program-discounted bulbs?

i. [PROBE: INCREASE, DECREASE, STAY THE SAME]

ii. [IF YES] What do you attribute this to? [IF MECHANISM FOR THESE EFFECTS IS NOT EXPLAINED, PROBE FOR MECHANISM]

iii. [IF YES] Can you quantify that change?

a. [IF NOT MENTIONED] About what percentage [increase or decrease] have you seen in non-program-discounted bulbs when sold alongside program-discounted bulbs?

b. How does this increase compare to program-discounted bulbs? i.e. When sold beside program discounted bulbs we find a 10% increase in non-discounted <TECHNOLOGY> sales. In number of bulbs, 10% of non-discounted <TECHNOLOGY> sales is equivalent to about 2% of program-discounted sales]

i. Earlier, you told us sales of <TECHNOLOGY> bulbs would have been [HIGHER/LOWER/THE SAME, AS REPORTED IN [READ RELEVANT QUESTION CORRESPONDING TO <TECHNOLOGY> Q 6-3 (BASIC/STANDARD SPIRAL CFL); Q 6-4 (SPECIALTY CFLS), Q 6-5 (BASIC LEDS), Q 6-6 (SPECIALTY LEDS) in the absence of manufacturer buydowns and program promotional materials. Now, you are telling us that sales of non-program-discounted bulbs also changed as a result of program factors. Are these changes separate, or did you include effects from the first change in your response here?

6-10. What effects, if any, do the program-discounted <TECHNOLOGY> bulbs have on your sales levels of non-program-discounted <TECHNOLOGY> bulbs?

[NOTE: THIS QUESTION IS SIMILAR TO QUESTION 6-8. THE DIFFERENCES ARE THAT 1) IT IS ONLY BEING ASKED OF THOSE MANUFACTURERS WHO SELL BOTH PROGRAM AND NON-PROGRAM BULBS AND 2) IT IS ASKING THEM ABOUT THEIR OWN BULBS SALES WHEREAS 6-8 IS FOCUSING ON THE CALIFORNIA LIGHTING MARKET IN GENERAL. THEREFORE IF THE RESPONDENT DESCRIBED SPILLOVER MECHANISMS IN RESPONSE TO 6-8, YOU ONLY NEED TO CONFIRM THAT THIS MECHANISM WOULD APPLY ALSO TO THEIR OWN BULBS IN PARTICULAR (OR MAKE NOTE OF ANY DIFFERENCES)]

a) [IF EFFECT(S) REPORTED] What do you attribute this to? [PROBE FOR MECHANISM IF MECHANISM FOR THESE EFFECTS IS NOT EXPLAINED]

b) [IF EFFECT(S) MENTIONED] What effect does this have on your <TECHNOLOGY> sales levels?

c) [PROBE TO CONFIRM EFFECTS ARE NOT CAPTURED IN EARLIER ESTIMATES [Q 6-3 (BASIC/STANDARD SPIRAL CFL); Q 6-4 (SPECIALTY CFLS), Q 6-5 (BASIC LEDS), Q 6-6 (SPECIALTY LEDS]

6-11. Would your sales of non-program-discounted <TECHNOLOGY> be the same, higher, or lower if the California Upstream Lighting program did not exist?

a) [IF HIGHER OR LOWER] Why do you say this? [PROBE FOR MECHANISM]

b) [IF HIGHER] By what percentage do you estimate your sales of non-program-discounted <TECHNOLOGY> bulbs would be higher if the program did not exist?

c) [IF LOWER] By what percentage do you estimate your sales of non-program-discounted <TECHNOLOGY> would be lower if the program did not exist?

6-12. Has the California lighting rebate and discount programs had any effect on the types of CFL products you sell or the way that you sell them?

a) [IF YES] What effect(s) did they have?

b) How did the program cause the effect(s) you mentioned? [PROBE FOR TYPES AND VARIETY OF BULBS SOLD]

6-13. Has the California lighting rebate and discount programs had any effect on the types of LED products you sell or the way that you sell them?

a) [IF YES] What effect(s) did they have?

b) How did the program cause this effect you mentioned? [PROBE FOR TYPES AND VARIETY OF BULBS SOLD]

6-14. Has your company experienced any reductions in manufacturing production costs for LEDs over the last 2 years?

a) [IF YES] By how much do you think these reductions in production costs have reduced the average per-bulb prices during this 2 year period?

b) How important a factor were the California lighting rebate programs, in particular, in influencing these reductions in your manufacturing costs? Please use a scale of 0 to 10 where 10 equals “very important” and 0 equals “not important at all.”

c) If the California rebate and discount programs went away, do you think your average production costs for LEDs would increase, decrease, or stay about the same?

i. [IF INCREASE/DECREASE] By what percent would the average production costs for LEDs increase/decrease?

6-15. If California eliminated its CFL rebate and discount programs starting in 2015, what effects would this have on the sales levels of specialty CFL products in California?

[IF NOT MENTIONED] Do you expect sales to stay the same, decrease or increase?

a) Why do you say that?

b) [IF DECREASE] By what percentage do you expect sales to decrease?

c) [IF INCREASE] By what percentage do you expect sales to increase?

Section 7: The Market Impacts of the California Program [ALL RESPONDENTS]

Possible Channel Shift Effects

7-1. Many discount, grocery stores, and drug stores are participating in the California Upstream Lighting Program, and did not sell Energy Star CFLs before joining this program. To what degree do you think these grocery, drug, and discount stores are creating new Energy Star CFL product sales as opposed to taking away Energy Star CFL sales that otherwise would have gone to national chain retailers such as Wal-Mart, Home Depot, or Lowe's?

a) [IF RESPONDENT INDICATES THESE GROCERY, DRUG, OR DISCOUNT STORES MAY BE TAKING SALES FROM OTHER RETAILERS] Which retailers do you think these grocery, drug, or discount stores are taking Energy Star CFL product sales away from?

b) What percentage of CFL sales in the grocery stores, drug stores and discount stores represented new sales that were not shifted from other channels?

[REPEAT QUESTION 7-1 SUBSTITUTING LEDS FOR CFLS]

The Impacts of EISA and Program Market Effects

7-2. Have the years of California lighting rebate and discount programs had any effects on the types of LED products you sell or the way that you sell them?

a) [IF YES] How so?

7-3. Do you think the EISA regulations that took effect from 2012 to 2014 have impacted the lighting market in California?

a) [IF YES] In what ways?

b) Have these regulations impacted the market in California differently than other states or regions?

i. [IF YES] How so?

7-4. Do you think Tier 2 of the EISA regulations, which will take effect in 2020, will impact the lighting market in California?

a) [IF YES] How so?

b) Do you think these regulations will impact the market in California differently than other states or regions?
   i. [IF YES] How so?

[IF NEEDED] Tier 2 of EISA requires 45% greater efficiency than traditional incandescents (e.g., 100 watt, 75 watt, 60 watt, and 40 watt bulbs) and will take effect in 2020. General service lamps manufactured in 2020 or later will have a required efficiency of no less than 45 lumens per watt. Tier 1 took place between 2012 and 2014 and required 25-30% greater efficiency than traditional incandescents.

Section 8: Out-of-State Lighting Sales

Now I would like to ask you briefly about out-of-state lighting sales.

8-1. Have you seen any evidence that some lighting products receiving discounts from the California Upstream Lighting Program are being sold out-of-state or through out-of-state buyers through the Internet?

a) [IF YES] What evidence have you seen?

Section 9: Market Characterization

9-1. [ALL RESPONDENTS WHO SELL LEDS] How would you characterize the current market for LED products in California in terms of manufacturer market share? For example, are there a few major manufacturers responsible for the major share of product sales? Or are there a large number of major players?

9-2. [ALL RESPONDENTS WHO SELL LEDS] How would you characterize your company in terms of market share for the California LED market? [ATTEMPT TO QUANTIFY PERCENT OF TOTAL LEDs SOLD THAT FIRM REPRESENTS]

9-3. [All Respondents] Are there factors inherent in the manufacturing, importing or distributing processes that have restricted the production and supply of LED products in the past year or so?

a) [IF SUPPLY BARRIERS IDENTIFIED] Has there been any progress recently to reduce these barriers?

   i. [IF YES] What factors lead to the reduced barriers?

9-4. [All Respondents] What are the most important factors that are limiting customer demand for LED products? Please explain.

a) [IF DEMAND BARRIERS IDENTIFIED] Has there been any progress recently to reduce these barriers?

i. [IF YES] What factors lead to the reduced barriers?

b) [IF DEMAND BARRIERS IDENTIFIED] What needs to happen to overcome these demand-side barriers?

Section 10: Product Quality [ALL RESPONDENTS]

10-1. Are you aware of any issues with the quality or performance of LEDs?

a) [IF YES] What issues are you aware of?

i. [IF NOT MENTIONED] Have you heard of any issues with early LED lamp failure? [IF YES] Why do you think this is occurring?

ii. [IF NOT MENTIONED] Have you heard of any issues with lumen degradation of LEDs? [IF YES] What issues have you heard about?

iii. [IF NOT MENTIONED] Have you heard of any issues with the performance of LEDs connected to dimmer switches? [IF YES] What issues have you heard about?

10-2. In your opinion, on what comparison basis do consumers use when replacing bulbs? For example, do you think consumers look for wattage equivalency or is lumen becoming a more important measure or something else?

Section 11: Sales/Shipment Comparison [ALL RESPONDENTS]

Finally I'm going to ask you about general sales trends for CFL and LED bulbs in the California lighting market.

11-1 Approximately what percentage of your total U.S. CFL lamp sales does California represent?

11-2 How would you characterize current and recent CFL sales trends in California? [PROBE FOR INCREASES/DECREASES IN CFL MARKET SHARES VS.

OTHER BULB TYPES (E.G. LEDS, HALOGENS), SHIFTS IN THE TYPES OF RETAILERS CARRYING CFLs, SHIFTS IN THE POPULARITY OF CERTAIN CFL TYPES, PROGRAM VS. NON-PROGRAM]

11-3 [IF RESPONSE TO 11-1 IS 100%, SKIP TO 11-4] Do these current and recent CFL sales trends in California differ from those in the rest of the U.S.?

a. In what ways? [PROBE FOR STATE/REGION IF NOT ALREADY MENTIONED]

11-4 How would you characterize future CFL sales trends in California? [PROBE FOR INCREASES/DECREASES IN CFL MARKET SHARES VS. OTHER BULB TYPES (E.G. LEDS, HALOGENS), SHIFTS IN THE TYPES OF RETAILERS CARRYING CFLs, SHIFTS IN THE POPULARITY OF CERTAIN CFL TYPES, PROGRAM VS. NON-PROGRAM]

11-5 Will these future CFL sales trends in California differ from those in the rest of the U.S.?

a. In what ways? [PROBE FOR STATE/REGION IF NOT ALREADY MENTIONED]

[REPEAT QUESTIONS 11-1 TO 11-5 SUBSTITUTING ‘LED’ FOR ‘CFL’]

That’s all the questions I had. Thank you for taking the time to speak with me today.

2015 retail buyer in-depth interview guide

Interview Guide for Retailer Lighting Buyers Participating in the 2013-2014 California Upstream Lighting Programs

Introduction

Contact Protocol

1. Send email interview invitation to appropriate interviewee. This invitation will include:
   a) Explanation of purpose and scope of interview.
   b) Explanation of time frame within which the interview will need to be completed.
   c) Instructions to propose a convenient interview time.
   d) Contact information for interviewers.
   e) Assurances of confidentiality.
   f) A letter attachment from the CPUC explaining the importance of the interview.
2. If target interviewee does not respond to the email invitation within a week, a follow-up call will be made to try to schedule an interview time, find an alternate interview target, or determine reasons for refusal.
3. Once an interview time has been arranged, the interviewee will be emailed, a couple days in advance of the interview, a copy of a summary of the interview guide as well as a customized data table similar to Table 1 below. The email will contain additional assurances of confidentiality.

At the beginning of the interview, collect information on interviewee's position and overall responsibilities, and experience with the program.

Section 1: Program Participation Confirmation

1-1. Pacific Gas and Electric, Southern California Edison, and San Diego Gas and Electric jointly participate in an Upstream Lighting Program which provides per bulb financial incentives to buy down the cost of energy efficient lighting products. According to our information your company has been receiving shipments of energy-efficient lighting products that receive buydown incentives from this California Upstream Lighting Program during the 2013-2014 program period. Are you aware of your company's participation in this program? [IF UNAWARE, FIND SOMEONE WITH THE COMPANY WHO IS AWARE. IF THEY RECOGNIZE THIS PROGRAM BY A DIFFERENT NAME, EXPLAIN THAT FOR THE SAKE OF SIMPLICITY YOU'LL HENCEFORTH REFER TO THE PROGRAM AS "THE CALIFORNIA UPSTREAM LIGHTING PROGRAM."]

Section 2: 2013-2014 Standard CFL Product Sales and California Upstream Lighting Program Trends

2-1. My next questions concern which lighting products you sell in California. Is this a topic that you are familiar with? [IF INTERVIEWEE IS FAMILIAR, PROCEED. IF NOT FAMILIAR, GET ALTERNATIVE CONTACT NAME AND SKIP TO NEXT SECTION]

2-2. First I'm going to ask you some questions about your sales of basic or general purpose CFLs and specialty CFL and LED bulbs in California.

By basic or general purpose CFLs I mean basic spiral CFLs that fit into a medium-base socket.

By "specialty" CFL or LED bulbs I mean bulbs that have special functions or features such as three-way bulbs or reflectors; or bulbs that have non-spiral shapes such as A-lamps or globes or bulbs with smaller sockets like candelabra; or CFLs which have greater than 30 watts.

Earlier I emailed you a table showing CFL and LED bulbs that your company sold through the California Upstream Lighting Program in 2013-2014, according to our records. Were you able to complete your non-program CFL and LED bulb sales in this table?

Table 1
Sample Data Table

Product Type	# Bulbs Sold Through Upstream Lighting Program			# Bulbs Sold in California Not Through Upstream Lighting Program		
	2013	2014	Total 2013-2014	2013	2014	Total 2013-2014
CFLs						
Basic or General Purpose CFL Bulbs of Type Sold Through Upstream Lighting Program						
Other Basic or General Purpose ENERGY STAR CFLs Sold in California But Not Through Upstream Lighting Program						
LEDs						
Basic or General Purpose LEDs Sold in California Through Upstream Lighting Program						
Other Basic or General Purpose ENERGY STAR LEDs Sold in California But Not Through Upstream Lighting Program						
Other Basic or General Purpose Non-ENERGY STAR LEDs Sold in California But Not Through Upstream Lighting Program						

2-3. Does the table I sent to you seem correct in terms of the types and volume of CFLs and LEDs you sold through the California Upstream Lighting Program?

a) [IF NO] [Record any corrections to the table]

2-4. Why did you choose to sell these particular products and packages through the California Upstream Lighting Program?

2-5. [IF THEY DIDN'T FILL IN NON-ULP DATA INTO TABLE] During the 2013-2014 period did you sell CFLs or LED bulbs in California that **did not** receive discounts from the California Upstream Lighting Program?

a) [IF YES] Are the bulb types and packages different from those you sell through the California Upstream Lighting Program?

i. [IF YES] How so?

ii. [IF YES] Why didn't you sell these bulbs through the California Upstream Lighting Program?

2-6. In the past 12 months did you experience any periods where program-discounted CFLs or LED bulbs were not available due to delays in program startup or because product allocations for program-discounted bulbs ran out?

2-7. [IF YES TO QUESTION 2-6] When discounts from the Upstream Lighting Program were not available, did you sell Energy Star CFL or LED bulbs in California? [MAKE SURE TO DISTINGUISH RESPONSES WHICH APPLY TO CFLS ONLY FROM THOSE WHICH APPLY TO LEDS ONLY]

a) [IF YES] Were the bulb types and packages different from those you sell through the California Upstream Lighting Program?

i. [IF YES] How so?

2-8. [IF THEY SOLD BASIC OR GENERAL PURPOSE CFLS THROUGH THE PROGRAM] Now I am going to ask you what percentage of your California sales of basic or general purpose CFLs are through the program. As a reminder, by basic or general purpose CFLs I mean basic spiral CFLs that fit into a medium-base socket. Please provide your best estimate of what % of basic or general purpose CFL bulbs that you sold in California during the 2013-2014 period fit into the following categories:

First consider the basic or general purpose CFL bulbs that were discounted by the California Upstream Lighting Program. About what % of the basic or general purpose CFL bulbs that you sold in California during the 2013-2014 period were discounted by the program?	__%
Next consider the basic or general purpose CFL bulbs that met Energy Star specifications but were not discounted by the program. About what % of the basic or general purpose CFL bulbs that you sold in California during the 2013-2014 period were not discounted by the program?	__%
Total basic or general purpose CFL bulbs sold in California during the 2013-2014 period	**100%**

2-9. Can you estimate what percentage of the basic or general purpose CFLs you sold through the California Upstream Lighting Program during the 2013-2014 program period were installed in residential vs. nonresidential applications?

a) [IF YES] What is your estimate of this breakdown?

b) [IF YES] What information is your estimate based upon?

Section 3: 2013-2014 Specialty CFL Product Sales and California Upstream Lighting Program Trends

Now I'm going to ask you some questions about your sales of specialty CFL bulbs during 2013-2014.

3-1. Now I am going to ask you what percentage of your California sales of specialty CFLs are through the program. By specialty CFLs I mean bulbs that have special functions or features such as high wattage (greater than 30 watts), three-way bulbs, or reflectors or CFLs that have non-spiral shapes such as A-lamps or globes or bulbs with smaller base types like candelabra. Please provide your best estimate of what % of specialty CFL bulbs that you sold in California during the 2013-2014 period fit into the following categories:

First consider the specialty CFL bulbs that were discounted by the California Upstream Lighting Program. About what % of the specialty CFL bulbs that you sold in California during the 2013-2014 period were discounted by the program?	__%
Next consider the specialty CFL bulbs that met Energy Star specifications but were not discounted by the program. About what % of the specialty CFL bulbs that you sold in California during the 2013-2014 period were not discounted by the program?	__%

Total specialty CFL bulbs sold in California during the 2013-2014 period	**100%**

3-2. We would like to know a little more about the types and distribution of specialty bulbs you sold in CA during 2013-2014. Please provide your best estimate of the percent of all [LAMP TYPE] you sold that were CFLs.

Lamp Type	% of All Sales that are CFLs
Reflectors/Flood	__%
A-Lamp/Globe	__%
High Wattage (>30 watts)	__%

3-3. Now I'd like you to think about the percentage of CFL sales that went through the Upstream Lighting Program during 2013-2014 for each of these lamp types. What percentage of CFL [LAMP TYPE] sales went through the program? (If all, record 100%)

Lamp Type	% of CFL Sales that are through Upstream Lighting Program (All=100%)
Reflectors/Flood	__%
A-Lamp/Globe	__%
High Wattage (>30 watts)	__%

3-4. Can you estimate what percentage of the specialty CFL products you sold through the California Upstream Lighting Program during the 2013-2014 program period were installed in residential vs. nonresidential applications?

a) [IF YES] What is your estimate of this breakdown?

b) [IF YES] What information is your estimate based upon?

Section 4: 2013-2014 LED Product Sales and California Upstream Lighting Program Trends [LED Parts Only]

Now we'll discuss your sales of LED bulbs sold during 2013-2014.

4-1. Now I am going to ask you what percentage of your California sales of LED basic or general purpose bulbs are sold through the program. By LED basic or general purpose I mean bulbs that have special functions or features such as dimmable bulbs, three-way bulbs, or reflectors. Please provide your best estimate of what % of basic or general purpose LED bulbs that you sold in California during the 2013-2014 period fit into the following categories:

First consider the LED basic or general purpose bulbs that were discounted by the California Upstream Lighting Program. About what % of LED basic or general purpose bulbs that you sold in California during the 2013-2014 period were discounted by the program?	__%
Next consider the LED basic or general purpose bulbs that met ENERGY STAR specifications but were **not** discounted by the program. About what % of these ENERGY STAR LED basic or general purpose bulbs that you sold in California during the 2013-2014 period were **not** discounted by the program?	__%
Next, consider the LED basic or general purpose bulbs that did **not** meet ENERGY STAR specifications and were **not** discounted by the program. About what % of LED basic or general purpose bulbs that you sold in California during the 2013-2014 period were **not** discounted by the program and did **not** meet ENERGY STAR specifications?	__%
Total LED basic or general purpose bulbs sold in California during the 2013-2014 period	**100%**

4-2. We would like to know a little more about the types and distribution of basic or general purpose bulbs you sold in CA during 2013-2014. Please provide your best estimate of the percent of all A-lamps you sold that were LEDs.

Lamp Type	% of All Sales that are LEDs
A-Lamps	__%

4-3. Next, what percent of these LED A-Lamps were sold through the California Upstream Lighting Program?

Lamp Type	% of LED Sales that are through ULP (All=100%)
A-Lamps	__%

4-4. Now I am going to ask you what percentage of your California sales of LED specialty bulbs are sold through the Upstream Lighting Program. By LED specialty bulbs I mean bulbs that have special functions or features such as dimmable bulbs, three-way bulbs, or reflectors. Please provide your best estimate of what % of specialty LED bulbs that you sold in California during the 2013-2014 program period fit into the following categories:

First consider the LED specialty bulbs that were discounted by the California Upstream Lighting Program and met ENERGY STAR specifications. About what % of the LED specialty bulbs that you sold in California during the 2013-2014 period were discounted by the program?	__%
Next consider the LED specialty bulbs that met ENERGY STAR specifications and were **not** discounted by the program. About what % of these ENERGY STAR LED specialty bulbs that you sold in California during the 2013-2014 period were not discounted by the program?	__%
Next, consider the LED specialty bulbs that did **not** meet ENERGY STAR specifications and were **not** discounted by the program. About what % of LED specialty bulbs that you sold in California during the 2013-2014 period were **not** discounted by the program and did **not** meet ENERGY STAR specifications?	__%
Total LED specialty bulbs sold in California during the 2013-2014 period	**100%**

4-5. We would like to know a little more about the types and distribution of specialty bulbs you sold in CA during 2013-2014. Please provide your best estimate of the percent of all reflectors you sold that were LEDs.

Lamp Type	% of All Reflector Sales that are LEDs
Reflectors	__%

4-6. Next, what percent of these LED reflectors were sold through the California Upstream Lighting Program?

[IF NEEDED: Reflector bulbs give off broad beamed light and can be used indoors or outdoors.].

Lamp Type	% of LED Reflector

	Sales that are through Upstream Lighting Program (All=100%)
Reflectors	__%

Section 5: Recent Trends & Policies for the California Upstream Lighting Program

5-1. In the past year have there been certain types of CFL or LED bulbs that the California Upstream Lighting Program has been encouraging your company to sell more than others?

a) [IF YES] Which products are these?

b) [IF YES] Have there been differences between the California investor-owned utilities involved in this program in terms of which lighting products they have been encouraging?

i. [IF YES] What are these differences?

5-2. Are there certain types of the energy-efficient lighting products that you think the California Upstream Lighting Program should be promoting that they are not currently promoting?

a) [IF YES] Which products are these?

Section 6: Free Ridership and In-State Spillover

My next questions are about the impact that the 2013-2014 California Upstream Lighting Program may have had on your California CFL product sales.

6-1. Do you think your company would have been selling CFL products during this 2013-2014 program period if the discounts of $0.20 to $6 per bulb from this program had not been available?

Basic or General Purpose CFL Bulbs

[ASK THE QUESTIONS IN THIS BATTERY IF THEY SELL BASIC OR GENERAL PURPOSE CFL BULBS ELSE SKIP TO 6-3.]

6-2. According to our records, in the 2013-2014 period you sold basic or general purpose CFL bulbs which received manufacturer buydown discounts of $0.20 to

$2.83 per bulb from the California Upstream Lighting Program. If these manufacturer buydown discounts and program promotional materials had not been available during this 2013-2014 period, do you think your sales of these types of basic or general purpose Energy Star CFL bulbs would have been about the same, lower, or higher?

a) [IF THE SAME OR HIGHER] Why do you say this? [RECORD RESPONSE AND THEN SKIP TO **Error! Reference source not found.**]

[IF LOWER] By what percentage do you estimate your sales of basic or general purpose Energy Star CFL bulbs would be lower during this 2013-2014 period if these manufacturer buydowns and program promotional materials for basic or general purpose CFLs had not been available? [RECORD % DECREASE]

i. I want to make sure I understand you correctly. You estimate that your sales would have been [PERCENTAGE FROM QUESTION 0] % lower without the manufacturer buydowns. So if you actually sold 100 basic or general purpose CFLs in a given week, you think you'd have sold only about [100 – (PERCENTAGE FROM QUESTION 0. * 100)] in that period if the manufacturer buydowns hadn't been available? [IF RESPONSE IS ≠ YES THEN CLARIFY ESTIMATED SALES DECREASE]

Specialty CFL bulbs

[ASK THE QUESTIONS IN THIS BATTERY IF THEY SELL SPECIALTY CFL BULBS ELSE SKIP TO **Error! Reference source not found.**.]

6-3. According to our records in the 2013-2014 period you sold specialty CFL bulbs which received manufacturer buydown discounts of $0.20 - $6 per bulb from the California Upstream Lighting Program. If these manufacturer buydown discounts and program promotional materials had not been available during this 2013-2014 period, do you think your sales of these types of specialty Energy Star CFL bulbs would have been about the same, lower, or higher?

a) [IF THE SAME OR HIGHER] Why do you say this? [RECORD RESPONSE AND THEN SKIP TO 6-3b)]

[IF LOWER] By what percentage do you estimate your sales of specialty Energy Star CFL bulbs would be lower during the 2013-2014 period if these manufacturer buydowns and program promotional materials for specialty CFLs had not been available? [RECORD % DECREASE]

i. I want to make sure I understand you correctly. You estimate that your sales would have been [PERCENTAGE FROM QUESTION b] % lower without the manufacturer buydowns. So if you actually sold 100 basic or general purpose CFLs in a given week, you think you'd have sold only about [100 – (PERCENTAGE FROM QUESTION b. * 100)] in that period if the manufacturer buydowns hadn't been available? [IF RESPONSE IS ≠ YES THEN CLARIFY ESTIMATED SALES DECREASE]

b) Does this estimate vary by the type of specialty bulb? For example, would you have sold more globes, but fewer high wattage bulbs (greater than 30 watts) without program influence? [ONLY ASK FOR TYPES THEY SELL]

c) [IF YES, FILL OUT TABLE]

Type of Bulb	**Would your sales have been about the same, lower, or higher?**	**Percent Higher/ Lower?**
Reflectors/Flood	(Same/Lower/Higher)	__%
A-Lamp	(Same/Lower/Higher)	__%
Globe	(Same/Lower/Higher)	__%
Decorative (flame or similar shape)	(Same/Lower/Higher)	__%
High Wattage (>30 watts)	(Same/Lower/Higher)	__%
Three-way	(Same/Lower/Higher)	__%
Other	(Same/Lower/Higher)	__%

LEDs

[ASK THE QUESTIONS IN THIS BATTERY IF THEY SELL LEDs ELSE SKIP TO 6-6]

LED Basic/General Purpose Bulbs

6-4. According to our records in the 2013-2014 program period you sold LED basic/general purpose medium-screw base LED bulbs which received manufacturer buydown discounts of $1.50 to $15 per bulb from the California Upstream Lighting Program. If these manufacturer buydown discounts and program promotional materials had not been available during this 2013-2014 period, do you think your sales of these types of LED basic/general purpose bulbs would have been about the same, lower, or higher?

a) [IF THE SAME OR HIGHER] Why do you say this? [RECORD RESPONSE AND THEN SKIP TO **Error! Reference source not found.**]

[IF LOWER] By what percentage do you estimate your sales of LED basic/general purpose bulbs would be lower during this 2013-2014 period if these manufacturer buydowns and program promotional materials for LED basic/general purpose bulbs had not been available? [RECORD % DECREASE]

i. I want to make sure I understand you correctly. You estimate that your sales would have been [PERCENTAGE FROM QUESTION 0] % lower without the manufacturer buydowns. So if you actually sold 100 LED basic/general purpose bulbs in a given week, you think you'd have sold only about [100 – (PERCENTAGE FROM QUESTION 0. * 100)] in that period if the manufacturer buydowns hadn't been available? [IF RESPONSE IS ≠ YES THEN CLARIFY ESTIMATED SALES DECREASE]

LED Specialty Bulbs

[ASK QUESTION 6-5 IF THEY SELL LED SPECIALTY BULBS ELSE SKIP TO 6-6]

6-5. According to our records in the 2013-2014 program period you sold LED specialty bulbs which received manufacturer buydown discounts of $1.50 to $20 per bulb from the California Upstream Lighting Program. If these manufacturer buydown discounts and program promotional materials had not been available during this 2013-2014 period, do you think your sales of these types of LED specialty bulbs would have been about the same, lower, or higher?

a) [IF THE SAME OR HIGHER] Why do you say this? [RECORD RESPONSE AND THEN SKIP TO **Error! Reference source not found.**6]

[IF LOWER] By what percentage do you estimate your sales of LED specialty bulbs would be lower during this 2013-2014 period if these manufacturer buydowns and program promotional materials for LED specialty bulbs had not been available? [RECORD % DECREASE]

i. I want to make sure I understand you correctly. You estimate that your sales would have been [PERCENTAGE FROM QUESTION 0] % lower without the manufacturer buydowns. So if you actually sold 100 LED specialty bulbs in a given week, you think you'd have sold only about [100 – (PERCENTAGE FROM QUESTION 0. * 100)] in that period if the manufacturer buydowns hadn't been available? [IF RESPONSE IS ≠ YES THEN CLARIFY ESTIMATED SALES DECREASE]

Spillover

6-6. [ASK OF ALL RETAIL BUYERS, EVEN THE ONES THAT ONLY SELL PROGRAM BULBS] Thinking in terms of the California lighting market in general, do you think the California Upstream Lighting Program has any impact on the sales of high-efficiency bulbs in California outside the program? And just to be clear, when I say sales of bulbs in California sold outside the program, I don't just mean bulbs that your company may sell in California outside the program, but non-program bulbs sold by any manufacturer in California.

a) [IF YES] How are the program bulbs affecting the non-program bulbs in California?

i. [IF NOT MENTIONED, PROBE FOR WHETHER THE PROGRAM BULBS ARE INCREASING OR DECREASING THE NON-PROGRAM BULB SALES.]

ii. [IF EFFECT(S) REPORTED] What do you attribute this to? [PROBE FOR MECHANISM E.G., IS THE PROGRAM HELPING CONSUMERS OVERCOME PERCEPTION BARRIERS TO LED BULBS? IS THE PROGRAM BRINGING MORE FOOT TRAFFIC INTO THE RETAIL LIGHTING SECTIONS? ETC.)

[NOTE TO INTERVIEWER: IF THEY INDICATED EARLIER THAT THEY SELL BOTH PROGRAM AND NON-PROGRAM CFLS/LEDS IN CA, READ QUESTIONS 6-7 TO 6-9 FOR EACH NON-PROGRAM BULB TECHNOLOGY SOLD]

<TECHNOLOGY> =

1. <CFL basic or standard spiral>
2. <CFL specialty>
3. <LED basic or general purpose>
4. <LED specialty>

6-7. Now I would like you to think in terms of **your own** sales**.** Do you sell program-discounted <TECHNOLOGY> at the same time as non-program-discounted <TECHNOLOGY>?

a) [IF YES] Do you promote these program-discounted bulbs differently than non-program discounted bulbs?

i. [IF YES] How so?

6-8. What effects, if any, do the program-discounted <TECHNOLOGY> bulbs have on your sales levels of non-program-discounted <TECHNOLOGY> bulbs?

[NOTE: THIS QUESTION IS SIMILAR TO QUESTION 6-6. THE DIFFERENCES ARE THAT 1] IT IS ONLY BEING ASKED OF THOSE RETAIL BUYERS WHO SELL BOTH PROGRAM AND NON-PROGRAM BULBS AND 2) IT IS ASKING THEM ABOUT THEIR OWN BULBS SALES WHEREAS 6-6 IS FOCUSING ON THE CALIFORNIA LIGHTING MARKET IN GENERAL. THEREFORE IF THE RESPONDENT DESCRIBED SPILLOVER MECHANISMS IN RESPONSE TO 6-6, YOU ONLY NEED TO CONFIRM THAT THIS MECHANISM WOULD APPLY ALSO TO THEIR OWN BULBS IN PARTICULAR (OR MAKE NOTE OF ANY DIFFERENCES)]

a) [IF EFFECT(S) REPORTED] What do you attribute this to? [PROBE FOR MECHANISM IF MECHANISM FOR THESE EFFECTS IS NOT EXPLAINED]

b) [IF EFFECT(S) REPORTED] Can you quantify that change?

i. [IF NOT MENTIONED] About what percentage [increase or decrease] have you seen in non-program-discounted bulbs when sold alongside program-discounted bulbs?

ii. How does this increase compare to program-discounted bulbs? i.e. When sold beside program discounted bulbs we find a 10% increase in non-discounted <TECHNOLOGY> sales. In number of bulbs, 10% of non-discounted <TECHNOLOGY> sales is equivalent to about 2% of program-discounted sales.

a. Earlier, you told us sales of <TECHNOLOGY> bulbs would have been [HIGHER/LOWER/THE SAME, AS REPORTED IN Q 6-3 TO Q 6-6] in the absence of manufacturer buydowns and program promotional materials. Now, you are telling us that sales of non-program-discounted bulbs also changed as a result of program factors. Are these changes separate, or did you include effects from the first change in your response here?

c) Do you think increased shopper foot traffic due to program-discounted <TECHNOLOGY> bulbs has any impact on the sales of non-program discounted <TECHNOLOGY> bulbs that are being sold at the same time?

6-9. Would your sales of non-program-discounted <TECHNOLOGY> be the same, higher, or lower if the California Upstream Lighting program did not exist?

a) [IF HIGHER OR LOWER] Why do you say this? [PROBE FOR MECHANISM]

b) [IF HIGHER] By what percentage do you estimate your sales of non-program-discounted <TECHNOLOGY> bulbs would change if the program did not exist?

c) [IF LOWER] By what percentage do you estimate your sales of non-program-discounted <TECHNOLOGY> would change if the program did not exist?

6-10. Has the California lighting rebate and discount programs had any effect on the types of CFL products you sell or the way that you sell them?

a) [IF YES] What effect(s) did they have?

b) How did the program cause the effect(s) you mentioned? [PROBE FOR TYPES AND VARIETY OF BULBS SOLD]

6-11. Has the California lighting rebate and discount programs had any effect on the types of LED products you sell or the way that you sell them?

a) [IF YES] What effect(s) did they have?

b) How did the program cause the effect(s) you mentioned? [PROBE FOR TYPES AND VARIETY OF BULBS SOLD]

6-12. If California eliminated its CFL rebate and discount programs starting in 2015 what effects would this have on the sales levels of specialty CFL products in California?

a) Why do you say that?

b) [IF NOT MENTIONED] Do you expect sales to stay the same, decrease or increase?

i. [IF DECREASE OR INCREASE] By what percentage do you expect sales to increase/decrease?

Section 7: The Market Impacts of the California Program [ALL RESPONDENTS]

Possible Channel Shift Effects

7-1. Many discount, grocery stores, and drug stores are participating in the California Upstream Lighting Program and did not sell Energy Star CFLs before joining this program. To what degree do you think these grocery, drug, and discount stores are creating new Energy Star CFL product sales as opposed to taking away Energy Star CFL sales that otherwise would have gone to national chain retailers such as Wal-Mart, Home Depot, or Lowe's?

a) [IF RESPONDENT INDICATES THESE GROCERY, DRUG, OR DISCOUNT STORES MAY BE TAKING SALES FROM OTHER RETAILERS] Which retailers do you think these grocery, drug, or discount stores are taking Energy Star CFL product sales away from?

b) What percentage of CFL sales in the grocery stores, drug stores and discount stores represented new sales that were not shifted from other channels?

[REPEAT QUESTION 7-1 SUBSTITUTING LEDS FOR CFLS]

The Impacts of EISA and Program Market Effects

7-2. Have the years of California lighting rebate and discount programs had any effects on the types of LED products you sell or the way that you sell them?

a) [IF YES] How so?

7-3. Do you think EISA regulations that took effect from 2012 to 2014 have impacted the lighting market in California?

   a) [IF YES] In what ways?

   b) Have these regulations impacted the market in California differently than other states or regions?

      i. [IF YES] How so?

7-4. Do you think Tier 2 of the EISA regulations, which will take effect in 2020, will impact the lighting market in California?

a. [IF YES] How so?

a) Do you think these regulations will impact the market in California differently than other states or regions?

i. [IF YES] How so?

[IF NEEDED] Tier 2 of EISA requires 45% greater efficiency than traditional incandescents (e.g., 100 watt, 75 watt, 60 watt, and 40 watt bulbs) and will take effect in 2020. General service lamps manufactured in 2020 or later will have a required efficiency of no less than 45 lumens per watt. Tier 1 took place between 2012 and 2014 and required 25-30% greater efficiency than traditional incandescents.

Section 8: Out-of-State Lighting Sales

Now I would like to ask briefly about out-of-state lighting sales.

8-1. Have you seen any evidence that some lighting products receiving discounts from the California Upstream Lighting Program are being sold out-of-state or through out-of-state buyers through the Internet?

a) [IF YES] What evidence have you seen?

Section 9: Market Characterization

9-1. Are there factors inherent in the manufacturing, importing or distributing processes that have restricted the production and supply of LED products in the past year or so?

a) [IF SUPPLY BARRIERS IDENTIFIED] Has there been any progress recently to reduce these barriers?

i. [IF YES] What factors lead to the reduced barriers?

9-2. What are the most important factors that are limiting customer demand for LED products? Please explain.

a) [IF DEMAND BARRIERS IDENTIFIED] Has there been any progress recently to reduce these barriers?

i. [IF YES] What factors lead to the reduced barriers?

b) [IF DEMAND BARRIERS IDENTIFIED] What needs to happen to overcome these demand-side barriers?

Section 10: Product Quality

10-1. [ALL RESPONDENTS] Are you aware of any issues with the quality or performance of LEDs?

a) [IF YES] What issues are you aware of?

i. [IF NOT MENTIONED] Have you heard of any issues with early lamp failure? [IF YES] Why do you think this is occurring?

ii. [IF NOT MENTIONED] Have you heard of any issues with lumen degradation? [IF YES] What issues have you heard about?

iii. [IF NOT MENTIONED] Have you heard of any issues with the performance of LEDs connected to dimmer switches? [IF YES] What issues have you heard about?

10-2. In your opinion, on what comparison basis do consumers use when replacing bulbs? For example, do you think consumers look for wattage equivalent or is lumen becoming a more important measure or do customers use something else?

Section 11: Sales/Shipment Comparison [ALL RESPONDENTS]

Finally I'm going to ask you about general sales trends for CFL and LED bulbs in the California lighting market.

11-1 Approximately what percentage of your total U.S. CFL lamp sales does California represent?

11-2 How would you characterize current and recent CFL sales trends in California? [PROBE FOR INCREASES/DECREASES IN CFL MARKET SHARES VS. OTHER BULB TYPES (E.G. LEDS, HALOGENS), SHIFTS IN THE TYPES OF RETAILERS CARRYING CFLs, SHIFTS IN THE POPULARITY OF CERTAIN CFL TYPES, PROGRAM VS. NON-PROGRAM]

11-3 [IF RESPONSE TO 11-1 IS 100%, SKIP TO 11-4] Do these current and recent CFL sales trends in California differ from those in the rest of the U.S.?

a) In what ways? [PROBE FOR STATE/REGION IF NOT ALREADY MENTIONED]

11-4 How would you characterize future CFL sales trends in California? [PROBE FOR INCREASES/DECREASES IN CFL MARKET SHARES VS. OTHER BULB TYPES (E.G. LEDS, HALOGENS), SHIFTS IN THE TYPES OF RETAILERS CARRYING CFLs, SHIFTS IN THE POPULARITY OF CERTAIN CFL TYPES, PROGRAM VS. NON-PROGRAM]

11-5 Will these future CFL sales trends in California differ from those in the rest of the U.S.?

a) In what ways? [PROBE FOR STATE/REGION IF NOT ALREADY MENTIONED]

[REPEAT QUESTIONS 11-1 TO 11-5 FOR LEDS]

That’s all the questions I had. Thank you for taking the time to talk with me today.

Winter 2014-15 shelf survey instrument

CA LIGHTING RETAIL STORE SHELF SURVEY, 2013-2014 EVALUATION

Winter 2014-2015

Field researcher name:	
Store name:	Date:
Store address:	Store city:
Store type:	Store zip code:
Utility name:	
Begin Time:	End Time:

LIGHTING SIGNAGE & PROMOTIONAL MATERIALS

A1. Are there any materials present promoting lighting? **[DO NOT INCLUDE MESSAGES ON LIGHTING PACKAGES OR SIMPLE PRICING INFORMATION ON SHELVES].**

1 Yes
2 No

[REPEAT A2 THROUGH A3D FOR EACH PROMOTIONAL SIGN OR DISPLAY IN STORE]

A2. [**IF PROMOTIONAL MATERIALS PRESENT]** Which lighting technologies are being promoted? **[MARK ALL THAT APPLY].**

1 CFLs
2 LEDs
3 Energy Efficient Incandescents (e.g., EISA-compliant halogens)
4 Traditional Incandescents (e.g., non-EISA-compliant halogens)
5 Other lighting technology [PLEASE SPECIFY]:____

A3a. **[IF PROMOTIONAL MATERIALS PRESENT] What type of signage is present?**

1 Sign on shelf/wall
2 Sign hung from ceiling
3 Brochures
4 Floor sticker/cling
5 Other [PLEASE SPECIFY]: ____

A3b. **[IF PROMOTIONAL MATERIALS PRESENT] Where is the promotional material located? [MARK ALL THAT APPLY]**

1. In the lighting aisle(s)
2. Near the cash register
3. In front of the store/near store entrance
4. Other location [PLEASE SPECIFY]:____

A3c. **[IF PROMOTIONAL MATERIALS PRESENT] Does the signage refer to a specific bulb model?**

1 Yes
2 No

A3d. **[IF A3C=YES] Please list the manufacturer, model number, base type, and style of the bulb.**

Summary of Key Messages in Signage or Promotional Materials:

____

____

BULB CODES (PRODUCT TYPE, BASE TYPE, AND STYLE CODES)

Product Type Codes		**Base Type Codes**	
Product Type	**Code**	**Base Type Codes**	**Code**
CFL	CF	Medium Screw	M
Incandescent/Halogen	I	Pin	P
LED	L	GU-Type	G
Cold Cathode	CC	Candelabra/Intermediate	C
Mercury Vapor, (Ceramic) Metal Halide, High Pressure Sodium	HID	Large Screw Base	L
Other	OT	Candelabra with Medium Screw Adaptor	C/M

Bulb Style Codes*					
Bulb Style	**Code**	**Image**	**Bulb Style**	**Code**	**Image**
Spiral/Twister	TW		Spotlight/Reflector/ Flood	See below	See spotlight/reflector/flood codes in table below.
Globe (e.g., for bathroom vanity fixtures)	GL		Circline	CI	
A-lamp (shaped like standard incandescent)	AL		Tube Style	TU	
Torpedo/Bullet	TO		Night Light	NL	
Bug Light	BU		Other/Unknown	OT	Record style code, if indicated on package.

*See LED Style Code Table below for further details and information on LED bulb styles.

Spotlight/Reflector/Flood Bulb Style Codes					
Bulb Style	**Code**	**Image**	**Bulb Style**	**Code**	**Image**
BR25	B25		PAR16	P16	
BR30	B30		PAR20	P20	
BR40	B40		PAR30	P30	
R20	R20		PAR38	P38	
R30	R30		MR16	M16	
R40	R40		Unknown Spotlight/Reflector/Flood	SP	

LED Style Codes			
Bulb Style	**Code**	**Bulb Style**	**Code**
A15, A19, A21, A23	AL	G16½, G25, G40, P25, PS35	GL
B10½, B13, BA9, BA9½, F10, F15, F20	TO	T 4½, T5, T6, T8, T10	TU
S8, S11, S14	S	C7	NL
BR25, BR30, BR40, R20, R30, R40, PAR15, PAR20, PAR30S, PAR30L, PAR38	See spot-light codes table above	Other/Unknown LED Bulb Style (record style code on package, if known)	OT

IF ONLY ONE PRICE SHOWN: Try to determine whether it's a discounted price/sale price or if it's a full-priced bulb. If sale price, record value in "Discounted price." If full price, record value in "Original Price."

Bulb Inventory

Inventory all replacement CFLs, incandescents, halogens, LEDs, HIDs, & cold cathodes.
Use as many pages as necessary.
For 3-way, dimmable, rough service incandescent, lighting facts, and ENERGY STAR columns: X if applicable.

Manufacturer/Brand	**Technology Type** (See Technology Codes table above)	**Base Type** (See Base Codes table above)	**Bulb Style** (See Style Codes table above)	**Barcode**	**Model Number**	**Quantity in Pack**	**# of Packages**	**Package Location** [Aisle=A; Endcap=E; Free Standing Display=FS; Pallet=P; Fenceline=F; Other-OT]	**Full/Original Price** (If discounted, record price *before* discount. If not discounted, record product price here)	**Discounted Price** (If on sale/discounted)	**Discount Provider** (if discounted) [R=Retailer; I=IOU; M=Manufacturer; O=Other; DK= don't know]	**Program Year** (If labeled as IOU discounted)	**Lumens**	**Wattage**	**Color Temperature** (Kelvin)	**Color Name** (e.g., Soft White, Daylight, Bright White)	**Color Rendering Index** (LEDs only)	**3-way?**	**Dimmable?**	**Energy Star?**	**DOE Lighting Facts Label?** (LEDs only)	**Rough service incandescent?**

Winter 2014-15 shopper intercept survey instrument

2014-15 California Intercepts Survey: Purchasers

2013-2014 Upstream Lighting Programs

Respondent Screening

[INTERVIEWER: IF RESPONDENT IS PURCHASER, SKIP TO R1]

R0. Are you planning to purchase any light bulbs today?

1	Yes	Switch to Purchaser Survey
2	No	M5
99	Don't know	M5

R1. Are you purchasing light bulbs for a home?

1	Yes	P1
2	No	R2
99	Don't know	R2

R2. Are you a contractor or builder?

1	Yes	R4
2	No	R3
99	Don't know	R3

R3. Are you planning to install these bulbs in your business or other location outside of your home?

1	Yes	R4
2	No	R4
99	Don't know	R4

R4. Will you share your contact information with us?

Name		Thank and terminate
Phone Number		Thank and terminate
Refused		Thank and terminate

2014-15 California Intercepts Survey: Purchasers
2013-2014 Upstream Lighting Programs

FOR THE PURPOSE OF THIS SURVEY, WE DEFINE UNIQUE PACKAGES AS FOLLOWS:

- **THE UNIQUE PACKAGES ARE DIFFERENT LIGHTING TECHNOLOGIES, OR**
- **THE UNIQUE PACKAGES ARE THE SAME LIGHTING TECHNOLOGY BUT DIFFERENT STYLES, OR**
- **THE UNIQUE PACKAGES ARE THE SAME LIGHTING TECHNOLOGY AND HAVE THE SAME STYLE, BUT THE PACKAGES HAVE DIFFERENT WATTAGES, OR**
- **THE UNIQUE PACKAGES ARE CFLS AND HAVE THE SAME STYLE, BUT ONE IS DIMMABLE AND THE OTHER IS NOT**

THIS DEFINITION APPLIES TO ALL QUESTIONS IN THIS SURVEY THAT REFER TO "UNIQUE PACKAGES."

Purchase Description

P1. May I look at the types of bulbs you are purchasing? [SCAN EACH PACKAGE WITH BARCODE SCANNER; FILL OUT THESE FIELDS FOR EACH UNIQUE PACKAGE] [IF PACKAGE SPECS DO NOT AUTO-POPULATE, ENTER MODEL NUMBER; IF FIELDS DO NOT AUTO-POPULATE, MANUALLY ENTER PACKAGE SPECS INTO FIELDS]

1	Barcode	P2
2	Model Number	P2
3	Manufacturer/Brand	P2
4	Lighting Technology (e.g., CFL, Incandescent, Halogen, LED, ONLY)	P2
5	Base Type (should only be MSB)	P2
6	Style (TW, AL, SP, GL ONLY)	P2
7	[IF CFL] Dimmable (Yes/No)	P2
8	3-Way (Yes/No)	P2
9	Number of Bulbs in Package	P2
10	Number of Packages Respondent is Purchasing	P2
11	Wattage	P2
12	Lumens	P2
16	Full Price	P2
17	[IF DISCOUNTED] Discounted Price	P2
18	[IF DISCOUNTED] Discounted Provider	P2
19	[IF IOU DISCOUNTED] Discount Year	P2

P2. How many of [UNIQUE PACKAGE 1, 2, 3] bulbs will you install within the next week?

1	[ANY INTEGER > 0]	A1
2	0	M1
99	Don't know [Try to get answer from respondent]	M1

2014-15 California Intercepts Survey: Purchasers
2013-2014 Upstream Lighting Programs

Application Use

[ASK A1-A4 ONLY IF P2 > 0]
[REPEAT A1 THROUGH A4 ONE TIME ONLY IF P2 > 1]
[ALWAYS PRIORITIZE INSTALLATIONS OF 2 UNIQUE BULBS OVER 2 OF THE SAME BULBS]
[SELECTION PRIORITY IS AS FOLLOWS: LEDS > SPECIALTY CFLS > BASIC SPIRAL CFLS > INCANDESCENTS]
[1st, 2nd INDICATES A1 – A4 CAN BE REPEATED UP TO ONE TIME]

A1. Great! [IF P2 > 2 SAY, "Let's just talk about two of the [P2] bulbs that you plan to install."] [PROGRAMMER: IF THE NUMBER OF UNIQUE PACKAGES IN P1 OR P3 > 1, RANDOMLY SELECT 2 UNIQUE PACKAGES WITH THE FOLLOWING CAVEAT: ALWAYS SELECT LEDS AND/OR SPECIALTY CFLS BEFORE BASIC CFLS AND ALL INCANDESCENTS (BASIC CFLS = CFLS THAT ARE SINGLE WATTAGE, NON-DIMMABLE TWISTER CFLS ≤ 30 WATTS)] [IF P2 ≥ 2] Let's talk about the [1st, 2nd] bulb from that you plan to install from this [UNIQUE PACKAGE #1, UNIQUE PACKAGE #2] package. [IF P2 = 1] In what room or other location at your home will you install the 1st bulb [DO NOT READ LIST]

1	Living room	A2
2	Family Room/Den	A2
3	Kitchen	A2
4	Dining room	A2
5	Bedroom	A2
6	Bathroom	A2
7	Hallway/Entry	A2
8	Office	A2
9	Laundry	A2
10	Basement	A2
11	Garage	A2
12	Closet	A2
13	Outside – porch/patio	A2
14	Outside – entry	A2
15	Outside – other	A2
77	Other	A2
99	Don't know	A2

A2. What type of fixture will you install this bulb in? [DO NOT READ LIST; IF NECESSARY PROVIDE RESPONDENT WITH EXAMPLES]

1	Ceiling	A3
2	Wall	A3
3	Table Lamp	A3
4	Desk Lamp	A3
5	Fan	A3
6	Recessed	A3
7	Suspended	A3
8	Torchiere	A3

2014-15 California Intercepts Survey: Purchasers
2013-2014 Upstream Lighting Programs

77	Other [SPECIFY]	A3
99	Don't know	A3

A3. Do you need a dimmable bulb for this fixture?

1	Yes	A4
2	No	A4
99	Don't know	A4

[DO NOT READ; IF RESPONDENT DOESN'T KNOW, PROMPT RESPONDENT WITH THE LIST PROVIDED HERE]

A4. What type of bulb will this bulb replace?

1	Incandescent	A5
2	Halogen	A5
3	CFL	A5
4	LED	A5
5	No bulb (socket is empty)	M1A
77	Other [SPECIFY]	A5
99	Don't know	A5

A5. Did the bulb that you are replacing burn out?

1	Yes	M1A
2	No	M1A
99	Don't know	M1A

Market Segmentation

Next I'd like to ask you about when you decided to buy these bulbs.

[REPEAT M1A THROUGH M4 ONE TIME ONLY IF P1 HAS MORE THAN 1 UNIQUE PACKAGE.]
BULB STYLE NOTES:
IF STYLE = A-LAMP THEN "TRADITIONAL SHAPED"
IF STYLE = A-LAMP AND A3=YES THEN "DIMMABLE TRADITIONAL SHAPED"
IF STYLE = A-LAMP AND P1=3-WAY THEN "3-WAY TRADITIONAL SHAPED"
IF STYLE = TWISTER SHAPED THEN "TWISTER SHAPED"
IF STYLE = TWISTER SHAPED AND A3=YES THEN "DIMMABLE TWISTER SHAPED"
IF STYLE = TWISTER SHAPED AND P1=3-WAY THEN "3-WAY TWISTER SHAPED"
IF STYLE = REFLECTOR/FLOOD THEN "FLOODLIGHT"
IF STYLE = REFLECTOR/FLOOD AND A3=YES THEN "DIMMABLE FLOODLIGHT"
IF STYLE = GLOBE THEN "GLOBE SHAPED"

BULB TECHNOLOGY = INCANDESCENTS, ENERGY EFFICIENT INCANDESCENTS, CFLS, LEDS

2014-15 California Intercepts Survey: Purchasers
2013-2014 Upstream Lighting Programs

M1A. Did you come to this store planning to buy light bulbs?

1	Yes	M1B
2	No	M5
99	Don't know	M5

M1B. Did you plan to buy [BULB STYLE] bulbs?

1	Yes	M1C
2	No	M5
99	Don't know	M5

M1C. Did you plan to buy [BULB TECHNOLOGY]?

1	Yes	M2
2	No	M5
99	Don't know	M5

M2. Did you come to this store expecting to find [UNIQUE PACKAGE #1 BULB STYLE + TECHNOLOGY, UNIQUE PACKAGE #2 BULB STYLE + TECHNOLOGY]?

1	Yes	M3
2	No	M5
99	Don't know	M5

M3. Would you have gone to another store if you hadn't found [UNIQUE PACKAGE #1 BULB STYLE + TECHNOLOGY, UNIQUE PACKAGE #2 BULB STYLE + TECHNOLOGY]?

1	Yes	M4
2	No	M5
99	Don't know	M5

[DO NOT READ; IF RESPONDENT DOESN'T KNOW, PROMPT RESPONDENT WITH THE LIST PROVIDED HERE]

M4. Which store would you go to? [Accept multiple responses]

1	99 Cent Only Store	M5
2	Albertsons	M5
3	Ace Hardware	M5
4	Costco	M5
5	CVS	M5
6	Dixieline Lumber Co.	M5
7	Food 4 Less	M5
8	HD Supply	M5
9	Home Depot	M5
10	Longs Drugs	M5
11	Lowes	M5
12	Orchard Supply	M5
13	Ralphs	M5
14	Rite Aid	M5
15	Sam's Club	M5
16	Stater Brothers	M5

17	Target	M5
18	True Value Hardware	M5
19	Walgreens	M5
20	Wal-Mart	M5
77	Other [SPECIFY]	M5
99	Don't know	M5

M5. Have you ever purchased CFLs in the past?

1	Yes	M6
2	No	M6
99	Don't know	M6

M6. On a scale of 1 to 5 where 1 means "very unlikely" and 5 means "very likely," how likely are you to choose CFLs the next time you buy light bulbs?

1	1	S1
2	2	S1
3	3	S1
4	4	S1
5	5	S1
99	Don't know	S1

Stated Preference

[REPEAT S1 THROUGH S4 ONE TIME ONLY, IF P1 HAS ONLY <u>1 UNIQUE PACKAGE</u>. <u>DO NOT REPEAT IF P1 HAS > 1 UNIQUE PACKAGE</u>]

Now I'd like to ask you some questions about the [BULB STYLE + TECHNOLOGY #1] you've chosen. The price you'll pay is about [ROUNDED PACKAGE PRICE PER BULB] per bulb. I'll show you your bulb and some other bulbs that have a similar brightness and functionality to your bulb. I'll include hypothetical prices for these other bulbs.

Tap the picture of your bulb to get started.

S1. Please rank these choices in order of the likelihood that you would buy them. [Show choice set #1 with up to 5 choices, with bulb pictures and prices]

S2. For respondent's top ranked choice, ask respondent:

You selected the [BULB STYLE + TECHNOLOGY] above as the one that you're most likely to buy.

- If you could buy the bulbs individually at [CHOICE SET #1 PRICE] per bulb, how many would you buy?
- If you could buy the bulbs individually at [CHOICE SET #1 PRICE +5-50%] per bulb, how many would you buy?

- If you could buy the bulbs individually at [CHOICE SET #1 PRICE -5-50%] per bulb, how many would you buy?

[IF PURCHASING 1 UNIQUE PACKAGE]
Next I'm going to repeat the questions we just asked about the [BULB STYLE + TECHNOLOGY #1] you chose for about [ROUNDED PACKAGE PRICE PER BULB] per bulb. The prices will be different this time.

[IF PURCHASING >1 UNIQUE PACKAGE]
Now I'd like to ask you some questions about the [BULB STYLE + TECHNOLOGY #2] which costs about [ROUNDED PACKAGE PRICE PER BULB] per bulb. Like last time, I'll show you your bulb along with some other bulbs that have a similar brightness and functionality to your bulb along with hypothetical prices.

Tap the picture of your bulb to get started.

S3. Now I'd like you to rank these choices in order of the likelihood that you would buy them. [Show choice set #2 with up to 5 choices, with bulb pictures and prices]

S4. For respondent's top ranked choice, ask respondent:

You selected the [BULB STYLE + TECHNOLOGY] above as the one that you're most likely to buy.

- If you could buy the bulbs individually at [CHOICE SET #2 PRICE] per bulb, how many would you buy?
- If you could buy the bulbs individually at [CHOICE SET #2 PRICE +5-50%] per bulb, how many would you buy?
- If you could buy the bulbs individually at [CHOICE SET #2 PRICE -5-50%] per bulb, how many would you buy?

CFL Purchasers/Choosers

[ASK C1 ONLY IF CUSTOMER IS PURCHASING/CHOOSING CFLS]
[REPEAT C1 ONE TIME <u>ONLY</u> IF P1 HAS MORE THAN 1 UNIQUE CFL PACKAGE]
FOR EACH UNIQUE PACKAGE, C1 SHOULD READ AS FOLLOWS:

- IF P1=CFL <u>AND</u> TWISTER THEN "TWISTER CFLs"
- IF P1=CFL <u>AND</u> TWISTER <u>AND</u> 3-WAY THEN "3-WAY TWISTER CFLs"
- IF P1=CFL <u>AND</u> TWISTER <u>AND</u> A3=YES THEN "DIMMABLE TWISTER CFLs"

- IF P1=CFL <u>AND</u> A-LAMP THEN "A-LAMP CFLs"
- IF P1=CFL <u>AND</u> A-LAMP <u>AND</u> A3=YES THEN "DIMMABLE A-LAMP CFLs"

- IF P1=CFL <u>AND</u> REFLECTOR/FLOOD THEN "FLOODLIGHT CFLs"
- IF P1=CFL <u>AND</u> REFLECTOR/FLOOD <u>AND</u> A3=YES THEN "DIMMABLE FLOODLIGHT CFLs"

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- IF P1=CFL AND GLOBE THEN "GLOBE CFLs"

C1. Why did you choose [UNIQUE CFL PACKAGE #1, UNIQUE CFL PACKAGE #2]? [DO NOT READ LIST. ACCEPT MULTIPLE RESPONSES]

1	Save energy	LA1
2	Save money	LA1
3	Low / affordable price	LA1
4	Environment	LA1
5	Prior experience	LA1
6	Packaging (e.g., wanted/didn't want multi-pack)	LA1
7	Location in store (caught my attention)	LA1
8	Saw signs or displays in store	LA1
9	Saw advertisement outside of store	LA1
10	Product quality / design	LA1
11	Recommended by friends/family	LA1
12	IOU discount	LA1
13	Need new bulb / old bulb burnt out	LA1
14	Long bulb life	LA1
15	Brightness	LA1
16	Quality / color of light	LA1
77	Other (Specify: ______)	LA1
99	Don't know	LA1

LED Awareness

[PROGRAMMER: ONLY ASK LA1 IF AN LED BULB WAS PRESENTED AS A CHOICE IN S1 OR S3. IF AN LED BULB WAS AN OPTION, ASK THIS QUESTION REGARDLESS OF THE RESPONDENT RANKING FOR THE LED BULB. IF S1 AND S3 PRESENTED TWO DIFFERENT BULB STYLES, REPEAT LA1 ONE TIME.]

BULB STYLE NOTES:

IF STYLE = A-LAMP THEN "TRADITIONAL SHAPED"
IF STYLE = A-LAMP AND A3=YES THEN "DIMMABLE TRADITIONAL SHAPED"
IF STYLE = A-LAMP AND P1=3-WAY THEN "3-WAY TRADITIONAL SHAPED"
IF STYLE = REFLECTOR/FLOOD THEN "FLOODLIGHT"
IF STYLE = REFLECTOR/FLOOD AND A3=YES THEN "DIMMABLE FLOODLIGHT"
IF STYLE = GLOBE THEN "GLOBE SHAPED"

LA1. On a scale of 1 to 5 where 1 means "very unfamiliar" and 5 means "very familiar," how familiar were you with [BULB STYLE + LEDs] before our conversation?

1	1	L1
2	2	L1
3	3	L1
4	4	L1

5	5	L1
99	Don't know	L1

LED Purchasers

[ASK L1-L2 ONLY IF CUSTOMER IS PURCHASING LEDS]
[REPEAT L1 ONE TIME ONLY IF P1 HAS MORE THAN 1 UNIQUE LED PACKAGE]
FOR EACH UNIQUE PACKAGE, L1 SHOULD READ AS FOLLOWS:

- IF P1=LED AND A-LAMP THEN "A-LAMP LEDs"
- IF P1=LED AND A-LAMP AND A3=YES THEN "DIMMABLE A-LAMP LEDs"
- IF P1=LED AND A-LAMP AND 3-WAY THEN "3-WAY A-LAMP LEDs"

- IF P1=LED AND REFLECTOR/FLOOD THEN "FLOODLIGHT LEDs"
- IF P1=LED AND REFLECTOR/FLOOD AND A3=YES THEN "DIMMABLE FLOODLIGHT LEDs"

- IF P1=LED AND GLOBE THEN "GLOBE LEDs"

L1. Why did you choose [UNIQUE LED PACKAGE #1, UNIQUE LED PACKAGE #2]? [DO NOT READ LIST. ACCEPT MULTIPLE RESPONSES]

1	Save energy	IN1
2	Save money	IN1
3	Low / affordable price	IN1
4	Environment	IN1
5	Prior experience	IN1
6	Packaging (e.g., wanted/didn't want multi-pack)	IN1
7	Location in store (caught my attention)	IN1
8	Saw signs or displays in store	IN1
9	Saw advertisement outside of store	IN1
10	Product quality / design	IN1
11	Recommended by friends/family	IN1
12	IOU discount	IN1
13	Need new bulb / old bulb burnt out	IN1
14	Long bulb life	IN1
15	Brightness	IN1
16	Quality / color of light	IN1
17	Dimmability	IN1
18	Instant on	IN1
77	Other (Specify: _____)	IN1
99	Don't know	IN1

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Incandescent Purchasers

[ASK IN1-IN2 ONLY IF CUSTOMER IS PURCHASING INCANDESCENTS]
[REPEAT IN1 ONE TIME ONLY IF P1 HAS MORE THAN 1 UNIQUE INCANDESCENT PACKAGE]
FOR EACH UNIQUE PACKAGE, IN1 SHOULD READ AS FOLLOWS:

- IF P1=INCANDESCENT AND A-LAMP THEN "A-LAMP INCANDESCENTS"
- IF P1=INCANDESCENT AND A-LAMP AND A3=YES THEN "DIMMABLE A-LAMP LEDs"
- IF P1=INCANDESCENT AND A-LAMP AND 3-WAY THEN "3-WAY A-LAMP INCANDESCENTs"

- IF P1=INCANDESCENT AND REFLECTOR/FLOOD THEN "FLOODLIGHT INCANDESCENTs"
- IF P1=LED AND REFLECTOR/FLOOD AND A3=YES THEN "DIMMABLE FLOODLIGHT INCANDESCENTs"

- IF P1=LED AND GLOBE THEN "GLOBE INCANDESCENTSs"

IN1. Why did you choose [UNIQUE INCANDESCENT PACKAGE #1, UNIQUE INCANDESCENT PACKAGE #2]? [DO NOT READ LIST. ACCEPT MULTIPLE RESPONSES]

1	Low / affordable price	HA1
2	Prior experience (with incandescents)	HA1
3	Packaging (e.g., wanted/didn't want multi-pack)	HA1
4	Location in store (caught my attention)	HA1
5	Saw signs or displays in store	HA1
6	Saw advertisement outside of store	HA1
7	Product quality / design	HA1
8	Recommended by friends/family	HA1
9	Need new bulb / old bulb burnt out	HA1
10	Brightness	HA1
11	Quality / color of light	HA1
12	Fixture compatibility (need incandescent bulb for fixture)	HA1
13	Lamp style / shape	HA1
14	No mercury	HA1
15	Dimmability	HA1
16	Needed a 3-way bulb	HA1
17	Instant on	HA1
77	Other (Specify: _____)	HA1
99	Don't know	HA1

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Halogen Purchasers

[ASK HA1-HA2 ONLY IF CUSTOMER IS PURCHASING HALOGENS]
[REPEAT IN1 ONE TIME ONLY IF P1 HAS MORE THAN 1 UNIQUE HALOGEN PACKAGE]
FOR EACH UNIQUE PACKAGE, HA1 SHOULD READ AS FOLLOWS:

- IF P1=HALOGEN AND A-LAMP THEN “A-LAMP HALOGENS”
- IF P1=HALOGEN AND A-LAMP AND A3=YES THEN “DIMMABLE A-LAMP LEDs”
- IF P1=HALOGEN AND A-LAMP AND 3-WAY THEN “3-WAY A-LAMP HALOGENs”

- IF P1=HALOGEN AND REFLECTOR/FLOOD THEN “FLOODLIGHT HALOGENs”
- IF P1=LED AND REFLECTOR/FLOOD AND A3=YES THEN “DIMMABLE FLOODLIGHT HALOGENs”

- IF P1=LED AND GLOBE THEN “GLOBE HALOGENSs”

HA1. Why did you choose [UNIQUE HALOGEN PACKAGE #1, UNIQUE HALOGEN PACKAGE #2]? [DO NOT READ LIST. ACCEPT MULTIPLE RESPONSES]

1	Low / affordable price	I1
2	Prior experience (with halogens)	I1
3	Packaging (e.g., wanted/didn’t want multi-pack)	I1
4	Location in store (caught my attention)	I1
5	Saw signs or displays in store	I1
6	Saw advertisement outside of store	I1
7	Product quality / design	I1
8	Recommended by friends/family	I1
9	Need new bulb / old bulb burnt out	I1
10	Brightness	I1
11	Quality / color of light	I1
12	Fixture compatibility (need halogen bulb for fixture)	I1
13	Lamp style / shape	I1
14	No mercury	I1
15	Dimmability	I1
16	Needed a 3-way bulb	I1
17	Instant on	I1
77	Other (Specify: _____)	I1
99	Don’t know	I1

Non-CFL and/or Non-LED Purchasers

[DO NOT REPEAT I1 AND I2.]

[PROGRAMMER: ONLY ASK I1 AND I2 IF CUSTOMER DID NOT CHOOSE CFLS]

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I1. Did you consider choosing CFLs?

1	Yes	I2
2	No	I2
99	Don't know	I2

[PROGRAMMER: ONLY ASK I1 AND I2 IF CUSTOMER DID NOT CHOOSE CFLS]

I2. Why didn't you choose CFLs?

Awareness	1	Not aware of CFLs	I3
	2	Don't know enough about CFLs	I3
Price	3	Too expensive	I3
Environment	4	Disposal/environmental concerns (e.g., mercury)	I3
Habit	5	Accustomed to incandescent bulbs / habit	I3
	6	Prefer this incandescent brand to available CFL brands	I3
Fixture Fit	7	Don't like the way they fit in the fixture	I3
	8	Don't like the way they look in the fixture	I3
Quality	9	Dislike the light quality/color from CFLs	I3
	10	CFLs take too long to reach full brightness	I3
	11	CFLs flicker	I3
	12	CFLs burn out too quickly	I3
Bulb Features	13	Need dimmable bulbs	I3
	14	Need 3-way bulbs	I3
	15	Need other specialty bulbs	I3
Packaging	16	CFLs only in multi-pack/didn't want a multi-pack CFL	I3
Other	77	Other (Specify:______________________)	I3
Don't know	99	Don't know	I3

[PROGRAMMER: ONLY ASK I3 AND I4 IF CUSTOMER DID NOT CHOOSE LEDS AND IF AN LED BULB WAS AN AVAILABLE CHOICE IN S1 OR S3. DO NOT REPEAT I3 AND I4.]

I3. Did you consider choosing LEDs?

1	Yes	I4
2	No	I4
99	Don't know	I4

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[PROGRAMMER: ONLY ASK I3 AND I4 IF CUSTOMER DID NOT CHOOSE LEDS]

I4. Why didn't you choose LEDs?

Awareness	1	Not aware of LEDs	H0
	2	Don't know enough about LEDs	H0
Price	3	Too expensive	H0
Environment	4	Disposal/environmental concerns	H0
Habit	5	Accustomed to incandescent bulbs / habit	H0
	6	Prefer this incandescent brand to available LED brands	H0
Fixture Fit	7	Don't like the way they fit in the fixture	H0
	8	Don't like the way they look in the fixture	H0
Quality	9	Dislike the light quality/color from LEDs	H0
	10	LEDs take too long to reach full brightness	H0
	11	LEDs flicker	H0
	12	LEDs burn out too quickly	H0
Bulb Features	13	Need dimmable bulbs	H0
	14	Need 3-way bulbs	H0
	15	Need other specialty bulbs	H0
Packaging	16	LEDs only in multi-pack/didn't want a multi-pack LED	H0
Other	77	Other (Specify:______________________)	H0
Don't know	99	Don't know	H0

Household Characteristics

The next few questions will help us get a sense of your home lighting usage.

H0. Do you rent or own your home?

1	Rent	H1
2	Own	H1
3	Other [DO NOT SPECIFY]	H1
99	Don't know	H1

H1. How many bedrooms do you have in your home?

1	[NUMBER OF BEDROOMS]	H2
99	Don't know	H2

H2. How many bathrooms do you have? [RECORD HALF BATH AS 0.5]

1	[NUMBER OF BATHS]	H3
99	Don't know	H3

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H3. And how many people live in your home year round?

1	[NUMBER OF PEOPLE]	E1
99	Don't know	E1

Electricity Provider

E1. Can I please get your zip code for our records?

1	[ZIP CODE]	E2
99	Don't know	E2

E2. Is [STORE IOU] your electricity provider?

1	Yes	D1
2	No	E3
99	Don't know	E3

E3. Who is your electricity provider?

1	PG&E	D1
2	SCE	D1
3	SDG&E	D1
4	Other California Utility	D1
5	Non-California Utility	D1
99	Don't know	D1

Demographics

[HAND IPAD TO RESPONDENT TO ENSURE ANONYMITY]

We're almost done! Please answer the next two demographic questions on the next two pages. Tap the circle next to your answer choice and then tap the "Next page" button. Your answers will remain confidential. Once you've answered both questions, please return the iPad to the interviewer.

D1. What is your education level?

1	Have not completed high school	D2
2	Completed high school or equivalent	D2
3	Bachelor's degree	D2
4	Master's, Ph.D, or other advanced degree	D2

D2. What is your household income level?

1	Less than $20,000 per year	Conclusion
2	$20,000 to less than $30,000	Conclusion
3	$30,000 to less than $40,000	Conclusion

4	$40,000 to less than $50,000	Conclusion
5	$50,000 to less than $60,000	Conclusion
6	$60,000 to less than $75,000	Conclusion
7	$75,000 to less than $100,000	Conclusion
8	$100,000 to less than $150,000	Conclusion
9	$150,000 to less than $200,000	Conclusion
10	$200,000 or more	Conclusion

Conclusion

Thanks for participating in this survey [GIVE RESPONDENT GIFT CARD]

APPENDIX K. RESPONSE TO PUBLIC COMMENTS

#	Comment	DNV GL Response
PG&E-1	We commend DNV GL for the retail lighting shelf survey research and for the high quality reporting in the Impact Evaluation of 2013-14 Upstream and Residential Downstream Lighting Programs. The IESR tables were completed fully, which helped review of the report and comparison to other impact evaluations. As in 2010 – 2012, the shelf surveys provide stakeholders a much needed picture of the retail arena the programs operate in and influence. The report is clear and well-written and DNV GL gives both quantitative and astute qualitative metrics that help put both the programs and the broader residential lighting market in context. The strengths and weaknesses of the model-based NTGR approach and the supplier-based NTGR approach included in this report were very useful in understanding each method. The historical data and current trends DNV-GL presents, along with the web resources they have provided to allow queries of the shelf survey results, are extremely valuable. These resources will provide foundational data for future evaluations and forecasts and essential insights for program planning.	DNV GL appreciates the comment. We thank the commenters for their thoughtful review and reflection on the report.

#	Comment	DNV GL Response
PG&E-2	The CPUC issued Decision 12-11-015 on November 8, 2012 requiring the California electric utilities to rebate only LED lamps that are compliant with the California Energy Commission Specification ("CEC-Spec"). The Decision states on page 30: "Pacific Gas and Electric Company, San Diego Gas & Electric Company, and Southern California Edison Company shall only offer incentives for light-emitting diode (LED) bulbs to products that are in the top half of quality on the market and that meet the Energy Star requirements prior to the adoption of a California quality specification for LEDs by the California Energy Commission (CEC). Once the CEC quality specification is adopted, the utilities shall design a transition period of less than one year, in consultation with the CEC and Commission staff, after which they shall only offer incentives to LED bulbs that meet the California quality specification." In the Upstream Lighting Program (ULP), the IOUs began introducing CEC-Spec LED lamps in 2013 and fully transitioned by January 1, 2014. These CEC-Spec LEDs typically have a higher Color Rendering Index (CRI), longer Effective Useful Life (EUL), longer warranty, are dimmable, as well as other specified quality attributes; and are therefore more expensive. The IOUs recognize and appreciate the importance of promoting only high quality LEDs to ensure that customers have a positive first experience, which will enable full market transformation. Therefore, the IOUs have made the CEC-Spec a central tenet of the ULP. The CEC-Spec products sold through the program are in direct competition not only with less efficient technologies, but with other, lower quality LEDs. However, it appears that the Net-to-Gross approaches used in this evaluation did not account for the difference between low quality LEDs and the CEC-Spec LEDs that the IOUs were ordered to incentivize. In page 45 of section 5, the report states the following: "To estimate the NTGR, we first asked interview participants whether they would have sold any CFLs in absence of the program and asked the same question about LED lamps. If the manufacturers identified any combinations of lamp types and retail channels through which they would not have sold any CFL or LED lamps without the program, we flagged these as program-reliant." Gauging the manufacture and sale of "any LEDs" instead of CEC-Spec LEDs does not accurately reflect the Upstream Lighting Program.	The Impact Evaluation of 2013-14 Upstream and Residential Downstream Lighting Programs determines the energy savings resulting from these IOU programs. While the California Quality LED specification imposed additional requirements on the IOUs related to lamp quality, DNV GL is unaware of any evidence that lamps not meeting this quality standard would have had different energy savings. We can conjecture that CEC spec lamps could have a different baseline, or that the effect of program promotions and discounts on purchases could have been different for non-CEC-spec LED lamps than for CEC spec LED lamps. Given the limited development of the LED market at this stage and the still relatively low penetration of the technology, gathering data to allow such distinctions in this study would have been challenging and costly. We agree that exploration of such differences in future studies is worthwhile. We added text in section 2.1 to briefly describe the quality specification.

#	Comment	DNV GL Response
PG&E-3	In the Free Ridership and In-State Spillover questions in the Interview Guide for Manufacturers Participating in the 2013-2014 California Upstream Lighting Programs in Appendix J of the report, it appears that, again, no designation was made for program-incentivized CEC-Spec LEDs. The free ridership question in the manufacturer survey reads as follows: "Do you think your company would have been selling LED products during this 2013-2014 program period if the discounts of $1.50 to $20 per bulb from this program had not been available?" An alternate wording, which would have accurately distinguished program-incentivized LEDs would be, “Do you think your company would have been selling CEC quality spec LED products during this 2013-2014 program period if the discounts of $1.50 to $20 per bulb from this program had not been available?" Similar to the manufacturer and retailer interviews, a distinction between CEC-Spec and other LEDs was also not made with customers in the shopper intercept surveys. These significant limitations in the NTGR analysis likely contributed to the low NTG values for LEDs provided in the report. Finally, we note that according to the DNV GL shelf survey results, CEC-Spec product availability remains very low in nearly every market channel. This is a clear indication that program bulbs are unique to the market, suggesting that NTG should be high for these products. Considering the low CEC-Spec product availability, competition for these products is very low. Currently CEC-Spec products are being driven largely by IOU programs. These considerations imply a NTG of near 1.0. Current NTGR results should not be put into DEER or ex ante updates. We also ask that DNV GL explain these methodological shortcomings in the updated report and consider assigning an LED NTGR of 1.0 or at the least pass through the ex ante NTG values.	As mentioned above, DNV GL believes the question of lamp quality is one that can be considered as a research question in the 2015 upstream lighting evaluation; however, this evaluation is intended to estimate energy savings, and the CEC spec is largely a quality specification. While the specification is likely to impact lifetime lamp savings and has potential to have transformative effects on the market, these questions were not identified in the scoping of this study due to the relatively small size of LED lamp savings. As such, the NTGR analysis that was performed in this study does draw on several sources of primary data to estimate annual savings. Still, DNV GL agrees that NTGR results should not directly be put into DEER or ex ante updates, but rather a prospective investigation be undertaken to estimate optimal magnitude of discounts, channel distribution, and combination of discounted lamp types.

#	Comment	DNV GL Response
PG&E-4	The manufacturer NTG battery is lengthy, was not provided to the IOUs for review, and the algorithm for a final NTG is not specified. It is also unclear which questions feed into a final NTG value and which are quality checks or used for other purposes. Nevertheless, manufacturers are asked a series of questions that equate to the following (taking CFL basic as an example): • Would your sale of CFL bulbs in 2013 – 2014 have been lower, the same, or higher in the absence of the ULP rebates? • [IF LOWER] By what percentage would your total CFL sales have been lower in the absence of the program? The answer to the second question appears to have directly implied the NTG ratio. If we are interpreting the methodology correctly, this is a mischaracterization that can have dramatic consequences. Consider a manufacturer who sold 100,000 CFLs in 2013 - 2014, 20,000 of which were rebated through the program. Using this methodology, the implication is a NTG of 0.2 (20,000/100,000) or less. While yielding an interesting metric, this ratio is simply not a measurement of NTG. Instead the NTGR should reflect the portion of program CFLs that would have been sold in the absence of the program, not the fraction of a manufacturer's total sales that benefited from program rebates. If the former approach were taken, a different set of questions would be needed: • How many CFLs did you sell in 2013 – 2014 that were rebated? • How many of those CFLs would you have sold in the absence of the program? The very same manufacturer would again report that 20,000 bulbs were incentivized and may also report that 4,000 of those bulbs would have been sold in the absence of the program. This would imply a vastly different NTG of 0.8. This latter method is standard and in line with the definition of NTG per California Energy Efficiency Evaluation Protocols.	We added the equations used to calculate supplier-based NTGR in section 5.1.1. Before the questions listed by the commenter, the interview guide includes these questions: 6-1. Do you think your company would have been selling CFL products during this 2013-2014 program period if the discounts of $0.20 to $6 per bulb from this program had not been available? a) [IF YES] Through which retailers or retailer categories would you have sold CFL products during 2013-2014 if the program discounts had not been available? [CATEGORIZE PER LIST BELOW; PROBE FOR AS MANY AS POSSIBLE]? If there are particular retail channels through which the manufacturer would not have sold any energy-efficient lamps in the absence of the program, these are identified at this stage and a 100% NTGR is applied to these lamps. A significant volume of the program lamps received a 100% NTGR at this stage because they were deemed "program reliant." The suppliers were only asked the questions listed by the commenter if the supplier indicates that they would have sold some bulbs through some of the retail channels in the absence of the program. So the questions the commenter is referring to and their related analysis is only relevant to the subset of bulbs which were sold through retail channels which were not program-reliant. In a number of cases all the supplier shipments were deemed program-reliant and therefore the suppliers were never asked the questions cited by the commenter. So to cite hypothetical NTG ratios based on these questions alone is an inaccurate summary of the method. DNV GL also notes that we posted the supplier interview guide on Basecamp for IOU review on June 5th, 2015 and received comments from all IOUs on June 16, 2015 (see https://basecamp.com/2320550/projects/6462658/messages/43252379 and https://basecamp.com/2320550/projects/6462658/messages/34067842 for details).

#	Comment	DNV GL Response
PG&E-5	Another short example shows that DNV GL's method can lead to some confounding situations which would clearly mischaracterize program influence. Consider the same program incentivizing CFLs with Manufacturer A in successive cycles. In the first cycle, the program incentivizes 10,000 CFLs and Manufacturer A sells a total of 100,000 CFLs. Presumably, Manufacturer A would have sold between 90,000 – 1000,000 bulbs in the absence of the program. In the second cycle, the program incentivizes 50,000 CFLs and Manufacturer A sells a total of 140,000 CFLs. In this case, just by increasing the size of the program offering, the NTG could increase from 0.10 to 0.36. A similar example could be drawn to show that a manufacturer receiving the same number of CFL incentives could prompt a dramatically higher NTG value just by reducing total CFL sales independent of the program. Valid NTGR calculation methodology should not be affected by program size or independent market factors. Based on CPUC direction the IOUs have dramatically reduced CFL incentives in the last several years. As DNV GL describes, this shift has left the programs very small compared to the recent past, which, based on the above example, inherently yields low NTG values from the supplier-based methods. PG&E is hopeful that in the near future we can promote increasing numbers of CEC-Spec LEDs in a cost effective manner as we continue to ramp down CFL incentives. However, in the short term we will continue to offer CFLs to both meet hard-to-reach customers and to offer customers most concerned with up-front cost a low price, energy efficient option. While we appreciate DNV GL's synopses of the NTG strengths and weaknesses, we do not believe that the concerns raised in this point are fully acknowledged or addressed. Can DNV GL please provide an explicit example of how the NTGRs are calculated based on a set of supplier responses to questions asked? PG&E recognizes the challenge of developing reliable NTG methodologies for upstream and midstream programs. However, we do not believe the current approach should be utilized in future research without significant revision to address these concerns. It could be helpful in the determination of a NTG to gauge which products are displaced, if any, by rebating energy efficient products.	DNV GL considered this interpretation when reviewing results and consulted the program lamp market share estimates that the suppliers provided. The approach and interpretation used in this report is consistent with the approach and interpretation used in impact evaluations of the IOUs' 2010-12 and 2006-08 upstream lighting programs in California. We added a more descriptive explanation of the methodology in section 5.1.1. We avoid presenting the exact results to protect supplier interview respondent confidentiality. Additionally, DNV GL clarified the description of our supplier NTGR methodology by adding the equations we used to generate these estimates. Readers can find these changes in section 5.1 of the report. In each of our evaluation efforts, we review the data collection instruments against the most current evaluation priorities and program activities, and will continue doing so in subsequent evaluations. If the impact evaluation of the IOUs' 2015 upstream and residential downstream lighting programs includes supplier interviews, we will revisit the data collection instrument and consider any revisions and/or consistency checks necessary to ensure that respondents understand the questions being asked.

#	Comment	DNV GL Response
PG&E-6	This evaluation lacks primary data collection for the development of accurate or reliable gross impact parameters, especially for LEDs. The lighting metering study that determined hours of use dates back to 2006. The residential/nonresidential split is based on CLASS and CMST dating to 2010. Interactive effects have never been experimentally researched and are applied directly from DEER. Delta Watts and other baseline assumptions are largely taken from previous research. Many assumptions and parameters developed specifically for CFLs are applied directly to LEDs in spite of the fact that technology differences make such applications questionable. While we recognize that comprehensive metering and saturation studies are beyond the budget of an impact evaluation, an attempt could, and should, have been made to collect new primary data for the assessment of select key parameters that are very outdated, questionable, or reasonably expected to be different for LEDs.	DNV GL agrees that the application of timely and rigorous primary data is essential to an impact evaluation. As established in the workplan, we used available budget to identify research priorities and gather new data to address the key factors expected to have changed, namely NTGR in light of market advances. The metering data used are from 2008-09 (not 2006), and these are used to determine lighting HOU and peak CF by room type, lamp type, application, IOU. We combined these values with 2012 inventory data collected just before the start of the 2013-14 program to estimate average HOU, peak CF and delta Watts. For LED lamps, we assumed the same usage profile as for CFLs. Direct metering data on LED lamps is not available, and LED lamp saturation was arguably too low during the 2013-14 program period to support rigorous direct measurement (had funds been available for such measurement). The Res/Nonres split was a research priority in the 2010-12 evaluation and Commission staff considered those results as reasonable to apply in the impact evaluation of the IOUs' 2013-14 upstream and residential downstream lighting programs. The potential cost to benefit ratio of establishing a better estimate of interactive effects was not considered high enough at the time of this evaluation and DNV GL has not found research that measured lighting interactive effects more accurately than engineering analysis in DEER. Lastly, delta Watts estimates on the 2012 CLASS results, which is appropriate as the starting point for the 2013-14 program. We added additional text in sections 4.2, 4.3, and 4.4 to address these points.

#	Comment	DNV GL Response
PG&E-7	The report does not speak to the fact that LEDs are still in the early adopters stage, which may partially explain the low NTGRs for LEDs. Can DNV GL speak to early adopter effects on Net-to-Gross?	The lamp choice model captures the impacts of price sensitivity and, in the case of LED lamps, produced low NTGR relative to other measures. Early adopters are one potential explanation for this, as early adopters may be less price sensitive than later adopters. This may suggest that as LED lamp prices decline and market shares increase, the NTGR could increase, however, this begins to enter the realm of conjecture which goes beyond the design of the study.
PG&E-8	Based on the CPUC "2015 Workpaper Guidance – Lighting Retrofits" memo dated January 27, 2015, the utilities updated the Net-to-Gross values in the workpapers around the June or July 2015 timeframe. Does this impact evaluation reflect these values? During this same timeframe, based on CPUC Disposition, the IOUs updated the ex ante savings values. These savings values were back-dated for the 2013-2014 cycle. Can DNV GL please state in the report which NTGR and ex ante savings values are used in this evaluation?	Itron published the final NTGR and ex ante savings used in this evaluation on November 2, 2015. This dataset includes the lighting disposition update that is referenced in the comment (see the updated footnote on Table 1 in the report).
PG&E-9	The report states, "…with the program discounts, efficient technologies are the least-cost option…" This is not entirely true. As DNV GL indicates in a footnote in Section 1.2, page 10, prices for IOU-discounted LED reflector lamps are roughly $0.80 more expensive per lamp, on average, than LED reflector lamps not discounted by the program. Can the authors of this report add this exception to body of the report (not footnote) on Section 1.2, page 10?	This footnote is an error and has been removed from the text. Program-discounted CFLs remain the lowest-cost options during the two data collection periods shown in Table 18 of the report.
PG&E-10	DNV GL discusses the significant misalignment between ex ante and ex post gross savings due to the different methods used to calculate delta watts. Specifically the Wattage Reduction Ratio (WRR) for ex ante savings was found to underestimate delta watts compared to evaluation findings. The WRR is complicated to understand with only an explanation. Can DNV GL please provide an example in the report to illustrate how the Wattage Reduction Ratio is applied and why large discrepancies arose in the delta watts determined by ex post evaluation?	DNV GL added 2 examples in section 4.4 of the report (Table 25).

#	Comment	DNV GL Response
PG&E-11	Another major discrepancy between ex ante and ex post gross savings arose due to a misalignment of ex ante and ex post installation rates. The ex ante installation rate in workpapers still assumes a policy in which bulbs in storage that will be installed are carried over into the next program cycle. However, the carryover policy has changed and bulbs in storage are now counted in the program year in which they are sold. This seems to indicate an obvious need for new ex ante direction. Can DNV GL provide a recommendation to make this workpaper and DEER update? Can the CPUC please include this update in the next DEER revision?	This comment is well suited for conversations around DEER updates, which will take place later this year. Per guidance from Commission staff, the impact evaluations will not provide direct recommendations to the ex ante team, but has recommend that DEER uses the best available data. We note this in recommendation 4: "If more up-to-date estimates are not developed through prospective work, use the results of this evaluation to true up ex ante assumptions for key impact parameters."
PG&E-12	The realization rates are very different for carried over CFLs of the same lamp category. On page 9, the authors state that "This evaluation recognizes savings for these carry-over lamps using impact parameters from the 2010-12 evaluation." After the presentation of savings results for the carried over lamps, can the evaluators describe the key parameters that varied considerably, that led to the differences for the same lamp types for carried over CFLs vs 2013-14 CFLs? Bullet points or a summary table would be helpful.	As mentioned in section 1.1, we used the same parameters for carry-over measures as applied in the 2010-12 evaluation. The primary ex post driver for different realization rates between cycles is due to an increase in delta Watts. Ex post HOU and peak CF did not change significantly, and ex post installation rates, res/non-res split, and interactive effects remained the same between the two evaluation cycles. We have added this additional clarification in section 1.1.
PG&E-13	The recommendations in this report seems to make sense only in the context of an impact evaluation. In the broader context of market transformation goals of the state (e.g., AB 1109 - to reduce residential lighting energy usage in indoor residences and state facilities by 50% by 2018; or ZNE goals), they are problematic. For example, Recommendation 1: Optimal Strategic Group (PG&E Lighting Conjoint Study, 2011) found that big box channels, particularly mass merchandise and home improvement stores, are where the majority of residential customers buy most of their lamps. If the IOUs follow this recommendation of reducing LED rebates to these channels, there is a danger of less efficient technologies (e.g., halogens and low quality LEDs) increasing, and high quality CEC-Spec LEDs significantly decreasing. Figure 1 in the Executive Summary shows that the fraction of high efficacy lamps is about the same (i.e., is not increasing - and may have slightly decreased) from 2013 to 2014. Results from the summer 2012 DNV GL shelf survey compared to the winter 2014/2015 shelf survey have found the same thing. The state of CA may not reach its market transformation goals - at least not short term - if the IOUs cut rebates to big box stores.	The recommendation was not necessarily to eliminate incentives to big box channels, but to consider the likely low NTGR for these channels during the program planning stage. It is important to note that channel-level program impacts depend not just on the NTGR but also on the costs of operating in these channels compared to others. At the same time, the fact that a large proportion of replacement lamps moves through these channels doesn't by itself make it worthwhile to offer a lot of program lamps there if the discounts aren't having much effect, regardless of market transformation goals. The results from this evaluation suggest that even though substantial CFL sales occur in the home improvement channel, many of these sales would have occurred in the absence of the program. Alternatively, despite fewer total lamp sales occurring in the discount channel, the NTGR suggests that the program was more likely to increase CFL sales. We have updated section 5.3.4 to clarify this point.

#	Comment	DNV GL Response
PG&E-14	It would be helpful if "big box" was defined in the following text: "In big box channels, NTGR are relatively low in the current evaluation and were relatively low in prior evaluations for most measure groups." It is not until you reach Section 5.1.21., page 47 that a definition of “big box” is provided: "...big box channels such as large home improvement, mass merchandise, and membership club (suggesting lower program influence on sales through these channels)." Can this definition be moved up to the Executive Summary, Section 1.5, page 1, as some readers will not read beyond the Executive Summary to see the definition.	DNV GL has updated the text in section 1.5 to define "big box channels."
PG&E-15	The report states, "...while the share comprised by halogen lamps increased from 11% to 24%—likely a result (at least in part) of the increasing presence of halogen lamps that comply with the efficacy standards set forth in the Energy Independence and Security Act of 2007 (EISA)." Another likely reason why halogen lamp share increased is because the IOUs significantly reduced the quantity of CFL incentives and so therefore consumers reverted back to what was familiar and least expensive.	PG&E's comment references sales (consumer reversion to low-cost options) while DNV GL's data in this instance references lamp stock in retail stores. As stated ("likely a result [at least in part] of ... EISA"), the text does not eliminate the possibility of other influences on the change in halogen lamp share of total lamp stock. DNV GL will address this topic more completely later this year in our update to the "California Residential Replacement Lamp Market Status Report: Upstream Lighting Program and Market Activities in California through 2013" (DNV GL, 2015).
PG&E-16	The authors note in footnote 15 that IOU-discounted LED reflector lamps were roughly $0.80 more expensive per lamp on average than non-discounted LED reflector lamps. "This may be a result of the higher quality associated with program-discounted LED reflector lamps per the CA LED Quality Standard..." This is a critical point that should be moved to the body of the report (i.e., not in a footnote) and in more detail. Can DNV GL provide a summary of the LED Quality Standard and note that the IOUs only rebate LEDs that meet this Standard, possibly in Section 2.1 (Program overview)? If the evaluators have pricing information (e.g., prices for CA Quality Standard LEDs vs non-Quality Standard LEDs) can this be provided in the report? Also, Table 18 does not appear to support the $0.80 difference: for both shelf surveys, IOU-discounted reflector LEDs are cheaper than non-IOU reflector LEDs.	Footnote 15 was incorrect and we have removed it from the report. We have updated the text in section 2.1 to summarize the CEC specification. We will present additional pricing data later this year (including details regarding LED lamps that do and do not meet the California Quality LED Specification) in our update to the 2015 market update report (referenced above).
PG&E-17	Can the evaluators provide more granularity in the price comparison table for table 18? For example, footnote 16 notes that "non-program lamps include a wide range of models that may not be directly comparable to program-discounted lamps beyond their wattage category". Perhaps show two columns for Non-IOU lamps: first for lamps that are more directly comparable to the IOU program lamps, and the second for other LEDs that are reflectors but that aren't comparable. This will better illustrate the effect of the rebate, and show the difference in prices within each lamp category.	As noted above, DNV GL will present additional detail regarding LED lamp prices in California in our update to the 2015 market update report later in 2016. Given that this is an impact evaluation report, the purpose of this table is to provide high-level context for impact evaluation results rather than to provide detailed market characterization data.

#	Comment	DNV GL Response
PG&E-18	Footnote 16 references Table 15. Should this reference be Table 16?	Yes; thank you. DNV GL has updated footnote 16 to reflect this correction.
PG&E-19	In the overview section, could DNV GL provide a flow chart or two that illustrates all the components of this study and how they interrelate? This would greatly enhance the report.	DNV GL added a flowchart-style figure to display the study components and overall methodology in the beginning of sections 4 of the report.
PG&E-20	The assumption that CFLs replace incandescents and LEDs replace a mix of incandescents and CFLs may be too simplistic, and probably overestimates savings for CFLs and underestimates savings for LEDs. Can DNV GL consider in future evaluations a new baseline methodology that looks at lamps by categories or class? For example - consider A lamps of a certain lumen range, and assume the same baseline for CFLs and LEDs. Future evaluations also need to incorporate halogens in the next baseline.	Per guidance from Commission staff based on the available data, DNV GL assumed that CFLs replace incandescent lamps and that LED lamps replace a mix of incandescent lamps and CFLs. Evaluators should review the available data at the time of subsequent evaluation studies to determine whether any changes in baseline assumptions are supported by these data. Commission staff and DNV GL look forward to the IOUs' active participation in 2015 impact evaluation study planning. Additionally, text was added in section 7 to underscore the informative (rather than applied) nature of the alternate section.
PG&E-21	For greater clarity, can the authors add the word "Gross" before the Table column headers that read, "Realization Rates" so they read, "Gross Realization Rates"?	Yes; we agree that this was unclear and have updated all of the relevant tables in section 4.8 to reflect this change in wording.
PG&E-22	Exactly how was the supplier-based NTGR calculated? Can DNV GL provide the algorithm?	DNV GL has updated the report to include equations used to estimate supplier NTGR in section 5 (equations 8, 9, and 10).
PG&E-23	For each type of lighting, DNV GL may have relied on a single question to estimate NTGRs. This is inconsistent with the Guidelines for Estimating Net-To-Gross Ratios Using the Self-Report Approaches (MECT, 2007) which states: “Regardless of the magnitude of the savings or the complexity of the decision-making process, one should assume that using multiple questionnaire items (both quantitative and qualitative) to measure a construct such as free-ridership is preferable to using only one item since reliability is increased by the use of multiple items” (p. 6). Can DNV GL please state in the report how many (and which) questions were used to estimate NTGRs?	DNV GL considered both supplier and model estimates and imputed from the supplier estimate when model results were not available due to data thinness. This approach avoids using a single methodology as the comment suggests. Additionally, we asked the supplier questions of two respondent groups (manufacturers and retail buyers), which provides the analysis with two supplier-based estimates. Lastly, we asked each supplier a three-part question intended to produce the best supplier NTGR estimate (questions 6-3, 6-3b, 6-3bi, 6-4, 6-4b, and 6-4bi in the supplier interview guides). See discussion in section 5.1.1 of the report.

#	Comment	DNV GL Response
PG&E-24	In the report it states, "Weight the NTRG: Section 0 describes how we weighted the model-based NTGR..." We do not see a Section 0. Is this a typo that can be corrected in the final report?	DNV GL has corrected the reference to refer to section 5.2.2.1.
PG&E-25	Can DNV GL please include in the final report the number or percent of lamps that each IOU rebated to each market channel, by lamp category, possibly at the start of the NTG section (p. 45)? This will provide some context for the reader, and help understand the results. Related to this question, p. 81, 83, 85: Can the report explain why the Net realization rates are so different among the IOUs for the same lamp categories? Is this because the IOUs assumed different NTGRs? Is it because they rebated lamps to market channels at different levels? For other reasons? This additional detail would be very helpful.	See tables 106-112 in Appendix I. We did not include these in the main body of the report because the granularity of the breakout produces multiple pages of data tables. We text in section 5 that reviews these differences and direct the reader to the appendix tables.
PG&E-26	DNV GL does not report the results of any sensitivity analyses for the NTGRs. This is inconsistent with Guidelines for Estimating Net-To-Gross Ratios Using the Self-Report Approaches (MECT, 2007): "Finally, evaluators must also conduct sensitivity analyses (e.g., changing weights, changing the questions used in estimating the NTGR, changing the probabilities assigned to different response categories, etc.) to assess the stability and possible bias of the estimated NTGR" p. 11). PG&E requests that sensitivity analyses be done by systematically changing each key input within its plausible range in order to see how stable the final NTGR is for each utility. Also, for the final IOU NTGRs, could DNV-GL also report the 90% relative precision?	Given the unanticipated complexities that had to be addressed in the analysis, it was not possible to complete a full sensitivity analysis. However, we have laid out our assembly of the final NTGR from the component pieces transparently in section 5.3 of the report. The extreme ends that would be considered would be either 100% weight to the supplier-based NTGR or 100% weight to the model-based NTGR. These separate values are shown in the table. We believe that the range of appropriate weighting would more reasonably fall within the range from 60% to 80% weight to the model-based NTGR, but this is a judgmental determination. Alternative weighting for the manufacturer versus retail buyer data could be considered, but for many channels, only the manufacturer data were available, and for others, the retail buyer data had low coverage. Accordingly, the range of variation that would be reasonable for the weighting between these two estimates is small, and that variation would contribute relatively little to the overall range of possible values. For the weighted combination of these two estimates, the relative precision of the model-based estimates is a reasonable approximation of the relative precision of the final overall estimate.

#	Comment	DNV GL Response
PG&E-27	Given all the sources of sampling and measurement error (e.g., sampling error for in-store intercepts, LCM error, self-report error, etc.), could DNV GL provide an estimate of the level of 90% confidence interval around the final estimates of net savings? We suspect that when one considers the sampling and measurement errors surrounding the multiple inputs to the gross savings and the NTGRs, the confidence intervals are very large and may not be calculable. Even qualitative assessments on a simple zero to ten scale (0=not at all reliable; 10=completely reliable) would be informative.	The reporting practice for impact evaluation reports is to quantify the random error via confidence intervals and identify qualitative sources of potential bias. The primary source of NTGR sampling error occurred in the lamp choice model. The manufacturer responses directly account for close to 100% of IOU-discounted lamps, so even if these were treated as if they were a random sample, they would contribute little additional sampling error. The retailer data are given low weight except in cases where they directly account for roughly 90% or more of the IOU-discounted lamps. Thus, if these responses were treated as random, they would also contribute very little to the overall confidence intervals. The standard errors from the lighting model are therefore a reasonable indication of the overall statistical accuracy. These can be found in Table 104 and Table 105. The report qualitatively discusses potential additional sources of error in section 5.1.3 and section 5.2.3.
PG&E-28	The NTGRs based on the manufacturer/retailer interviews were nearly twice those produced by the LCM. Based on the reported NTGRs in Table 59, the overall, the unweighted values for the modelled and supplier NTGRs were 0.37 and 0.65, respectively. While these two NTGRs were attempting to assess the same underlying construct (i.e., program influence), they are so different that we wonder if they are actually measuring the same thing. Given these substantial differences, simply weighting the results to reflect greater confidence in the modelled NTGRs doesn't solve the measurement problem. If they are not measuring the same thing, then which one is the better estimate of program influence? Going forward, what could be done methodologically to increase the chances that the two estimates are more similar/converge?	DNV GL agrees that moving toward methods that result in better convergence between model-based and supplier-based estimates is desirable. We have a number of ideas of how to improve the methodology in the next cycle, and will be sharing these ideas and asking the IOUs for feedback as we develop the 2015 impact evaluation workplan.
PG&E-29	For the LCM, could DNV GL discuss the disadvantages of the stated intentions model in the updated report?	Please refer to Table 64 in section 5.2.3.
PG&E-30	Table 50 is a good discussion of the strengths and weaknesses of the supplier-based NTGR approach. DNV GL noted that they attempted to mitigate the disadvantages posed by this approach by including questions that were used as consistency checks for their responses to the primary questions regarding NTGR. These included questions about the magnitude and nature of any non-program lamps sales and what happened to the respondents' lamp sales when program discounts were not available. How were these consistency checks used in estimating/adjusting the NTGRs?	We have updated the text in section 5.1.3 to direct the reader to more information regarding these consistency checks.

#	Comment	DNV GL Response
PG&E-31	Can the evaluators provide a rationale for the 70/30 weighting of the two NTGR methods?	See section 5.3.1 in the report for this discussion.
PG&E-32	The NTGRs based on the manufacturer/retailer interviews were nearly twice those produced by the LCM. Based on the reported NTGRs in Table 59, the overall, the unweighted values for the modelled and supplier NTGRs were 0.37 and 0.65, respectively. While these two NTGRs were attempting to assess the same underlying construct (i.e., program influence), they are so different that we wonder if they are actually measuring the same thing. Given these substantial differences, simply weighting the results to reflect greater confidence in the modelled NTGRs doesn't solve the measurement problem. If they are not measuring the same thing, then which one is the better estimate of program influence? Going forward, what could be done methodologically to increase the chances that the two estimates are more similar/converge?	This is a duplicate comment; please see response to PG&E-28.
PG&E-33	The NTG results for the supplier and modelled methods often have wide discrepancies for the same market channel and lamp category. Can the evaluators please explain why there could be such a wide difference, if they believe both methods to be credible?	This comment follows the line of thought of the previous comment. These two estimates are developed from two different methodologies and consider two very different perspectives. We describe the advantages and disadvantages of each approach in section 5.1.3 and section 5.2.3. While it is not necessarily surprising that supplier-based NTGR are higher than model estimates, as noted earlier, DNV GL agrees that moving toward methods with better convergence is desirable. We have a number of ideas how to improve the methodology in the next cycle, and will be sharing these ideas and asking the IOUs for feedback as we develop the 2015 impact evaluation workplan.
PG&E-34	PG&E did not rebate any globe lamps, and the evaluation shows savings for these lamps as 0, or 0% in some tables (e.g., Table 66). Can the evaluators please change these occurrences to N/A? As it stands, PG&E's results for globe lamps appear to be very poor, rather than just not applicable.	DNV GL has updated PG&E's values to N/A in all tables that include CFL globe lamps.
PG&E-35	The description of program /non-program substitution effects is an important one. However can DNV GL please add to this a discussion regarding the higher quality program LEDs vs. non-program LEDs? Does DNV GL have any information as to whether retailers and/or customers 1. Recognize the difference between LEDs meeting the CA Quality Standard and LEDs that don't? 2. Are willing to pay more for LEDs that meet this Standard? These are also questions that could be added to the NTG battery in future evaluations to understand whether retailers would stock, and customers would pay more for, CA Quality Standard LEDs without the rebate.	Please see responses above regarding the California Quality LED Specification (e.g., PG&E-2 and PG&E-3). We agree that these are important questions and we will consider them further as we develop the workplan for the 2015 impact evaluation.

#	Comment	DNV GL Response
PG&E-36	How will the results of the Alternate Savings analysis be used? Were they used in this evaluation? (It doesn't appear so.) Does the Energy Division plan to use them for other evaluation work going forward? If applied to LEDs, this methodology raises the concern noted above, that high quality program LEDs shouldn't be treated the same as other lower quality LEDs.	The results in this section represent an initial presentation of the methodology and will be first utilized in the 2015 evaluation cycle. The alternate methodology leveraged the best available data at the time of this evaluation. See updated text in section 7.
PG&E-37	Could DNV GL provide the sample disposition for the consumer telephone surveys?	We have added Table 93 in Appendix E to include this information.
PG&E-38	Can DNV GL please provide savings for residential downstream measures in the Impact Evaluation Standard Reporting (IESR) tables? Without documenting these savings, stakeholders do not have the full information needed to understand these programs. IESR guidelines clearly indicate that passed through measures are included.	Appendix A includes the IESR tables and includes "Pass-Through Res Downstream" and "Pass-Through Upstream." We present these two line items for each IOU and provide the data requested in PG&E's comment.
PG&E-39	While both DNV GL and PG&E understand the challenges of estimating program attribution given the multiple sources of unavoidable random and systematic error. In light of these pervasive errors, the NTGRs in Appendix A should be viewed as directional at best with wide and incalculable confidence intervals. This suggests that TRC calculations and decisions to eliminate measures should not be driven by the point estimates of NTGRs. Rather, these decisions should be based on TRC scenarios covering the plausible range of NTGRs that are based on the preponderance of evidence.	DNV GL agrees with this conclusion. We have added language to the report to note that the drivers behind NTGR results are complex and changing over time, and that cost effectiveness analyses may be useful moving forward. Again, with the introduction of new technologies, the lighting market is rapidly changing, and it is important to consider how these complex interactions may alter program impact. See section 5.3.4 for the added text in the report.
PG&E-40	For the in-store intercepts, could DNV GL provide the refusal rate by channel?	On average, 5 potential respondents per store refused to participate in the survey when offered the opportunity. This translated into a 46% refusal rate across all retail channels. We did not calculate refusal rates at the channel level.
PG&E-41	Could DNV GL provide a map of store locations and percent of stores in original sample that could not for various reasons be visited?	DNV GL added Table 87 in Appendix D to show the targeted number of store visits by survey phase and retail channel as well as the number of completed store visits, and the number of store visits attempted but not completed (because of staff refusal, store closure, or because the store had no lamps in stock).
PG&E-42	On page I-4, could DNV GL note in the updated report that their estimates of uncertainty are conservative since they only concentrated their uncertainty analysis on the NTGRs from the model-based approach?	DNV GL has added text just before Table 104 in Appendix I to clarify that the uncertainty range is based only on the model-based NTGR.

#	Comment	DNV GL Response
SCE-1	On p. 19, DNV states "SCE's ex ante assumptions allocated roughly three to five times the share of LED lamps to nonresidential applications as ex post assumptions. The evaluation has no data to support the assumptions of higher installations of LED lamps in nonresidential applications versus CFLs." In fact, SCE uses the 94%/6% assumptions for all of the ULP program, per the 2010-12 impact evaluation. DNV should use the Building Type variable to determine the reported ex ante split, not the sector. This will result in the correct split. The apparent mistake in the residential/non-residential split ex ante reporting by SCE is due to an idiosyncrasy of the Master Measure Data Base (MMDB). When breaking down the numbers by sector, it appears that the non-residential portion is too high. This was due to the nature of MMDB at the time and was corrected some time in 2014. While the sector mismatch to building type is now a data inconsistency, this is how it had been represented in MMDB. Further, Sector determines the NTG and does not determine savings, so Sector should not be used for savings summary statistics. Building Type determines reported savings. Therefore the savings data SCE reported is correct and should not be adjusted. For illustration, we show primary lighting data broken out by Sector and by Building Type. The percentages almost exactly mirror a 94%/6% split when using Building Type.	After investigation, this issue only pertains to SCE for a small number of measures as stated in SCE's comment. DNV GL has adjusted the text in the report so as to state the correct res/non-res split. We also updated tables throughout the report to align with these revised values. The final ATR dataset will also reflect these changes.
SCE-2	DNV defines the baseline for LED lamps "as the average of the incandescent lamp and CFL wattages in the 2012 CLASS inventory by lamp shape (A-lamp and reflector) and IOU, weighted by the relative quantities of each lamp technology in the inventory." The current mixed baseline assumptions provides too simplistic a view of lighting characteristics among LED reflectors. In particular, it obfuscates that different lamp types within this measure category do not have the same baseline. Notably, a mixed CFL and halogen baseline is only appropriate for flood lights (beam angle >45°), but not for spotlights (beam angle < 45°). The reason is that LED spotlights have no equivalent in CFLs. CFLs cannot have low beam angles, as they disperse light widely. Therefore a 100% halogen baseline should be used for low beam angle spotlights. SCE recognizes the need to lump measure categories together by shape and wattage for the purposes of primary data collection. However, there is an opportunity for more accuracy with regard to other elements of the impact evaluation. DNV should create a protocol to address different characteristics within measure categories in baseline assumptions.	This comment presents a valuable perspective on the difference between these lamp types. However, this evaluation moved forward with the baseline methodology as presented in the Interim report. As noted in section 5.3.4 of this report, the market was more complex in this cycle compared to prior program cycles with more varied technologies competing in non-negligible quantities. As a result, some distinctions that were previously not worth addressing may merit more detailed attention. We introduced additional refinements in this cycle, and we will consider any changes to this approach as part of our study planning for the 2015 impact evaluation.

#	Comment	DNV GL Response
SCE-3	The intercept store sample has the appearance of a convenience sample. It is heavily weighted towards home improvement, mass merchandise and membership club channels, which have higher lighting sales volume, though not necessarily for program lamps. This sample does not accurately reflect SCE's program, which had the largest volume in discount and grocery chain stores. Future evaluations should sample across channels to account for where the measures with highest overall impacts are sold (e.g., grocery and discount stores in the case of high wattage CFLs). Arguably , covering the most high impact channel and measure combinations is much more important than covering all channels. DNV should also consider data collection methods beyond store intercepts for specialty bulb measure categories that are difficult to capture in store intercepts.	The shelf survey store sample is not a sample of convenience and does not weight more heavily toward any particular channel. DNV GL attempted to visit roughly the same number of stores in each of the seven retail channel (28 or 29 stores per channel) and we conducted shopper intercept surveys in all of these stores (see Appendix D for sampling approach details). From the perspective that we have no control over the number of shoppers per channel at the time of our store visits, the intercept surveys are based on a convenience sample. There are fewer intercepts in the discount and grocery channels (as well as in the drug channel) because lamp purchases happen less frequently in these channels. Researchers spend at least four hours per store attempting to intercept shoppers and intercept fewer shoppers in stores where lamp sales volumes are lower (such as drug, discount, and grocery). DNV GL agrees that additional data collection could yield insights into specialty measure categories. Establishing a reliable methodology that will yield enough sample points is a key challenge. Telephone surveys can provide robust qualitative data, but finding purchasers of IOU-discounted lamps is very challenging. DNV GL is hesitant to propose an online survey because of similar challenges. Other methods (such as focus groups) yield qualitative rather than quantitative results. If the IOUs are able to provide up-to-date store-level shipment data to DNV GL during future field data collection efforts, we may be able to actively target stores participating in the program. The IOUs, Commission staff, and DNV GL should revisit this issue during 2015 impact evaluation planning discussions.

#	Comment	DNV GL Response
SCE-4	Related to the above comment, SCE's program is quite different from the other IOUs in that it relies much more heavily on independent retailers/discount stores, and grocery chains. The data collection for the supplier based NTG does not adequately capture that population, as retailer interviews captured only 27% of discount channel program sales (p. 46), and in particular capture only 9% of the highest impact measure category, high wattage CFLs. Because of the importance of this channel to the SCE program, and in particular for the primary measure category of high wattage CFLs, it is vital to conduct more primary data collection in this channel for the supply-side NTG component in future evaluations, before applying this study's findings too broadly.	DNV GL conducted interviews with lamp manufacturers who were responsible for nearly 100% of program-discounted lamp sales. These interviews yielded channel-specific results. The IOU-specific weighting methodology thus generates a tailored measure group NTGR that fits each IOU's program. See equations in section 5.1.1.

#	Comment	DNV GL Response
SCE-5	On p. 56, DNV notes: "There is one additional replacement lamp category: high-wattage lamps. However, during the shopper intercept surveys, we did not encounter enough shoppers purchasing lamps of this type to generate model based estimates of market shift for the related measure group (CFL high-wattage [>30 W])." The failure to collect store intercept data for the high wattage CFL measure category is of great concern to SCE. High wattage CFLs are now the primary component of SCE's program, making up close to 60 % of claimed gross and net energy savings. Statewide, this measure still accounts for over 45% of gross and net savings, making it the single largest measure category. DNV should spell out how the data gap on high wattage CFLs is addressed and demonstrate the adequacy of their estimates and assumptions. SCE asks that DNV provide additional explanation on how NTG was imputed for high wattage CFLs in the report, as well as opportunity for discussion. At present, the report glosses over this important omission. In the absence of store intercept data, DNV seemed to impute NTG estimates for high wattage CFLs by applying the NTG for basic spiral CFL. P. 69 states "Because the majority of the high-wattage CFLs were basic spiral CFLs, we applied the imputation factor from basic spiral CFLs to this measure group." It is erroneous to equate high wattage CFLs with basic spiral CFLs due to the similarity in shape, as their function is quite different. In fact, DNV points out themselves in the delta watts section that high wattage CFLs are not likely to replace the most common incandescent lamps (p. 26): "Given the brightness and wattage of high-wattage CFLs compared with lower-wattage incandescent lamps, it seems unlikely that many consumers would, for instance, replace a 40 W or 60 W incandescent lamp with a 32 W CFL." High wattage CFLs are a specialty lamp category, used anywhere people want brightness. They arguably elicit different customer choices than low wattage basic spiral CFL bulbs. It is not the shape that is relevant, but the end use. A high wattage CFL replaces a 120 W to 150 W incandescent. These make great reading lights, or are used in single-socket rooms (only product to light the room). They are also sometimes used in outside applications, e.g., garages. All in all, this means it is unlikely that the basic CFL NTG provides an adequate imputation factor. In the absence of primary data, it is unclear what constitutes an adequate imputation factor for high wattage CFL NTG. SCE would like to request a meeting with the CPCU and the evaluation team to discuss possible alternatives.	The research plan for the 2013-14 impact evaluation recognizes High Wattage CFLs as a new measure for which DNV GL would establish a baseline—however, the extent to which they dominated SCE's portfolio savings was unknown at that time, so the plan did not include primary research dedicated to these lamps. Additionally, despite the share of savings for which these lamps were responsible in SCE's territory, finding these lamps in the population would have been very challenging and required waiting in stores until high wattage CFL shoppers came along. Despite spending more 1,000 hours in retail stores collecting data, we intercepted only 5 of these shoppers during the most recent phase of data collection. Ultimately, DNV GL drew from the best available data to estimate savings of these measures. In the case of the imputation factor, as SCE notes, a high-wattage CFL could serve purposes ranging from a reading lamp to a room's single source of light. Given the best available information, DNV GL considered the shape and application of a spiral CFL to be most representative of this category.

#	Comment	DNV GL Response
SCE-6	The development of parameters for new LED measures also suffers from lack of primary data. It appears that DNV encountered many challenges in collecting primary data for new measures; challenges that were not anticipated when this study was devised. DNV should not gloss over these challenges in the report, as they provide important lessons for the design of future studies. DNV chose to apply CFL data for LED measures in many instances where primary data is lacking. SCE does not believe that the decision context for LED measures is the same as for LED measures. The two technologies are very different.	See comment PG&E-6 for a discussion on the rigor behind the assumptions made for LEDs lamps. While we were unable to produce LED-specific estimates of gross savings or peak demand reductions, the assumptions made are justifiable (see the clarifications added to section 4.2 and section 4.3 of the report). Regarding NTGR, it was difficult to find shoppers purchasing program-discounted LED lamps given the relatively small quantity of these lamps as compared to other lamps available at retail. The number of program-discounted lamps and intercept surveys that were completed under these conditions is very strong given this challenge. Nevertheless, we will continue to consider how to best capture data on program-discounted lamps going forward.
SCE-7	As noted several times in the report (e.g., p. 14), the program changed substantially between the two instances of data collection. Can DNV elaborate on the degree of representativeness of data collection timing? Notably, how where the two different data collection periods weighted in the final analysis?	In an attempt to collect data throughout the 2013-14 program period, DNV GL conducted shelf and intercept surveys in the winter of 2012-2013, in the summer of 2013, and in the winter of 2014-2015. Appendix D presents the sample sizes for these data sources. In addition, to represent the activity of the program more accurately, DNV GL applied weights based on the blend of lamp technology and styles sent to stores during different timeframes in the program; please refer to section 5.2.1.2 for more detail.

#	Comment	DNV GL Response
SCE-8	On p. 76, DNV states: "The basic program theory is that providing incentives for a lamp will pull sales away from non-discounted lamps and toward program discounted lamps. The upstream lighting program provided discounts for lamps in multiple measure groups in many retail channels and as such, incentives for one program-discounted upstream lighting measure group pull sales away one or more other program-discounted upstream lighting measure groups." This seems to suggest that the program receives no credit in the lamp choice model, if the surveyed customer indicates they would have bought another program incented lamp had their primary choice not been available. Can DNV please spell out how exactly this substitution logic is applied in the lamp choice model? It is unclear if these substitution effects plays out in the context of activity weighting (section 5.2.1.2). The entire activity weighting section is opaque. More generally, intra-program or cross-measure substitution should not be construed as free-ridership. Namely, lamp choices among program lamps provide no relevant information on what a customer would have done in the complete absence of the program. The influence by SCE to convert consumers to high efficiency lighting should not be discounted if consumers choose one incentivized high efficiency product over another. The value of market freedom and choice to enhance energy efficiency purchases is overlooked. The survey questions did not incorporate concepts that would validate the consumer's choice as having a third, underlying motive to save energy compared to the product being replaced, which is still a valid market choice. The answer that the consumer would have purchased another program-incentivized product as a second choice does not indicate the consumer would have still purchased an efficient, non-program product in the absence of an incentive bringing down the price of those efficient products. DNV should consider ways to valuate customer choice in the Discrete Choice Model, instead of completely zeroing out substitution effects from savings.	We have revised the discussions of substitution and program activity weighting for greater clarity (see section 5.2.1.2 for this discussion and Tables 99-103 in Appendix I for more detail). DNV GL does evaluate customer choices in the lamp choice model. It is not the case that "the program receives no credit in the lamp choice model, if the surveyed customer indicates they would have bought another program incented lamp had their primary choice not been available." Please see Appendix H in the report, which describes how we develop the model-based NTGR based on the survey responses. More generally, intra-program substitution is not construed as free ridership. However, the increased adoption of any one discounted technology is less when multiple discounted technologies are jointly available in the same store at the same time. For each purchase that would have occurred without the program, the discount will increase the chance of an efficient lamp purchase instead. If only basic spiral CFLs were discounted in a given store at a given time, all the increased efficient share goes to basic spiral CFLs. If basic spiral CFLs and A-lamp CFLs are both discounted in the same store and time, the increased efficient share is split between basic spiral CFLs and A-lamp CFLs. Exactly how this falls out depends on the relative prices, relative discounts, and relative value consumers attach specifically to one efficient technology versus another. Lastly, DNV GL notes that the supplier interviews account for some of the additional considerations that are not captured through the model.

#	Comment	DNV GL Response
SCE-9	Characterizing substitution effects as free-riding is also problematic in the context of the requirement on California IOUs to only incentivize LEDs that meet CEC quality specifications (e.g., longer lifetimes, dimmability, and high color rendering index). In general, SCE agrees with the notion that (p. 76) "Shifting sales between program and functionally non-program program lamps does not result in savings." However, this treatment of non-program efficient lamp type choices completely disregards the requirement on California IOUs to incentivize only CEC spec compliant LED lamps, which are in competition with non-compliant, lower quality LEDs. Arguably, a customer who indicated they would have bought a non-compliant LED in the absence of a program incentive, still draws utility from the program's existence, by obtaining a higher quality product at a lower price. The net-to-gross survey does not address LED lamp quality and therefore fails to attribute value to this program service. Notably, non CEC spec lamps have shorter life-times and would not have contributed to life-cycle savings in the same way as an incented product.	Please refer to our response to comment PG&E-2 above.

#	Comment	DNV GL Response
SCE-10	The report also states that both intra- and extra-program substitution effects are at the source of lower NTG values, and recommends changing program design to address substitution effects. This leaves no clear way forward for the program design to counter both substitution effects at the same time. In fact, the ways program design could counteract intra- vs. extra program substitution effects seem to contradict each other. Can DNV describe how this can be reconciled? In our reading, if incentivizing lamps in multiple measure groups in a retail channel (p. 76) "pulls sales away from one or more other program-discounted upstream lighting measure groups," it follows that the program design should change to incentivize fewer measure groups per retail channel. However (p.76), "Unlike during the 2010-12 upstream lighting program, most channels stocked both program and non-program lamps. Shifting sales between program and functionally non-program program lamps does not result in savings." From this, it follows that the program should seek to saturate a given retail channel with only program lamps. But wouldn't this action result in cross-measure substitution effects? Recommendations should be based on data and actionable. DNV needs to reconsider both whether their substitution assumptions are internally consistent, necessary to NTG analysis, and whether it is even possible for the program to act upon them in a consistent manner. SCE has no argument with the extra-program substitution effects (competition between incentivized and non-incentivized efficient lamps), expect where quality is not taken into account as determinant of customer choice. Yet intra-program substitution is not a free-rider issue and creates a conflict for program design. Not giving credit for having participated in the ULP program via a different measure strikes SCE as unfairly penalizing the program for offering more than one attractive product. It appears that the Discrete Choice Model has trouble accounting for the presence of multiple efficient lamp types. The prime question for NTG estimation is what the customer would have bought in the absence of any program lamps. The Discrete Choice Model seems to have lost sight of this primary goal to estimate the counterfactual. SCE urges DNV to reconsider how the decision model is applied to obtain NTG estimates.	Please refer to our response to comment SCE-8 above. We agree that the most effective way to include multiple competing technologies in the upstream program is not completely clear from the results of this study. One possibility is to explore alternative incentive scenarios, with different levels of discounts, and different combinations of discounted lamps. The lamp choice model could be used to predict which combinations would result in the greatest net energy savings. The lamp choice model is capable of addressing the effects of competing efficient technologies.

#	Comment	DNV GL Response
SDG&E-1	When was the HOU data collected for this 2013-14 analysis? On Table 1 of Appendix F, are "# of Meters" light loggers or some other measurement instrument? Can you provide this table by IOU?	This table represents the number of Dent lighting loggers. The “Final Evaluation Report: Upstream Lighting Program” prepared for the CPUC ED by KEMA, Inc. et al. on February 8, 2010 includes detailed methods for the metering study. The study is available online at www.calmac.org (study ID: CPU0015.01).
SDG&E-2	SDG&E's HOU are about ~75% of SCE's and ~80% of PG&E's. Is there a reasonable explanation for this outcome? Given this discrepancy and the confidence intervals, the recommendation should be to use the statewide HOU for all PA's and not to use the IOU specific HOUs.	In an effort to provide the best available IOU-specific data, DNV GL made a concerted effort to separate estimates by IOU unless confidence intervals were significantly higher for one IOU or measure group. DNV GL respects the importance of this parameter and notes that the CPUC ED's upcoming residential lighting inventory and metering study will be an opportunity to collect new primary HOU data for all IOUs.
SDG&E-3	Same question for Peak CF: is the recommendation to use the statewide HOU for all PA's or to use the IOU specific CFs?	As noted in the our response to comment SDGE&-2 above, in an effort to provide the best available IOU-specific data, DNV GL made a concerted effort to separate estimates by IOU unless confidence intervals were significantly higher for one IOU or measure group. As noted above, we respect the importance of this parameter and notes that the upcoming metering study will be an opportunity to collect new peak CF data for all IOUs.
SDG&E-4	During the webinar presentation on 3/9/2016, it was clarified that the NTGR was being formulated at the statewide response level weighted by the individual IOU delivery channel. Given the shorter HOU in the SDG&E service territory, then SDG&E participants would be experiencing a longer payback, lower internal rate of return and lower Net Present Value on their investment. Given this, wouldn't the program influence SDG&E participants more than the other IOU territories and result in higher NTGR than the other IOUs? However, if the recommendation is to use the statewide HOU and CF then the statewide NTGR would be in alignment and appropriate for SDG&E.	This argument suggests that the average retail lamp purchaser is mindful of a lamp's cost effectiveness as it specifically relates to their HOU at a granularity of 20 minutes. To suggest that an upstream lamp purchaser looks past the savings estimates marketed on an efficient lamp package and applies the kind of logic used with more costly measures such as HVAC is an unlikely assertion, and would demand additional primary data to investigate, which DNV GL does not recommend at this time.

About DNV GL

Driven by our purpose of safeguarding life, property and the environment, DNV GL enables organizations to advance the safety and sustainability of their business. We provide classification and technical assurance along with software and independent expert advisory services to the maritime, oil and gas, and energy industries. We also provide certification services to customers across a wide range of industries. Operating in more than 100 countries, our 16,000 professionals are dedicated to helping our customers make the world safer, smarter and greener.