STATEWIDE LED TRAFFIC SIGNAL SATURATION STUDY

FINAL

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EXECUTIVE SUMMARY

This section presents a summary of results from the statewide LED Traffic Signal Saturation Study. The work conducted as part of this Study is an integral part of the statewide Market Assessment and Evaluation activities, and is intended to inform policymakers, regulators, stakeholders, as well as program managers, implementers and evaluators about the remaining market potential for LED traffic signals in California.

The first objective of the Study was to estimate the baseline usage of traffic signals, i.e. the usage of traffic signals in the absence of any LED traffic signal program. 1995 billing data were used to accomplish this task, assuming that few or no LED traffic signals were installed in any of the IOU service territories at that time. The baseline usage for all intersections was estimated at 134.1 GWh/yr for PG&E, 176.8 GWh/yr for SCE, and 46.3 GWh/yr for SDG&E.

The Study then developed an estimate of the full potential of LED traffic signal retrofits. This calculation was based on the distribution of measures for an average intersection, and ex ante estimates for pre-retrofit wattage, post-retrofit wattage, average hourly duty cycles (or annual operating hours) and coincident peak duty cycles, for each measure covered by the LED programs. According to these data, the technical potential associated with retrofitting all incandescent traffic signals with currently-available LED signals is 89% of baseline. However, due to several technical and implementation-related factors, the Study used the more conservative figure of 80%.

Next the current LED saturation levels were determined by employing two separate methods. In the first method, the current LED saturation levels were calculated for each IOU by dividing the total usage currently attributable to traffic signals by the technical potential of LED traffic signal retrofits. In the second method, the current LED saturation levels were calculated by dividing the total pre-PY2001 LED Traffic Signal Program accomplishments by the technical potential of the LED traffic signal retrofits. The results show very good agreement, and indicate that at the end of 2001, the saturation level of LED traffic signals was 45% in PG&E territory, 18% in SCE territory, and 57% in SDG&E territory. The LED saturation level across the IOU territories was approximately 33%.

Finally, the PY2001 Program data provided an estimate for total expected program savings, assuming that all committed projects will be implemented. According to these data, the remaining market potential for LED traffic signals for 2002 and beyond is 12% in PG&E territory, 28% in SCE territory, and 0% in SDG&E territory, or 18% across the IOU territories.

Exhibit ES.1
Remaining Market Potential for LED Traffic Signals

	PG&E	SCE	SDG&E	All IOUs
Remaining Potential After PY2000/2001 Programs - Percent	12%	28%	0%	18%
Remaining Potential After PY2000/2001 Programs - MWh/year	13,325	39,199	0	52,524
Remaining Potential After PY2000/2001 Programs - Coincident Peak kW	1,521	4,475	0	5,996

1. INTRODUCTION

Over the past five years, a significant amount of LED traffic signal retrofit activity has occurred in California. Most of this activity is attributable to programs implemented by Pacific Gas & Electric (PG&E), Southern California Edison (SCE), San Diego Gas & Electric (SDG&E), and in the past year, by the California Energy Commission (CEC). The goal of this Study was to develop an estimate of the remaining market potential for LED traffic signals.

To meet this goal, three additional research objectives were developed: (1) to estimate the baseline energy usage of traffic signals in the absence of the LED technology, (2) to estimate the market potential for retrofitting traffic signals with LEDs, and (3) to estimate the current saturation of LED traffic signals. A key set of intermediate outputs that were developed as part of this Study in order to estimate the market potential for LED retrofits, were estimates of a number of technical parameters including: (1) typical wattage of incandescent signals for each signal type, (2) typical wattage of LED signals for each signal type, and (3) duty cycles for each signal type[1].

Section 2 presents the methodology used to evaluate the level of baseline usage, market saturation, and remaining market potential for the LED Traffic Signal end use. Section 3 presents the results of this study. Appendix A presents a summary of the technical data collected as part of this study in order to develop estimates of market potential.

[1] It should be noted that only energy duty cycles were developed for this Study. Demand duty cycles should be expected to be very close to the energy duty cycles.

2. METHODOLOGY

This section discusses our approach for estimating the penetration level of LED traffic lights in the service territories of the IOUs. The study was conducted in three stages: (1) a baseline evaluation to determine energy usage by traffic signals in the absence of the LED technology, (2) an evaluation of the market potential of LED traffic signals, and (3) a market penetration/saturation analysis. The methods employed for conducting the analysis at each stage are presented below.

2.1 BASELINE ANALYSIS

This first stage of the Study estimates the baseline usage of traffic signals, i.e. the usage of traffic signals in the absence of any LED traffic signal program. To accomplish this task we relied on 1995 billing data, assuming that few or no LED traffic signals were installed in any of the IOU service territories at that time. Using all of the TC-1 and A-TC account data corresponding to traffic signals for PG&E and SCE, we calculated the average usage per account (intersection) during 1995:

$$\text{Average Intersection Usage in 1995} = \frac{\text{Total Intersection Usage in 1995}}{\text{Number of Intersections in 1995}}$$

Unfortunately, SDG&E's databases do not contain any billing data prior to 1998, so the 1995 billing data were not available. Consequently, we estimated the baseline usage for SDG&E to be equal to the *current* usage of their A-TC traffic signal accounts, *plus* the kWh impacts associated with LED measures implemented prior to the PY00-01 Summer Initiative.

Average SDG&E Intersection Usage in 1995 = Total Current Intersection Usage + Pre-2000 kWh Impacts

Using billing data for a year starting in Spring 2000 and ending in Spring 2001, we then determined the number of accounts (intersections) currently active in each of the IOU service territories. The number of current intersections, multiplied by the average intersection usage in 1995, provided the baseline usage of traffic signals.

1995 Baseline = Current Number of Intersections * Average Intersection Usage in 1995

This baseline usage represents the estimated usage of all current intersections, assuming that no signals were retrofitted. We estimate that the baseline usage for all intersections is 134.1 GWh/yr for PG&E, 176.8 GWh/yr for SCE, and 46.3 GWh/yr for SDG&E.

2.2 MARKET POTENTIAL OF LED TRAFFIC SIGNALS

To develop an estimate of the full potential of LED retrofits, we employed data from the 1997-98 PG&E Retrofit Express Study to determine the distribution of measures for an average intersection. We also relied on literature and secondary data sources to develop ex ante estimates for pre-retrofit wattage, post-retrofit wattage, average hourly duty cycles (or annual operating hours) and peak period duty cycles, for each measure covered by the LED programs. These data are presented in detail in Appendix A.

By using the average intersection data in conjunction with the pre- and post-wattage and duty cycle data by traffic signal type, we estimated that the technical potential associated with retrofitting all incandescent traffic signals with currently-available LED signals is 89% of baseline (see Exhibit 2.1). [2]

Exhibit 2.1
LED Traffic Signals Technical Potential Calculations – Average Intersection

Traffic Signal Type	Average Number of Signals	Pre Wattage	Post Wattage Nominal (@ 25°C)	Wattage Change	kWh Duty Cycle	Annual Baseline MWh	Annual Impact MWh
Red Signals							
Red Ball - 12 Inch	3.8	150	11	139	55%	2,746	2,545
Red Arrow - 12 Inch	2	150	9	141	80%	2,102	1,976
Red Ball - 8 Inch	7.7	69	8	61	55%	2,560	2,263
Yellow Signals							
Yellow Ball - 12 Inch	2.5	150	22	128	3%	99	84
Yellow Arrow - 12 Inch	0	150	11	139	3%	0	0
Yellow Ball - 8 Inch	9	69	13	56	3%	163	132
Green Signals							
Green Ball - 12 Inch	2.5	150	15	135	42%	1,380	1,242
Green Arrow - 12 Inch	2	150	11	139	20%	526	487
Green Ball - 8 Inch	9	69	12	57	42%	2,285	1,887
LED Yellow Flashing Beacon							
Yellow Flashing - 12 Inch	0.2	150	22	128	50%	133	113
Yellow Flashing - 8 Inch	0.1	69	13	56	50%	38	31
LED Pedestrian Signals							
Hand/Walking Person - Combo	4	69	9	60	90%	2,176	1,892
All Signals							
All	42.8					14,207	12,653
Technical Potential for LED Retrofits							**89%**

[2] To be clear, the technical potential corresponds to the savings that could be achieved relative to the 1995 baseline level of consumption developed in Section 2.1, prior to any LED retrofit activity. Furthermore, the 89% can be considered relatively conservative, as the distribution of 8" and 12" balls retrofitted statewide indicated that there may be a greater proportion of 12" balls. This would result in a slightly larger estimate of potential.

where

$$\text{Baseline MWh} = \text{Average Number of Signals} * \text{Pre Wattage}/10^6 * \text{kWh Duty Cycle} * 8760 \text{ h/year}$$

$$\text{Annual Impact MWh} = \text{Average Number of Signals} * \text{Wattage Change}/10^6 * \text{kWh Duty Cycle} * 8760 \text{ h/year}$$

and

$$\text{Technical Potential} = \frac{\text{Annual Impact MWh}}{\text{Baseline MWh}}$$

We recommend the use of a more conservative 80% technical potential, for the following reasons:

- Some traffic signals cannot be retrofitted (polarized traffic signals), or a retrofit is not cost-effective (most yellows, which have very long payback time).
- The wattage of LED traffic signals that have been retrofitted prior to PY2000 is slightly higher than the wattage of LED signals currently available.
- At high temperatures the connected load of LEDs can increase.
- Traffic signal accounts include additional loads (control boxes, street lighting sometimes), and these loads will not be reduced by retrofitting the signals.

2.3 MARKET PENETRATION/SATURATION OF LED TRAFFIC SIGNALS

To determine the current penetration or saturation of LED traffic signals, the current number of TC and/or A-TC accounts for each IOU was used in conjunction with the current usage per account to determine the total usage currently attributable to traffic signals. By dividing the total usage by the technical potential of LED traffic signal retrofits, we estimated the current LED saturation levels by IOU, as well as across all IOUs.

$$\text{Current LED Saturation Level} = \frac{\text{Total Current Intersection Usage}}{\text{Technical Potential of LED Retrofits}} \text{ ,OR}$$

$$\text{Current LED Saturation Level} = \frac{\text{Total Current Intersection Usage}}{80\% * \text{Total Intersection Usage in 1995}}$$

3. RESULTS

Based on the current billing data, we estimate that, in Spring/Summer 2001, the saturation level of LED traffic signals was 40% in PG&E territory, 10% in SCE territory, and 43% in SDG&E territory. The LED saturation level across the IOU territories was approximately 26% (see Exhibit 3.1).

Exhibit 3.1
LED Traffic Signal Saturation Analysis

	PG&E	SCE	SDG&E	All IOUs
Baseline Usage Calculation				
Pre-1995 Baseline Usage per Account (MWh/year/acct)	13.3	14.9	11.8	13.8
Current Number of Accounts	10,120	11,906	3,933	25,960
IOU Traffic Signal Baseline (MWh/year)	134,165	176,854	46,312	357,331
LED Traffic Light Saturation				
Potential Impact, Equal to 80% of Baseline (MWh/year)	107,332	141,483	37,050	285,865
Current Penetration Observed from Billing Data				
Current Number of Accounts	10,120	11,906	3,933	25,960
Current Usage per Account (MWh/year/acct)	9.0	13.6	7.7	10.9
Most Recent Bills (1 yr of data) (MWh)	91,058	162,487	30,462	284,007
% of Potential Impact Reflected in Most Recent Bills	40%	10%	43%	26%
Current Usage Projected Using Most Recent 3 Months of Data (MWh/year/acct)*	8.5	12.7	6.4	10.1
Current Bills Projected to 1-Year Period (MWh)	85,634	151,793	25,162	262,589
% of Potential Impact Projected Using Most Recent 3 Months of Billing Data	45%	18%	57%	33%
Achievements Claimed by pre-2001 Programs				
Measures Already Installed‡ (MWh)	45,926	19,122	19,633	84,680
% of Potential Impact Claimed by Pre-2001 Programs	43%	14%	53%	30%
Total Program Impacts and Achievements †				
Total Program Impacts Claimed (MWh/year)	94,006	102,285	37,050	233,341
% of Baseline Saved by Committed Projects	70%	58%	80%	65%
% of Potential Achieved by Committed Projects	88%	72%	100%	82%
% of Potential Remaining after all Committed Projects are Implemented	12%	28%	0%	18%
Total Program Impacts and Achievements Since PY2000				
Total Program Impacts Claimed (MWh/year)	48,081	102,285	21,200	171,565
% of Baseline Saved by Committed Projects	36%	58%	46%	48%
% of Potential Achieved by Committed Projects	45%	72%	57%	60%

* Based on TC/A-TC billing data from Spring 2001
- for PG&E: bills from February through April 2001
- for SCE: bills from March through May 2001
- for SDG&E: bills from April through June 2001

‡ Measures installed under Programs that would have been implemented before Spring 2001:
- for PG&E: the REO, PSP and SPC Programs
- for SCE: the SPC Programs, as well as 1/2 of the PY00 Summer Initiative
- for SDG&E: the PY97 and SPC Programs, as well as 1/4 of the PY00-01 Summer Initiative

† Program Achievements assume that all committed measures are installed

While analyzing the most current billing data, we observed that the usage per account has substantially decreased in the most recent months, probably as a result of the PY2000-2001 Summer Initiatives. By projecting the Spring 2001 data to a full year, the LED traffic signal penetration levels increase to 45% in PG&E territory, 18% in SCE territory, and 57% in SDG&E territory. LED traffic signal penetration across the IOUs is projected to 33%.

To confirm the penetration levels estimated using billing data, we developed a back-up estimate based on program accomplishments to date. We collected all available program tracking data associated with LED traffic signal initiatives from each of the IOUs and the CEC (see Exhibit 3.3). These data provided an estimate for program savings to date, and agree well with our billing estimates developed above. We do not believe there has been significant LED retrofit activity outside of these programs. It is interesting to note that, while more than half of the LED traffic light impacts in PG&E and SDG&E territories are due to pre-PY2000 programs, all of the impacts in SCE territory are due to the PY2000-2001 programs.

Finally, the IOU Program data provided an estimate for total expected program savings, assuming that all committed projects will be implemented. Using these data in conjunction with our saturation/penetration estimates, we estimated that the remaining market potential for LED traffic signals for 2002 and beyond is 12% in PG&E territory, 28% in SCE territory, and 0% in SDG&E territory (or 18% across the IOU territories). Exhibit 3.2 below illustrates the remaining market potential in the three IOU service territories.[3]

Exhibit 3.2
Remaining Market Potential for LED Traffic Signals

	PG&E	SCE	SDG&E	All IOUs
Remaining Potential After PY2000/2001 Programs - Percent	12%	28%	0%	18%
Remaining Potential After PY2000/2001 Programs - MWh/year	13,325	39,199	0	52,524
Remaining Potential After PY2000/2001 Programs - Coincident Peak kW	1,521	4,475	0	5,996

[3] The remaining coincident peak kW potential is estimated assuming that the coincident demand duty cycles are equal to the energy duty cycles.

Exhibit 3.3
LED Traffic Signal Program Summary

	PG&E Territory							SCE Territory					SDG&E Territory					ALL IOUs
	Program #1	Program #2	Program #3	Program #4	Program #5	Program #6	Total	Program #1	Program #2	Program #3	Program #4	Total	Program #1	Program #2	Program #3	Program #4	Total	
Utility	PG&E	PG&E	PG&E	PG&E	PG&E	CEC		SCE	SCE	SCE	CEC		SDG&E	SDG&E	SDG&E	CEC		
Program Year	PY97-98	PY98-99-00	PY99	PY00	PY01	PY01		PY98/PY00	PY00	PY01	PY01		PY97	PY98-99	PY01	PY01		
Program Name	REO	PSP	LNSPC	Sum. Init.	Sum. Init.	AB970		NSPC, LNSPC	Sum. Init.	Sum. Init.	AB970		LED Prog	NSPC, SBSPC	Sum. Init.	AB970		
Committed Rebate Amount ($)	$1,322,840	$5,105,138	$40,863	$12,685,013	$1,216,750	$55,760	$20,426,364	$153,406	$6,174,512	$4,601,246	$4,387,700	$15,316,864	$1,025,235	$33,649	$3,877,189	$1,717,890	$6,653,963	$42,397,191
Admin Cost ($)																		
# of Entities/Applications Received	59	62		87	37	3			34	63	20		17		25	3		
# of Intersections affected	2,493	2,387				27					2,723					1,426		
kW Committed/Paid	2,674	2,519	89	4,432	1,020	37	10,771	268	3,830	5,093	2,485	11,676	1,747	63	1,727	692	4,229	26,676
kWh Committed/Paid	23,431,755	21,710,863	783,082	38,822,825	8,936,024	321,812	94,006,360	2,347,560	33,548,336	44,618,929	21,769,991	102,284,816	15,302,018	548,158	15,130,402	6,069,269	37,049,847	233,341,023
$/kW Committed/Paid	$495	$2,027	$457	$2,862	$1,193	$1,499	$1,896	$572	$1,612	$903	$1,766	$1,312	$587	$538	$2,245	$2,483	$1,574	$1,589
Total # of Measures	41,141	38,357		98,968	23,933	905	203,304		60,259	80,767	67,827	208,853	23,437		33,785	19,621	76,843	489,000
$/Measure	$32	$133		$128	$51	$62	$100		$102	$57	$65	$73	$44		$115	$88	$87	$87
# of Committed/Paid Measures:																		
12" Red Ball	15,720	12,078		6,692	1,210	59	35,759		27,051	37,063	8,356	72,470	18,157		3,464	339	21,960	130,189
8" Red Ball	11,706	12,742		5,214	979	149	30,790				2,490	2,490			349	36	385	33,665
12" Red Arrow	6,520	5,159		2,640	630	20	14,969				2,904	2,904	5,280		1,292	153	6,725	24,598
8" Red Arrow						NA												
12" Flashing Red Beacon						NA												
8" Flashing Red Beacon						NA												
12" Amber Ball						58	58				9,146	9,146			814	514	1,328	10,532
8" Amber Ball						162	162				7,827	7,827			2	35	37	8,026
12" Amber Arrow			NA			20	20	NA			3,844	3,844		NA		295	295	4,159
12" Flashing Amber Beacon				1,060	222	0	1,282		224	3,792	699	4,715				13	13	6,010
8" Flashing Amber Beacon				582	215	0	797				200	200				0	0	997
12" Green Ball				34,507	6,627	59	41,193		29,537	33,270	12,874	75,681			14,738	11,978	26,716	143,590
8" Green Ball				24,989	6,657	149	31,795				9,223	9,223			3,199	1,423	4,622	45,640
12" Green Arrow		55		16,642	4,723	31	21,451				5,548	5,548			6,111	4,607	10,718	37,717
8" Green Arrow						NA									551		551	551
Pedestrian Hand only	7,195	8,323		1,877	1,051	0	18,446		998	615	1,473	3,086			226	0	226	21,758
Pedestrian Man only						NA												
Pedestrian Combo				4,765	1,619	198	6,582		2,449	6,027	3,243	11,719			3,039	228	3,267	21,568

APPENDIX A. TECHNICAL DATA

This section presents the ex ante estimates that we derived for the measures associated with the various LED Traffic Signal Programs offered statewide.

The ex ante estimates presented in Exhibits A.1-A.10 were developed using available literature and secondary data sources. These data sources included each of the IOUs Work Papers and Technical Documentation from their Applications and Advice Filings, PG&E's Pre-1998 CEEI Impact Evaluation[4]; PG&E's PSP Impact Evaluations; evaluations conducted by the CEC and Schiller Associates; studies conducted by CEE and ACEEE[5]; documentation from E-Source[6]; and manufacturer data. As part of the data gathering process, we have contacted each of the IOUs, the CEC, and Schiller Associates. We have also reviewed publications and papers from ACEEE, CEE, E-Source and manufacturers.

The key ex ante estimates that we collected are pre-retrofit wattage, post-retrofit wattage, average hourly duty cycles (or annual operating hours) and peak period duty cycles, for each measure covered by the LED programs. For each measures presented in Exhibits A.1-A.10, a recommended set of parameters is listed corresponding to the inputs that were used to develop the technical potential estimate provided in Exhibit 2-1.

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[4] Quantum Consulting, "Evaluation of Pacific Gas & Electric Company's pre-1998 Commercial Energy Efficiency Incentives Program Carry-Over: Traffic Signal Technologies", PG&E Study ID #404D, March 2000.

[5] Suozzo, M., "A Market Transformation Opportunity Assessment for LED Traffic Signals", ACEEE, Washington, DC, 1998.

[6] Houghton, D., "LED Traffic Lights – New Technology Signals Major Energy Savings", E-Source Tech Update #TU-94-1,Boulder, CO, 1994.

Exhibit A.1
Ex Ante Estimates for 12″ Red Balls

Measure data:	PG&E PSP	PG&E 2001	SCE 2001	SDG&E 2001	CEC 2001	Energy Star	ACEEE	E-Source	Schiller for PSP	Schiller, 2000	Recommended
Pre- wattage	150	150	136	136			150	150			150
Post-wattage	15	11	11	11	12	11	15	20			11
kW duty cycle	58%		100%								55%
kWh duty cycle	58%	55%	55%	55%	59%		55%	60%	51%	55%	55%
kW impact per unit	141										0.076
kWh impact per unit (per year)		670					650	683			670
Rebate per unit	$80	$30		$65/$32.50	$50						
Measure cost per unit	$125						$150	$230			

Exhibit A.2
Ex Ante Estimates for 12″ Red Arrows

Measure data:	PG&E PSP	PG&E 2001	SCE 2001	SDG&E 2001	CEC 2001	Energy Star	ACEEE	E-Source	Schiller for PSP	Schiller, 2000	Recommended
Pre- wattage	150	150		134			150	150			150
Post-wattage	10	9		9	10	9	9	9			9
kW duty cycle	84%										80%
kWh duty cycle	84%	80%		90%	81%		90%	90%	89%	88%	80%
kW impact per unit	142										0.113
kWh impact per unit (per year)		988					1,112	1,112			988
Rebate per unit	$80	$30		$65/$32.50	$50						
Measure cost per unit	$75						$75	$120			

Exhibit A.3
Ex Ante Estimates for 8″ Red Balls

Measure data:	PG&E PSP	PG&E 2001	SCE 2001	SDG&E 2001	CEC 2001	Energy Star	ACEEE	E-Source	Schiller for PSP	Schiller, 2000	Recommended
Pre- wattage	90	69	133	68			67	135			69
Post-wattage	10	8	8	8	9	8	10	15			8
kW duty cycle	58%		100%								55%
kWh duty cycle	58%	55%	55%	55%	59%		55%	60%			55%
kW impact per unit	84										0.034
kWh impact per unit (per year)		294					275	631			294
Rebate per unit	$64	$30		$65/$32.50	$40						
Measure cost per unit	$75							$200			

Exhibit A.4
Ex Ante Estimates for 12″ Green Balls

Measure data:	PG&E PSP	PG&E 2001	SCE 2001	SDG&E 2001	CEC 2001	Energy Star	ACEEE	E-Source	Schiller for PSP	Schiller, 2000	Recommended
Pre- wattage		150	140	136			150				150
Post-wattage		15	15	12	16	15	25				15
kW duty cycle			100%								42%
kWh duty cycle		42%	42%	42%	38%		42%				42%
kW impact per unit											0.057
kWh impact per unit (per year)		497					460				497
Rebate per unit		$80		$175/$87.50	$100						
Measure cost per unit							$375				

Exhibit A.5
Ex Ante Estimates for 12″ Green Arrows

Measure data:	PG&E PSP	PG&E 2001	SCE 2001	SDG&E 2001	CEC 2001	Energy Star	ACEEE	E-Source	Schiller for PSP	Schiller, 2000	Recommended
Pre- wattage	150	150		139			150				150
Post-wattage	5	11		13	12	11	12				11
kW duty cycle	unk										20%
kWh duty cycle	unk	20%		10%	16%		10%	7%			20%
kW impact per unit											0.028
kWh impact per unit (per year)		244					121				244
Rebate per unit	$80	$60		$175/$87.50	$70						
Measure cost per unit	$150						$150				

Exhibit A.6
Ex Ante Estimates for 8″ Green Balls

Measure data:	PG&E PSP	PG&E 2001	SCE 2001	SDG&E 2001	CEC 2001	Energy Star	ACEEE	E-Source	Schiller for PSP	Schiller, 2000	Recommended
Pre- wattage		69	137	70			67				69
Post-wattage		12	12	10	13	12	15				12
kW duty cycle			100%								42%
kWh duty cycle		42%	42%	42%	38%		42%	37%			42%
kW impact per unit											0.024
kWh impact per unit (per year)		210					191				210
Rebate per unit		$40		$175/$87.50	$80						
Measure cost per unit											

Exhibit A.7
Ex Ante Estimates for 12″ Flashing Amber Beacons

Measure data:	PG&E PSP	PG&E 2001	SCE 2001	SDG&E 2001	CEC 2001	Energy Star	ACEEE	E-Source	Schiller for PSP	Schiller, 2000	Recommended
Pre- wattage		150									150
Post-wattage		22		22	32						22
kW duty cycle											50%
kWh duty cycle		50%			50%						50%
kW impact per unit											0.064
kWh impact per unit (per year)		561									561
Rebate per unit		$60		$125/$62.50	$50						
Measure cost per unit											

Exhibit A.8
Ex Ante Estimates for 8″ Flashing Amber Beacons

Measure data:	PG&E PSP	PG&E 2001	SCE 2001	SDG&E 2001	CEC 2001	Energy Star	ACEEE	E-Source	Schiller for PSP	Schiller, 2000	Recommended
Pre- wattage		69									69
Post-wattage		13		13	16						13
kW duty cycle											50%
kWh duty cycle		50%			50%						50%
kW impact per unit											0.028
kWh impact per unit (per year)		245									245
Rebate per unit		$60		$125/$62.50	$50						
Measure cost per unit											

Exhibit A.9
Ex Ante Estimates for Pedestrian Hand

Measure data:	PG&E PSP	PG&E 2001	SCE 2001	SDG&E 2001	CEC 2001	Energy Star	ACEEE	E-Source	Schiller for PSP	Schiller, 2000	Recommended
Pre- wattage	69	69	135	121				67			69
Post-wattage	10	10	10	10	11	13		12			10
kW duty cycle	85%		100%								80%
kWh duty cycle	85%	80%	90%	100%	90%			75%	97%	99%	80%
kW impact per unit	61										0.047
kWh impact per unit (per year)		413						440			413
Rebate per unit	$72	$25		$70/$35	$25						
Measure cost per unit	$85							$150			

Exhibit A.10
Ex Ante Estimates for Pedestrian Hand/Man Combination

Measure data:	PG&E PSP	PG&E 2001	SCE 2001	SDG&E 2001	CEC 2001	Energy Star	ACEEE	E-Source	Schiller for PSP	Schiller, 2000	Recommended
Pre- wattage		69	134	133							69
Post-wattage		9	9	10	11						9
kW duty cycle			100%								90%
kWh duty cycle		90%	100%	100%	90%						90%
kW impact per unit											0.054
kWh impact per unit (per year)		473									473
Rebate per unit		$35			$70						
Measure cost per unit											