Evaluation, Measurement and Evaluation Study of

San Diego Gas & Electric Company's

2004-2005 LOCAL NONRESIDENTIAL RETROFIT CUSTOMER ENERGY SAVINGS BID PROGRAM – PROCUREMENT

Volume 2 of 2 (Appendix B)

Project-Specific M&V Reports

Final Report

Project ID No. 1320-04

CALMAC Study ID SDG0215.02

Prepared for

The California Public Utilities Commission

Prepared by

KEMA Inc.

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7. Appendix B: Individual M&V Reports

This appendix contains the M&V reports for each project. The reports are presented in the order of increasing ID Numbers.

Table 1. 2004-05 CESB Projects

ID No.	No. Sites	Type of Project	Type of Customer	Project Sponsor	NAICS	Measure Type	Measure Description
04-01-010	4	Aggregate	Single Customer	Self-Sponsor	921190, 921110, 921190, 624110	HVAC	HVAC (controls: Hartman loop, VFD)
04-01-017	1	Single Site	Single Customer	EESP	928110	HVAC, Lighting	Lighting: controls and occ sensors, HVAC: upgrades and controls; VFD's & Control Logic
04-01-018	2	Aggregate	Single Customer	Self-Sponsor	531121	Lighting	Lighting retrofit
04-01-028	4	Aggregate	Single Customer	Self-Sponsor	531121	Lighting	Lighting retrofit
04-02-001	1	Single Site		EESP	334111	HVAC	HVAC (central plant)
04-02-003	77	Aggregate	Multiple Customers	EESP	Various	Lighting	Lighting retrofit-high bay: HID to T8
04-02-004 & 04-02-024	28	Aggregate	Single Customer	EESP	611112 various govt	Other (vending miser)	Other: Vending Miser
04-02-007	23	Aggregate	Single Customer	EESP	611110	HVAC, Lighting	Lighting and HVAC
04-02-008	1	Single Site	Single Customer	EESP	928110	Compressed Air, HVAC	EMS, central plant, compressed air retrofit, chiller,Variable Volume
05-04-001	34	Aggregate	Single Customer	EESP	611112	HVAC, Lighting	Lighting, t-stat, HE a/c and h/p, VS control of pool pump
05-04-002	1	Single Site	Single Customer	Self-Sponsor	928110	Lighting	Lighting (High bay lighting HID to T5)
05-04-003	17	Aggregate	Multiple Customers	EESP	445110	Refrigeration, Lighting	Refrig: ASH control, multiplex compressor, night covers, oversized condenser, Floating head/suction pressure, ECM for evap fans. Lighting: T12-T8.
05-04-004	16	Aggregate	Multiple Customers	EESP	445110	Refrigeration, Lighting	Refrig: ASH control, multiplex compressor, night covers, oversized condenser, Floating head/suction pressure, ECM for evap fans,. Lighting: T12-T8.
05-04-006	13	Aggregate	Multiple Customers	EESP	Various	Lighting	Lighting retrofit: CFL replacement
05-05-001	28	Aggregate	Single Customer	Self-Sponsor	445110	Refrigeration	Refrig: ECM motors on evap fans
05-05-002	478	Aggregate	Multiple Customers	EESP	Various	HVAC, Lighting	HVAC: RCA and DTS, Lighting: CFL
05-05-004	1	Single Site		Self-Sponsor	531121	Lighting	Lighting retrofit

Table 1. 2004-05 CESB Projects (con't)

ID No.	No. Sites	Type of Project	Type of Customer	Project Sponsor	NAICS	Measure Type	Measure Description
05-05-006	9	Aggregate	Single Customer	Self-Sponsor	444110	Lighting	Lighting retrofit: HID to T5
05-05-007	1	Single Site	Single Customer	Self-Sponsor	531312	Lighting	Lighting retrofit
05-05-008	86	Aggregate	Multiple Customers	EESP	445110	Refrigeration, Lighting	Refrig: ASH control, multiplex compressor, night covers, oversized condenser, Floating head/suction pressure, ECM for evap fans,. Lighting: T12-T8.
05-06-001	1	Aggregate	Multiple Customers	EESP	424490	Refrigeration, Lighting	Lighting, refrigeration, and other
05-06-005	4	Aggregate	Single Customer	Self-Sponsor	453910	Lighting	Lighting retrofit
05-07-003	33	Aggregate	Multiple Customers	EESP	Various	Lighting	Lighting retrofit in parking garage: HID to T8
05-07-004	1	Single Site	Single Customer	Self-Sponsor	325412	HVAC	VFD CHW pump, condensing water pump, cooling tower spray pump, upgraded controls fo AH 1-4, 8,9 based on airflow
05-07-006	1	Single Site	Single Customer	Self-Sponsor	561920	HVAC	3 new chillers w/ VFD, over-sized heat exchangers;; VFD on CHW pumps, condensing water pumps and cooling tower fans
05-07-007	20	Aggregate	Single Customer	Self-Sponsor	448120	Lighting	Lighting retrofit
05-08-001	14	Aggregate	Multiple Customers	EESP	Various	Lighting	Lighting (8-ft T12 to 2L4-ft T8)
05-08-002	1	Single Site	Multiple Customers	EESP	445110	Refrigeration	Refrig: Cooler control system for evaporator fans, door heaters, scheduling. ECM motors, Remote Site Manager.
05-08-004	380	Aggregate	Multiple Customers	EESP	445110	Refrigeration	Strip curtains on commercial refrigeration coolers
05-08-005	1	Single Site		Self-Sponsor	541511	Lighting	Lighting control EMS and Lighting fixture retrofit
05-08-007	1	Single Site	Single Customer	Self-Sponsor	721110	HVAC	HVAC: repl 2 chillers w/ vfd, vfd, to CHW pumps. T-stats
05-08-010	18	Aggregate	Multiple Customers	EESP	Various	Lighting	Parking garage lighting HID to T8
04-02-002	4	Aggregate	Single Customer			Lighting	Lighting and HVAC
04-03-002	1	Single Site	Single Customer	EESP	611310	HVAC, Lighting	Lighting, HVAC controls, fans, VFDs (inlet vane to VFD)
05-06-004	1	Single Site		Self-Sponsor	721110	HVAC	HVAC: Hartman loop, VAV AH
05-07-002	1	Single Site	Single Customer	Self-Sponsor	312111	Refrigeration, Lighting	New condenser, floating head/suction pressure, improved system balance.
05-08-008	1	Single Site	Single Customer	Self-Sponsor	312111	Compressed Air	Compressed air system upgrade: variable speed air compressor, reduce artificial demand, stop idle eqmt

7.1 04-01-010 – HVAC: Hartman Loop, Controls, VFD

This project, 04-01-010, was an HVAC project where four (4) buildings of a local organization (Project Sponsor) were retrofit with upgraded chillers, pumps and control technologies.
The four buildings were:

(1) Site 1
(2) Site 2
(3) Site 3
(4) Site 4

Each building was retrofitted with a combination of the following measures:

(1) Install VFDs on all chillers
(2) Remove Primary Chilled Water Pumps or retrofit with VFDs
(3) Install VFDs on Condenser Water Pumps
(4) Install VFDs on Cooling Tower Fans
(5) Install a full variable speed chiller loop (HARTMAN Loop)
(6) Reprogram control strategies for chiller plant upgrades

Table 2. M&V Savings Summary – ID 04-01-010

Total Contracted kWh Savings	3,910,000
Total Reported / Invoiced kWh Savings	3,910,000
M&V Savings (kWh)	**2,354,008**
Percent of Reported kWh Savings	60%
Percent of Contracted kWh Savings	60%
Total Contracted kW Savings	551.0
Total Reported / Invoiced kW Savings	551.0
M&V Savings (kW)	**629.2**
Percent of Reported kW Savings	114%
Percent of Contracted kW Savings	114%

7.1.1 Project Overview

Table 3 through Table 6 show the modifications for each facility.

Table 3. Modifications at Site 1

Existing Equipment	Retrofit	Quantity
500-ton constant speed chiller	Install VFD	1
1000-ton constant speed chiller	Install VFD	2
50hp Condenser water pump, constant speed	Install VFD	4
20hp Primary pump, constant speed	Remove	1
40hp Primary pump, constant speed	Remove	2
Secondary pump, variable speed	No action	3

Table 4. Modifications at Site 2

Existing Equipment	Retrofit	Quantity
436-ton constant speed chiller	Install VFD	1
450-ton variable speed chiller	No action	1
40hp Condenser water pump, constant speed	Install VFD	1
10hp Primary pump, constant speed	Remove	3
50hp Secondary pump, variable speed	No action	2
25hp Cooling tower fan, constant speed	Install VFD	2

Table 5. Modifications at Site 3

Existing Equipment	Retrofit	Quantity
450-ton constant speed chiller	Install VFD	2
700-ton variable speed chiller	Install VFD	1
30hp Condenser water pump, constant speed	Install VFD	1
25hp Condenser water pump, constant speed	Install VFD	2
20hp Primary pump, constant speed	Remove	1
10hp Primary pump, constant speed	Remove	2
75hp Secondary pump, variable speed	No action	1
50hp Secondary pump, variable speed	No action	2
30hp Cooling tower fan, constant speed	Install VFD	3

Table 6. Modifications at Site 4

Existing Equipment	Retrofit	Quantity
450-ton constant speed chiller	Install VFD	1
300-ton variable speed chiller	Install new VFD	1
40hp Condenser water pump, constant speed	Install VFD	1
15hp Condenser water pump, constant speed	Install VFD	1
7.5hp Primary pump, constant speed	Install VFD	1
15hp Primary pump, constant speed	Install VFD	1
Secondary pump, variable speed	Install new VFD	6

7.1.1.1 HARTMAN Loop Technology

In essence, the Hartman loop attempts to control a chiller plant in such a way to minimize energy use. The Hartman loop accomplishes this with the removal of the normal Primary/Secondary chiller water loops and replaces it with an all variable speed chiller water loop as well as a new sensors and a control mechanism custom programmed for the specific plant. The Hartman loop technology controls the chiller variable speed drives as well as the

VSDs on the associated chilled water pumps, condenser water pumps and cooling tower fans for optimum performance. Savings attributed to the Hartman loop are captured in the trend data from the individual pieces of equipment and are not measured separately.

7.1.2 Measurement and Verification (M&V) Approach

The energy savings is calculated as the sum of the measured energy consumption of all the post-modification equipment subtracted from the sum of the measured or calculated energy consumption of the baseline equipment at the loads measured. The method for estimating the baseline and new equipment energy consumption is outlined below.

The methodology detailed below is based on trend data provided by the Project Sponsor for each building in question. Each building in question trended data for at least 45 days. Trend points included:

- Chiller kW (both on an individual chiller and system basis)
- Outside Air Temperature
- Chilled Water Supply and Return Temperatures
- Condenser Water Supply and Return Temperatures
- Chilled Water Pump kW
- Condenser Water Pump kW
- Cooling Tower Fan kW

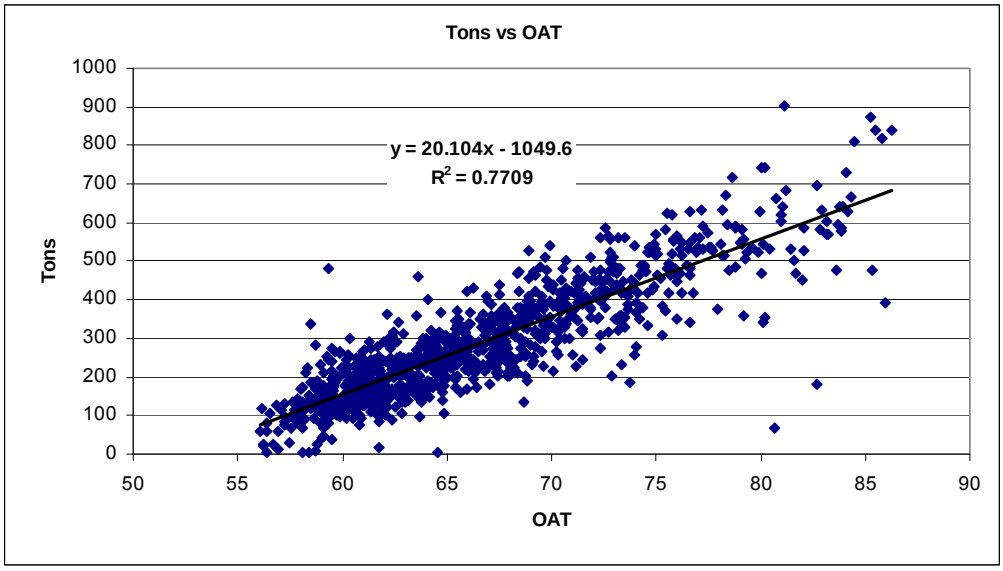
The load impact estimation methodology complies with IPMVP Option A.

7.1.2.1 Ton-Hour Profiles

The annual ton-hour profiles were calculated based on a ton-hour profile compiled from post-installation trend data. A correlation between outside air temperature and tons was developed for each site. The monitoring period data was extrapolated to an annual ton-hour profile using this relationship and a typical meteorological year. The average daily temperature for each day

of a Typical Meteorological Year (TMY)[1] was obtained for Climate Zone 7 (San Diego). Figure 1 shows and example of the correlation for one facility.

Figure 1. Annual Ton-Hour Profile



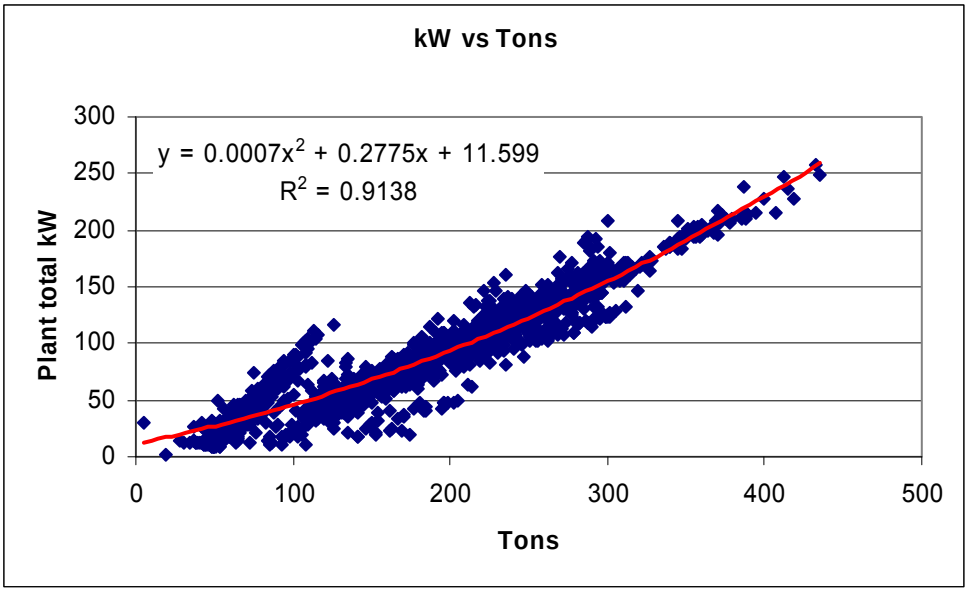
7.1.2.2 New Chiller Plant Energy Consumption

The total plant energy consumption, including chillers, pumps, and cooling towers, was trended. The data was annualized based on the relationship between kWh and tons developed from the data. This correlation was applied to the annual ton-hour profile to estimate the total energy consumption for a year.

Figure 2 shows a sample calculated whole plant performance curve from the Site 4 facility. Trend data supplied by the Project Sponsor was analyzed and for each building a plant performance curve was created. With plant kW calculated in this manner, the need to capture each individual pump and chiller profile is not necessary. Using the annual ton-hour profile, the calculated performance curve was used in conjunction with TMY data to estimate the annual performance of the new equipment.

[1] TMY data are published by ASHRAE and use 30-year averages to represent typical weather data for specific locales. This is appropriate for annualizing the savings since the savings will be anticipated for more than for the first year.

Figure 2. Calculated Whole Plan Performance Curve



7.1.2.3 Baseline Energy Consumption

Pre-retrofit data was not available for any of the facilities. Therefore, the baseline chiller plant energy consumption was estimated for each piece of equipment in the existing plant and summed to get the estimate of the entire chiller plant baseline energy consumption.

7.1.2.3.1 Baseline Chillers

The baseline, constant speed or variable speed depending on the existing equipment, chiller energy consumption was developed by applying a performance curve from supporting reference materials to the annual ton-hour profile developed described above. The ton-hour profile was the same for the baseline and retrofitted facilities. Nameplate data and supporting chiller reference information was used because baseline measurement of the original chiller was not obtained due to the timing of the project. Some chillers had VFDs prior to the retrofits. For these chillers that were not modified trend data was available showing kW vs. tons for the chillers. This was used to estimate the performance curve of these chillers. The baseline performance curves for constant speed chillers modified with VFDs was either supplied by the Project Sponsor from the original manufactures data or a standard chiller curve was used. Where original performance data available the chillers were derated by a factor of 1.2 to account for degradation. The sequence of operation was supplied by the Project Sponsor for

each chiller plant. The number of chillers on-line was assumed to follow the ton-hour profile and the sequence of operation. It is possible that inefficiencies occurred in the actual staging and operation that was unable to be accounted for in the M&V effort.

7.1.2.3.2 Baseline Pumping

The sequence of operations for the primary and condenser pumping was straight-forward. Each chiller had an associated primary chilled water and condenser water pump. When the chiller was on the associated primary chilled water pump and condenser water pump was running. Based on the reported horsepower of the pumps the energy consumption was calculated for each hour the associated baseline chiller was assumed on using the methodology described above.

The secondary chilled water pumps were all variable speed. The speed of the pumps was assumed to follow the load factor of the plant. The energy consumption was estimated using the pump horsepower and the affinity laws which apply to variable speed applications. For example, if the cooling load for a given hour was 70% of the chiller plant capacity (in tons) the secondary chilled water pumps were assumed to be operating at 70% speed.

The cooling towers were also assumed to stage similar to the chillers. If the facility load required one chiller then one of the cooling towers was assumed running. The fan energy was calculated based on the reported horsepower of the pumps.

An example of the analysis is shown in the appendix.

7.1.3 Results

The Measurement and Verification of savings achieved by this project results in an estimate of 2,354,008 kWh annual savings and 629.24 kW of peak demand reduction. This is 60% and 114% of the contracted savings respectively. The contracted savings of 3,910,000 kWh per year is not being achieved mainly because the existing chiller plant efficiencies were better than estimated. The M&V results compared with the contracted savings for each facility is shown Table 7.

Table 7. M&V and Predicted Savings

Building	M&V kWh Savings	Predicted kWh Savings		M&V kW Savings	Predicted kW Savings	
Site 1	1,370,926	1,700,000	81%	621.24	194.00	320%
Site 2	217,024	612,000	35%	8.00	175.00	5%
Site 3	528,637	1,088,000	49%	0.00	124.00	0%
Site 4	237,421	510,000	47%	0.00	58.00	0%
Total	2,354,008	3,910,000	60%	629.24	551.00	114%

Table 8. Pre Retrofit Usage Profiles

Building	Predicted Ton-hours	M&V Ton-hours	% of Predicted	Predicted Base Plant kW/ton	M&V Base Plant kW/ton	Predicted Final kW/ton	M&V Final kW/ton
Site 1	3,400,000	4,034,362	119%	1.10	0.92	0.60	0.58
Site 2	1,224,000	973,692	80%	1.10	0.83	0.60	0.61
Site 3	2,176,000	2,194,852	101%	1.10	0.77	0.60	0.53
Site 4	1,020,000	1,156,467	113%	1.10	0.79	0.60	0.58

Table 8 compares the M&V and predicted ton-hour profiles and plant efficiencies. The comparison shows that the initial estimates of total ton-hours for each facility were fairly accurate. However, based on performance information gathered about the pre-existing equipment, the energy usage for the base-case was overestimated, especially in the case of the Site 2, Site 3, and Site 4. This is due to the assumption that base-case chiller plants were operating at an average of 1.10 kW/ton. This, in fact, was not the case as several of the facilities already had functional variable-speed chillers and energy reduction practices in place.

All post-retrofit plants are operating at the specified efficiency or better and that the installations were of good quality, are not malfunctioning, and are providing real energy savings. The comparison of base-case efficiencies show that the original plants were operating at a better efficiency than was predicted and that while the upgrades are reducing energy usage, the predicted savings were over-estimated. Trend data was unavailable for the base-case conditions in any of the four facilities and was calculated from nameplate, mechanical inventory data, and stated sequence of operation. Actual inefficiencies due to poor chiller and pump staging are not captured here. Given that no pre-retrofit data was available the M&V is not able to account for such inefficiencies.

Figure 3. Chiller Plant Energy Use Spectrum

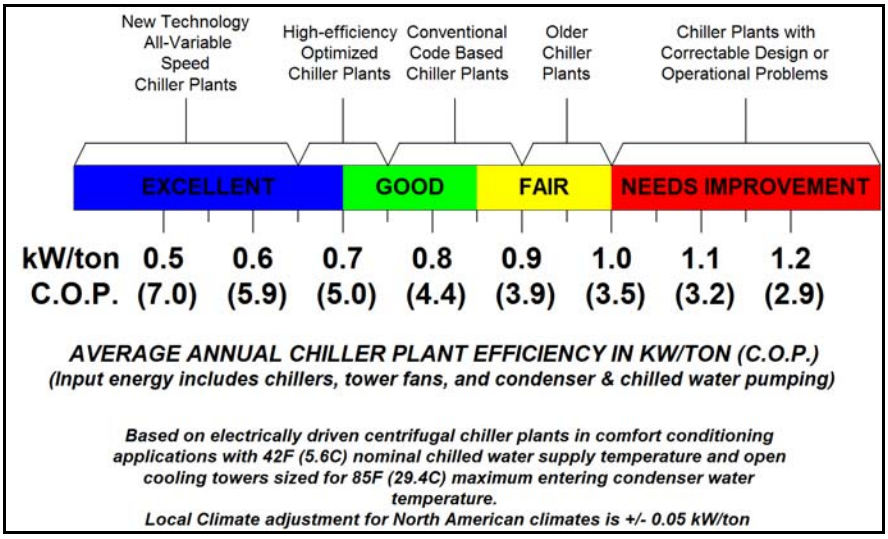


Figure 3 was provided by the San Diego Regional Energy Office and shows a spectrum of plant kW/ton averages with various levels of technology and maintenance. It shows that a plant operating at 1.1 kW/ton, as was assumed in the base-case for the Project Sponsor's project, is either an ill-maintained older chiller plant, or a plant with serious flaws in operation or design. Data provided by the Project Sponsor does not support a base-case in which the chiller plant is old or had serious problems. As was mentioned above, several of the facilities had existing variable speed chillers with conventional primary-secondary loops. The M&V estimates these facilities to operate at between 0.7 and 0.8 kW per ton, which supports Figure 3.

Sample of the Hourly Analysis

							New	Base										Savings
Month	Day	Hour	Date	Day	Avg TMY DBT	Avg Tons	New Plant kWh	CH1 Tons	CH2 Tons	CH1 kWh	CH2 kWh	Prim Pump kWh	CDW Pump kWh	Sec Pump kWh	CT Fan kWh	Base kW/ton	Base kWh/day	kWh Savings
7	16	1	7/16/2007	weekday	62	190.2	81.54	190	0	67	0	7.5	29.8	8.7	18.7	0.691	131	49.87
7	16	2	7/16/2007	weekday	61	179.1	75.22	179	0	63	0	7.5	29.8	8.7	18.7	0.711	127	52.14
7	16	3	7/16/2007	weekday	60	168.1	69.22	168	0	59	0	7.5	29.8	8.7	18.7	0.735	124	54.33
7	16	4	7/16/2007	weekday	57	134.8	53.14	135	0	49	0	7.5	29.8	8.7	18.7	0.843	114	60.46
7	16	5	7/16/2007	weekday	57	134.8	53.14	135	0	49	0	7.5	29.8	8.7	18.7	0.843	114	60.46
7	16	6	7/16/2007	weekday	56	0.0	0.00	0	0	0	0	0.0	0.0	0.0	0.0		0	0.00
7	16	7	7/16/2007	weekday	61	179.1	75.22	179	0	63	0	7.5	29.8	8.7	18.7	0.711	127	52.14
7	16	8	7/16/2007	weekday	69	267.9	134.75	268	0	102	0	7.5	29.8	10.0	18.7	0.627	168	33.26
7	16	9	7/16/2007	weekday	73	312.3	172.20	312	0	128	0	7.5	29.8	15.2	18.7	0.636	199	26.53
7	16	10	7/16/2007	weekday	77	356.7	214.77	357	0	157	0	7.5	29.8	21.7	18.7	0.658	235	20.01
7	16	11	7/16/2007	weekday	80	390.0	250.07	390	0	182	0	7.5	29.8	27.6	18.7	0.681	265	15.36
7	16	12	7/16/2007	weekday	85	445.5	315.29	10	436	31	397	14.9	59.7	53.5	37.3	1.332	594	278.21
7	16	13	7/16/2007	weekday	85	445.5	315.29	10	436	31	397	14.9	59.7	53.5	37.3	1.332	594	278.21
7	16	14	7/16/2007	weekday	92	523.2	420.06	87	436	39	397	14.9	59.7	53.5	37.3	1.148	601	180.64
7	16	15	7/16/2007	weekday	91	512.1	404.13	76	436	37	397	14.9	59.7	53.5	37.3	1.170	599	194.80
7	16	16	7/16/2007	weekday	89	489.9	373.24	54	436	34	397	14.9	59.7	53.5	37.3	1.217	596	222.90
7	16	17	7/16/2007	weekday	85	445.5	315.29	10	436	31	397	14.9	59.7	53.5	37.3	1.332	594	278.21
7	16	18	7/16/2007	weekday	82	412.2	275.20	412	0	200	0	7.5	29.8	32.1	18.7	0.698	288	12.40
7	16	19	7/16/2007	weekday	77	0.0	0.00	0	0	0	0	0.0	0.0	0.0	0.0		0	0.00
7	16	20	7/16/2007	weekday	73	0.0	0.00	0	0	0	0	0.0	0.0	0.0	0.0		0	0.00
7	16	21	7/16/2007	weekday	69	0.0	0.00	0	0	0	0	0.0	0.0	0.0	0.0		0	0.00
7	16	22	7/16/2007	weekday	67	0.0	0.00	0	0	0	0	0.0	0.0	0.0	0.0		0	0.00
7	16	23	7/16/2007	weekday	65	0.0	0.00	0	0	0	0	0.0	0.0	0.0	0.0		0	0.00
7	16	24	7/16/2007	weekday	64	0.0	0.00	0	0	0	0	0.0	0.0	0.0	0.0		0	0.00

7.2 04-01-017 – HVAC: Upgrades, Controls, VFDs, Lighting Controls

This was a self-M&V. The verified savings results shown in Table 9 reflects a review of the M&V performed by the Project Sponsor. This project comprises a total of 11 measures, some of which were combined for M&V purposes.

Several measures where savings were claimed were given no verified savings for the following reasons: (1) as shown in Table 9 the savings for Measure 2, AHU Control Sequence & Scheduling Upgrades were included in the savings for Measures 1 and 10; (2) the savings for Measure 4, also AHU Control Sequence & Scheduling Upgrades, were included in the savings for Measure 3; (3) no M&V report was produced for Measure 7, New Air Handler to Replace Existing Constant Air Volume Units.; (4) the methodology used to calculate kW reduction for Measures 5 and 8, Lighting Control Systems, was not in the M&V report, thus, these verified impacts were zero.

Table 9. Verified Energy Savings For Entire Project

			Claimed Savings			Verified Savings			
Msr #	Section & Measure Description	Bldg	kWh	kW	Therms	kWh	kW	Therms	Notes
1	7.1.1. Convert Constant Volume Air Handling Units to Variable Air Volume Operation	Bldg 2	321,554	0	14,445	321,554	0	14,445	
2	AHU Control Sequence & Scheduling Upgrades	Bldg 2	43,094	0	1,120	0	0	0	Savings Included in Measures 1 & 10
3	7.1.2. Convert Constant Air Volume Air Handling Units to Variable Air Volume Operation & Replace Inlet Vanes with VFD	Bldg 1	499,289	0	34,056	499,289	0	34,056	
4	AHU Control Sequence & Scheduling Upgrades		60,012	0	3,406	0	0	0	Savings included in Measure 3
5	7.1.4. Lighting Control System	Bldg 1	788,988	143.2	0	617,986	0	0	No M&V for kW reduced.
6	7.1.5. Occupancy Lighting Controls	Bldg 1	220,387	0	0	220,387	0	0	
7	New AH 34 to replace existing CAV AHUs		86,692	0	0	0	0	0	No M&V
8	7.1.5. Replace DX with CHW CRAC	Bldg 1	55,077	0	0	55,077	0	0	
9	7.1.6. Lighting Control System	Bldg 2	572,094	103.5	0	572,094	0	0	No M&V for kW reduced.
10	7.1.1. Replace Inlet Guide Vanes with VFD	Bldg 2	298,906	0	5,600	298,906	0	5,600	
11	7.1.6. Occupancy Lighting Controls	Bldg 2	118,018	0	0	118,018	0	0	
Total			**3,064,111**	**246.7**	**58,627**	**2,703,311**	**0**	**54,101**	

7.2.1 Measure 1: Convert Constant Air Volume Air Handling Units to Variable Air Volume Operation

The Project Sponsor has completed the proposed retrofits at the Customer's facility in San Diego. The project consisted of retrofitting twelve (12) constant air volume (CAV) air handling units (AHU) to variable air volume (VAV) operation. The affected equipment is shown in Table 10. The retrofit included the installation of variable frequency drives (VFD) to both the supply and return fans and VAV boxes at the zones for each affected AHU. Additionally the existing Project Sponsor's building automation system (BAS) was upgraded as part of this project.

Table 10. Affected Equipment

Equipment ID	Supply Fan HP	Return Fan HP	CFM
AH-4	10	5	9,985
AH-5	5	3	3,200
AH-10	7.5	2	7,300
AH-14B	7.5	3	8,240
AH-14A	7.5	3	8,240
AH-18A	10	5	11,200
AH-18B	10	5	11,200
AH-19A	5	3	8,000
AH-20	10	3	8,750
AH-21	10	3	9,430
AH-22	10	3	10,000
AH-24	7.5	3	6,000

The verified energy savings summary is shown in Table 11. There was no demand savings associated with this project.

Table 11. Verified Energy Savings Summary

Estimated Savings kWh	Verified Savings KWh	Percent Difference
284,239	321,554	13.1%

** Savings are based on fan energy savings only*

7.2.1.1 Savings Calculations

7.2.1.1.1 Baseline Energy

The baseline energy is calculated using the instantaneous power measurement of the baseline supply and return fan motors shown in Table 12.

Table 12. Instantaneous kW Measurement

Load Description	Equip ID	Hp	Power kW	Power Factor	Amps	Voltage
Supply Fan	AHU-4	10	4.14	0.67	17.73	201.4
Return Fan	AHU-4	5	1.83	0.73	7.22	200.7
Supply Fan	AHU-5	5	1.36	0.68	5.64	204.6
Return Fan	AHU-5	3	0.60	0.69	2.44	204.4
Supply Fan	AHU-10	7.5	3.84	0.85	12.63	206.5
Return Fan	AHU-10	2	0.87	0.63	3.87	206.5
Supply Fan	AHU-14A	7.5	4.78	0.60	22.52	204.1
Return Fan	AHU-14A	3	1.19	0.71	4.75	204.3
Supply Fan	AHU-14B	7.5	4.76	0.54	24.97	203.9
Return Fan	AHU-14B	3	1.26	0.75	4.75	204.7
Supply Fan	AHU-18A	10	4.61	0.67	19.80	200.7
Return Fan	AHU-18A	5	1.11	0.55	6.00	200.6
Supply Fan	AHU-18B	10	4.72	0.72	18.84	200.7
Return Fan	AHU-18B	5	1.62	0.80	5.77	202.3
Supply Fan	AHU-19A	5	3.40	0.86	11.43	199.8
Return Fan	AHU-19A	3	1.17	0.85	3.98	200.0
Supply Fan	AHU-20	10	4.20	0.80	15.01	201.9
Return Fan	AHU-20	3	1.16	0.72	4.63	201.5
Supply Fan	AHU-21	10	4.31	0.79	15.59	201.9
Return Fan	AHU-21	3	1.11	0.71	4.49	201.5
Supply Fan	AHU-22	10	4.65	0.71	18.80	201.2
Return Fan	AHU-22	3	1.19	0.62	5.52	201.3
Supply Fan	AHU-24	7.5	3.22	0.83	10.81	207.1
Return Fan	AHU-24	3	1.33	0.83	4.46	207.1

Additionally, current (amperage) data loggers were installed on the fan motors to measure and verify run times. The sample of fan motors are used as a representative sample of the fan motors located in the facility. The logged data shows that most AHU were continuously operating and others were scheduled. The baseline annual run hours are based on the average run time of the logged fan motors and extrapolated for the year. The logged data is summarized in Table 13.

Table 13. Logged Data Summary

Equipment ID	AHU-4	AHU-5	AHU-14A	AHU-21
Analysis Period	12/21/05 to 1/27/06	12/21/05 to 1/27/06	12/21/05 to 1/27/06	12/21/05 to 1/27/06
Monitored Hours	888.5	888.7	886.3	886.9
Supply Fan Hours	8760.0	8760.0	3640.0	8760.0
Return Fan Hours	8760.0	8760.0	3640.0	8760.0

**Average annual run time is 7,480 hours per year*

The annual baseline energy consumption is calculated using the spot measurements in Table 12 and the run times that were summarized in Table 13. The baseline energy is calculated using the following equation.

Equation for Baseline Energy:

$$kWh_{baseline} = Fan\ kW_{avg} * Annual\ Hours$$

where:

$kWh_{baseline}$	Annual baseline energy, kWh per year
Fan kW_{avg}	Baseline spot power measurement, kW
Annual Hours	Annual operating hours, hours per year

The annual baseline energy consumption is calculated and summarized in Table 14.

Table 14. Baseline Energy

AHU	Equipment	HP	Average kW	Annual Run Hour	Annual kWh
4	Supply Fan	10	4.14	7,480	30,995
4	Return Fan	5	1.83	7,480	13,704
5	Supply Fan	5	1.36	7,480	10,166
5	Return Fan	3	0.60	7,480	4,458
10	Supply Fan	7.5	3.84	7,480	28,720
10	Return Fan	2	0.87	7,480	6,523
14A	Supply Fan	7.5	4.78	7,480	35,728
14A	Return Fan	3	1.19	7,480	8,926
14B	Supply Fan	7.5	4.76	7,480	35,619
14B	Return Fan	3	1.26	7,480	9,448
18A	Supply Fan	10	4.61	7,480	34,493
18A	Return Fan	5	1.11	7,480	8,303
18B	Supply Fan	10	4.72	7,480	35,270
18B	Return Fan	5	1.62	7,480	12,098
19A	Supply Fan	5	3.40	7,480	25,444
19A	Return Fan	3	1.17	7,480	8,766
20	Supply Fan	10	4.20	7,480	31,409
20	Return Fan	3	1.16	7,480	8,702
21	Supply Fan	10	4.31	7,480	32,215
21	Return Fan	3	1.11	7,480	8,322
22	Supply Fan	10	4.65	7,480	34,793
22	Return Fan	3	1.19	7,480	8,925
24	Supply Fan	7.5	3.22	7,480	24,073
24	Return Fan	3	1.33	7,480	9,932
			22.65		**467,034**

7.2.1.1.2 Post-Installation Energy

The post-installation consumption is based on trended data from the building automation system (BAS) collected from 09/24/07 to 10/14/07 of AHU 14A, 14B, 18A and 18B. Trended data included 15-minute interval data of frequency drive output on the supply and return fan. The percent of full speed and resulting air flow is then calculated. The hourly average weekday and weekend percent of full flow was calculated. We use this air flow profile and apply it to remaining air handling units AHU-4, 5, 10, 19A, 20, 21, 22, and 24. The weekday and weekend profile is used to represent a typical day. The resulting post-installation energy use was then calculated using the following equation:

Equation 1:

$$kW_2 = \left(\frac{CFM_2}{CFM_1}\right)^3 * kW_1$$

Equation 2:

$$kWh_i = \sum_{i=0}^{24} \mathrm{kW}_i$$

7.2.2 Measure 3: Convert Constant Air Volume Air Handling Units to Variable Air Volume Operation & Replace Inlet Guide Vanes with Variable

The project consisted of two retrofits:

1. Retrofitting constant air volume (CAV) air handling units (AHU) to a variable air volume (VAV) operation
2. Replacing existing inlet guide vanes (IGV) with variable frequency drives (VFDs).

Four (4) CAV AHUs were converted to VAV operation and are identified in the Table 15. The retrofit included the installation of variable frequency drives (VFD) to both the supply and return fans and VAV boxes at the zones for each affected AHU. Additionally the existing the Project Manager's existing building automation system (BAS) was upgraded as part of this project.

Table 15. Affected Equipment – CAV to VAV

Equipment ID	Supply Fan HP	Return Fan HP	Baseline CFM
AH-13	5	2	7,303
AH-14	5	2	7,503
AH-16	5	2	4,852
AH-24	5	1	3,697

Nine (9) AHUs equipped with inlet guide vanes were removed and replaced with VFDs to control the supply and return fans on the AHUs. The retrofit also included upgrades to the existing EMCS to accommodate the VFDs. The affected equipment is shown in Table 16.

Table 16. Affected Equipment – IGV to VFD

Equipment ID	Supply Fan HP	Return Fan HP	Baseline CFM
AHU-3	25	7.5	17,908
AHU-4	25	7.5	17,908
AHU-5	15	5	15,307
AHU-6	15	5	13,306
AHU-7	15	7.5	18,208
AHU-8	15	5	14,006
AHU-9	15	5	18,708
AHU-10	15	7.5	10,000
AHU-12	15	5	16,307

The verified energy savings summary is shown in Table 17.

Table 17. Verified Energy Savings Summary

Estimated Savings kWh	Verified Savings KWh	Percent Difference
330,067	499,299	51.3%

** Savings are based on fan energy savings only*

7.2.2.1 Savings Calculations

7.2.2.1.1 Baseline Energy

The baseline energy is calculated using the instantaneous power measurement of the baseline supply and return fan motors shown in Table 18 and Table 19, respectively.

Table 18. Instantaneous kW Measurement (CAV to VAV)

Load Description	Equip ID	Hp	Power	Power Factor	Amps	Voltage
Supply Fan	AHU-13	5	3.19	0.85	10.73	198.9
Return Fan	AHU-13	2	0.87	0.64	3.43	198.7
Supply Fan	AHU-14	5	3.19	0.86	10.95	197.7
Return Fan	AHU-14	2	0.79	0.69	3.63	197.4
Supply Fan	AHU-16	5	3.12	0.85	10.36	206.4
Return Fan	AHU-16	2	1.60	0.88	5.49	206.2
Supply Fan	AHU-24	5	2.62	0.83	9.30	209.3
Return Fan	AHU-24	1	1.05	0.76	3.83	210.4

Table 19. Instantaneous kW Measurement (IGV to VFD)

Load Description	Equip ID	Hp	Power	Power Factor	Amps	Voltage
Supply Fan	AHU-5	15.0	3.19	0.46	20.36	196.1
Return Fan	AHU-5	5.0	1.25	0.61	5.92	196.1
Supply Fan	AHU-6	15.0	3.17	0.40	19.76	196.1
Return Fan	AHU-6	5.0	1.83	0.72	7.45	196.4
Supply Fan	AHU-7	15.0	4.86	0.62	22.80	195.4
Return Fan	AHU-7	7.5	2.59	0.62	12.10	195.5
Supply Fan	AHU-8	15.0	2.41	0.42	18.00	194.6
Return Fan	AHU-8	5.0	1.20	0.58	5.30	195.1
Supply Fan	AHU-9	15.0	2.75	0.49	14.75	194.3
Return Fan	AHU-9	5.0	0.79	0.46	5.06	194.1
Supply Fan	AHU-10	15.0	3.59	0.46	22.17	203.5
Return Fan	AHU-10	7.5	1.13	0.29	9.93	203.8
Supply Fan	AHU-12	15.0	2.77	0.39	20.90	195.1
Return Fan	AHU-12	5.0	1.24	0.60	5.96	195.1

Additionally, current (amperage) data loggers were installed on the fan motors to measure and verify run times. The sample of fan motors are used as a representative sample of the fan motors located in Building 1. The logged data shows that some AHUs are continuously operating and others are scheduled to operate five days a week. However, for energy savings calculations, we have assumed that the four constant volume AHUs were scheduled. The logged data is summarized in Table 20.

Table 20. Logged Data Summary

Equipment ID	AHU-3	AHU-4	AHU-9	AHU-10
Monitored Period	12/16/05 to 1/27/06	12/16/05 to 1/26/06	12/16/05 to 1/27/06	12/21/05 to 1/27/06
Monitored Hours	982	982	1002.167	1002.75
Supply Fan Hours	8760	8760	4 AM to 8 PM	4 AM to 8 PM
Return Fan Hours	8760	8760	4 AM to 8 PM	4 AM to 8 PM

Note: AHU 9 and 10 operate 5 days a week

The annual baseline energy consumption for the CAV to VAV retrofit is calculated using the spot measurements and the run times that was determined using logged data. The baseline energy is calculated using the following equation.

Equation for Baseline Energy (CAV to VAV):

$$kWh_{baseline} = Fan\ kW_{avg} * Annual\ Hours$$

where:

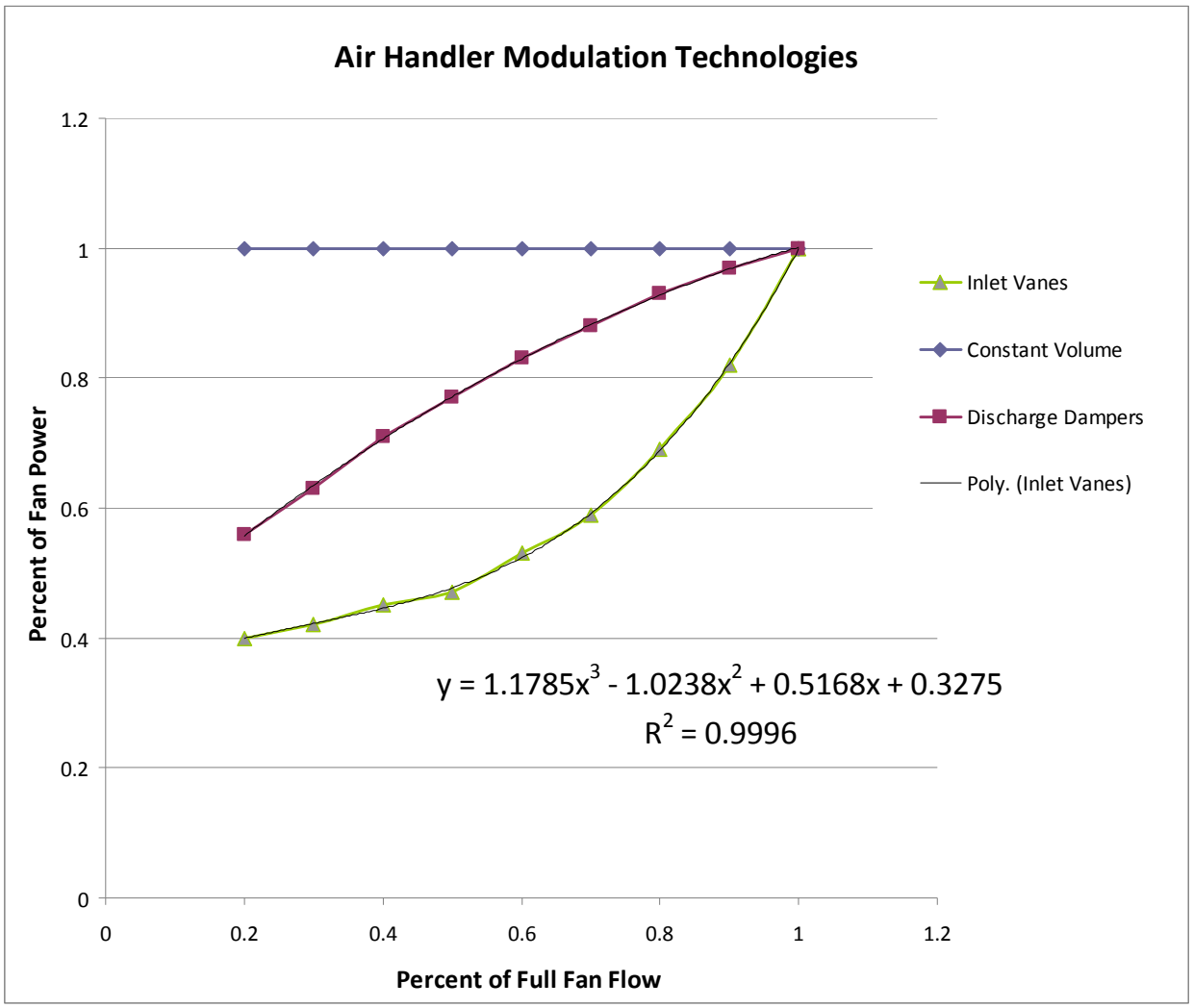
$kWh_{baseline}$ = Annual baseline energy, kWh per year

Fan kW_{avg} = Baseline spot power measurement, kW

Annual Hours = Annual operating hours, hours per year

The baseline energy consumption for the IGV is calculated using the post-installation hourly air flow (CFM) data. The percent of full flow is calculated based on the trended data collected from 3/2/07 to 3/16/07 of AHU 3 and 12. The hourly profile is calculated for a weekday and weekend. This hourly profile is used to represent a typical day. Using a performance curve for an inlet vane fan, a third order polynomial curve fit is generated and shown in Figure 4.

Figure 4. Air Handler Performance Curves



Using the results of the curve fit, the fan power is calculated for a given flow. The baseline energy consumption is calculated using the following equation for a typical day and then extrapolated for the year.

$$kWH_{baseline} = \sum_{i=0}^{24} (1.18 * CFM_i^3 - 1.02 * CFM_i^2 + 0.517 * CFM_i + 0.328) * kW$$

where:

$kWh_{baseline}$	Annual baseline energy, kWh per year
CFM	Percent of full fan air flow
kW	Power at full load

The annual baseline energy consumption is calculated and summarized in the tables below.

Table 21. Baseline Energy (CAV to VAV)

AHU	Equipment	Fan HP	Average kW	Annual Run Hour[1]	Annual kWh
13	Supply Fan	5	3.19	4,160	13,270
13	Return Fan	2	0.87	4,160	3,619
14	Supply Fan	5	3.19	4,160	13,270
14	Return Fan	2	0.79	4,160	3,286
16	Supply Fan	5	3.12	4,160	12,979
16	Return Fan	2	1.60	4,160	6,656
24	Supply Fan	5	2.62	4,160	10,899
24	Return Fan	1	1.05	4,160	4,368
	Total		**16.43**		**68,349**

Table 22. Baseline Energy (IGV to VFD)

Equip ID	Supply Fan Hp	Return Fan HP	Baseline kWh
AHU-3	25.0	7.5	100,421
AHU-4	25.0	7.5	100,421
AHU-5	15.0	5.0	43,640
AHU-6	15.0	5.0	43,640
AHU-7	15.0	7.5	48,346
AHU-8	15.0	5.0	48,346
AHU-9	15.0	5.0	48,346
AHU-10	15.0	7.5	48,346
AHU-12	15.0	5.0	48,346
			529,853

7.2.2.1.2 Post-Installation Energy

CAV to VAV The post-installation consumption is based on trended data from the building automation system (BAS) collected from 07/09/07 to 07/14/07 of AHU-24. Trended data included 15-minute interval data of frequency drive output on the supply and return fan. The percent of full speed and resulting air flow is then calculated. The hourly average weekday and weekend percent of full flow was calculated. We use this air flow profile and apply it to remaining air handling units AHU-13, 14 and 16. The weekday and weekend profile is used to

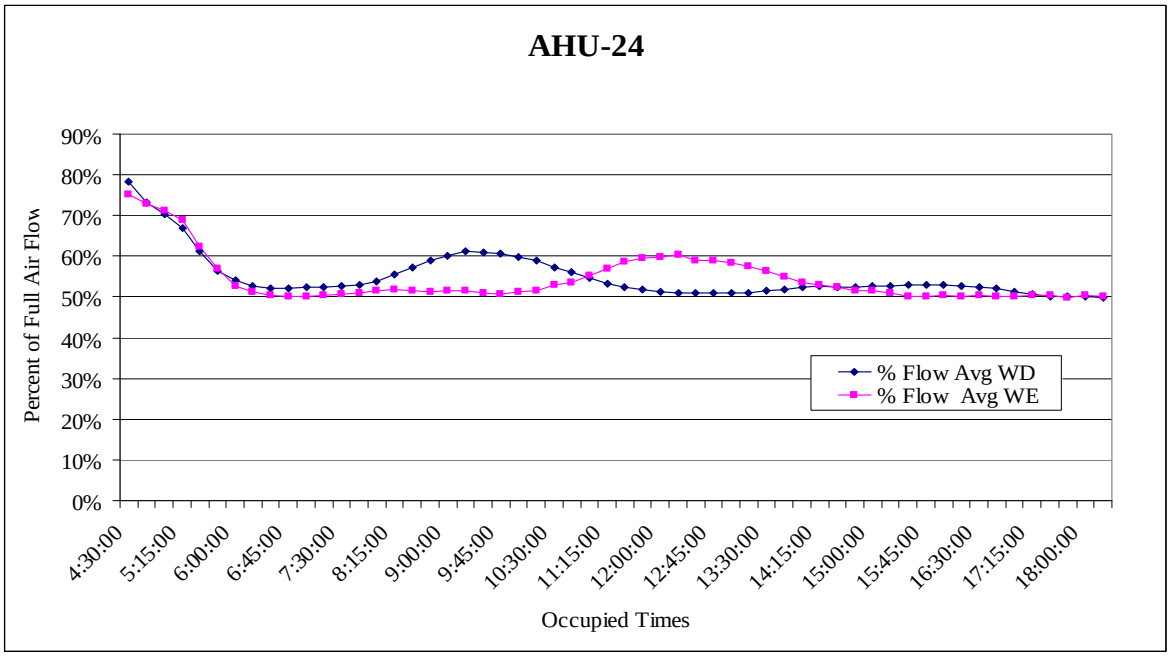
represent a typical day. The resulting post-installation energy use is then calculated using the following equations:

$$kW_2 = \left(\frac{CFM_2}{CFM_1}\right)^3 * kW_1$$

$$kWh_i = \sum_{i=0}^{24} \mathrm{kW_i}$$

The average air flow profile is shown in Figure 5.

Figure 5. Average Air Flow Profile



IGV to VFD The post-installation consumption is based on same trended data used in the development of the baseline energy use from 3/2/07 to 3/16/07. The same hourly flow profile is used for the post-installation and the energy consumption is calculated using the following equation:

$$\mathrm{kW_2} = \sum\left(\frac{\mathrm{CFM_2}}{\mathrm{CFM_1}}\right)^3 * \mathrm{kW_1}$$

7.2.3 Measure 5 & 9: Lighting Control System

The Project Sponsor has completed the installation of new lighting control system in Buildings 1 and 2. The project included the installation of 16 Lumisys lighting control panels (LCPs) in Building 1 and Building 2 and the installation of photocells. The LCPs have also been integrated to the existing building automation system (BAS).

There are three sources of energy savings resulting from this project, permanently shutting off unnecessary lighting, optimizing lighting schedules and implementing daylighting. The BAS controls the lighting circuits through a 365 day scheduling strategy. The BAS employs daylight harvesting by using photocells to measure ambient light levels. When light levels are sufficient, the affected lighting circuits are de-energized. The resulting energy savings are summarized in the table below.

Table 23. Verified Savings Summary

Bldg	Estimated Savings kWh	Verified Savings KWh	Percent Difference
Bldg 1	568,779	788,988	38.70%
Bldg 2	194,407	572,094	194.30%
Total	**763,186**	**887,227**	**78.3**

7.2.3.1 Assumptions

1. Spawar currently has no plans to significantly alter the number of lighting circuits or fixtures.

2. The existing lighting schedule as determined by auditing each electromechanical timer has not been altered in the past year.

7.2.3.2 Measurement and Verification Activities

To verify lighting operating hours, the Project Sponsor performed short term metering of a sample of lighting circuits in Building 1 and 2 using Onset Hobo light loggers as well as current loggers. Baseline measurements included measuring several lighting circuits within a sample of lighting panels. The lighting circuits that were measured included only the high bay lighting. The mezzanine lighting is comprised on 2 lamp linear fluorescent lights that are on 24/7. Baseline data is summarized in the tables below.

Table 24. Building 1: Baseline Data Summary

Lighting Circuit Numbers	HOBO Serial Number	Start	End	Sampling Period (Hours)	Annual Burn Hours
26_28_30_32	834424	12/14/2005 9:37	1/26/2006 4:41	1,027	5,044
17_19_21_23	822761	12/14/2005 9:31	1/26/2006 4:39	1,027	5,018
2_4_6_8	834425	12/14/2005 9:34	1/27/2006 8:43	1,055	5,018
1_3_5_7	834423	12/14/2005 9:28	1/27/2006 8:41	1,055	5,018
Channel 1 Circuit #: 1_3_5_7 Channel 2 Circuit #:18_20_2	790784	12/14/2005 10:36:44	1/27/2006 7:21:44	1,053	4,602
PNL 1C-22	822619	12/30/2005 2:48:25	1/27/2006 8:08:25	677	4,732
Average Annual Burn Hours					**4,905**

Table 25. Building 2: Baseline Data Summary

Lighting Circuit Numbers	HOBO Serial Number	Start	End	Sampling Period (Hours)	Annual Burn Hours
LTC102_Channel 1 Circuit#_21_23 Channel 2 Circuit:6_8	822617	12/14/2005 13:33	1/27/2006 7:18	1,050	4,030
L1B27E_CH1_6_8_	790783	12/14/2005 14:11	1/27/2006 8:11	1,050	6,240
L1B14E_CH1_5_7	804580	12/14/2005 14:25	1/27/2006 7:15	1,049	4,550
Average Annual Burn Hours					**4,940**

The post installation data was collected from trended data from the BAS. A total of 20 circuits were trended and six of those utilize the photocells for daylight harvesting. The trend data is used to demonstrate that the time of day schedules are implemented. Additionally, the data shows the number of hours the lighting is de-energized from the use of the light sensors. Based on 129 days of monitoring from May 1, 2007 to September 6, 2007, Buildings 1 and 2 shed 812 and 904 hours. This represents an average reduction of 6 to 7 hours of lights that have been scheduled ON that are OFF because the ambient lighting is sufficient.

7.2.3.3 Calculations and Adjustments

The savings are calculated by using the baseline short term metered data and trends from the BAS. The collected data is used to establish the baseline and post-installation operating hours. The annual burn hours is calculated by examining the seven day time schedule and extrapolating it for the year. The power consumption is based on the SPC Table of Standard Fixture wattages. Annual energy savings is calculated by subtracting the annual post retrofit

operating hours (OH_{Post}) from the baseline operating hours (OH_{Base}) multiplied by the baseline kW. Energy savings will be calculated using the following formula:

Scheduling Savings:

$$kWh_{saved} = \Sigma kW_{Base} * (OH_{Base} - OH_{Post})$$

where:

kWh_{saved} = Total energy savings (summation of 16 lighting panels)

kW_{Base} = Baseline based on short term power measurement of lighting circuits

OH_{Base} & OH_{Post} = Pre & Post retrofit circuit operating hours data

The detailed energy savings by lighting panel is provided in Table 26 and Table 27 for Building 1 and Building 2, respectively.

Table 26. Energy Savings Worksheet – Lighting Controls Bldg 1

Panel	Circuit	Lumisys Panel	Lumisys Relay # (Zone #)	Area Served Description	SPC Code	Qty Fix	Watts per Fix	Baseline Watts	Baseline Hours	Baseline kWh	Shut Off Lights	Post Hours	Post kWh	Energy Savings 1	Time On	Time Off	Operating Hours Hrs/Day	Post Annual Hours	Post kWh	Energy Savings 2	Daylight Harvest (y/n)	Daylight Hours Saved	Post kWh	Energy Savings 3	Total Savings	Installation Notes
P-IC4B	25	LP-3	25	High Bay: Ge	MH400PS/1	5	456	2,280	4,905	11,183	N	N/A	11,183	0	4:30	17:00	12.5	3,250	7,410	3,773	N	0	7,410	0	3,773	
P-IC4B	27	LP-3	27	High Bay: Ge	MH400PS/2	4	456	1,824	4,905	8,947	N	N/A	8,947	0	4:30	17:00	12.5	3,250	5,928	3,019	N	0	5,928	0	3,019	
P-IC4B	29	LP-3	29	High Bay: Ge	MH400PS/3	4	456	1,824	4,905	8,947	N	N/A	8,947	0	4:30	17:00	12.5	3,250	5,928	3,019	N	0	5,928	0	3,019	
P-IC4B	31	LP-3	31	High Bay: Ge	MH400PS/4	4	456	1,824	4,905	8,947	Y	0	0	8,947	n/a	n/a	0	0	0	0	N	0	0	0	8,947	Lights Off - Located above break area (open tables)
P-IC4B	33	LP-3	33	High Bay: Ge	MH400PS/5	4	456	1,824	4,905	8,947	N	N/A	8,947	0	0	1	12.5	3,250	5,928	3,019	N	0	5,928	0	3,019	
P-IC4B	23	LP-3	23	High Bay: Ge	MH400PS/6	3	456	1,368	4,905	6,710	N	N/A	6,710	0	0	1	13	3,380	4,624	2,086	Y	1,637	2,239	2,385	4,471	
P-IC4B	21	LP-3	21	High Bay: Ge	MH400PS/7	4	456	1,824	4,905	8,947	Y2	N/A	4,473	4,473	5:00	22:00	17	4,420	4,031	442	N	0	4,031	0	4,916	2 Fixtures (BC:12) located above enclosed space.
P-IC4B	35	LP-3	35	High Bay: Ge	MH400PS/8	3	456	1,368	4,905	6,710	N	N/A	6,710	0	0	1	17	4,420	6,047	663	N	0	6,047	0	663	
P-IC4B	42	LP-3	39	High Bay: Ge	MH400PS/9	4	456	1,824	4,905	8,947	Y	0:00	0	8,947	n/a	n/a	0	0	0	0	N	0	0	0	8,947	Lights Off - Located above enclosed space.
P-IC4B	24	LP-3	24	High Bay: Ge	MH400PS/10	4	456	1,824	4,905	8,947	Y	0:00	0	8,947	n/a	n/a	0	0	0	0	N	0	0	0	8,947	Lights Off - Located above enclosed space.
P-IC4B	28	LP-3	28	High Bay: Ge	MH400PS/11	4	456	1,824	4,905	8,947	Y	0:00	0	8,947	n/a	n/a	0	0	0	0	N	0	0	0	8,947	Lights Off - Located above enclosed space.
P-IC4B	32	LP-3	32	High Bay: Ge	MH400PS/12	4	456	1,824	4,905	8,947	Y	0	0	8,947	n/a	n/a	0	0	0	0	N	0	0	0	8,947	Lights Off - Located above enclosed space.
P-IC4B	40	LP-3	38	High Bay: Ge	MH400PS/13	4	456	1,824	4,905	8,947	Y	0	0	8,947	n/a	n/a	0	0	0	0	N	0	0	0	8,947	Lights Off - Located above enclosed space.
P-IC4B	36	LP-3	36	High Bay: Ge	MH400PS/14	4	456	1,824	4,905	8,947	Y3	N/A	2,237	6,710	4:30	17:00	12.5	3,250	1,482	755	Y	1,637	746	736	8,200	3 fixtures located above enclosed space. Aisle Light
P-IC4B	22	LP-3	22	High Bay: Ge	MH400PS/15	4	456	1,824	4,905	8,947	Y	0	0	8,947	n/a	n/a	0	0	0	0	N	0	0	0	8,947	Lights Off - Located above enclosed space.
P-IC4B	26	LP-3	26	High Bay: Ge	MH400PS/16	4	456	1,824	4,905	8,947	Y	0	0	8,947	n/a	n/a	0	0	0	0	N	0	0	0	8,947	Lights Off - Located above enclosed space.
P-IC4B	30	LP-3	30	High Bay: Ge	MH400PS/17	4	456	1,824	4,905	8,947	Y	0:00	0:00	8,947	n/a	n/a	0	0	0	0	N	0	0	0	8,947	Lights Off - Located above enclosed space.
P-IC4B	38	LP-3	37	High Bay: Ge	MH400PS/18	4	456	1,824	4,905	8,947	Y	0	0	8,947	n/a	n/a	0	0	0	0	N	0	0	0	8,947	Lights Off - Located above enclosed space.
P-IC4B	34	LP-3	34	High Bay: Ge	MH400PS/19	4	456	1,824	4,905	8,947	Y	0	0	8,947	n/a	n/a	0	0	0	0	N	0	0	0	8,947	Lights Off - Located above enclosed space.
P-IC4A	15	LP-3	15	High Bay: Ge	MH400PS/20	4	456	1,824	4,905	8,947	N	N/A	8,947	0	5:00	18:00	13	3,380	6,165	2,782	Y	1,637	2,985	3,180	5,962	
P-IC4A	1	LP-3	1	High Bay: Ge	MH400PS/21	4	456	1,824	4,905	8,947	Y	0	0	8,947	n/a	n/a	0	0	0	0	N	0	0	0	8,947	Lights Off - Located above enclosed space.
P-IC4A	3	LP-3	3	High Bay: Ge	MH400PS/22	4	456	1,824	4,905	8,947	N	N/A	8,947	0	5:00	18:00	13	3,380	6,165	2,782	Y	1,637	2,985	3,180	5,962	
P-IC4A	5	LP-3	5	High Bay: Ge	MH400PS/23	4	456	1,824	4,905	8,947	N	N/A	8,947	0	0	1	13	3,380	6,165	2,782	Y	1,637	2,985	3,180	5,962	
P-IC4A	7	LP-3	7	High Bay: Ge	MH400PS/24	4	456	1,824	4,905	8,947	N	N/A	8,947	0	5:00	18:00	13	3,380	6,165	2,782	Y	1,637	2,985	3,180	5,962	
P-IC4A	9	LP-3	9	High Bay: Ge	MH400PS/25	4	456	1,824	4,905	0:00	N	N/A	8,947	0	0	18:00	13	3,380	6,165	2,782	Y	1,637	2,985	3,180	5,962	
P-IC4A	11	LP-3	11	High Bay: Ge	MH400PS/26	4	456	1,824	4,905	0:00	N	N/A	8,947	0	0	18:00	13	3,380	6,165	2,782	Y	1,637	2,985	3,180	5,962	
P-IC4A	13	LP-3	13	High Bay: Ge	MH400PS/27	4	456	1,824	4,905	8,947	N	N/A	8,947	0	0	1	13	3,380	6,165	2,782	Y	1,637	2,985	3,180	5,962	
P-IC4A	17	LP-3	17	High Bay: Ge	MH400PS/28	4	456	1,824	4,905	8,947	Y	0:00	0:00	8,947	n/a	n/a	0	0	0	0	N	0	0	0	8,947	Lights Off - Located above enclosed space.
P-IC4A	19	LP-3	19	High Bay: Ge	MH400PS/29	4	456	1,824	4,905	8,947	Y	0:00	0:00	8,947	n/a	n/a	0	0	0	0	N	0	0	0	8,947	Lights Off - Located above enclosed space.
P-IC4A	4	LP-3	4	High Bay: Ge	MH400PS/30	4	456	1,824	4,905	8,947	Y	0:00	0	8,947	n/a	n/a	0	0	0	0	N	0	0	0	8,947	Lights Off - Located above enclosed space.
P-IC4A	8	LP-3	8	High Bay: Ge	MH400PS/31	4	456	1,824	4,905	8,947	Y	0	0	8,947	n/a	n/a	0	0	0	0	N	0	0	0	8,947	Lights Off - Located above enclosed space.
P-IC4A	12	LP-3	12	High Bay: Ge	MH400PS/32	4	456	1,824	4,905	8,947	N	N/A	8,947	0	4:30	17:00	12.5	3,250	5,928	3,019	Y	1,637	2,985	2,943	5,962	
P-IC4A	16	LP-3	16	High Bay: Ge	MH400PS/33	4	456	1,824	4,905	8,947	N	N/A	8,947	0	5:00	18:00	13	3,380	6,165	2,782	Y	1,637	2,985	3,180	5,962	
P-IC4A	20	LP-3	20	High Bay: Ge	MH400PS/34	4	456	1,824	4,905	8,947	Y	0	0	8,947	n/a	n/a	0	0	0	0	N	0	0	0	8,947	Lights Off - Located above enclosed space.
P-IC4A	2	LP-3	2	High Bay: Ge	MH400PS/35	4	456	1,824	4,905	8,947	N	N/A	8,947	0	0	1	17	4,420	8,062	885	Y	1,637	2,985	5,077	5,962	Aisle Lights
P-IC4A	6	LP-3	6	High Bay: Ge	MH400PS/36	4	456	1,824	4,905	8,947	Y	0:00	0	8,947	n/a	n/a	0	0	0	0	N	0	0	0	8,947	Lights Off - Located above enclosed space.
P-IC4A	10	LP-3	10	High Bay: Ge	MH400PS/37	4	456	1,824	4,905	8,947	Y	0	0	8,947	n/a	n/a	0	0	0	0	N	0	0	0	8,947	Lights Off - Located above enclosed space.
P-IC4A	14	LP-3	14	High Bay: Ge	MH400PS/38	4	456	1,824	4,905	8,947	Y	0	0	8,947	n/a	n/a	0	0	0	0	N	0	0	0	8,947	Lights Off - Located above enclosed space.
P-IC4A	18	LP-3	18	High Bay: Ge	MH400PS/39	4	456	1,824	4,905	8,947	Y	0	0	8,947	n/a	n/a	0	0	0	0	N	0	0	0	8,947	Lights Off - Located above enclosed space.
P-IC22F	23	LP-1	22	High Bay: Ge	MH400PS/40	4	456	1,824	4,905	8,947	Y	0	0	8,947	n/a	n/a	0	0	0	0	N	0	0	0	8,947	Lights Off - Located above enclosed space.
P-IC22F	29	LP-1	28	High Bay: Ge	MH400PS/41	4	456	1,824	4,905	8,947	Y	0	0	8,947	n/a	n/a	0	0	0	0	N	0	0	0	8,947	Lights Off - Located above enclosed space.
P-IC22F	33	LP-1	32	High Bay: Ge	MH400PS/42	4	456	1,824	4,905	8,947	N	N/A	8,947	0	5:00	22:00	17	4,420	8,062	885	Y	1,637	2,985	5,077	5,962	Aisle Lights
P-IC22F	27	LP-1	26	High Bay: Ge	MH400PS/43	4	456	1,824	4,905	8,947	Y	0	0	8,947	n/a	n/a	0	0	0	0	N	0	0	0	8,947	Lights Off - Located above enclosed space.
P-IC22F	22	LP-1	21	High Bay: Ge	MH400PS/44	4	456	1,824	4,905	8,947	Y	0	0	8,947	n/a	n/a	0	0	0	0	N	0	0	0	8,947	Lights Off - Located above enclosed space.
P-IC22F	28	LP-1	27	High Bay: Ge	MH400PS/45	4	456	1,824	4,905	8,947	Y	0	0	8,947	n/a	n/a	0	0	0	0	N	0	0	0	8,947	Lights Off - Located above enclosed space.
P-IC22F	32	LP-1	31	High Bay: Ge	MH400PS/46	4	456	1,824	4,905	8,947	N	N/A	8,947	0	5:00	18:00	13	3,380	6,165	2,782	Y	1,637	2,985	3,180	5,962	
P-IC22F	34	LP-1	33	High Bay: Ge	MH400PS/47	4	456	1,824	4,905	8,947	N	N/A	8,947	0	5:00	18:00	13	3,380	6,165	2,782	Y	1,637	2,985	3,180	5,962	
P-IC22F	40	LP-1	37	High Bay: Ge	MH400PS/48	4	456	1,824	4,905	8,947	Y	0	0	8,947	n/a	n/a	0	0	0	0	N	0	0	0	8,947	Lights Off - Located above enclosed space.
P-IC22F	31	LP-1	30	High Bay: Ge	MH400PS/49	4	456	1,824	4,905	8,947	N	N/A	8,947	0	5:00	18:00	13	3,380	6,165	2,782	Y	1,637	2,985	3,180	5,962	
P-IC22F	35	LP-1	34	High Bay: Ge	MH400PS/50	4	456	1,824	4,905	8,947	N	N/A	8,947	0	5:00	18:00	13	3,380	6,165	2,782	Y	1,637	2,985	3,180	5,962	

Table 26. Energy Savings Worksheet – Lighting Controls Bldg 1 (con't)

											Shut Off Lights				Lighting Control Savings						Daylighting					
Panel	Circuit	Lumisys Panel	Lumisys Relay # (Zone #)	Area Served Description	SPC Code	Qty Fix	Watts per Fix	Baseline Watts	Baseline Hours	Baseline kWh	Shut Off Lights	Post Hours	Post kWh	Energy Savings 1	Time On	Time Off	Operating Hours Hrs/Day	Post Annual Hours	Post kWh	Energy Savings 2	Daylight Harvest (y/n)	Daylight Hours Saved	Post kWh	Energy Savings 3	Total Savings	Installation Notes
																	13	3,380	0							
P-IC22F	25	LP-1	24	High Bay: Gr	MH400PS/51	4	456	1,824	4,905	8,947	N	N/A	8,947	0	5:00	18:00	13	3,380	6,165	2,782	N	0	6,165	0	2,782	
P-IC22F	24	LP-1	23	High Bay: Gr	MH400PS/52	4	456	1,824	4,905	8,947	N	N/A	8,947	0	5:00	18:00	13	3,380	6,165	2,782	N	0	6,165	0	2,782	
P-IC22F	26	LP-1	25	High Bay: Gr	MH400PS/53	4	456	1,824	4,905	8,947	N	N/A	8,947	0	5:00	18:00	13	3,380	6,165	2,782	N	0	6,165	0	2,782	
P-IC22F	30	LP-1	29	High Bay: Gr	MH400PS/54	4	456	1,824	4,905	8,947	N	N/A	8,947	0	5:00	18:00	13	3,380	6,165	2,782	N	0	6,165	0	2,782	
P-IC22F	36	LP-1	35	High Bay: Gr	MH400PS/55	4	456	1,824	4,905	8,947	N	N/A	8,947	0	5:00	18:00	13	3,380	6,165	2,782	N	0	6,165	0	2,782	
P-IC22F	38	LP-1	36	High Bay: Gr	MH400PS/56	4	456	1,824	4,905	8,947	N	N/A	8,947	0	5:00	18:00	13	3,380	6,165	2,782	N	0	6,165	0	2,782	
P-IC22E	5	LP-1	5	High Bay: Gr	MH400PS/57	4	456	1,824	4,905	8,947	Y	0	0	8,947	n/a	n/a	0	0	0	0	N	0	0	0	8,947	Lights Off - Located above enclosed space.
P-IC22E	7	LP-1	7	High Bay: Gr	MH400PS/58	4	456	1,824	4,905	8,947	Y	0	0	8,947	n/a	n/a	0	0	0	0	N	0	0	0	8,947	Lights Off - Located above enclosed space.
P-IC22E	15	LP-1	15	High Bay: Gr	MH400PS/59	4	456	1,824	4,905	8,947	Y	0	0	8,947	n/a	n/a	0	0	0	0	N	0	0	0	8,947	Lights Off - Located above enclosed space.
P-IC22E	13	LP-1	13	High Bay: Gr	MH400PS/60	4	456	1,824	4,905	8,947	Y	0	0	8,947	n/a	n/a	0	0	0	0	N	0	0	0	8,947	Lights Off - Located above enclosed space.
P-IC22E	19	LP-1	19	High Bay: Gr	MH400PS/61	3	456	1,368	4,905	6,710	Y	0	0	6,710	n/a	n/a	0	0	0	0	N	0	0	0	6,710	Lights Off - Located above enclosed space.
P-IC22E	1	LP-1	1	High Bay: Gr	MH400PS/62	3	456	1,368	4,905	6,710	Y	0	0	6,710	n/a	n/a	0	0	0	0	N	0	0	0	6,710	Lights Off - Located above enclosed space.
P-IC22E	3	LP-1	3	High Bay: Gr	MH400PS/63	3	456	1,368	4,905	6,710	Y	0	0	6,710	n/a	n/a	0	0	0	0	N	0	0	0	6,710	Lights Off - Located above enclosed space.
P-IC22E	9	LP-1	9	High Bay: Gr	MH400PS/64	3	456	1,368	4,905	6,710	Y	0	0	6,710	n/a	n/a	0	0	0	0	N	0	0	0	6,710	Lights Off - Located above enclosed space.
P-IC22E	11	LP-1	11	High Bay: Gr	MH400PS/65	3	456	1,368	4,905	6,710	Y	0	0	6,710	n/a	n/a	0	0	0	0	N	0	0	0	6,710	Lights Off - Located above enclosed space.
P-IC22E	4	LP-1	4	High Bay: Gr	MH400PS/67	4	456	1,824	4,905	8,947	Y	0	0	8,947	n/a	n/a	0	0	0	0	N	0	0	0	8,947	Lights Off - Located above enclosed space.
P-IC22E	6	LP-1	6	High Bay: Gr	MH400PS/68	4	456	1,824	4,905	8,947	Y	0	0	8,947	n/a	n/a	0	0	0	0	N	0	0	0	8,947	Lights Off - Located above enclosed space.
P-IC22E	10	LP-1	10	High Bay: Gr	MH400PS/69	4	456	1,824	4,905	8,947	Y	0	0	8,947	n/a	n/a	0	0	0	0	N	0	0	0	8,947	Lights Off - Located above enclosed space.
P-IC22E	16	LP-1	16	High Bay: Gr	MH400PS/70	4	456	1,824	4,905	8,947	Y	0	0	8,947	n/a	n/a	0	0	0	0	N	0	0	0	8,947	Lights Off - Located above enclosed space.
P-IC22E	18	LP-1	18	High Bay: Gr	MH400PS/71	4	456	1,824	4,905	8,947	Y	0	0	8,947	n/a	n/a	0	0	0	0	N	0	0	0	8,947	Lights Off - Located above enclosed space.
P-IC22E	2	LP-1	2	High Bay: Gr	MH400PS/72	4	456	1,824	4,905	8,947	N	N/A	8,947	0	5:00	18:00	13	3,380	6,165	2,782	N	0	6,165	0	2,782	
P-IC22E	8	LP-1	8	High Bay: Gr	MH400PS/73	4	456	1,824	4,905	8,947	N	N/A	8,947	0	5:00	18:00	13	3,380	6,165	2,782	N	0	6,165	0	2,782	
P-IC22E	12	LP-1	12	High Bay: Gr	MH400PS/74	4	456	1,824	4,905	8,947	N	N/A	8,947	0	5:00	18:00	13	3,380	6,165	2,782	N	0	6,165	0	2,782	
P-IC22E	14	LP-1	14	High Bay: Gr	MH400PS/75	4	456	1,824	4,905	8,947	N	N/A	8,947	0	5:00	18:00	13	3,380	6,165	2,782	N	0	6,165	0	2,782	
P-IC22E	20	LP-1	20	High Bay: Gr	MH400PS/76	4	456	1,824	4,905	8,947	N	N/A	8,947	0	5:00	18:00	13	3,380	6,165	2,782	N	0	6,165	0	2,782	
P-IC16D	27	LP-2	27	High Bay: Gr	MH400PS/77	4	456	1,824	4,905	8,947	N	N/A	8,947	0	4:30	17:00	12.5	3,250	5,928	3,019	N	0	5,928	0	3,019	
P-IC16D	25	LP-2	25	High Bay: Gr	MH400PS/78	4	456	1,824	4,905	8,947	N	N/A	8,947	0	4:30	17:00	12.5	3,250	5,928	3,019	N	0	5,928	0	3,019	
P-IC16D	33	LP-2	33	High Bay: Gr	MH400PS/79	4	456	1,824	4,905	8,947	N	N/A	8,947	0	4:30	17:00	12.5	3,250	5,928	3,019	N	0	5,928	0	3,019	
P-IC16D	31	LP-2	31	High Bay: Gr	MH400PS/80	4	456	1,824	4,905	8,947	N	N/A	8,947	0	4:30	17:00	12.5	3,250	5,928	3,019	N	0	5,928	0	3,019	
P-IC16D	39	LP-2	38	High Bay: Gr	MH400PS/81	4	456	1,824	4,905	8,947	Y	0	0	8,947	n/a	n/a	0	0	0	0	N	0	0	0	8,947	Lights Off - Located above enclosed space.
P-IC16D	41	LP-2	39	High Bay: Gr	MH400PS/82	4	456	1,824	4,905	8,947	Y	0	0	8,947	n/a	n/a	0	0	0	0	N	0	0	0	8,947	Lights Off - Located above enclosed space.
P-IC16D	21	LP-2	21	High Bay: Gr	MH400PS/83	3	456	1,368	4,905	6,710	Y	0	0	6,710	n/a	n/a	0	0	0	0	N	0	0	0	6,710	Lights Off - Located above enclosed space.
P-IC16D	23	LP-2	23	High Bay: Gr	MH400PS/84	3	456	1,368	4,905	6,710	Y	0	0	6,710	n/a	n/a	0	0	0	0	N	0	0	0	6,710	Lights Off - Located above enclosed space.
P-IC16D	29	LP-2	29	High Bay: Gr	MH400PS/85	3	456	1,368	4,905	6,710	Y	0	0	6,710	n/a	n/a	0	0	0	0	N	0	0	0	6,710	Lights Off - Located above enclosed space.
P-IC16D	35	LP-2	35	High Bay: Gr	MH400PS/86	3	456	1,368	4,905	6,710	Y	0	0	6,710	n/a	n/a	0	0	0	0	N	0	0	0	6,710	Lights Off - Located above enclosed space.
P-IC16D	37	LP-2	37	High Bay: Gr	MH400PS/87	3	456	1,368	4,905	6,710	Y	0	0	6,710	n/a	n/a	0	0	0	0	N	0	0	0	6,710	Lights Off - Located above enclosed space.
P-IC16D	36	LP-2	36	Spare	MH400PS/88		456	0	4,905	0	N	N/A	0	0	0	0	0	0	N	0	N	0	0	0		
P-IC16D	24	LP-2	24	High Bay: Gr	MH400PS/89	4	456	1,824	4,905	8,947	Y	0	0	8,947	n/a	n/a	0	0	0	0	N	0	0	0	8,947	Lights Off - Located above enclosed space.
P-IC16D	28	LP-2	28	High Bay: Gr	MH400PS/90	4	456	1,824	4,905	8,947	Y	0	0	8,947	n/a	n/a	0	0	0	0	N	0	0	0	8,947	Lights Off - Located above enclosed space.
P-IC16D	32	LP-2	32	High Bay: Gr	MH400PS/91	4	456	1,824	4,905	8,947	Y	0	0	8,947	n/a	n/a	0	0	0	0	N	0	0	0	8,947	Lights Off - Located above enclosed space.
P-IC16D	34	LP-2	34	High Bay: Gr	MH400PS/92	4	456	1,824	4,905	8,947	Y	0	0	8,947	n/a	n/a	0	0	0	0	N	0	0	0	8,947	Lights Off - Located above enclosed space.
P-IC16D	22	LP-2	22	High Bay: Gr	MH400PS/93	4	456	1,824	4,905	8,947	N	N/A	8,947	0	5:00	18:00	13	3,380	6,165	2,782	Y	1,637	2,985	3,180	5,962	
P-IC16D	26	LP-2	26	High Bay: Gr	MH400PS/94	4	456	1,824	4,905	8,947	N	N/A	8,947	0	5:00	18:00	13	3,380	6,165	2,782	Y	1,637	2,985	3,180	5,962	
														454,057						**103,191**				**60,738**	**617,986**	

Table 27. Energy Savings Worksheet – Lighting Controls Bldg 2

											Shut Off Lights				Lighting Control Savings						Daylighting					
Panel	Circuit	Lumisys Panel	Lumisys Relay # (Zone #)	Area Served Description	SPC Code	Qty Fix	Watts per Fix	Baseline Watts	Baseline Hours	Baseline kWh	Shut Off Lights	Post Hours	Post kWh	Energy Savings 1	Time On	Time Off	Operating Hours Hrs/Day	Post Annual Hours	Post kWh	Energy Savings 2	Daylight Harvest (y/n)	Daylight Hours Saved	Post kWh	Energy Savings 3	Net Savings	Installation Notes
LTC42	2,4	LP-6	1,2	High Bay: Section DE:	MH1000/1	2	1,080	2,160	4,940	10,670	N	N/A	10,670	0	0	18:00	13.5	3,510	7,582	3,089	N	0	7,582	0	3,089	Aisle Lights
LTC42	6,8	LP-6	3,4	High Bay: Section D:1	MH1000/1	2	1,080	2,160	4,940	10,670	N	N/A	10,670	0	4:30	1	17.5	4,550	9,828	842	N	0	9,828	0	842	
LTC42	10,12	LP-6	5,6	High Bay: Section DE:	MH1000/1	2	1,080	2,160	4,940	10,670	N	N/A	10,670	0	0	18:00	13.5	3,510	7,582	3,089	N	0	7,582	0	3,089	
LTC42	14,16	LP-6	7,8	High Bay: Section CD:	MH1000/1	2	1,080	2,160	4,940	10,670	N	N/A	10,670	0	4:30	18:00	13.5	3,510	7,582	3,089	Y	1,822	3,936	3,646	6,735	
LTC42	18,20	LP-6	9,10	High Bay: Section CD:	MH1000/1	2	1,080	2,160	4,940	10,670	N	N/A	10,670	0	0	1	13.5	3,510	7,582	3,089	Y	1,822	3,936	3,646	6,735	Lights Off - Located above enclosed space.
LTC42	22,24	LP-6	11,12	High Bay: Section CD:	MH1000/1	2	1,080	2,160	4,940	10,670	Y	0	0	10,670	n/a	n/a	0.0	0	0	0	N	0	0	0	10,670	Lights Off - Located above enclosed space.
LTC42	1,3	LP-6	13,14	High Bay: Section AB:	MH1000/1	2	1,080	2,160	4,940	10,670	Y	0	0	10,670	n/a	n/a	0.0	0	0	0	N	0	0	0	10,670	Lights Off - Located above enclosed space.
LTC42	5,7	LP-6	15,16	High Bay: Section AB:	MH1000/1	2	1,080	2,160	4,940	10,670	Y	0	0	10,670	n/a	n/a	0.0	0	0	0	N	0	0	0	10,670	Lights Off - Located above enclosed space.
LTC42	9,11	LP-6	17,18	High Bay: Section A:3	MH1000/1	2	1,080	2,160	4,940	10,670	Y	0	0	10,670	n/a	n/a	0.0	0	0	0	N	0	0	0	10,670	Locally controlled via pushbutton switch.
LTC42	13,15	LP-6	19,20	High Bay: Section B:7	MH1000/1	1	1,080	1,080	4,940	5,335	Y	0	0	5,335	n/a	n/a	0.0	0	0	0	N	0	0	0	5,335	Locally controlled via pushbutton switch.
LTC42	17,19	LP-6	21,22	High Bay: Column BC:	MH1000/1	2	1,080	2,160	4,940	10,670	N	N/A	10,670	0	4:30	18:00	13.5	3,510	7,582	3,089	N	0	7,582	0	3,089	
LTC5E	1,3	LP-7	1,2	High Bay: Section DE:	MH1000/1	2	1,080	2,160	4,940	10,670	N	N/A	10,670	0	4:30	1	13.5	3,510	7,582	3,089	N	0	7,582	0	3,089	
LTC5E	5,7	LP-7	3,4	High Bay: Section DE:	MH1000/1	2	1,080	2,160	4,940	10,670	N	N/A	10,670	0	0	18:00	13.5	3,510	7,582	3,089	N	0	7,582	0	3,089	
LTC5E	9,11	LP-7	5,6	High Bay: Section DE:	MH1000/1	2	1,080	2,160	4,940	10,670	N	N/A	10,670	0	0	18:00	13.5	3,510	7,582	3,089	N	0	7,582	0	3,089	
LTC5E	13,15	LP-7	7,8	High Bay: Section CD:	MH1000/1	2	1,080	2,160	4,940	10,670	N	N/A	10,670	0	4:30	1	13.5	3,510	7,582	3,089	Y	1,822	3,936	3,646	6,735	
LTC5E	17,19	LP-7	9,10	High Bay: Section CD:	MH1000/1	2	1,080	2,160	4,940	10,670	N	N/A	10,670	0	4:30	18:00	13.5	3,510	7,582	3,089	Y	1,822	3,936	3,646	6,735	
LTC5E	21,23	LP-7	11,12	High Bay: Section CD:	MH1000/1	2	1,080	2,160	4,940	10,670	N	N/A	10,670	0	4:30	18:00	13.5	3,510	7,582	3,089	Y	1,822	3,936	3,646	6,735	
LTC-102	2,4	LP-8	1,2	High Bay: Section DE:	MH1000/1	2	1,080	2,160	4,940	10,670	N	N/A	10,670	0	0	18:00	13.5	3,510	7,582	3,089	N	0	7,582	0	3,089	Aisle Lights
LTC-102	6,8	LP-8	3,4	High Bay: Section D:8	MH1000/1	2	1,080	2,160	4,940	10,670	N	N/A	10,670	0	4:30	22:00	17.5	4,550	9,828	842	N	0	9,828	0	842	
LTC-102	10,12	LP-8	5,6	High Bay: Section DE:	MH1000/1	2	1,080	2,160	4,940	10,670	Y	0	0	10,670	n/a	n/a	0.0	0	0	0	N	0	0	0	10,670	Lights Off - Located above enclosed space.
LTC-102	14,16	LP-8	7,8	High Bay: Section CD:	MH1000/1	2	1,080	2,160	4,940	10,670	Y	0	0	10,670	n/a	n/a	0.0	0	0	0	N	0	0	0	10,670	Lights Off - Located above enclosed space.
LTC-102	18,20	LP-8	9,10	High Bay: Section CD:	MH1000/1	2	1,080	2,160	4,940	10,670	Y	0	0	10,670	n/a	n/a	0.0	0	0	0	N	0	0	0	10,670	Lights Off - Located above enclosed space.
LTC-102	22,24	LP-8	11,12	High Bay: Section CD:	MH1000/1	2	1,080	2,160	4,940	10,670	Y	0	0	10,670	n/a	n/a	0.0	0	0	0	N	0	0	0	10,670	Lights Off - Located above enclosed space.
LTC-102	1,3	LP-8	13,14	High Bay: Section AB:	MH1000/1	2	1,080	2,160	4,940	10,670	Y	0	0	10,670	n/a	n/a	0.0	0	0	0	N	0	0	0	10,670	Lights Off - Located above enclosed space.
LTC-102	5,7	LP-8	15,16	High Bay: Section AB:	MH1000/1	2	1,080	2,160	4,940	10,670	Y	0	0	10,670	n/a	n/a	0.0	0	0	0	N	0	0	0	10,670	Lights Off - Located above enclosed space.
LTC-102	9,11	LP-8	17,18	High Bay: Section AB:	MH1000/1	2	1,080	2,160	4,940	10,670	Y	0	0	10,670	n/a	n/a	0.0	0	0	0	N	0	0	0	10,670	Lights Off - Located above enclosed space.
LTC-102	13,15	LP-8	19,20	High Bay: Section B:3	MH1000/1	2	1,080	2,160	4,940	10,670	Y	0	0	10,670	n/a	n/a	0.0	0	0	0	N	0	0	0	10,670	Lights Off - Located above enclosed space.
LTC-102	17,19	LP-8	21,22	High Bay: Section B:5	MH1000/1	2	1,080	2,160	4,940	10,670	Y	0	0	10,670	n/a	n/a	0.0	0	0	0	N	0	0	0	10,670	Lights Off - Located above enclosed space.
LTC-102	21,23	LP-8	23,24	High Bay: Section B:5	MH1000/1	1	1,080	1,080	4,940	5,335	Y	0	0	5,335	n/a	n/a	0.0	0	0	0	N	0	0	0	5,335	Lights Off - Located above enclosed space.
LTC14E	2,4	LP-9	1,2	High Bay: Section DE:	MH1000/1	2	1,080	2,160	4,940	10,670	N	N/A	10,670	0	0	1	13.5	3,510	7,582	3,089	N	0	7,582	0	3,089	Aisle Lights
LTC14E	6,8	LP-9	3,4	High Bay: Section DE:	MH1000/1	2	1,080	2,160	4,940	10,670	N	N/A	10,670	0	4:30	1	17.5	4,550	9,828	842	N	0	9,828	0	842	
LTC14E	10,12	LP-9	5,6	High Bay: Section DE:	MH1000/1	2	1,080	2,160	4,940	10,670	N	N/A	10,670	0	0	1	13.5	3,510	7,582	3,089	N	0	7,582	0	3,089	Aisle Lights
LTC14E	14,16	LP-9	7,8	High Bay: Section CD:	MH1000/1	2	1,080	2,160	4,940	10,670	Y	0	0	10,670	n/a	n/a	0.0	0	0	0	N	0	0	0	10,670	Lights Off - Located above enclosed space.
LTC-162	2,4	LP-10	1,2	High Bay: Section BC:	MH1000/1	2	1,080	2,160	4,940	10,670	Y	0	0	10,670	n/a	n/a	0.0	0	0	0	N	0	0	0	10,670	Lights Off - Located above enclosed space.
LTC-162	6,8	LP-10	3,4	High Bay: Section BC:	MH1000/1	2	1,080	2,160	4,940	10,670	Y	0	0	10,670	n/a	n/a	0.0	0	0	0	N	0	0	0	10,670	Lights Off - Located above enclosed space.
LTC-162	10,12	LP-10	5,6	High Bay: Section B:5	MH1000/1	1	1,080	1,080	4,940	5,335	Y	0	0	5,335	n/a	n/a	0.0	0	0	0	N	0	0	0	5,335	Lights Off - Located above enclosed space.
LTC-162	14,16	LP-10	7,8	High Bay: Section BC:	MH1000/1	2	1,080	2,160	4,940	10,670	Y	0	0	10,670	n/a	n/a	0.0	0	0	0	N	0	0	0	10,670	Lights Off - Located above enclosed space.
LTC-162	1,3	LP-10	9,10	High Bay: Section DE:	MH1000/1	2	1,080	2,160	4,940	10,670	N	N/A	10,670	0	4:30	18:00	13.5	3,510	7,582	3,089	N	0	7,582	0	3,089	Aisle Lights
LTC-162	5,7	LP-10	11,12	High Bay: Section D:1	MH1000/1	2	1,080	2,160	4,940	10,670	N	N/A	10,670	0	4:30	22:00	17.5	4,550	9,828	842	N	0	9,828	0	842	
LTC-162	9,11	LP-10	13,14	High Bay: Section DE:	MH1000/1	2	1,080	2,160	4,940	10,670	Y	0	0	10,670	n/a	n/a	0.0	0	0	0	N	0	0	0	10,670	Lights Off - Located above enclosed space.
LTC-162	13,15	LP-10	15,16	High Bay: Section CD:	MH1000/1	2	1,080	2,160	4,940	10,670	Y	0	0	10,670	n/a	n/a	0.0	0	0	0	N	0	0	0	10,670	Lights Off - Located above enclosed space.
LTC-162	17,19	LP-10	17,18	High Bay: Section CD:	MH1000/1	2	1,080	2,160	4,940	10,670	Y1	0	5,335	5,335	4:30	18:00	13.5	3,510	3,791	1,544	N	0	3,791	0	6,880	Note: 1 lamp located above enclosed space
LTC-162	21,23	LP-10	19,20	High Bay: Section CD:	MH1000/1	2	1,080	2,160	4,940	10,670	N	N/A	10,670	0	n/a	n/a	0.0	0	0	0	Y	1,822	3,936	-3,936	6,735	Lights Off - Located above enclosed space.
LTC-222	2,4	LP-11	1,2	High Bay: Section AB:	MH1000/1	2	1,080	2,160	4,940	10,670	Y1	0	5,335	5,335	4:30	18:00	13.5	3,510	3,791	1,544	N	0	3,791	0	6,880	Note: 1 lamp located above enclosed space
LTC-222	6,8	LP-11	3,4	High Bay: Section AB:	MH1000/1	2	1,080	2,160	4,940	10,670	N	N/A	10,670	0	5:00	20:00	15.0	3,900	8,424	2,246	Y	1,822	3,936	4,488	6,735	
LTC-222	10,12	LP-11	5,6	High Bay: Section AB:	MH1000/1	2	1,080	2,160	4,940	10,670	Y	0	0	10,670	n/a	n/a	0.0	0	0	0	N	0	0	0	10,670	Lights Off - Located above enclosed space.
LTC-222	14,16	LP-11	7,8	High Bay: Section B:7	MH1000/1	2	1,080	2,160	4,940	10,670	Y	0	0	10,670	n/a	n/a	0.0	0	0	0	N	0	0	0	10,670	Lights Off - Located above enclosed space.
LTC-222	18,20	LP-11	9,10	High Bay: Section B:5	MH1000/1	2	1,080	2,160	4,940	10,670	Y	0	0	10,670	n/a	n/a	0.0	0	0	0	N	0	0	0	10,670	Lights Off - Located above enclosed space.
LTC-222	1,3	LP-11	11,12	High Bay: Section DE:	MH1000/1	2	1,080	2,160	4,940	10,670	N	N/A	10,670	0	0	20:00	15.0	3,900	8,424	2,246	N	0	8,424	0	2,246	Note: 2 Aisle Lights and 1 Warehouse Light
LTC-222	5,7	LP-11	13,14	High Bay: D:20, D:23	MH1000/1	3	1,080	3,240	4,940	16,006	N	N/A	16,006	0	0	1	17.5	4,550	14,742	1,264	Y	1,822	5,903	8,839	10,102	
LTC-222	9,11	LP-11	15,16	High Bay: Section DE:	MH1000/1	2	1,080	2,160	4,940	10,670	N	N/A	10,670	0	0	18:00	13.5	3,510	7,582	3,089	N	0	7,582	0	3,089	
LTC-222	13,15	LP-11	17,18	High Bay: Section C:9	MH1000/1	1	1,080	1,080	4,940	5,335	N	N/A	5,335	0	0	20:00	15.0	3,900	4,212	1,123	Y	1,822	1,968	2,244	3,367	
LTC-222	17,19	LP-11	19,20	High Bay: Section C:5	MH1000/1	2	1,080	2,160	4,940	10,670	Y	0	0	10,670	n/a	n/a	0.0	0	0	0	N	0	0	0	10,670	Light Off - Located above enclosed space.
LTC-222	21,23	LP-11	21,22	High Bay: Section C:9	MH1000/1	1	1,080	1,080	4,940	5,335	Y	0	0	5,335	n/a	n/a	0.0	0	0	0	N	0	0	0	5,335	Light Off - Located above enclosed space.
LTC27E	1,3	LP-12	1,2	High Bay: Section DE:	MH1000/1	2	1,080	2,160	4,940	10,670	N	N/A	10,670	0	0	20:00	15.0	3,900	8,424	2,246	N	0	8,424	0	2,246	

Table 27. Energy Savings Worksheet – Lighting Controls Bldg 2 (con't)

											Shut Off Lights				Lighting Control Savings						Daylighting					
Panel	Circuit	Lumisys Panel	Lumisys Relay # (Zone #)	Area Served Description	SPC Code	Qty Fix	Watts per Fix	Baseline Watts	Baseline Hours	Baseline kWh	Shut Off Lights	Post Hours	Post kWh	Energy Savings 1	Time On	Time Off	Operating Hours Hrs/Day	Post Annual Hours	Post kWh	Energy Savings 2	Daylight Harvest (y/n)	Daylight Hours Saved	Post kWh	Energy Savings 3	Net Savings	Installation Notes
L1C27E	5,7	LP-12	3,4	High Bay: Section DE:	MH1000/1	2	1,080	2,160	4,940	10,670	N	N/A	10,670	0	0	20:00	15.0	3,900	8,424	2,246	N	0	8,424	0	2,246	
L1C27E	9,11	LP-12	5,6	High Bay: Section DE:	MH1000/1	2	1,080	2,160	4,940	10,670	N	N/A	10,670	0	4:30	18:00	13.5	3,510	7,582	3,089	N	0	7,582	0	3,089	
L1C27E	13,15	LP-12	7,8	High Bay: Section CD:	MH1000/1	2	1,080	2,160	4,940	10,670	Y1	0	5,335	5,335	5:00	20:00	15.0	3,900	4,212	1,123	Y	1,822	3,936	276	6,735	Note: 1 lamp located above enclosed space.
L1C27E	17,19	LP-12	9,10	High Bay: Section C.3:	MH1000/1	2	1,080	2,160	4,940	10,670	N	N/A	10,670	0	5:00	20:00	15.0	3,900	8,424	2,246	Y	1,822	3,936	4,488	6,735	
LTC-282	2,4	LP-13	1,2	High Bay: Section DE:	MH1000/1	2	1,080	2,160	4,940	10,670	N	N/A	10,670	0	5:00	20:00	15.0	3,900	8,424	2,246	N	0	8,424	0	2,246	Aisle Lights
LTC-282	6,8	LP-13	3,4	High Bay: Section D.2:	MH1000/1	2	1,080	2,160	4,940	10,670	N	N/A	10,670	0	4:30	22:00	17.5	4,550	9,828	842	N	0	9,828	0	842	
LTC-282	10,12	LP-13	5,6	High Bay: Section DE:	MH1000/1	2	1,080	2,160	4,940	10,670	N	N/A	10,670	0	5:00	20:00	15.0	3,900	8,424	2,246	N	0	8,424	0	2,246	
LTC-282	14,16	LP-13	7,8	High Bay: Section CD:	MH1000/1	2	1,080	2,160	4,940	10,670	N	N/A	10,670	0	5:00	20:00	15.0	3,900	8,424	2,246	Y	1,822	3,936	4,488	6,735	
LTC-282	18,20	LP-13	9,10	High Bay: Section C.3:	MH1000/1	1	1,080	1,080	4,940	5,335	Y	0	0	5,335	n/a	n/a	0.0	0	0	0	N	0	0	0	5,335	Lights Off - Located above enclosed space.
LTC-282	1,3	LP-13	11,12	High Bay: Section AB:	MH1000/1	2	1,080	2,160	4,940	10,670	Y	0	0	10,670	n/a	n/a	0.0	0	0	0	N	0	0	0	10,670	Lights Off - Located above enclosed space.
LTC-282	5,7	LP-13	13,14	High Bay: Section AB:	MH1000/1	2	1,080	2,160	4,940	10,670	N	N/A	10,670	0	5:00	20:00	15.0	3,900	8,424	2,246	N	0	8,424	0	2,246	Aisle Light
LTC-282	9,11	LP-13	15,16	High Bay: Section A.5:	MH1000/1	1	1,080	1,080	4,940	5,335	Y	0	0	5,335	n/a	n/a	0.0	0	0	0	N	0	0	0	5,335	Lights Off - Located above enclosed space.
LTC-282	13,15	LP-13	17,18	High Bay: Section BC:	MH1000/1	2	1,080	2,160	4,940	10,670	Y	0	0	10,670	n/a	n/a	0.0	0	0	0	N	0	0	0	10,670	Lights Off - Located above enclosed space.
LTC-282	17,19	LP-13	19,20	High Bay: Section B.5:	MH1000/1	1	1,080	1,080	4,940	5,335	Y	0	0	5,335	n/a	n/a	0.0	0	0	0	N	0	0	0	5,335	Serves 2nd Floor Aisle
L1B27E	2,4	LP-14	1,2	High Bay: Section BC:	MH1000/1	2	1,080	2,160	4,940	10,670	Y	0	0	10,670	n/a	n/a	0.0	0	0	0	n	0	0	0	10,670	Lights Off - Located above enclosed space.
L1B27E	6,8	LP-14	3,4	High Bay: Section AB:	MH1000/1	2	1,080	2,160	4,940	10,670	Y	0	0	10,670	n/a	n/a	0.0	0	0	0	N	0	0	0	10,670	Lights Off - Located above enclosed space.
L1B27E	10,12	LP-14	5,6	High Bay: Section AB:	MH1000/1	2	1,080	2,160	4,940	10,670	Y	0	0	10,670	n/a	n/a	0.0	0	0	0	N	0	0	0	10,670	Aisle Light
L1B27E	14,16	LP-14	7,8	High Bay: Section A.1:	MH1000/1	1	1,080	1,080	4,940	5,335	N	N/A	5,335	0	0	20:00	15.0	3,900	4,212	1,123	Y	1,822	1,968	2,244	3,367	Aisle Light
L1B14E	1,3	LP-15	1,2	High Bay: Section B.5:	MH1000/1	1	1,080	1,080	4,940	5,335	N	N/A	5,335	0	0	22:00	17.5	4,550	4,914	421	N	0	4,914	0	421	Lights Off - Located above enclosed space.
L1B14E	5,7	LP-15	3,4	High Bay: Section AB:	MH1000/1	2	1,080	2,160	4,940	10,670	Y	0	0	10,670	n/a	n/a	0.0	0	0	0	N	0	0	0	10,670	Note: 1 lamp located above enclosed space.
L1B14E	9,11	LP-15	5,6	High Bay: Section AB:	MH1000/1	2	1,080	2,160	4,940	10,670	N	N/A	10,670	0	0	20:00	15.0	3,900	8,424	2,246	Y	1,822	3,936	4,488	6,735	Aisle Lights
L1B14E	13,15	LP-15	7,8	High Bay: Section AB:	MH1000/1	2	1,080	2,160	4,940	10,670	N	N/A	10,670	0	0	20:00	15.0	3,900	8,424	2,246	Y	1,822	3,936	4,488	6,735	Locally controlled via pushbutton switch.
L1B5E	2,4	LP-16	1,2	High Bay: Section B.5:	MH1000/1	1	1,080	1,080	4,940	5,335	N	N/A	5,335	0	0	18:00	14.0	3,640	3,931	1,404	N	0	3,931	0	1,404	Aisle Lights
L1B5E	6,8	LP-16	3,4	High Bay: Section BC:	MH1000/1	2	1,080	2,160	4,940	10,670	N	N/A	10,670	0	0	22:00	17.5	4,550	9,828	842	N	0	9,828	0	842	Aisle Lights
L1B5E	10,12	LP-16	5,6	High Bay: Section A.7:	MH1000/1	2	1,080	2,160	4,940	10,670	N	N/A	10,670	0	5:00	20:00	15.0	3,900	8,424	2,246	Y	1,822	3,936	4,488	6,735	Aisle Lights
L1B5E	14,16	LP-16	7,8	High Bay: Section AB:	MH1000/1	2	1,080	2,160	4,940	10,670	N	N/A	10,670	0	0	20:00	15.0	3,900	8,424	2,246	Y	1,822	3,936	4,488	6,735	Locally controlled via pushbutton switch.
L1B5E	18,20	LP-16	9,10	High Bay: Section B.3:	MH1000/1	1	1,080	1,080	4,940	5,335	N	N/A	5,335	0	n/a	n/a	1.0	260	281	5,054	N	0	281	0	5,054	Override Switch, 39449 hour interval (adjustable)
L2C9	9	LP-9	13	Mezzanine: Section C:	F42ILL-R/F32T8-Prem-R	5	48	240	8,760	2,102	N	N/A	2,102	0	n/a	n/a	1.0	260	62	2,040	N	0	62	0	2,040	Override Switch, 39449 hour interval (adjustable)
L2C9	11	LP-9	10	Mezzanine: Section B:	F42ILL-R/F32T8-Prem-R	12	48	576	8,760	5,046	N	N/A	5,046	0	n/a	n/a	1.0	260	150	4,896	N	0	150	0	4,896	Override Switch, 39449 hour interval (adjustable)
L2C9	13	LP-9	12	Mezzanine: Section C:	F42ILL-R/F32T8-Prem-R	7	48	336	8,760	2,943	N	N/A	2,943	0	n/a	n/a	1.0	260	87	2,856	N	0	87	0	2,856	Override Switch, 39449 hour interval (adjustable)
L1C15	1	LP-9	11	Mezzanine: Section C:	F42ILL-R/F32T8-Prem-R	8	48	384	8,760	3,364	N	N/A	3,364	0	n/a	n/a	1.0	260	100	3,264	N	0	100	0	3,264	Override Switch, 39449 hour interval (adjustable)
L1C15	3	LP-9	9	Mezzanine: Section C:	F42ILL-R/F32T8-Prem-R	16	48	768	8,760	6,728	N	N/A	6,728	0	n/a	n/a	1.0	260	200	6,528	N	0	200	0	6,528	Override Switch, 39449 hour interval (adjustable)
L1B4	7	LP-15	9	Mezzanine: Section B:	F42ILL-R/F32T8-Prem-R	13	48	624	8,760	5,466	N	N/A	5,466	0	n/a	n/a	1.0	260	162	5,304	N	0	162	0	5,304	Override Switch, 39449 hour interval (adjustable)
L1B4	9	LP-15	11	Mezzanine: Section B:	F42ILL-R/F32T8-Prem-R	9	48	432	8,760	3,784	N	N/A	3,784	0	n/a	n/a	1.0	260	112	3,672	N	0	112	0	3,672	Override Switch, 39449 hour interval (adjustable)
L2B30	19	LP-15	12	Mezzanine: Section B:	F42ILL-R/F32T8-Prem-R	14	48	672	8,760	5,887	N	N/A	5,887	0	n/a	n/a	1.0	260	175	5,712	N	0	175	0	5,712	Override Switch, 39449 hour interval (adjustable)
L2B30	21	LP-15	10	Mezzanine: Section B:	F42ILL-R/F32T8-Prem-R	9	48	432	8,760	3,784	N	N/A	3,784	0	n/a	n/a	1.0	260	112	3,672	N	0	112	0	3,672	
483,920	**855,390**	**492,597**	**362,794**	**342,613**	**149,983**	**283,296**	**59,317**	**572,094**						**362,780**						**149,977**				**59,319**	**572,080**	

7.2.4 Measure 6: Occupancy Lighting Controls

The Project Sponsor has completed the installation of occupancy sensors Buildings 1 and 2. The project included the installation of occupancy sensors for the workspace lighting serving offices, conference rooms, restrooms and large open workspaces. Table 28 reflects the verified savings.

Table 28. Verified Savings Summary

Bldg	Estimated Savings kWh	Verified Savings KWh	Percent Difference
Bldg 1	108,972	220,387	102%
Bldg 2	77,045	118,018	53%

7.2.4.1 Assumptions

The customer currently has no plans to significantly alter the number of workspace lighting circuits or fixtures. The present operation and use of each area does not change and the hours remain constant.

7.2.4.2 Savings Calculations

The annual energy savings for each space was calculated by multiplying the power and the difference in annual operating hours. The operating hours was determined with the use of metering equipment. The power consumed for each fixture type is based on the SDGE Appendix B, Table of Standard Fixture Wattages and Sample Lighting Table from the SPC Program. The baseline operating hours (T_b) for each area was determined by averaging the percent burn hours for a sample of areas and extrapolating that data to create a typical year's usage. A total of twelve (12) rooms were monitored for eight days. The overall average percent burn hours were monitored for each room and applied to the total population of the affected rooms. Based on the results in Table 29, the baseline annual burn hour is calculated to be 4,424 hours per year.

Table 29. Baseline Measurements

Bldg	Room	% Burn Hours	Hobo Serial Number	Start	End
OT-2	2021	39.1%	478916	6/29/2005	7/8/2005
OT-2	2232	35.0%	843077	6/29/2005	7/8/2005
OT-2	2528	99.1%	802417	6/29/2005	7/8/2005
OT-2	2635	9.1%	843082	6/29/2005	7/8/2005
OT-2	2738g	32.3%	843075	6/29/2005	7/8/2005
OT-2	2849	86.6%	802420	6/29/2005	7/8/2005
OT-2	2755	38.0%	843081	6/29/2005	7/8/2005
OT-2	1144	99.2%	802416	6/29/2005	7/8/2005
OT-2	1146	17.7%	478924	6/29/2005	7/8/2005
OT-1	1751	32.2%	843080	6/29/2005	7/8/2005
OT-1	2551	38.3%	843076	6/29/2005	7/8/2005
OT-1	2532	79.9%	843079	6/29/2005	7/8/2005
		50.5%	**Average Percent Burn Hours**		

Similarly, the annual operating hours for the post-installation scenario (T_{pi}) for each area was calculated using the same HOBO lighting loggers and the same methodologies described for the baseline case. Based on the results, the post-installation annual burn hour is calculated to be 2,812 hours per year shown in Table 30.

Table 30. Post Installation Measurements

Bldg	Room	% Burn Hours	Hobo Serial Number	Start	End
OT-2	1144	0.01%	843080	10/10/2006	11/16/2006
OT-2	1146	3.82%	802420	10/10/2006	11/16/2006
OT-2	1435	10.51%	843077	10/10/2006	11/16/2006
OT-2	2021	40.08%	478921	10/10/2006	11/16/2006
OT-2	2232	37.72%	843081	10/10/2006	11/16/2006
OT-2	2528	26.88%	478924	10/10/2006	11/16/2006
OT-2	2635	14.40%	843074	10/10/2006	11/16/2006
OT-2	2738	35.32%	802419	10/10/2006	11/16/2006
OT-2	2755	41.92%	843078	10/10/2006	11/16/2006
OT-2	1244	9.24%	843076	10/10/2006	11/16/2006
OT-2	1432	36.22%	478916	10/10/2006	11/16/2006
OT-2	1433	22.13%	843083	10/10/2006	11/16/2006
OT-1	2551	63.76%	843075	8/23/2006	9/29/2006
OT-1	2428	33.27%	802418	8/23/2006	9/29/2006
OT-1	2355	33.55%	802419	8/23/2006	9/29/2006
OT-1	2152	46.72%	802411	8/23/2006	9/29/2006
OT-1	2144	23.17%	843079	8/23/2006	9/29/2006
OT-1	2043	48.74%	843080	8/23/2006	9/29/2006
OT-1	2040	9.35%	802415	8/23/2006	9/29/2006
OT-1	1926	7.58%	843074	8/23/2006	9/29/2006
OT-1	1811	52.51%	802413	8/23/2006	9/29/2006
OT-1	1751	47.78%	843082	8/23/2006	9/29/2006
OT-1	1046	10.80%	843078	8/23/2006	9/29/2006
OT-1	1032	85.12%	802420	8/23/2006	9/29/2006
OT-1	1075	60.73%	802414	8/23/2006	9/29/2006
		32.1%	**Average Percent Burn Hours**		

The following typical equations are used to calculate the annual energy savings.

T_b & T_{pi} = % run time * 8760

Energy Savings, kWh = kW/FIX * FIX QNTY * (T_b - T_{pi})

The total lighting energy savings for each building was calculated by summing the total energy savings for workspace types. Each workspace energy savings is determined by multiplying the annual savings per fixture as defined above by the total number of fixtures in the workspace type. The verified savings are shown in the Appendix A.

7.2.5 Measure 8: Replace DX with CHW CRAC

The Project Sponsor has completed the replacement of and existing direct expansion (DX) computer room air conditioning (CRAC) with an equivalent 20 ton chilled water (CHW) CRAC unit Building 1. The CRAC unit is equipped with variable speed fan with chilled water coils for cooling and electric resistance heating. The unit serves a computer office space in Building 1 and is currently monitored by the Project Sponsor's building automation system (BAS). The project included new CHW supply and return piping, control valves and ductwork. The energy savings resulting from the implementation of this energy conservation opportunity (ECO) are from the cooling efficiency improvements from DX to chilled water and scheduling equipment to a time of day.

Table 31. Verified Savings Summary

Bldg	Estimated Savings kWh	Verified Savings KWh	Percent Difference
Bldg 1	38,586	55,077	42.7%

7.2.5.1 Assumptions

The assumptions are that the cooling load for the baseline and post-installation are the constant.

7.2.5.2 Savings Calculations

During the initial site visit, the Liebert was providing conditioned air to a computer workspace area. This enclosed area is housed within the high bay building. The CRAC units were conditioning the air continuously. However, the area only requires conditioning when the workspace is occupied. As a result, the CRAC unit has been replaced with an equivalent CHW unit and is currently on a time of day scheduled, from 4 AM to 8 PM five days a week.

The baseline energy use is calculated based on the short term metering of the 20-ton Liebert CRAC unit and the instantaneous power measurement. The total input current was monitored for approximately one week. Based on the logged data, the percent fan and cooling operating hours were calculated and summarized in Table 32. The annualized operating hours were calculated by multiplying the percent operating hours by 8,760 hours per year.

Table 32. Baseline Data

Baseline Logger Summary	
Analysis Period	7/8/05 - 7/15/05
Monitored Hours	173
Fan Hours	173
Stage 1 Cooling Hrs	99
Stage 2 Cooling Hrs	18.53
Calculated Percent Operations	
% Fan Hours	100%
% Stage 1 Cooling	57%
% Stage 2 Cooling	11%

Table 33. Instantaneous Measurement

Power	Power Factor	Amperage	Voltage
23	0.8	33	493

The post-installation energy use is calculated using the baseline cooling and fan hours of operation, however, the cooling and fan energy is now disabled during the unoccupied period from 8 PM to 4 AM 5 days a week and during weekends. The cooling savings results from scheduling the unit off during unoccupied period and the cooling efficiency gains. The trend report has been provided to demonstrate the scheduled operating hours from 4 AM to 8 PM seven days a week operation, provided in Appendix.

There are negative fan energy savings. The savings offset is based on an increase in motor size. The following equation was used to determine energy savings

$$\text{Fan kWh}_{\text{saved}} = \frac{3.0\ \text{HP} * .746\ \text{kW/HP} * \text{OHF}_{\text{base}}}{\text{EFF}_{\text{Base Motor}}} - \frac{7.5\ \text{HP} * .746\ \text{kW/HP} * \text{OHF}_{\text{post}}}{\text{EFF}_{\text{Post Motor}}},$$

where:

Fan kWh_{saved}	= Annual fan energy savings, kWh/yr
OHF base	= Baseline fan operating hours, 8760 hrs/yr
OHF post	= Post installation operating hours, 4,160 hrs/yr
$EFF_{Base\ Motor}$	= Baseline motor efficiency, 85%
$EFF_{Post\ Motor}$	= Post installation motor efficiency, 90%

The two sources of cooling energy savings are cooling efficiency gains and the reduction in run hours. The following equation is used to calculate the savings:

$$\text{Cooling kWh}_{\text{saved}} = \frac{10\ \text{Ton} * \text{OH1}_{\text{base}} + 10\ \text{Ton} * .\text{OH2}_{\text{base}}}{\text{EFF}_{\text{DX}}} - \frac{10\ \text{Ton} * \text{OH1}_{\text{post}} + 10\ \text{Ton} * .\text{OH2}_{\text{post}}}{\text{EFF}_{\text{CHW}}},$$

where:

Cooling kWh_{saved}	= Annual cooling energy savings, kWh/yr
OH1 base	= Stage 1 cooling operating hours, 5012 hrs/yr
OH2 base	= Stage 2 cooling operating hours, 940 hrs/yr
EFF_{DX}	= DX cooling efficiency 1.57 kW/ton
OH1 post	= Post stage 1 cooling operating hours, 2,465 hrs/yr
OH2 post	= Post stage 2 cooling operating hours, 70 hrs/yr
EFF_{CHW}	= Post central plant cooling efficiency 0.65 kW/ton

The total energy saving for this ECO is the sum of the fan savings and the cooling savings.

7.2.6 Measure 10: Replace Inlet Guide Vanes with Variable Frequency Drives

The Project Sponsor has completed the proposed retrofits at the Customer's facility. The project consisted of replacing existing inlet guide vanes (IGV) with variable frequency drives (VFDs). The retrofit included the removal of the IGV and the installation of VFDs to both the supply and return fans. Additionally the existing Project Sponsor's building automation system (BAS) was upgraded as part of this project.

Table 34. Affected Equipment

Equip ID	Supply Fan Hp	Return Fan HP	CFM
AHU-7	7.5	3.0	6,200
AHU-11	10.0	3.0	7,100
AHU-12	15.0	5.0	11,400
AHU-13	10.0	3.0	7,800
AHU-15	7.5	2.0	5,000
AHU-16	10.0	5.0	8,100
AHU-17	10.0	5.0	8,100
AHU-18	15.0	5.0	10,500
AHU-19	7.5	5.0	7,000
AHU-23	10.0	3.0	7,500
AHU-26	7.5	3.0	5,500
AHU-27	10.0	5.0	5,500
AHU-29	5.0	1.5	3,000
AHU-30	10.0	3.0	7,800
AHU-31	5.0	2.0	4,000
AHU-32	7.5	3.0	7,300
AHU-33	5.0	1.5	3,500
AHU-35	7.5	3.0	6,000
AHU-36	7.5	3.0	6,600
AHU-37	5.0	2.0	3,600
AHU-38	7.5	3.0	6,700
AHU-39	5.0	1.5	4,100

The verified energy savings summary is shown in Table 35.

Table 35. Verified Energy Savings Summary

Estimated Savings kWh	Verified Savings KWh	Percent Difference
287,291	298,906	4.0%

** Savings are based on fan energy savings only*

7.2.6.1 Savings Calculations

7.2.6.1.1 Baseline Energy

The baseline energy is calculated using the instantaneous power measurement of the baseline supply and return fan motors shown in the tables below.

Table 36. Instantaneous kW Measurement

Load Description	Equip ID	Hp	Power	Power Factor	Amps	Voltage
Supply Fan	AHU-7	7.5	2.54	0.85	13.90	206.2
Return Fan	AHU-7	3	0.82	0.85	4.74	207.2
Supply Fan	AHU-11	10	4.30	0.73	16.96	200.5
Return Fan	AHU-11	3	2.27	0.99	6.59	201.1
Supply Fan	AHU-12	15	5.36	0.86	17.87	201.3
Return Fan	AHU-12	5	1.82	0.87	5.99	201.4
Supply Fan	AHU-13	10	3.91	0.86	13.17	199.3
Return Fan	AHU-13	3	1.07	0.87	3.56	199.7
Supply Fan	AHU-15	7.5	3.76	0.86	12.23	206.4
Return Fan	AHU-15	2	0.86	0.66	3.67	204.9
Supply Fan	AHU-16	10	4.49	0.92	13.73	205.3
Return Fan	AHU-16	5	1.86	0.91	5.74	205.2
Supply Fan	AHU-17	10	4.73	0.71	18.74	205.3
Return Fan	AHU-17	5	2.17	0.79	7.76	204.8
Supply Fan	AHU-18	15	5.16	0.78	18.53	206.1
Return Fan	AHU-18	5	1.90	0.84	6.28	207.8
Supply Fan	AHU-19	7.5	3.50	0.77	13.18	199.1
Return Fan	AHU-19	5	1.27	0.72	5.12	199.4
Supply Fan	AHU-23	10	2.80	0.79	17.70	205.7
Return Fan	AHU-23	3	0.80	0.71	5.64	206.5
Supply Fan	AHU-26	7.5	1.48	0.33	11.19	207.0
Return Fan	AHU-26	3	0.54	0.38	4.27	207.8
Supply Fan	AHU-27	10	4.83	0.72	18.62	207.1
Return Fan	AHU-27	5	2.39	0.80	9.46	208.0
Supply Fan	AHU-29	5	1.33	0.67	4.75	208.1
Return Fan	AHU-29	1.5	0.45	0.25	4.05	208.2
Supply Fan	AHU-30	10	1.85	0.49	11.49	208.3
Return Fan	AHU-30	3	0.29	0.32	2.74	207.7
Supply Fan	AHU-31	5	1.74	0.69	6.86	209.7
Return Fan	AHU-31	2	0.07	0.10	1.96	209.3
Supply Fan	AHU-32	7.5	2.29	0.42	14.91	209.6
Return Fan	AHU-32	3	2.27	0.98	6.46	207.1
Supply Fan	AHU-33	5	1.10	0.54	5.89	207.2
Return Fan	AHU-33	1.5	0.49	0.34	4.05	207.2
Supply Fan	AHU-35	7.5	1.56	0.30	14.45	208.0
Return Fan	AHU-35	3	1.23	0.49	6.68	207.6
Supply Fan	AHU-36	7.5	3.28	0.66	13.37	209.6
Return Fan	AHU-36	3	1.12	0.69	4.48	209.6
Supply Fan	AHU-37	5	1.28	0.61	6.06	208.8
Return Fan	AHU-37	2	0.52	0.58	2.52	208.7
Supply Fan	AHU-38	7.5	1.8	0.31	14.73	207.8
Return Fan	AHU-38	3	0.5	0.33	4.03	208.3
Supply Fan	AHU-39	5	2.7	0.96	8.07	207.0
Return Fan	AHU-39	1.5	0.8	0.78	2.78	208.7

Additionally, current (amperage) data loggers were installed on the fan motors to measure and verify run times. The sample of fan motors are used as a representative sample of the fan motors located in Building 2. The logged data shows that AHUs that were sampled were currently scheduled. We have assumed that all the AHUs were on the same schedule, except for AHU 31, which is shown in the post-installation to operate continuously. The logged data is summarized in Table 37.

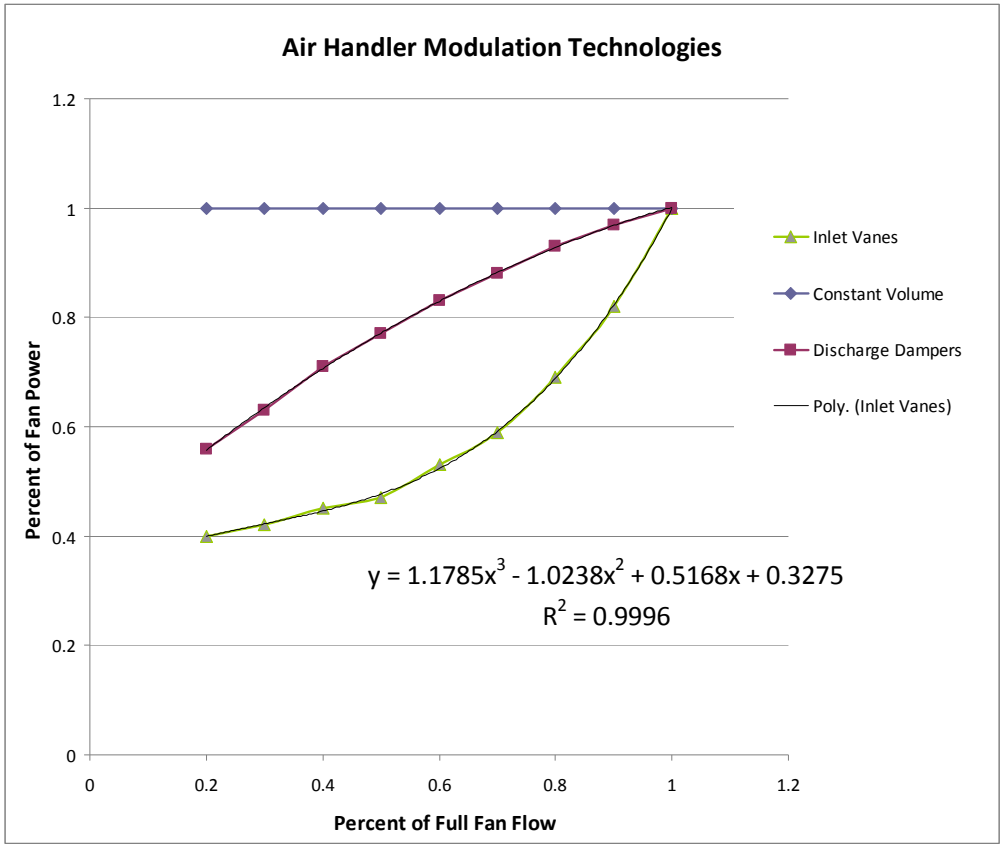
Table 37. Logged Data Summary

Equipment ID	AHU-26	AHU-29	AHU-30
Analysis Period	7/12/05 to 7/15/05	7/8/05 to 7/15/05	7/8/05 to 7/15/05
Monitored Hours	78	169.25	169.2
Supply Fan Hours	0400 to 1800	0400 to 1800	0400 to 1800
Return Fan Hours	0400 to 1800	0400 to 1800	0400 to 1800

**Weekdays only, off on weekends*

The baseline energy consumption for the IGV is calculated using the post-installation 15-minute air flow rate (CFM) data. The percent of full flow is calculated based on the trended data collected from 9/7/07 to 10/14/07 of AHU 11, 19, and 31. The 15-minute profile is calculated for a weekday and weekend. This profile is used to represent a typical day. Using a performance curve for an inlet vane fan, a third order polynomial curve fit is generated and shown in Figure 6.

Figure 6. Performance Curve for Inlet Vane Fan



Using the results of the curve fit, the fan power is calculated for a given flow. The baseline energy consumption is calculated using the following equation for a typical day and then extrapolated for the year.

$$kWH_{baseline} = \sum_{i=0}^{24} (1.18 * CFM_i^3 - 1.02 * CFM_i^2 + 0.517 * CFM_i + 0.328) * kW$$

where:

$kWh_{baseline}$ = Annual baseline energy, kWh per year
CFM = Percent of full fan air flow
kW = Power at full load

The annual baseline energy consumption is calculated. An example of the consumption calculation is shown in Table 38. The total baseline consumption for all units is summarized in Table 39.

Table 38. Example of Basecase Energy Consumption – AH-7

	Weekday				Weekend			
Time	WD Avg% Flow	WD Flow CFM	WD Power kW	WD Power kWh	WE Avg % Flow	WE Flow CFM	WE Power kW	WE kWh
0:00:00		0	0.0	0.0		0	0.0	0.0
0:15:00		0	0.0	0.0		0	0.0	0.0
0:30:00		0	0.0	0.0		0	0.0	0.0
0:45:00		0	0.0	0.0		0	0.0	0.0
1:00:00		0	0.0	0.0		0	0.0	0.0
1:15:00		0	0.0	0.0		0	0.0	0.0
1:30:00		0	0.0	0.0		0	0.0	0.0
1:45:00		0	0.0	0.0		0	0.0	0.0
2:00:00		0	0.0	0.0		0	0.0	0.0
2:15:00		0	0.0	0.0		0	0.0	0.0
2:30:00		0	0.0	0.0		0	0.0	0.0
2:45:00		0	0.0	0.0		0	0.0	0.0
3:00:00		0	0.0	0.0		0	0.0	0.0
3:15:00		0	0.0	0.0		0	0.0	0.0
3:30:00		0	0.0	0.0		0	0.0	0.0
3:45:00		0	0.0	0.0		0	0.0	0.0
4:00:00		0	0.0	0.0		0	0.0	0.0
4:15:00		0	0.0	0.0		0	0.0	0.0
4:30:00		0	0.0	0.0		0	0.0	0.0
4:45:00	74%	4,577	5.5	1.4	44.6%	2,762	4.1	1.0
5:00:00	75%	4,668	5.6	1.4	44.7%	2,773	4.1	1.0
5:15:00	76%	4,708	5.7	1.4	44.6%	2,762	4.1	1.0
5:30:00	76%	4,690	5.7	1.4	44.8%	2,778	4.1	1.0
5:45:00	75%	4,673	5.7	1.4	44.1%	2,736	4.0	1.0
6:00:00	75%	4,663	5.6	1.4	44.6%	2,765	4.1	1.0
6:15:00	74%	4,619	5.6	1.4	44.7%	2,772	4.1	1.0
6:30:00	74%	4,593	5.5	1.4	44.6%	2,766	4.1	1.0
6:45:00	73%	4,551	5.5	1.4	44.6%	2,766	4.1	1.0
7:00:00	72%	4,485	5.4	1.4	53.1%	3,291	4.3	1.1
7:15:00	71%	4,410	5.3	1.3	53.5%	3,315	4.3	1.1
7:30:00	70%	4,327	5.2	1.3	54.0%	3,351	4.4	1.1
7:45:00	69%	4,284	5.2	1.3	54.5%	3,376	4.4	1.1
8:00:00	69%	4,257	5.1	1.3	54.7%	3,393	4.4	1.1
8:15:00	69%	4,248	5.1	1.3	54.6%	3,385	4.4	1.1
8:30:00	68%	4,229	5.1	1.3	54.6%	3,387	4.4	1.1
8:45:00	68%	4,227	5.1	1.3	54.7%	3,391	4.4	1.1
9:00:00	68%	4,216	5.1	1.3	54.7%	3,390	4.4	1.1
9:15:00	68%	4,206	5.1	1.3	54.7%	3,392	4.4	1.1
9:30:00	68%	4,185	5.1	1.3	54.8%	3,395	4.4	1.1
9:45:00	68%	4,187	5.1	1.3	54.6%	3,387	4.4	1.1
10:00:00	67%	4,168	5.0	1.3	54.3%	3,365	4.4	1.1
10:15:00	67%	4,182	5.1	1.3	54.0%	3,347	4.4	1.1
10:30:00	67%	4,136	5.0	1.3	53.6%	3,325	4.3	1.1
10:45:00	67%	4,141	5.0	1.3	53.1%	3,290	4.3	1.1
11:00:00	66%	4,121	5.0	1.2	52.0%	3,227	4.3	1.1
11:15:00	66%	4,122	5.0	1.2	52.0%	3,227	4.3	1.1
11:30:00	67%	4,152	5.0	1.3	52.1%	3,228	4.3	1.1
11:45:00	67%	4,162	5.0	1.3	52.1%	3,231	4.3	1.1
12:00:00	67%	4,167	5.0	1.3	51.7%	3,203	4.3	1.1
12:15:00	68%	4,190	5.1	1.3	51.7%	3,206	4.3	1.1
12:30:00	68%	4,188	5.1	1.3	51.7%	3,208	4.3	1.1
12:45:00	67%	4,183	5.1	1.3	51.9%	3,218	4.3	1.1
13:00:00	68%	4,190	5.1	1.3	52.3%	3,240	4.3	1.1
13:15:00	68%	4,195	5.1	1.3	52.0%	3,226	4.3	1.1
13:30:00	68%	4,199	5.1	1.3	51.9%	3,219	4.3	1.1
13:45:00	68%	4,213	5.1	1.3	51.6%	3,198	4.3	1.1
14:00:00	68%	4,226	5.1	1.3	51.9%	3,217	4.3	1.1

Table 38. Example of Basecase Energy Consumption – AH-7 (con't)

	Weekday				Weekend			
Time	WD Avg% Flow	WD Flow CFM	WD Power kW	WD Power kWh	WE Avg % Flow	WE Flow CFM	WE Power kW	WE kWh
14:15:00	68%	4,237	5.1	1.3	52.1%	3,229	4.3	1.1
14:30:00	69%	4,278	5.2	1.3	51.9%	3,220	4.3	1.1
14:45:00	69%	4,308	5.2	1.3	51.9%	3,216	4.3	1.1
15:00:00	70%	4,339	5.2	1.3	52.0%	3,226	4.3	1.1
15:15:00	71%	4,390	5.3	1.3	52.2%	3,238	4.3	1.1
15:30:00	71%	4,426	5.3	1.3	52.1%	3,233	4.3	1.1
15:45:00	71%	4,420	5.3	1.3	51.6%	3,202	4.3	1.1
16:00:00	71%	4,413	5.3	1.3	51.7%	3,205	4.3	1.1
16:15:00	71%	4,381	5.3	1.3	52.0%	3,222	4.3	1.1
16:30:00	70%	4,368	5.3	1.3	51.8%	3,213	4.3	1.1
16:45:00	70%	4,330	5.2	1.3	51.9%	3,217	4.3	1.1
17:00:00	69%	4,279	5.2	1.3	52.0%	3,223	4.3	1.1
17:15:00	68%	4,242	5.1	1.3	51.6%	3,200	4.3	1.1
17:30:00	68%	4,214	5.1	1.3	51.7%	3,205	4.3	1.1
17:45:00	67%	4,183	5.1	1.3	51.8%	3,215	4.3	1.1
18:00:00		0	0.0	0.0		0	0.0	0.0
18:15:00		0	0.0	0.0		0	0.0	0.0
18:30:00		0	0.0	0.0		0	0.0	0.0
18:45:00		0	0.0	0.0		0	0.0	0.0
19:00:00		0	0.0	0.0		0	0.0	0.0
19:15:00		0	0.0	0.0		0	0.0	0.0
19:30:00		0	0.0	0.0		0	0.0	0.0
19:45:00		0	0.0	0.0		0	0.0	0.0
20:00:00		0	0.0	0.0		0	0.0	0.0
20:15:00		0	0.0	0.0		0	0.0	0.0
20:30:00		0	0.0	0.0		0	0.0	0.0
20:45:00		0	0.0	0.0		0	0.0	0.0
21:00:00		0	0.0	0.0		0	0.0	0.0
21:15:00		0	0.0	0.0		0	0.0	0.0
21:30:00		0	0.0	0.0		0	0.0	0.0
21:45:00		0	0.0	0.0		0	0.0	0.0
22:00:00		0	0.0	0.0		0	0.0	0.0
22:15:00		0	0.0	0.0		0	0.0	0.0
22:30:00		0	0.0	0.0		0	0.0	0.0
22:45:00		0	0.0	0.0		0	0.0	0.0
23:00:00		0	0.0	0.0		0	0.0	0.0
23:15:00		0	0.0	0.0		0	0.0	0.0
23:30:00		0	0.0	0.0		0	0.0	0.0
23:45:00		0	0.0	0.0		0	0.0	0.0
Total - Daily				**69.1**				**56.6**
Subtotal - Annual Weekday & Weekend				**17,961**				**5,881**
Total Annual (Weekday + Weekend)				**23,842**				

Table 39. Baseline Energy Summary

Equip ID	Supply Fan Hp	Return Fan HP	CFM	Baseline kWh
AHU-7	7.5	3.0	6,200	23,842
AHU-11	10.0	3.0	7,100	29,348
AHU-12	15.0	5.0	11,400	44,588
AHU-13	10.0	3.0	7,800	31,476
AHU-15	7.5	2.0	5,000	21,651
AHU-16	10.0	5.0	8,100	33,906
AHU-17	10.0	5.0	8,100	33,906
AHU-18	15.0	5.0	10,500	44,588
AHU-19	7.5	5.0	7,000	28,385
AHU-23	10.0	3.0	7,500	29,348
AHU-26	7.5	3.0	5,500	23,827
AHU-27	10.0	5.0	5,500	33,906
AHU-29	5.0	1.5	3,000	15,814
AHU-30	10.0	3.0	7,800	29,348
AHU-31	5.0	2.0	4,000	28,345
AHU-32	7.5	3.0	7,300	23,827
AHU-33	5.0	1.5	3,500	15,814
AHU-35	7.5	3.0	6,000	23,827
AHU-36	7.5	3.0	6,600	26,375
AHU-37	5.0	2.0	3,600	16,909
AHU-38	7.5	3.0	6,700	23,827
AHU-39	5.0	1.5	4,100	15,814
Total				**598,669**

7.2.6.1.2 Post-Installation Energy

The post-installation consumption is based on same trended data used in the development of the baseline energy use from 9/7/07 to 10/14/07. The same hourly air flow profile is used for the post-installation and the energy consumption is calculated using the following equation:

$$kW_2 = \sum \left(\frac{CFM_2}{CFM_1} \right)^3 * kW_1$$

Table 40 shows an example of the post-installation energy consumption calculations.

Table 40. Example of Post-Installation Energy Consumption – AH-7

	Weekday				Weekend			
Time	WD Avg% Flow	WD Flow CFM	WD Power kW	WD Power kWh	WE Avg % Flow	WE Flow CFM	WE Power kW	WE kWH
0:00:00		0	0.0	0.0		0	0.0	0.0
0:15:00		0	0.0	0.0		0	0.0	0.0
0:30:00		0	0.0	0.0		0	0.0	0.0
0:45:00		0	0.0	0.0		0	0.0	0.0
1:00:00		0	0.0	0.0		0	0.0	0.0
1:15:00		0	0.0	0.0		0	0.0	0.0
1:30:00		0	0.0	0.0		0	0.0	0.0
1:45:00		0	0.0	0.0		0	0.0	0.0
2:00:00		0	0.0	0.0		0	0.0	0.0
2:15:00		0	0.0	0.0		0	0.0	0.0
2:30:00		0	0.0	0.0		0	0.0	0.0
2:45:00		0	0.0	0.0		0	0.0	0.0
3:00:00		0	0.0	0.0		0	0.0	0.0
3:15:00		0	0.0	0.0		0	0.0	0.0
3:30:00		0	0.0	0.0		0	0.0	0.0
3:45:00		0	0.0	0.0		0	0.0	0.0
4:00:00		0	0.0	0.0		0	0.0	0.0
4:15:00		0	0.0	0.0		0	0.0	0.0
4:30:00	72%	4,455	3.3	0.8	44.7%	2,769	0.8	0.2
4:45:00	74%	4,577	3.6	0.9	44.6%	2,762	0.8	0.2
5:00:00	75%	4,668	3.8	0.9	44.7%	2,773	0.8	0.2
5:15:00	76%	4,708	3.9	1.0	44.6%	2,762	0.8	0.2
5:30:00	76%	4,690	3.8	1.0	44.8%	2,778	0.8	0.2
5:45:00	75%	4,673	3.8	0.9	44.1%	2,736	0.8	0.2
6:00:00	75%	4,663	3.8	0.9	44.6%	2,765	0.8	0.2
6:15:00	74%	4,619	3.7	0.9	44.7%	2,772	0.8	0.2
6:30:00	74%	4,593	3.6	0.9	44.6%	2,766	0.8	0.2
6:45:00	73%	4,551	3.5	0.9	44.6%	2,766	0.8	0.2
7:00:00	72%	4,485	3.3	0.8	53.1%	3,291	1.3	0.3
7:15:00	71%	4,410	3.2	0.8	53.5%	3,315	1.4	0.3
7:30:00	70%	4,327	3.0	0.8	54.0%	3,351	1.4	0.3
7:45:00	69%	4,284	2.9	0.7	54.5%	3,376	1.4	0.4
8:00:00	69%	4,257	2.9	0.7	54.7%	3,393	1.5	0.4
8:15:00	69%	4,248	2.8	0.7	54.6%	3,385	1.4	0.4
8:30:00	68%	4,229	2.8	0.7	54.6%	3,387	1.4	0.4
8:45:00	68%	4,227	2.8	0.7	54.7%	3,391	1.4	0.4
9:00:00	68%	4,216	2.8	0.7	54.7%	3,390	1.4	0.4
9:15:00	68%	4,206	2.8	0.7	54.7%	3,392	1.4	0.4
9:30:00	68%	4,185	2.7	0.7	54.8%	3,395	1.5	0.4
9:45:00	68%	4,187	2.7	0.7	54.6%	3,387	1.4	0.4
10:00:00	67%	4,168	2.7	0.7	54.3%	3,365	1.4	0.4
10:15:00	67%	4,182	2.7	0.7	54.0%	3,347	1.4	0.3
10:30:00	67%	4,136	2.6	0.7	53.6%	3,325	1.4	0.3
10:45:00	67%	4,141	2.6	0.7	53.1%	3,290	1.3	0.3
11:00:00	66%	4,121	2.6	0.6	52.0%	3,227	1.2	0.3
11:15:00	66%	4,122	2.6	0.6	52.0%	3,227	1.2	0.3
11:30:00	67%	4,152	2.7	0.7	52.1%	3,228	1.2	0.3
11:45:00	67%	4,162	2.7	0.7	52.1%	3,231	1.3	0.3
12:00:00	67%	4,167	2.7	0.7	51.7%	3,203	1.2	0.3
12:15:00	68%	4,190	2.7	0.7	51.7%	3,206	1.2	0.3
12:30:00	68%	4,188	2.7	0.7	51.7%	3,208	1.2	0.3
12:45:00	67%	4,183	2.7	0.7	51.9%	3,218	1.2	0.3
13:00:00	68%	4,190	2.7	0.7	52.3%	3,240	1.3	0.3
13:15:00	68%	4,195	2.7	0.7	52.0%	3,226	1.2	0.3
13:30:00	68%	4,199	2.7	0.7	51.9%	3,219	1.2	0.3
13:45:00	68%	4,213	2.8	0.7	51.6%	3,198	1.2	0.3
14:00:00	68%	4,226	2.8	0.7	51.9%	3,217	1.2	0.3
14:15:00	68%	4,237	2.8	0.7	52.1%	3,229	1.2	0.3
14:30:00	69%	4,278	2.9	0.7	51.9%	3,220	1.2	0.3
14:45:00	69%	4,308	3.0	0.7	51.9%	3,216	1.2	0.3
15:00:00	70%	4,339	3.0	0.8	52.0%	3,226	1.2	0.3
15:15:00	71%	4,390	3.1	0.8	52.2%	3,238	1.3	0.3
15:30:00	71%	4,426	3.2	0.8	52.1%	3,233	1.3	0.3
15:45:00	71%	4,420	3.2	0.8	51.6%	3,202	1.2	0.3
16:00:00	71%	4,413	3.2	0.8	51.7%	3,205	1.2	0.3

Table 40. Example of Post-Installation Energy Consumption – AH-7 (con't)

	Weekday				Weekend			
Time	WD Avg% Flow	WD Flow CFM	WD Power kW	WD Power kWh	WE Avg % Flow	WE Flow CFM	WE Power kW	WE kWH
16:15:00	71%	4,381	3.1	0.8	52.0%	3,222	1.2	0.3
16:30:00	70%	4,368	3.1	0.8	51.8%	3,213	1.2	0.3
16:45:00	70%	4,330	3.0	0.8	51.9%	3,217	1.2	0.3
17:00:00	69%	4,279	2.9	0.7	52.0%	3,223	1.2	0.3
17:15:00	68%	4,242	2.8	0.7	51.6%	3,200	1.2	0.3
17:30:00	68%	4,214	2.8	0.7	51.7%	3,205	1.2	0.3
17:45:00	67%	4,183	2.7	0.7	51.8%	3,215	1.2	0.3
18:00:00		0	0.0	0.0		0	0.0	0.0
18:15:00		0	0.0	0.0		0	0.0	0.0
18:30:00		0	0.0	0.0		0	0.0	0.0
18:45:00		0	0.0	0.0		0	0.0	0.0
19:00:00		0	0.0	0.0		0	0.0	0.0
19:15:00		0	0.0	0.0		0	0.0	0.0
19:30:00		0	0.0	0.0		0	0.0	0.0
19:45:00		0	0.0	0.0		0	0.0	0.0
20:00:00		0	0.0	0.0		0	0.0	0.0
20:15:00		0	0.0	0.0		0	0.0	0.0
20:30:00		0	0.0	0.0		0	0.0	0.0
20:45:00		0	0.0	0.0		0	0.0	0.0
21:00:00		0	0.0	0.0		0	0.0	0.0
21:15:00		0	0.0	0.0		0	0.0	0.0
21:30:00		0	0.0	0.0		0	0.0	0.0
21:45:00		0	0.0	0.0		0	0.0	0.0
22:00:00		0	0.0	0.0		0	0.0	0.0
22:15:00		0	0.0	0.0		0	0.0	0.0
22:30:00		0	0.0	0.0		0	0.0	0.0
22:45:00		0	0.0	0.0		0	0.0	0.0
23:00:00		0	0.0	0.0		0	0.0	0.0
23:15:00		0	0.0	0.0		0	0.0	0.0
23:30:00		0	0.0	0.0		0	0.0	0.0
23:45:00		0	0.0	0.0		0	0.0	0.0
Total - Daily				**40.5**				**16.3**
Subtotal - Annual Weekday & Weekend				**10,541**				**1,691**
Total Annual (Weekday + Weekend)				**12,232**				

7.2.6.1.3 Savings Calculations

The savings was calculated as the difference of the baseline usage and post-installation usage.

Table 41. Energy Savings

Equip ID	Supply Fan Hp	Return Fan HP	CFM	Baseline kWh	Post-Installation kWh	Savings kWh
AHU-7	7.5	3.0	6,200	23,842	12,232	11,610
AHU-11	10.0	3.0	7,100	29,348	15,066	14,282
AHU-12	15.0	5.0	11,400	44,588	22,890	21,698
AHU-13	10.0	3.0	7,800	31,476	16,159	15,318
AHU-15	7.5	2.0	5,000	21,651	11,115	10,536
AHU-16	10.0	5.0	8,100	33,906	17,406	16,500
AHU-17	10.0	5.0	8,100	33,906	17,406	16,500
AHU-18	15.0	5.0	10,500	44,588	22,890	21,698
AHU-19	7.5	5.0	7,000	28,385	14,572	13,813
AHU-23	10.0	3.0	7,500	29,348	15,066	14,282
AHU-26	7.5	3.0	5,500	23,827	11,998	11,829
AHU-27	10.0	5.0	5,500	33,906	17,406	16,500
AHU-29	5.0	1.5	3,000	15,814	7,963	7,851
AHU-30	10.0	3.0	7,800	29,348	14,778	14,570
AHU-31	5.0	2.0	4,000	28,345	9,207	19,138
AHU-32	7.5	3.0	7,300	23,827	12,232	11,595
AHU-33	5.0	1.5	3,500	15,814	8,118	7,696
AHU-35	7.5	3.0	6,000	23,827	11,998	11,829
AHU-36	7.5	3.0	6,600	26,375	12,232	14,143
AHU-37	5.0	2.0	3,600	17,317	9,089	8,229
AHU-38	7.5	3.0	6,700	23,827	12,232	11,595
AHU-39	5.0	1.5	4,100	15,814	8,118	7,696
Total				**599,077**	**300,171**	**298,906**

7.3 04-01-018 & 04-01-028 - Lighting Retrofit Project At Six Sites

These two projects were originally proposed as a single project by the Project Sponsor. It was actually implemented by two contractors at six locations owned by the Project Sponsor. The project was implemented as two CESB projects, one for each contractor. The installations of the two contractors were verified separately and combined for the total project impacts.

7.3.1 Total Project M&V

Table 42 shows the summary of the M&V for the entire project proposed by the Project Sponsor.

Table 42. M&V Savings Summary: 04-01-018 and 04-01-028

TOTAL PROJECT							
	Contractor A		Contractor B				
	Site A1	Site A2	Site B1	Site B2	Site B3	Site B4	Total
Energy Savings (kWh)							
Total Contracted Savings (kWh)	1,450,365	490,540	727,566	1,883,136	434,869	689,159	5,675,635
Total Reported / Invoiced Savings (kWh)	1,450,365	490,450	727,566	1,883,136	434,869	687,743	5,674,129
M&V Savings (kWh)	**1,347,742**	**490,450**	**727,566**	**1,883,136**	**427,543**	**686,561**	5,562,998
Realization Rate (kWh)							**98.0%**
Demand Reduction (kW)							
Total Contracted Savings (kW)	251.00	103.00	170.66	362.39	98.19	165.03	1,150.27
Total Reported / Invoiced Savings (kW)	251.05	102.61	170.66	362.39	98.19	164.64	1,149.54
M&V Savings (kW)	**227.62**	**102.61**	**170.66**	**362.39**	**96.19**	**164.41**	1,123.88
Realization Rate (kW)							**97.8%**

7.3.1.1 Program Overview

This project was a lighting retrofit project conducted in common areas at six locations in the San Diego area.

The Project Sponsor contracted with two lighting contractors, Contractor A and Contractor B, to implement this project. Separate M&V reports were written for the projects installed by these two contractors. These reports follow the current combined report. This final report summarizes the results for the project overall.

Table 43 provides a list of measures proposed by the Project Sponsor.

Table 43. Proposed Measures and Savings
04-01-018 & 04-01-028 Lighting Retrofit Projects

Measure	Quantity of Lamps	Gross kWh Energy Savings	Gross kW Demand Reduction	Gross Therm Savings
Elec Ballast and T-8 lamps (28 Watt)	2,357	185,826	28.3	0
Elec Ballast and T-8 lamps (49 Watt)	1,982	201,837	30.7	0
Elec Ballast and T-8 lamps (77 Watt)	165	8,609	2.4	0
Elec Ballast and T-8 lamps (104 Watt)	1,332	67,879	18.6	0
Compact Fluorescent (42 Watt)	200	59,276	11.6	0
Compact Fluorescent (18 Watt)	20	5,825	1.1	0
Elec Ballast and T-8 lamps (32 Watt)	80	6,989	1.9	0
Retrofit to 200 Watt Pulse Start	339	109,134	21.4	0
Retrofit to 750 Watt Pulse Start	468	447,548	0.0	0
Retrofit to 320 Pulse Start	887	301,092	82.5	0
Retrofit to Compact Fluorescent (85 Watt)	1,640	1,173,256	229.6	0
New LED Sign	96	29,434	3.4	0
Compact Fluorescent Kit (65)	1,443	553,030	108.2	0
Retrofit to 2 T-8 lamps	10	840	0.2	0
Retrofit to 4 T-8 lamps	76	5,271	1.4	0
Install New 3 Lamp t-5 fixture	1,151	869,638	0.0	0
Install New 2 Lamp t-5 fixture	2,256	1,082,000	0.0	0
Install New 4 Lamp t-5 fixture	234	344,373	0.0	0
Compact Fluorescent Kit (42)	221	76,954	0.0	0
Compact Fluorescent Kit (18)	1,251	121,460	23.8	0
Total Proposed		**5,650,271**	**565.1**	**0**

7.3.1.2 Measurement and Verification (M&V) Approach

The M&V approach used for the project is summarized in this section. KSI coordinated with Project Sponsor to perform pre- and post-retrofit M&V activities to support the tasks described following subsections.

7.3.1.3 Load Impact Verification Methodology

The load impact estimation methodology complies with IPMVP Option A. Site inspections were employed to verify key M&V parameters.

7.3.1.3.1 Analysis Approach

The basic equation used to estimate the energy savings of this project is shown in Equation 1.

(Eq. 1) $kWh\ savings = kWh_{Pre} - kWh_{Post}$

where:

$kWh_{Pre} = (\#\ Fixures_{Pre}) \times (Fixture\ Wattage_{Pre}/1000) \times (Hours\ of\ Operation_{Pre})$; and

$kWh_{Post} = (\#\ Fixures_{Post}) \times (Fixture\ Wattage_{Post}/1000) \times (Hours\ of\ Operation_{Post})$.

The key parameters of Equation 1 are shown in Table 44.

Table 44. Key M&V Parameters

Parameter	M&V Activity
Fixture Counts	Fixture counts were verified through on-site inspection. Leverage pre-inspections by SDG&E program staff.
Fixture $Wattage_{Pre}$ and Fixture $Wattage_{Post}$	Stipulated wattage values on verification of fixture types. Leverage pre-inspections by SDG&E program staff.
Hours of Operation	The lighting fixture retrofits were typically controlled by timeclocks. Timeclocks are usually reliable and accurate when operating. Timeclocks were confirmed to be in operation and the settings were verified.

7.3.1.3.2 On-Site Verification Inspections

On-site inspections were conducted to verify the equipment types, quantities and operating hours. Site inspections consisted of the following activities:

- Verification of the installation of lighting equipment, including
  - fixture wattage, and
  - counts.
- Verify the operation of lighting controls, such as timeclocks.
- Verify hours of operation for lighting by obtaining lighting schedules and/or reviewing settings on timeclocks.

The verification was based on as-built documentation provided to KSI.

7.3.1.4 Results

This section provides the results of the M&V process.

Some of the key findings are:

- **Realization Rates:** The realization rates are 98.0% for kWh savings and 97.8% for kW reduced. This means that the verified kWh savings were 98.0% of kWh savings reported through the as-built documentation. There were two reasons for the realization rate less than 100%: (1) The Project Sponsor elected not to proceed with several measures at one facility; and (2) a discrepancy in fixture counts in the as-built documentation was found at one facility.

- **Hours of Operation:** The proposed hours of operation were verified through the confirmation of the schedule of the timeclocks used to control the lights throughout each facility.
- **Fixture Counts:** Fixture counts were verified during the post-inspection. Two discrepancies were found. Discussions of these discrepancies follow. (1) Some of the contracted lighting retrofits initially proposed by Contractor B were not installed due to business decisions made by the Project Sponsor. These included retrofits that the Project Sponsor had concluded were either not cost-effective or would occur in areas where remodeling projects had been planned. (2) A 3rd party contractor hired by the Project Sponsor conducted an initial lighting audit. This audit was the basis for the program agreement and was used by Contractor A for reporting the installed program impacts. During the verification inspections a discrepancy was found with the counts for one line item at Site A1. Item 9 in Site A1 retrofit of 239 canopy surface mount fixtures from 250w Metal Halide to 150w Pulse Start Metal Halide fixtures. Twenty-six canopy surface mount fixtures were verified during the post-inspection. A thorough review of facility plans and discussions with site facilities engineering staff indicated that there were only 26 such fixtures at the site. Therefore, the reported fixture counts were overstated by 213, thus reducing the load impacts.
- **Relamps:** A few of the retrofits involved merely replacing old fixtures and bulbs with new components, without altering the load wattage. Thus, no savings were allocated to the verified totals. Contractor B performed these replacements at the request of the Project Sponsor.
- **Fixture Wattages:** Reported fixture wattages were verified to be consistent with the installed fixtures.

7.3.2 04-01-018: Contractor A

Project 04-01-018 was implemented by Contractor A. The M&V summary for 04-01-018 is shown in Table 45.

Table 45. M&V Summary, Project 04-01-018: Contractor A

Project 04-01-018: Contractor A			
	Site A1	**Site A2**	**Total**
Energy Savings (kWh)			
Total Contracted Savings (kWh)[1]	1,450,365	490,450	1,940,815
Total Reported / Invoiced Savings (kWh)	1,450,365	490,450	1,940,815
Verified Savings (kWh)	**1,347,742**	**490,450**	**1,838,192**
Realization Rate (kWh)			**94.7%**
Demand Reduction (kW)			
Total Contracted Savings (Kw) [1]	251	103	354.00
Total Reported / Invoiced Savings (kW)	251.05	102.61	353.66
Verifiied Savings (kW)	**227.62**	**102.61**	**330.23**
Realization Rate (kW)			**93%**

7.3.2.1 Program Overview

This project was essentially a lighting retrofit program conducted in common areas at two Project Sponsor locations in the San Diego area. The facilities are located in:

- Site A1
- Site A2

Table 46 provides a list of measures proposed by the Project Sponsor.

Table 46. Proposed Measures and Savings
Project Sponsor Lighting Retrofit Project at Six Locations

Measure	Quantity of Lamps	Gross kWh Energy Savings	Gross kW Demand Reduction	Gross Therm Savings
Elec Ballast and T-8 lamps (28 Watt)	2,357	185,826	28.3	0
Elec Ballast and T-8 lamps (49 Watt)	1,982	201,837	30.7	0
Elec Ballast and T-8 lamps (77 Watt)	165	8,609	2.4	0
Elec Ballast and T-8 lamps (104 Watt)	1,332	67,879	18.6	0
Compact Fluorescent (42 Watt)	200	59,276	11.6	0
Compact Fluorescent (18 Watt)	20	5,825	1.1	0
Elec Ballast and T-8 lamps (32 Watt)	80	6,989	1.9	0
Retrofit to 200 Watt Pulse Start	339	109,134	21.4	0
Retrofit to 750 Watt Pulse Start	468	447,548	0.0	0
Retrofit to 320 Pulse Start	887	301,092	82.5	0
Retrofit to Compact Fluorescent (85 Watt)	1,640	1,173,256	229.6	0
New LED Sign	96	29,434	3.4	0
Compact Fluorescent Kit (65)	1,443	553,030	108.2	0
Retrofit to 2 T-8 lamps	10	840	0.2	0
Retrofit to 4 T-8 lamps	76	5,271	1.4	0
Install New 3 Lamp t-5 fixture	1,151	869,638	0.0	0
Install New 2 Lamp t-5 fixture	2,256	1,082,000	0.0	0
Install New 4 Lamp t-5 fixture	234	344,373	0.0	0
Compact Fluorescent Kit (42)	221	76,954	0.0	0
Compact Fluorescent Kit (18)	1,251	121,460	23.8	0
Westfield Total		**5,650,271**	**565.1**	**0**

7.3.2.2 Measurement and Verification (M&V) Approach

The M&V approach used for the project is summarized in this section. KSI coordinated with Westfield to perform pre and post-retrofit M&V activities to support the tasks described below.

7.3.2.3 Load Impact Verification Methodology

The load impact estimation methodology described in this plan complies with IPMVP Option A. Site inspections were employed to verify key M&V parameters.

7.3.2.3.1 Analysis Approach

The basic equation used to estimate the energy savings of this project is shown in Equation 1.

(Eq. 1) $kWh\ savings = kWh_{Pre} - kWh_{Post}$

where:

$kWh_{Pre} = (\#\ Fixures_{Pre}) \times (Fixture\ Wattage_{Pre}/1000) \times (Hours\ of\ Operation_{Pre})$; and

$$kWh_{Post} = (\#\ Fixures_{Post}) \times (Fixture\ Wattage_{Post}/1000) \times (Hours\ of\ Operation_{Post}).$$

The key parameters of Equation 1 are shown in Table 47.

Table 47. Key M&V Parameters

Parameter	M&V Activity
Fixture Counts	Fixture counts were verified through on-site inspection. Leverage pre-inspections by SDG&E program staff.
Fixture $Wattage_{Pre}$ and Fixture $Wattage_{Post}$	Stipulated wattage values on verification of fixture types. Leverage pre-inspections by SDG&E program staff.
Hours of Operation	The lighting fixtures retrofit were typically controlled by timeclocks. Timeclocks are usually reliable and accurate when operating. Timeclocks were confirmed to be in operation and the settings were verified.

7.3.2.3.2 On-Site Verification Inspections

On-site inspections were conducted to verify the equipment types, quantities and operating hours. Site inspections consisted of the following activities:

- Verification of the installation of lighting equipment, including
  - fixture wattage, and
  - counts.
- Verify the operation of lighting controls, such as timeclocks.
- Verify hours of operation for lighting by obtaining lighting schedules and/or reviewing settings on timeclocks.

The verification was based on as-built documentation provided to KSI.

7.3.2.4 Results

This section provides the results of the M&V process. Table 48 shows a summary of the M&V findings compared to the reported load impacts. Table 49 shows the "as-built" configuration for Site A1 and Site A2, while Table 50 shows the results of the verification.

Some of the key findings are:

- **Realization Rates:** The realization rates are 94.7% and 93.0% for kWh savings and kW reduced, respectively. This means that the verified kWh savings were 94.7% of kWh savings reported through the as-built documentation. The reason for this result was a discrepancy in fixture counts for a specific fixture as discussed below.
- **Hours of Operation:** The proposed hours of operation were verified through the confirmation of the schedule of the timeclocks used to control the lights throughout each shopping center.
- **Fixture Counts:** A 3rd party contractor hired by Westfield conducted an initial lighting audit. This audit was the basis for the program agreement and was used by Contractor A for reporting the installed program impacts. During the verification inspections a discrepancy was found with the counts for one line item at Mission Valley. Item 9 in Site A1 retrofit of 239 canopy surface mount fixtures from 250w Metal Halide to 150w Pulse Start Metal Halide fixtures. Twenty-six canopy surface mount fixtures were verified during the post-inspection. A thorough review of facility plans and discussions with site facilities engineering staff indicated that there were only 26 such fixtures at the site. Therefore, the reported fixture counts were overstated by 213, thus reducing the load impacts.
- **Fixture Wattages:** Reported fixture wattages were verified to be consistent with the installed fixtures.

Table 48. Summary of M&V of 04-01-018 Lighting Retrofit Projects, Site A1 and Site A2

04-01-018: Contractor A			
	Site A1	**Site A2**	**Total**
Energy Savings (kWh)			
Total Contracted Savings (kWh)[1]	1,450,365	490,540	1,940,905
Total Reported / Invoiced Savings (kWh)	1,450,365	490,450	1,940,815
M&V Savings (kWh)	**0**	**0**	**0**
Realization Rate (kWh)			**0.0%**
Demand Reduction (kW)			
Total Contracted Savings (kW) [1]	251	103	354
Total Reported / Invoiced Savings (kW)	251.05	102.61	353.66
M&V Savings (kW)	**0.00**	**0.00**	**0.00**
Realization Rate (kW)			**0%**

Table 49. Reported "As-Built" For Site A1 and Site A2

			PROPOSED													
			PRE-RETROFIT						POST-RETROFIT		POST-RETROFIT				REPORTED	
Description / Area	Existing Lighting Equipment	Proposed Lighting Equipment	Daily Hours of Op.	Annual Hours of Op.	Pre Qty	Fixt. Watts	Pre kW	Pre Total Annual kWh	Daily Hours of Op.	Annual Hours of Op.	Post Qty	Fixt. Watts	Post kW	Post Total Annual kWh	kW Reduced	Annual kWh Saved
SITE A																
Parking lot pole lights (MV & MV West)	400w MH	Pulse Start 320w MH	10.00	3,650	310	458	141.98	518,227	10.00	3,650	310	365	113.15	412,998	28.83	105,230
Parking lot pole lights	1000w MH	750w MH	10.00	3,650	2	1,100	2.20	8,030	10.00	3,650	2	850	1.70	6,205	0.50	1,825
Mall and alley lights	250w MH	Pulse Start 150w MH	12.00	4,380	218	290	63.22	276,904	12.00	4,380	218	185	40.33	176,645	22.89	100,258
Circulation areas downlights throughout	70w MH recessed downlight	Janmar 20w CMH vertical downlight with clear refl	12.00	4,380	242	95	22.99	100,696	12.00	4,380	242	22	5.32	23,319	17.67	77,377
Under mall walkway lights	100w MH	4ft 2 lamp (T8) Gasketed enclosed fixture.	20.00	7,300	162	128	20.74	151,373	20.00	7,300	162	58	9.40	68,591	11.34	82,782
Under mall parking and mall lights	175w MH	8ft 4L T8 Gasketed enclosed fixture LPEB	20.00	7,300	861	210	180.81	1,319,913	20.00	7,300	861	96	82.66	603,389	98.15	716,524
Circulation areas downlights throughout project Including low pedestrian pole lights	250w MH	Pulse Start 150w MH	12.00	4,380	79	295	23.31	102,076	12.00	4,380	79	185	14.62	64,014	8.69	38,062
Pedestrian pole lights	400w MH	Pulse Start 250w MH	12.00	4,380	6	458	2.75	12,036	12.00	4,380	6	290	1.74	7,621	1.01	4,415
Canopy surface mounted lights	250w MH	Pulse Start 150w MH	12.00	4,380	239	295	70.51	308,812	12.00	4,380	239	185	44.22	193,662	26.29	115,150
Corridors, alleys, utility rooms, docks	2ft 1L T12 & Mag Bal	2ft 1L T8	16.00	5,840	2	32	0.06	374	16.00	5,840	2	17	0.03	199	0.03	175
Corridors, alleys, utility rooms, docks	4ft 1L T12 & Mag Bal	4ft 1L T8 & LPEB	16.00	5,840	9	40	0.36	2,102	16.00	5,840	9	28	0.25	1,472	0.11	631
Corridors, alleys, utility rooms, docks	4ft 2L T12 & Mag Bal	4ft 2L T8 & LPEB	16.00	5,840	371	72	26.71	155,998	16.00	5,840	371	51	18.92	110,499	7.79	45,499
Corridors, alleys, utility rooms, docks	4ft 3L T12 & Mag Bal	4ft 2L T8 & EB-Ref	16.00	5,840	9	111	1.00	5,834	16.00	5,840	9	58	0.52	3,048	0.48	2,786
Corridors, alleys, utility rooms, docks	4ft 4L T12 & Mag Bal	4ft 2L T8 & EB-Ref	16.00	5,840	9	144	1.30	7,569	16.00	5,840	9	58	0.52	3,048	0.77	4,520
Corridors, alleys, utility rooms, docks	8ft 2L T12 & Mag Bal	4ft 2L T8 & EB & new Ballast Cover Kit	16.00	5,840	1	140	0.14	818	16.00	5,840	1	58	0.06	339	0.08	479
Corridors, alleys, utility rooms, docks	8ft 2L T12 & Mag Bal	4ft 4L T8 & LPEB & new Ballast Cover Kit	16.00	5,840	23	140	3.22	18,805	16.00	5,840	23	96	2.21	12,895	1.01	5,910
Corridors, alleys, utility rooms, docks	8ft 2L T12 & Mag Bal	8ft 2L T8 & EB	16.00	5,840	22	140	3.08	17,987	16.00	5,840	22	118	2.60	15,161	0.48	2,827
Corridors, alleys, utility rooms, docks	4ft 6L T12 & Mag Bal	4ft 4L T8 & EB-Ref	16.00	5,840	135	216	29.16	170,294	16.00	5,840	67	108	7.24	42,258	21.92	128,036
Security Offices, Admin. Offices, restrooms	T8 existing	leave as is	12.00	4,380	0	31	0.00	0	error-LDO	#VALUE!	0	31	0.00	0	0.00	0
Tunnel lights	150w HPS	Pulse Start 70w MH	12.00	4,380	32	190	6.08	26,630	12.00	4,380	32	130	4.16	18,221	1.92	8,410
Exit signs	Exit Signs	LED Exit Sign	24.00	8,760	47	25	1.18	10,293	24.00	8,760	47	2	0.09	823	1.08	9,470
TOTAL - SITE A					**2,779**		**600.78**	**3,214,771**			**2,711**		**349.73**	**1,764,406**	**251.05**	**1,450,365**

Table 49. Reported "As-Built" For Site A1 and Site A2 (con't)

			PRE-RETROFIT						POST-RETROFIT						REPORTED	
Description / Area	Existing Lighting Equipment	Proposed Lighting Equipment	Daily Hours of Op.	Annual Hours of Op.	Pre Qty	Fixt. Watts	Pre kW	Pre Total Annual kWh	Daily Hours of Op.	Annual Hours of Op.	Post Qty	Fixt. Watts	Post kW	Post Total Annual kWh	kW Reduced	Annual kWh Saved
SITE A2																
Parking lot pole lights	1000w MH	Pulse Start 750w MH	6.50	2,373	134	1,080	144.72	343,348	6.50	2,373	134	818	109.61	260,054	35.11	83,294
Mall high ceiling	400w mMH	150w T6G12 150 T6 PAR30 EB	10.50	3,833	46	458	21.07	80,743	10.50	3,833	46	150	6.90	26,444	14.17	54,299
Mall ceiling	250w MH	100w PAR38 CMH EB	8.00	2,920	10	290	2.90	8,468	8.00	2,920	10	110	1.10	3,212	1.80	5,256
Mall ceiling	175w MH	70w T6G12 70 T6 PAR30 EB	10.50	3,833	58	210	12.18	46,680	10.50	3,833	58	78	4.52	17,338	7.66	29,342
Mall ceiling	175w MH	39w PAR30 EB	10.50	3,833	310	210	65.10	249,496	10.50	3,833	310	42	13.02	49,899	52.08	199,597
Skylight lighting	4ft 1L T12, Mag Bal	4ft 1L T8 & LPEB	10.50	3,833	778	40	31.12	119,267	10.50	3,833	778	28	21.78	83,487	9.34	35,780
Corridor	2x2 3-lamp T12	2ft T8 (3 lamps), EB	12.00	4,380	8	76	0.61	2,663	12.00	4,380	8	50	0.40	1,752	0.21	911
Corridor	3ft 1L T12, Mag Bal	3ft T8 32w EB	12.00	4,380	2	36	0.07	315	12.00	4,380	2	25	0.05	219	0.02	96
Security Admin., restrooms	4ft 1L T12, Mag Bal	4ft 1L T8, LPEB	15.00	5,475	168	40	6.72	36,792	15.00	5,475	168	28	4.70	25,754	2.02	11,038
Security Admin., restrooms	4ft 2L T12, Mag Bal	4ft 2L T8, LPEB	12.00	4,380	62	72	4.46	19,552	12.00	4,380	62	51	3.16	13,850	1.30	5,703
Security Admin., restrooms	4ft 4L T12, Mag Ball	4ft 2L T8, EB-Ref	12.00	4,380	32	144	4.61	20,183	12.00	4,380	32	58	1.86	8,129	2.75	12,054
Security Admin., restrooms	1L F96T12	4' 2L T8, New conversion kit, LPEB	12.00	4,380	10	85	0.85	3,723	12.00	4,380	10	51	0.51	2,234	0.34	1,489
Security Admin., restrooms	2L F96T12	4' 4L T8, New conversion kit, LPEB	12.00	4,380	17	165	2.81	12,286	12.00	4,380	17	96	1.63	7,148	1.17	5,138
Security Admin., restrooms	2L 2x2 U-bend	T8 U-bend lamps (2), EB	12.00	4,380	24	80	1.92	8,410	12.00	4,380	24	56	1.34	5,887	0.58	2,523
Exit Signs	Exit Signs	New LED Exit Sign	24.00	8,760	37	25	0.93	8,103	24.00	8,760	37	2	0.07	648	0.85	7,455
Level 2 ceiling	1/2 moom flag lights	Disable Power	12.00	4,380	14	150	2.10	9,198	12.00	4,380	14	0	0.00	0	0.00	zero
Exterior Canopy	175w MH	39 Watt MH / EB	12.00	4,380	42	210	8.82	38,632	12.00	4,380	42	42	1.76	7,726	7.06	30,905
External Canopy	100w MH	20 Watt MH / EB	12.00	4,380	12	128	1.54	6,728	12.00	4,380	12	22	0.26	1,156	1.27	5,571
TOTAL - SITE B					**1,764**		**312.52**	**1,014,587**			**1,764**		**172.70**	**514,939**	**137.72**	**490,450**
PROJECT TOTAL					**4,543**		**913.30**	**4,229,358**			**4,475**		**522.43**	**2,279,345**	**388.77**	**1,940,815**

Table 50. Verified Savings For Site A1 and Site A2

			VERIFIED															
			PRE-RETROFIT							POST-RETROFIT							SAVINGS	
Description / Area	Existing Lighting Equipment	Proposed Lighting Equipment	Daily Hours of Op.	Annual Hours	Pre Qty	Fixt. Watts	Verified Qty	Pre kW	Pre Total Annual kWh	Lighting Controls	Verified Hours Per Day	Annual Hours	Verified Qty	Verified Wattage	Verified Post kW	Verified Post kWh	Verified kW Reduced	Verified kWh Savings
SITE A1																		
Parking lot pole lights (MV & MV West)	400w MH	Pulse Start 320w MH	10.00	3,650	310	458	310	141.98	518,227	Time Clock	10	3,650	310	365	113.15	412,998	28.83	105,230
Parking lot pole lights	1000w MH	750w MH	10.00	3,650	2	1,100	2	2.20	8,030	Time Clock	10	3,650	2	850	1.70	6,205	0.50	1,825
Mall and alley lights	250w MH	Pulse Start 150w MH	12.00	4,380	218	290	218	63.22	276,904	Time Clock	12	4,380	218	185	40.33	176,645	22.89	100,258
Circulation areas downlights throughout	70w MH recessed downlight	Janmar 20w CMH vertical downlight with clear refl	12.00	4,380	242	95	242	22.99	100,696	Time Clock	12	4,380	242	22	5.32	23,319	17.67	77,377
Under mall walkway lights	100w MH	4ft 2 lamp (T8) Gasketed enclosed fixture.	20.00	7,300	162	128	162	20.74	151,373	Time Clock	20	7,300	162	58	9.40	68,591	11.34	82,782
Under mall parking and mall lights	175w MH	8ft 4L T8 Gasketed enclosed fixture LPEB	20.00	7,300	861	210	861	180.81	1,319,913	Time Clock	20	7,300	861	96	82.66	603,389	98.15	716,524
Circulation areas downlights throughout project Including low pedestrian pole lights	250w MH	Pulse Start 150w MH	12.00	4,380	79	295	79	23.31	102,076	Time Clock	12	4,380	79	185	14.62	64,014	8.69	38,062
Pedestrian pole lights	400w MH	Pulse Start 250w MH	12.00	4,380	6	458	6	2.75	12,036	Time Clock	12	4,380	6	290	1.74	7,621	1.01	4,415
Canopy surface mounted lights	250w MH	Pulse Start 150w MH	12.00	4,380	239	295	26	7.67	33,595	Time Clock	12	4,380	26	185	4.81	21,068	2.86	12,527
Corridors, alleys, utility rooms, docks	2ft 1L T12 & Mag Bal	2ft 1L T8	16.00	5,840	2	**32**	2	0.06	374	Time Clock	16	5,840	2	17	0.03	199	0.03	175
Corridors, alleys, utility rooms, docks	4ft 1L T12 & Mag Bal	4ft 1L T8 & LPEB	16.00	5,840	9	**40**	9	0.36	2,102	Time Clock	16	5,840	9	28	0.25	1,472	0.11	631
Corridors, alleys, utility rooms, docks	4ft 2L T12 & Mag Bal	4ft 2L T8 & LPEB	16.00	5,840	371	72	371	26.71	155,998	Time Clock	16	5,840	371	51	18.92	110,499	7.79	45,499
Corridors, alleys, utility rooms, docks	4ft 3L T12 & Mag Bal	4ft 2L T8 & EB-Ref	16.00	5,840	9	111	9	1.00	5,834	Time Clock	16	5,840	9	58	0.52	3,048	0.48	2,786
Corridors, alleys, utility rooms, docks	4ft 4L T12 & Mag Bal	4ft 2L T8 & EB-Ref	16.00	5,840	9	144	9	1.30	7,569	Time Clock	16	5,840	9	58	0.52	3,048	0.77	4,520
Corridors, alleys, utility rooms, docks	8ft 2L T12 & Mag Bal	4ft 2L T8 & EB & new Ballast Cover Kit	16.00	5,840	1	140	1	0.14	818	Time Clock	16	5,840	1	58	0.06	339	0.08	479
Corridors, alleys, utility rooms, docks	8ft 2L T12 & Mag Bal	4ft 4L T8 & LPEB & new Ballast Cover Kit	16.00	5,840	23	140	23	3.22	18,805	Time Clock	16	5,840	23	96	2.21	12,895	1.01	5,910
Corridors, alleys, utility rooms, docks	8ft 2L T12 & Mag Bal	8ft 2L T8 & EB	16.00	5,840	22	140	22	3.08	17,987	Time Clock	16	5,840	22	118	2.60	15,161	0.48	2,827
Corridors, alleys, utility rooms, docks	4ft 6L T12 & Mag Bal	4ft 4L T8 & EB-Ref	16.00	5,840	135	216	135	29.16	170,294	Time Clock	16	5,840	**67**	108	7.24	42,258	21.92	128,036
Security Offices, Admin. Offices, restrooms	T8 existing	leave as is	12.00	4,380	0	31	0	0.00	0	Time Clock	error-LDO	#VALUE!	0	31	0.00		0.00	0
Tunnel lights	150w HPS	Pulse Start 70w MH	12.00	4,380	32	190	32	6.08	26,630	Time Clock	12	4,380	32	130	4.16	18,221	1.92	8,410
exit signs	Exit Signs	LED Exit Sign	24.00	8,760	47	25	47	1.18	10,293	Always on	24	8,760	47	2	0.09	823	1.08	9,470
TOTAL - Site A1					**2,779**		**2,566**	**537.95**	**2,939,554**				**2,498**		**310.32**	**1,591,812**	**227.62**	**1,347,742**

Table 50. Verified Savings For Site A1 and Site A2

			VERIFIED																
			PRE-RETROFIT							POST-RETROFIT							SAVINGS	
Description / Area	Existing Lighting Equipment	Proposed Lighting Equipment	Daily Hours of Op.	Annual Hours	Pre Qty	Fixt. Watts	Verified Qty	Pre kW	Pre Total Annual kWh	Lighting Controls	Verified Hours Per Day	Annual Hours	Verified Qty	Verified Wattage	Verified Post kW	Verified Post kWh	Verified kW Reduced	Verified kWh Savings
SITE A2																		
Parking lot pole lights	1000w MH	Pulse Start 750w MH	6.50	2,373	134	1,080	134	144.72	343,348	Time Clock	6.5	2,373	134	818	109.61	260,054	0.00	83,294
Mall high ceiling	400w mMH	150w T6G12 150 T6 PAR30 EB	10.50	3,833	46	458	46	21.07	80,743	Time Clock	10.5	3,833	46	150	6.90	26,444	14.17	54,299
Mall ceiling	250w MH	100w PAR38 CMH EB	8.00	2,920	10	290	10	2.90	8,468	Time Clock	8	2,920	10	110	1.10	3,212	1.80	5,256
Mall ceiling	175w MH	70w T6G12 70 T6 PAR30 EB	10.50	3,833	58	210	58	12.18	46,680	Time Clock	10.5	3,833	58	78	4.52	17,338	7.66	29,342
Mall ceiling	175w MH	39w PAR30 EB	10.50	3,833	310	210	310	65.10	249,496	Time Clock	10.50	3,833	310	42	13.02	49,899	52.08	199,597
Skylight lighting	4ft 1L T12, Mag Bal	4ft 1L T8 & LPEB	10.50	3,833	778	40	778	31.12	119,267	Time Clock	10.50	3,833	778	28	21.78	83,487	9.34	35,780
Corridor	2x2 3-lamp T12	2ft T8 (3 lamps), EB	12.00	4,380	8	76	8	0.61	2,663	Time Clock	12.00	4,380	8	50	0.40	1,752	0.21	911
Corridor	3ft 1L T12, Mag Bal	3ft T8 32w EB	12.00	4,380	2	36	2	0.07	315	Time Clock	12.00	4,380	2	25	0.05	219	0.02	96
Security Admin., restrooms	4ft 1L T12, Mag Bal	4ft 1L T8, LPEB	15.00	5,475	168	40	168	6.72	36,792	Time Clock	15.00	5,475	168	28	4.70	25,754	2.02	11,038
Security Admin., restrooms	4ft 2L T12, Mag Bal	4ft 2L T8, LPEB	12.00	4,380	62	72	62	4.46	19,552	Time Clock	12.00	4,380	62	51	3.16	13,850	1.30	5,703
Security Admin., restrooms	4ft 4L T12, Mag Ball	4ft 2L T8, EB-Ref	12.00	4,380	32	144	32	4.61	20,183	Time Clock	12.00	4,380	32	58	1.86	8,129	2.75	12,054
Security Admin., restrooms	1L F96T12	4' 2L T8, New conversion kit, LPEB	12.00	4,380	10	85	10	0.85	3,723	Time Clock	12.00	4,380	10	51	0.51	2,234	0.34	1,489
Security Admin., restrooms	2L F96T12	4' 4L T8, New conversion kit, LPEB	12.00	4,380	17	165	17	2.81	12,286	Time Clock	12.00	4,380	17	96	1.63	7,148	1.17	5,138
Security Admin., restrooms	2L 2x2 U-bend	T8 U-bend lamps (2), EB	12.00	4,380	24	80	24	1.92	8,410	Time Clock	12.00	4,380	24	56	1.34	5,887	0.58	2,523
Exit Signs	Exit Signs	New LED Exit Sign	24.00	8,760	37	25	37	0.93	8,103	Always on	24.00	8,760	37	2	0.07	648	0.85	7,455
Level 2 ceiling	1/2 moom flag lights	Disable Power	12.00	4,380	14	150	0	0.00		no significant	12.00	4,380	14	0	0.00	0	0.00	0
Exterior Canopy	175w MH	39 Watt MH / EB	12.00	4,380	42	210	42	8.82	38,632	Time Clock	12.00	4,380	42	42	1.76	7,726	7.06	30,905
External Canopy	100w MH	20 Watt MH / EB	12.00	4,380	12	128	12	1.54	6,728	Time Clock	12.00	4,380	12	22	0.26	1,156	1.27	5,571
TOTAL - SITE A2					**1,764**		**1,750**	**310**	**1,005,389**				**1,764**		**172.70**	**514,939**	**102.61**	**490,450**
TOTAL- PROJECT					**4,543**		**4,316**	**848**	**3,944,943**				**4,262.0**		**483.0**	**2,106,751**	**330.23**	**1,838,192**

7.3.3 04-01-028: M&V For Contractor B Sites

Table 51. M&V Summary For Contractor B – 04-01-028

	Site B1	Site B2	Site B3	Site B4	Total
Energy Savings (kWh)					
Total Contracted Savings (kWh)[1]	727,566	1,883,136	434,869	689,159	3,734,730
Total Reported / Invoiced Savings (kWh)	2,523	427	342	0	3,292
M&V Savings (kWh)	**2,523**	**427**	**342**	**0**	3,292
Realization Rate (kWh)					**0.1%**
Demand Reduction (kW)					
Total Contracted Savings (kW) [1]	170.66	362.39	98.19	165.03	796.27
Total Reported / Invoiced Savings (kW)	0.38	0.12	0.05	0.00	0.55
M&V Savings (kW)	**0.38**	**0.12**	**0.05**	**0.00**	0.55
Realization Rate (kW)					**0.1%**

7.3.3.1 Program Overview

This project was a lighting retrofit program conducted in common areas at six Project Sponsor locations in the San Diego area.

The Project Sponsor contracted with two lighting contractors to implement this project. **This M&V report applies to four projects implemented by Contractor B. The subject facilities for this M&V report are Sites B1, B2, B3, and B4.**

Table 52 provides a list of measures originally proposed by the Project Sponsor.

Table 52. Proposed Measures and Savings, 04-01-018 and 04-01-028 Lighting Retrofit Project

Measure	Quantity of Lamps	Gross kWh Energy Savings	Gross kW Demand Reduction	Gross Therm Savings
Elec Ballast and T-8 lamps (28 Watt)	2,357	185,826	28.3	0
Elec Ballast and T-8 lamps (49 Watt)	1,982	201,837	30.7	0
Elec Ballast and T-8 lamps (77 Watt)	165	8,609	2.4	0
Elec Ballast and T-8 lamps (104 Watt)	1,332	67,879	18.6	0
Compact Fluorescent (42 Watt)	200	59,276	11.6	0
Compact Fluorescent (18 Watt)	20	5,825	1.1	0
Elec Ballast and T-8 lamps (32 Watt)	80	6,989	1.9	0
Retrofit to 200 Watt Pulse Start	339	109,134	21.4	0
Retrofit to 750 Watt Pulse Start	468	447,548	0.0	0
Retrofit to 320 Pulse Start	887	301,092	82.5	0
Retrofit to Compact Fluorescent (85 Watt)	1,640	1,173,256	229.6	0
New LED Sign	96	29,434	3.4	0
Compact Fluorescent Kit (65)	1,443	553,030	108.2	0
Retrofit to 2 T-8 lamps	10	840	0.2	0
Retrofit to 4 T-8 lamps	76	5,271	1.4	0
Install New 3 Lamp t-5 fixture	1,151	869,638	0.0	0
Install New 2 Lamp t-5 fixture	2,256	1,082,000	0.0	0
Install New 4 Lamp t-5 fixture	234	344,373	0.0	0
Compact Fluorescent Kit (42)	221	76,954	0.0	0
Compact Fluorescent Kit (18)	1,251	121,460	23.8	0
Westfield Total		**5,650,271**	**565.1**	**0**

7.3.3.2 Measurement and Verification (M&V) Approach

The M&V approach used for the project is summarized in this section. KSI coordinated with the Project Sponsor to perform pre- and post-retrofit M&V activities to support the tasks described below.

7.3.3.3 Load Impact Verification Methodology

The load impact estimation methodology described in this plan complies with IPMVP Option A. Site inspections were employed to verify key M&V parameters.

7.3.3.3.1 Analysis Approach

The basic equation used to estimate the energy savings of this project is shown in Equation 1.

(Eq. 1) $kWh\ savings = kWh_{Pre} - kWh_{Post}$

where:

$kWh_{Pre} = (\#\ Fixures_{Pre}) \times (Fixture\ Wattage_{Pre}/1000) \times (Hours\ of\ Operation_{Pre})$; and

$$kWh_{Post} = (\#\ Fixures_{Post}) \times (Fixture\ Wattage_{Post}/1000) \times (Hours\ of\ Operation_{Post}).$$

The key parameters of Equation 1 are shown in Table 53.

Table 53. Key M&V Parameters

Parameter	M&V Activity
Fixture Counts	Fixture counts were verified through on-site inspection. Leverage pre-inspections by SDG&E program staff.
Fixture $Wattage_{Pre}$ and Fixture $Wattage_{Post}$	Stipulated wattage values on verification of fixture types. Leverage pre-inspections by SDG&E program staff.
Hours of Operation	The lighting fixture retrofits were typically controlled by timeclocks. Timeclocks are usually reliable and accurate when operating. Timeclocks were confirmed to be in operation and the settings were verified.

7.3.3.3.2 On-Site Verification Inspections

On-site inspections were conducted to verify the equipment types, quantities and operating hours. Site inspections consisted of the following activities:

- Verification of the installation of lighting equipment, including
  - fixture wattage, and
  - counts.
- Verify the operation of lighting controls, such as timeclocks.
- Verify hours of operation for lighting by obtaining lighting schedules and/or reviewing settings on timeclocks.

The verification was based on as-built documentation provided to KSI.

7.3.3.4 Results

This section provides the results of the M&V process. Table 54 shows a summary of the M&V findings compared to the reported load impacts. The attached spreadsheet workbook contains data collected to perform the analysis.

Table 54. Summary of M&V Findings – 04-01-028

		Proposed Pre-Installation					Proposed Post-Installation					Proposed Installed Savings				Verified Measures						Verified Savings	
Facility	Area	Existing Fixture Type	Existing W/Fix	Hours Per Year	No. of Fix	Existing Total Annual kWh	Proposed Fixture Type	Prop. W/Fix	Hours Per Year	No. of Fix	Proposed Total Annual kWh	Total Annual kWh Saved	Baseline kW	Proposed kW	kW Saved	Verified W/Fix	Lighting Controls	Verified Annual Hours	Verified Quantity	Verified Installed kW	Verified Installed kWh	Verified Savings kW	Verified Savings kWh
Site B1	B1-1																						
Site B1	B1-2	F40CWEW	115	4380	8	4,030	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (2x4)	54	4,380	8	1,892	2,137	0.92	0.43	0.49	54	Time Clock	4,380	8	0.43	1,892	0.49	2,137
Site B1	B1-3	F40CWEW	115	4380	1	504	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (2x4)	54	4,380	1	237	267	0.12	0.05	0.06	54	Time Clock	4,380	1	0.05	237	0.06	267
Site B1	B1-4	F40CWEW	80	4380	1	350	1L F32T8 W/ STND ELEC BALLAST & REFLECTOR	28	4,380	1	123	228	0.08	0.03	0.05	28	Time Clock	4,380	1	0.03	123	0.05	228
Site B1	B1-5	FB40CWU-6EW	80	4380	1	350	2L F17T8 W/ STND ELEC BALLAST & WHITE REFLECTOR	32	4,380	1	140	210	0.08	0.03	0.05	32	Time Clock	4,380	1	0.03	140	0.05	210
Site B1	B1-6	40A15	40	4380	2	350	5W Cold Cathode Lamp	5	4,380	2	44	307	0.08	0.01	0.07	5	Time Clock	4,380	2	0.01	44	0.07	307
Site B1	B1-7	F40CWEW	115	4380	2	1,007	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (2x4)	54	4,380	2	473	534	0.23	0.11	0.12	54	Time Clock	4,380	2	0.11	473	0.12	534
Site B1	B1-8	F40CWEW	115	4380	2	1,007	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (2x4)	54	4,380	2	473	534	0.23	0.11	0.12	54	Time Clock	4,380	2	0.11	473	0.12	534
Site B1	B1-9	F40CWEW	115	4380	4	2,015	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (2x4)	54	4,380	4	946	1,069	0.46	0.22	0.24	54	Time Clock	4,380	4	0.22	946	0.24	1,069
Site B1	B1-10	F40CWEW	115	4380	2	1,007	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (2x4)	54	4,380	2	473	534	0.23	0.11	0.12	54	Time Clock	4,380	2	0.11	473	0.12	534
Site B1	B1-11	F40CWEW	115	4380	1	504	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (2x4)	54	4,380	1	237	267	0.12	0.05	0.06	54	Time Clock	4,380	1	0.05	237	0.06	267
Site B1	B1-12	F40CWEW	115	4380	4	2,015	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (2x4)	54	4,380	4	946	1,069	0.46	0.22	0.24	54	Time Clock	4,380	4	0.22	946	0.24	1,069
Site B1	B1-13	F40CWEW	80	4380	1	350	1L F32T8 W/ STND ELEC BALLAST & REFLECTOR	28	4,380	1	123	228	0.08	0.03	0.05	28	Time Clock	4,380	1	0.03	123	0.05	228
Site B1	B1-14	F40CWEW	115	4380	2	1,007	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (2x4)	54	4,380	2	473	534	0.23	0.11	0.12	54	Time Clock	4,380	2	0.11	473	0.12	534
Site B1	B1-15	F40CWEW	80	4380	2	701	1L F32T8 W/ STND ELEC BALLAST & REFLECTOR	28	4,380	2	245	456	0.16	0.06	0.10	28	Time Clock	4,380	2	0.06	245	0.10	456
Site B1	B1-16	F40CWEW	115	4380	2	1,007	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (2x4)	54	4,380	2	473	534	0.23	0.11	0.12	54	Time Clock	4,380	2	0.11	473	0.12	534
Site B1	B1-17	F40CWEW	115	4380	2	1,007	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (2x4)	54	4,380	2	473	534	0.23	0.11	0.12	54	Time Clock	4,380	2	0.11	473	0.12	534
Site B1	B1-18	F40CWEW	80	4380	1	350	1L F32T8 W/ STND ELEC BALLAST & REFLECTOR	28	4,380	1	123	228	0.08	0.03	0.05	28	Time Clock	4,380	1	0.03	123	0.05	228
Site B1	B1-19	F40CWEW	115	4380	2	1,007	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (2x4)	54	4,380	2	473	534	0.23	0.11	0.12	54	Time Clock	4,380	2	0.11	473	0.12	534
Site B1	B1-20	F40CWEW	80	4380	1	350	1L F32T8 W/ STND ELEC BALLAST & REFLECTOR	28	4,380	1	123	228	0.08	0.03	0.05	28	Time Clock	4,380	1	0.03	123	0.05	228

Table 54. Summary of M&V Findings – 04-01-028 (con't)

		Proposed Pre-Installation					Proposed Post-Installation					Proposed Installed Savings				Verified Measures						Verified Savings	
Facility	Area	Existing Fixture Type	Existing W/Fix	Hours Per Year	No. of Fix	Existing Total Annual kWh	Proposed Fixture Type	Prop. W/Fix	Hours Per Year	No. of Fix	Proposed Total Annual kWh	Total Annual kWh Saved	Baseline kW	Proposed kW	kW Saved	Verified W/Fix	Lighting Controls	Verified Annual Hours	Verified Quantity	Verified Installed kW	Verified Installed kWh	Verified Savings kW	Verified Savings kWh
Site B1	B1-21	F40CWEW	80	6570	13	6,833	1L F32T8 W/ STND ELEC BALLAST & REFLECTOR	28	6,570	13	2,391	4,441	1.04	0.36	0.68	28	Time Clock	6,570	13	0.36	2,391	0.68	4,441
Site B1	B1-22	F40CWEW	40	6570	17	4,468	1L F32T8 W/ STND ELEC BALLAST & REFLECTOR	28	6,570	17	3,127	1,340	0.68	0.48	0.20	28	Time Clock	6,570	17	0.48	3,127	0.20	1,340
Site B1	B1-23	F40CWEW	40	6570	13	3,416	1L F32T8 W/ STND ELEC BALLAST	28	6,570	13	2,391	1,025	0.52	0.36	0.16	28	Time Clock	6,570	13	0.36	2,391	0.16	1,025
Site B1	B1-24	F40CWEW	80	6570	1	526	2L F32T8 W/ STND ELEC BALLAST	54	6,570	1	355	171	0.08	0.05	0.03	54	Time Clock	6,570	1	0.05	355	0.03	171
Site B1	B1-25	F40CWEW	40	6570	10	2,628	1L F32T8 W/ STND ELEC BALLAST	28	6,570	10	1,840	788	0.40	0.28	0.12	28	Time Clock	6,570	10	0.28	1,840	0.12	788
Site B1	B1-26	F40CWEW	40	6570	7	1,840	1L F32T8 W/ STND ELEC BALLAST	28	6,570	7	1,288	552	0.28	0.20	0.08	28	Time Clock	6,570	7	0.20	1,288	0.08	552
Site B1	B1-27	F40CWEW	40	6570	10	2,628	1L F32T8 W/ STND ELEC BALLAST	28	6,570	10	1,840	788	0.40	0.28	0.12	28	Time Clock	6,570	10	0.28	1,840	0.12	788
Site B1	B1-28	F40CWEW	40	6570	9	2,365	1L F32T8 W/ STND ELEC BALLAST & REFLECTOR	28	6,570	9	1,656	710	0.36	0.25	0.11	28	Time Clock	6,570	9	0.25	1,656	0.11	710
Site B1	B1-29	F40CWEW	80	6570	1	526	2L F32T8 W/ STND ELEC BALLAST	54	6,570	1	355	171	0.08	0.05	0.03	54	Time Clock	6,570	1	0.05	355	0.03	171
Site B1	B1-30	F40CWEW	40	6570	3	788	1L F32T8 W/ STND ELEC BALLAST	28	6,570	3	552	237	0.12	0.08	0.04	28	Time Clock	6,570	3	0.08	552	0.04	237
Site B1	B1-31	F40CWEW	40	6570	6	1,577	1L F32T8 W/ STND ELEC BALLAST	28	6,570	6	1,104	473	0.24	0.17	0.07	28	Time Clock	6,570	6	0.17	1,104	0.07	473
Site B1	B1-32	20T61/2DC	40	8760	1	350	NEW 2 WATT LED EXIT SIGN	2	8,760	1	18	333	0.04	0.00	0.04	2	Aways ON	8,760	1	0.00	18	0.04	333
Site B1	B1-33			6570		0	NO WORK		6,570		0	0	0.00	0.00	0.00		Time Clock	6,570		0.00	0	0.00	0
Site B1	B1-34	F40CWEW	40	6570	3	788	1L F32T8 W/ STND ELEC BALLAST & REFLECTOR	28	6,570	3	552	237	0.12	0.08	0.04	28	Time Clock	6,570	3	0.08	552	0.04	237
Site B1	B1-35	F40CWEW	40	6570	3	788	1L F32T8 W/ STND ELEC BALLAST	28	6,570	3	552	237	0.12	0.08	0.04	28	Time Clock	6,570	3	0.08	552	0.04	237
Site B1	B1-36	15T6	30	8760	2	526	NEW 2 WATT LED EXIT SIGN	2	8,760	2	35	491	0.06	0.00	0.06	2	Aways ON	8,760	2	0.00	35	0.06	491
Site B1	B1-37	F40CWEW	40	6570	2	526	1L F32T8 W/ STND ELEC BALLAST	28	6,570	2	368	158	0.08	0.06	0.02	28	Time Clock	6,570	2	0.06	368	0.02	158
Site B1	B1-38	F40CWEW	40	6570	3	788	1L F32T8 W/ STND ELEC BALLAST & REFLECTOR	28	6,570	3	552	237	0.12	0.08	0.04	28	Time Clock	6,570	3	0.08	552	0.04	237
Site B1	B1-39	F40CWEW	80	6570	1	526	2L F32T8 W/ STND ELEC BALLAST	54	6,570	1	355	171	0.08	0.05	0.03	54	Time Clock	6,570	1	0.05	355	0.03	171
Site B1	B1-40	F40CWEW	40	6570	1	263	1L F32T8 W/ STND ELEC BALLAST	28	6,570	1	184	79	0.04	0.03	0.01	28	Time Clock	6,570	1	0.03	184	0.01	79
Site B1	B1-41	F40CWEW	40	6570	10	2,628	1L F32T8 W/ STND ELEC BALLAST	28	6,570	10	1,840	788	0.40	0.28	0.12	28	Time Clock	6,570	10	0.28	1,840	0.12	788
Site B1	B1-42	F40CWEW	40	4380	8	1,402	1L F32T8 W/ STND ELEC BALLAST	28	4,380	8	981	420	0.32	0.22	0.10	28	Time Clock	4,380	8	0.22	981	0.10	420
Site B1	B1-43	F40CWEW	80	4380	15	5,256	1L F32T8 W/ STND ELEC BALLAST & REFLECTOR	28	4,380	15	1,840	3,416	1.20	0.42	0.78	28	Time Clock	4,380	15	0.42	1,840	0.78	3,416
Site B1	B1-44	100W Inc	100	4380	62	27,156	27W SCREW IN GLOBE	27	4,380	62	7,332	19,824	6.20	1.67	4.53	27	Time Clock	4,380	62	1.67	7,332	4.53	19,824
Site B1	B1-45	100W Inc	100	4380	38	16,644	26W CF CONVERSION	26	4,380	38	4,327	12,317	3.80	0.99	2.81	26	Time Clock	4,380	38	0.99	4,327	2.81	12,317
Site B1	B1-46	H39KC175DX	225	4380	2	1,971	70W CMH DEL REY	78	4,380	2	683	1,288	0.45	0.16	0.29	78	Time Clock	4,380	2	0.16	683	0.29	1,288
Site B1	B1-47	H39KC175DX	225	4380	19	18,725	70W CMH DEL REY	78	4,380	19	6,491	12,233	4.28	1.48	2.79	78	Time Clock	4,380	19	1.48	6,491	2.79	12,233

Table 54. Summary of M&V Findings – 04-01-028 (con't)

		Proposed Pre-Installation					Proposed Post-Installation					Proposed Installed Savings				Verified Measures						Verified Savings	
Facility	Area	Existing Fixture Type	Existing W/Fix	Hours Per Year	No. of Fix	Existing Total Annual kWh	Proposed Fixture Type	Prop. W/Fix	Hours Per Year	No. of Fix	Proposed Total Annual kWh	Total Annual kWh Saved	Baseline kW	Proposed kW	kW Saved	Verified W/Fix	Lighting Controls	Verified Annual Hours	Verified Quantity	Verified Installed kW	Verified Installed kWh	Verified Savings kW	Verified Savings kWh
Site B1	B1-48	MH-250-U	295	4380	5	6,461	70W PS MH w/ Elec HID Ballast	78	4,380	5	1,708	4,752	1.48	0.39	1.09	78	Time Clock	4,380	5	0.39	1,708	1.09	4,752
Site B1	B1-49	H38JA100DX	130	4380	20	11,388	70W CMH DEL REY	78	4,380	20	6,833	4,555	2.60	1.56	1.04	78	Time Clock	4,380	20	1.56	6,833	1.04	4,555
Site B1	B1-50	CF-42 DT E IN 841	84	4380	24	8,830	70W CMH DEL REY	78	4,380	24	8,199	631	2.02	1.87	0.14	78	Time Clock	4,380	24	1.87	8,199	0.14	631
Site B1	B1-51	F40CWEW	40	4380	20	3,504	1L F32T8 W/ STND ELEC BALLAST & REFLECTOR	28	4,380	20	2,453	1,051	0.80	0.56	0.24	28	Time Clock	4,380	20	0.56	2,453	0.24	1,051
Site B1	B1-52	F48CWHO	60	4380	28	7,358	1L F32T8 W/ STND ELEC BALLAST & REFLECTOR	45	4,380	28	5,519	1,840	1.68	1.26	0.42	45	Time Clock	4,380	28	1.26	5,519	0.42	1,840
Site B1	B1-53				0	0	NO WORK			0	0	0	0.00	0.00	0.00				0	0.00	0	0.00	0
Site B1	B1-54	F40CWEW	40	6570	6	1,577	1L F32T8 W/ STND ELEC BALLAST & REFLECTOR	28	6,570	6	1,104	473	0.24	0.17	0.07	28	Time Clock	6,570	6	0.17	1,104	0.07	473
Site B1	B1-55	F40CWEW	40	6570	4	1,051	1L F32T8 W/ STND ELEC BALLAST	28	6,570	4	736	315	0.16	0.11	0.05	28	Time Clock	6,570	4	0.11	736	0.05	315
Site B1	B1-56	F40CWEW	40	6570	3	788	1L F32T8 W/ STND ELEC BALLAST	28	6,570	3	552	237	0.12	0.08	0.04	28	Time Clock	6,570	3	0.08	552	0.04	237
Site B1	B1-57	F40CWEW	40	6570	4	1,051	1L F32T8 W/ STND ELEC BALLAST & REFLECTOR	28	6,570	4	736	315	0.16	0.11	0.05	28	Time Clock	6,570	4	0.11	736	0.05	315
Site B1	B1-58	F40CWEW	40	6570	3	788	1L F32T8 W/ STND ELEC BALLAST	28	6,570	3	552	237	0.12	0.08	0.04	28	Time Clock	6,570	3	0.08	552	0.04	237
Site B1	B1-59	F40CWEW	80	6570	6	3,154	2L F32T8 W/ STND ELEC BALLAST	54	6,570	6	2,129	1,025	0.48	0.32	0.16	54	Time Clock	6,570	6	0.32	2,129	0.16	1,025
Site B1	B1-60	F40CWEW	80	6570	1	526	2L F32T8 W/ STND ELEC BALLAST	54	6,570	1	355	171	0.08	0.05	0.03	54	Time Clock	6,570	1	0.05	355	0.03	171
Site B1	B1-61	F40CWEW	40	6570	15	3,942	1L F32T8 W/ STND ELEC BALLAST & REFLECTOR	28	6,570	15	2,759	1,183	0.60	0.42	0.18	28	Time Clock	6,570	15	0.42	2,759	0.18	1,183
Site B1	B1-62	F40CWEW	40	6570	11	2,891	1L F32T8 W/ STND ELEC BALLAST	28	6,570	11	2,024	867	0.44	0.31	0.13	28	Time Clock	6,570	11	0.31	2,024	0.13	867
Site B1	B1-63	F40CWEW	40	6570	1	263	1L F32T8 W/ STND ELEC BALLAST	28	6,570	1	184	79	0.04	0.03	0.01	28	Time Clock	6,570	1	0.03	184	0.01	79
Site B1	B1-64	20T61/2DL	40	8760	3	1,051	NEW 2 WATT LED EXIT SIGN	2	8,760	3	53	999	0.12	0.01	0.11	2	Aways ON	8,760	3	0.01	53	0.11	999
Site B1	B1-65	20T61/2DL	40	8760	2	701	NEW 2 WATT LED EXIT SIGN	2	8,760	2	35	666	0.08	0.00	0.08	2	Aways ON	8,760	2	0.00	35	0.08	666
Site B1	B1-66	H100JA36	130	6570	1	854	70W CMH DEL REY	78	6,570	1	512	342	0.13	0.08	0.05	78	Time Clock	6,570	1	0.08	512	0.05	342
Site B1	B1-67	F40CWEW	40	6570	6	1,577	1L F32T8 W/ STND ELEC BALLAST	28	6,570	6	1,104	473	0.24	0.17	0.07	28	Time Clock	6,570	6	0.17	1,104	0.07	473
Site B1	B1-68	20T61/2DC	40	8760	1	350	NEW 2 WATT LED EXIT SIGN	2	8,760	1	18	333	0.04	0.00	0.04	2	Aways ON	8,760	1	0.00	18	0.04	333
Site B1	B1-69	F40CWEW	40	6570	8	2,102	1L F32T8 W/ STND ELEC BALLAST	28	6,570	8	1,472	631	0.32	0.22	0.10	28	Time Clock	6,570	8	0.22	1,472	0.10	631
Site B1	B1-70	F40CWEW	40	6570	6	1,577	1L F32T8 W/ STND ELEC BALLAST	28	6,570	6	1,104	473	0.24	0.17	0.07	28	Time Clock	6,570	6	0.17	1,104	0.07	473
Site B1	B1-71	F40CWEW	40	6570	7	1,840	1L F32T8 W/ STND ELEC BALLAST	28	6,570	7	1,288	552	0.28	0.20	0.08	28	Time Clock	6,570	7	0.20	1,288	0.08	552
Site B1	B1-72	F40CWEW	40	6570	8	2,102	1L F32T8 W/ STND ELEC BALLAST & REFLECTOR	28	6,570	8	1,472	631	0.32	0.22	0.10	28	Time Clock	6,570	8	0.22	1,472	0.10	631
Site B1	B1-73	F40CWEW	115	4380	29	14,607	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (2x4)	54	4,380	29	6,859	7,748	3.34	1.57	1.77	54	Time Clock	4,380	29	1.57	6,859	1.77	7,748
Site B1	B1-74	F40CWEW	80	4380	1	350	1L F32T8 W/ STND ELEC BALLAST & REFLECTOR	28	4,380	1	123	228	0.08	0.03	0.05	28	Time Clock	4,380	1	0.03	123	0.05	228

Table 54. Summary of M&V Findings – 04-01-028 (con't)

		Proposed Pre-Installation					Proposed Post-Installation					Proposed Installed Savings				Verified Measures						Verified Savings	
Facility	Area	Existing Fixture Type	Existing W/Fix	Hours Per Year	No. of Fix	Existing Total Annual kWh	Proposed Fixture Type	Prop. W/Fix	Hours Per Year	No. of Fix	Proposed Total Annual kWh	Total Annual kWh Saved	Baseline kW	Proposed kW	kW Saved	Verified W/Fix	Lighting Controls	Verified Annual Hours	Verified Quantity	Verified Installed kW	Verified Installed kWh	Verified Savings kWs	Verified Savings kWh
Site B1	B1-75	20T61/2DC	40	8760	3	1,051	NEW 2 WATT LED EXIT SIGN	2	8,760	3	53	999	0.12	0.01	0.11	2	Aways ON	8,760	3	0.01	53	0.11	999
Site B1	B1-76	F40CWEW	40	6570	3	788	1L F32T8 W/ STND ELEC BALLAST	28	6,570	3	552	237	0.12	0.08	0.04	28	Time Clock	6,570	3	0.08	552	0.04	237
Site B1	B1-77	F40CWEW	40	6570	1	263	1L F32T8 W/ STND ELEC BALLAST	28	6,570	1	184	79	0.04	0.03	0.01	28	Time Clock	6,570	1	0.03	184	0.01	79
Site B1	B1-78	F40CWEW	40	6570	1	263	1L F32T8 W/ STND ELEC BALLAST	28	6,570	1	184	79	0.04	0.03	0.01	28	Time Clock	6,570	1	0.03	184	0.01	79
Site B1	B1-79	H39KC175DX	225	4380	18	17,739	70W CMH DEL REY	78	4,380	18	6,150	11,589	4.05	1.40	2.65	78	Time Clock	4,380	18	1.40	6,150	2.65	11,589
Site B1	B1-80	H39KC175DX	225	4380	55	54,203	70W CMH DEL REY	78	4,380	55	18,790	35,412	12.38	4.29	8.09	78	Time Clock	4,380	55	4.29	18,790	8.09	35,412
Site B1	B1-81	H38JA100DX	130	4380	36	20,498	70W CMH DEL REY	78	4,380	36	12,299	8,199	4.68	2.81	1.87	78	Time Clock	4,380	36	2.81	12,299	1.87	8,199
Site B1	B1-82	H38JA100DX	130	4380	3	1,708	70W CMH DEL REY	78	4,380	3	1,025	683	0.39	0.23	0.16	78	Time Clock	4,380	3	0.23	1,025	0.16	683
Site B1	B1-83	F40CWEW	40	4380	4	701	1L F32T8 W/ STND ELEC BALLAST & REFLECTOR	28	4,380	4	491	210	0.16	0.11	0.05	28	Time Clock	4,380	4	0.11	491	0.05	210
Site B1	B1-84	CF-42 DT E IN 841	84	4380	78	28,698	70W CMH DEL REY	78	4,380	78	26,648	2,050	6.55	6.08	0.47	78	Time Clock	4,380	78	6.08	26,648	0.47	2,050
Site B1	B1-85	Q50MR16	78	4380	6	2,050	70W CMH DEL REY FIXTURE	78	4,380	6	2,050	0	0.47	0.47	0.00	78	Time Clock	4,380	6	0.47	2,050		0
Site B1	B1-86	75PAR38	75	4380	2	657	70W CMH DEL REY	78	4,380	2	683	-26	0.15	0.16	-0.01	78	Time Clock	4,380	2	0.16	683	-0.01	-26
Site B1	B1-87	100W Inc	100	4380	88	38,544	26W CF CONVERSION	26	4,380	88	10,021	28,523	8.80	2.29	6.51	26	Time Clock	4,380	88	2.29	10,021	6.51	28,523
Site B1	B1-88	100W Inc	100	4380	30	13,140	26W CF CONVERSION	26	4,380	30	3,416	9,724	3.00	0.78	2.22	26	Time Clock	4,380	30	0.78	3,416	2.22	9,724
Site B1	B1-89	F40CWEW	40	4380	75	13,140	1L F32T8 W/ STND ELEC BALLAST & REFLECTOR	28	4,380	75	9,198	3,942	3.00	2.10	0.90	28	Time Clock	4,380	75	2.10	9,198	0.90	3,942
Site B1	B1-90	F48CWHO	60	4380	28	7,358	1L F32T8 W/ STND ELEC BALLAST & REFLECTOR	45	4,380	28	5,519	1,840	1.68	1.26	0.42	45	Time Clock	4,380	28	1.26	5,519	0.42	1,840
Site B1	B1-91	MH-250-U	295	4380	5	6,461	70W PS MH w/ Elec HID Ballast	78	4,380	5	1,708	4,752	1.48	0.39	1.09	78	Time Clock	4,380	5	0.39	1,708	1.09	4,752
Site B1	B1-92	MH-250-U	295	4380	57	73,650	70W PS MH w/ Elec HID Ballast	78	4,380	57	19,473	54,176	16.82	4.45	12.37	78	Time Clock	4,380	57	4.45	19,473	12.37	54,176
Site B1	B1-93					0	NO WORK					0											0
Site B1	B1-94	F40CWEW	40	6570	4	1,051	1L F32T8 W/ STND ELEC BALLAST & REFLECTOR	28	6,570	4	736	315	0.16	0.11	0.05	28	Time Clock	6,570	4	0.11	736	0.05	315
Site B1	B1-95	F40CWEW	40	6570	3	788	1L F32T8 W/ STND ELEC BALLAST	28	6,570	3	552	237	0.12	0.08	0.04	28	Time Clock	6,570	3	0.08	552	0.04	237
Site B1	B1-96	F40CWEW	40	6570	8	2,102	1L F32T8 W/ STND ELEC BALLAST & REFLECTOR	28	6,570	8	1,472	631	0.32	0.22	0.10	28	Time Clock	6,570	8	0.22	1,472	0.10	631
Site B1	B1-97	F40CWEW	115	6570	2	1,511	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (2x4)	54	6,570	2	710	802	0.23	0.11	0.12	54	Time Clock	6,570	2	0.11	710	0.12	802
Site B1	B1-98	F40CWEW	115	4380	3	1,511	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (2x4)	54	4,380	3	710	802	0.35	0.16	0.18	54	Time Clock	4,380	3	0.16	710	0.18	802
Site B1	B1-99	F40CWEW	40	4380	58	10,162	1L F32T8 W/ STND ELEC BALLAST	28	4,380	58	7,113	3,048	2.32	1.62	0.70	28	Time Clock	4,380	58	1.62	7,113	0.70	3,048
Site B1	B1-100	H39KC175DX	225	4380	39	38,435	70W CMH DEL REY	78	4,380	39	13,324	25,111	8.78	3.04	5.73	78	Time Clock	4,380	39	3.04	13,324	5.73	25,111

Table 54. Summary of M&V Findings – 04-01-028 (con't)

		Proposed Pre-Installation					Proposed Post-Installation					Proposed Installed Savings				Verified Measures						Verified Savings	
Facility	Area	Existing Fixture Type	Existing W/Fix	Hours Per Year	No. of Fix	Existing Total Annual kWh	Proposed Fixture Type	Prop. W/Fix	Hours Per Year	No. of Fix	Proposed Total Annual kWh	Total Annual kWh Saved	Baseline kW	Proposed kW	kW Saved	Verified W/Fix	Lighting Controls	Verified Annual Hours	Verified Quantity	Verified Installed kW	Verified Installed kWh	Verified Savings kW	Verified Savings kWh
Site B1	B1-101	H38JA100DX	130	4380	38	21,637	70W CMH DEL REY	78	4,380	38	12,982	8,655	4.94	2.96	1.98	78	Time Clock	4,380	38	2.96	12,982	1.98	8,655
Site B1	B1-102	H38JA100DX	130	4380	1	569	70W CMH DEL REY	78	4,380	1	342	228	0.13	0.08	0.05	78	Time Clock	4,380	1	0.08	342	0.05	228
Site B1	B1-103	MH-250-U	295	4380	56	72,358	70W PS MH w/ Elec HID Ballast	78	4,380	56	19,132	53,226	16.52	4.37	12.15	78	Time Clock	4,380	56	4.37	19,132	12.15	53,226
Site B1	B1-104	100W Inc	100	4380	72	31,536	26W CF CONVERSION	26	4,380	72	8,199	23,337	7.20	1.87	5.33	26	Time Clock	4,380	72	1.87	8,199	5.33	23,337
Site B1	B1-105	100W Inc	100	4380	42	18,396	26W CF CONVERSION	26	4,380	42	4,783	13,613	4.20	1.09	3.11	26	Time Clock	4,380	42	1.09	4,783	3.11	13,613
Site B1	B1-106	100W Inc	100	4380	8	3,504	26W CF CONVERSION	26	4,380	8	911	2,593	0.80	0.21	0.59	26	Time Clock	4,380	8	0.21	911	0.59	2,593
Site B1	B1-107	Q50MR16	78	4380	8	2,733	70W CMH DEL REY FIXTURE	78	4,380	8	2,733	0	0.62	0.62	0.00	78	Time Clock	4,380	8	0.62	2,733		0
Site B1	B1-108	F40CWEW	40	4380	2	350	1L F32T8 W/ STND ELEC BALLAST & REFLECTOR	28	4,380	2	245	105	0.08	0.06	0.02	28	Time Clock	4,380	2	0.06	245	0.02	105
Site B1	B1-109	Q50MR16	50	4380	16	3,504	39W CERAMIC MH TRACK LIGHT	48	4,380	16	3,364	140	0.80	0.77	0.03	48	Time Clock	4,380	16	0.77	3,364	0.03	140
Site B1	B1-110	20WSC-BAY	20	4380	16	1,402	5W Cold Cathode Lamp	5	4,380	16	350	1,051	0.32	0.08	0.24	5	Time Clock	4,380	16	0.08	350	0.24	1,051
Site B1	B1-111	F40CWEW	40	6570	28	7,358	1L F32T8 W/ STND ELEC BALLAST	28	6,570	28	5,151	2,208	1.12	0.78	0.34	28	Time Clock	6,570	28	0.78	5,151	0.34	2,208
Site B1	B1-112	F40CWEW	40	6570	7	1,840	1L F32T8 W/ STND ELEC BALLAST	28	6,570	7	1,288	552	0.28	0.20	0.08	28	Time Clock	6,570	7	0.20	1,288	0.08	552
Site B1	B1-113	20T61/2DC	40	8760	7	2,453	NEW 2 WATT LED EXIT SIGN	2	8,760	7	123	2,330	0.28	0.01	0.27	2	Aways ON	8,760	7	0.01	123	0.27	2,330
Site B1	B1-114	F40CWEW	80	4380	1	350	2L F32T8 W/ STND ELEC BALLAST	54	4,380	1	237	114	0.08	0.05	0.03	54	Time Clock	4,380	1	0.05	237	0.03	114
Site B1	B1-115	F40CWEW	40	6570	2	526	1L F32T8 W/ STND ELEC BALLAST	28	6,570	2	368	158	0.08	0.06	0.02	28	Time Clock	6,570	2	0.06	368	0.02	158
Site B1	B1-116	20T61/2DC	40	8760	1	350	NEW 2 WATT LED EXIT SIGN	2	8,760	1	18	333	0.04	0.00	0.04	2	Aways ON	8,760	1	0.00	18	0.04	333
Site B1	B1-117	F40CWEW	40	6570	11	2,891	1L F32T8 W/ STND ELEC BALLAST	28	6,570	11	2,024	867	0.44	0.31	0.13	28	Time Clock	6,570	11	0.31	2,024	0.13	867
Site B1	B1-118	20T61/2DC	40	8760	3	1,051	NEW 2 WATT LED EXIT SIGN	2	8,760	3	53	999	0.12	0.01	0.11	2	Aways ON	8,760	3	0.01	53	0.11	999
Site B1	B1-119	F40CWEW	80	4380	32	11,213	1L F32T8 W/ STND ELEC BALLAST & REFLECTOR	28	4,380	32	3,924	7,288	2.56	0.90	1.66	28	Time Clock	4,380	32	0.90	3,924	1.66	7,288
Site B1	B1-120	F40CWEW	80	4380	3	1,051	1L F32T8 W/ STND ELEC BALLAST & REFLECTOR	28	4,380	3	368	683	0.24	0.08	0.16	28	Time Clock	4,380	3	0.08	368	0.16	683
Site B1	B1-121	F40CWEW	80	4380	1	350	1L F32T8 W/ STND ELEC BALLAST & REFLECTOR	28	4,380	1	123	228	0.08	0.03	0.05	28	Time Clock	4,380	1	0.03	123	0.05	228
Site B1	B1-122	F40CWEW	80	4380	8	2,803	1L F32T8 W/ STND ELEC BALLAST & REFLECTOR	28	4,380	8	981	1,822	0.64	0.22	0.42	28	Time Clock	4,380	8	0.22	981	0.42	1,822
Site B1	B1-123	F40CWEW	115	4380	1	504	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (2x4)	54	4,380	1	237	267	0.12	0.05	0.06	54	Time Clock	4,380	1	0.05	237	0.06	267
Site B1	B1-124	60A19		4380	1	0	RELAMP W/ (2) 60A19		4,380	1	0	0	0.00	0.00	0.00		Time Clock	4,380	1	0.00	0		0
Site B1	B1-125	60A19		4380	1	0	RELAMP W/ (1) 60A19		4,380	1	0	0	0.00	0.00	0.00		Time Clock	4,380	1	0.00	0		0
Site B1	B1-126	F40CWEW	40	4380	13	2,278	1L F32T8 W/ STND ELEC BALLAST	28	4,380	13	1,594	683	0.52	0.36	0.16	28	Time Clock	4,380	13	0.36	1,594	0.16	683

Table 54. Summary of M&V Findings – 04-01-028 (con't)

		Proposed Pre-Installation					Proposed Post-Installation					Proposed Installed Savings				Verified Measures						Verified Savings	
Facility	Area	Existing Fixture Type	Existing W/Fix	Hours Per Year	No. of Fix	Existing Total Annual kWh	Proposed Fixture Type	Prop. W/Fix	Hours Per Year	No. of Fix	Proposed Total Annual kWh	Total Annual kWh Saved	Baseline kW	Proposed kW	kW Saved	Verified W/Fix	Lighting Controls	Verified Annual Hours	Verified Quantity	Verified Installed kW	Verified Installed kWh	Verified Savings kWs	Verified Savings kWh
Site B1	B1-127	F40CWEW	40	4380	2	350	1L F32T8 W/ STND ELEC BALLAST	28	4,380	2	245	105	0.08	0.06	0.02	28	Time Clock	4,380	2	0.06	245	0.02	105
Site B1	B1-128	F40CWEW	40	4380	12	2,102	1L F32T8 W/ STND ELEC BALLAST	28	4,380	12	1,472	631	0.48	0.34	0.14	28	Time Clock	4,380	12	0.34	1,472	0.14	631
Site B1	B1-129	F40CWEW	40	4380	2	350	1L F32T8 W/ STND ELEC BALLAST	28	4,380	2	245	105	0.08	0.06	0.02	28	Time Clock	4,380	2	0.06	245	0.02	105
Site B1	B1-130	F40CWEW	80	4380	4	1,402	2L F32T8 W/ STND ELEC BALLAST	54	4,380	4	946	456	0.32	0.22	0.10	54	Time Clock	4,380	4	0.22	946	0.10	456
Site B1	B1-131	F40CWEW	80	4380	4	1,402	2L F32T8 W/ STND ELEC BALLAST	54	4,380	4	946	456	0.32	0.22	0.10	54	Time Clock	4,380	4	0.22	946	0.10	456
Site B1	B1-132	F40CWEW	40	4380	13	2,278	1L F32T8 W/ STND ELEC BALLAST	28	4,380	13	1,594	683	0.52	0.36	0.16	28	Time Clock	4,380	13	0.36	1,594	0.16	683
Site B1	B1-133	F40CWEW	40	4380	15	2,628	1L F32T8 W/ STND ELEC BALLAST	28	4,380	15	1,840	788	0.60	0.42	0.18	28	Time Clock	4,380	15	0.42	1,840	0.18	788
Site B1	B1-134	F40CWEW	40	4380	14	2,453	1L F32T8 W/ STND ELEC BALLAST	28	4,380	14	1,717	736	0.56	0.39	0.17	28	Time Clock	4,380	14	0.39	1,717	0.17	736
Site B1	B1-135	F40CWEW	40	4380	11	1,927	1L F32T8 W/ STND ELEC BALLAST	28	4,380	11	1,349	578	0.44	0.31	0.13	28	Time Clock	4,380	11	0.31	1,349	0.13	578
Site B1	B1-136	F40CWEW	40	4380	14	2,453	1L F32T8 W/ STND ELEC BALLAST	28	4,380	14	1,717	736	0.56	0.39	0.17	28	Time Clock	4,380	14	0.39	1,717	0.17	736
Site B1	B1-137	F40CWEW	40	4380	12	2,102	1L F32T8 W/ STND ELEC BALLAST	28	4,380	12	1,472	631	0.48	0.34	0.14	28	Time Clock	4,380	12	0.34	1,472	0.14	631
Site B1	B1-138	F40CWEW	80	4380	1	350	2L F32T8 W/ STND ELEC BALLAST	54	4,380	1	237	114	0.08	0.05	0.03	54	Time Clock	4,380	1	0.05	237	0.03	114
Site B1	B1-139	F40CWEW	40	4380	12	2,102	1L F32T8 W/ STND ELEC BALLAST	28	4,380	12	1,472	631	0.48	0.34	0.14	28	Time Clock	4,380	12	0.34	1,472	0.14	631
Site B1	B1-140				0	0	NO WORK			0		0							0				0
Site B1	B1-141	H38JA100DX	129	4380	52	29,381	42W CF CONVERSION	42	4,380	52	9,566	19,815	6.71	2.18	4.52	42	Time Clock	4,380	52	2.18	9,566	4.52	19,815
Site B1	B1-142	MP-100-U-MED	129	4380	2	1,130	42W CF CONVERSION	42	4,380	2	368	762	0.26	0.08	0.17	42	Time Clock	4,380	2	0.08	368	0.17	762
Site B1	B1-143	H38JA100DX	130	4380	40	22,776	70W CMH DEL REY	78	4,380	40	13,666	9,110	5.20	3.12	2.08	78	Time Clock	4,380	40	3.12	13,666	2.08	9,110
Site B1	B1-144	MERC175 OR 250	458	4380	8	16,048	70W CMH DEL REY	78	4,380	8	2,733	13,315	3.66	0.62	3.04	78	Time Clock	4,380	8	0.62	2,733	3.04	13,315
Site B1	B1-145	MERC175 OR 250	458	4380	4	8,024	70W CMH DEL REY	78	4,380	4	1,367	6,658	1.83	0.31	1.52	78	Time Clock	4,380	4	0.31	1,367	1.52	6,658
Site B1	B1-146	MH-100-U-MED	130	4380	8	4,555	70W PS MH w/ HID Elec Ballast	78	4,380	8	2,733	1,822	1.04	0.62	0.42	78	Time Clock	4,380	8	0.62	2,733	0.42	1,822
Site B1	B1-147	H38-AV-100-DX	130	6570	8	6,833	70W PS MH w/ HID Elec Ballast	78	6,570	8	4,100	2,733	1.04	0.62	0.42	78	Time Clock	6,570	8	0.62	4,100	0.42	2,733
Site B1	B1-148	F40CWEW	40	6570	2	526	1L F32T8 W/ STND ELEC BALLAST	28	6,570	2	368	158	0.08	0.06	0.02	28	Time Clock	6,570	2	0.06	368	0.02	158
Site B1	B1-149	H38JA100DX	130	6570	1	854	70W CMH DEL REY	78	6,570	1	512	342	0.13	0.08	0.05	78	Time Clock	6,570	1	0.08	512	0.05	342
Site B1	B1-150	H38JA100DX	130	6570	21	17,936	70W CMH DEL REY	78	6,570	21	10,762	7,174	2.73	1.64	1.09	78	Time Clock	6,570	21	1.64	10,762	1.09	7,174
Site B1	B1-151	F96CWEW	158	3650	1	577	4L F32T8 W/ STND ELEC BALLAST & PAN KIT	110	3,650	1	402	175	0.16	0.11	0.05	110	Time Clock	3,650	1	0.11	402	0.05	175
Site B1	B1-152	MH-175-U-MED	225	3650	1	821	100W PS MH w/ HID Elec Ballast	108	3,650	1	394	427	0.23	0.11	0.12	108	Time Clock	3,650	1	0.11	394	0.12	427
Site B1	B1-153	20T61/2DC	40	8760	2	701	NEW 2 WATT LED EXIT SIGN	2	8,760	2	35	666	0.08	0.00	0.08	2	Aways ON	8,760	2	0.00	35	0.08	666

Table 54. Summary of M&V Findings – 04-01-028 (con't)

		Proposed Pre-Installation					Proposed Post-Installation					Proposed Installed Savings				Verified Measures						Verified Savings	
Facility	Area	Existing Fixture Type	Existing W/Fix	Hours Per Year	No. of Fix	Existing Total Annual kWh	Proposed Fixture Type	Prop. W/Fix	Hours Per Year	No. of Fix	Proposed Total Annual kWh	Total Annual kWh Saved	Baseline kW	Proposed kW	kW Saved	Verified W/Fix	Lighting Controls	Verified Annual Hours	Verified Quantity	Verified Installed kW	Verified Installed kWh	Verified Savings kW	Verified Savings kWh
Site B1	B1-154	MH-1000-U	4320	3650	15	236,520	(4 Head) 750W PS MH	3120	3,650	15	170,820	65,700	64.80	46.80	18.00	3120	Time Clock	3,650	15	46.80	170,820	18.00	65,700
Site B1	B1-155	MH-1000-U	3240	3650	18	212,868	(3 Head) 750W PS MH	2340	3,650	18	153,738	59,130	58.32	42.12	16.20	2340	Time Clock	3,650	18	42.12	153,738	16.20	59,130
Site B1	B1-156	MH-1000-U	2160	3650	31	244,404	(2 Head) 750W PS MH	1560	3,650	31	176,514	67,890	66.96	48.36	18.60	1560	Time Clock	3,650	31	48.36	176,514	18.60	67,890
Site B1	B1-157	MH-250-U	295	3650	39	41,993	150W PS MH w/ Elec HID Ballast	166	3,650	39	23,630	18,363	11.51	6.47	5.03	166	Time Clock	3,650	39	6.47	23,630	5.03	18,363
Site B1	B1-158	MH-250-U	295	3650	20	21,535	150W PS MH w/ Elec HID Ballast	166	3,650	20	12,118	9,417	5.90	3.32	2.58	166	Time Clock	3,650	20	3.32	12,118	2.58	9,417
Site B1	B1-159	MH175/U/MED	225	3650	6	4,928	70W PS MH w/ HID Elec Ballast	78	3,650	6	1,708	3,219	1.35	0.47	0.88	78	Time Clock	3,650	6	0.47	1,708	0.88	3,219
Site B1	B1-160	15T6	30	8760	69	18,133	NEW 2 WATT LED EXIT SIGN	2	8,760	69	1,209	16,924	2.07	0.14	1.93	2	Aways ON	8,760	69	0.14	1,209	1.93	16,924
Site B1	B1-161					0	NO WORK					0											0
Site B1	B1-162	NO EXISTING				0	70W CMH DEL REY FIXTURE	78	4,380	2	683	-683	0.00	0.16	-0.16	78	Time Clock	4,380	2	0.16	683	-0.16	-683
Site B1	B1-163	NO EXISTING				0	70W CMH DEL REY FIXTURE	78	4,380	2	683	-683	0.00	0.16	-0.16	78	Time Clock	4,380	2	0.16	683	-0.16	-683
Site B1	B1-164	NO EXISTING				0	70W CMH DEL REY FIXTURE	78	4,380	2	683	-683	0.00	0.16	-0.16	78	Time Clock	4,380	2	0.16	683	-0.16	-683
Site B1	B1-165	F40CWEW	80	4380	1	350	2L F32T8 W/ STND ELEC BALLAST	54	4,380	1	237	114	0.08	0.05	0.03	54	Time Clock	4,380	1	0.05	237	0.03	114
TOTALS Site B1					**1,978**	**1,645,808**				**1,984**	**918,242**	**727,566**	**399.55**	**228.88**	**170.66**				**1,984**	**228.88**	**918,242**	**170.66**	**727,566**
Site B2	B2-1	F40CWWM	40	6570	4	1,051	1L F32T8 W/ STND ELEC BALLAST	28	6,570	4	736	315	0.16	0.11	0.05	28	Time Clock	6,570	4	0.11	736	0.05	315
Site B2	B2-2	F40CWWM	40	6570	5	1,314	1L F32T8 W/ STND ELEC BALLAST	28	6,570	5	920	394	0.20	0.14	0.06	28	Time Clock	6,570	5	0.14	920	0.06	394
Site B2	B2-3	F40CWWM	40	6570	36	9,461	1L F32T8 W/ STND ELEC BALLAST	28	6,570	36	6,623	2,838	1.44	1.01	0.43	28	Time Clock	6,570	36	1.01	6,623	0.43	2,838
Site B2	B2-4	F40CWWM	80	6570	3	1,577	2L F32T8 W/ STND ELEC BALLAST	54	6,570	3	1,064	512	0.24	0.16	0.08	54	Time Clock	6,570	3	0.16	1,064	0.08	512
Site B2	B2-5	F40CWWM	144	6570	9	8,515	4L F32T8 W/ LP ELEC BALLAST	96	6,570	9	5,676	2,838	1.30	0.86	0.43	96	Time Clock	6,570	9	0.86	5,676	0.43	2,838
Site B2	B2-6	F40CWWM	80	6570	1	526	2L F32T8 W/ STND ELEC BALLAST	54	6,570	1	355	171	0.08	0.05	0.03	54	Time Clock	6,570	1	0.05	355	0.03	171
Site B2	B2-7	F96CWWM	126	4380	4	2,208	2L F96T8 W/ STND ELEC BALLAST	108	4,380	4	1,892	315	0.50	0.43	0.07	108	Time Clock	4,380	4	0.43	1,892	0.07	315
Site B2	B2-8	F96CWWM	126	4380	2	1,104	2L F96T8 W/ STND ELEC BALLAST	108	4,380	2	946	158	0.25	0.22	0.04	108	Time Clock	4,380	2	0.22	946	0.04	158
Site B2	B2-9	F96CWWM	126	4380	2	1,104	2L F96T8 W/ STND ELEC BALLAST	108	4,380	2	946	158	0.25	0.22	0.04	108	Time Clock	4,380	2	0.22	946	0.04	158
Site B2	B2-10	F96CWWM	126	4380	2	1,104	2L F96T8 W/ STND ELEC BALLAST	108	4,380	2	946	158	0.25	0.22	0.04	108	Time Clock	4,380	2	0.22	946	0.04	158
Site B2	B2-11	F40CWWM	80	4380	2	701	2L F32T8 W/ STND ELEC BALLAST	54	4,380	2	473	228	0.16	0.11	0.05	54	Time Clock	4,380	2	0.11	473	0.05	228
Site B2	B2-12	F40CWWM	40	4380	2	350	1L F32T8 W/ STND ELEC BALLAST	28	4,380	2	245	105	0.08	0.06	0.02	28	Time Clock	4,380	2	0.06	245	0.02	105
Site B2	B2-13	F40CWWM	144	4380	4	2,523	4L F32T8 W/ LP ELEC BALLAST	96	4,380	4	1,682	841	0.58	0.38	0.19	96	Time Clock	4,380	4	0.38	1,682	0.19	841
Site B2	B2-14	F40CWWM	144	6570	8	7,569	4L F32T8 W/ LP ELEC BALLAST	96	6,570	8	5,046	2,523	1.15	0.77	0.38	96	Time Clock	6,570	8	0.77	5,046	0.38	2,523

Table 54. Summary of M&V Findings – 04-01-028 (con't)

		Proposed Pre-Installation					Proposed Post-Installation					Proposed Installed Savings				Verified Measures						Verified Savings	
Facility	Area	Existing Fixture Type	Existing W/Fix	Hours Per Year	No. of Fix	Existing Total Annual kWh	Proposed Fixture Type	Prop. W/Fix	Hours Per Year	No. of Fix	Proposed Total Annual kWh	Total Annual kWh Saved	Baseline kW	Proposed kW	kW Saved	Verified W/Fix	Lighting Controls	Verified Annual Hours	Verified Quantity	Verified Installed kW	Verified Installed kWh	Verified Savings kW	Verified Savings kWh
Site B2	B2-15	F40CWWM	80	4380	10	3,504	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR	54	4,380	10	2,365	1,139	0.80	0.54	0.26	54	Time Clock	4,380	10	0.54	2,365	0.26	1,139
Site B2	B2-16	F40CWWM	80	4380	2	701	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR	54	4,380	2	473	228	0.16	0.11	0.05	54	Time Clock	4,380	2	0.11	473	0.05	228
Site B2	B2-17	F40CWWM	80	4380	2	701	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR	54	4,380	2	473	228	0.16	0.11	0.05	54	Time Clock	4,380	2	0.11	473	0.05	228
Site B2	B2-18	F40CWWM	80	6570	5	2,628	2L F32T8 W/ STND ELEC BALLAST	54	6,570	5	1,774	854	0.40	0.27	0.13	54	Time Clock	6,570	5	0.27	1,774	0.13	854
Site B2	B2-19	F40CWWM	80	4380	14	4,906	1L F32T8 W/ STND ELEC BALLAST & REFLECTOR	28	4,380	14	1,717	3,189	1.12	0.39	0.73	28	Time Clock	4,380	14	0.39	1,717	0.73	3,189
Site B2	B2-20	F40CWWM	144	4380	7	4,415	4L F32T8 W/ LP ELEC BALLAST	96	4,380	7	2,943	1,472	1.01	0.67	0.34	96	Time Clock	4,380	7	0.67	2,943	0.34	1,472
Site B2	B2-21	F40CWWM	144	4380	1	631	4L F32T8 W/ LP ELEC BALLAST	96	4,380	1	420	210	0.14	0.10	0.05	96	Time Clock	4,380	1	0.10	420	0.05	210
Site B2	B2-22	F40CWWM	144	4380	2	1,261	4L F32T8 W/ LP ELEC BALLAST	96	4,380	2	841	420	0.29	0.19	0.10	96	Time Clock	4,380	2	0.19	841	0.10	420
Site B2	B2-23	F40CWWM	115	4380	2	1,007	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (2x4)	54	4,380	2	473	534	0.23	0.11	0.12	54	Time Clock	4,380	2	0.11	473	0.12	534
Site B2	B2-24	F40CWWM	115	4380	2	1,007	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (2x4)	54	4,380	2	473	534	0.23	0.11	0.12	54	Time Clock	4,380	2	0.11	473	0.12	534
Site B2	B2-25	F40CWWM	115	4380	3	1,511	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (2x4)	54	4,380	3	710	802	0.35	0.16	0.18	54	Time Clock	4,380	3	0.16	710	0.18	802
Site B2	B2-26	F40CWWM	115	4380	1	504	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (2x4)	54	4,380	1	237	267	0.12	0.05	0.06	54	Time Clock	4,380	1	0.05	237	0.06	267
Site B2	B2-27	F40CWWM	115	4380	2	1,007	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (2x4)	54	4,380	2	473	534	0.23	0.11	0.12	54	Time Clock	4,380	2	0.11	473	0.12	534
Site B2	B2-28	F40CWWM	115	4380	2	1,007	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (2x4)	54	4,380	2	473	534	0.23	0.11	0.12	54	Time Clock	4,380	2	0.11	473	0.12	534
Site B2	B2-29	F40CWWM	115	4380	3	1,511	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (2x4)	54	4,380	3	710	802	0.35	0.16	0.18	54	Time Clock	4,380	3	0.16	710	0.18	802
Site B2	B2-30	F40CWWM	40	6570	6	1,577	1L F32T8 W/ STND ELEC BALLAST	28	6,570	6	1,104	473	0.24	0.17	0.07	28	Time Clock	6,570	6	0.17	1,104	0.07	473
Site B2	B2-31	F40CWWM	40	6570	9	2,365	1L F32T8 W/ STND ELEC BALLAST	28	6,570	9	1,656	710	0.36	0.25	0.11	28	Time Clock	6,570	9	0.25	1,656	0.11	710
Site B2	B2-32	F40CWWM	144	6570	8	7,569	4L F32T8 W/ LP ELEC BALLAST	96	6,570	8	5,046	2,523	1.15	0.77	0.38	96	Time Clock	6,570	8	0.77	5,046	0.38	2,523
Site B2	B2-33	F40CWWM	40	6570	13	3,416	1L F32T8 W/ STND ELEC BALLAST	28	6,570	13	2,391	1,025	0.52	0.36	0.16	28	Time Clock	6,570	13	0.36	2,391	0.16	1,025
Site B2	B2-34	F40CWWM	40	6570	7	1,840	1L F32T8 W/ STND ELEC BALLAST	28	6,570	7	1,288	552	0.28	0.20	0.08	28	Time Clock	6,570	7	0.20	1,288	0.08	552
Site B2	B2-35	F40CWWM	80	4380	2	701	2L F32T8 W/ STND ELEC BALLAST	54	4,380	2	473	228	0.16	0.11	0.05	54	Time Clock	4,380	2	0.11	473	0.05	228
Site B2	B2-36	F40CWWM	80	4380	2	701	2L F32T8 W/ STND ELEC BALLAST	54	4,380	2	473	228	0.16	0.11	0.05	54	Time Clock	4,380	2	0.11	473	0.05	228
Site B2	B2-37	F40CWWM	80	4380	22	7,709	2L F32T8 W/ STND ELEC BALLAST	54	4,380	22	5,203	2,505	1.76	1.19	0.57	54	Time Clock	4,380	22	1.19	5,203	0.57	2,505
Site B2	B2-38	F40CWWM	40	6570	6	1,577	1L F32T8 W/ STND ELEC BALLAST	28	6,570	6	1,104	473	0.24	0.17	0.07	28	Time Clock	6,570	6	0.17	1,104	0.07	473

Table 54. Summary of M&V Findings – 04-01-028 (con't)

		Proposed Pre-Installation					Proposed Post-Installation					Proposed Installed Savings				Verified Measures						Verified Savings	
Facility	Area	Existing Fixture Type	Existing W/Fix	Hours Per Year	No. of Fix	Existing Total Annual kWh	Proposed Fixture Type	Prop. W/Fix	Hours Per Year	No. of Fix	Proposed Total Annual kWh	Total Annual kWh Saved	Baseline kW	Proposed kW	kW Saved	Verified W/Fix	Lighting Controls	Verified Annual Hours	Verified Quantity	Verified Installed kW	Verified Installed kWh	Verified Savings kW	Verified Savings kWh
Site B2	B2-39	F40CWWM	40	4380	2	350	1L F32T8 W/ STND ELEC BALLAST	28	4,380	2	245	105	0.08	0.06	0.02	28	Time Clock	4,380	2	0.06	245	0.02	105
Site B2	B2-40	F40CWWM		4380	0	0	NO WORK		4,380	0	0	0	0.00	0.00	0.00			4,380	0	0.00	0	0.00	0
Site B2	B2-41	F40CWWM	40	6570	6	1,577	1L F32T8 W/ STND ELEC BALLAST	28	6,570	6	1,104	473	0.24	0.17	0.07	28	Time Clock	6,570	6	0.17	1,104	0.07	473
Site B2	B2-42	H39KC175DX	225	4380	347	341,969	70W CMH DEL REY	78	4,380	347	118,549	223,419	78.08	27.07	51.01	78	Time Clock	4,380	347	27.07	118,549	51.01	223,419
Site B2	B2-43	H37KC250DX	295	4380	10	12,921	100W CMH DEL REY	108	4,380	10	4,730	8,191	2.95	1.08	1.87	108	Time Clock	4,380	10	1.08	4,730	1.87	8,191
Site B2	B2-44	H37KC250DX	295	4380	51	65,897	100W CMH DEL REY	108	4,380	51	24,125	41,772	15.05	5.51	9.54	108	Time Clock	4,380	51	5.51	24,125	9.54	41,772
Site B2	B2-45	H39KC175DX	225	4380	8	7,884	70W CMH DEL REY	78	4,380	8	2,733	5,151	1.80	0.62	1.18	78	Time Clock	4,380	8	0.62	2,733	1.18	5,151
Site B2	B2-46	H37KC250DX	295	4380	11	14,213	100W CMH DEL REY	108	4,380	11	5,203	9,010	3.25	1.19	2.06	108	Time Clock	4,380	11	1.19	5,203	2.06	9,010
Site B2	B2-47	H37KC250DX	295	4380	26	33,595	100W CMH DEL REY	108	4,380	26	12,299	21,296	7.67	2.81	4.86	108	Time Clock	4,380	26	2.81	12,299	4.86	21,296
Site B2	B2-48	MH175CUMED	225	4380	2	1,971	70W CMH DEL REY	78	4,380	2	683	1,288	0.45	0.16	0.29	78	Time Clock	4,380	2	0.16	683	0.29	1,288
Site B2	B2-49	100A19	100	4380	190	83,220	27W SCREW IN (Lift Needed)	27	4,380	190	22,469	60,751	19.00	5.13	13.87	27	Time Clock	4,380	190	5.13	22,469	13.87	60,751
Site B2	B2-50	MH400U	458	4380	2	4,012	320W MH Exterior	345	4,380	2	3,022	990	0.92	0.69	0.23	345	Time Clock	4,380	2	0.69	3,022	0.23	990
Site B2	B2-51	H33400DX	458	4380	4	8,024	100W CMH DEL REY	108	4,380	4	1,892	6,132	1.83	0.43	1.40	108	Time Clock	4,380	4	0.43	1,892	1.40	6,132
Site B2	B2-52	F40CWWM	80	4380	16	5,606	2L F32T8 W/ STND ELEC BALLAST	54	4,380	16	3,784	1,822	1.28	0.86	0.42	54	Time Clock	4,380	16	0.86	3,784	0.42	1,822
Site B2	B2-53	F30CWSS	70	4380	8	2,453	2L F25T8 W/ STND ELEC BALLAST	45	4,380	8	1,577	876	0.56	0.36	0.20	45	Time Clock	4,380	8	0.36	1,577	0.20	876
Site B2	B2-54	F40CWWM	80	4380	60	21,024	2L F32T8 W/ STND ELEC BALLAST	54	4,380	60	14,191	6,833	4.80	3.24	1.56	54	Time Clock	4,380	60	3.24	14,191	1.56	6,833
Site B2	B2-55	F30CWSS	70	4380	8	2,453	2L F25T8 W/ STND ELEC BALLAST	45	4,380	8	1,577	876	0.56	0.36	0.20	45	Time Clock	4,380	8	0.36	1,577	0.20	876
Site B2	B2-56	F40CWWM	40	4380	6	1,051	1L F32T8 W/ STND ELEC BALLAST	28	4,380	6	736	315	0.24	0.17	0.07	28	Time Clock	4,380	6	0.17	736	0.07	315
Site B2	B2-57	F30CWSS	74	4380	4	1,296	1L F25T8 W/ STND ELEC BALLAST & REFLECTOR	24	4,380	4	420	876	0.30	0.10	0.20	24	Time Clock	4,380	4	0.10	420	0.20	876
Site B2	B2-58	F40CWWM	40	4380	2	350	1L F32T8 W/ STND ELEC BALLAST	28	4,380	2	245	105	0.08	0.06	0.02	28	Time Clock	4,380	2	0.06	245	0.02	105
Site B2	B2-59	H39KC175DX	225	4380	2	1,971	70W CMH DEL REY	78	4,380	2	683	1,288	0.45	0.16	0.29	78	Time Clock	4,380	2	0.16	683	0.29	1,288
Site B2	B2-60	300A23	300	4380	14	18,396	Remove & Cap Fixture		4,380	14	0	18,396	4.20	0.00	4.20		Time Clock	4,380	14	0.00	0	4.20	18,396
Site B2	B2-61	H37KC250DX	458	4380	13	26,079	70W CMH DEL REY	78	4,380	13	4,441	21,637	5.95	1.01	4.94	78	Time Clock	4,380	13	1.01	4,441	4.94	21,637
Site B2	B2-62	H39KC175DX	225	4380	46	45,333	70W CMH DEL REY	78	4,380	46	15,715	29,618	10.35	3.59	6.76	78	Time Clock	4,380	46	3.59	15,715	6.76	29,618
Site B2	B2-63	H38JA100DX	130	4380	16	9,110	70W CMH DEL REY	78	4,380	16	5,466	3,644	2.08	1.25	0.83	78	Time Clock	4,380	16	1.25	5,466	0.83	3,644
Site B2	B2-64	90PAR38	90	4380	6	2,365	70W CMH DEL REY	78	4,380	6	2,050	315	0.54	0.47	0.07	78	Time Clock	4,380	6	0.47	2,050	0.07	315
Site B2	B2-65	120PAR38	120	4380	30	15,768	39W CERAMIC MH TRACK LIGHT	45	4,380	30	5,913	9,855	3.60	1.35	2.25	45	Time Clock	4,380	30	1.35	5,913	2.25	9,855

Table 54. Summary of M&V Findings – 04-01-028 (con't)

		Proposed Pre-Installation					Proposed Post-Installation					Proposed Installed Savings				Verified Measures						Verified Savings	
Facility	Area	Existing Fixture Type	Existing W/Fix	Hours Per Year	No. of Fix	Existing Total Annual kWh	Proposed Fixture Type	Prop. W/Fix	Hours Per Year	No. of Fix	Proposed Total Annual kWh	Total Annual kWh Saved	Baseline kW	Proposed kW	kW Saved	Verified W/Fix	Lighting Controls	Verified Annual Hours	Verified Quantity	Verified Installed kW	Verified Installed kWh	Verified Savings kW	Verified Savings kWh
Site B2	B2-66	F40CWWM	80	4380	89	31,186	2L F32T8 W/ STND ELEC BALLAST	54	4,380	89	21,050	10,135	7.12	4.81	2.31	54	Time Clock	4,380	89	4.81	21,050	2.31	10,135
Site B2	B2-67	F30CWSS	70	4380	9	2,759	2L F25T8 W/ STND ELEC BALLAST	45	4,380	9	1,774	986	0.63	0.41	0.23	45	Time Clock	4,380	9	0.41	1,774	0.23	986
Site B2	B2-68	50R20		4380	6	0	RELAMP W/ (1) 50R20		4,380	6	0	0	0.00	0.00	0.00			4,380	6	0.00	0	0.00	0
Site B2	B2-69	F32T8SP35		4380	18	0	RELAMP W/ (2) F32T8/SPX41		4,380	18	0	0	0.00	0.00	0.00			4,380	18	0.00	0	0.00	0
Site B2	B2-70	F32T8SP35		4380	70	0	RELAMP W/ (2) F32T8/SPX41		4,380	70	0	0	0.00	0.00	0.00			4,380	70	0.00	0	0.00	0
Site B2	B2-71	MH175CU	225	4380	42	41,391	70W CMH DEL REY	78	4,380	42	14,349	27,042	9.45	3.28	6.17	78	Time Clock	4,380	42	3.28	14,349	6.17	27,042
Site B2	B2-72	Q50MR16		4380	12	0	NO WORK		4,380	12	0	0	0.00	0.00	0.00			4,380	12	0.00	0	0.00	0
Site B2	B2-73	F40CWWM	80	4380	5	1,752	2L F32T8 W/ STND ELEC BALLAST	54	4,380	5	1,183	569	0.40	0.27	0.13	54	Time Clock	4,380	5	0.27	1,183	0.13	569
Site B2	B2-74	F40CWWM	40	4380	14	2,453	1L F32T8 W/ STND ELEC BALLAST	28	4,380	14	1,717	736	0.56	0.39	0.17	28	Time Clock	4,380	14	0.39	1,717	0.17	736
Site B2	B2-75	F40CWWM	40	4380	2	350	1L F32T8 W/ STND ELEC BALLAST	28	4,380	2	245	105	0.08	0.06	0.02	28	Time Clock	4,380	2	0.06	245	0.02	105
Site B2	B2-76	F40CWWM	40	4380	14	2,453	1L F32T8 W/ STND ELEC BALLAST	28	4,380	14	1,717	736	0.56	0.39	0.17	28	Time Clock	4,380	14	0.39	1,717	0.17	736
Site B2	B2-77	F40CWWM	80	4380	1	350	2L F32T8 W/ STND ELEC BALLAST	54	4,380	1	237	114	0.08	0.05	0.03	54	Time Clock	4,380	1	0.05	237	0.03	114
Site B2	B2-78	F96T12CW	76	4380	3	999	1L F96T8 W/ STND ELEC BALLAST	58	4,380	3	762	237	0.23	0.17	0.05	58	Time Clock	4,380	3	0.17	762	0.05	237
Site B2	B2-79	F40CWWM	40	4380	3	526	1L F32T8 W/ STND ELEC BALLAST	28	4,380	3	368	158	0.12	0.08	0.04	28	Time Clock	4,380	3	0.08	368	0.04	158
Site B2	B2-80	F40CWWM	80	4380	12	4,205	2L F32T8 W/ STND ELEC BALLAST	54	4,380	12	2,838	1,367	0.96	0.65	0.31	54	Time Clock	4,380	12	0.65	2,838	0.31	1,367
Site B2	B2-81	F96CW	76	4380	3	999	1L F96T8 W/ STND ELEC BALLAST	58	4,380	3	762	237	0.23	0.17	0.05	58	Time Clock	4,380	3	0.17	762	0.05	237
Site B2	B2-82	F40CWWM	80	4380	4	1,402	2L F32T8 W/ STND ELEC BALLAST	54	4,380	4	946	456	0.32	0.22	0.10	54	Time Clock	4,380	4	0.22	946	0.10	456
Site B2	B2-83	F40CWWM	40	4380	14	2,453	1L F32T8 W/ STND ELEC BALLAST	28	4,380	14	1,717	736	0.56	0.39	0.17	28	Time Clock	4,380	14	0.39	1,717	0.17	736
Site B2	B2-84			4380	0	0	NO WORK		4,380	0	0	0	0.00	0.00	0.00			4,380	0	0.00	0	0.00	0
Site B2	B2-85	H37KC250DX	295	3650	2	2,154	100W CMH DEL REY	108	3,650	2	788	1,365	0.59	0.22	0.37	108	Time Clock	3,650	2	0.22	788	0.37	1,365
Site B2	B2-86	H37KC250DX	295	3650	18	19,382	100W CMH DEL REY	108	3,650	18	7,096	12,286	5.31	1.94	3.37	108	Time Clock	3,650	18	1.94	7,096	3.37	12,286
Site B2	B2-87	H38JA100DX	130	3650	1	475	70W CMH DEL REY	78	3,650	1	285	190	0.13	0.08	0.05	78	Time Clock	3,650	1	0.08	285	0.05	190
Site B2	B2-88	H38JA100DX	130	3650	17	8,067	70W CMH DEL REY	78	3,650	17	4,840	3,227	2.21	1.33	0.88	78	Time Clock	3,650	17	1.33	4,840	0.88	3,227
Site B2	B2-89	MH400U	458	3650	4	6,687	320W MH Exterior	345	3,650	4	5,037	1,650	1.83	1.38	0.45	345	Time Clock	3,650	4	1.38	5,037	0.45	1,650
Site B2	B2-90	60A19	90	3650	1	329	26W CF CONVERSION	26	3,650	1	95	234	0.09	0.03	0.06	26	Time Clock	3,650	1	0.03	95	0.06	234
Site B2	B2-91	Q300T3CL		3650	5	0	RELAMP W/ (1) Q300T3/CL		3,650	5	0	0	0.00	0.00	0.00		Time Clock	3,650	5	0.00	0	0.00	0
Site B2	B2-92	MH175U	225	3650	6	4,928	70W PS MH w/ HID Elec Ballast	78	3,650	6	1,708	3,219	1.35	0.47	0.88	78	Time Clock	3,650	6	0.47	1,708	0.88	3,219
Site B2	B2-93	LU100MED	130	3650	1	475	70W PS MH w/ HID Elec Ballast	78	3,650	1	285	190	0.13	0.08	0.05	78	Time Clock	3,650	1	0.08	285	0.05	190

Table 54. Summary of M&V Findings – 04-01-028 (con't)

		Proposed Pre-Installation					Proposed Post-Installation					Proposed Installed Savings				Verified Measures						Verified Savings	
Facility	Area	Existing Fixture Type	Existing W/Fix	Hours Per Year	No. of Fix	Existing Total Annual kWh	Proposed Fixture Type	Prop. W/Fix	Hours Per Year	No. of Fix	Proposed Total Annual kWh	Total Annual kWh Saved	Baseline kW	Proposed kW	kW Saved	Verified W/Fix	Lighting Controls	Verified Annual Hours	Verified Quantity	Verified Installed kW	Verified Installed kWh	Verified Savings kW	Verified Savings kWh
Site B2	B2-94	MH175UMED	225	3650	2	1,643	100W PS MH w/ HID Elec Ballast	108	3,650	2	788	854	0.45	0.22	0.23	108	Time Clock	3,650	2	0.22	788	0.23	854
Site B2	B2-95	MH250U	295	3650	2	2,154	100W PS MH w/ Elec HID Ballast	108	3,650	2	788	1,365	0.59	0.22	0.37	108	Time Clock	3,650	2	0.22	788	0.37	1,365
Site B2	B2-96	HR75DX	96	3650	8	2,803	42W CF CONVERSION	42	3,650	8	1,226	1,577	0.77	0.34	0.43	42	Time Clock	3,650	8	0.34	1,226	0.43	1,577
Site B2	B2-97	LU400	458	3650	2	3,343	320W MH Exterior	345	3,650	2	2,519	825	0.92	0.69	0.23	345	Time Clock	3,650	2	0.69	2,519	0.23	825
Site B2	B2-98	MH100UMED	130	3650	5	2,373	70W PS MH w/ HID Elec Ballast	78	3,650	5	1,424	949	0.65	0.39	0.26	78	Time Clock	3,650	5	0.39	1,424	0.26	949
Site B2	B2-99	HQI-DE-70-NDX		3650	10	0	RELAMP W/ (1) HQI-DE-70-NDX		3,650	10	0	0	0.00	0.00	0.00		Time Clock	3,650	10	0.00	0	0.00	0
Site B2	B2-100	MH400U	458	3650	3	5,015	175W PS MH w/ Elec HID Ballast	191	3,650	3	2,091	2,924	1.37	0.57	0.80	191	Time Clock	3,650	3	0.57	2,091	0.80	2,924
Site B2	B2-101	MH100UMED	130	3650	25	11,863	70W PS MH w/ HID Elec Ballast	78	3,650	25	7,118	4,745	3.25	1.95	1.30	78	Time Clock	3,650	25	1.95	7,118	1.30	4,745
Site B2	B2-102	MH100UMED	130	3650	16	7,592	70W PS MH w/ HID Elec Ballast	78	3,650	16	4,555	3,037	2.08	1.25	0.83	78	Time Clock	3,650	16	1.25	4,555	0.83	3,037
Site B2	B2-103	MH100UMED	130	3650	6	2,847	70W PS MH w/ HID Elec Ballast	78	3,650	6	1,708	1,139	0.78	0.47	0.31	78	Time Clock	3,650	6	0.47	1,708	0.31	1,139
Site B2	B2-104	MH100UMED	130	3650	22	10,439	70W PS MH w/ HID Elec Ballast	78	3,650	22	6,263	4,176	2.86	1.72	1.14	78	Time Clock	3,650	22	1.72	6,263	1.14	4,176
Site B2	B2-105	MH1000U	4320	3650	27	425,736	(4 Head) 750W PS MH	3120	3,650	27	307,476	118,260	116.64	84.24	32.40	3120	Time Clock	3,650	27	84.24	307,476	32.40	118,260
Site B2	B2-106	MH1000U	2160	3650	22	173,448	(2 Head) 750W PS MH	1560	3,650	22	125,268	48,180	47.52	34.32	13.20	1560	Time Clock	3,650	22	34.32	125,268	13.20	48,180
Site B2	B2-107	MH1000U	1080	3650	28	110,376	750W PS MH	780	3,650	28	79,716	30,660	30.24	21.84	8.40	780	Time Clock	3,650	28	21.84	79,716	8.40	30,660
Site B2	B2-108	MH400U	916	3650	11	36,777	(2) 320W MH Parking Lot Fixture	690	3,650	11	27,704	9,074	10.08	7.59	2.49	690	Time Clock	3,650	11	7.59	27,704	2.49	9,074
Site B2	B2-109	MH400U	458	3650	17	28,419	320W MH Exterior	345	3,650	17	21,407	7,012	7.79	5.87	1.92	345	Time Clock	3,650	17	5.87	21,407	1.92	7,012
Site B2	B2-110	MH175UMED	225	6570	347	512,953	2L 1x4 Vapor Tight	54	6,570	347	123,109	389,844	78.08	18.74	59.34	54	Time Clock	6,570	347	18.74	123,109	59.34	389,844
Site B2	B2-111	MH250U	295	6570	65	125,980	2L 1x4 Vapor Tight	54	6,570	65	23,061	102,919	19.18	3.51	15.67	54	Time Clock	6,570	65	3.51	23,061	15.67	102,919
Site B2	B2-112	100A19	100	3650	4	1,460	26W CF CONVERSION	26	3,650	4	380	1,080	0.40	0.10	0.30	26	Time Clock	3,650	4	0.10	380	0.30	1,080
Site B2	B2-113	F40CWWM	72	6570	4	1,892	2L 1x4 Vapor Tight	54	6,570	4	1,419	473	0.29	0.22	0.07	54	Time Clock	6,570	4	0.22	1,419	0.07	473
Site B2	B2-114	F40CWWM	43	6570	20	5,650	2L 1x4 Vapor Tight	54	6,570	20	7,096	-1,445	0.86	1.08	-0.22	54	Time Clock	6,570	20	1.08	7,096	-0.22	-1,445
Site B2	B2-115	F32T8SP35		3650	1	0	RELAMP W/ (4) F32T8/SPX41		3,650	1	0	0	0.00	0.00	0.00			3,650	1	0.00	0	0.00	0
Site B2	B2-116	F32T8SP35		3650	1	0	RELAMP W/ (2) F32T8/SPX41		3,650	1	0	0	0.00	0.00	0.00			3,650	1	0.00	0	0.00	0
Site B2	B2-117	F40CWWM	40	3650	12	1,752	1L F32T8 W/ STND ELEC BALLAST	28	3,650	12	1,226	526	0.48	0.34	0.14	28	Time Clock	3,650	12	0.34	1,226	0.14	526
Site B2	B2-118	MH175U	225	3650	8	6,570	100W PS MH w/ HID Elec Ballast	108	3,650	8	3,154	3,416	1.80	0.86	0.94	108	Time Clock	3,650	8	0.86	3,154	0.94	3,416
Site B2	B2-119	MH400U	916	3650	9	30,091	(2) 320W MH Parking Lot Fixture	690	3,650	9	22,667	7,424	8.24	6.21	2.03	690	Time Clock	3,650	9	6.21	22,667	2.03	7,424
Site B2	B2-120	MH400U	458	3650	18	30,091	320W MH Exterior	345	3,650	18	22,667	7,424	8.24	6.21	2.03	345	Time Clock	3,650	18	6.21	22,667	2.03	7,424

Table 54. Summary of M&V Findings – 04-01-028 (con't)

		Proposed Pre-Installation					Proposed Post-Installation					Proposed Installed Savings				Verified Measures						Verified Savings	
Facility	Area	Existing Fixture Type	Existing W/Fix	Hours Per Year	No. of Fix	Existing Total Annual kWh	Proposed Fixture Type	Prop. W/Fix	Hours Per Year	No. of Fix	Proposed Total Annual kWh	Total Annual kWh Saved	Baseline kW	Proposed kW	kW Saved	Verified W/Fix	Lighting Controls	Verified Annual Hours	Verified Quantity	Verified Installed kW	Verified Installed kWh	Verified Savings kW	Verified Savings kWh
Site B2	B2-121	MH175UMED	225	6570	3	4,435	2L 1x4 Vapor Tight	54	6,570	3	1,064	3,370	0.68	0.16	0.51	54	Time Clock	6,570	3	0.16	1,064	0.51	3,370
Site B2	B2-122	MH175UMED	225	6570	356	526,257	2L 1x4 Vapor Tight	54	6,570	356	126,302	399,955	80.10	19.22	60.88	54	Time Clock	6,570	356	19.22	126,302	60.88	399,955
Site B2	B2-123	MH250U	295	6570	69	133,732	2L 1x4 Vapor Tight	54	6,570	69	24,480	109,253	20.36	3.73	16.63	54	Time Clock	6,570	69	3.73	24,480	16.63	109,253
Site B2	B2-124	100A19	100	3650	4	1,460	26W CF CONVERSION	26	3,650	4	380	1,080	0.40	0.10	0.30	26	Time Clock	3,650	4	0.10	380	0.30	1,080
Site B2	B2-125	MH175U	225	3650	16	13,140	100W PS MH w/ HID Elec Ballast	108	3,650	16	6,307	6,833	3.60	1.73	1.87	108	Time Clock	3,650	16	1.73	6,307	1.87	6,833
Site B2	B2-126	MH100UMED	130	6570	4	3,416	70W PS MH w/ HID Elec Ballast	78	6,570	4	2,050	1,367	0.52	0.31	0.21	78	Time Clock	6,570	4	0.31	2,050	0.21	1,367
Site B2	B2-127	F40CWWM	43	6570	20	5,650	2L 1x4 Vapor Tight	54	6,570	20	7,096	-1,445	0.86	1.08	-0.22	54	Time Clock	6,570	20	1.08	7,096	-0.22	-1,445
Site B2	B2-128	F40CWWM	115	3650	2	840	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (2x4)	54	3,650	2	394	445	0.23	0.11	0.12	54	Time Clock	3,650	2	0.11	394	0.12	445
Site B2	B2-129	F40CWWM	80	3650	132	38,544	2L F32T8 W/ STND ELEC BALLAST	54	3,650	132	26,017	12,527	10.56	7.13	3.43	54	Time Clock	3,650	132	7.13	26,017	3.43	12,527
Site B2	B2-130	20T6	40	8760	91	31,886	NEW 2 WATT LED EXIT SIGN	2	8,760	91	1,594	30,292	3.64	0.18	3.46	2	Always ON	8,760	91	0.18	1,594	3.46	30,292
TOTALS Site B2					**2,875**	**3,258,145**				**2,875**	**1,375,009**	**1,883,136**	**681.04**	**318.65**	**362.39**				**2,875**	**318.65**	**1,375,009**	**362.39**	**1,883,136**
Site B3	B3-1	MH175CU	225	3650	203	166,714	2X32 CF DEL REY KIT	64	3,650	203	47,421	119,293	45.68	12.99	32.68	64	Time Clock	3,650	203	12.99	47,421	32.68	119,293
Site B3	B3-2	MH175CU	225	3650	4	3,285	2X32 CF DEL REY KIT	64	3,650	4	934	2,351	0.90	0.26	0.64	64	Time Clock	3,650	4	0.26	934	0.64	2,351
Site B3	B3-3	75PAR38	75	3650	4	1,095	2X32 CF DEL REY KIT	66	3,650	4	964	131	0.30	0.26	0.04	66	Time Clock	3,650	4	0.26	964	0.04	131
Site B3	B3-4	H38JA100DX	130	3650	17	8,067	2X32 CF DEL REY KIT	66	3,650	17	4,095	3,971	2.21	1.12	1.09	66	Time Clock	3,650	17	1.12	4,095	1.09	3,971
Site B3	B3-5	MH70 OR 100 U MED		3650	27	0	RELAMP W/ (1) CMH100/C/U/MED/830		3,650	27	0	0	0.00	0.00	0.00		Time Clock	3,650	0	0.00	0	0.00	0
Site B3	B3-6	F40CWSS	80	3650	4	1,168	1L F32T8 W/ STND ELEC BALLAST & REFLECTOR	28	3,650	4	409	759	0.32	0.11	0.21	28	Time Clock	3,650	4	0.11	409	0.21	759
Site B3	B3-7	60A19	60	3650	1	219	RELAMP W/ 15W SCREW IN CF	15	3,650	1	55	164	0.06	0.02	0.05	15	Time Clock	3,650	0	0.00	0	0.06	219
Site B3	B3-8	50PAR30	50	3650	1	183	5W Cold Cathode Lamp	5	3,650	1	18	164	0.05	0.01	0.05	5	Time Clock	3,650	1	0.01	18	0.05	164
Site B3	B3-9	F40CWSS	80	3650	1	292	1L F32T8 W/ STND ELEC BALLAST & REFLECTOR	28	3,650	1	102	190	0.08	0.03	0.05	28	Time Clock	3,650	1	0.03	102	0.05	190
Site B3	B3-10	MH70UMED		3650	1	0	RELAMP W/ (1) CMH70PAR30		3,650	1	0	0	0.00	0.00	0.00		Time Clock	3,650	0	0.00	0	0.00	0
Site B3	B3-11	Q50MR16		3650	9	0	NO WORK		3,650	9	0	0	0.00	0.00	0.00		Time Clock	3,650	0	0.00	0	0.00	0
Site B3	B3-12	LU70MED	90	3650	2	657	42W CF CONVERSION	42	3,650	2	307	350	0.18	0.08	0.10	42	Time Clock	3,650	2	0.08	307	0.10	350
Site B3	B3-13	CF-13 DS 827		3650	1	0	RELAMP W/ (1) F13BX/SPX41		3,650	1	0	0	0.00	0.00	0.00		Time Clock	3,650	0	0.00	0	0.00	0
Site B3	B3-14	MH175CU	225	3650	1	821	100W PS MH w/ HID Elec Ballast	108	3,650	1	394	427	0.23	0.11	0.12	108	Time Clock	3,650	1	0.11	394	0.12	427
Site B3	B3-15	MH175UMED	225	3650	25	20,531	100W PS MH w/ HID Elec Ballast	108	3,650	25	9,855	10,676	5.63	2.70	2.93	108	Time Clock	3,650	25	2.70	9,855	2.93	10,676

Table 54. Summary of M&V Findings – 04-01-028 (con't)

		Proposed Pre-Installation					Proposed Post-Installation					Proposed Installed Savings				Verified Measures						Verified Savings	
Facility	Area	Existing Fixture Type	Existing W/Fix	Hours Per Year	No. of Fix	Existing Total Annual kWh	Proposed Fixture Type	Prop. W/Fix	Hours Per Year	No. of Fix	Proposed Total Annual kWh	Total Annual kWh Saved	Baseline kW	Proposed kW	kW Saved	Verified W/Fix	Lighting Controls	Verified Annual Hours	Verified Quantity	Verified Installed kW	Verified Installed kWh	Verified Savings kW	Verified Savings kWh
Site B3	B3-16	LU100MED	129	3650	1	471	42W CF CONVERSION	42	3,650	1	153	318	0.13	0.04	0.09	42	Time Clock	3,650	1	0.04	153	0.09	318
Site B3	B3-17	F40CWSS	80	3650	1	292	1L F32T8 W/ STND ELEC BALLAST & REFLECTOR	28	3,650	1	102	190	0.08	0.03	0.05	28	Time Clock	3,650	1	0.03	102	0.05	190
Site B3	B3-18	THOUSANDS OF FEET 120V WIDE LOYAL INDUSTRIES IP44/E172629		3650	0	0	NO WORK		3,650	0	0	0	0.00	0.00	0.00		Time Clock	3,650	0	0.00	0	0.00	0
Site B3	B3-19	H38JA100DX	129	3650	4	1,883	42W CF CONVERSION	42	3,650	4	613	1,270	0.52	0.17	0.35	42	Time Clock	3,650	4	0.17	613	0.35	1,270
Site B3	B3-20	MH175CU	225	3650	5	4,106	2X32 CF DEL REY KIT	64	3,650	5	1,168	2,938	1.13	0.32	0.81	64	Time Clock	3,650	5	0.32	1,168	0.81	2,938
Site B3	B3-21	MH		3650	22	0	NO WORK		3,650	22	0	0	0.00	0.00	0.00		Time Clock	3,650	0	0.00	0	0.00	0
Site B3	B3-22	MH		3650	5	0	NO WORK		3,650	5	0	0	0.00	0.00	0.00		Time Clock	3,650	0	0.00	0	0.00	0
Site B3	B3-23	MH70UMED		3650	171	0	NO WORK		3,650	171	0	0	0.00	0.00	0.00		Time Clock	3,650	0	0.00	0	0.00	0
Site B3	B3-24	MH70UMED		3650	3	0	NO WORK		3,650	3	0	0	0.00	0.00	0.00		Time Clock	3,650	0	0.00	0	0.00	0
Site B3	B3-25	Q50MR16		3650	24	0	NO WORK		3,650	24	0	0	0.00	0.00	0.00		Time Clock	3,650	0	0.00	0	0.00	0
Site B3	B3-26	MP100UMED		3650	36	0	NO WORK		3,650	36	0	0	0.00	0.00	0.00		Time Clock	3,650	0	0.00	0	0.00	0
Site B3	B3-27	50PAR20	50	3650	14	2,555	5W Cold Cathode Lamp	5	3,650	14	256	2,300	0.70	0.07	0.63	5	Time Clock	3,650	0	0.00	0	0.70	2,555
Site B3	B3-28	F40CWSS	80	6570	8	4,205	2L F32T8 W/ STND ELEC BALLAST & EMERGENCY BALLAST	54	6,570	8	2,838	1,367	0.64	0.43	0.21	54	Time Clock	6,570	8	0.43	2,838	0.21	1,367
Site B3	B3-29	F96CWSS	158	6570	7	7,266	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR	54	6,570	7	2,483	4,783	1.11	0.38	0.73	54	Time Clock	6,570	7	0.38	2,483	0.73	4,783
Site B3	B3-30	F40CWSS	80	6570	1	526	2L F32T8 W/ STND ELEC BALLAST	54	6,570	1	355	171	0.08	0.05	0.03	54	Time Clock	6,570	1	0.05	355	0.03	171
Site B3	B3-31	20T6 1/2	40	8760	11	3,854	NEW 2 WATT LED EXIT SIGN	2	8,760	11	193	3,662	0.44	0.02	0.42	2	Time Clock	8,760	11	0.02	193	0.42	3,662
Site B3	B3-32	F40CWSS	40	6570	3	788	1L F32T8 W/ STND ELEC BALLAST	28	6,570	3	552	237	0.12	0.08	0.04	28	Time Clock	6,570	3	0.08	552	0.04	237
Site B3	B3-33	20T6 1/2	40	8760	2	701	NEW 2 WATT LED EXIT SIGN	2	8,760	2	35	666	0.08	0.00	0.08	2	Time Clock	8,760	2	0.00	35	0.08	666
Site B3	B3-34	150W MH	188	3650	12	8,234	70W PS MH w/ Elec HID Ballast	78	3,650	12	3,416	4,818	2.26	0.94	1.32	78	Time Clock	3,650	12	0.94	3,416	1.32	4,818
Site B3	B3-35	150W MH	188	3650	4	2,745	70W PS MH w/ Elec HID Ballast	78	3,650	4	1,139	1,606	0.75	0.31	0.44	78	Time Clock	3,650	4	0.31	1,139	0.44	1,606
Site B3	B3-36	150W MH	188	3650	20	13,724	70W PS MH w/ Elec HID Ballast	78	3,650	20	5,694	8,030	3.76	1.56	2.20	78	Time Clock	3,650	20	1.56	5,694	2.20	8,030
Site B3	B3-37	CF-13 DS 827		3650	1	0	RELAMP W/ (1) F13DBX23T4/SPX41 (PCR)		3,650	1	0	0	0.00	0.00	0.00		Time Clock	3,650	0	0.00	0	0.00	0
Site B3	B3-38	50PAR20	50	3650	8	1,460	5W Cold Cathode Lamp	5	3,650	8	146	1,314	0.40	0.04	0.36	5	Time Clock	3,650	8	0.04	146	0.36	1,314
Site B3	B3-39	50PAR20	50	3650	4	730	5W Cold Cathode Lamp	5	3,650	4	73	657	0.20	0.02	0.18	5	Time Clock	3,650	4	0.02	73	0.18	657
Site B3	B3-40	50PAR20	50	3650	9	1,643	5W Cold Cathode Lamp	5	3,650	9	164	1,478	0.45	0.05	0.41	5	Time Clock	3,650	9	0.05	164	0.41	1,478

Table 54. Summary of M&V Findings – 04-01-028 (con't)

		Proposed Pre-Installation					Proposed Post-Installation					Proposed Installed Savings				Verified Measures						Verified Savings	
Facility	Area	Existing Fixture Type	Existing W/Fix	Hours Per Year	No. of Fix	Existing Total Annual kWh	Proposed Fixture Type	Prop. W/Fix	Hours Per Year	No. of Fix	Proposed Total Annual kWh	Total Annual kWh Saved	Baseline kW	Proposed kW	kW Saved	Verified W/Fix	Lighting Controls	Verified Annual Hours	Verified Quantity	Verified Installed kW	Verified Installed kWh	Verified Savings kW	Verified Savings kWh
Site B3	B3-41	F40CWSS	80	3650	6	1,752	1L F32T8 W/ STND ELEC BALLAST & REFLECTOR	28	3,650	6	613	1,139	0.48	0.17	0.31	28	Time Clock	3,650	6	0.17	613	0.31	1,139
Site B3	B3-42	LU70MED	90	3650	1	329	42W CF CONVERSION	42	3,650	1	153	175	0.09	0.04	0.05	42	Time Clock	3,650	1	0.04	153	0.05	175
Site B3	B3-43	F96CWSS	158	3650	1	577	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR	54	3,650	1	197	380	0.16	0.05	0.10	54	Time Clock	3,650	1	0.05	197	0.10	380
Site B3	B3-44	100A19	100	3650	2	730	RELAMP W/ 18W SCREW IN CF	18	3,650	2	131	599	0.20	0.04	0.16	18	Time Clock	3,650	0	0.00	0	0.20	730
Site B3	B3-45	MH175UMED	225	3650	1	821	100W PS MH w/ HID Elec Ballast	108	3,650	1	394	427	0.23	0.11	0.12	108	Time Clock	3,650	1	0.11	394	0.12	427
Site B3	B3-46	F96CWSS	158	3650	19	10,957	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR	54	3,650	19	3,745	7,212	3.00	1.03	1.98	54	Time Clock	3,650	19	1.03	3,745	1.98	7,212
Site B3	B3-47	F40CWSS	80	3650	2	584	2L F32T8 W/ STND ELEC BALLAST	54	3,650	2	394	190	0.16	0.11	0.05	54	Time Clock	3,650	2	0.11	394	0.05	190
Site B3	B3-48	100A19	100	3650	1	365	RELAMP W/ 18W SCREW IN CF	18	3,650	1	66	299	0.10	0.02	0.08	18	Time Clock	3,650	0	0.00	0	0.10	365
Site B3	B3-49	F40CWSS	80	3650	1	292	1L F32T8 W/ STND ELEC BALLAST & REFLECTOR	28	3,650	1	102	190	0.08	0.03	0.05	28	Time Clock	3,650	1	0.03	102	0.05	190
Site B3	B3-50	100A19	100	3650	1	365	RELAMP W/ 18W SCREW IN CF	18	3,650	1	66	299	0.10	0.02	0.08	18	Time Clock	3,650	0	0.00	0	0.10	365
Site B3	B3-51	100A19	100	3650	11	4,015	RELAMP W/ 18W SCREW IN CF	18	3,650	11	723	3,292	1.10	0.20	0.90	18	Time Clock	3,650	0	0.00	0	1.10	4,015
Site B3	B3-52	100A19	100	3650	1	365	RELAMP W/ 18W SCREW IN CF	18	3,650	1	66	299	0.10	0.02	0.08	18	Time Clock	3,650	0	0.00	0	0.10	365
Site B3	B3-53			3650	0	0	NO WORK		3,650	0	0	0	0.00	0.00	0.00		Time Clock	3,650	0	0.00	0	0.00	0
Site B3	B3-54	F96CWSS	158	6570	5	5,190	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR	54	6,570	5	1,774	3,416	0.79	0.27	0.52	54	Time Clock	6,570	5	0.27	1,774	0.52	3,416
Site B3	B3-55	F40CWSS	80	6570	4	2,102	2L F32T8 W/ STND ELEC BALLAST & EMERGENCY BALLAST	54	6,570	4	1,419	683	0.32	0.22	0.10	54	Time Clock	6,570	4	0.22	1,419	0.10	683
Site B3	B3-56	F40CWSS	80	6570	1	526	2L F32T8 W/ STND ELEC BALLAST	54	6,570	1	355	171	0.08	0.05	0.03	54	Time Clock	6,570	1	0.05	355	0.03	171
Site B3	B3-57	CF-26 DD 841		6570	1	0	RELAMP W/ (1) F26DBXT4/SPX41		6,570	1	0	0	0.00	0.00	0.00		Time Clock	6,570	0	0.00	0	0.00	0
Site B3	B3-58	20T6 1/2	40	8760	6	2,102	NEW 2 WATT LED EXIT SIGN	2	8,760	6	105	1,997	0.24	0.01	0.23	2	Time Clock	8,760	6	0.01	105	0.23	1,997
Site B3	B3-59	20T6 1/2	40	8760	1	350	NEW 2 WATT LED EXIT SIGN	2	8,760	1	18	333	0.04	0.00	0.04	2	Always On	8,760	1	0.00	18	0.04	333
Site B3	B3-60	F40CWSS	40	3650	7	1,022	1L F32T8 W/ STND ELEC BALLAST	28	3,650	7	715	307	0.28	0.20	0.08	28	Time Clock	3,650	7	0.20	715	0.08	307
Site B3	B3-61	F40CWSS	40	6570	11	2,891	1L F32T8 W/ STND ELEC BALLAST & EMERGENCY BALLAST	28	6,570	11	2,024	867	0.44	0.31	0.13	28	Time Clock	6,570	11	0.31	2,024	0.13	867
Site B3	B3-62	F40CWSS	40	6570	6	1,577	1L F32T8 W/ STND ELEC BALLAST	28	6,570	6	1,104	473	0.24	0.17	0.07	28	Time Clock	6,570	6	0.17	1,104	0.07	473
Site B3	B3-63	20T6 1/2	40	8760	5	1,752	NEW 2 WATT LED EXIT SIGN	2	8,760	5	88	1,664	0.20	0.01	0.19	2	Always On	8,760	5	0.01	88	0.19	1,664
Site B3	B3-64	20T6 1/2	40	8760	1	350	NEW 2 WATT LED EXIT SIGN	2	8,760	1	18	333	0.04	0.00	0.04	2	Always On	8,760	1	0.00	18	0.04	333
Site B3	B3-65	F40CWSS	40	6570	3	788	1L F32T8 W/ STND ELEC BALLAST & EMERGENCY BALLAST	28	6,570	3	552	237	0.12	0.08	0.04	28	Time Clock	6,570	3	0.08	552	0.04	237

Table 54. Summary of M&V Findings – 04-01-028 (con't)

		Proposed Pre-Installation					Proposed Post-Installation					Proposed Installed Savings				Verified Measures						Verified Savings	
Facility	Area	Existing Fixture Type	Existing W/Fix	Hours Per Year	No. of Fix	Existing Total Annual kWh	Proposed Fixture Type	Prop. W/Fix	Hours Per Year	No. of Fix	Proposed Total Annual kWh	Total Annual kWh Saved	Baseline kW	Proposed kW	kW Saved	Verified W/Fix	Lighting Controls	Verified Annual Hours	Verified Quantity	Verified Installed kW	Verified Installed kWh	Verified Savings kW	Verified Savings kWh
Site B3	B3-66	F96CWSS	158	6570	2	2,076	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR	54	6,570	2	710	1,367	0.32	0.11	0.21	54	Time Clock	6,570	2	0.11	710	0.21	1,367
Site B3	B3-67	20T6 1/2	40	8760	1	350	NEW 2 WATT LED EXIT SIGN	2	8,760	1	18	333	0.04	0.00	0.04	2	Always On	8,760	1	0.00	18	0.04	333
Site B3	B3-68	F40CWSS	80	6570	1	526	2L F32T8 W/ STND ELEC BALLAST & EMERGENCY BALLAST	54	6,570	1	355	171	0.08	0.05	0.03	54	Time Clock	6,570	1	0.05	355	0.03	171
Site B3	B3-69	F96CWSS	158	6570	1	1,038	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR	54	6,570	1	355	683	0.16	0.05	0.10	54	Time Clock	6,570	1	0.05	355	0.10	683
Site B3	B3-70			3650	1	0	RELAMP W/ (1) F26DBXT4/SPX41		3,650	1	0	0	0.00	0.00	0.00		Time Clock	3,650	0	0.00	0	0.00	0
Site B3	B3-71	F40CWSS	80	6570	1	526	1L F32T8 W/ STND ELEC BALLAST & REFLECTOR	28	6,570	1	184	342	0.08	0.03	0.05	28	Time Clock	6,570	1	0.03	184	0.05	342
Site B3	B3-72	F32T8TL735	114	6570	1	749	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR	54	6,570	1	355	394	0.11	0.05	0.06	54	Time Clock	6,570	1	0.05	355	0.06	394
Site B3	B3-73	F40CWSS	80	6570	2	1,051	2L F32T8 W/ STND ELEC BALLAST & EMERGENCY BALLAST	54	6,570	2	710	342	0.16	0.11	0.05	54	Time Clock	6,570	2	0.11	710	0.05	342
Site B3	B3-74	F96CWSS	158	3650	9	5,190	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR	54	3,650	9	1,774	3,416	1.42	0.49	0.94	54	Time Clock	3,650	9	0.49	1,774	0.94	3,416
Site B3	B3-75	20T6 1/2	40	8760	1	350	NEW 2 WATT LED EXIT SIGN	2	8,760	1	18	333	0.04	0.00	0.04	2	Always On	8,760	1	0.00	18	0.04	333
Site B3	B3-76	F40CWSS	80	6570	6	3,154	1L F32T8 W/ STND ELEC BALLAST & REFLECTOR & EMERGENCY BALLAST	28	6,570	6	1,104	2,050	0.48	0.17	0.31	28	Time Clock	6,570	6	0.17	1,104	0.31	2,050
Site B3	B3-77	F40CWSS	80	6570	3	1,577	2L F32T8 W/ STND ELEC BALLAST & EMERGENCY BALLAST	54	6,570	3	1,064	512	0.24	0.16	0.08	54	Time Clock	6,570	3	0.16	1,064	0.08	512
Site B3	B3-78	F96CWSS	158	6570	4	4,152	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR	54	6,570	4	1,419	2,733	0.63	0.22	0.42	54	Time Clock	6,570	4	0.22	1,419	0.42	2,733
Site B3	B3-79	CF-42 DT E IN 841		4380	12	0	RELAMP W/ (1) F42TBXSPX30/A/4P		4,380	12	0	0	0.00	0.00	0.00		Time Clock	4,380	0	0.00	0	0.00	0
Site B3	B3-80	F32T8		4380	10	0	RELAMP W/ (2) F32T8/SPX41		4,380	10	0	0	0.00	0.00	0.00		Time Clock	4,380	0	0.00	0	0.00	0
Site B3	B3-81	H38JA100DX	130	4380	75	42,705	2X32 CF DEL REY KIT	66	4,380	75	21,681	21,024	9.75	4.95	4.80	66	Time Clock	4,380	75	4.95	21,681	4.80	21,024
Site B3	B3-82	H38JA100DX	130	4380	7	3,986	2X32 CF DEL REY KIT	66	4,380	7	2,024	1,962	0.91	0.46	0.45	66	Time Clock	4,380	7	0.46	2,024	0.45	1,962
Site B3	B3-83	H37KC250DX	295	4380	1	1,292	2X32 CF DEL REY KIT	64	4,380	1	280	1,012	0.30	0.06	0.23	64	Time Clock	4,380	1	0.06	280	0.23	1,012
Site B3	B3-84	MH100UMED	130	4380	9	5,125	2X32 CF DEL REY KIT	66	4,380	9	2,602	2,523	1.17	0.59	0.58	66	Time Clock	4,380	9	0.59	2,602	0.58	2,523
Site B3	B3-85	F40CWSS	40	4380	20	3,504	1L F32T8 W/ STND ELEC BALLAST & EMERGENCY BALLAST	28	4,380	20	2,453	1,051	0.80	0.56	0.24	28	Time Clock	4,380	20	0.56	2,453	0.24	1,051
Site B3	B3-86	F40CWSS	40	4380	11	1,927	1L F32T8 W/ STND ELEC BALLAST & EMERGENCY BALLAST	28	4,380	11	1,349	578	0.44	0.31	0.13	28	Time Clock	4,380	11	0.31	1,349	0.13	578
Site B3	B3-87	FB40CWU-6SS	80	4380	7	2,453	2L F17T8 W/ STND ELEC BALLAST & WHITE REFLECTOR	32	4,380	7	981	1,472	0.56	0.22	0.34	32	Time Clock	4,380	7	0.22	981	0.34	1,472
Site B3	B3-88	FB40CWU-6SS	80	4380	5	1,752	2L F17T8 W/ STND ELEC BALLAST & WHITE REFLECTOR	32	4,380	5	701	1,051	0.40	0.16	0.24	32	Time Clock	4,380	5	0.16	701	0.24	1,051

Table 54. Summary of M&V Findings – 04-01-028 (con't)

		Proposed Pre-Installation					Proposed Post-Installation					Proposed Installed Savings				Verified Measures						Verified Savings	
Facility	Area	Existing Fixture Type	Existing W/Fix	Hours Per Year	No. of Fix	Existing Total Annual kWh	Proposed Fixture Type	Prop. W/Fix	Hours Per Year	No. of Fix	Proposed Total Annual kWh	Total Annual kWh Saved	Baseline kW	Proposed kW	kW Saved	Verified W/Fix	Lighting Controls	Verified Annual Hours	Verified Quantity	Verified Installed kW	Verified Installed kWh	Verified Savings kW	Verified Savings kWh
Site B3	B3-89	Q50MR16		4380	58	0	NO WORK		4,380	58	0	0	0.00	0.00	0.00		Time Clock	4,380	0	0.00	0	0.00	0
Site B3	B3-90	36PAR36		4380	20	0	NO WORK		4,380	20	0	0	0.00	0.00	0.00		Time Clock	4,380	0	0.00	0	0.00	0
Site B3	B3-91			4380	0	0	NO WORK		4,380	0	0	0	0.00	0.00	0.00		Time Clock	4,380	0	0.00	0	0.00	0
Site B3	B3-92	20T6 1/2	40	8760	7	2,453	NEW 2 WATT LED EXIT SIGN	2	8,760	7	123	2,330	0.28	0.01	0.27	2	Always On	8,760	7	0.01	123	0.27	2,330
Site B3	B3-93	H38JA100DX	130	4380	16	9,110	2X32 CF DEL REY KIT	66	4,380	16	4,625	4,485	2.08	1.06	1.02	66	Time Clock	4,380	16	1.06	4,625	1.02	4,485
Site B3	B3-94	F40CWSS	40	4380	6	1,051	1L F32T8 W/ STND ELEC BALLAST & EMERGENCY BALLAST	28	4,380	6	736	315	0.24	0.17	0.07	28	Time Clock	4,380	6	0.17	736	0.07	315
Site B3	B3-95	50PAR30	50	4380	3	657	5W Cold Cathode Lamp	5	4,380	3	66	591	0.15	0.02	0.14	5	Time Clock	4,380	3	0.02	66	0.14	591
Site B3	B3-96	20T6 1/2	40	8760	4	1,402	NEW 2 WATT LED EXIT SIGN	2	8,760	4	70	1,332	0.16	0.01	0.15	2	Always On	8,760	4	0.01	70	0.15	1,332
Site B3	B3-97	F40CWSS	80	4380	6	2,102	1L F32T8 W/ STND ELEC BALLAST & REFLECTOR	28	4,380	6	736	1,367	0.48	0.17	0.31	28	Time Clock	4,380	6	0.17	736	0.31	1,367
Site B3	B3-98	F40CWSS	115	4380	3	1,511	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (2x4)	54	4,380	3	710	802	0.35	0.16	0.18	54	Time Clock	4,380	3	0.16	710	0.18	802
Site B3	B3-99	75R40	75	4380	1	329	42W CF CONVERSION	42	4,380	1	184	145	0.08	0.04	0.03	42	Time Clock	4,380	1	0.04	184	0.03	145
Site B3	B3-100	F40CWSS	144	4380	9	5,676	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (8' Kit)	54	4,380	9	2,129	3,548	1.30	0.49	0.81	54	Time Clock	4,380	9	0.49	2,129	0.81	3,548
Site B3	B3-101	F40CWSS	144	4380	2	1,261	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (8' Kit)	54	4,380	2	473	788	0.29	0.11	0.18	54	Time Clock	4,380	2	0.11	473	0.18	788
Site B3	B3-102	F40CWSS	144	4380	4	2,523	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (8' Kit)	54	4,380	4	946	1,577	0.58	0.22	0.36	54	Time Clock	4,380	4	0.22	946	0.36	1,577
Site B3	B3-103	50R20	50	4380	7	1,533	5W Cold Cathode Lamp	5	4,380	7	153	1,380	0.35	0.04	0.32	5	Time Clock	4,380	7	0.04	153	0.32	1,380
Site B3	B3-104	F40CWSS	144	4380	2	1,261	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (8' Kit)	54	4,380	2	473	788	0.29	0.11	0.18	54	Time Clock	4,380	2	0.11	473	0.18	788
Site B3	B3-105	F40CWSS	144	4380	2	1,261	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (8' Kit)	54	4,380	2	473	788	0.29	0.11	0.18	54	Time Clock	4,380	2	0.11	473	0.18	788
Site B3	B3-106	F40CWSS	144	4380	2	1,261	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (8' Kit)	54	4,380	2	473	788	0.29	0.11	0.18	54	Time Clock	4,380	2	0.11	473	0.18	788
Site B3	B3-107	F40CWSS	144	4380	4	2,523	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (8' Kit)	54	4,380	4	946	1,577	0.58	0.22	0.36	54	Time Clock	4,380	4	0.22	946	0.36	1,577
Site B3	B3-108	F40CWSS	144	4380	2	1,261	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (8' Kit)	54	4,380	2	473	788	0.29	0.11	0.18	54	Time Clock	4,380	2	0.11	473	0.18	788
Site B3	B3-109	F40CWSS	144	4380	2	1,261	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (8' Kit)	54	4,380	2	473	788	0.29	0.11	0.18	54	Time Clock	4,380	2	0.11	473	0.18	788

Table 54. Summary of M&V Findings – 04-01-028 (con't)

		Proposed Pre-Installation					Proposed Post-Installation					Proposed Installed Savings				Verified Measures						Verified Savings	
Facility	Area	Existing Fixture Type	Existing W/Fix	Hours Per Year	No. of Fix	Existing Total Annual kWh	Proposed Fixture Type	Prop. W/Fix	Hours Per Year	No. of Fix	Proposed Total Annual kWh	Total Annual kWh Saved	Baseline kW	Proposed kW	kW Saved	Verified W/Fix	Lighting Controls	Verified Annual Hours	Verified Quantity	Verified Installed kW	Verified Installed kWh	Verified Savings kW	Verified Savings kWh
Site B3	B3-110	F40CWSS	144	4380	1	631	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (8' Kit)	54	4,380	1	237	394	0.14	0.05	0.09	54	Time Clock	4,380	1	0.05	237	0.09	394
Site B3	B3-111	F40CWSS	80	4380	2	701	2L F32T8 W/ STND ELEC BALLAST	54	4,380	2	473	228	0.16	0.11	0.05	54	Time Clock	4,380	2	0.11	473	0.05	228
Site B3	B3-112	F40CWSS	115	4380	2	1,007	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (2x4)	54	4,380	2	473	534	0.23	0.11	0.12	54	Time Clock	4,380	2	0.11	473	0.12	534
Site B3	B3-113	F40CWSS	80	3650	2	584	1L F32T8 W/ STND ELEC BALLAST & REFLECTOR	28	3,650	2	204	380	0.16	0.06	0.10	28	Time Clock	3,650	2	0.06	204	0.10	380
Site B3	B3-114	F96CWSS	158	3650	4	2,307	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR	54	3,650	4	788	1,518	0.63	0.22	0.42	54	Time Clock	3,650	4	0.22	788	0.42	1,518
Site B3	B3-115	F40CWSS	144	3650	2	1,051	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (8' Kit)	54	3,650	2	394	657	0.29	0.11	0.18	54	Time Clock	3,650	2	0.11	394	0.18	657
Site B3	B3-116	F32T8	114	3650	1	416	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR	54	3,650	1	197	219	0.11	0.05	0.06	54	Time Clock	3,650	1	0.05	197	0.06	219
Site B3	B3-117	F96CWSS	158	6570	2	2,076	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR	54	6,570	2	710	1,367	0.32	0.11	0.21	54	Time Clock	6,570	2	0.11	710	0.21	1,367
Site B3	B3-118	F40CWSS	80	6570	1	526	2L F32T8 W/ STND ELEC BALLAST & EMERGENCY BALLAST	54	6,570	1	355	171	0.08	0.05	0.03	54	Time Clock	6,570	1	0.05	355	0.03	171
Site B3	B3-119	F40CWSS	80	6570	2	1,051	2L F32T8 W/ STND ELEC BALLAST	54	6,570	2	710	342	0.16	0.11	0.05	54	Time Clock	6,570	2	0.11	710	0.05	342
Site B3	B3-120	20T6 1/2	40	8760	4	1,402	NEW 2 WATT LED EXIT SIGN	2	8,760	4	70	1,332	0.16	0.01	0.15	2	Time Clock	8,760	4	0.01	70	0.15	1,332
Site B3	B3-121	F40CWSS	40	6570	2	526	1L F32T8 W/ STND ELEC BALLAST	28	6,570	2	368	158	0.08	0.06	0.02	28	Time Clock	6,570	2	0.06	368	0.02	158
Site B3	B3-122	F40CWSS	80	6570	1	526	1L F32T8 W/ STND ELEC BALLAST & REFLECTOR	28	6,570	1	184	342	0.08	0.03	0.05	28	Time Clock	6,570	1	0.03	184	0.05	342
Site B3	B3-123	FB40CWU-6SS	80	3650	9	2,628	2L F17T8 W/ STND ELEC BALLAST & WHITE REFLECTOR	32	3,650	9	1,051	1,577	0.72	0.29	0.43	32	Time Clock	3,650	9	0.29	1,051	0.43	1,577
Site B3	B3-124	20T6 1/2	40	8760	1	350	NEW 2 WATT LED EXIT SIGN	2	8,760	1	18	333	0.04	0.00	0.04	2	Always On	8,760	1	0.00	18	0.04	333
Site B3	B3-125	FB40CWU-6SS	80	3650	4	1,168	2L F17T8 W/ STND ELEC BALLAST & WHITE REFLECTOR	32	3,650	4	467	701	0.32	0.13	0.19	32	Time Clock	3,650	4	0.13	467	0.19	701
Site B3	B3-126	FB40CWU-6SS	80	3650	2	584	2L F17T8 W/ STND ELEC BALLAST & WHITE REFLECTOR	32	3,650	2	234	350	0.16	0.06	0.10	32	Time Clock	3,650	2	0.06	234	0.10	350
Site B3	B3-127	F32T8	86	3650	36	11,300	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR	54	3,650	36	7,096	4,205	3.10	1.94	1.15	54	Time Clock	3,650	36	1.94	7,096	1.15	4,205
Site B3	B3-128	FB40CWU-6SS	80	3650	1	292	2L F17T8 W/ STND ELEC BALLAST & WHITE REFLECTOR	32	3,650	1	117	175	0.08	0.03	0.05	32	Time Clock	3,650	1	0.03	117	0.05	175
Site B3	B3-129	20T6 1/2	40	8760	4	1,402	NEW 2 WATT LED EXIT SIGN	2	8,760	4	70	1,332	0.16	0.01	0.15	2	Always On	8,760	4	0.01	70	0.15	1,332
Site B3	B3-130	FB40CWU-6SS	80	3650	30	8,760	2L F17T8 W/ STND ELEC BALLAST & WHITE REFLECTOR	32	3,650	30	3,504	5,256	2.40	0.96	1.44	32	Time Clock	3,650	30	0.96	3,504	1.44	5,256
Site B3	B3-131	20T6 1/2	40	8760	2	701	NEW 2 WATT LED EXIT SIGN	2	8,760	2	35	666	0.08	0.00	0.08	2	Always On	8,760	2	0.00	35	0.08	666
Site B3	B3-132	PENDING		3650	0	0	NO WORK		3,650	0	0	0	0.00	0.00	0.00		Time Clock	3,650	0	0.00	0	0.00	0

Table 54. Summary of M&V Findings – 04-01-028 (con't)

		Proposed Pre-Installation					Proposed Post-Installation					Proposed Installed Savings				Verified Measures						Verified Savings	
Facility	Area	Existing Fixture Type	Existing W/Fix	Hours Per Year	No. of Fix	Existing Total Annual kWh	Proposed Fixture Type	Prop. W/Fix	Hours Per Year	No. of Fix	Proposed Total Annual kWh	Total Annual kWh Saved	Baseline kW	Proposed kW	kW Saved	Verified W/Fix	Lighting Controls	Verified Annual Hours	Verified Quantity	Verified Installed kW	Verified Installed kWh	Verified Savings kW	Verified Savings kWh
Site B3	B3-133	F40CWSS	80	6570	1	526	1L F32T8 W/ STND ELEC BALLAST & REFLECTOR	28	6,570	1	184	342	0.08	0.03	0.05	28	Time Clock	6,570	1	0.03	184	0.05	342
Site B3	B3-134	F40CWSS	80	6570	12	6,307	2L F32T8 W/ STND ELEC BALLAST	54	6,570	12	4,257	2,050	0.96	0.65	0.31	54	Time Clock	6,570	12	0.65	4,257	0.31	2,050
Site B3	B3-135	F40CWSS	80	3650	1	292	1L F32T8 W/ STND ELEC BALLAST & REFLECTOR	28	3,650	1	102	190	0.08	0.03	0.05	28	Time Clock	3,650	1	0.03	102	0.05	190
Site B3	B3-136	F96CWSS	94	3650	4	1,372	2L F32T8 w/ LP Elec Ballast	54	3,650	4	788	584	0.38	0.22	0.16	54	Time Clock	3,650	4	0.22	788	0.16	584
Site B3	B3-137	F96CWSS	158	3650	2	1,153	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR	54	3,650	2	394	759	0.32	0.11	0.21	54	Time Clock	3,650	2	0.11	394	0.21	759
Site B3	B3-138	F96CWSS	94	3650	16	5,490	2L F32T8 w/ LP Elec Ballast	54	3,650	16	3,154	2,336	1.50	0.86	0.64	54	Time Clock	3,650	16	0.86	3,154	0.64	2,336
Site B3	B3-139	F40CWSS	144	3650	2	1,051	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (8' Kit)	54	3,650	2	394	657	0.29	0.11	0.18	54	Time Clock	3,650	2	0.11	394	0.18	657
Site B3	B3-140	F40CWSS	144	3650	5	2,628	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (8' Kit)	54	3,650	5	986	1,643	0.72	0.27	0.45	54	Time Clock	3,650	5	0.27	986	0.45	1,643
Site B3	B3-141	F40CWSS	40	3650	1	146	1L F32T8 W/ STND ELEC BALLAST	28	3,650	1	102	44	0.04	0.03	0.01	28	Time Clock	3,650	1	0.03	102	0.01	44
Site B3	B3-142	100A19	100	3650	1	365	RELAMP W/ 18W SCREW IN CF	18	3,650	1	66	299	0.10	0.02	0.08	18	Time Clock	3,650	1	0.02	66	0.08	299
Site B3	B3-143	F40CWSS	144	3650	1	526	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (8' Kit)	54	3,650	1	197	329	0.14	0.05	0.09	54	Time Clock	3,650	1	0.05	197	0.09	329
Site B3	B3-144	F96CWSS	158	3650	6	3,460	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR	54	3,650	6	1,183	2,278	0.95	0.32	0.62	54	Time Clock	3,650	6	0.32	1,183	0.62	2,278
Site B3	B3-145	PENDING		3650	0	0	NO WORK		3,650	0	0	0	0.00	0.00	0.00		Time Clock	3,650	0	0.00	0	0.00	0
Site B3	B3-146	90PAR38		3650	7	0	NO WORK		3,650	7	0	0	0.00	0.00	0.00		Time Clock	3,650	0	0.00	0	0.00	0
Site B3	B3-147	MH175U	225	3650	12	9,855	2X32 CF DEL REY KIT	64	3,650	12	2,803	7,052	2.70	0.77	1.93	64	Time Clock	3,650	12	0.77	2,803	1.93	7,052
Site B3	B3-148	MH175U	225	3650	16	13,140	2X32 CF DEL REY KIT	64	3,650	16	3,738	9,402	3.60	1.02	2.58	64	Time Clock	3,650	16	1.02	3,738	2.58	9,402
Site B3	B3-149	LU50MED	62	3650	2	453	42W CF CONVERSION	42	3,650	2	307	146	0.12	0.08	0.04	42	Time Clock	3,650	2	0.08	307	0.04	146
Site B3	B3-150	60A19	60	3650	5	1,095	RELAMP W/ 15W SCREW IN CF	15	3,650	5	274	821	0.30	0.08	0.23	15	Time Clock	3,650	0	0.00	0	0.30	1,095
Site B3	B3-151	F40CWSS	80	3650	2	584	1L F32T8 W/ STND ELEC BALLAST & REFLECTOR	28	3,650	2	204	380	0.16	0.06	0.10	28	Time Clock	3,650	2	0.06	204	0.10	380
Site B3	B3-152	60A19	60	3650	3	657	18W SCREW IN GLOBE	18	3,650	3	197	460	0.18	0.05	0.13	18	Time Clock	3,650	3	0.05	197	0.13	460
Site B3	B3-153	20T6 1/2	40	8760	2	701	NEW 2 WATT LED EXIT SIGN	2	8,760	2	35	666	0.08	0.00	0.08	2	Always On	8,760	2	0.00	35	0.08	666
Site B3	B3-154	F40CWSS	80	3650	8	2,336	1L F32T8 W/ STND ELEC BALLAST & REFLECTOR	28	3,650	8	818	1,518	0.64	0.22	0.42	28	Time Clock	3,650	8	0.22	818	0.42	1,518
Site B3	B3-155	F40CWSS	80	3650	1	292	1L F32T8 W/ STND ELEC BALLAST & REFLECTOR	28	3,650	1	102	190	0.08	0.03	0.05	28	Time Clock	3,650	1	0.03	102	0.05	190
Site B3	B3-156	PENDING	40	3650	64	9,344	1L F32T8 W/ STND ELEC BALLAST	28	3,650	64	6,541	2,803	2.56	1.79	0.77	28	Time Clock	3,650	64	1.79	6,541	0.77	2,803
Site B3	B3-157	PENDING		3650	0	0	NO WORK		3,650	0	0	0	0.00	0.00	0.00		Time Clock	3,650	0	0.00	0	0.00	0

Table 54. Summary of M&V Findings – 04-01-028 (con't)

		Proposed Pre-Installation					Proposed Post-Installation					Proposed Installed Savings				Verified Measures						Verified Savings	
Facility	Area	Existing Fixture Type	Existing W/Fix	Hours Per Year	No. of Fix	Existing Total Annual kWh	Proposed Fixture Type	Prop. W/Fix	Hours Per Year	No. of Fix	Proposed Total Annual kWh	Total Annual kWh Saved	Baseline kW	Proposed kW	kW Saved	Verified W/Fix	Lighting Controls	Verified Annual Hours	Verified Quantity	Verified Installed kW	Verified Installed kWh	Verified Savings kW	Verified Savings kWh
Site B3	B3-158	PENDING		3650	0	0	NO WORK		3,650	0	0	0	0.00	0.00	0.00		Time Clock	3,650	0	0.00	0	0.00	0
Site B3	B3-159	PENDING		3650	0	0	NO WORK		3,650	0	0	0	0.00	0.00	0.00		Time Clock	3,650	0	0.00	0	0.00	0
Site B3	B3-160	60A19	60	3650	11	2,409	RELAMP W/ 15W SCREW IN CF	15	3,650	11	602	1,807	0.66	0.17	0.50	15	Time Clock	3,650	0	0.00	0	0.66	2,409
Site B3	B3-161	LU100MED		3650	130	0	NO WORK		3,650	130	0	0	0.00	0.00	0.00		Time Clock	3,650	0	0.00	0	0.00	0
Site B3	B3-162	LU150		3650	3	0	NO WORK		3,650	3	0	0	0.00	0.00	0.00		Time Clock	3,650	0	0.00	0	0.00	0
Site B3	B3-163	MH400U		3650	16	0	NO WORK		3,650	16	0	0	0.00	0.00	0.00		Time Clock	3,650	0	0.00	0	0.00	0
Site B3	B3-164	LU150		3650	2	0	NO WORK		3,650	2	0	0	0.00	0.00	0.00		Time Clock	3,650	0	0.00	0	0.00	0
Site B3	B3-165	20T6 1/2	40	8760	3	1,051	NEW 2 WATT LED EXIT SIGN	2	8,760	3	53	999	0.12	0.01	0.11	2	Always On	8,760	3	0.01	53	0.11	999
Site B3	B3-166	LU100	130	6570	160	136,656	2L 1x4 Vapor Tight	54	6,570	160	56,765	79,891	20.80	8.64	12.16	54	Time Clock	6,570	160	8.64	56,765	12.16	79,891
Site B3	B3-167	F32T8SP35		3650	1	0	RELAMP W/ (4) F32T8/SPX41		3,650	1	0	0	0.00	0.00	0.00		Time Clock	3,650	0	0.00	0	0.00	0
Site B3	B3-168	F40CWSS	144	3650	1	526	4L F32T8 W/ LP ELEC BALLAST	96	3,650	1	350	175	0.14	0.10	0.05	96	Time Clock	3,650	1	0.10	350	0.05	175
Site B3	B3-169	LU150	185	3650	6	4,052	100W PS MH w/ Elec HID Ballast	108	3,650	6	2,365	1,686	1.11	0.65	0.46	108	Time Clock	3,650	6	0.65	2,365	0.46	1,686
Site B3	B3-170	MH400U	916	3650	9	30,091	(2) 320W MH Parking Lot Fixture	690	3,650	9	22,667	7,424	8.24	6.21	2.03	690	Time Clock	3,650	9	6.21	22,667	2.03	7,424
Site B3	B3-171	LU150	188	3650	4	2,745	70W PS MH w/ HID Elec Ballast	78	3,650	4	1,139	1,606	0.75	0.31	0.44	78	Time Clock	3,650	4	0.31	1,139	0.44	1,606
Site B3	B3-172	20T6 1/2	40	8760	4	1,402	NEW 2 WATT LED EXIT SIGN	2	8,760	4	70	1,332	0.16	0.01	0.15	2	Always On	8,760	4	0.01	70	0.15	1,332
Site B3	B3-173	20T6 1/2	40	8760	48	16,819	NEW 2 WATT LED EXIT SIGN	2	8,760	48	841	15,978	1.92	0.10	1.82	2	Always On	8,760	48	0.10	841	1.82	15,978
TOTALS Site B3					**1,812**	**717,450**				**1,812**	**282,581**	**434,869**	**163.02**	**64.82**	**98.19**				**1,204**	**64.21**	**280,343**	**96.19**	**427,543**
Site B4	B4-1	MP-100-U-MED	130	4380	300	170,820	2X32 CF DEL REY KIT	66	4,380	300	86,724	84,096	39.00	19.80	19.20	66	Time Clock	4,380	300	19.80	86,724	19.20	84,096
Site B4	B4-2	MP-100-U-MED	130	4380	24	13,666	2X32 CF DEL REY KIT	66	4,380	24	6,938	6,728	3.12	1.58	1.54	66	Time Clock	4,380	24	1.58	6,938	1.54	6,728
Site B4	B4-3	CF-13 DS 827		4380	7	0	RELAMP W/ (6) F13BX/SPX41		4,380	7	0	0	0.00	0.00	0.00		Time Clock	4,380	0	0.00	0	0.00	0
Site B4	B4-4	CF-18 DD 835		4380	3	0	RELAMP W/ (2) F18DBXT4/SPX41		4,380	3	0	0	0.00	0.00	0.00		Time Clock	4,380	0	0.00	0	0.00	0
Site B4	B4-5	MH-175-U	225	4380	24	23,652	70W CMH DEL REY	78	4,380	24	8,199	15,453	5.40	1.87	3.53	78	Time Clock	4,380	24	1.87	8,199	3.53	15,453
Site B4	B4-6	120PAR67VNSP	120	4380	22	11,563	39W CERAMIC MH TRACK LIGHT	45	4,380	22	4,336	7,227	2.64	0.99	1.65	45	Time Clock	4,380	22	0.99	4,336	1.65	7,227
Site B4	B4-7	F40CWSS	80	4380	72	25,229	2L F32T8 W/ STND ELEC BALLAST	54	4,380	72	17,029	8,199	5.76	3.89	1.87	54	Time Clock	4,380	72	3.89	17,029	1.87	8,199
Site B4	B4-8	Q150CL	185	4380	18	14,585	70W CMH DEL REY	78	4,380	18	6,150	8,436	3.33	1.40	1.93	78	Time Clock	4,380	18	1.40	6,150	1.93	8,436
Site B4	B4-9	FT-18-DL-830		4380	80	0	RELAMP W/ (1) F18BX/SPX41		4,380	80	0	0	0.00	0.00	0.00		Time Clock	4,380	0	0.00	0	0.00	0

Table 54. Summary of M&V Findings – 04-01-028 (con't)

		Proposed Pre-Installation					Proposed Post-Installation					Proposed Installed Savings				Verified Measures						Verified Savings	
Facility	Area	Existing Fixture Type	Existing W/Fix	Hours Per Year	No. of Fix	Existing Total Annual kWh	Proposed Fixture Type	Prop. W/Fix	Hours Per Year	No. of Fix	Proposed Total Annual kWh	Total Annual kWh Saved	Baseline kW	Proposed kW	kW Saved	Verified W/Fix	Lighting Controls	Verified Annual Hours	Verified Quantity	Verified Installed kW	Verified Installed kWh	Verified Savings kW	Verified Savings kWh
Site B4	B4-10	MH175 OR 250V	225	4380	24	23,652	70W CMH DEL REY	78	4,380	24	8,199	15,453	5.40	1.87	3.53	78	Time Clock	4,380	24	1.87	8,199	3.53	15,453
Site B4	B4-11	F40D30SS	40	4380	406	71,131	1L F32T8 W/ STND ELEC BALLAST	28	4,380	406	49,792	21,339	16.24	11.37	4.87	28	Time Clock	4,380	406	11.37	49,792	4.87	21,339
Site B4	B4-12	F40D30SS	40	4380	42	7,358	1L F32T8 W/ STND ELEC BALLAST	28	4,380	42	5,151	2,208	1.68	1.18	0.50	28	Time Clock	4,380	42	1.18	5,151	0.50	2,208
Site B4	B4-13	F40D30SS	80	4380	70	24,528	2L F32T8 W/ STND ELEC BALLAST	54	4,380	70	16,556	7,972	5.60	3.78	1.82	54	Time Clock	4,380	70	3.78	16,556	1.82	7,972
Site B4	B4-14	F40CWSS	80	6570	2	1,051	2L F32T8 W/ STND ELEC BALLAST	54	6,570	2	710	342	0.16	0.11	0.05	54	Time Clock	6,570	2	0.11	710	0.05	342
Site B4	B4-15	F40CWSS	80	6570	13	6,833	2L F32T8 W/ STND ELEC BALLAST	54	6,570	13	4,612	2,221	1.04	0.70	0.34	54	Time Clock	6,570	13	0.70	4,612	0.34	2,221
Site B4	B4-16	F40CWSS	80	6570	1	526	2L F32T8 W/ STND ELEC BALLAST	54	6,570	1	355	171	0.08	0.05	0.03	54	Time Clock	6,570	1	0.05	355	0.03	171
Site B4	B4-17	F40CWSS	80	6570	1	526	2L F32T8 W/ STND ELEC BALLAST	54	6,570	1	355	171	0.08	0.05	0.03	54	Time Clock	6,570	1	0.05	355	0.03	171
Site B4	B4-18	F40CWSS	80	6570	1	526	2L F32T8 W/ STND ELEC BALLAST	54	6,570	1	355	171	0.08	0.05	0.03	54	Time Clock	6,570	1	0.05	355	0.03	171
Site B4	B4-19	F30CWSS	40	6570	2	526	1L F25T8 W/ STND ELEC BALLAST & REFLECTOR	24	6,570	2	315	210	0.08	0.05	0.03	24	Time Clock	6,570	2	0.05	315	0.03	210
Site B4	B4-20	50PAR20	50	4380	1	219	8W Cold Cathode Lamp	8	4,380	1	35	184	0.05	0.01	0.04	8	Time Clock	4,380	1	0.01	35	0.04	184
Site B4	B4-21	F40CWSS	80	4380	2	701	2L F32T8 W/ STND ELEC BALLAST	54	4,380	2	473	228	0.16	0.11	0.05	54	Time Clock	4,380	2	0.11	473	0.05	228
Site B4	B4-22	60A19	60	4380	2	526	RELAMP W/ 15W SCREW IN CF	15	4,380	2	131	394	0.12	0.03	0.09	15	Time Clock	4,380	0	0.00	0	0.12	526
Site B4	B4-23	F40CWSS	80	4380	1	350	2L F32T8 W/ STND ELEC BALLAST	54	4,380	1	237	114	0.08	0.05	0.03	54	Time Clock	4,380	1	0.05	237	0.03	114
Site B4	B4-24	50R20 OR 60A19	50	4380	2	438	5W Cold Cathode Lamp	5	4,380	2	44	394	0.10	0.01	0.09	5	Time Clock	4,380	2	0.01	44	0.09	394
Site B4	B4-25	F40CWSS	80	6570	1	526	2L F32T8 W/ STND ELEC BALLAST	54	6,570	1	355	171	0.08	0.05	0.03	54	Time Clock	6,570	1	0.05	355	0.03	171
Site B4	B4-26	F40CWSS	80	6570	2	1,051	2L F32T8 W/ STND ELEC BALLAST	54	6,570	2	710	342	0.16	0.11	0.05	54	Time Clock	6,570	2	0.11	710	0.05	342
Site B4	B4-27	DELAMPED R30	50	6570	2	657	5W Cold Cathode Lamp	5	6,570	2	66	591	0.10	0.01	0.09	5	Time Clock	6,570	2	0.01	66	0.09	591
Site B4	B4-28	F40CWSS	40	6570	5	1,314	1L F32T8 W/ STND ELEC BALLAST	28	6,570	5	920	394	0.20	0.14	0.06	28	Time Clock	6,570	5	0.14	920	0.06	394
Site B4	B4-29	F40CWSS	80	6570	1	526	2L F32T8 W/ STND ELEC BALLAST	54	6,570	1	355	171	0.08	0.05	0.03	54	Time Clock	6,570	1	0.05	355	0.03	171
Site B4	B4-30	F32T8TL741		6570	1	0	RELAMP W/ (2) F32T8/SPX41		6,570	1	0	0	0.00	0.00	0.00		Time Clock	6,570	0	0.00	0	0.00	0
Site B4	B4-31	F40CWSS	40	6570	5	1,314	1L F32T8 W/ STND ELEC BALLAST	28	6,570	5	920	394	0.20	0.14	0.06	28	Time Clock	6,570	5	0.14	920	0.06	394
Site B4	B4-32	F40CWSS	144	6570	2	1,892	4L F32T8 W/ LP ELEC BALLAST	96	6,570	2	1,261	631	0.29	0.19	0.10	96	Time Clock	6,570	2	0.19	1,261	0.10	631
Site B4	B4-33	F40CWSS	40	6570	5	1,314	1L F32T8 W/ STND ELEC BALLAST	28	6,570	5	920	394	0.20	0.14	0.06	28	Time Clock	6,570	5	0.14	920	0.06	394
Site B4	B4-34	H38AV100DX	130	4380	3	1,708	70W PS MH w/ HID Elec Ballast	78	4,380	3	1,025	683	0.39	0.23	0.16	78	Time Clock	4,380	3	0.23	1,025	0.16	683
Site B4	B4-35	F40CWSS	80	6570	1	526	2L F32T8 W/ STND ELEC BALLAST	54	6,570	1	355	171	0.08	0.05	0.03	54	Time Clock	6,570	1	0.05	355	0.03	171
Site B4	B4-36	F40CWSS	40	4380	1	175	1L F32T8 W/ STND ELEC BALLAST	28	4,380	1	123	53	0.04	0.03	0.01	28	Time Clock	4,380	1	0.03	123	0.01	53

Table 54. Summary of M&V Findings – 04-01-028 (con't)

		Proposed Pre-Installation					Proposed Post-Installation					Proposed Installed Savings				Verified Measures						Verified Savings	
Facility	Area	Existing Fixture Type	Existing W/Fix	Hours Per Year	No. of Fix	Existing Total Annual kWh	Proposed Fixture Type	Prop. W/Fix	Hours Per Year	No. of Fix	Proposed Total Annual kWh	Total Annual kWh Saved	Baseline kW	Proposed kW	kW Saved	Verified W/Fix	Lighting Controls	Verified Annual Hours	Verified Quantity	Verified Installed kW	Verified Installed kWh	Verified Savings kWs	Verified Savings kWh
Site B4	B4-37	F40CWSS	80	6570	2	1,051	2L F32T8 W/ STND ELEC BALLAST	54	6,570	2	710	342	0.16	0.11	0.05	54	Time Clock	6,570	2	0.11	710	0.05	342
Site B4	B4-38	F40CWSS	80	4380	1	350	2L F32T8 W/ STND ELEC BALLAST	54	4,380	1	237	114	0.08	0.05	0.03	54	Time Clock	4,380	1	0.05	237	0.03	114
Site B4	B4-39	H38AV100DX	130	4380	4	2,278	70W PS MH w/ HID Elec Ballast	78	4,380	4	1,367	911	0.52	0.31	0.21	78	Time Clock	4,380	4	0.31	1,367	0.21	911
Site B4	B4-40	F40CWSS	80	4380	5	1,752	2L F32T8 W/ STND ELEC BALLAST	54	4,380	5	1,183	569	0.40	0.27	0.13	54	Time Clock	4,380	5	0.27	1,183	0.13	569
Site B4	B4-41	F40CWSS	80	6570	2	1,051	2L F32T8 W/ STND ELEC BALLAST	54	6,570	2	710	342	0.16	0.11	0.05	54	Time Clock	6,570	2	0.11	710	0.05	342
Site B4	B4-42	F40CWSS	80	6570	1	526	2L F32T8 W/ STND ELEC BALLAST	54	6,570	1	355	171	0.08	0.05	0.03	54	Time Clock	6,570	1	0.05	355	0.03	171
Site B4	B4-43	20T61/2	40	8760	1	350	NEW 2 WATT LED EXIT SIGN	2	8,760	1	18	333	0.04	0.00	0.04	2	Always ON	8,760	1	0.00	18	0.04	333
Site B4	B4-44	F40CWSS	80	6570	5	2,628	2L F32T8 W/ STND ELEC BALLAST	54	6,570	5	1,774	854	0.40	0.27	0.13	54	Time Clock	6,570	5	0.27	1,774	0.13	854
Site B4	B4-45	20T61/2	40	8760	3	1,051	NEW 2 WATT LED EXIT SIGN	2	8,760	3	53	999	0.12	0.01	0.11	2	Always ON	8,760	3	0.01	53	0.11	999
Site B4	B4-46	F40CWSS	40	6570	8	2,102	1L F32T8 W/ STND ELEC BALLAST	28	6,570	8	1,472	631	0.32	0.22	0.10	28	Time Clock	6,570	8	0.22	1,472	0.10	631
Site B4	B4-47	F40CWSS	43	6570	3	848	1L F32T8 W/ STND ELEC BALLAST & REFLECTOR	28	6,570	3	552	296	0.13	0.08	0.05	28	Time Clock	6,570	3	0.08	552	0.05	296
Site B4	B4-48	20T61/2	40	8760	2	701	NEW 2 WATT LED EXIT SIGN	2	8,760	2	35	666	0.08	0.00	0.08	2	Always ON	8,760	2	0.00	35	0.08	666
Site B4	B4-49	F40CWSS	40	6570	3	788	1L F32T8 W/ STND ELEC BALLAST	28	6,570	3	552	237	0.12	0.08	0.04	28	Time Clock	6,570	3	0.08	552	0.04	237
Site B4	B4-50	F40CWSS	40	6570	7	1,840	1L F32T8 W/ STND ELEC BALLAST	28	6,570	7	1,288	552	0.28	0.20	0.08	28	Time Clock	6,570	7	0.20	1,288	0.08	552
Site B4	B4-51	LU-70-MED	90	4380	1	394	42W CF CONVERSION	42	4,380	1	184	210	0.09	0.04	0.05	42	Time Clock	4,380	1	0.04	184	0.05	210
Site B4	B4-52	LU-150-MED	188	4380	1	823	70W PS MH w/ HID Elec Ballast	78	4,380	1	342	482	0.19	0.08	0.11	78	Time Clock	4,380	1	0.08	342	0.11	482
Site B4	B4-53	50R20	50	4380	1	219	5W Cold Cathode Lamp	5	4,380	1	22	197	0.05	0.01	0.05	5	Time Clock	4,380	1	0.01	22	0.05	197
Site B4	B4-54	H38AV100DX	130	4380	4	2,278	70W PS MH w/ HID Elec Ballast	78	4,380	4	1,367	911	0.52	0.31	0.21	78	Time Clock	4,380	4	0.31	1,367	0.21	911
Site B4	B4-55	CF-13 DD 841		4380	1	0	RELAMP W/ (1) F13DBX23T4/SPX41 (PCR)		4,380	1	0	0	0.00	0.00	0.00		Time Clock	4,380	1	0.00	0	0.00	0
Site B4	B4-56	F40CWSS	40	6570	3	788	1L F32T8 W/ STND ELEC BALLAST	28	6,570	3	552	237	0.12	0.08	0.04	28	Time Clock	6,570	3	0.08	552	0.04	237
Site B4	B4-57	20T61/2	40	8760	2	701	NEW 2 WATT LED EXIT SIGN	2	8,760	2	35	666	0.08	0.00	0.08	2	Always ON	8,760	2	0.00	35	0.08	666
Site B4	B4-58	F40CWSS	40	4380	1	175	1L F32T8 W/ STND ELEC BALLAST	28	4,380	1	123	53	0.04	0.03	0.01	28	Time Clock	4,380	1	0.03	123	0.01	53
Site B4	B4-59	H38AV100DX	130	4380	3	1,708	70W PS MH w/ HID Elec Ballast	78	4,380	3	1,025	683	0.39	0.23	0.16	78	Time Clock	4,380	3	0.23	1,025	0.16	683
Site B4	B4-60	F40CWSS	40	6570	4	1,051	1L F32T8 W/ STND ELEC BALLAST	28	6,570	4	736	315	0.16	0.11	0.05	28	Time Clock	6,570	4	0.11	736	0.05	315
Site B4	B4-61			4380		0	NO WORK		4,380		0	0	0.00	0.00	0.00		Time Clock	4,380	0	0.00	0	0.00	0
Site B4	B4-62	MP-100-U-MED	130	4380	422	240,287	2X32 CF DEL REY KIT	66	4,380	422	121,992	118,295	54.86	27.85	27.01	66	Time Clock	4,380	422	27.85	121,992	27.01	118,295
Site B4	B4-63	MP-100-U-MED	130	4380	34	19,360	2X32 CF DEL REY KIT	66	4,380	34	9,829	9,531	4.42	2.24	2.18	66	Time Clock	4,380	34	2.24	9,829	2.18	9,531

Table 54. Summary of M&V Findings – 04-01-028 (con't)

		Proposed Pre-Installation					Proposed Post-Installation					Proposed Installed Savings				Verified Measures						Verified Savings	
Facility	Area	Existing Fixture Type	Existing W/Fix	Hours Per Year	No. of Fix	Existing Total Annual kWh	Proposed Fixture Type	Prop. W/Fix	Hours Per Year	No. of Fix	Proposed Total Annual kWh	Total Annual kWh Saved	Baseline kW	Proposed kW	kW Saved	Verified W/Fix	Lighting Controls	Verified Annual Hours	Verified Quantity	Verified Installed kW	Verified Installed kWh	Verified Savings kW	Verified Savings kWh
Site B4	B4-64	MP-100-U-MED	130	4380	2	1,139	2X32 CF DEL REY KIT	66	4,380	2	578	561	0.26	0.13	0.13	66	Time Clock	4,380	2	0.13	578	0.13	561
Site B4	B4-65	CF-13 DS 827		4380	4	0	RELAMP W/ (6) F13BX/SPX41 (PCR)		4,380	4	0	0	0.00	0.00	0.00		Time Clock	4,380	0	0.00	0	0.00	0
Site B4	B4-66	CF-13 DS 827		4380	18	0	RELAMP W/ (5) F13BX/SPX41 (PCR)		4,380	18	0	0	0.00	0.00	0.00		Time Clock	4,380	0	0.00	0	0.00	0
Site B4	B4-67	CF-18 DD 835		4380	32	0	RELAMP W/ (2) F18DBXT4/SPX41		4,380	32	0	0	0.00	0.00	0.00		Time Clock	4,380	0	0.00	0	0.00	0
Site B4	B4-68	75PAR38	75	4380	12	3,942	39W CERAMIC MH TRACK LIGHT	48	4,380	12	2,523	1,419	0.90	0.58	0.32	48	Time Clock	4,380	12	0.58	2,523	0.32	1,419
Site B4	B4-69	F40CWSS	115	4380	1	504	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (2x4)	54	4,380	1	237	267	0.12	0.05	0.06	54	Time Clock	4,380	1	0.05	237	0.06	267
Site B4	B4-70	25W G25 CLEAR	75	4380	115	37,778	(3) 5W Cold Cathode Lamp	15	4,380	115	7,556	30,222	8.63	1.73	6.90	15	Time Clock	4,380	115	1.73	7,556	6.90	30,222
Site B4	B4-71	FT-18-DL-830		4380	116	0	RELAMP W/ (1) F18BX/SPX41		4,380	116	0	0	0.00	0.00	0.00		Time Clock	4,380	0	0.00	0	0.00	0
Site B4	B4-72	Q150CLMC	150	4380	24	15,768	8W DEL RAY COLD CATHODE KIT	8	4,380	24	841	14,927	3.60	0.19	3.41	8	Time Clock	4,380	24	0.19	841	3.41	14,927
Site B4	B4-73	F40D30SS	80	4380	40	14,016	2L F32T8 W/ STND ELEC BALLAST	54	4,380	40	9,461	4,555	3.20	2.16	1.04	54	Time Clock	4,380	40	2.16	9,461	1.04	4,555
Site B4	B4-74	F40D30SS	40	4380	64	11,213	1L F32T8 W/ STND ELEC BALLAST	28	4,380	64	7,849	3,364	2.56	1.79	0.77	28	Time Clock	4,380	64	1.79	7,849	0.77	3,364
Site B4	B4-75	25W G25 CLEAR	25	4380	58	6,351	5W Cold Cathode Lamp	5	4,380	58	1,270	5,081	1.45	0.29	1.16	5	Time Clock	4,380	58	0.29	1,270	1.16	5,081
Site B4	B4-76	50R20	50	4380		0	5W Cold Cathode Lamp	5	4,380		0	0	0.00	0.00	0.00	5	Time Clock	4,380		0.00	0	0.00	0
Site B4	B4-77	F40D30SS	40	4380	64	11,213	1L F32T8 W/ STND ELEC BALLAST	28	4,380	64	7,849	3,364	2.56	1.79	0.77	28	Time Clock	4,380	64	1.79	7,849	0.77	3,364
Site B4	B4-78	F40D30SS	40	4380	44	7,709	1L F32T8 W/ STND ELEC BALLAST	28	4,380	44	5,396	2,313	1.76	1.23	0.53	28	Time Clock	4,380	44	1.23	5,396	0.53	2,313
Site B4	B4-79	F40D30SS	80	4380	128	44,851	2L F32T8 W/ STND ELEC BALLAST	54	4,380	128	30,275	14,577	10.24	6.91	3.33	54	Time Clock	4,380	128	6.91	30,275	3.33	14,577
Site B4	B4-80	F30D30SS	70	4380	42	12,877	2L F25T8 W/ STND ELEC BALLAST	45	4,380	42	8,278	4,599	2.94	1.89	1.05	45	Time Clock	4,380	42	1.89	8,278	1.05	4,599
Site B4	B4-81	F40CWSS	80	6570	3	1,577	2L F32T8 W/ STND ELEC BALLAST	54	6,570	3	1,064	512	0.24	0.16	0.08	54	Time Clock	6,570	3	0.16	1,064	0.08	512
Site B4	B4-82	F40CWSS	80	4380	2	701	2L F32T8 W/ STND ELEC BALLAST	54	4,380	2	473	228	0.16	0.11	0.05	54	Time Clock	4,380	2	0.11	473	0.05	228
Site B4	B4-83	20T61/2	40	8760	2	701	NEW 2 WATT LED EXIT SIGN	2	8,760	2	35	666	0.08	0.00	0.08	2	Time Clock	8,760	2	0.00	35	0.08	666
Site B4	B4-84	F40CWSS	40	6570	6	1,577	1L F32T8 W/ STND ELEC BALLAST	28	6,570	6	1,104	473	0.24	0.17	0.07	28	Time Clock	6,570	6	0.17	1,104	0.07	473
Site B4	B4-85	F40CWSS	80	6570	13	6,833	2L F32T8 W/ STND ELEC BALLAST	54	6,570	13	4,612	2,221	1.04	0.70	0.34	54	Time Clock	6,570	13	0.70	4,612	0.34	2,221
Site B4	B4-86	F40CWSS	80	4380	1	350	2L F32T8 W/ STND ELEC BALLAST	54	4,380	1	237	114	0.08	0.05	0.03	54	Time Clock	4,380	1	0.05	237	0.03	114
Site B4	B4-87	F40CWSS	115	4380	9	4,533	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (2x4)	54	4,380	9	2,129	2,405	1.04	0.49	0.55	54	Time Clock	4,380	9	0.49	2,129	0.55	2,405
Site B4	B4-88	75R40		4380	2	0	NO WORK		4,380	2	0	0	0.00	0.00	0.00		Time Clock	4,380	0	0.00	0	0.00	0

Table 54. Summary of M&V Findings – 04-01-028 (con't)

		Proposed Pre-Installation					Proposed Post-Installation					Proposed Installed Savings				Verified Measures						Verified Savings	
Facility	Area	Existing Fixture Type	Existing W/Fix	Hours Per Year	No. of Fix	Existing Total Annual kWh	Proposed Fixture Type	Prop. W/Fix	Hours Per Year	No. of Fix	Proposed Total Annual kWh	Total Annual kWh Saved	Baseline kW	Proposed kW	kW Saved	Verified W/Fix	Lighting Controls	Verified Annual Hours	Verified Quantity	Verified Installed kW	Verified Installed kWh	Verified Savings kW	Verified Savings kWh
Site B4	B4-89	F40CWSS	115	4380	4	2,015	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (2x4)	54	4,380	4	946	1,069	0.46	0.22	0.24	54	Time Clock	4,380	4	0.22	946	0.24	1,069
Site B4	B4-90	75R40		4380	4	0	NO WORK		4,380	4	0	0	0.00	0.00	0.00		Time Clock	4,380	0	0.00	0	0.00	0
Site B4	B4-91	F40CWSS	115	4380	2	1,007	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (2x4)	54	4,380	2	473	534	0.23	0.11	0.12	54	Time Clock	4,380	2	0.11	473	0.12	534
Site B4	B4-92	F40CWSS	115	4380	2	1,007	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (2x4)	54	4,380	2	473	534	0.23	0.11	0.12	54	Time Clock	4,380	2	0.11	473	0.12	534
Site B4	B4-93	F40CWSS	115	4380	2	1,007	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (2x4)	54	4,380	2	473	534	0.23	0.11	0.12	54	Time Clock	4,380	2	0.11	473	0.12	534
Site B4	B4-94	F40CWSS	115	4380	3	1,511	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (2x4)	54	4,380	3	710	802	0.35	0.16	0.18	54	Time Clock	4,380	3	0.16	710	0.18	802
Site B4	B4-95	F40CWSS	115	4380	2	1,007	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (2x4)	54	4,380	2	473	534	0.23	0.11	0.12	54	Time Clock	4,380	2	0.11	473	0.12	534
Site B4	B4-96	F40CWSS	144	4380	1	631	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (8' Kit)	54	4,380	1	237	394	0.14	0.05	0.09	54	Time Clock	4,380	1	0.05	237	0.09	394
Site B4	B4-97	F40CWSS	115	4380	2	1,007	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (2x4)	54	4,380	2	473	534	0.23	0.11	0.12	54	Time Clock	4,380	2	0.11	473	0.12	534
Site B4	B4-98	F40CWSS	115	4380	2	1,007	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (2x4)	54	4,380	2	473	534	0.23	0.11	0.12	54	Time Clock	4,380	2	0.11	473	0.12	534
Site B4	B4-99	F40CWSS	115	4380	2	1,007	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (2x4)	54	4,380	2	473	534	0.23	0.11	0.12	54	Time Clock	4,380	2	0.11	473	0.12	534
Site B4	B4-100	CF-32-DT-E-IN-830		4380	14	0	RELAMP W/ (1) F32TBX/SPX30/A/4P		4,380	14	0	0	0.00	0.00	0.00		Time Clock	4,380	0	0.00	0	0.00	0
Site B4	B4-101	CF-32-DT-E-IN-830		4380	42	0	RELAMP W/ (1) F32TBX/SPX30/A/4P		4,380	42	0	0	0.00	0.00	0.00		Time Clock	4,380	0	0.00	0	0.00	0
Site B4	B4-102	FO32735		4380	16	0	RELAMP W/ F32T8/SPX41		4,380	16	0	0	0.00	0.00	0.00		Time Clock	4,380	0	0.00	0	0.00	0
Site B4	B4-103	PLC-18W-27-4P		4380	4	0	RELAMP W/ (1) F18DBX/SPX41/4P		4,380	4	0	0	0.00	0.00	0.00		Time Clock	4,380	0	0.00	0	0.00	0
Site B4	B4-104	25W CAND		4380	12	0	NO WORK		4,380	12	0	0	0.00	0.00	0.00		Time Clock	4,380	0	0.00	0	0.00	0
Site B4	B4-105	25W G25 CLEAR	25	4380	4	438	5W Cold Cathode Lamp	5	4,380	4	88	350	0.10	0.02	0.08	5	Time Clock	4,380	4	0.02	88	0.08	350
Site B4	B4-106	F40CWSS	80	6570	2	1,051	2L F32T8 W/ STND ELEC BALLAST	54	6,570	2	710	342	0.16	0.11	0.05	54	Time Clock	6,570	2	0.11	710	0.05	342
Site B4	B4-107	F40CWSS	40	6570	2	526	1L F32T8 W/ STND ELEC BALLAST	28	6,570	2	368	158	0.08	0.06	0.02	28	Time Clock	6,570	2	0.06	368	0.02	158
Site B4	B4-108	F40CWSS	80	6570	2	1,051	2L F32T8 W/ STND ELEC BALLAST	54	6,570	2	710	342	0.16	0.11	0.05	54	Time Clock	6,570	2	0.11	710	0.05	342
Site B4	B4-109	FB40CWU-6SS	80	6570	3	1,577	3L F17T8 W/ LP ULTRA ELEC BALLAST & WHITE REFLECTOR	42	6,570	3	828	749	0.24	0.13	0.11	42	Time Clock	6,570	3	0.13	828	0.11	749
Site B4	B4-110	F40CWSS	80	6570	1	526	2L F32T8 W/ STND ELEC BALLAST	54	6,570	1	355	171	0.08	0.05	0.03	54	Time Clock	6,570	1	0.05	355	0.03	171

Table 54. Summary of M&V Findings – 04-01-028 (con't)

		Proposed Pre-Installation					Proposed Post-Installation					Proposed Installed Savings				Verified Measures						Verified Savings	
Facility	Area	Existing Fixture Type	Existing W/Fix	Hours Per Year	No. of Fix	Existing Total Annual kWh	Proposed Fixture Type	Prop. W/Fix	Hours Per Year	No. of Fix	Proposed Total Annual kWh	Total Annual kWh Saved	Baseline kW	Proposed kW	kW Saved	Verified W/Fix	Lighting Controls	Verified Annual Hours	Verified Quantity	Verified Installed kW	Verified Installed kWh	Verified Savings kWs	Verified Savings kWh
Site B4	B4-111	F40CWSS	80	6570	2	1,051	2L F32T8 W/ STND ELEC BALLAST	54	6,570	2	710	342	0.16	0.11	0.05	54	Time Clock	6,570	2	0.11	710	0.05	342
Site B4	B4-112	F40CWSS	40	6570	1	263	1L F32T8 W/ STND ELEC BALLAST	28	6,570	1	184	79	0.04	0.03	0.01	28	Time Clock	6,570	1	0.03	184	0.01	79
Site B4	B4-113	F40CWSS	80	6570	7	3,679	2L F32T8 W/ STND ELEC BALLAST	54	6,570	7	2,483	1,196	0.56	0.38	0.18	54	Time Clock	6,570	7	0.38	2,483	0.18	1,196
Site B4	B4-114	F40CWSS	80	6570	1	526	2L F32T8 W/ STND ELEC BALLAST	54	6,570	1	355	171	0.08	0.05	0.03	54	Time Clock	6,570	1	0.05	355	0.03	171
Site B4	B4-115	20T61/2	40	8760	1	350	NEW 2 WATT LED EXIT SIGN	2	8,760	1	18	333	0.04	0.00	0.04	2	Always ON	8,760	1	0.00	18	0.04	333
Site B4	B4-116	F40CWSS	80	6570	1	526	2L F32T8 W/ STND ELEC BALLAST	54	6,570	1	355	171	0.08	0.05	0.03	54	Time Clock	6,570	1	0.05	355	0.03	171
Site B4	B4-117	60A19	60	6570	2	788	RELAMP W/ 15W SCREW IN CF	15	6,570	2	197	591	0.12	0.03	0.09	15	Time Clock	6,570	0	0.00	0	0.12	788
Site B4	B4-118	H38AV100DX	130	4380	3	1,708	70W PS MH w/ HID Elec Ballast	78	4,380	3	1,025	683	0.39	0.23	0.16	78	Time Clock	4,380	3	0.23	1,025	0.16	683
Site B4	B4-119	F40CWSS	80	6570	5	2,628	2L F32T8 W/ STND ELEC BALLAST	54	6,570	5	1,774	854	0.40	0.27	0.13	54	Time Clock	6,570	5	0.27	1,774	0.13	854
Site B4	B4-120	F40CWSS	80	6570	1	526	2L F32T8 W/ STND ELEC BALLAST	54	6,570	1	355	171	0.08	0.05	0.03	54	Time Clock	6,570	1	0.05	355	0.03	171
Site B4	B4-121	F40CWSS	80	6570	14	7,358	2L F32T8 W/ STND ELEC BALLAST	54	6,570	14	4,967	2,391	1.12	0.76	0.36	54	Time Clock	6,570	14	0.76	4,967	0.36	2,391
Site B4	B4-122	F40CWSS	80	6570	2	1,051	2L F32T8 W/ STND ELEC BALLAST	54	6,570	2	710	342	0.16	0.11	0.05	54	Time Clock	6,570	2	0.11	710	0.05	342
Site B4	B4-123	F40CWSS	80	6570	1	526	2L F32T8 W/ STND ELEC BALLAST	54	6,570	1	355	171	0.08	0.05	0.03	54	Time Clock	6,570	1	0.05	355	0.03	171
Site B4	B4-124	F40CWSS	80	6570	4	2,102	2L F32T8 W/ STND ELEC BALLAST	54	6,570	4	1,419	683	0.32	0.22	0.10	54	Time Clock	6,570	4	0.22	1,419	0.10	683
Site B4	B4-125	20T61/2	40	8760	3	1,051	NEW 2 WATT LED EXIT SIGN	2	8,760	3	53	999	0.12	0.01	0.11	2	Always ON	8,760	3	0.01	53	0.11	999
Site B4	B4-126	F40CWSS	80	4380	1	350	2L F32T8 W/ STND ELEC BALLAST	54	4,380	1	237	114	0.08	0.05	0.03	54	Time Clock	4,380	1	0.05	237	0.03	114
Site B4	B4-127	F96CWEW	158	4380	1	692	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR	54	4,380	1	237	456	0.16	0.05	0.10	54	Time Clock	4,380	1	0.05	237	0.10	456
Site B4	B4-128	F40CWSS	115	4380	9	4,533	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR (2x4)	54	4,380	9	2,129	2,405	1.04	0.49	0.55	54	Time Clock	4,380	9	0.49	2,129	0.55	2,405
Site B4	B4-129	60A19	60	4380	1	263	RELAMP W/ 15W SCREW IN CF	15	4,380	1	66	197	0.06	0.02	0.05	15	Time Clock	4,380	0	0.00	0	0.06	263
Site B4	B4-130	FO32741	114	4380	7	3,495	2L F32T8 W/ STND ELEC BALLAST & REFLECTOR	54	4,380	7	1,656	1,840	0.80	0.38	0.42	54	Time Clock	4,380	7	0.38	1,656	0.42	1,840
Site B4	B4-131			4380		0	NO WORK		4,380		0	0	0.00	0.00	0.00		Time Clock	4,380	0	0.00	0	0.00	0
Site B4	B4-132	MH-400-U	458	3650	21	35,106	320W MH Exterior	345	3,650	21	26,444	8,661	9.62	7.25	2.37	345	Time Clock	3,650	21	7.25	26,444	2.37	8,661
Site B4	B4-133	MP-100-U-MED	130	3650	9	4,271	2X32 CF DEL REY KIT	66	3,650	9	2,168	2,102	1.17	0.59	0.58	66	Time Clock	3,650	9	0.59	2,168	0.58	2,102
Site B4	B4-134	H39BP175DX	225	3650	38	31,208	70W PS MH w/ HID Elec Ballast	78	3,650	38	10,819	20,389	8.55	2.96	5.59	78	Time Clock	3,650	38	2.96	10,819	5.59	20,389
Site B4	B4-135	MH-250-U	295	3650	5	5,384	150W PS MH w/ Elec HID Ballast	166	3,650	5	3,030	2,354	1.48	0.83	0.65	166	Time Clock	3,650	5	0.83	3,030	0.65	2,354
Site B4	B4-136	60A19	60	3650	6	1,314	5W Cold Cathode Lamp	5	3,650	6	110	1,205	0.36	0.03	0.33	5	Time Clock	3,650	6	0.03	110	0.33	1,205

Table 54. Summary of M&V Findings – 04-01-028 (con't)

		Proposed Pre-Installation					Proposed Post-Installation					Proposed Installed Savings				Verified Measures						Verified Savings	
Facility	Area	Existing Fixture Type	Existing W/Fix	Hours Per Year	No. of Fix	Existing Total Annual kWh	Proposed Fixture Type	Prop. W/Fix	Hours Per Year	No. of Fix	Proposed Total Annual kWh	Total Annual kWh Saved	Baseline kW	Proposed kW	kW Saved	Verified W/Fix	Lighting Controls	Verified Annual Hours	Verified Quantity	Verified Installed kW	Verified Installed kWh	Verified Savings kW	Verified Savings kWh
Site B4	B4-137	MH-175-U	225	3650	10	8,213	70W PS MH w/ HID Elec Ballast	78	3,650	10	2,847	5,366	2.25	0.78	1.47	78	Time Clock	3,650	10	0.78	2,847	1.47	5,366
Site B4	B4-138	MH-400-U	458	3650	6	10,030	320W MH Exterior	345	3,650	6	7,556	2,475	2.75	2.07	0.68	345	Time Clock	3,650	6	2.07	7,556	0.68	2,475
Site B4	B4-139	Q500T3CL	500	3650	2	3,650	150W PS MH Micro Flood	188	3,650	2	1,372	2,278	1.00	0.38	0.62	188	Time Clock	3,650	2	0.38	1,372	0.62	2,278
Site B4	B4-140	H39KC175DX	225	3650	1	821	70W PS MH w/ HID Elec Ballast	78	3,650	1	285	537	0.23	0.08	0.15	78	Time Clock	3,650	1	0.08	285	0.15	537
Site B4	B4-141	H38JA100DX	130	3650	6	2,847	2X32 CF DEL REY KIT	66	3,650	6	1,445	1,402	0.78	0.40	0.38	66	Time Clock	3,650	6	0.40	1,445	0.38	1,402
Site B4	B4-142	MH-250-U	295	3650	4	4,307	150W PS MH w/ Elec HID Ballast	166	3,650	4	2,424	1,883	1.18	0.66	0.52	166	Time Clock	3,650	4	0.66	2,424	0.52	1,883
Site B4	B4-143	LU-70-MED	90	3650	1	329	42W CF CONVERSION	42	3,650	1	153	175	0.09	0.04	0.05	42	Time Clock	3,650	1	0.04	153	0.05	175
Site B4	B4-144	MH-400-U	458	3650	2	3,343	320W MH Exterior	345	3,650	2	2,519	825	0.92	0.69	0.23	345	Time Clock	3,650	2	0.69	2,519	0.23	825
Site B4	B4-145	MH-400-U	458	3650	3	5,015	320W MH Exterior	345	3,650	3	3,778	1,237	1.37	1.04	0.34	345	Time Clock	3,650	3	1.04	3,778	0.34	1,237
Site B4	B4-146	MH-400-U	458	3650	402	672,023	320W MH Exterior	345	3,650	402	506,219	165,805	184.12	138.69	45.43	345	Time Clock	3,650	402	138.69	506,219	45.43	165,805
Site B4	B4-147	MH-400-U	458	3650	28	46,808	320W MH Exterior	345	3,650	28	35,259	11,549	12.82	9.66	3.16	345	Time Clock	3,650	28	9.66	35,259	3.16	11,549
Site B4	B4-148	MH-175-U	225	3650	3	2,464	100W PS MH w/ HID Elec Ballast	108	3,650	3	1,183	1,281	0.68	0.32	0.35	108	Time Clock	3,650	3	0.32	1,183	0.35	1,281
Site B4	B4-149	MH-400-U	458	3650	2	3,343	320W MH Exterior	345	3,650	2	2,519	825	0.92	0.69	0.23	345	Time Clock	3,650	2	0.69	2,519	0.23	825
Site B4	B4-150	F96CWEW	252	3650	7	6,439	4L F96T8 W/ STND ELEC BALLAST	220	3,650	7	5,621	818	1.76	1.54	0.22	220	Time Clock	3,650	7	1.54	5,621	0.22	818
Site B4	B4-151	F96CWEW	252	3650	1	920	4L F96T8 W/ STND ELEC BALLAST	220	3,650	1	803	117	0.25	0.22	0.03	220	Time Clock	3,650	1	0.22	803	0.03	117
Site B4	B4-152	F40CWSS	40	3650	1	146	1L F32T8 W/ STND ELEC BALLAST	28	3,650	1	102	44	0.04	0.03	0.01	28	Time Clock	3,650	1	0.03	102	0.01	44
Site B4	B4-153	F40CWSS	80	3650	5	1,460	2L F32T8 W/ STND ELEC BALLAST	54	3,650	5	986	475	0.40	0.27	0.13	54	Time Clock	3,650	5	0.27	986	0.13	475
Site B4	B4-154	F40CWSS	144	3650	4	2,102	4L F32T8 W/ LP ELEC BALLAST	96	3,650	4	1,402	701	0.58	0.38	0.19	96	Time Clock	3,650	4	0.38	1,402	0.19	701
Site B4	B4-155	MH-175-U	225	3650	2	1,643	70W PS MH w/ HID Elec Ballast	78	3,650	2	569	1,073	0.45	0.16	0.29	78	Time Clock	3,650	2	0.16	569	0.29	1,073
Site B4	B4-156	MH400U-BD	458	3650	16	26,747	320W MH Exterior	345	3,650	16	20,148	6,599	7.33	5.52	1.81	345	Time Clock	3,650	16	5.52	20,148	1.81	6,599
Site B4	B4-157	75PAR38		3650	1	0	NO WORK		3,650	1	0	0	0.00	0.00	0.00		Time Clock	3,650	0	0.00	0	0.00	0
Site B4	B4-158	100W MERC		3650	2	0	26W Rudd Flood Fixture	97	3,650	2	708	-708	0.00	0.19	-0.19	97	Time Clock	3,650	2	0.19	708	-0.19	-708
Site B4	B4-159	100A19		3650	1	0	NO WORK		3,650	1	0	0	0.00	0.00	0.00		Time Clock	3,650	0	0.00	0	0.00	0
Site B4	B4-160	100A19		3650	1	0	NO WORK		3,650	1	0	0	0.00	0.00	0.00		Time Clock	3,650	0	0.00	0	0.00	0
Site B4	B4-161	F40CWSS	40	3650	6	876	1L F32T8 W/ STND ELEC BALLAST	28	3,650	6	613	263	0.24	0.17	0.07	28	Time Clock	3,650	6	0.17	613	0.07	263

Table 54. Summary of M&V Findings – 04-01-028 (con't)

		Proposed Pre-Installation					Proposed Post-Installation					Proposed Installed Savings				Verified Measures						Verified Savings	
Facility	Area	Existing Fixture Type	Existing W/Fix	Hours Per Year	No. of Fix	Existing Total Annual kWh	Proposed Fixture Type	Prop. W/Fix	Hours Per Year	No. of Fix	Proposed Total Annual kWh	Total Annual kWh Saved	Baseline kW	Proposed kW	kW Saved	Verified W/Fix	Lighting Controls	Verified Annual Hours	Verified Quantity	Verified Installed kW	Verified Installed kWh	Verified Savings kW	Verified Savings kWh
Site B4	B4-162	F40CWSS	40	6570	4	1,051	1L F32T8 W/ STND ELEC BALLAST	28	6,570	4	736	315	0.16	0.11	0.05	28	Time Clock	6,570	4	0.11	736	0.05	315
Site B4	B4-163	15T6	30	8760	1	263	NEW 2 WATT LED EXIT SIGN	2	8,760	1	18	245	0.03	0.00	0.03	2	Always ON	8,760	1	0.00	18	0.03	245
Site B4	B4-164	F40CWSS	40	6570	2	526	1L F32T8 W/ STND ELEC BALLAST	28	6,570	2	368	158	0.08	0.06	0.02	28	Time Clock	6,570	2	0.06	368	0.02	158
Site B4	B4-165	15T6	30	8760	2	526	NEW 2 WATT LED EXIT SIGN	2	8,760	2	35	491	0.06	0.00	0.06	2	Always ON	8,760	2	0.00	35	0.06	491
Site B4	B4-166	15T6	30	8760	34	8,935	NEW 2 WATT LED EXIT SIGN	2	8,760	34	596	8,340	1.02	0.07	0.95	2	Always ON	8,760	34	0.07	596	0.95	8,340
TOTALS SITE B4					**3,309**	**1,820,091**				**3,309**	**1,132,348**	**687,743**	**448.84**	**284.20**	**164.64**				**2,946**	**284.12**	**1,131,954**	**164.41**	**686,561**
TOTALS Proj. 04-01-028					**9,974**	**7,441,494**				**9,980**	**3,708,180**	**3,733,314**	**1,692.44**	**896.56**	**795.88**				**9,009**	**895.87**	**3,705,549**	**793.65**	**3,724,806**

Some of the key findings are:

- **Realization Rates:** The realization rates are 99.7% for both kWh savings and kW reduced. This means that the verified kWh savings were 99.7% of kWh savings reported through the as-built documentation. The Project Sponsor elected not to proceed with several measures resulting in this discrepancy.
- **Hours of Operation:** The proposed hours of operation were verified through the confirmation of the schedule of the timeclocks used to control the lights throughout each shopping center.
- **Quantity of Retrofits Performed:** Some of the contracted lighting retrofits initially proposed by Contractor B were not installed due to business decisions made by Westfield. These included retrofits that Westfield had concluded were either not cost-effective or would occur in areas where remodeling projects had been planned.
- **Relamps:** A few of the retrofits involved merely replacing old fixtures and bulbs with new components, without altering the load wattage. Thus, no savings were allocated to the verified totals. Contractor B performed these replacements at the request of Westfield.
- **Fixture Wattages:** Reported fixture wattages were verified to be consistent with the installed fixtures.

Table 55. Summary of M&V of 04-04-028 Lighting Retrofit Projects

04-01-028					
	Site B1	**Site B2**	**Site B3**	**Site B4**	**Total**
Energy Savings (kWh)					
Total Contracted Savings (kWh)[1]	727,566	1,883,136	434,869	689,159	3,734,730
Total Reported / Invoiced Savings (kWh)	727,566	1,883,136	434,869	687,743	3,733,314
M&V Savings (kWh)	**727,566**	**1,883,136**	**427,543**	**686,561**	3,724,806
Realization Rate (kWh)					**99.7%**
Demand Reduction (kW)					
Total Contracted Savings (kW) [1]	170.66	362.39	98.19	165.03	796.27
Total Reported / Invoiced Savings (kW)	170.66	362.39	98.19	164.64	795.88
M&V Savings (kW)	**170.66**	**362.39**	**96.19**	**164.41**	793.65
Realization Rate (kW)					**99.7%**

7.4 04-02-001 – Chiller Replacement

This M&V was conducted by the Project Sponsor.

7.4.1 Summary

The Project Sponsor has completed the required measurement and verification for energy efficiency upgrades completed at the central chilled water plant serving the Site facility. Table 56 summarizes the findings of the completed M&V effort.

Table 56. Verified Energy Savings

Measure	Demand Savings (kW)	Electric Energy Savings (kWh)	Natural Gas Savings (therms)
Central Plant Upgrade	128	1,433,921	0

7.4.2 Project Overview

The Project Sponsor and its subcontractor teamed up in 2004 to retrofit and upgrade the Site's central chilled water plant serving its manufacturing campus. This document has been prepared to discuss the approach to calculate annual savings resulting from installation of two new chillers and improved condenser water pump control.

The central plant is located in Location A. At the time of the retrofit, the chilled water plant was served by two electric chillers (Chiller #4 at 900 tons and Chiller #6 at 1200 tons) and a natural gas fired absorption chiller (Chiller #5) which serves as a back-up chiller.

The pre-retrofit condenser water system consisted of condenser water pumps interlocked with a dedicated chiller. Pump P-61 (a 75-hp pump delivering 3600 gpm at 65 ft of head) supplied condenser water for Chiller #4 and Pump P-62 (a 100 hp pump delivering 3600 gpm at 80 ft of head) supplied condenser water to Chiller #6. Pump P-30 (a 20 hp pump delivering 2000 gpm at 30 ft of head) was dedicated to Chiller #5. Both P-61 and P-62 were operated with 8-10 year old variable speed drives which operated at full speed when its associated chiller was running.

The retrofit involved installation of two new chillers, new variable speed drives on chilled water plant primary chilled water pumps, installation of new variable speed drives on all condenser

water pumps, addition of a new 100-hp condenser water pump (P-63) and reconfiguration of the condenser water piping.

Chiller #7 at *900 tons* and Chiller #8 at *700 tons*, were installed and Chiller #4 was removed leaving the plant with three electric chillers, Chiller #6, Chiller #7 and Chiller #8. The two new electric chillers from Trane (Chiller #7 and Chiller #8) are equipped with variable speed drives to modulate motor speed and compressor inlet vane positioning for maximum efficiency.

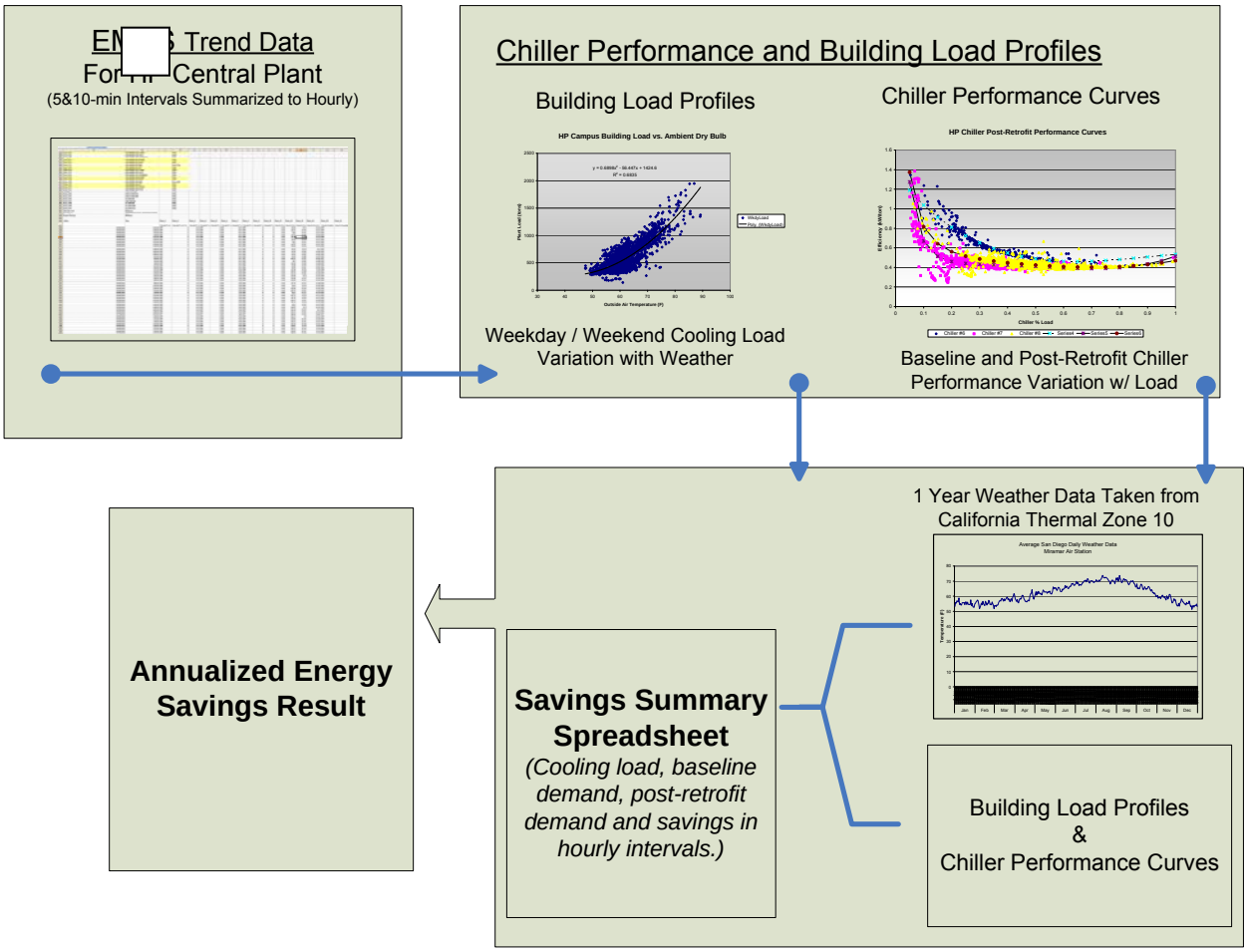
7.4.3 Energy Savings Analysis

Energy savings for this retrofit project has been completed in accordance with the approved measurement and verification. The load impact estimation methodology complies with IPMVP Option A. Annual energy savings are calculated for the two new chillers and the new condenser water pumping system.

Energy savings for the project have been annualized using a full year of weather data from a weather file for California Thermal Zone 10 which is applicable to the city of the Site. Post-retrofit data collected between December 24, 2004 and September 9, 2005 was used to characterize current plant load variation with time and the efficiency of the new equipment.

Figure 7 provides and overview of the process used to calculate annual energy savings for this project.

Figure 7. Process To Calculate Energy Savings



As indicated in the figure above, a year of weather data for the site and the post retrofit plant load curve was used to calculate hourly cooling loads. This load data was used to determine pre-retrofit and post-retrofit chiller staging and condenser water pumping demands through the year.

Performance curves for chillers 6, 7, and 8 were prepared using measured data. Performance curves for chillers 4 and 6 were prepared using DOE-2 performance curves and manufacturers data for chiller efficiency.

7.4.3.1 Data Collection and Analysis

Data used to calculate post-retrofit chiller performance and total plant loads has been collected using the trending capabilities of the Project Sponsor's EMCS. Trended data points included

ambient temperature and relative humidity, chilled water temperatures, flows, chiller kW for all new chillers.

Raw trend data from the EMCS system was recorded in 5-minute intervals. Raw data used for all performance calculation is included as a part of this submittal. To complete the energy savings analysis, 5-minute trend data was averaged to hourly intervals.

Table 57 shows an excerpt of the energy savings analysis. The source spreadsheet analyzed energy used for baseline and post-retrofit chiller configurations for each of the 8,760 hours in the year.

Table 57. Energy Savings Analysis

Line	Date/Time	OAT F	OWB F	Cooling Load Tons	Baseline Chiller 4 Tons	kW	Chiller 6 Tons	kW	Total Chiller kW	Post Retrofit Chiller 8 Tons	kW	Chiller 7 Tons	kW	Chiller 6 Tons	kW	Total Chiller kW	Demand Savings	Pre-Mode	Post Mode	Baseline CWP kW	Post CWP kW
1	1/1/05 0:00	34		288.0	288.0	201.5	0	0	201.5	288.0	128.2	0	0	0	0	128.2	73.2	1	1	61.00931	27.88
2	1/1/05 1:00	34		288.0	288.0	201.5	0	0	201.5	288.0	128.2	0	0	0	0	128.2	73.2	1	1	61.00931	27.88
3	1/1/05 2:00	37		288.0	288.0	201.5	0	0	201.5	288.0	128.2	0	0	0	0	128.2	73.2	1	1	61.00931	27.88
385	1/17/05 0:00	41		288.0	288.0	201.5	0	0	201.5	288.0	128.2	0	0	0	0	128.2	73.2	1	1	61.00931	27.88
386	1/17/05 1:00	40		288.0	288.0	201.5	0	0	201.5	288.0	128.2	0	0	0	0	128.2	73.2	1	1	61.00931	27.88
387	1/17/05 2:00	39		288.0	288.0	201.5	0	0	201.5	288.0	128.2	0	0	0	0	128.2	73.2	1	1	61.00931	27.88
388	1/17/05 3:00	37		288.0	288.0	201.5	0	0	201.5	288.0	128.2	0	0	0	0	128.2	73.2	1	1	61.00931	27.88
389	1/17/05 4:00	38		288.0	288.0	201.5	0	0	201.5	288.0	128.2	0	0	0	0	128.2	73.2	1	1	61.00931	27.88
390	1/17/05 5:00	39		288.0	288.0	201.5	0	0	201.5	288.0	128.2	0	0	0	0	128.2	73.2	1	1	61.00931	27.88
391	1/17/05 6:00	39		288.0	288.0	201.5	0	0	201.5	288.0	128.2	0	0	0	0	128.2	73.2	1	1	61.00931	27.88
392	1/17/05 7:00	40		288.0	288.0	201.5	0	0	201.5	288.0	128.2	0	0	0	0	128.2	73.2	1	1	61.00931	27.88
393	1/17/05 8:00	45		288.0	288.0	201.5	0	0	201.5	288.0	128.2	0	0	0	0	128.2	73.2	1	1	61.00931	27.88
394	1/17/05 9:00	49		253.6	253.6	185.9	0	0	185.9	253.6	116.8	0	0	0	0	116.8	69.1	1	1	61.00931	27.88
395	1/17/05 10:00	53		303.3	303.3	208.6	0	0	208.6	303.3	133.2	0	0	0	0	133.2	75.3	1	1	61.00931	27.88
396	1/17/05 11:00	56		352.8	352.8	232.4	0	0	232.4	352.8	149.3	0	0	0	0	149.3	83.1	1	1	61.00931	27.88
397	1/17/05 12:00	60		435.1	435.1	274.6	0	0	274.6	435.1	176.5	0	0	0	0	176.5	98.1	1	1	61.00931	27.88
398	1/17/05 13:00	62		483.2	483.2	300.9	0	0	300.9	483.2	194.0	0	0	0	0	194.0	106.9	1	1	61.00931	27.88
399	1/17/05 14:00	58		391.6	391.6	251.9	0	0	251.9	391.6	162.0	0	0	0	0	162.0	89.9	1	1	61.00931	27.88
6913	10/16/05 0:00	64		536.1	536.1	331.2	0	0	331.2	536.1	216.3	0	0	0	0	216.3	115.0	1	1	61.00931	27.88
6914	10/16/05 1:00	62		483.2	483.2	300.9	0	0	300.9	483.2	194.0	0	0	0	0	194.0	106.9	1	1	61.00931	27.88
6915	10/16/05 2:00	61		458.6	458.6	287.3	0	0	287.3	458.6	184.8	0	0	0	0	184.8	102.5	1	1	61.00931	27.88
6916	10/16/05 3:00	60		435.1	435.1	274.6	0	0	274.6	435.1	176.5	0	0	0	0	176.5	98.1	1	1	61.00931	27.88
6917	10/16/05 4:00	60		435.1	435.1	274.6	0	0	274.6	435.1	176.5	0	0	0	0	176.5	98.1	1	1	61.00931	27.88
6918	10/16/05 5:00	58		391.6	391.6	251.9	0	0	251.9	391.6	162.0	0	0	0	0	162.0	89.9	1	1	61.00931	27.88
6919	10/16/05 6:00	63		509.1	509.1	315.6	0	0	315.6	509.1	204.4	0	0	0	0	204.4	111.1	1	1	61.00931	27.88
6920	10/16/05 7:00	73		831.6	415.8	264.4	415.78025	247.4781	511.9	415.8	170.0	415.7803	173.0952	0	0	343.1	168.8	2	2	135.0411	60.2
6921	10/16/05 8:00	82		1221.6	610.8	376.7	610.79	334.0961	710.8	610.8	257.0	610.79	238.0327	0	0	495.0	215.8	2	2	135.0411	60.2
6922	10/16/05 9:00	87		1479.1	739.6	462.7	739.55125	398.3124	861.0	493.0	197.9	493.0342	199.2662	493.0342	232.467	629.6	231.4	2	3	135.0411	146.4
6923	10/16/05 10:00	90		1647.6	823.8	524.6	823.81	443.5743	968.1	549.2	222.5	549.2067	217.3224	549.2067	253.3327	693.1	275.0	2	3	135.0411	146.4
6924	10/16/05 11:00	91		1706.1	853.1	547.2	853.06325	459.9137	1007.1	568.7	232.4	568.7088	223.6675	568.7088	261.6751	717.7	289.3	2	3	135.0411	146.4
6925	10/16/05 12:00	94		1888.6	944.3	621.5	944.324	513.0339	1134.5	629.5	269.6	629.5493	244.9329	629.5493	291.5644	806.1	328.4	2	3	135.0411	146.4
6926	10/16/05 13:00	94		1888.6	944.3	621.5	944.324	513.0339	1134.5	629.5	269.6	629.5493	244.9329	629.5493	291.5644	806.1	328.4	2	3	135.0411	146.4
6927	10/16/05 14:00	92		1765.8	882.9	570.8	882.9	476.9193	1047.7	588.6	243.4	588.6	230.3072	588.6	270.7986	744.5	303.2	2	3	135.0411	146.4
6928	10/16/05 15:00	90		1647.6	823.8	524.6	823.81	443.5743	968.1	549.2	222.5	549.2067	217.3224	549.2067	253.3327	693.1	275.0	2	3	135.0411	146.4
8756	12/31/05 19:00	55		335.1	335.1	223.8	0	0	223.8	335.1	143.6	0	0	0	0	143.6	80.1	1	1	61.00931	27.88
8757	12/31/05 20:00	50		264.3	264.3	190.7	0	0	190.7	264.3	120.4	0	0	0	0	120.4	70.3	1	1	61.00931	27.88
8758	12/31/05 21:00	47		235.8	235.8	178.0	0	0	178.0	235.8	110.8	0	0	0	0	110.8	67.2	1	1	61.00931	27.88
8759	12/31/05 22:00	42		288.0	288.0	201.5	0	0	201.5	288.0	128.2	0	0	0	0	128.2	73.2	1	1	61.00931	27.88
8760	12/31/05 23:00	37		288.0	288.0	201.5	0	0	201.5	288.0	128.2	0	0	0	0	128.2	73.2	1	1	61.00931	27.88
			Total	5,654,138	4,054,631	2,613,369	1,599,507	896,382	3,509,751	3,536,418	1,501,053	1,721,422	700,175	396,298	185,673	2,386,901	128.2			733,069	421,998
			Max	2572.908																	
			Min	235.8225		0.62074		0.560411			0.4244557		0.406742		0.468519						
																				CWP Savings	311,071

7.5 04-02-003 – High Bay Lighting Retrofit

This project will be an aggregation project conducted at a large number of sites of individual SDG&E customers. A preliminary list of 277 sites was provided in the proposal in August 2004. This list is subject to customer acceptance of terms and conditions and subsequent marketing efforts to other customers. Most sites will have high bay facilities such as warehouse and service bays. Some sites will have low-bay facilities.

The M&V for this project was done through two M&V phases that are shown in following subsections. Subsection 7.5.2 contains the first interim report while Subsection 7.5.3 contains the second interim report and shows a compilation of the results from both interim reports into the project savings. The load impact estimation methodology complies with IPMVP Option A.

7.5.1 Project M&V Summary

Table 58 shows the compiled results of the two M&V interim reports.

Table 58. M&V Summary – Project 04-02-003

CONTRACTED	
Energy Savings (kWh)	
Total Contracted Savings (kWh)	14,000,000 kWh
Total Reported / Invoiced Savings (kWh)	10,848,717 kWh
M&V Savings (kWh)	**10,311,216 kWh**
Realization Rate to Invoice (kWh)	**95%**
Demand Reduction (kW)	
Total Contracted Savings (kW)	3,904 kW
Total Reported / Invoiced Savings (kW)	1,855.55 kW
M&V Savings (kW)	**1,800.88kW**
Realization Rate to Invoice (kW)	**97%**

7.5.2 1st Interim Measurement and Evaluation Report Project ID # 04-02-003

This M&V is the first of two conducted on 04-02-003. This project was an aggregate project with lighting installations done at multiple customers. For this report there were 73 sites.

7.5.2.1 M&V Savings Summary

Table 59 shows a summary of the M&V results.

Table 59. M&V Summary – Project 04-02-003, First Interim Report

CONTRACTED	
Energy Savings (kWh)	
Total Contracted Savings (kWh)	14,000,000 kWh
Total Reported / Invoiced Savings (kWh)	8,650,025 kWh
M&V Savings (kWh)	**8,109,548 kWh**
Realization Rate (kWh)	**93.75%**
Demand Reduction (kW)	
Total Contracted Savings (kW)	3,904 kW
Total Reported / Invoiced Savings (kW)	(from proposed) 1,554.89 kW
M&V Savings (kW)	**1,498.62**
Realization Rate	**96.38%**

7.5.2.1.1 MEASURE DESCRIPTION

Install energy efficient fluorescent lighting fixtures in place of 400W HID fixtures in primarily high-bay facilities.

7.5.2.1.1.1 Pre-Retrofit Conditions

- High-bay facilities.
- 400W HID lamps
- Fixture wattage uses stipulated values of 458 watts per fixture.

7.5.2.1.1.2 Post-Retrofit Conditions

- Energy efficient fluorescent high-bay fixture.
- 6-lamp T8 fixture rated at 228 watts, or 206 watts (at 277 volts) or 210 watts (at 120 volts) per fixture, depending on the date of installation.
- Amerillum part number E8HW246UWALS for high-bay applications. Low-bay applications will be retrofit with Amerillum part number A-BRP184HRLUE.
- Lamps used are: SLI or Philips
  850 series T8
  5000° K
- Ballast: GE Ultraballast

- Two ballasts per fixture in one of the following combinations to allow for dimming:
  Two (2) 3-lamp ballasts
  One (1) 4-lamp ballast and one (1) 2-lamp ballast

7.5.2.2 Measurement and Verification (M&V) Approach

The M&V approach used for the project is summarized in this section. KSI coordinated with the customers to perform pre- and post-retrofit M&V activities to support the tasks described below.

7.5.2.2.1 Load Impact Verification Methodology

The load impact estimation methodology described in this plan complies with IPMVP Option A. Site inspections were employed to verify key M&V parameters.

7.5.2.2.2 Analysis Approach

The basic equation used to estimate the energy savings of this project is shown in Equation 1.

(Equation 1) kWh savings = $kWh_{Pre} - kWh_{Post}$

where:

kWh_{Pre} = (# $Fixures_{Pre}$) × (Fixture $Wattage_{Pre}$/1000) × (Hours of $Operation_{Pre}$); and

kWh_{Post} = (# $Fixures_{Post}$) × (Fixture $Wattage_{Post}$/1000) × (Hours of $Operation_{Post}$).

The M&V activities for the key parameters of (Equation 3 are shown in Table 60.

Table 60. Key M&V Parameters

Parameter	M&V Activity
Fixture Counts	Fixture counts were verified through on-site inspection. Leverage inspections by SDG&E program staff.
Fixture $Wattage_{Pre}$ and Fixture $Wattage_{Post}$	Stipulated wattage values or weighted average of wattage on verification of fixtures.
Hours of Operation	Hours of operation were verified through the following lighting control scenarios: (1) Timeclocks: Timeclocks are usually reliable and accurate when operating. If timeclocks were confirmed to be in operation and the settings were verified. (2) Switches and/or breaker panel controls: The sample sites were monitored via light loggers. A realization rate was calculated and compared statistically to the proposed hours.

7.5.2.2.3 On-Site Verification Inspections

On-site inspections were conducted to verify the equipment types, quantities and operating hours. Site inspections consisted of the following activities:

- Verification of the installation of lighting equipment, including
  - fixture wattage, and
  - counts.
- Verify the operation of lighting controls, such as timeclocks.
- Verify hours of operation for lighting by obtaining lighting schedules, reviewing settings on timeclocks, or install light loggers.

The verification was based on as-built documentation provided to KSI by the Project Sponsor.

7.5.2.3 Results

This section provides the results of the M&V process.
Table 61 and Table 62 show detailed data for the proposed and verified savings analysis, respectively.

Some of the key findings are:

- **Realization Rates:** The realization rates are 91.95% for kWh savings and 94.32% for kW reduced. This means that the verified kWh savings were 91.95% of kWh savings reported through the as-built documentation.
  - Virtually all of the discrepancy in savings, approximately 700,000 kWh, is attributed to Site 2, where the basecase fixture was proposed as 400-watt metal halide, but they were actually 250-watt metal halide, as verified during the on-site inspection.
- **Hours of Operation:** The proposed hours of operation were verified through the confirmation of the schedule of the timeclocks/EMS system, and through a verification of the reported hours of operation through the use of light loggers. The findings of the light loggers suggest that the reported hours of operation were not significantly different from verified (logger) hours at the 90% confidence level, and can be used for verified savings estimation calculations.
- **Quantity of Fixtures Retrofit:** The basis for the quantity of fixtures retrofit were post-inspection request forms submitted to KSI by the Project Sponsor. These forms included final as-built quantities and fixture wattages. Adjustments to fixture quantities due to fixture removal found during post-inspection (Site 23). Several other projects had fixture removal, but these were captured in the as-builts. Several projects had fixture counts on the invoice that were different from the as-built and/or verified (Site 5, Site 13, Site 20, and Site 40).

- **Fixture Wattages:** In general, reported fixture wattages were verified to be consistent with the installed fixtures. However, there were two projects (Site 2 and Site 35) where some or all of the basecase fixtures retrofit were 250-watt metal halide instead of 400-watt metal halide; and where the retrofit fixtures were either 4-Lamp HO T8 (100w) (Four Site 72 and Site 2) or 4-Lamp HO T5 (234w) (Site 62).

  In addition, ballasts installed after March 2005 were newer models that were rated at lower wattage than the previous model by the manufacturer, General Electric. Fixture wattage is dependent on the input voltage. These ballasts automatically sense the voltage and internally set themselves properly with no interaction from the technician. Based on KSI's experience it was estimated that approximately 80 to 90 percent of the high bay applications are 277 volts. A weighted average of the fixture wattages was taken to approximate the distribution of 277 and 120 volt facilities. It was assumed that 75 percent of the high bay facilities are 277 volts and 25 percent are 120 volts. The fixture wattages are 206 watts and 210 watts for 277 volts and 120 volts, respectively. The weighted average wattage used in the M&V was 207 watts.

Table 61. Proposed Savings Detail: 04-02-003, First Interim Report

		PROPOSED																
Site #	Meas #	Basecase Fixture Type	Watts per Fixture	Prop. Qty	Retrofit Fixture Type	Watts Per Fixture Retrofit	Prop. Qty	Hours Per Day	Days Per Week	Annual Hours	Prop. kW pre	Prop. kWh pre	Prop. kW post	Prop. kWh post	Prop. kW Reduced per line item	Prop. Annual KWh Savings per line item	Prop. kW Reduced per Project	Prop. Annual KWh Savings per project
1	1	400W MH	458	170	6 Lamp T8 HO	228	171	12.00	7.00	4,368	77.86	340,092	38.99	170,300	38.87	169,793	38.87	169,793
3	1	400W MH	458	165	6 Lamp T8 HO	228	165	24.00	5.00	6,240	75.57	471,557	37.62	234,749	37.95	236,808	37.95	236,808
4	1	400W MH	458	66	6 Lamp T8 HO	228	66	18.00	5.00	4,680	30.23	141,467	15.05	70,425	15.18	71,042	15.18	71,042
5	1	400W MH	458	18	6 Lamp T8 HO	228	18	24.00	5.00	6,240	8.24	51,443	4.10	25,609	4.14	25,834	4.14	25,834
6	1	400W MH	458	128	6 Lamp T8 HO	228	128	17.00	7.00	6,188	58.62	362,765	29.18	180,591	29.44	182,175	29.44	182,175
7	1	400W MH	458	33	6 Lamp T8 HO	228	33	12.00	5.00	3,120	15.11	47,156	7.52	23,475	7.59	23,681	7.59	23,681
8	1	400W MH	458	46	6 Lamp T8 HO	228	46	17.50	6.00	5,460	21.07	115,031	10.49	57,264	10.58	57,767	10.58	57,767
9		400W MH	458	73	6 Lamp T8 HO	228	73	12.00	5.00	3,120	33.43	104,314	16.64	51,929	16.79	52,385	16.79	52,385
10	1	400W MH	458	65	6 Lamp T8 HO	228	65	24.00	6.00	7,488	29.77	222,918	14.82	110,972	14.95	111,946	14.95	111,946
11	1	400W MH	458	69	6 Lamp T8 HO	228	69	10.20	6.00	3,182	31.60	100,570	15.73	50,066	15.87	50,505	15.87	50,505
12	1	400W MH	458	241	6 Lamp T8 HO	228	241	22.00	6.00	6,864	110.38	757,635	54.95	377,163	55.43	380,472	55.43	380,472
13	1	400W MH	458	34	6 Lamp T8 HO	228	34	10.20	6.00	3,182	15.57	49,556	7.75	24,670	7.82	24,886	7.82	24,886
14	1	400W MH	458	27	6 Lamp T8 HO	228	27	12.00	6.00	3,744	12.37	46,298	6.16	23,048	6.21	23,250	6.21	23,250
15	1	400W MH	458	53	6 Lamp T8 HO	228	53	14.00	7.00	5,096	24.27	123,700	12.08	61,580	12.19	62,120	12.19	62,120
16	1	400W MH	458	46	6 Lamp T8 HO	228	46	24.00	6.00	7,488	21.07	157,757	10.49	78,534	10.58	79,223	10.58	79,223
17	1	400W MH	458	172	6 Lamp T8 HO	228	172	20.00	6.00	6,240	78.78	491,562	39.22	244,708	39.56	246,854	39.56	246,854
18	1	400W MH	458	20	6 Lamp T8 HO	228	20	24.00	7.00	8,736	9.16	80,022	4.56	39,836	4.60	40,186	4.60	40,186
19	1	400W MH	458	23	6 Lamp T8 HO	228	23	16.00	7.00	5,824	10.53	61,350	5.24	30,541	5.29	30,809	5.29	30,809
20	1	400W MH	458	72	6 Lamp T8 HO	228	72	15.00	7.00	5,460	32.98	180,049	16.42	89,631	16.56	90,418	16.56	90,418
21	1	400W MH	458	19	6 Lamp T8 HO	228	19	9.00	7.00	3,276	8.70	28,508	4.33	14,192	4.37	14,316	4.37	14,316
22	1	400W MH	458	52	6 Lamp T8 HO	228	52	12.00	5.00	3,120	23.82	74,306	11.86	36,991	11.96	37,315	11.96	37,315
23	1																	
23	2																	
23	3	400W MH	458	71	6 Lamp T8 HO	228	71	12.00	6.00	3,744	32.52	121,747	16.19	60,608	16.33	61,140	16.33	61,140

Table 61. Proposed Savings Detail: 04-02-003, First Interim Report (continued)

		PROPOSED																
Site #	Meas #	Basecase Fixture Type	Watts per Fixture	Prop. Qty	Retrofit Fixture Type	Watts Per Fixture Retrofit	Prop. Qty	Hours Per Day	Days Per Week	Annual Hours	Prop. kW pre	Prop. kWh pre	Prop. kW post	Prop. kWh post	Prop. kW Reduced per line item	Prop. Annual KWh Savings per line item	Prop. kW Reduced per Project	Prop. Annual KWh Savings per project
24	1	400W MH	458	24	6 Lamp T8 HO	228	24	24.00	6.00	7,488	10.99	82,308	5.47	40,974	5.52	41,334	5.52	41,334
25	1	400W MH	458	38	6 Lamp T8 HO	228	38	18.00	7.00	6,552	17.40	114,031	8.66	56,767	8.74	57,264	8.74	57,264
26	1	400W MH	458	22	6 Lamp T8 HO	228	22	12.00	5.00	3,120	10.08	31,437	5.02	15,650	5.06	15,787	5.06	15,787
28	1	400W MH	458	7	6 Lamp T8 HO	228	7	11.00	6.00	3,432	3.21	11,003	1.60	5,477	1.61	5,526	1.61	5,526
28b	1	400W MH	458	11	6 Lamp T8 HO	228	11	11.00	6.00	3,432	5.04	17,290	2.51	8,607	2.53	8,683	2.53	8,683
29	1	400W MH	458	137	6 Lamp T8 HO	228	137	12.50	5.00	3,250	62.75	203,925	31.24	101,517	31.51	102,408	31.51	102,408
30	1	400W MH	458	142	6 Lamp T8 HO	228	142	18.00	5.50	5,148	65.04	334,805	32.38	166,672	32.66	168,134	32.66	168,134
31	1	400W MH	458	18	6 Lamp T8 HO	228	18	12.00	5.50	3,432	8.24	28,293	4.10	14,085	4.14	14,208	4.14	14,208
32	1	400W MH	458	65	6 Lamp T8 HO	228	65	12.00	5.00	3,120	29.77	92,882	14.82	46,238	14.95	46,644	14.95	46,644
33	1	400W MH	458	66	6 Lamp T8 HO	228	66	24 in Summer, 11 in winter	5.00	need seasonal hours in the savings calc.	30.23	137,537	15.05	68,468	15.18	69,069	15.18	69,069
34	1	400W MH	458	62	6 Lamp T8 HO	228	62	15.10	6.00	4,711	28.40	133,779	14.14	66,598	14.26	67,182	14.26	67,182
2	1	250W MH	458	674	4 Lamp T8 HO	100	674	18.00	7.00	6,552	308.69	2,022,550	67.40	441,605	241.29	1,580,945	241.29	1,580,945
35	1																	
	2																	
	3	400W MH	458	96	6 Lamp T8 HO	228	96	19.50	5.00	5,070	43.97	222,918	21.89	110,972	22.08	111,946	22.08	111,946
36	1	400W MH	458	40	6 Lamp T8 HO	228	40	12.50	5.00	3,250	18.32	59,540	9.12	29,640	9.20	29,900	9.20	29,900
37	1	400W MH	458	550	6 Lamp T8 HO	228	550	20.00	7.00	7,280	251.90	1,833,832	125.40	912,912	126.50	920,920	126.50	920,920
38	1	400W MH	458	179	6 Lamp T8 HO	228	179	11.00	6.00	3,432	81.98	281,362	40.81	140,067	41.17	141,295	41.17	141,295
39	1	400W MH	458	30	6 Lamp T8 HO	218	30	18.00	5.50	5,148	13.74	70,734	6.54	33,668	7.20	37,066	7.20	37,066
40	1	400W MH	458	52	6 Lamp T8 HO	218	52	12.00	5.00	3,120	23.82	74,306	11.34	35,368	12.48	38,938		
40	2	400W MH	458	5	6 Lamp T8 HO	218	5	24.00	7.00	8,736	2.29	20,005	1.09	9,522	1.20	10,483		
40	3														13.68	49,421	13.68	49,421
41	1	400W MH	458	72	6 Lamp T8 HO	218	72	21.00	5.00	5,460	32.98	180,049	15.70	85,700	17.28	94,349	17.28	94,349
42	1	400W MH	458	232	6 Lamp T8 HO	228	232	10.50	6.00	3,276	106.26	348,095	52.90	173,287	53.36	174,807	53.36	174,807
43	1	400W MH	458	50	6 Lamp T8 HO	228	50	15.00	5.00	3,900	22.90	89,310	11.40	44,460	11.50	44,850	11.50	44,850
44	1	400W MH	458	78	6 Lamp T8 HO	228	78	12.00	5.50	3,432	35.72	122,605	17.78	61,035	17.94	61,570	17.94	61,570

Table 61. Proposed Savings Detail: 04-02-003, First Interim Report (continued)

		PROPOSED																
Site #	Meas #	Basecase Fixture Type	Watts per Fixture	Prop. Qty	Retrofit Fixture Type	Watts Per Fixture Retrofit	Prop. Qty	Hours Per Day	Days Per Week	Annual Hours	Prop. kW pre	Prop. kWh pre	Prop. kW post	Prop. kWh post	Prop. kW Reduced per line item	Prop. Annual KWh Savings per line item	Prop. kW Reduced per Project	Prop. Annual KWh Savings per project
45	1	400W MH	458	47	6 Lamp T8 HO	228	47	12.00	5.00	3,120	21.53	67,161	10.72	33,434	10.81	33,727	10.81	33,727
46	1	400W MH	458	278	6 Lamp T8 HO	218	278	24.00	7.00	8,736	127.32	1,112,302	60.60	529,437	66.72	582,866	66.72	582,866
47	1	400W MH	458	43	6 Lamp T8 HO	218	43	13.00	5.50	3,718	19.69	73,222	9.37	34,853	10.32	38,370	10.32	38,370
48	1	400W MH	458	20	6 Lamp T8 HO	218	20	12.00	5.50	3,432	9.16	31,437	4.36	14,964	4.80	16,474	4.80	16,474
49	1	400W MH	458	29	6 Lamp T8 HO	218	29	12.00	6.00	3,744	13.28	49,728	6.32	23,670	6.96	26,058	6.96	26,058
50	1	400W MH	458	11	6 Lamp T8 HO	218	11	24.00	7.00	8,736	5.04	44,012	2.40	20,949	2.64	23,063	2.64	23,063
51	1	400W MH	458	172	6 Lamp T8 HO	218	172	20.00	7.00	7,280	78.78	573,489	37.50	272,971	41.28	300,518	41.28	300,518
52	1	400W MH	458	40	6 Lamp T8 HO	218	40	15.00	7.00	5,460	18.32	100,027	8.72	47,611	9.60	52,416	9.60	52,416
53	1	400W MH	458	60	6 Lamp T8 HO	218	60	14.00	6.00	4,368	27.48	120,033	13.08	57,133	14.40	62,899	14.40	62,899
54	1	400W MH	458	23	6 Lamp T8 HO	218	23	12.00	7.00	4,368	10.53	46,013	5.01	21,901	5.52	24,111	5.52	24,111
55	1	400W MH	458	75	6 Lamp T8 HO	218	75	12.00	5.50	3,432	34.35	117,889	16.35	56,113	18.00	61,776	18.00	61,776
56	1	400W MH	458	53	6 Lamp T8 HO	218	53	12.00	5.00	3,120	24.27	75,735	11.55	36,048	12.72	39,686	12.72	39,686
57	1	400W MH	458	70	6 Lamp T8 HO	218	70	12.00	7.00	4,368	32.06	140,038	15.26	66,656	16.80	73,382		
57	2	400W MH	458	12	6 Lamp T8 HO	0	12	12.00	7.00	4,368	5.50	24,007	0.00	0	5.50	24,007		
57	3						82								22.30	97,389	22.30	97,389
58	1	400W MH	458	31	6 Lamp T8 HO	218	31	16.00	5.00	4,160	14.20	59,064	6.76	28,113	7.44	30,950	7.44	30,950
59	1	400W MH	458	19	6 Lamp T8 HO	218	19	24.00	7.00	8,736	8.70	76,021	4.14	36,185	4.56	39,836	4.56	39,836
60	1	400W MH	458	104	6 Lamp T8 HO	218	104	12.00	5.50	3,432	47.63	163,473	22.67	77,810	24.96	85,663	24.96	85,663
61	1	400W MH	458	45	6 Lamp T8 HO	218	45	12.00	7.00	4,368	20.61	90,024	9.81	42,850	10.80	47,174	10.80	47,174
62	1	400W MH	458	85	6 Lamp T8 HO	218	85	12.00	6.00	3,744	38.93	145,754	18.53	69,376	20.40	76,378	20.40	76,378
63	1	400W MH	458	132	6 Lamp T8 HO	218	132	13.00	6.00	4,056	60.46	245,210	28.78	116,715	31.68	128,494	31.68	128,494
64	1	400W MH	458	18	6 Lamp T8 HO	218	18	12.00	6.00	3,744	8.24	30,866	3.92	14,691	4.32	16,174	4.32	16,174
65	1	400W MH	458	38	6 Lamp T8 HO	218	38	13.00	7.00	4,732	17.40	82,356	8.28	39,200	9.12	43,156	9.12	43,156
66	1	400W MH	458	9	6 Lamp T8 HO	218	9	24.00	6.00	7,488	4.12	30,866	1.96	14,691	2.16	16,174	2.16	16,174
67	1	400W MH	458	107	6 Lamp T8 HO	218	107	18.00	6.00	5,616	49.01	275,218	23.33	130,999	13.44	144,219	13.44	144,219

Table 61. Proposed Savings Detail: 04-02-003, First Interim Report (continued)

		PROPOSED																
Site #	Meas #	Basecase Fixture Type	Watts per Fixture	Prop. Qty	Retrofit Fixture Type	Watts Per Fixture Retrofit	Prop. Qty	Hours Per Day	Days Per Week	Annual Hours	Prop. kW pre	Prop. kWh pre	Prop. kW post	Prop. kWh post	Prop. kW Reduced per line item	Prop. Annual KWh Savings per line item	Prop. kW Reduced per Project	Prop. Annual KWh Savings per project
68	1	400W MH	458	54	6 Lamp T8 HO	218	54	16.00	5.50	4,576	24.73	113,174	11.77	53,869	12.96	59,305		
68	2	400W MH	458	18	6 Lamp T8 HO	0	18	16.00	5.50	4,576	8.24	37,725	0.00	0	8.24	37,725		
68	3						72								21.20	97,030	21.20	97,030
69	1	400W MH	458	58	6 Lamp T8 HO	218	58	20.00	7.00	7,280	26.56	193,386	12.64	92,048	13.92	101,338	13.92	101,338
70	1	400W MH	458	110	6 Lamp T8 HO	218	110	24.00	7.00	8,736	50.38	440,120	23.98	209,489	26.40	230,630	26.40	230,630
71	1	400W MH	458	4	6 Lamp T8 HO	218	4	24.00	5.00	6,240	1.83	11,432	0.87	5,441	0.96	5,990	0.96	5,990
72	1	400W MH	458	21	6 Lamp T8 HO	218	21	24.00	7.00	8,736	9.62	84,023	4.58	39,993	5.04	44,029	5.04	44,029
73	1	400W MH	458	53	6 Lamp T8 HO	218	53	24.00	7.00	8,736	24.27	212,058	11.55	100,936	12.72	111,122	12.72	111,122
74	1	400W MH	458	167	6 Lamp T8 HO	218	167	14.00	5.50	4,004	76.49	306,250	36.41	145,770	40.08	160,480	40.08	160,480
TOTAL																	1,554.89	8,654,422

Table 62. Verified Savings Detail: 04-02-003, First Interim Report

		VERIFIED									
Site #	Meas #	Ver. Qty Retrofit	Ver. Pre-Wattage	Ver. Post-Wattage	Ver. kW Reduced per line item	Hours Per Day	Days Per Week	Ver. Annual Hours	Ver. kWh Savings per line item	Ver. kW Reduced per Project	Ver. kWh Savings per Project
1	1	171	458	228	39.33	12.00	7.00	4,368	171,793	39.33	171,793
3	1	165	458	228	37.95	24.00	5.00	6,240	236,808	37.95	236,808
4	1	66	458	228	15.18	18.00	5.00	4,680	71,042	15.18	71,042
5	1	18	458	228	4.14	24.00	5.00	6,240	25,834	4.14	25,834
6	1	128	458	228	29.44	17.00	7.00	6,188	182,175	29.44	182,175
7	1	33	458	228	7.59	12.00	5.00	3,120	23,681	7.59	23,681
8	1	46	458	228	10.58	17.50	6.00	5,460	57,767	10.58	57,767
9		73	458	228	16.79	12.00	5.00	3,120	52,385	16.79	52,385
10	1	65	458	228	14.95	24.00	6.00	7,488	111,946	14.95	111,946
11	1	69	458	228	15.87	10.20	6.00	3,182	50,505	15.87	50,505
12	1	241	458	228	55.43	22.00	6.00	6,864	380,472	55.43	380,472
13	1	34	458	228	7.82	10.20	6.00	3,182	24,886	7.82	24,886
14	1	27	458	228	6.21	12.00	6.00	3,744	23,250	6.21	23,250
15	1	53	458	228	12.19	14.00	7.00	5,096	62,120	12.19	62,120
16	1	46	458	228	10.58	24.00	6.00	7,488	79,223	10.58	79,223
17	1	172	458	228	39.56	20.00	6.00	6,240	246,854	39.56	246,854
18	1	20	458	228	4.60	24.00	7.00	8,760	40,296	4.60	40,296
19	1	23	458	228	5.29	16.00	7.00	5,824	30,809	5.29	30,809
20	1	72	458	228	16.56	15.00	7.00	5,460	90,418	16.56	90,418
21	1	19	458	228	4.37	9.00	7.00	3,276	14,316	4.37	14,316
22	1	52	458	228	11.96	12.00	5.00	3,120	37,315	11.96	37,315
23	1	68	458	228	15.64	12.00	6.00	3,744	58,556	15.64	
23	2	3	458	0	1.37	12.00	6.00	3,744	5,144	1.37	
23	3				17.01				63,700	17.01	63,700
24	1	24	458	228	5.52	24.00	6.00	7,488	41,334	5.52	41,334
25	1	38	458	228	8.74	18.00	7.00	6,552	57,264	8.74	57,264
26	1	22	458	228	5.06	12.00	5.00	3,120	15,787	5.06	15,787
28	1	7	458	228	1.61	11.00	6.00	3,432	5,526	1.61	5,526
28b	1	11	458	228	2.53	11.00	6.00	3,432	8,683	2.53	8,683
29	1	137	458	228	31.51	12.50	5.00	3,250	102,408	31.51	102,408
30	1	119	458	228	27.37	18.00	5.50	5,148	140,901	27.37	140,901
31	1	18	458	228	4.14	12.00	5.50	3,432	14,208	4.14	14,208
32	1	65	458	228	14.95	12.00	5.00	3,120	46,644	14.95	46,644
33	1	66	458	228	15.18	24 in Summer, 11 in winter	5.00	4,550	69,069	15.18	69,069
34	1	62	458	228	14.26	15.10	6.00	4,711	67,182	14.26	67,182
2	1	674	295	100	131.43	18.00	7.00	6,552	861,129	131.43	861,129
35	1	23	458	207	5.77	19.50	5.00	5,070	56,485		
	2	73	295	207	6.42	19.50	5.00	5,070	56,485		
	3	96			12.20				112,970	12.20	112,970
36	1	40	458	207	10.04	12.50	5.00	3,250	32,630	10.04	32,630
37	1	550	458	228	126.50	20.00	7.00	7,280	920,920	126.50	920,920
38	1	179	458	207	44.93	11.00	6.00	3,432	154,196	44.93	154,196
39	1	30	458	207	7.53	18.00	5.50	5,148	38,764	7.53	38,764
40	1	52	458	207	13.05	12.00	5.00	3,120	40,722		
40	2	5	458	207	1.26	24.00	7.00	8,760	10,994		
40	3	57			14.31				51,716	14.31	51,716
41	1	72	458	207	18.07	21.00	5.00	5,460	98,673	18.07	98,673
42	1	232	458	207	58.23	10.50	6.00	3,276	190,768	58.23	190,768

Table 62. Verified Savings Detail: 04-02-003, First Interim Report (continued)

		VERIFIED									
Site #	Meas #	Ver. Qty Retrofit	Ver. Pre-Wattage	Ver. Post-Wattage	Ver. kW Reduced per line item	Hours Per Day	Days Per Week	Ver. Annual Hours	Ver. kWh Savings per line item	Ver. kW Reduced per Project	Ver. kWh Savings per Project
43	1	50	458	207	12.55	15.00	5.00	3,900	48,945	12.55	48,945
44	1	78	458	207	19.58	12.00	5.50	3,432	67,192	19.58	67,192
45	1	47	458	207	11.80	12.00	5.00	3,120	36,807	11.80	36,807
46	1	278	458	207	69.78	24.00	7.00	8,760	611,255	69.78	611,255
47	1	43	458	207	10.79	13.00	5.50	3,718	40,128	10.79	40,128
48	1	20	458	207	5.02	12.00	5.50	3,432	17,229	5.02	17,229
49	1	29	458	207	7.28	12.00	6.00	3,744	27,253	7.28	27,253
50	1	11	458	207	2.76	24.00	7.00	8,760	24,186	2.76	24,186
51	1	172	458	207	43.17	20.00	7.00	7,280	314,292	43.17	314,292
52	1	40	458	207	10.04	15.00	7.00	5,460	54,818	10.04	54,818
53	1	60	458	207	15.06	14.00	6.00	4,368	65,782	15.06	65,782
54	1	23	458	207	5.77	12.00	7.00	4,368	25,216	5.77	25,216
55	1	75	458	207	18.83	12.00	5.50	3,432	64,607	18.83	64,607
56	1	53	458	207	13.30	12.00	5.00	3,120	41,505	13.30	41,505
57	1	70	458	207	17.57	12.00	7.00	4,368	76,746		
57	2	12	458	0	5.50	12.00	7.00	4,368	24,007		
57	3	82			23.07				100,752	23.07	100,752
58	1	31	458	207	7.78	16.00	5.00	4,160	32,369	7.78	32,369
59	1	19	458	207	4.77	24.00	7.00	8,760	41,776	4.77	41,776
60	1	104	458	207	26.10	12.00	5.50	3,432	89,589	26.10	89,589
61	1	45	458	207	11.30	12.00	7.00	4,368	49,337	11.30	49,337
62	1	85	458	207	21.34	12.00	6.00	3,744	79,878	21.34	79,878
63	1	132	458	207	33.13	13.00	6.00	4,056	134,383	33.13	134,383
64	1	18	458	207	4.52	12.00	6.00	3,744	16,915	4.52	16,915
65	1	38	458	207	9.54	13.00	7.00	4,732	45,134	9.54	45,134
66	1	9	458	207	2.26	24.00	6.00	7,488	16,915	2.26	16,915
67	1	107	458	207	26.86	18.00	6.00	5,616	150,829	26.86	150,829
68	1	54	458	207	13.55	16.00	5.50	4,576	62,023		
68	2	18	458	0	8.24	16.00	5.50	4,576	37,725		
68	3	72	458	207	21.80	16.00	5.50	4,576	99,748	21.80	99,748
69	1	58	458	207	14.56	20.00	7.00	7,280	105,982	14.56	105,982
70	1	110	458	207	27.61	24.00	7.00	8,760	241,864	27.61	241,864
71	1	4	458	207	1.00	24.00	5.00	6,240	6,265	1.00	6,265
72	1	21	458	100	7.52	24.00	7.00	8,760	65,858	7.52	65,858
73	1	53	458	207	13.30	24.00	7.00	8,760	116,534	13.30	116,534
74	1	167	458	207	41.92	14.00	5.50	4,004	167,836	41.92	167,836
TOTAL										**1,498.62**	**8,109,548**

Table 63. Summary of M&V: 04-02-003

	(Proposed) As-Built	Invoiced	Verified	Realization Rate[Note 1]
# Projects	74	74	74	
kW Reduced	1,554.89	n/a	1,498.62	96.38%
kWh Savings	8,654,422	8,650,025	8,109,548	93.75%
Note 1: (kW based on As-built documentation, kWh based on Invoiced)				

7.5.2.3.1 Verified Hours of Operation

The hours of operation were verified through the installation of light loggers on a sample of sites. The data of the light loggers was used to calculate a realization rate for the site. The average realization rate of the sample was statistically compared to the proposed value (100%).

7.5.2.3.1.1 Lighting Controls

Five (5) sites used timeclocks or energy management systems (EMS) to control their lighting. Sixty nine (69) controlled their lights manually using switches or breakers at an electrical panel. Due to the fact that a vast majority of the sites controlled their lighting manually the lighting hours of operation were verified through light loggers.

7.5.2.3.1.2 Light Loggers

Light loggers were installed at 13 sites. Table 64 shows the proposed and logged annual hours for the 13 sites. A realization rate for hours of operation was calculated for each site using (Equation 4).

(Equation 2) $$\text{Realization Rate}_{\text{Hours}} = \frac{\text{Annual Hours}_{\text{Logged}}}{\text{Annual Hours}_{\text{Proposed}}}$$

The realization rate is a measure of how the proposed hours compare with the logged hours. A realization rate of 100% means that the logged hours equals the proposed hours. A realization rate less than 100% means that the logged hours were less than the proposed hours, while a rate greater than 100% means the logged hours were greater than the proposed.

The average realization rate for the sample was calculated, as well as the standard deviation and confidence interval (at a 90% level of confidence). Table 64 shows these calculated values. The confidence interval provides an indication of whether the average realization rate is statistically different from the expected value of 100%, i.e., the logged hours perfectly match the proposed hours.

As shown in Table 64, the average realization rate, i.e., proposed hours divided by logged hours, was 94.5 percent, with a standard deviation of 14.9 percent. Our expected value was 100 percent, i.e., the proposed hours equals the logged hours. If the expected value falls within the 90% confidence interval the expected value cannot be rejected. The expected value does fall with the confidence interval of 87.7 to 101.3 percent. Therefore, the hours of operation cannot be rejected. Thus, the hours of operation used in the M&V are the proposed hours.

Table 64. Light Logger Results: 04-02-003

Site #	Proposed Annual Hours	Logged Annual Hours	Real. Rate for Hours
2	8,760	7,895	90.13%
22	3,120	3,355	107.53%
26	3,120	3,314	106.22%
38	3,406	3,889	114.18%
42	3,432	3,276	95.45%
45	3,120	2,435	78.04%
47	3,718	3,393	91.26%
49	3,744	3,745	100.03%
62	3,744	4,092	109.29%
65	4,732	4,625	97.74%
69	7,280	5,492	75.44%
70	8,760	5,488	62.65%
72	8,760	8,760	100.00%
		Average	94.46%
		Standard Deviation	
		n	13
		Confidence Limit (90%)	6.80%
		Confidence Interval (90%)	87.7% to 101.3%

7.5.2.3.2 Verified Fixture Counts

The fixture counts on the post-inspection request represented the as-built quantity. This was the basis for the verification of fixture counts. Pre-inspection and post-inspection visits were made to most sites. It wasn't unusual for the pre- and post- counts to differ, as there were sites

where fixtures were added to the project during installation, and in some cases fixtures were removed. Thus, the as-built counts were used for the verification, since the claimed savings were based on these values. There were few deviations found from the as-built quantities. The following anomaly was observed:

- Several projects involved the retrofit of some fixtures and the removal of others. This effectively reduces the connected load for these facilities.

7.5.2.3.3 Verified Fixture Wattage

Fixture wattages were verified on a sample basis. The basecase fixtures were verified to be 400-watt metal halide (total fixture wattage is 458 watts) in most cases. During the early stages of the program retrofit fixtures were 228-watt 6-lamp high output T8 fixtures. More recently, new ballasts were used with fixture wattages of either 206-watt or 210-watts for a 6-lamp high output T8 fixtures depending on the fixture voltage. As described earlier in Section 3, a weighted average of 207-watts per fixture was used for these fixtures. Several anomalies regarding fixture wattage were observed:

- The basecase fixture for two sites was a 250-watt metal halide fixture (fixture wattage is 295 watts).
- The retrofit fixture for several sites was a 100-watt 4-lamp T8 fixture.
- The retrofit fixture for one facility was 4-lamp high output T5 fixture (234 watt fixture wattage).

7.5.3 2nd Interim and Final Measurement and Evaluation Report Project ID # 04-02-003

This project was an aggregation project conducted at a large number of sites of individual SDG&E customers. A preliminary list of 277 sites was provided in the proposal in August 2004. This list was subject to customer acceptance of terms and conditions, and subsequent marketing efforts to other customers. Most sites were high bay facilities such as warehouse and service bays. Some sites are low-bay facilities.

The measurement and verification of savings (M&V) for this project was done in two groups. The first group comprised 74 sites and the verified savings were documented in the *Interim Measurement and Verification Report* (2006). This M&V report provides the M&V for the second group of three sites and compiles the results of the two groups into the final report for the project.

7.5.3.1 M&V Savings Summary

Table 65. M&V Summary – Project 04-02-003

CONTRACTED	
Energy Savings (kWh)	
Total Contracted Savings (kWh)	14,000,000 kWh
Total Reported / Invoiced Savings (kWh)	10,848,717 kWh
M&V Savings (kWh)	**10,311,216 kWh**
Realization Rate to Invoice (kWh)	**95%**
Demand Reduction (kW)	
Total Contracted Savings (kW)	3,904 kW
Total Reported / Invoiced Savings (kW)	1,855.55 kW
M&V Savings (kW)	**1,800.88kW**
Realization Rate to Invoice (kW)	**97%**

7.5.3.1.1 MEASURE DESCRIPTION

Install energy efficient fluorescent lighting fixtures in place of 400W HID fixtures in primarily high-bay facilities.

7.5.3.1.1.1 Pre-Retrofit Conditions

- High-bay facilities.
- 400W HID lamps
- Fixture wattage used stipulated values of 458 watts per fixture.

7.5.3.1.1.2 Post-Retrofit Conditions

- Energy efficient fluorescent high-bay fixture.
- 6-lamp T8 fixture rated at 228 watts (for fixtures installed prior to July 2005); for fixtures installed from July 2005 the fixture wattages were 206 watts (at 277 volts) or 210 watts (at 120 volts). These reduced wattages were verified from manufacturer's cut sheets.
- Amerillum part number E8HW246UWALS for high-bay applications. Low-bay applications were retrofit with Amerillum part number A-BRP184HRLUE.
- Lamps used are: SLI or Philips
  850 series T8
  5000° K
- Ballast: GE Ultramax ballast (GE-332-MAX-H/Ultra)
- Two ballasts per fixture in one of the following combinations to allow for dimming:
  Two (2) 3-lamp ballasts, or
  One (1) 4-lamp ballast and one (1) 2-lamp ballast.

7.5.3.2 Measurement and Verification (M&V) Approach

The M&V approach used for the project is summarized in this section. KSI coordinated with the customers to perform pre- and post-retrofit M&V activities to support the tasks described below.

7.5.3.2.1 Load Impact Verification Methodology

The load impact estimation methodology complies with IPMVP Option A. Site inspections were employed to verify key M&V parameters.

7.5.3.2.2 Analysis Approach

The basic equation used to estimate the energy savings of this project is shown in Equation 1.

(Equation 3) kWh savings = $kWh_{Pre} - kWh_{Post}$

where:

kWh_{Pre} = (# $Fixures_{Pre}$) × (Fixture $Wattage_{Pre}$/1000) × (Hours of $Operation_{Pre}$); and

kWh_{Post} = (# $Fixures_{Post}$) × (Fixture $Wattage_{Post}$/1000) × (Hours of $Operation_{Post}$).

The M&V activities for the key parameters of Equation 1 are shown in Table 66.

Table 66. Key M&V Parameters

Parameter	M&V Activity
Fixture Counts	Fixture counts were verified through on-site inspection. Leverage inspections by SDG&E program staff.
Fixture $Wattage_{Pre}$ and Fixture $Wattage_{Post}$	Stipulated wattage values or weighted average of wattage on verification of fixtures.
Hours of Operation	Hours of operation were verified through the following lighting control scenarios: (1) Timeclocks: Timeclocks are usually reliable and accurate when operating. If timeclocks were confirmed to be in operation and the settings were verified. (2) Switches and/or breaker panel controls: The sample sites were monitored via light loggers. A realization rate was calculated and compared statistically to the proposed hours.

7.5.3.2.3 On-Site Verification Inspections

On-site inspections were conducted to verify the equipment types, quantities and operating hours. Site inspections consisted of the following activities:

- Verification of the installation of lighting equipment, including
  - fixture wattage, and
  - counts.
- Verify the operation of lighting controls, such as timeclocks.
- Verify hours of operation for lighting by obtaining lighting schedules, reviewing settings on timeclocks, or install light loggers.

The verification was based on as-built documentation provided to KSI by the Project Sponsor.

7.5.3.3 Results – 2nd Interim M&V Report

This section provides the results of the M&V for the 2nd Interim M&V Report. As stated previously, the total number of sites for this program is split into two groups based on how SDG&E was invoiced. The verified results for the first 74 sites were presented in the Interim *Measurement and Verification Report,* and the verified savings for the last three sites are shown in this report. In addition, this report shows the results of the two groups together to represent the project-level results.

Table 67 shows the summary of the M&V findings for the 2nd Interim Report. The attached spreadsheet workbook contains the analysis of the second group.

Some of the key findings are:

- **Realization Rates for Interim 2:** The realization rates for the 2nd Interim M&V Report are 100% for kWh savings and 101% for kW reduced.
    - The kW reduced is greater due to the lower wattage of ballast introduced in July 2005 fixture wattage being proposed at 208 watts. In addition on customer, Site 77, proposed 17 fixtures to be 400-watt metal halide bulbs, but they were actually 500-watt incandescent, as verified during the on-site pre-inspection.
- **Hours of Operation:** The hours of operation was verified with light loggers. Two of the three sites were monitored. Logger data was then compared to the proposed hours of operation. The verified hours confirmed the proposed hours.
- **Quantity of Fixtures Retrofit:** The basis for the quantity of fixtures retrofit were post-inspection request forms submitted to KSI by the Project Sponsor. These forms included final as-built quantities and fixture wattages.
- **Fixture Wattages:** In general, reported pre-fixture wattages were verified to be consistent with the installed fixtures.

Table 67. Summary of M&V for Interim 2 - Project 04-02-003

	(Proposed) As-Built	Invoiced	Verified	Realization Rate[Note 1]
# Projects	3	3	3	
kW Reduced	288.00	300.70	302.30	104.97%
kWh Savings	2,194,294	1,265,514	2,201,667	173.97%
Note 1: (kW based on As-built documentation, kWh based on Invoiced)				

7.5.3.3.1 Verified Hours of Operation

The hours of operation were verified through the installation of light loggers on a sample of sites. The data of the light loggers was used to calculate a realization rate for the site. The average realization rate of the sample was statistically compared to the proposed value (100%).

7.5.3.3.1.1 Lighting Controls

Lighting controls for the three sites were controlled manually by switches and panel boxes.

7.5.3.3.1.2 Light Loggers

Light loggers were installed at two of the three sites. The data from the loggers were analyzed and compared with the proposed hours of operation. A realization rate for hours of operation was calculated for each site using (Equation 4).

(Equation 4) $$\text{Realization Rate}_{\text{Hours}} = \frac{\text{Annual Hours}_{\text{Logged}}}{\text{Annual Hours}_{\text{Proposed}}}$$

The realization rate is a measure of how the proposed hours compare with the logged hours. A realization rate of 100% means that the logged hours equals the proposed hours. A realization rate less than 100% means that the logged hours were less than the proposed hours, while a rate greater than 100% means the logged hours were greater than the proposed. Table 68 shows the two sites that were logged.

Table 68. Light Logger Results

	Proposed Annual Hours	Annual Hours Logged	Realization Rate Hours
Site 1	6,240	6,115	98.00%
Site 2	8,760	8,760	100.00%
Average			**99.00%**

7.5.3.3.2 Verified Fixture Counts

- The fixture counts on the post-inspection request represented the as-built quantity. This was the basis for the verification of fixture counts.

- The fixture counts of the as-built of 899 fixtures for the three projects combined were verified to be correct.

7.5.3.3.3 Verified Fixture Wattage

Fixture wattages evolved through the course of the project as ballast technology changed. The fixture wattages were:

- Six-lamp T8 fixtures installed through mid-July 2005 were rated at 228.
- Six-lamp T8 fixtures installed after mid-July 2005 had fixture wattages of 206 watts (at 277 volts) or 210 watts (at 120 volts).

These reduced wattages were verified from General Electric's manufacturer's cut sheets for GE Ultramax T8 Ballast and lamps.

7.5.3.4 Results – Entire Project (77 sites)

This section presents the M&V results for the entire project. The results of the two interim reports were combined and evaluated.

Some of the key findings are:

- **Realization Rates for Interim 1:** The realization rates for Interim 1 is 91.95% for kWh savings and 94.32% for kW reduced. This means that the verified kWh savings were 91.95% of kWh savings reported through the as-built documentation.
    - Virtually all of the discrepancy in savings for Interim 1, approximately 700,000 kWh, is attributed to one site, where the basecase fixture was proposed as 400-watt metal halide; however, these fixtures were actually 250-watt metal halide, as verified during the on-site inspection.

- **Realization Rates for Interim 2:** The realization rates for Interim 2 are 100% for kWh savings and 101% for kW reduced (see table 2).
    - The kW reduced is high due to the new fixture wattage being proposed at 208-watts and was verified by manufacture's cut sheet and post-inspection to be 207-watts. In addition, Site 77 proposed 17 fixtures to be 400-watt metal halide bulbs, but they were actually 500-watt incandescent, as verified during the on-site inspection. This increased the kW reduced for Interim 2.

- **Hours of Operation:** The proposed hours of operation were verified through the confirmation of the schedule of the time clocks/EMS system, and through a verification of the reported hours of operation through the use of light loggers. The findings of the light loggers suggest that the reported hours of operation were not significantly different from verified (logger) hours at the 90% confidence level, and can be used for verified savings estimation calculations.

- **Quantity of Fixtures Retrofit:** The basis for the quantity of fixtures retrofit were post-inspection request forms submitted to KSI by the Project Sponsor. These forms included final as-built quantities and fixture wattages. Adjustments were made to fixture quantities due to fixture removal found during post-inspection by one site. Several other projects had fixture removal, but these were captured in the as-built. Several projects had fixture counts on the invoice that were different from the as-built and/or verified.

- **Fixture Wattages:** In general, reported pre-fixture wattages were verified to be consistent with the installed fixtures, However, there were two projects where some or all of the basecase fixtures retrofit were 250-watt metal halide instead of 400-watt metal halide; and where the retrofit fixtures were either 4-Lamp HO T8 (100w) or 4-Lamp HO T5 (234w).

In addition, ballasts installed after mid-July 2005 were newer models that were rated at lower wattage than prior models of ballasts. Fixture wattage was also dependent on the input voltage. These ballasts automatically sense the voltage and internally set themselves properly with no interaction from the technician. Based on KSI's experience it was estimated that approximately 80 to 90 percent of the high bay applications are 277 volts. A weighted average of the fixture wattages was taken to approximate the distribution of 277 and 120 volt facilities. It was assumed that 75 percent of the high bay facilities are 277 volts and 25 percent are 120 volts. The fixture wattages are 206-watts and 210-watts for 277 volts and 120 volts, respectively. The weighted average wattage used in the M&V was 207-watts.

Table 69. Summary of M&V for Interim Report 1, Project 04-02-003

	(Proposed) As-Built	Invoiced	Verified	Realization Rate[Note 1]
# Projects	74	74	74	
kW Reduced	1,554.89	n/a	1,498.62	96.38%
kWh Savings	8,654,422	8,650,025	8,109,548	93.75%
Note 1: (kW based on As-built documentation, kWh based on Invoiced)				

7.6 04-02-004 & 04-02-024 – Vending Misers

The 04-02-004 & 04-02-024 projects were combined in this report. The Project Sponsor installed energy efficiency measures on vending machines at schools in a School District, and facilities of a Municipality. Table 70 shows a summary of the M&V for this project.

Table 70. Verified Savings Summary - 04-02-004 & 04-02-024

	Contracted	Verified
Verified Realization Rate	N/A	1.00
Number of Vending Misers Installed	368	316
Gross Energy Savings Based on Deemed Values (kWh)	585,120 kWh	502,440 kWh
Verified Gross Energy Savings (kWh)	N/A	502,440 kWh
Gross Peak Demand Reduction (kW)	0 kW	0 kW
Gross Therm Savings	0 Therm	0 Therm
Incentive Amount	$54,011	TBD

7.6.1 Measurement and Verification (M&V) Approach

The M&V approach for each measure proposed in the project is summarized in this section

- Use results of San Diego Gas and Electric's (SDG&E's) pre-retrofit inspections to verify that Vending Misers were not installed at existing conditions.
- Perform post-retrofit inspections to verify installation of Vending Misers, the quantity of vending machines, type of vending machine (lighted/not lighted), and type of location installed.
- Develop an energy savings equation to estimate verified savings on the sample of machines that were post-inspected.
- Estimate a realization rate for the sample as a percent of the contracted savings for those machines.
- Apply the realization rate to the proposed savings of entire list of vending machines on which Vending Misers were installed as reported by Project Sponsor.

The load impact estimation methodology complies with IPMVP Option A.

7.6.2 Pre-Inspections

Due to project schedules KSI was not able to conduct pre-inspections of the vending machines. However, SDG&E staff conducted pre-inspections and verified that no Vending Misers were installed on any of the targeted machines.

7.6.3 Post-Installation Inspections

KSI conducted post-installation inspections on a sample of vending machines to verify the installation of the Vending Miser and to gather additional information to be used in the estimation of the energy savings. Among the data gathered were:

- Verify the installation of the Vending Miser
- Verify the operation of the Vending Miser where feasible
- Verify the type of vending machine, lighted or unlighted
- Note operation of lights, where applicable
- Note any unrefrigerated machines on which Vending Misers were installed

The post-inspection data were collected and entered into a spreadsheet for analysis.

Table 71 shows a summary of the implementation of the post-inspections conducted by KSI. The Project Sponsor reported the installation of a total of 316 Vending Misers, 280 at the School District and 36 at Municipality facilities. A total sample of 126 vending machines was inspected. Access could not be gained to three (3) machines. Two machines could not be found (matching serial/model numbers and location). The remaining 121 machines were surveyed. Of the 121 machines:

- Two (2) machines had no Vending Misers.
- Four (4) additional vending machines with Vending Misers were found during the post-inspection.

Table 71. Post-Inspection Sample

	School District	Municipality	Total
No of Sites	30	27	57
No. Site Sampled	10	12	22
No. Vending Misers Installed: As-Built	280	36	316
Sample Size	108	18	126
No Access During Post-Inspection	3	0	3
No Machine	2	0	2
No. Vending Machines Surveyed	103	18	121
Machines Available for Survey	103	18	121
No. of Verified Vending Misers Installed	101	18	119
No. of Vending Misers Not Installed	2	0	2
Installation Rate (%-installed)	98.1%	100.0%	98.3%
Additional Machine Found During Post-Insp	2	2	4
Adjusted Installation Rate (%-installed including additional machines found during post-inspection)	100.0%	111.1%	101.7%

The type of doors on vending machines is one factor in determining whether a machine was categorized as lighted or unlighted for the purpose of the calculating savings. There are two basic types of doors on vending machines:

- **Lens door.** A lens door has a plastic lens in front of a metal substructure. The lens is translucent and allows the backlight from long fluorescent lamps to light the front of the machine.
- **Solid.** These machines have solid metal doors and are considered unlighted. There may be a small lamp lighting the buttons, but not the long fluorescent tubes

Table 72 shows the types of doors found on the inspected vending machines. As can be seen approximately 40 percent of the vending machines have doors that are solid and are, therefore, unlighted.

Table 72. Verified Type of Door on Vending Machines

Customer	Type of Door	Verified Quantity	Percent
School District	Solid Door	45	42%
	Lens	58	54%
	Not Accessible	3	3%
	Machine Not Located	2	2%
	Subtotal	108	100%
Municipality	Solid Door	4	22%
	Lens	14	78%
	Not Accessible	0	0%
	Machine Not Located	0	0%
	Subtotal	18	100%
Total	Solid Door	49	39%
	Lens	72	57%
	Not Accessible	3	2%
	Machine Not Located	2	2%
	Total	126	100%

Table 73 shows the status of the installation of lights on vending machines as verified during the post-inspections. KSI did not attempt to open the machines to determine the presence of lights. The "*unknown*" category applies to machines with lenses where it could not be determined whether or not lights were installed. Thus, for the machines with lenses, if the lights were not on or did not turn on when the inspector approached the status of "*unknown*" was given. In the analysis machines in the *unknown* category were treated as unlighted, since the lights did not come on when the inspector was at the machine. Four machines with lenses had the lamps removed per a conversation with the principal of the school.

Table 73. Verified Installation of Lights on Vending Machines

Customer	Status Lights Installed	Verified Quantity	Percent
School District	Not Installed	38	35%
	Lights Installed	2	2%
	Unknown	63	58%
	Not Accessible	3	3%
	Machine Not Installed	2	2%
	Subtotal	108	100%
Municipality	Not Installed	5	28%
	Lights Installed	9	50%
	Unknown	4	22%
	Not Accessible	0	0%
	Machine Not Installed	0	0%
	Subtotal	18	100%
Total	Not Installed	43	34%
	Lights Installed	11	9%
	Unknown	67	53%
	Not Accessible	3	2%
	Machine Not Installed	2	2%
	Total	126	100%

During the post-inspection the status of the lights of the vending machine was observed when the inspector was in front of the machine. Table 74 these results. Almost no lights were turned on in vending machines inspected at the schools. M&V staff received an e-mail from the school district confirming that the lights are used during the normal school year, especially during periods when there is a need to increase sales. It was estimated by the Project Sponsor, the school district, and the retail operator of the machines, that the lights of approximately 50% of the machines that have lights are turned on at any given time during the school year.

Table 74. Lights On or Off During Post-Inspection

Customer	Lights On or Off	Verified Quantity	Percent
School District	Off	67	62%
	On	2	2%
	Solid door, no lights	34	31%
	Not Accessible	3	3%
	Machine Not Installed	2	2%
	Subtotal	108	100%
Municipality	Off	5	28%
	On	9	50%
	Solid door, no lights	4	22%
	Not Accessible	0	0%
	Machine Not Installed	0	0%
	Subtotal	18	100%
Total	On	72	57%
	Off	11	9%
	Solid door, no lights	38	30%
	Not Accessible	3	2%
	Machine Not Installed	2	2%
	Total	126	100%

Table 75 shows the installation of Vending Misers. The table shows that over 94% of reported Vending Misers were installed, however, when accounting for the machines with no access the installation rate increased to 98% (118 installed of 121 inspected).

During the post-inspections a total of five vending machines with Vending Misers that were not on the installation list provided by Project Sponsor were located. To account for the energy savings attributed to these additional units an implementation rate of 100% will be used.

Table 75. Installation of Vending Misers

Customer	Status	Verified Quantity	Percent
School District	Vending Miser Installed	101	94%
	Not Installed	2	2%
	Not Accessible	3	3%
	Machine Not Installed	2	2%
	Subtotal	108	100%
Municipality	Vending Miser Installed	18	100%
	Not Installed	0	0%
	Not Accessible	0	0%
	Machine Not Installed	0	0%
	Subtotal	18	100%
Total	Vending Miser Installed	119	94%
	Not Installed	2	2%
	Not Accessible	3	2%
	Machine Not Installed	2	2%
	Total	126	100%
Additional Vending Machines with Vending Misers	School District	2	
	Municipality	2	
	Total	4	

7.6.4 Energy Savings Calculation

This section describes the energy savings calculation and the values used as inputs to the equation.

7.6.4.1 Contracted Energy Savings

Ex ante savings estimates proposed by the Project Sponsor and used in the program contract were based on the deemed savings value from the Statewide Express Efficiency Program. The deemed value is 1,590 kWh saved per Vending Miser installed. The total contracted savings are shown in Table 76.

Table 76. Vending Miser, Contracted Energy Savings

	Quantity	Savings per Vending Miser	Annual kWh Savings
School District	328	1,590	521,520
Municipality	40	1,590	63,600
Total	368		585,120

7.6.4.2 Verified Energy Savings Equation and Inputs

The project proposal and its supporting documentation did not provide energy usage calculations for the base case nor efficient case, only savings based on deemed savings and the projected number of units installed.

Some operational conditions were observed that impacted the base case for vending machines.

- **Lighted and Unlighted Vending Machines:** A number of vending machines were observed that were either not equipped with lights as purchased from the manufacturer, or the lights were deactivated, i.e., they would never turn on.
- **California Standards on Vending Machine Lighting:** California has appliance standards, *Appliance Efficiency Regulations, California Code of Regulations, Title 20: Division 2, Chapter 4, Article 4, Sections 1601-1608* (*"Title 20 Standards"*), effective August 19, 2003, for vending machine lighting. These standards require vending machines to have T8 and electronic ballasts, or have lumen per watt characteristics no less than that for T8 and electronic ballasts.

7.6.4.2.1 Basecase and Savings Equations

The basic energy savings equation was used to estimate the energy savings resulting from the installation of Vending Misers is:

$$\text{kWh Savings} = \sum_{\text{t=lighting, unlighted}} \left(\text{kW}_\text{t} \times \text{operating hours} \times \text{\% - Savings}\right) \times \text{n}_\text{t},$$

where,

kWh Savings = Total kWh Savings for Project,

t = Type of vending machine, either lighted or unlighted,

kW_t = Average kW for machine type *t*,

Operating hours = 8,760 hours per year,

% - Savings = Percent savings from installation of Vending Miser,

n_t = Number of type *t* vending machines with Vending Miser Installed

7.6.4.2.2 Average Wattage of Vending Machine

The average wattage of lighted vending machines of 400 watts has been widely accepted. A number of studies show average wattage figures that hover around 400 watts.

The average wattage of lighting fixtures in vending machines is dependent on the vintage of the machine. The *2003 Title 20 Standards* require the installation of T8 and electronic ballasts. Discussions with several vending machine manufacturers revealed that T8 lights are, in fact, installed, and that T8's have been installed for three to four years. Prior to that it was common for T12 HO lamps ranging from 5-feet to 7-feet in length were installed in vending machines. Table 77 shows the type and wattage of lighting that has been installed per discussions with manufacturers.

During post-inspections and discussions with manufacturers KSI determined that most of the machines were fairly recent in vintage, thus, most lighting equipment would be T8 with electronic ballasts. We assumed that 75% of the vending machines had T8 lighting, while 25% had T12 lighting. This produced a weighted average lighting wattage of 99.75 watts per machine.

Table 77. Lighting Wattages For Vending Machines

Lighting Description	Wattage
2L 5-ft F64 T12HO 80W Std Ballast	180
2L 6-ft F72 T12HO 85W Std Ballast	220
2L 5-ft F40 T8 40W Elec. Ballast	73
Weighted average wattage of lights, assuming 75% with T8 and 25% with 5-ft T12	99.75

Table 78 shows the average wattage of the vending machines used in the energy savings calculations. As discussed in Section 5, the school district, implementer and retail operator concurred that approximately 50% of the machines with lights will have the lights turned on during the course of a school year. To account for this diversity the weighted average wattage of lights was multiplied by 0.50 to provide a diversified average lighting wattage estimate.

Table 78. Average Wattage of Vending Machine

Vending Machine Description	Wattage
Vending machine with operating lights	400
Vending machine with deactivated lights: schools	350
Vending machine with deactivated lights: non-schools	300
Vending machine - unlighted	300

7.6.4.2.3 Percent-Savings From Vending Misers

Numerous studies have been conducted to determine the savings and %-savings from Vending Misers. Many of these studies used low sample sizes and very short term measurement periods. Several such studies were conducted on college campuses by engineering students. Another study conducted by Quantec (*"Evaluation of the LiteVend Program,"* Quantec LLC for Ecos Consulting, June 30, 2004) concluded that its monitoring of 15 vending machines with Vending Misers produced savings estimates that were unrealistically high. The study authors corroborated this with BayView Technologies, who indicated the maximum possible savings under ideal conditions is 50 to 56%.

The %-savings associated with the deemed savings (1,590 kWh) used to prepare the contracted savings is 45.4% was based on the deemed value from the Express Efficiency Program. This value was used for vending machines at Municipality-owned facilities.

The %-savings is impacted by the occupancy of the facility. The lower the occupancy, the higher the %-savings, since the vending machine lights and refrigeration are shut down more frequently. The School District identified five schools where summer school is conducted, as shown in Table 79. The remaining schools have traditional schedules with limited non-school activities. Based on this information and other information provided by the manufacturer of VendingMiser it was determined that the short schedule of the schools under a traditional schedule should be attributed with a %-savings of 56%, while those with the summer sessions with a %-savings of 45.4%. These values were applied to the as-built listing of VendingMisers for the school district to estimate an average %-savings for schools of 54%. This value was used to estimate the realization rate of energy savings for schools that were post-inspected. Table 80 shows the percent savings by facility type.

Table 79. Schools With Summer School Sessions

Site #	# of Machines
S-3	5
S-11	12
S-14	16
S-22	4
S-26	15
Total	**52**

Table 80. %-Savings By Facility Type

Facility	%-Savings
Municipality	54.0%
Schools without summer school	56.0%
Schools with summer school	45.4%
Average for schools	54.0%

7.6.4.2.4 Operating Hours

The operating hours for the vending machines is assumed to be 8,760 hours per year.

7.6.4.2.5 Installations Reported

The Project Sponsor reported installing the total Vending Misers shown in Table 81.

Table 81. Summary of Vending Miser Installations, Through July 15, 2005

Customer	Contracted	Installed
School District	328	280
Municipality	40	36
Total	368	316

7.6.5 Verified Savings Estimates

This section presents the verified savings estimates for the installation of Vending Misers on vending machines at facilities of the School District and the Municipality. The energy savings calculation described in Section 7.6.4 was used to estimate verified energy savings for machines that were in the sample that were post-inspected. A realization rate was estimated by comparing the verified energy savings with the projected savings for those machines in the

sample. The realization rate was applied to the projected savings for all machines the Project Sponsor installed Vending Misers for the total verified kWh savings for the project.

Table 82 shows the estimation of the realization rate. The data collected during the post-inspection was used to determine the base case kW for each machine in the sample. A detailed table showing the results of the post-inspection is shown in Table 84. The realization rate of 104% is slightly higher than 100% due to the higher %-savings values used for all facilities except for schools on a normal school schedule. The small size of this project did not support monitoring. A prior study (Quantec, 2004, Evaluation of the LiteVend Program) yielded poor monitoring results for a significantly larger scale number of installations, and other studies, typically performed by a university's engineering school, yielded widely variable results due to low sample sizes. Due to the uncertainty associated with the %-savings value a realization rate of 100% will be used to estimate verified savings.

There is no kW reduction nor therm savings associated with this project.

Table 82. Realization Rate Estimate - Vending Miser

Total Verified Savings for Sample	200,630 kWh
Total Proposed Savings for Sample (1,590 kWh per machine)	192,390 kWh
Verified Realization Rate	104%

Table 83 shows the verified kWh savings estimates for Vending Miser Retrofit project.

Table 83. Verified KWh Savings Estimate - Vending Miser Retrofit

Proposed kWh Savings (based on 368 proposed Vending Miser installations)	
Contracted Quantity	368 Vending Misers
Proposed Unit Savings per Vending Miser	1,590 kWh per year per Vending Miser
Contracted Annual kWh Savings	585,120 kWh per year
Verified kWh Savings (based on 316 verified Vending Miser installations)	
Installed Quantity	
School District	280 Vending Misers
Municipality	36 Vending Misers
Total	316 Vending Misers
Total Savings Based on Proposed Unit Savings	502,440 kWh per year
Verified Realization Rate	100%
Total Verified kWh Savings	502,440 kWh per year

Table 84. Verified Savings Calculations - Sample

Site ID	Make_Model	Door Type	Lights Installed	Lights On / Off	VM Installed	Deduct W if No Lites	Verified W / HR	Op. Hrs	Base kWh/YR	Avg. % Savings	Verified kWh Savings /YR	Deemed kWh Savings/YR
M-2	5409325	Lens	Yes	On	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
M-3	5213525	Solid	No		Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
M-5	608218	Lens	Unknown	Off	Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
M-7	5432754	Lens	Yes	On	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
M-7	5432792	Lens	Yes	On	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
M-7	5238770	Lens	Unknown	Off	Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
M-8	5237451	Lens	Yes	On	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
M-10	5432631	Lens	Yes	On	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
M-12	5432828	Lens	Yes	On	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
M-12	5228458	Lens	Yes	On	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
M-12	5408827	Lens	Yes	On	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
M-12	5228457	Lens	Yes	On	Yes		400.00	8,760	3,504.00	54%	1,892	1,590
M-14	5237662	Solid	No		Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
M-18	5421721	Lens	Unknown	Off	Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590

Table 84. Verified Savings Calculations - Sample (con't)

Site ID	Make_Model	Door Type	Lights Installed	Lights On / Off	VM Installed	Deduct W if No Lites	Verified W / HR	Op. Hrs	Base kWh/YR	Avg. % Savings	Verified kWh Savings /YR	Deemed kWh Savings/YR
M-19	5300519	Lens	Unknown	Off	Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
M-20	5253080	Lens	No	Off	Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
M-23	5270957	Solid	No		Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
M-23	5270956	Solid	No		Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
S-1	VN601MC	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-1	VN601MC	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-1	VN601MC	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-1	VN601MC	Solid	No		Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
S-1	VN601MC	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-1	VN601MC	Solid	No		Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
S-1	VN601 Robo Door	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-1	VN601 Robo Door	Solid	No		Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
S-1	VN511	Lens	Yes	On	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-1	VN601MC	No Machine	No Machine	No Machine	No						0	
S-1	VN601MC	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-1	V Max 840	Solid	No		Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
S-1	V Max 840 Robo Door	Solid	No		Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
S-1	V Max 840	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-1	V Max 840	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-1	V Max 840	Solid	No		Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
S-1	V Max 840	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-1	V Max 840 Robo Door	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-1	V Max 840 Robo Door	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-1	V Max 840 Robo Door	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-1	V Max 840	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-2	DNCB440M (85)	No Access	No Access	No Access	No Access							
S-2	DNCB600E	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-2	VN511	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-2	VN601MC	Solid	No		Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
S-2	VN601MC	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-2	VN601MC	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-2	VN601MC	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-2	VN601MC	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-2	VN601MC	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-2	VN601 Robo Door	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-2	VN601MC	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-2		Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-6	V Max 840	No Machine	No Machine	No Machine	No							
S-6	V Max 840	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-6	V Max 840	Solid	No		Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
S-6	V Max 840	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-6	V Max 840	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-6	V Max 840	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-6	V Max 840	Solid	No		No	99.75	300.25	8,760	2,630.19	0%	0	1,590
S-6	V Max 840	Solid	No		No	99.75	300.25	8,760	2,630.19	0%	0	1,590
S-6	V Max 840	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-6	V Max 840	Solid	No		Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590

Table 84. Verified Savings Calculations - Sample (con't)

Site ID	Make_Model	Door Type	Lights Installed	Lights On / Off	VM Installed	Deduct W if No Lites	Verified W / HR	Op. Hrs	Base kWh/YR	Avg. % Savings	Verified kWh Savings /YR	Deemed kWh Savings/YR
S-6	V Max 840 Robo Door	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-6	V Max 840 Robo Door	Solid	Unknown	Off	Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
S-6	V Max 840 Robo Door	Solid	Unknown	Off	Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
S-6	V Max 840 Robo Door	Solid	Unknown	Off	Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
S-6	V Max 840 Robo Door	Solid	Unknown	Off	Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
S-6	V Max 840 Robo Door	Solid	Unknown	Off	Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
S-6	V Max 840 Robo Door	Solid	Unknown	Off	Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
S-6	V Max 840 Robo Door	Solid	Unknown	Off	Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
S-6	V Max 840 Robo Door	Solid	Unknown	Off	Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
S-6	V Max 840 Robo Door	Solid	Unknown	Off	Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
S-6	V Max 840 Robo Door	Solid	Unknown	Off	Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
S-6	V Max 840 Robo Door	Solid	Unknown	Off	Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
S-9	AQUAFINA MACHINE	Lens	No	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-9	AQUAFINA MACHINE	Lens	No	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-9	GATORADE MACHINE	Lens	No	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-9	GATORADE MACHINE	Lens	No	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-12	VN392 (89)	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-12	V Max 840	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-12	V Max 840 Expanded Upgrade	No Access	No Access	No Access	No Access							
S-13	V Max 540	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-15	V Max 840 Robo Door	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-15	V Max 840	Solid	No		Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
S-15	V Max 840 Robo Door	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-15	Mini V Max 576	No Access	No Access	No Access	No Access							
S-15		Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-15		Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-17	VN601MC	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-17	VN601MC	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-17	VN601MC	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-17	VN601MC	Solid	No		Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
S-17	VN601MC	Solid	No		Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
S-17	VN601MC	Solid	No		Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
S-17	VN601MC	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-17	VN601MC	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-17	VN601MC	Solid	No		Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
S-17	VN601MC	Solid	No		Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
S-17	VN601MC	Solid	No		Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590

Table 84. Verified Savings Calculations - Sample (con't)

Site ID	Make_Model	Door Type	Lights Installed	Lights On / Off	VM Installed	Deduct W if No Lites	Verified W / HR	Op. Hrs	Base kWh/YR	Avg. % Savings	Verified kWh Savings /YR	Deemed kWh Savings/YR
S-17	V Max 720	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-17	V Max 720	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-17	V Max 840	Solid	No		Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
S-17	V Max 840	Solid	No		Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
S-17	V Max 840	Solid	No		Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
S-17	V Max 840	Solid	No		Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
S-17	V Max 840	Solid	No		Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
S-19	V570P Robo Door	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-19	V570P Robo Door	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-23	VN601MC	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-23	VN601MC	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-23	V Max 840	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-23	V Max 840	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-23	V Max 840	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-23	V Max 840	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-23	V407	Lens	Unknown	Off	Yes	0.00	400.00	8,760	3,504.00	54%	1,892	1,590
S-25	VN392	Lens	Yes	On	Yes		400.00	8,760	3,504.00	54%	1,892	1,590
S-25	VN324 (89)	Solid	No		Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
S-25	VN601 Robo Door	Solid	No		Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
S-25	VN601 Robo Door	Solid	No		Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
S-25	VN601MC	Solid	No		Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
S-25	VN601 Robo Door	Solid	No		Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
S-25	V Max 840	Solid	No		Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
S-25	V Max 840 Robo Door	Solid	No		Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
S-25	V Max 840 Robo Door	Solid	No		Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
S-25	V Max 840 Robo Door	Solid	No		Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
S-25	V Max 840 Robo Door	Solid	No		Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
S-25	V Max 840 Robo Door	Solid	No		Yes	99.75	300.25	8,760	2,630.19	54%	1,420	1,590
											200,630	**192,390**
		108	**108**	**108**	**108**							**1.04**

7.7 04-02-007 – Lighting and HVAC System Upgrades For a Single School District

This was a self-M&V. The results were reviewed by KSI and found to be credible.

7.7.1 Executive Summary

In May of 2005 the Project Sponsor completed an energy retrofit for the Customer which included the installation of ninety seven new AC units and a lighting retrofit at schools in the Customer's district. The project was completed to support the Customer in meeting its goals to decrease utility and maintenance costs, improve its learning environment through improved environmental comfort and indoor air quality, and to optimize its heating, ventilating, and air conditioning (HVAC) systems for improved efficiency and operating life.

This project has been submitted to the 2004 Energy Savings Bid program, administered by SDG&E. This program provides incentives to SDG&E customers to motivate the implementation of energy efficiency projects. This program requires the measurement and verification of energy savings achieved. This report presents the results of the measurement and verification effort for this project.

The project consists of two primary facility improvement measures (FIMs) that are summarized below:

- Lighting Retrofit: Replace the existing inefficient fluorescent T-12 lighting fixtures with more efficient T-8 fixtures.
- Packaged Heat Pump Replacement: Replace inefficient packaged air conditioning units with new higher efficiency units and add new programmable thermostats with 2-hr bypass capability.

Table 85 presents the summarized energy savings for each measure.

The load impact estimation methodology complies with IPMVP Option B.

Table 85. FIM Energy Savings

Facility Improvement Measure (FIM)	Energy (kWh)	Demand (kW)	Natural Gas Energy (Therms)
Lighting Retrofit	390,631	184.3	0
Packaged AC Retrofit	152,713	76.35	0
Total	**543,344**	**260.65**	**0**

7.7.2 Project Overview

7.7.2.1 General Facility Description

The Customer has a student population of 27,045 and twenty-four (24) separate school sites that include two (2) high schools, four (4) middle schools, fourteen (14) elementary schools and eight (8) other academies and special purpose schools.

The sites vary from older schools built in the 1980's to schools less than ten years old. Building construction is a mix of permanent classrooms, libraries, and multi-purpose and administration buildings with numerous 24'x40' portable classrooms. An extensive site audit identified 271 permanent structure classrooms and 336 portable classrooms that all have three to four-ton package heat pumps for space conditioning.

The majority of the package heat pump systems are 1992 or older and are in poor condition. Two hundred and eight portable classrooms were found to be equipped with T-12 lighting with magnetic ballasts.

7.7.2.2 Packaged Air Conditioning Systems

A majority of the schools are conditioned by 3 to 4-ton package and split system heat pumps. A typical packaged split system or heat pump serving a permanent or portable classroom was installed in 1992 or earlier, has only minimum outside dampers and are in poor condition.

The units are controlled by wall mounted thermostats which are enabled and disabled by a central control system on a fixed schedule of 6:00 a.m. to 5:00 p.m. The systems operate to maintain a fixed temperature set point set manually by the thermostat.

7.7.2.3 Lighting Systems

The lighting system is generally in good condition and is predominately comprised of 4' 2-lamp 3-lamp, and 4-lamp fluorescent fixtures with T-12 lamps and magnetic ballasts. Wall-mounted switches (Title 24 compliant) typically control the lighting.

7.7.2.4 Project Schedule

In July 2004, the Customer authorized the Project Sponsor to conduct an audit which resulted in a scope for the proposed energy retrofit project. The major portion of the project construction took place between August 2004 and May 2005.

7.7.3 Facility Improvement Measures (FIM)

Based on our experience in developing and implementing energy efficiency programs with various types of facilities nationwide, the following Facility Improvement Measures (FIM) were identified during our audit.

7.7.3.1 FIM 1 – Lighting Upgrade

7.7.3.1.1 Existing Conditions

Approximately 70% of the Customer's existing lighting system consists of efficient T-8 lighting fixtures with electronic ballasts. The remaining portions of the Customer's facilities (mostly portable classrooms) had inefficient T-12 lighting.

Figure 8. Typical 2 foot by 2 foot T-12 U-Tube fixture

7.7.3.1.2 Completed Modifications

1. Retrofit all existing T-12 fluorescent fixtures with more efficient T-8 fixtures equipped with electronic ballasts and high efficiency reflectors.

2. Replace incandescent lighting fixtures with more efficient compact fluorescent fixtures and with Halogen PAR lamps (select areas).

7.7.3.1.3 Benefits

The comprehensive lighting upgrade has been found to reduce lighting electrical load by 390,631 kWh per year and the building's cooling load by approximately 58,703 ton-hours per year, resulting in an annual avoided cost of approximately $58,594 at an average cost of $0.15/kWh.

7.7.3.2 FIM 2 – Packaged / Split Air Conditioning Unit Replacement

7.7.3.2.1 Existing Conditions

An audit of all the Customer's school sites identified over three hundred small 3 to 4 Ton package heat pump and split air conditioning units that were in poor condition and were past their useful life. These units have low efficiencies (SEER 7.2 to 9.0), minimum outside air make-up and require excessive maintenance.

Figure 9. Old and New Units During Installation

7.7.3.2.2 Proposed Modifications

1. Replace the condensing units and 'A' type cooling coils located in the cooling cabinet with new, high efficiency (SEER 12) split air conditioning units for forty-five (42) permanent classrooms at the Bobier and Beaumont elementary schools.

2. Replace existing wall hung, package heat pump on forty-four (54) temporary class rooms at several elementary schools. The new units will have SEER 12 efficiency, full economizer sections for maximum outside air (free cooling) capability and exceed current title 24 energy efficiency requirements.

3. Each of (97 total) classrooms with upgrade heat pump and split air conditioning units will include new Totaline model CPV230 programmable thermostats with an override button providing 2 hours of air conditioning on a demand from the teacher.

These upgrades will provide a good start to the Customer's HVAC equipment upgrade program by replacing some of the oldest and least reliable air conditioning units.

7.7.3.2.3 Expected Benefits

The result of replacing ninety-seven of the oldest, least efficient heat pumps and split air conditioning units will significantly improve levels of service in classrooms retrofit with new equipment while providing annual electric savings. Installation of the new programmable thermostats with integrated bypass timer control will significantly reduce equipment run times.

Operational savings by replacing equipment that is operating past their useful life will be significant.

7.7.4 Energy Savings Analysis

7.7.4.1 Air Conditioning Unit Savings Analysis

7.7.4.1.1 General

Expected energy savings for new packaged HVAC units will be due to increased unit efficiency (12 vs. 8.5 and below) and reduced equipment run times (use of Totaline T-stats with override buttons). Based on conversations with SDG&E, energy savings for retrofit high efficiency air conditioning units has been calculated using measured baseline energy consumption collected for similar systems and classrooms. Post-retrofit energy use has been determined by monitoring power consumption of representative systems at the three school sites. Energy savings are calculated as the difference between baseline and measured post-retrofit energy use.

Measured post-retrofit data for each system type (Split AC, Heat Pump) was collected over a period of 2 - 3 months using portable data loggers. This measured data was used to characterize daily energy consumption vs. average dry bulb temperature. These curves of post-retrofit consumption vs. ambient weather were used with a five years of average daily weather data to extrapolate a full year of operation. Predicted post-retrofit annual energy use is based on scheduled school occupancy and weather data.

Baseline energy use for each system is calculated using measured power data for typical 3.0 - 4.0 ton packaged air conditioners serving similar elementary school classrooms in San Diego's coastal north county. Measured unit power data was used to calculate the annual equivalent full load hours of operation for units serving 800 to 1000 square foot elementary classrooms. The ge of the existing equipment replaced as a part of this project ranged between 10 and 30 years. When these systems were new their efficiency rating was 9.0 EER. Therefore, an energy efficiency rating of 8.5 EER is a conservative estimate of the actual unit efficiencies for the purpose of calculating baseline system energy use.

7.7.4.1.2 Site Data Collection

7.7.4.1.2.1 Dates and Times of Data Collected

Table 86 provides an overview of the dates, times, location and metering equipment installed to collect savings verification data.

Baseline monitoring data was collected at one school between 9/21/05 and 11/17/05. During this period, seven classrooms served by packaged rooftop A/C units similar to those replaced in this project were monitored. All units were enabled to operate under thermostat control during school hours. These data showed the average annual equivalent full load hours for the seven classrooms to be equal to 707 hours per year as calculated by the following formula:

$$\text{Equivlent Full Load Hour} = \frac{\sum(\text{AC\_Unit} \times \text{AC\_Unit\_kW})}{\text{AC\_Unit\_kW}} \times \frac{8760}{\text{Monitored\_Hours}}$$

The above performance data was collected during two in-session months. As the elementary school schedule shows the schools in session 9 of 12 months per year, the baseline annual equivalent full load hours are as follows:

Baseline Equivalent Hours of Operation = 707 hrs/yr * 9 / 12 = 530.25 hrs/yr

Table 86. Data Logger Field Installation Record

Site ID	Room	Measurement	Sample Interval	HOBO Logger Model	Logger Serial #	Meter Description	Date Installed	Date Removed
Site 01	28	Light on/off	Status	H06-002-02	478925	Light	4/15/2005	6/10/2005
Site 02	16	Light on/off	Status	H06-002-02	802411	Light	4/22/2005	6/10/2005
Site 03	310	Amps	5 Minutes	H08-006-04	804584	CT-B CT-B Amp	3/31/2005	6/10/2005
Site 03	310	Light on/off	Status	H06-002-02	802418	Light	3/31/2005	6/10/2005
Site 03	310	Light on/off	Status	H06-002-02	802414	Light	3/31/2005	6/10/2005
Site 03	310	Temp/RH%	5 Minutes	H06-002-02	852119	Light	3/31/2005	6/10/2005
Site 03	305	Amps	5 Minutes	H08-006-04	804583	CT-A CT-A Amp	3/31/2005	6/10/2005
Site 03	106	Light on/off	Status	H06-002-02	843083	Light	3/31/2005	6/10/2005
Site 03	501	Amps	5 Minutes	H08-006-04	822616	CT-A CT-A Amp	4/14/2005	6/10/2005
Site 03	Admin	Amps	5 Minutes	H08-006-04	498303	CT-A CT-A Amp	4/14/2005	6/10/2005
Site 04	12	Light on/off	Status	H06-002-02	478924	Light	4/5/2005	6/10/2005
Site 04	12	Amps	5 Minutes	H08-008-04	804580	CT-A CT-A Amp	4/5/2005	6/10/2005
Site 04	AM/PM(old)	Amps	5 Minutes	H08-006-04	498304	CT-A CT-A Amp	4/5/2005	4/12/2005
Site 04	AM/PM	Light on/off	Status	H06-002-02	802412	Light	4/5/2005	6/10/2005
Site 04	24	Amps	5 Minutes	H08-006-04	498302	CT-A CT-A Amp	4/5/2005	6/10/2005
Site 04	AM/PM(new)	Amps	5 Minutes	H08-006-04	498304	CT-A CT-A Amp	4/14/2005	6/10/2005
Site 04	17	Amps	5 Minutes	H08-006-04	790781	CT-A CT-A Amp	4/14/2005	6/10/2005
Site 05	14	Light on/off	Status	H06-002-02	478922	Light	4/15/2005	6/10/2005
Site 06	AM/PM	Light on/off	Status	H06-002-02	843082	Light	4/15/2005	6/10/2005
Site 07	704	Light on/off	Status	H06-002-02	478923	Light	4/22/2005	6/10/2005
Site 08	AM/PM	Light on/off	Status		802416	Light	4/22/2005	6/10/2005
Site 09	AM/PM	Light on/off	Status	H06-002-02	802417	Light	4/15/2005	6/10/2005
Site 10	AM/PM	Light on/off	Status	H06-002-02	843077	Light	4/22/2005	6/10/2005
Site 11	602	Light on/off	Status	H06-002-02	843078	Light	4/6/2005	6/10/2005
Site 11	602	Amps	5 Minutes	H08-006-04	790782	CT-A CT-A Amp	4/6/2005	6/10/2005
Site 11	300	Amps	5 Minutes	H08-006-04	822619	CT-A CT-A Amp	4/6/2005	6/10/2005
Site 12	503	Light on/off	Status	H06-002-02	802415	Light	4/22/2005	6/10/2005
Site 13	K2	Light on/off	Status	H06-002-02	843079	Light	4/6/2006	6/10/2005
Site 13	K2	Amps	5 Minutes	H08-008-04	804581	CT-A CT-A Amp	4/6/2005	6/10/2005
Site 13	12	Amps	5 Minutes	H08-006-04	790780	CT-A CT-A Amp	4/6/2005	6/10/2005
Site 14	311	Light on/off	Status	H06-002-02	802420	Light	4/6/2005	6/10/2005
Site 14	311	Amps	5 Minutes	H08-006-04	822618	CT-A CT-A Amp	4/6/2005	6/10/2005
Site 14	104	Amps	5 Minutes	H08-006-04	822617	CT-A CT-A Amp	4/6/2005	6/10/2005
Site 15	802	Light on/off	Status	H06-002-02	843080	Light	4/22/2005	6/10/2005
Site 16	822	Light on/off	Status	H06-002-02	843076	Light	4/22/2005	6/10/2005
Site 17	G12	Light on/off	Status	H06-002-02	843075	Light	4/15/2005	6/10/2005
Site 18	500	Light on/off	Status	H06-002-02	478916	Light	4/15/2005	6/10/2005
Site 19	200	Light on/off	Status	H06-002-02	843081	Light	4/22/2005	6/10/2005
Site 20	V26	Light on/off	Status	H06-002-02	802413	Light	4/15/2005	6/10/2005
Site 21	Library	Light on/off	Status	H06-002-02	478921	Light	4/22/2005	6/10/2005

7.7.4.1.2.2 Data Collection Interval

The sample interval used to collect performance data, including unit amperage and ambient weather conditions, on packaged split-DX condensing units and heat pump systems was 5minutes.

Data collected using HOBO H6 Light ON/OFF loggers reflect an internal sample rate of 0.5s. The monitoring device records the date and time of each change of state and the state to which the device changed.

7.7.4.1.2.3 Equipment Used to Collect Data

Performance data was collected using HOBO state and amperage loggers from Onset Computer Corporation. Model and serial numbers of the loggers used are provided in a table located in Table 86.

7.7.4.1.3 System Types – Split-DX Cooling: Heat Pumps

7.7.4.1.3.1 Split-DX

This project included the replacement of split-DX air conditioners installed on permanent classroom buildings with gas heating. Condensing units and associated electrical disconnects were installed on built up platforms secured to roof structures. Refrigerant lines and “A” shaped coils were installed in supply air ductwork above existing furnace units for each classroom.

7.7.4.1.3.2 Heat Pump

Heat pumps retrofit under this project were primarily wall mounted units serving portable classrooms. These units were configured both with and without supply air duct work.

7.7.4.1.4 System Operational Characterization vs. Measured Weather

Measured performance data from a 2 to 3 month performance period was used to determine curves of total DAILY kWh energy use for each system type vs. average daily ambient dry bulb temperature. Data collected from all equipment of similar system type (split-DX, Heat Pump) was used to develop curves of energy use per day based versus daily average ambient dry bulb temperature for each system type.

It was very difficult to distinguish energy consumption results for systems of different capacity. The reasons for this are related to the limited variation in equipment type and capacity (3, 3.5, 5

tons) and between due to the influence of factors such as operating hours and room temperature settings. In addition, the performance data for these systems was collected after the installation of the project which included the installation of new thermostats with a push button override feature which requires teachers to push a button to activate the a/c unit during occupied hours. In this way, the units will operate only when the classroom is occupied and there is a need for either heating or cooling as felt by the classroom occupants.

As a result, data collected on all equipment of a similar design were used together to prepare characteristic curves of energy use patterns vs. ambient weather data.

7.7.4.1.5 Occupancy Schedules

Definition of days of school occupancy is based on published school calendar for the 2006 school year.

7.7.4.1.6 Extrapolation of Weather Characterization to Annual Performance with Historical Weather Data

Measured performance curves showing total daily energy use vs. ambient dry bulb temperature were developed using 5-minute measurement data. These performance curves were seen as reflective of occupied school usage patterns. Therefore on non-occupied days the energy consumption would be zero.

The performance curves together with average daily weather data and school occupancy data could then be used to calculate an annualized energy use for each retrofitted system.

7.7.4.1.6.1 Weather Site Used

Average annual weather data was obtained at the following URL:

http://www.ipm.ucdavis.edu/WEATHER/wxretrieve.html

7.7.4.1.6.2 Span of Years Used to Define Average Weather Condition

Five year of average weather data was used to develop a “typical” weather year. The years of weather used to develop the average year of weather included the five years starting 1999 and ending 2004.

7.7.4.1.7 Application of Baseline vs. New Performance Parameters

As air conditioning equipment ages its efficiency declines. Many of the units replaced in this project were 20 to 30 years in age. The air conditioning systems replaced in this project generally were rated with an energy efficiency ratio (EER) of 9.

7.7.4.2 Lighting Savings Analysis

Lighting savings were calculated based on the following as given in the measurement and verification plan:

- The pre-retrofit power (PL1) for each fixture will be the manufacturer's stated value.
- The post-retrofit power (PL2) for each monitored fixture will be the manufacturer's stated value.
- The annual energy savings for each monitored fixture will be calculated using the difference of the pre and post retrofit power, multiplied by the post-retrofit hours of operation. The annual post-retrofit hours (TL-pr) of operation for each unit will be determined by summing the hours of operation during the monitoring period (TL-m) and extrapolating that data to create a typical year of operation. The calculation is represented by the following formula:

  Lighting Fixture Energy Savings (kWh) = (PL1 - PL2)* TL-pr

The lighting energy savings for each school was determined by multiplying the annual savings for the monitored fixture(s) by the total number of fixtures at that school.

School Lighting Savings (kWh) = Lighting Fixture Savings * Total Number of Fixtures

7.8 04-02-008 – HVAC Central Plant and Compressed Air Improvements

This was a self-M&V. The results were reviewed by KSI and found to be credible.

The project's primary objective was to upgrade aging mechanical, electrical, and control systems with new and energy efficient systems that will support the Customer's goals to decrease utility and maintenance costs, improve its working environment and to optimize its Heating, Ventilating and Air Conditioning (HVAC) systems for improved efficiency and extended operating life.

Energy efficiency measures summarized in this report were installed and commissioned in the Summer and Fall of 2005. These measures included the following:

B 250

- Retrofit 80 ton air cooled chiller with new Turbocor compressor and chiller controls.
- Reconfigure primary constant volume chilled water system from series to parallel operation.

B 469

- Install two new 120-ton high efficiency water chillers with two (2) new OEM Turbocor based chillers from McQuay and convert chilled water system from constant volume primary to variable volume primary/secondary design.
- Renew controls on thirteen (13) air handling units with variable speed motor drives, two-way DDC
- Convert primary/secondary/tertiary constant volume heating hot water system to variable volume primary/secondary design.

B 35, 65, 94, 249, 250, 306, 378, 379, 458, 460, 463, 464-468 and 472

- Install new compressed air fixtures and fittings to eliminate leaks.
- Install new compressed air isolation valves and controls and integrate into the Customer's building automation system (BAS) system.

Table 87. Energy Savings Results

		Energy Savings		
Location	**Measure**	**kW**	**kWh**	**Therms**
250	Air Cooled Chiller Retrofit	15.7	140,304	0
469	Building Central Plant Retrofit	49.6	434,965	0
469	Air Handler Retrofit	33.9	296,738	0
Various	Compressed Air Retrofit	151.5	1,327,349	0
Total		**250.7**	**2,199,356**	**0**

The load impact estimation methodology complies with IPMVP Option B.

Design and development of these projects began with preliminary audits which took place in 2003 and 2004. Detailed design as well as submittal of the proposed measures to SDG&E's Energy Savings Bid program took place in the Spring and Summer of 2004. Contracts were finalized by the end of 2004 leading to the ordering of major mechanical equipment and initial construction beginning in the Spring of 2005. Major installation work was completed in June, July and August of 2005.

7.8.1 Facility Description

7.8.1.1 General Description

The Customer manages more than 30 buildings which house shops dedicated to disciplines such as machining, plating and cleaning, painting, system repair and component calibration. Many command buildings are equipped with building controls provided by the Project Sponsor.

Facilities where major HVAC retrofits were completed include B250 and B469. Additional buildings where compressed air work was completed included B35, 65, 94, 249, 250, 306, 378, 379, 458, 460, 463, 464-468 and 472.

7.8.2 Facility Improvement Measures

The project's primary objective is to upgrade an aging mechanical, electrical, and control systems with new and energy efficient systems that will support the Customer's goals to decrease utility and maintenance costs, improve its working environment and to optimize its Heating, Ventilating and Air Conditioning (HVAC) systems for improved efficiency and extended operating life. The following section describes the major Facility Improvement Measures completed as a part of this project:

7.8.2.1 FIM 1 – Retrofit B250 Air Cooled Chiller with Turbocor Compressor

7.8.2.1.1 Existing Conditions

B250 is served by an 84-ton air cooled water chiller and constant volume chilled water pumping system connected to five air handling units located within the building. The air cooled chiller was served by four reciprocating compressors configured two separate refrigeration circuits. The chiller was enabled and disabled by the building management system and given a chilled water supply temperature set point. The chiller's internal controls sequenced the four reciprocating compressors in response to chilled water loads.

The chilled water system operated with two 7.5-hp constant volume pumps piped in series. Due to this configuration and the pressure losses through the pump casing when one of the two pumps was not operating, facilities staff was required to operate both pumps to meet chilled water flow requirements.

7.8.2.1.2 Solution

The project included the retrofit of the existing air cooled water chiller with new refrigeration system and repiping of the chilled water loop and installation of new chilled water pumps converting the chilled water pumping system from series to parallel operation.

1. Upgrade air cooled chiller with new 90-ton variable speed centrifugal compressor from Danfoss/Turbocor.
2. Provide new refrigeration piping and charge system with refrigerant (R-134a).
3. Provide new chiller controls and integrate new chiller controls into existing building automation system.
4. Provide new chilled water pumps and piping. Reconfigure chilled water pumps in parallel.

Figure 10. Existing Air-Cooled Chiller

Figure 11. Completed Turbocor Chiller Retrofit

7.8.2.1.3 Savings Result

Performance data used to assess system performance was collected using portable measurements and the Project Sponsor's BAS.

Table 88. Energy Savings Result for B250 Air Cooled Chiller Retrofit

	Energy Savings		
Measure	**kW**	**kWh**	**Therms**
Air Cooled Chiller Retrofit	8.66	78,820	0
Chilled Water Pump Reconfiguration	7.02	61,484	0
Total	**15.67**	**140,304**	**0**

Energy savings for the new chiller was determined through pre- and post-retrofit data of the power consumption and cooling load served by the chiller. Pre-retrofit data was used to determine a baseline efficiency profile for the chiller. This baseline efficiency profile is shown in Figure 12.

During the performance period, the chilled water supply temperature, chilled water return temperature and total chiller power were trended in 15-minute intervals. Chilled water flow rate for the constant volume system was measured using a portable ultrasonic flow meter. The flow rate with one pump running was found to be 185 gallons per minute (gpm).

For each interval in the post retrofit period, flow and temperature difference across the chiller was used to calculate the tons supplied by the chiller. Baseline energy use was determined using the baseline regression equation for the chiller. Post retrofit energy use in each interval was determined through measurement with a 3-phase power meter installed on the chiller and trended in the Project Sponsor's BAS.

7.8.2.1.4 Savings Calculations – Air Cooled Turbocor Retrofit at B250

Summary Results	Energy Savings kW	kWh
Air Cooled Chiller Retrofit	8.66	78,820
Chilled Water Pump Retrofit	7.02	61,484
Total	15.67	140,304

Energy Calculation Inputs

Baseline Chiller Efficinecy	1.12	kW/t1
Chiller Nominal Load:	90	t1s
CHW Flowrate:	185	gpm

Condenser Fan Power		
Stage 1	2.8	kW
Stage 2	3.2	kW
Stage 3	3.3	kW

Analysis Start Date	18-Nov-05
End Date	03-Aug-06
Hours	5,744
Average Load	20.1
T1-Hours	115,987
Average Pre-Ret. Eff.	1.12
Average Post-Ret. Eff.	0.80
Baseline Energy Use	129,542
Post-Retrofit Energy Use	77,864
Energy Savings	51,678

Building 250 Chilled Water Pumps

Baseline kW	13.5	kW
Post kW	6.5	kW
Baseline Hours	8760.0	hours
Baseline kWhs	8760.0	hours
Baseline kWh	118,668	kWh
Post kWh	57,184	kWh

Energy Savings Results

Energy Savings	78,820	Energy Savings	61,484	kWh
	8.66		7.02	kW

7.8.2.2 FIM 2 – Retrofit B469 Central Plant

7.8.2.2.1 Existing Conditions

B469 is single story building supports testing and calibration of electronic components. The building, therefore, requires constant and stable ambient conditions to maintain measurement accuracy and to provide adequate cooling for the sensitive computer testing and analysis systems.

Figure 12. Baseline Chiller Efficiency Curve – B250 Air Cooled Chiller

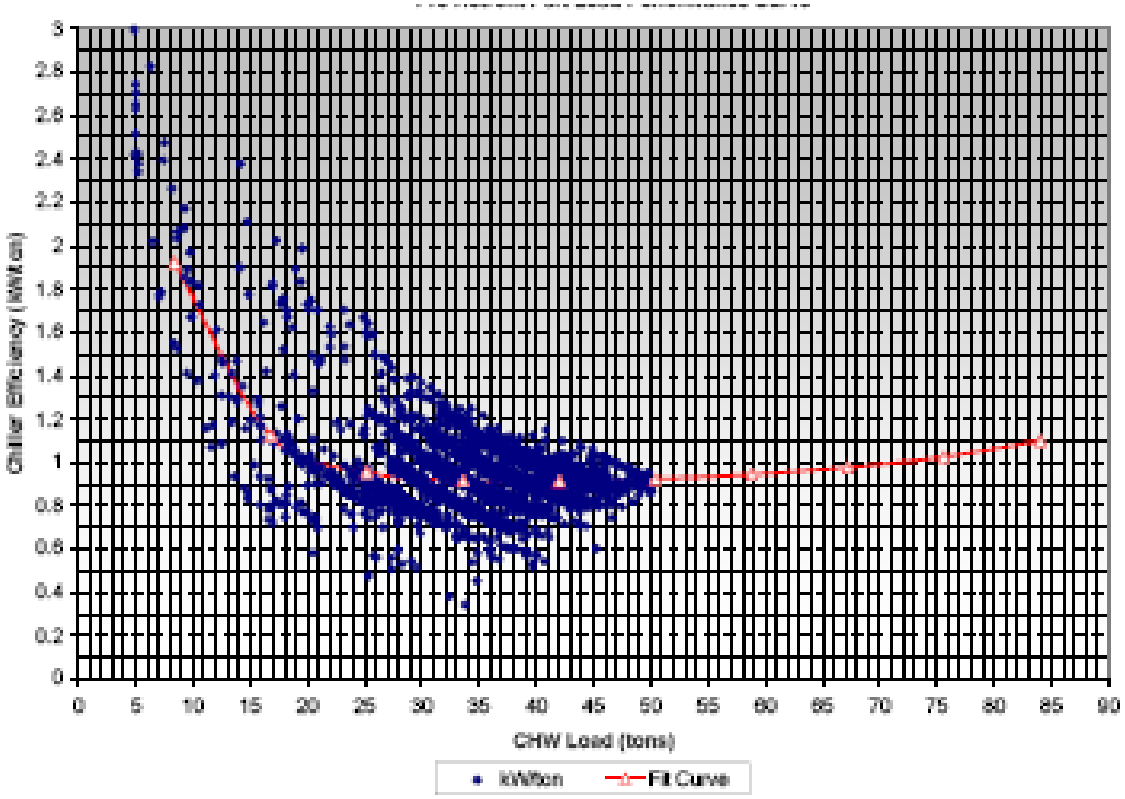
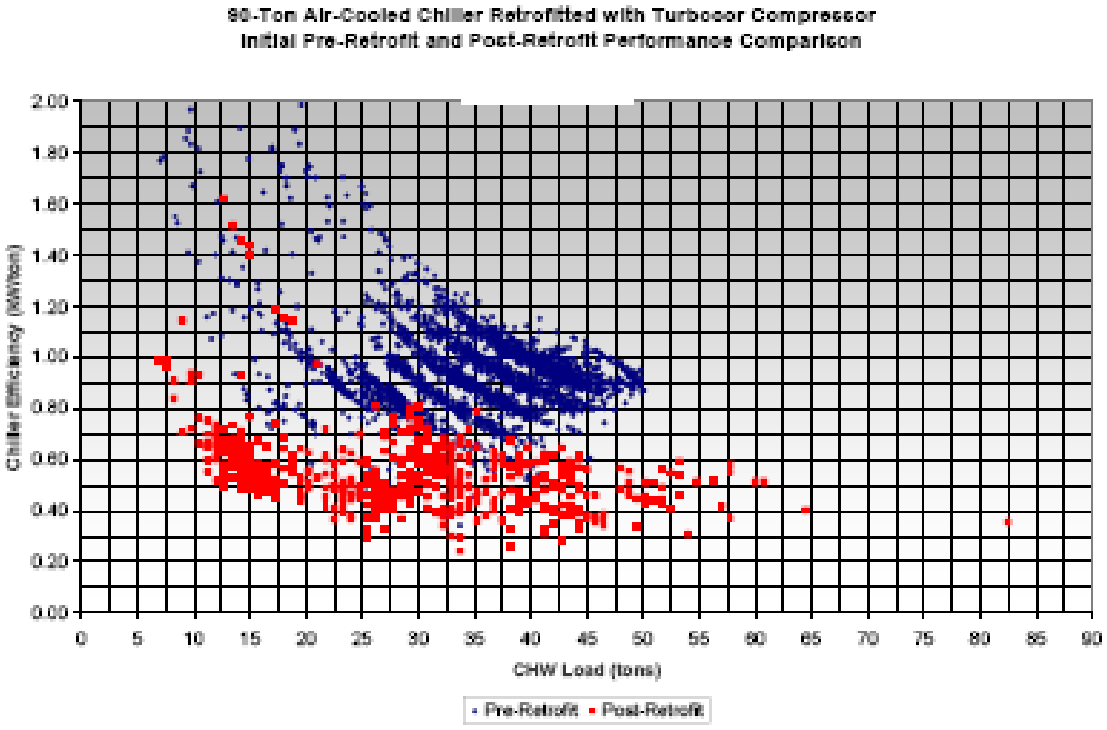


Figure 13. Comparison of Pre-Retrofit and Post-Retrofit Chiller Efficiency



The HVAC system is composed of a centralized water cooled chilled water plant with a constant volume chilled water system. The cooling plant was served by two McQuay water cooled 120-ton screw chillers connected to eighteen (18) air handling units located in the building's mezzanine.

The building air handling system consists of 14 air conditioning (AC) units and four (4) heating and ventilating (HV) units. These units are installed in mezzanines located above the first floor. Table 89 provides a summary of the air handling units serving B469.

Figure 14. Existing 120-Ton Screw Chiller

Figure 15. Central Chiller Water Plant Piping Configurations

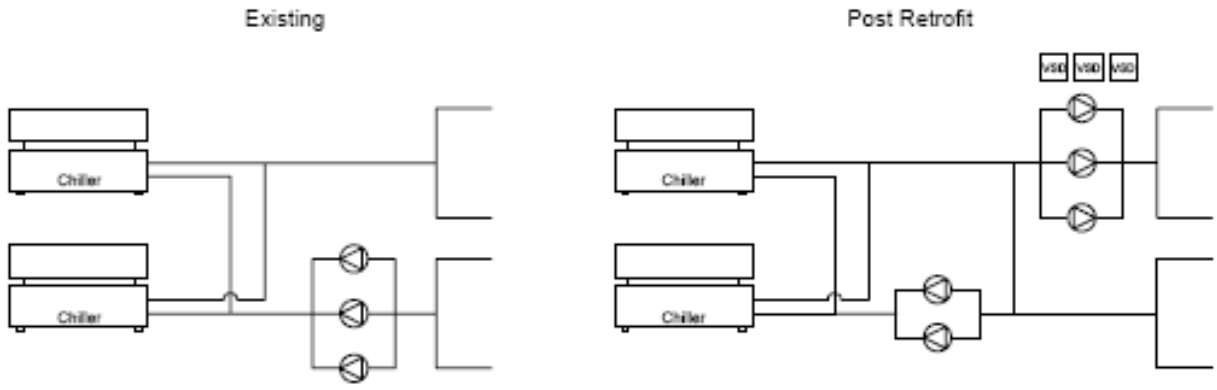


Table 89. Summary of Air Handling Units

Unit ID	Unit Type	Supply Fan Size (HP)	Return Fan Size (HP)	Notes
AC-01	CHW Only	7.5	3.00	w/ Inlet Vanes & Economizer
AC-02	CHW Only	3.0	1.00	w/ Inlet Vanes & Economizer
AC-03	CHW, HHW	5.0	n/a	No Retrofit
AC-04	CHW, HHW	3.0	n/a	No Retrofit
AC-05	CHW Only	3.0	1.50	w/ Inlet Vanes & Economizer
AC-06	CHW Only	7.5	n/a	w/ Inlet Vanes
AC-07	CHW, HHW	2.0	n/a	No Retrofit
AC-08	CHW, HHW	15.0	n/a	w/ Inlet Vanes
AC-09	CHW Only	5.0	n/a	w/ Inlet Vanes
AC-10	CHW, HHW	15.0	n/a	w/ Inlet Vanes
AC-11	CHW Only	3.0	n/a	w/ Inlet Vanes
AC-12	CHW, HHW	3.0	n/a	w/ Inlet Vanes & Economizer
AC-13	CHW Only	10.0	n/a	w/ Inlet Vanes
AC-14	CHW, HHW	7.5	n/a	w/ Inlet Vanes
HV-01	HHW Only	7.5	3.00	w/ Economizer
HV-02	HHW Only	10.0	5.00	w/ Economizer
HV-03	HHW Only	2.0	0.75	w/ Economizer
HV-04	HHW Only	5.0	1.00	w/ Economizer

7.8.2.2.2 Solution

The scope of the energy project involves replacing the existing chillers with new same size chillers which utilize small variable speed centrifugal compressors, converting the chilled water distribution system from constant volume primary to primarysecondary with variable volume distribution in the secondary loop, converting the hot-water distribution system to variable

volume, expanding the energy management system, refurbishing the air-handling units and active heating and ventilating units.

The project included the following elements:

a. Convert three (3) constant volume AHU's to VAV operation with VFD control.

b. Replace inoperable pneumatic economizer actuators on twelve (12) AHU's with new Direct Digital Control (DDC) actuators.

c. Install new DDC economizer control on six (6) AHU's.

d. Install sixteen (16) variable speed drives on air handlers AC-1, 2, 5,6,8,9,10,11,13 and 14 and HV-1 and HV-2.

e. Expand the existing Project Sponsor's EMCS to accommodate the new Turbocor chillers and primary / secondary chilled water pumping system.

f. Replace two (2) inoperable cooling tower fan VFD's with new VFD's.

g. Convert the existing constant volume primary chilled water pumping system to primary / secondary variable volume operation.

h. Replace the two (2) existing 120-ton McQuay screw chillers with new equally sized McQuay chillers with Turbocor compressors. Each chiller is served by a pair of 60-ton compressors.

i. Convert the existing constant volume primary / secondary / tertiary hot water pumping system to primary secondary variable volume operation.

7.8.2.2.3 Savings Result

Performance data used to assess system performance was collected using portable measurements and the Project Sponsor's BAS.

Table 90. Energy Savings Result for Building 469 Retrofit

	Energy Savings		
Measure	**kW**	**kWh**	**Therms**
Chilled Water Plant Retrofit	43.5	381,154	0
Heating Water Plant Retrofit	33.9	296,738	0
Air Handler Retrofit	6.1	53,811	0
Total	83.5	731,703	0

Energy savings for the new chilled water plant as determined through pre- and post-retrofit data of the total plant power consumption and cooling load. Pre-retrofit data was used to determine a baseline efficiency profile for the chilled water plant including the chiller, chilled water pumps, condensing water pump, and cooling tower fans. This baseline plant efficiency profile is shown in Figure 16.

During the performance period, the chiller leaving water temperature, chilled water return temperature, chilled water flow rate and total plant power were trended in 15-minute intervals. For each interval in the post retrofit period, flow and temperature difference across the chiller was used to calculate the tons supplied by the chilled water plant. Baseline energy use was determined using the baseline regression equation for the chilled water plant. Post retrofit energy use in each interval was determined by the BAS as the sum of system using 3-phase power meters installed on the two new chillers and by power from the variable speed drives for chilled water pumps, condenser water pumps, and cooling tower fans.

The air handling system in B469 was found to operate in the performance period as a constant volume system. This fact is seen in the post retrofit operation of the air handler fans shown in Figure 18. There are two primary reasons for this fact. First, it was found during the implementation of the project that while the air handling units were equipped with inlet guide vanes and therefore variable volume flow capability, these inlet guide vanes were for filter loading purposes. Second, the air conditioning load in the building is dominated by internal heat gains from computer systems and testing equipment which reach a point of equilibrium and remain largely constant. Both factors are significant in their impact on the system. Energy savings for air handling unit fan motors has been therefore determined the difference in pre- and post-retrofit fan motor kW times the annual fan operating hours.

Figure 16. B469 Central Plant Baseline Efficiency Curve

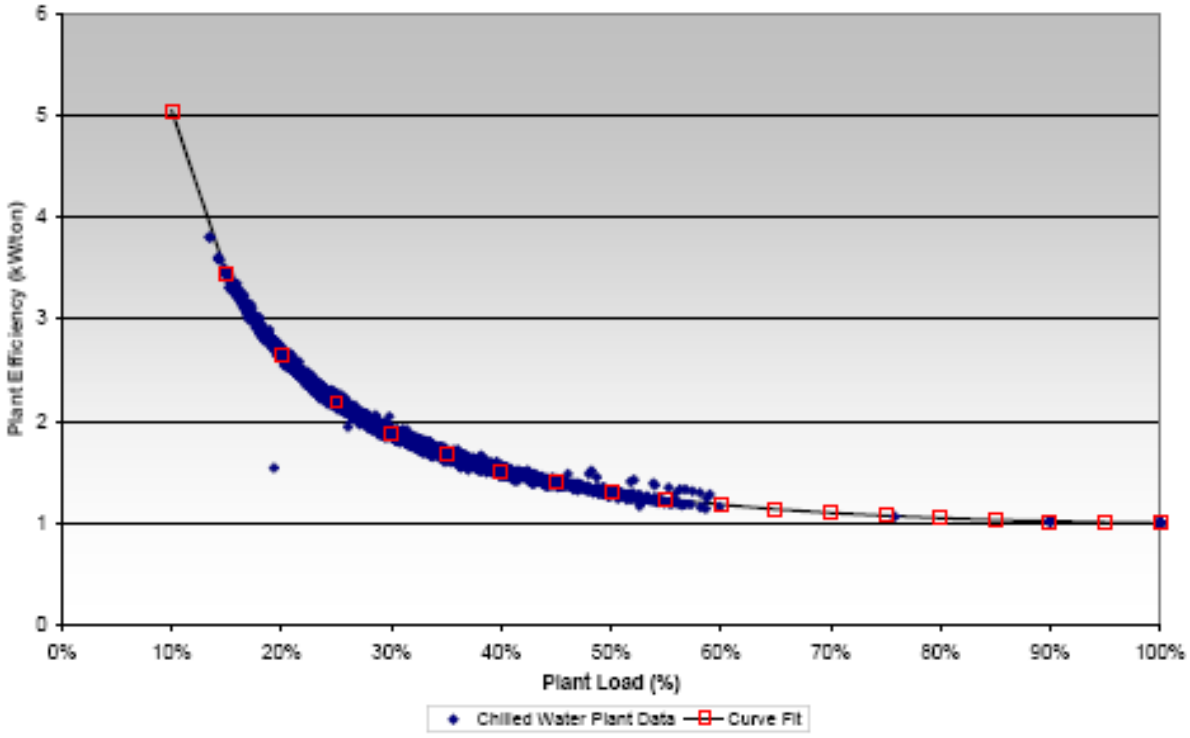


Figure 17. B469 Central Plant Post Retrofit Efficiency Curve

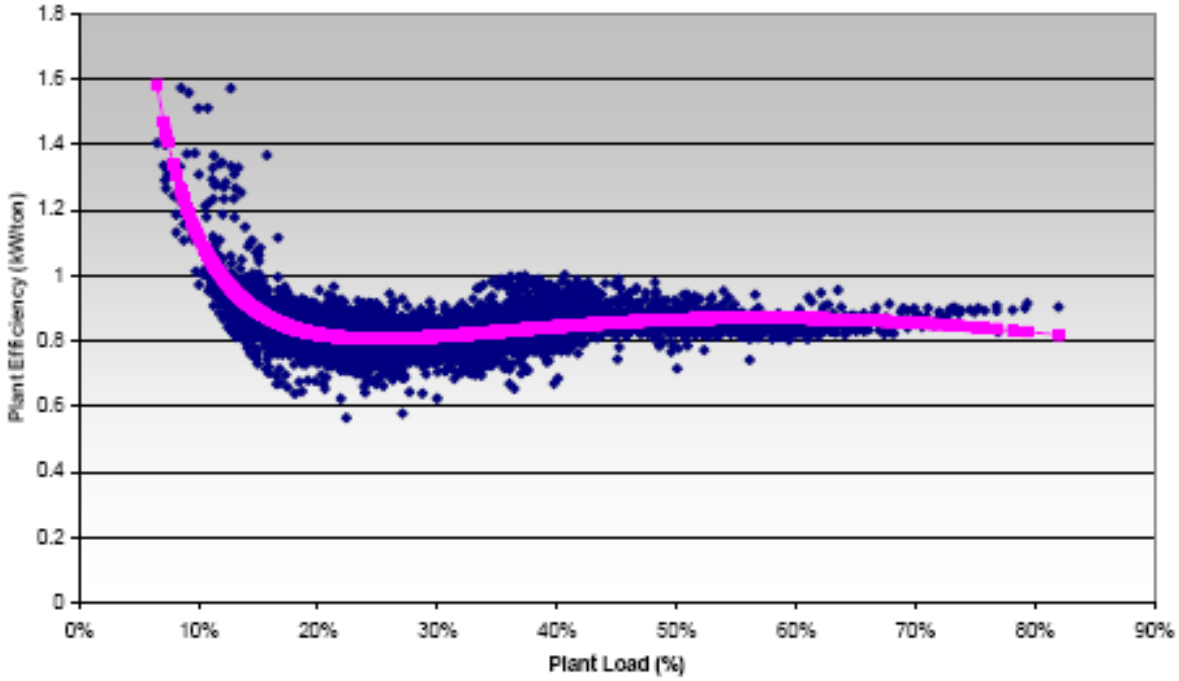


Figure 18. Building 469 Air Handling Unit Pre-Measurement Data

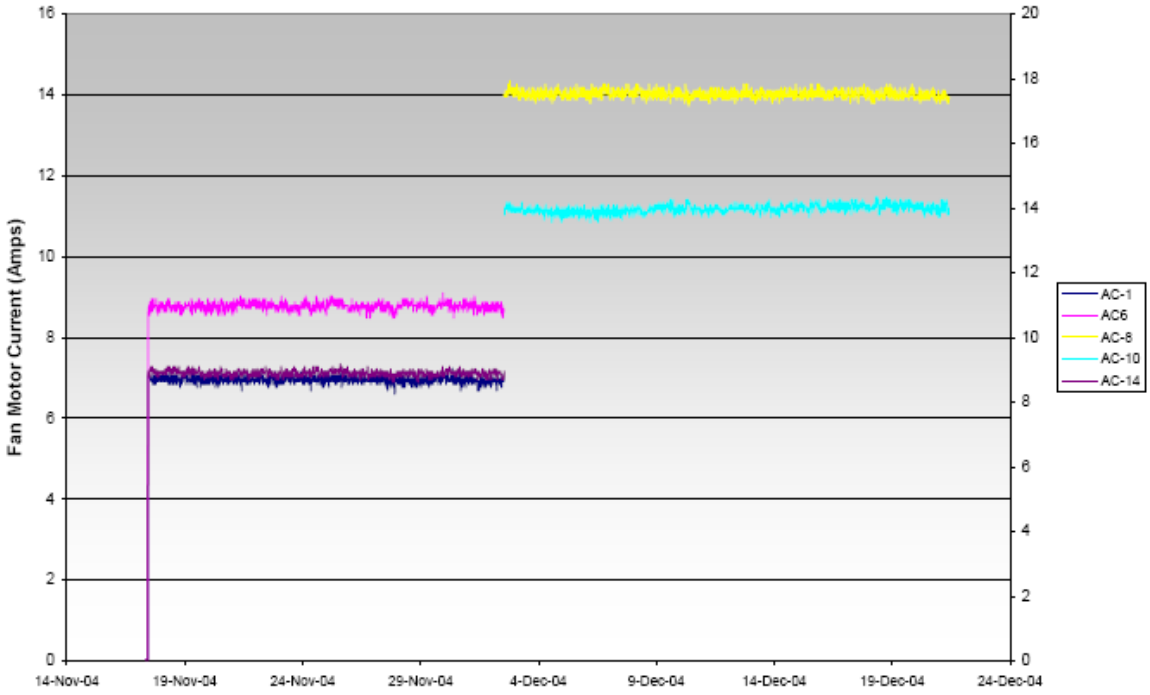


Figure 19. Building 469 Air Handling Unit Pre-Measurement Data

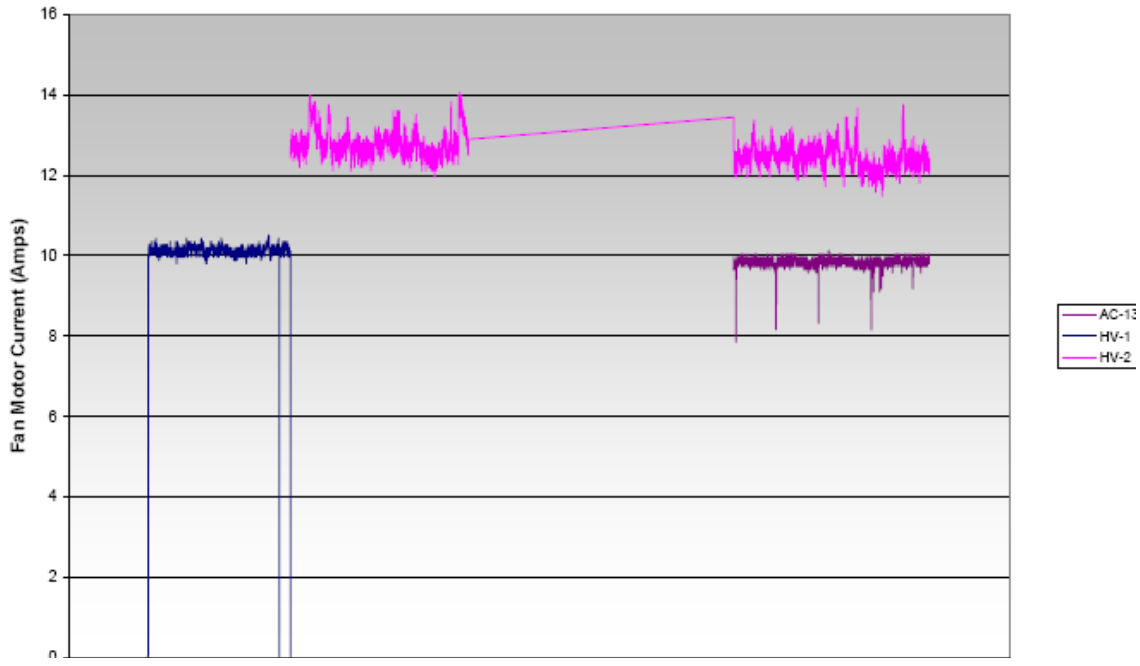


Figure 20. B469 Fan Power

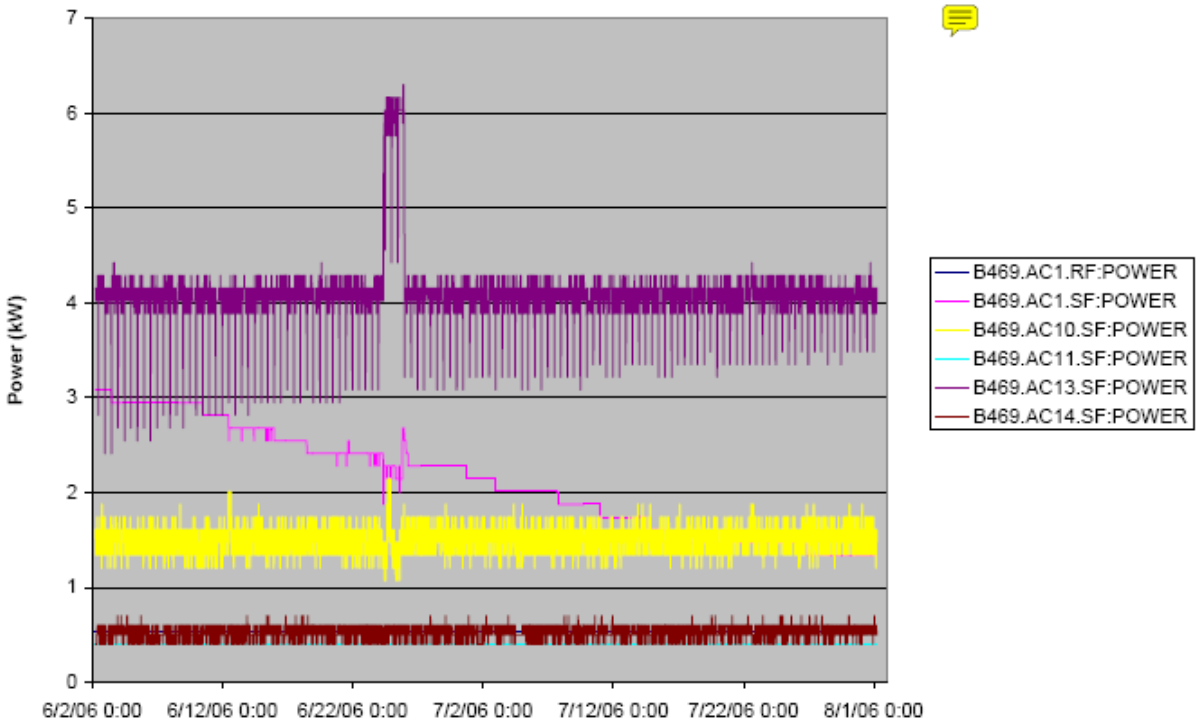


Figure 21. B469 Fan Power

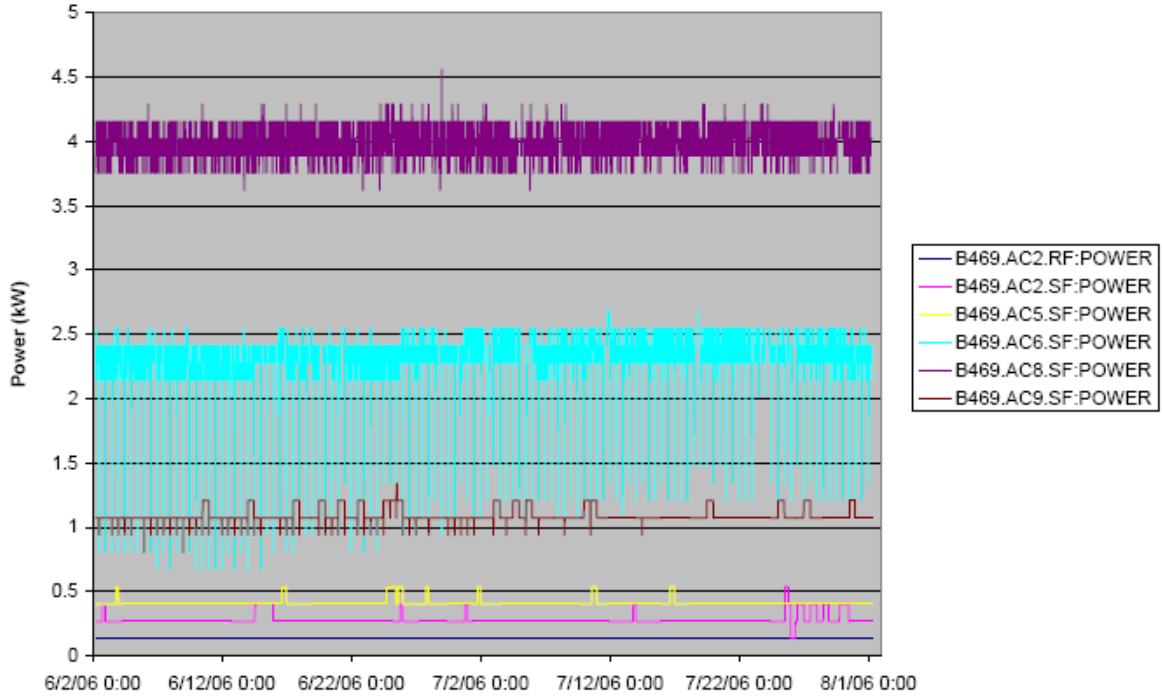
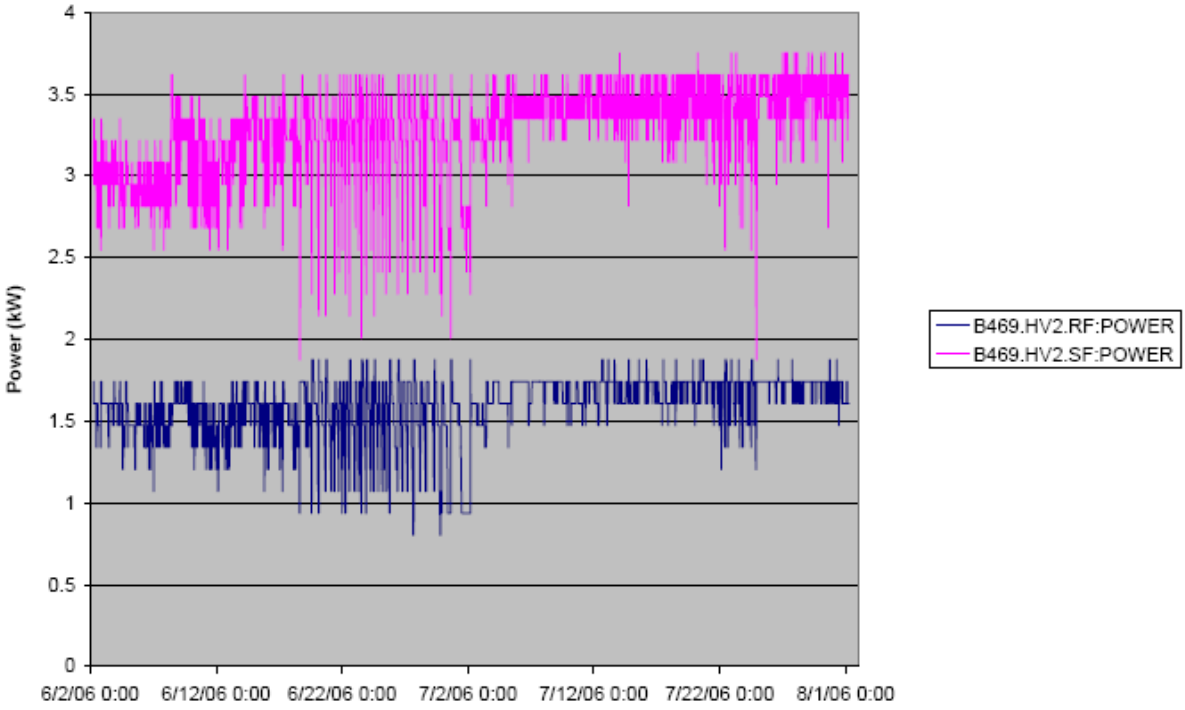


Figure 22. B469 Fan Power



7.8.2.2.4 Savings Calculations – B469 Central Plant

Table 91. Central Plant Savings Calculations – B469

0	0	51.60525	30.78	44.17	76.45896326	51.60525	0.855920667	32.28896326
		Ton_Hours	Chr_kWHs	Plant_kWhs	Baseline_Plnt_kWhs			43.51491807
		279941.629	139128.9	196268.0	501963.8			

Building 469 - Central Plant Energy Savings

Energy		434965.3 kWh
Power		49.6 kW

Energy Savings		305695.7 kWh/yr
		43.5 kW
Annualized		381154.3 kWh/yr
HHW Pump Analysis	Distribution Pump Power	
Baseline Energy Use		
	Baseline Power	6.6 kW
	Baseline Hours	8760 Hours
	Baseline kWh	57816 kWh
Post_Ret. Energy Use		
	Period Start	10/1/2005
	Period End	8/24/2006 5:45
	Hours	7853.75 Hours
	P7 Energy Use	2648 kWh
	Average kW	0.337163775 kW
	P8 Energy Use	1357 kWh
	Average kW	0.172783702 kW
	Post_Ret. kWh	4005 kWh
	Avg_Post_kW	0.509947477 kW
	HHW Pump Savings	53811 kWh
		6.090052523

Table 92. B469 Air Handling Unit Savings Calculation

Load Description	Equipment ID	HP	kW_base_average	Hours_base	kWh_base	kW_post	Hours_post	kWh_post	kW_Savings	kWh_Savings
Supply Fan	AC-1	7.5	4.5	8760	39,420	2.12	8760	18,528	2.38	20,892
Return Fan	AC-1R	3	1.34	8760	11,738	0.54	8760	4,695	0.8	7,043
Supply Fan	AC-2	3	1.36	8760	11,914	0.28	8760	2,442	1.08	9,472
Return Fan	AC-2R	1	0.49	8760	4,292	0.13	8760	1,174	0.36	3,119
Supply Fan	AC-5	3	1.7	8760	14,892	0.41	8760	3,575	1.29	11,317
Supply Fan	AC-6	7.5	4.3	8760	37,668	2.31	8760	20,279	1.99	17,389
Supply Fan	AC-8	15	7.86	8760	68,854	3.98	8760	34,888	3.88	33,965
Supply Fan	AC-9	5	2.7	8760	23,652	1.09	8760	9,555	1.61	14,097
Supply Fan	AC-10	15	7.6	8760	66,576	1.51	8760	13,193	6.09	53,383
Supply Fan	AC-11	3	2.3	8760	20,148	0.4	8760	3,504	1.9	16,644
Supply Fan	AC-13	10	6.4	8760	56,064	4.11	8760	36,036	2.29	20,028
Supply Fan	AC-14	7.5	4.8	8760	42,048	0.52	8760	4,558	4.28	37,490
Supply Fan	HV-1	7.5	5.9	8760	51,684	3.66	8760	32,039	2.24	19,645
Return Fan	HV-1R	3	1.7	8760	14,892	1.04	8760	9,117	0.66	5,775
Supply Fan	HV2	10	5.3	8760	46,428	3.29	8760	28,781	2.01	17,647
Return Fan	HV2R	5	2.6	8760	22,776	1.59	8760	13,944	1.01	8,832
Total		**106.00**	**60.85**		**533,046**	**26.98**	**140,160**	**236,308**	**33.87**	**296,738**

Table 93. B369 Power Measurement

Load Description	Equip. ID	HP	Motor Efficiency	Meter Description	Measure Type (1 Phase, 3 Phase)	Power	Power Factor	Amperage	Voltage	%-Load
Chilled Water Pump	P-1	20	85%	Fluke 42B Power Quality Analyzer	3-Phase	12.7	0.85	N/A	480	72%
Condenser Water Pump	P-5	10	85%	Fluke 42B Power Quality Analyzer	3-Phase	4.08	0.73	N/A	480	46%
Hot Water Pump	P-7	15	85%	Fluke 42B Power Quality Analyzer	3-Phase	6.6	0.75	N/A	480	50%
Supply Fan	AC-6	7.5	85%	Fluke 42B Power Quality Analyzer	3-Phase	4.3	0.63	N/A	480	65%
Return Fan	HV2R	5	85%	Fluke 42B Power Quality Analyzer	3-Phase	2.6		N/A	480	59%
Supply Fan	AC-9	5	85%	Fluke 42B Power Quality Analyzer	3-Phase	2.7		N/A	480	62%
Supply Fan	AC-5	3	85%	Fluke 42B Power Quality Analyzer	3-Phase	1.7	0.63	N/A	480	65%
Supply Fan	AC-14	7.5	85%	Fluke 42B Power Quality Analyzer	3-Phase	4.8	0.75	N/A	480	73%
Supply Fan	AC-13	10	85%	Fluke 42B Power Quality Analyzer	3-Phase	6.4	0.8	N/A	480	73%
Supply Fan	AC-8	15	85%	Fluke 42B Power Quality Analyzer	3-Phase	7.86	0.73	N/A	480	60%
Supply Fan	AC-10	15	85%	Fluke 42B Power Quality Analyzer	3-Phase	7.6	0.75	N/A	480	58%
Supply Fan	AC-11	3	85%	Fluke 42B Power Quality Analyzer	3-Phase	2.3	0.61	N/A	480	87%
Supply Fan	AC-2	3	85%	Fluke 42B Power Quality Analyzer	3-Phase	1.36	0.76	N/A	480	52%
Supply Fan	HV2	10	85%	Fluke 42B Power Quality Analyzer	3-Phase	5.3	0.66	N/A	480	60%
Supply Fan	HV-1	7.5	85%	Fluke 42B Power Quality Analyzer	3-Phase	5.9	0.75	N/A	480	90%
Return Fan	HV-1R	3	85%	Fluke 42B Power Quality Analyzer	3-Phase	1.7	0.55	N/A	480	65%
Supply Fan	AC-1	7.5	85%	Fluke 42B Power Quality Analyzer	3-Phase	4.5	0.85	N/A	480	68%
Return Fan	AC-1R	3	85%	Fluke 42B Power Quality Analyzer	3-Phase	1.34	0.42	N/A	480	51%

7.8.2.3 FIM 3 – Retrofit Compressed Air System

7.8.2.3.1 Existing Conditions

The Customer receives utility services (including compressed air) from its landlord's facilities. Maintenance and distribution of these utility services is the responsibility of the landlord which operates the main compressed air central plant.

This plant, located in B653 delivers compressed air at approximately 90-100 psig. The central compressed air plant serves the main facility. Compressed air leaves the central plant through demand expanders (pressure regulating devices) in pipes connected to individual buildings via an underground piping network.

The compressed air plant operates five industrial air compressors from Atlas-Copco and Ingersol-Rand. These compressors are fed by dedicated 4,160V switchgear. The central plant is equipped with the following compressors:

Compressor #1 (Screw):
Atlas-Copco ZR-275 (333HP) / Installed 2000

Compressor #2 (Reciprocating):

Igersol-Rand (Not Operating)

Compressor #3 (Reciprocating):
Igersol-Rand Recip (Not Operating)

Compressor #4 (Screw):
Atlas-Copco ZR6-60 (600HP) / Installed 1991

Compressor #5 (Screw):
Atlas-Copco ZR6-60 (600HP) / Installed 1991

Compressed air is used for numerous applications throughout the the Customer's facility including many types of hand tools, metal presses, printing systems and many other uses.

7.8.2.3.2 Solution

Install new compressed air fixtures (hose disconnects, valves, gaskets, etc. per identified scope of work and provide new digitally controlled compressed air flow meters, isolation valves and associated control panels to measure and operate compressed air service to buildings on a schedule provided by the customer. These changes will reduce leaks during normal occupied hours and eliminate leaks during unoccupied hours where the building compressed air isolation valve is closed.

Table 94 summarizes the mechanical scope of work and new compressed air controls installed by the Project Sponsor.

Table 94. Compressed Air Retrofit Scope Summary

Bldg #	Scope of Work Description
35	Install new meter w/ electronic control valve on time-of-day schedule, in-line filter, replace approx 22 female disconnects and secure from use leaking packing pumps.
65	Install new meter w/ electronic control valve on time-of-day schedule, in-line filter and replace approx 86 female disconnects.
94	Install new meter w/electronic control valve on time-of-day schedule, in-line filter and replace approx 75 female disconnects. Replace (5) 50 ft hose reels.
249	Install new meter w/ electronic control valve on time of day schedule, in-line filter, replace approx 40 female disconnects, cap approx 60 unused compressed air drops above offices.
250	Install new meter w/electronic control valve on time-of-day schedule, in-line filter and replace approx 200 female disconnects.
306	Install new meter w/electronic control valve on time-of-day schedule, in-line filter and replace approx 40 female disconnects.
378	Install new meter w/electronic control valve on time-of-day schedule, in-line filter and replace approx 95 female disconnects.
379	Install (2) new meters and (2) in-line filters. Install electronic shut-off valve on TOD schedule at fuel bladder hoists, replace approx 40 female disconnects.
458	Install new meter w/electronic control valve and push button activation. Install new in-line filter and replace approx 10 female disconnects.
460	Install new CA meter, replace (11) leaking gate valves and manifold assemblies, replace approx 92 female disconnects.
463	Install new CA meter and electronic control valve on TOD schedule. Replace approx 12 female disconnects.
464-468	Install new CA meter and in-line filter Install new electronic control valve with push button activation for wash down area, replace 12 existing control valves with new valve and push button activation.
472	Install (2) new CA meters with in-line filters. Install (5) electronic control valves with TOD schedule, repair (1) leaking valve, (2) manifold leaks, (1) new hose reel, install (1) new shut-off valve in heat treat shop, replace approx 125 female disconnects

7.8.2.3.3 Savings Result

Data used to assess system performance was collected using portable metering equipment and the Project Sponsor's BAS. Energy savings were determined using a typical month of operation before and after the retrofit to calculate flow reductions in an average week due to the retrofit. Hourly air flow reductions for the average week before and after the retrofit times the average central compressed air plant efficiency times fifty-two (52) weeks per year equal the annual energy savings.

Table 95. Energy Savings Result For Compressed Air System Retrofit

Measure	Energy Savings		
	kW	kWh	Therms
Compressed Air System Retrofit	151.5	1,327,349	0
Total	151.5	1,327,349	0

Implementation of the project was coordinated such that the new mass flow meters were installed first along with the Project Sponsor's BAS components necessary to read and store data from these meters. This allowed the new metering to collect both baseline and post retrofit usage profiles.

Data for the central compressed air plant was obtained using portable data loggers installed on existing switch gear and central plant compressed air meters. This data was used to measure the efficiency of the compressed air plant expressed as the average cubic feet per minute of air produced by the plant per break horsepower of power required by the compressor.

7.8.2.3.4 Savings Calculations – Compressed Air System

Table 96. Savings Calculation - Compressed Air System

(Baseline Average Hourly Flow - Post-Retrofit Average Hourly Flow)

Day	Hr	Bldg 250	Bldg 35	Bldg 378	Bldg 379	Bldg 463	Bldg 467	Bldg 472	Bldg 94	Bldg 65	Bldg 249	Bldg 306	Bldg 460	Total Savings (SCFM)	Energy Savings (kWh)
Sunday	0	-11.525	6.041667	16.65833	88.95	5.729167	285.7083	609.9333	-1062.35	47.223	2.123333	1.280508	74.256	1126.4	12201.3
Sunday	1	-11.5833	6.041667	16.67083	90.925	5.716667	285.6583	610.45	-1065.5	47.71667	2.126667	1.051892	69.43942	1124.2	12177.9
Sunday	2	-11.6	6.054167	17.80417	89.54583	5.691667	285.7708	610.7417	-1065.5	47.81	2.086667	0.54375	48.39504	1102.8	11946.4
Sunday	3	-11.6167	6.025	27.89583	93.6375	5.5125	285.7417	610.7625	-1064.82	48.081	2.1	0.599983	42.21442	1111.0	12034.2
Sunday	4	-11.9583	5.954167	17.11667	36.05	5.725	285.9625	605.6083	-1064.88	12.796	2.063333	0.601567	44.21392	1004.1	10877.1
Sunday	5	-11.1667	5.941667	31.6625	5.625	5.729167	257.6333	613.4083	-1064.4	15.33917	0.469167	0.159775	46.87563	971.7	10525.5
Sunday	6	4.854167	-6.00833	30.13333	-118.108	5.675	-243.579	599.275	-1062.85	17.5635	1.22	0.098617	45.74525	336.9	3649.1
Sunday	7	-17.4917	-5.82917	28.71667	-106.421	5.695833	-100.396	593.25	-1065.13	14.62333	1.538333	0.54185	37.57963	451.8	4894.1
Sunday	8	-4.0375	-6.1625	17.5625	-126.333	6.979167	266.5333	599.0667	-1065.33	12.4105	1.955833	0.751067	35.11575	803.8	8707.5
Sunday	9	-1.92917	-6.08333	14.39583	-130.967	6.741667	-164.433	606.6125	-1065.5	6.4685	1.770833	0.858342	32.66592	366.1	3965.7
Sunday	10	-12.2708	-6.02917	10.1875	-143.846	5.7	290.9333	614.5375	-1065.5	12.13317	1.904167	0.305775	38.21029	811.8	8793.3
Sunday	11	3.583333	-6.05417	8.708333	-137.033	5.754167	352.1417	614.2333	-1065.5	10.77267	1.371667	1.215194	67.43033	922.1	9988.7
Sunday	12	-11.2	-5.85	9.079167	-138.942	5.716667	354.56	604.9083	-1065.5	13.57933	1.315	0.166417	78.46167	911.8	9876.8
Sunday	13	0.416667	-5.67917	7.491667	-145.279	5.929167	294.4	612.6292	-1065.5	16.35767	1.254167	0.064833	80.95054	868.5	9408.3
Sunday	14	6.454167	-5.6875	7.475	-127.929	6.016667	286.2625	613.0625	-1065.5	15.8695	0.565	0.492417	82.47983	885.1	9587.3
Sunday	15	8.208333	-0.02917	7.645833	-31.8583	6.066667	285.3208	614.15	-1066.13	15.94183	0.390833	0.524458	77.85442	984.2	10661.4
Sunday	16	8.166667	5.691667	7.995833	61.75833	6.108333	285.0458	613.5875	-1065.5	38.90333	0.778333	0.038167	63.52971	1091.6	11824.6
Sunday	17	8.125	5.641667	8.0125	61.74167	6.0375	285.0042	613.6167	-1065.5	45.8475	2.085833	0.678708	45.38808	1082.2	11722.5
Sunday	18	8.108333	5.629167	8.620833	60.77083	6.004167	285.0542	612.1542	-1065.5	47.79867	2.123333	1.193583	44.42808	1081.9	11719.3
Sunday	19	8.033333	5.654167	8.866667	60.17917	6.066667	284.9708	611.6167	-1065.5	46.62333	2.15	1.123458	44.15475	1079.4	11692.8
Sunday	20	8.0375	5.641667	7.2375	58.20417	6.091667	283.6708	611.1042	-1065.5	46.35667	2.113333	0.191792	41.27171	1069.9	11589.7
Sunday	21	8.0125	5.695833	7.3625	59.35833	6.075	267.775	613.4875	-1065.5	46.41667	2.06	0.005125	40.94042	1057.2	11451.8
Sunday	22	8.020833	5.7375	7.5875	58.50417	5.908333	267.8	611.6667	-1065.5	46.44	2.03	0.977833	37.05042	1051.7	11392.6
Sunday	23	1.454167	5.841667	7.366667	58.49583	5.954167	267.6917	610.0958	-1065.5	46.53333	2.036667	0.635208	36.77942	1042.9	11296.9
Monday	0	-10.5958	5.8625	10.07708	58.15	6.0625	268.4542	610.2	-1064.22	46.74	2.013333	0.209292	38.589	1035.8	11219.7
Monday	1	-10.6833	5.866667	8.095833	59.36667	6.041667	268.3292	610.9708	-1065	46.96667	2.016667	-0.01979	37.19242	1034.1	11202.2
Monday	2	-10.6917	5.866667	8.070833	61.25	6.108333	268.65	607.875	-1065	47.04333	2.006667	-0.01792	39.29342	1035.5	11216.4
Monday	3	-10.7792	5.866667	8.291667	60.77917	4.129167	268.7	611.3625	-1065.5	47.21667	2.02	0.181417	47.18742	1045.0	11319.3
Monday	4	-0.84583	5.8625	7.225	-2.21667	2.454167	187.85	608.2	-1066.65	12.1525	1.976667	0.370833	57.01317	880.0	9532.9
Monday	5	-7.03333	5.8625	-11.425	-35.425	2.341667	-615.568	615.9875	-1065.5	13.55667	0.750833	1.102625	63.90025	134.0	1451.9
Monday	6	-16.4417	-6.4	-7.8625	-141.688	-9.08667	175.5208	573.8792	-1065.5	8.168333	1.764167	4.764417	69.37271	652.0	7062.8
Monday	7	-13.7333	-5.15417	-15.9917	-142.758	1.120833	-240.846	296.5792	-1065.5	-5.06083	1.641667	0.995042	62.41342	-60.8	-658.5
Monday	8	8.654167	-4.08333	-16.9083	-133.483	1.508333	-97.7875	364.1875	-1065.5	-7.72583	1.470833	-0.05213	64.28725	180.1	1950.6
Monday	9	-2.34167	-4.12083	-15.9375	-101.913	-1.82917	-761.6	374.6708	-1065.5	-10.2533	1.5725	-6.38662	70.90513	-457.2	-4952.9
Monday	10	24.45833	-5.54167	-3.29583	-104.271	4.120833	-1296.23	354.15	-1065.5	0.4975	1.0925	-2.07883	65.93225	-961.2	-10411.6
Monday	11	-2.23333	-5.82083	-6	-123.183	0.220833	131.9792	406	-1065.5	-9.23167	1.548333	2.378958	97.09654	492.8	5337.7
Monday	12	-1.47083	-5.4125	-8.475	-100.067	0.029167	-339.517	391.2417	-1065.5	-0.61	1.885833	-1.71875	134.7866	70.7	765.6
Monday	13	12.76667	-5.79167	-6.4625	-120.229	0.729167	-149.975	447.2958	-1065.5	-5.59917	1.8525	-3.94925	97.76408	268.4	2907.4
Monday	14	6.2625	-5.86667	0.479167	-103.092	5.095833	278.6958	446.775	-1065.5	6.945833	1.3525	-2.23396	78.36992	712.8	7721.1
Monday	15	8.029167	0.129167	-8.34583	-58.4542	23.80417	275.0333	545.7667	-1065.5	-7.6675	0.464167	-4.28888	96.69621	871.2	9436.8
Monday	16	16.21667	5.866667	0.9125	44.9875	40.72083	275.3292	497.4625	-1065.17	33.49083	0.649167	0.506292	83.22658	999.4	10825.5
Monday	17	9.141667	5.85	12.71667	44.64583	40.64583	275.5333	477.1125	-1065.5	46.58667	2.050833	-1.98379	54.24958	966.5	10470.0
Monday	18	9.15	5.833333	0.541667	45.36667	40.74583	274.2333	504.0833	-1065.5	47.72333	2.1	-1.93021	48.22358	976.1	10573.1
Monday	19	6.383333	5.833333	-2.0125	48.20417	40.55417	274.0875	495.7208	-1065.5	46.68667	2.22	-2.459	50.84438	966.1	10464.7
Monday	20	11.89167	5.8125	-9.20417	44.1625	40.6375	274.7333	603.6042	-1065.13	46.27	2.123333	-1.96329	49.51342	1067.6	11564.4
Monday	21	16.59583	5.820833	-1.60417	46.27917	40.8375	274.1	604.6083	-1065.5	46.88333	2.146667	-0.88733	78.76608	1113.5	12062.3

Table 96. Savings Calculation - Compressed Air System (con't)

(Baseline Average Hourly Flow - Post-Retrofit Average Hourly Flow)

Day	Hr	Bldg 250	Bldg 35	Bldg 378	Bldg 379	Bldg 463	Bldg 467	Bldg 472	Bldg 94	Bldg 65	Bldg 249	Bldg 306	Bldg 460	Total Savings (SCFM)	Energy Savings (kWh)
Monday	22	2.05	5.858333	1.3375	47.0125	32.24583	274.5583	613.6792	-1065.5	46.88333	2.103333	-1.76483	80.53542	1104.5	11964.3
Monday	23	7.0125	5.8625	-3.325	50.24583	8.608333	274.2958	612.8375	-1065.5	47.05667	2.096667	-1.43867	76.03421	1079.3	11691.2
Tuesday	0	8.429167	5.895833	-3.625	50.57917	8.791667	274.5458	612.7167	-1063.75	47.07	2.096667	2.239308	74.49387	1083.2	11733.9
Tuesday	1	8.4375	5.9	6.3375	51.20417	8.8	274.4833	611.7917	-1066.33	47.13667	2.07	0.044825	73.66767	1089.9	11805.9
Tuesday	2	8.425	5.879167	7.133333	51.31667	8.741667	274.4458	612.6542	-1065.5	47.43667	2.083333	6.681658	74.05467	1098.9	11903.1
Tuesday	3	8.433333	5.879167	6.979167	51.3375	8.3375	274.4667	608.2	-1066.17	47.55333	2.08	2.151767	74.8083	1090.2	11809.7
Tuesday	4	6.754167	5.883333	4.916667	-56.2042	8.5625	126.45	600.1375	-1065.65	6.373333	2.023333	3.685983	81.02437	789.6	8553.3
Tuesday	5	1.920833	5.879167	-25.3167	-125.704	-4.07917	-1036.07	583.5042	-1065.5	2.62	0.816667	2.758617	86.6097	-507.1	-5492.7
Tuesday	6	-18.9042	-6.33333	-11.0375	-154.308	-20.9417	-136.729	541.6042	-1065.5	-2.88	1.516667	3.958192	96.68783	292.6	3169.9
Tuesday	7	17.3125	-4.74583	-4.3375	-94.1458	1.6625	-955.663	462.5333	-1066.32	-13.5833	1.99	-1.97925	104.7119	-486.2	-5267.2
Tuesday	8	14.7625	3.191667	3.204167	-99.6583	0.254167	-131.421	455.1083	-1065.5	-0.34	1.72	1.006492	63.5161	311.3	3372.6
Tuesday	9	-22.7625	8.666667	-8.25417	-90.3708	0.575	-211.813	399.35	-1065.5	-8.57667	1.81	-2.72282	43.64873	109.6	1186.7
Tuesday	10	-4.09167	7.375	0.695833	-97.8958	-1.925	-840.546	414.6417	-1025.5	-10.1033	1.59	-2.33554	16.6679	-515.9	-5588.7
Tuesday	11	-12.0958	6.908333	-4.55	-119.946	-1.78333	-9.93333	400.6083	-1125.5	-15.4167	1.483333	-0.75357	42.6443	287.2	3110.7
Tuesday	12	-1.06667	-4.31667	5.1875	-121.538	-0.9875	-369.896	291.6625	-1125.5	-4.66667	1.16	-0.84957	42.41797	-162.9	-1764.7
Tuesday	13	-4.39583	-3.23333	-1.89167	-124.467	-0.34167	-27.0542	429.2458	-1125.5	-4.34333	1.283333	-0.94922	72.7136	336.6	3645.8
Tuesday	14	-0.33333	-5.03333	-2.77917	-140.317	13.00833	107.4792	496.5667	-1125.5	-9.43667	1.043333	1.339642	50.12357	511.7	5542.5
Tuesday	15	7.383333	0.570833	-12.4333	-56.5167	18.10833	-33.9958	625.8792	-1125.5	-12.6833	0.62	-2.59763	32.90317	567.2	6144.5
Tuesday	16	6.35	5.766667	0.929167	52.24167	20.30833	270.85	576.1542	-1125.5	29.59333	0.453333	-2.43633	27.09047	987.3	10694.8
Tuesday	17	2.254167	5.775	1.304167	49.24583	40.2375	270.6167	515.1417	-1125.5	43.65667	2.24	-2.50166	31.6483	959.6	10394.9
Tuesday	18	-2.39167	5.695833	-6.15833	49.1875	40.34583	286.0667	592.475	-1125.5	43.99	2.13	-1.91446	37.93787	1047.4	11345.4
Tuesday	19	2.216667	5.658333	-3.17917	47.9875	40.60417	282.4583	582.925	-1125.5	42.75333	2.166667	-0.39199	45.83417	1049.0	11363.5
Tuesday	20	-12.0542	5.641667	-14.5667	45.35	40.7625	282.4542	617.3125	-1125.5	42.43333	2.12	-0.00527	32.04393	1041.5	11281.8
Tuesday	21	4.633333	5.658333	2.295833	50.66667	41.22083	282.625	621.8333	-1125.5	42.79667	2.113333	0.455717	27.0329	1081.3	11713.3
Tuesday	22	16.72083	5.791667	10.56667	49.91667	39.2875	282.6875	609.025	-1125.5	43.2	2.1	2.9198	18.94017	1081.2	11711.4
Tuesday	23	9.154167	5.833333	2.2625	52.32083	13.99167	282.925	609.0375	-1125.5	43.13667	2.086667	-0.97868	18.5517	1038.3	11247.4
Wednesday	0	8.491667	5.858333	-13.3508	51.6625	-15.9633	174.6292	610.3742	-1162.87	43.34667	2.063333	1.574292	20.36807	889.1	9630.5
Wednesday	1	8.504167	5.858333	5.013333	53.69167	-16.2983	174.8708	609.6533	-1155.5	43.39667	2.066667	0.163692	31.27233	918.2	9946.2
Wednesday	2	8.491667	5.866667	1.86	54.24167	-16.4	174.8458	607.8692	-1155.5	43.59333	2.043333	0.061692	37.05733	919.3	9958.5
Wednesday	3	8.520833	5.858333	5.13	54.47917	-15.6633	174.8708	607.4625	-1156.32	43.95	2.043333	0.733476	31.264	918.6	9951.1
Wednesday	4	8.303333	5.858333	0.660833	-21.1367	-16.3867	153.6633	599.2908	-1156.65	-1.19	2.01	-0.64901	25.45337	755.9	8187.9
Wednesday	5	-2.12333	5.845833	-2.995	-83.235	-16.0367	-497.08	615.1092	-1155.5	5.846667	0.843333	-1.3228	19.7748	44.6	483.4
Wednesday	6	-8.99833	-4.67417	3.2725	-164.802	-20.5467	-64.38	609.1517	-1155.5	8.69	1.503333	-2.20409	30.70627	387.7	4199.9
Wednesday	7	29.67667	-2.56083	-9.74833	-141.438	-5.83833	-407.747	369.595	-1155.5	15.48	1.693333	-4.01743	36.5188	-118.4	-1282.4
Wednesday	8	24.94583	-2.54	5.105833	-118.567	-5.45	-198.751	299.3683	-1155.5	26.63333	1.776667	-1.27123	57.4098	88.7	960.4
Wednesday	9	2.808333	-2.84417	1.335833	-102.314	-6.28	-593.532	304.0367	-1156.38	26.71667	1.64	-2.76274	80.00577	-291.2	-3154.3
Wednesday	10	34.07417	-3.32417	4.385	-81.4633	-5.615	-653.902	187.5233	-1156.75	38.09333	1.936667	-2.6628	42.39477	-438.6	-4750.6
Wednesday	11	-4.01417	-3.00333	4.406667	-61.2367	-5.00167	-19.355	389.16	-1156.38	29.12333	1.513333	-1.04182	24.17073	354.7	3842.5
Wednesday	12	-7.95583	-3.0875	16.03833	-49.8433	-4.195	-370.075	256.97	-1155.2	35.37667	1.35	-0.55536	36.93073	-90.0	-975.4
Wednesday	13	3.59	-3.33583	11.2625	-74.15	-6.8825	-32.3183	391.305	-1154.83	41.09667	1.843333	-3.30863	50.72873	379.8	4114.3
Wednesday	14	11.775	-3.035	4.485	-72.6858	5.358333	64.52167	498.9483	-1156.38	14.59667	0.753333	-1.21387	52.49473	576.0	6239.4
Wednesday	15	4.144167	1.365833	-18.085	-30.6692	23.87583	201.4483	636.49	-1156.75	-3.07333	0.496667	-2.85178	63.5144	876.7	9496.2
Wednesday	16	4.496667	5.9	-8.28833	47.70417	25.88583	202.0383	630.865	-1156.75	32.20667	0.92	-0.47432	66.66973	907.9	9834.9
Wednesday	17	9.336491	8.619298	-7.2314	73.79825	27.99386	195.4596	532.4353	-1155.01	42.28667	2	-0.86467	103.2841	987.1	10692.8
Wednesday	18	29.32	9.33	8.36	77.56	38.20667	193.3633	533.1567	-1151.12	45.28	2.096667	-0.32302	94.00573	1030.4	11161.2
Wednesday	19	8.746667	9.383333	7.14	80.84333	38.41667	192.6067	630.7133	-1150.56	43.88667	2.113333	-1.48371	76.01207	1088.4	11789.7
Wednesday	20	23.66	9.33	-4.06333	79.00667	38.24667	193.74	628.0467	-1149.98	43.83667	2.09	0.7099	70.13873	1084.7	11750.3
Wednesday	21	32.91	9.396667	6.873333	81.48667	37.66667	193.6967	632.1133	-1149.99	44.03	2.053333	-0.40632	71.7644	1111.6	12041.1
Wednesday	22	23.32	9.526667	6.12	81.81	31.4	194.1067	636.6833	-1150.75	44.09	2.053333	0.969892	70.4194	1100.5	11921.0

Table 96. Savings Calculation - Compressed Air System (con't)

(Baseline Average Hourly Flow - Post-Retrofit Average Hourly Flow)

Day	Hr	Bldg 250	Bldg 35	Bldg 378	Bldg 379	Bldg 463	Bldg 467	Bldg 472	Bldg 94	Bldg 65	Bldg 249	Bldg 306	Bldg 460	Total Savings (SCFM)	Energy Savings (kWh)
Wednesday	23	11.82	9.56	-5.02667	84.01333	8.666667	208.6333	630.4367	-1150.57	44.01	2.036667	-2.04926	65.63073	1057.7	11457.6
Thursday	0	12.28667	9.593333	-6.23083	83.76667	4.6	289.55	649.3167	-1121.12	46.43278	2.102778	-0.3761	55.74918	1146.8	12422.4
Thursday	1	11.76333	9.596667	5.911667	85.29	4.666667	289.7733	630.4	-1121.13	46.53861	2.1	-0.4392	51.86001	1137.5	12321.2
Thursday	2	11.81	9.583333	10.185	83.51333	4.666667	290.0567	628.4733	-1121.12	46.99833	2.075	-0.27003	51.50973	1138.6	12333.7
Thursday	3	11.81667	9.536667	10.82917	82.86	4.49	290.22	629.9133	-1121.13	47.03194	2.077778	0.106967	51.78307	1140.7	12356.1
Thursday	4	10.94833	9.51	8.625	4.098333	4.640833	271.8475	623.5483	-1121.19	10.53528	2	-0.4242	52.25946	997.6	10806.2
Thursday	5	-5.2325	9.476667	1.444167	-19.8383	4.58	-407.446	634.6967	-1121.13	16.30639	0.552778	-1.19213	54.9489	288.3	3122.9
Thursday	6	-0.27917	1.17	-3.0375	-86.6242	-23.2658	142.78	580.1875	-1121.13	20.00833	1.056667	-0.3967	68.11418	699.7	7579.5
Thursday	7	-1.285	-0.71167	-4.37667	-6.62917	9.909167	-200.344	369.9908	-1193.73	36.92739	1.584928	1.546833	36.42698	243.0	2632.7
Thursday	8	17.3725	-1.11667	8.975	-3.225	10.64583	-52.1975	324.6608	-1128.38	30.55733	2.343333	0.8296	20.19707	359.0	3889.3
Thursday	9	21.59083	-1.3425	0.7	32.4725	10.21917	-571.874	330.1117	-1127.8	36.07967	1.643333	0.1145	31.18117	-109.1	-1181.8
Thursday	10	18.15083	-0.6825	11.44833	-54.3075	11	-488.505	286.455	-1134.3	26.898	2.686667	-2.18673	24.78397	-164.3	-1779.3
Thursday	11	8.905	0.203333	2.0575	-97.0058	10.355	212.9675	362.6125	-1004.27	25.76033	1.546667	-0.6543	29.22073	556.0	6022.4
Thursday	12	18.04667	-0.36667	11.76667	-96.3875	10.99083	-452.891	278.4833	-1035.9	33.896	1.333333	-2.2109	24.86417	-172.5	-1868.3
Thursday	13	21.92083	1.55	2.283333	-102.961	9.334167	-45.1733	336.525	-1100.3	24.45733	1.003333	-0.60493	26.6881	275.0	2979.1
Thursday	14	15.36333	3.103333	8.410833	-62.3333	14.69	284.8667	479.3625	-1182.61	14.93567	1.023333	-1.35833	25.68823	783.8	8489.9
Thursday	15	5.255	1.703333	-0.47333	-10.0858	32.89	479.4733	660.1933	-1117.57	4.258	0.353333	-2.37023	26.4538	1197.7	12973.4
Thursday	16	5.0625	4.643333	-4.00583	78.3	50.95333	280.1267	586.625	-1126	37.449	0.656667	-0.56	29.03757	1068.3	11572.1
Thursday	17	6.884167	4.626667	14.29833	82.28333	50.17417	274.1467	625.6808	-1126	47.763	2.106667	-1.01983	31.88427	1138.8	12336.2
Thursday	18	16.38333	4.61	9.605	79.83333	49.89917	275.3467	608.3667	-1126	50.088	2.343333	-1.1372	31.01137	1126.3	12201.0
Thursday	19	8.665833	4.56	13.59083	81.6	50.5	274.22	593.6325	-1126	49.109	2.39	-0.60617	28.70553	1106.4	11984.5
Thursday	20	11.98333	4.553333	3.857778	80.08667	49.93	274.3067	539.6256	-1126	48.79833	2.296667	-1.34863	26.26887	1040.4	11269.5
Thursday	21	14.21333	4.566667	12.82333	81.81333	45.37333	274.3967	572.7278	194	48.80933	2.29	0.006733	32.02117	1089.0	11796.9
Thursday	22	25.00556	4.623333	6.766667	83.99333	13.08333	275.4967	612.8411	194	49.025	2.346667	-0.57827	47.58757	1120.2	12134.3
Thursday	23	18.81	4.7	7.892222	84.87333	4.506667	274.22	618.9244	194	48.82767	2.346667	-4.2724	46.2079	1107.0	11991.8
Friday	0	10.80333	4.73	5.106667	82.61333	4.68	274.4	622.8633	-1124.17	49.109	2.356667	-0.1871	42.6329	1099.1	11905.9
Friday	1	23.17	4.713333	18.79333	83.86	4.613333	274.63	621.59	-1126	49.17733	2.333333	0.592367	39.0223	1122.5	12159.2
Friday	2	23.19667	4.703333	17.52	83.80667	4.67	274.66	623.5633	-1126	49.405	2.323333	1.687867	34.14733	1119.7	12128.8
Friday	3	23.21667	4.72	17.26333	83.01667	4.51	274.75	620.5667	-1126	49.39933	2.333333	-0.0396	28.73967	1108.5	12007.6
Friday	4	22.97917	4.736667	16.13417	-3.71333	4.5725	163.8333	609.8242	-1126.1	13.485	2.163333	-0.04637	26.75147	860.7	9323.6
Friday	5	23.21917	4.73	-1.16417	-57.625	4.843333	-616.382	619.765	-1126	14.86	0.783333	-3.25173	29.03817	18.8	203.8
Friday	6	4.768333	-1.22583	10.50833	-131.002	10.51	-109.371	587.3525	-1126	6.902333	1.533333	-0.1444	40.88063	420.7	4557.3
Friday	7	-3.90583	-0.90417	-2.125	-58.5867	20.175	-927.148	434.4792	-1126	14.55767	1.283333	-2.86287	72.16617	-452.9	-4905.7
Friday	8	12.675	-0.6575	9.01	-68.0675	19.83583	-442.196	335.355	-1126	10.66367	1.66	0.261167	68.3467	-53.1	-575.3
Friday	9	-7.1225	0.178333	3.8175	-103.179	16.2	-538.858	336.66	-1126	11.638	1.936667	-3.813	87.65437	-194.9	-2111.1
Friday	10	17.7975	-0.51	14.00083	-130.748	13.03667	-499.573	346.4325	-1126	20.98433	2.336667	-1.16207	71.64847	-145.8	-1578.9
Friday	11	0.144167	-0.49667	0.8	-103.995	10.14417	302.8567	374.7775	-1126	20.81467	1.69	-2.2158	86.6593	691.2	7487.1
Friday	12	19.92083	-0.55	11.29667	-84.7992	8.6225	-89.46	313.98	-1126	13.43433	1.593333	-1.4182	84.79967	277.4	3005.1
Friday	13	27.47333	-1.10333	8.7275	-107.242	12.03583	175.2433	364.6567	-1126	5.836	1.43	-2.7476	80.29427	564.6	6116.0
Friday	14	18.60167	-0.83667	15.90583	-81.0383	12.22083	291.0733	550.5325	-1126	1.511	0.906667	-0.90513	69.04503	877.0	9500.1
Friday	15	7.374167	1.954167	-1.115	17.0125	48.66833	281.3433	622.8267	-1126	-1.551	0.513333	-1.24967	66.73387	1042.5	11292.8
Friday	16	12.5025	4.85	-4.90667	75.46	50.3075	281.1067	571.8408	-1126.63	35.18833	0.78	-1.87993	70.84173	1096.1	11873.2
Friday	17	4.615	4.863333	7.320833	74.23667	50.49667	280.92	560.9542	-1126	47.728	2.096667	-3.63783	77.35663	1107.0	11990.9
Friday	18	16.83167	4.85	3.7575	75.01333	50.62667	280.8367	637.3767	-1126	49.05733	2.24	1.385433	73.03153	1195.0	12944.7
Friday	19	1.383333	4.846667	3.3025	75.96	42.75667	281.0433	623.4767	-1126	48.87867	2.286667	-0.9185	75.173	1158.2	12545.9
Friday	20	15.105	4.73	-2.74333	73.61333	33.21667	281.1033	609.1058	-1049.07	48.551	2.203333	0.2409	60.6851	1125.8	12195.2
Friday	21	14.45	4.76	9.9325	72.75333	27.61333	281.1267	552.7883	-1006	49.18	2.233333	1.1448	79.35323	1095.3	11865.0
Friday	22	13.95333	4.82	-1.55583	74.59667	8.023333	281.15	622.8	-1006	48.763	2.243333	-0.04813	75.15403	1129.9	12239.4
Friday	23	6.810833	4.796667	13.1325	74.76333	4.36	281.1767	624.4367	-1006	48.80867	2.24	-0.6085	71.4007	1131.3	12254.8

Table 96. Savings Calculation - Compressed Air System (con't)

(Baseline Average Hourly Flow - Post-Retrofit Average Hourly Flow)

Day	Hr	Bldg 250	Bldg 35	Bldg 378	Bldg 379	Bldg 463	Bldg 467	Bldg 472	Bldg 94	Bldg 65	Bldg 249	Bldg 306	Bldg 460	Total Savings (SCFM)	Energy Savings (kWh)
Saturday	0	19.385	4.833333	7.301667	76.56	4.57	281.2533	623.2133	-1066.27	49.18133	2.256667	1.40085	68.6	1138.6	12333.4
Saturday	1	19.3125	4.836667	4.785	76.21	4.65	281.2933	624.9067	-1066	49.20933	2.253333	0.8036	68.56671	1136.8	12314.5
Saturday	2	18.96	4.85	9.435	75.28	4.64	281.28	624.0867	-1066	49.145	2.213333	0.998233	68.56875	1139.5	12343.0
Saturday	3	18.7575	4.83	12.095	75.64667	4.51	281.3633	624.48	-1066	49.24567	2.206667	1.088883	68.54608	1142.8	12378.9
Saturday	4	19.615	4.846667	8.0325	8.765833	4.555833	284.4867	620.1183	-1066.3	10.97033	2.063333	1.915233	70.40158	1035.8	11219.8
Saturday	5	19.34583	4.753333	-3.7175	-64.5342	4.333333	404.7533	618.6067	-1066	16.82933	0.443333	-0.62921	71.58088	1071.8	11609.7
Saturday	6	5.085833	-7.23	-5.21917	-150.623	4.565	-117.267	548.1642	-1065.67	-0.65617	1.22	0.575017	83.16554	361.8	3918.9
Saturday	7	-28.1433	-7.07417	-10.315	-110.011	2.31	-276.297	461.815	-1066	-5.45067	1.113333	1.434275	98.27475	127.7	1382.8
Saturday	8	-5.21667	-7.02917	-10.32	-87.3017	-22.6733	-37.2017	475.3208	-1066	11.36233	1.731667	0.902017	102.8106	422.4	4575.4
Saturday	9	-26.0458	-6.78083	-10.5042	-53.8975	-36.6383	-540.463	516.0425	-1066	-11.2317	1.749167	-0.85578	101.6828	-66.9	-725.1
Saturday	10	-11.515	-7.05667	-9.20083	-53.28	-24.1992	60.24333	509.3758	-1066	-4.11183	1.384167	-1.08816	81.64517	542.2	5873.3
Saturday	11	-1.90833	-6.96417	-12.7708	-60.5417	-16.345	107.6075	585.63	-1066	2.1125	1.5125	-1.58442	89.60325	686.4	7434.8
Saturday	12	-31.0942	-6.59917	-19.2817	-70.5867	-15.9825	177.4208	443.2717	-1066	0.765667	1.64	-4.5467	76.23971	551.2	5971.3
Saturday	13	-1.9	-6.46417	-6.8425	-99.02	-15.9875	289.84	486.8192	-1066	1.181	1.2525	-4.01449	82.26742	727.1	7876.5
Saturday	14	2.341667	-5.75333	9.629167	-99.4325	-8.92167	288.7433	577.2475	-1066	9.219	0.655	-2.10664	82.78621	854.4	9255.2
Saturday	15	6.284167	-0.85833	13.3975	-14.585	4.606667	286.8692	628.5367	-1066	13.215	0.41	-3.30328	50.79913	985.4	10673.9
Saturday	16	13.92083	4.84	6.77	72.06	4.606667	288.54	473.0592	-1065.82	36.4695	0.718333	-0.35725	47.13258	947.8	10266.4
Saturday	17	9.210833	4.84	17.425	72.8	4.59	288.4067	491.1983	-1066.45	45.354	2.048333	-2.73084	69.40275	1002.5	10859.9
Saturday	18	5.156667	4.92	8.1175	72.96333	4.59	288.46	594.785	-1066	48.221	2.2425	-0.18069	80.03008	1109.3	12016.4
Saturday	19	7.55	4.923333	8.219167	73.22	4.586667	288.4867	599.4908	-1066	47.53133	2.266667	0.416108	76.61254	1113.3	12059.7
Saturday	20	10.97333	4.886667	-9.20833	71.45333	4.616667	288.5067	626.07	-1066.67	46.956	2.193333	1.080675	75.73988	1123.3	12167.6
Saturday	21	6.51	4.843333	-4.43583	72.19667	4.553333	288.4	626.97	-1064.83	46.89367	2.163333	1.325425	82.88758	1132.3	12265.5
Saturday	22	6.503333	4.836667	-1.63583	71.13	4.273333	288.5267	626.2533	-1065.67	47.094	2.133333	0.865992	84.06792	1134.0	12284.4
Saturday	23	-1.24917	4.84	11.80333	71.52	4.463333	288.5567	626.6967	-1064.83	47.17467	2.146667	0.870742	84.73217	1141.6	12365.7

Total Savings	1,327,349	kWh/yr
	152	kW

Figure 23. 4.12 Baseline Compressed Air Profiles for Building 35, 94, 250, 378, 379, 463, 467, 472

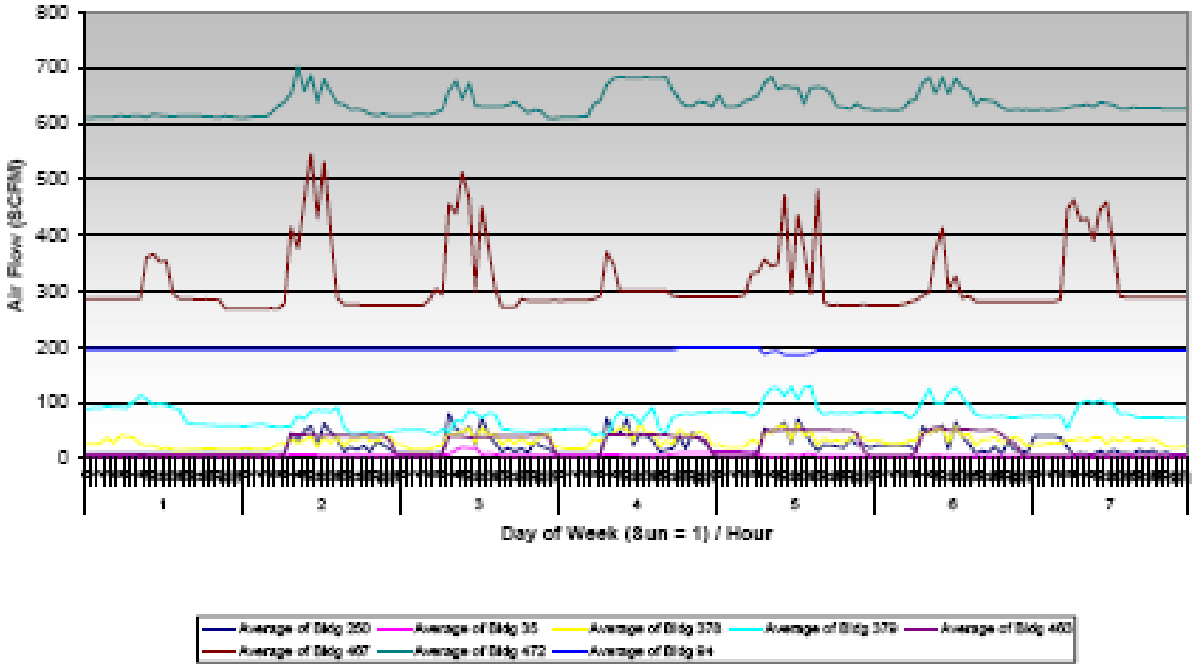


Figure 24. 4.13 Baseline Compressed Air Profiles for Building 65, 249, 306, 460

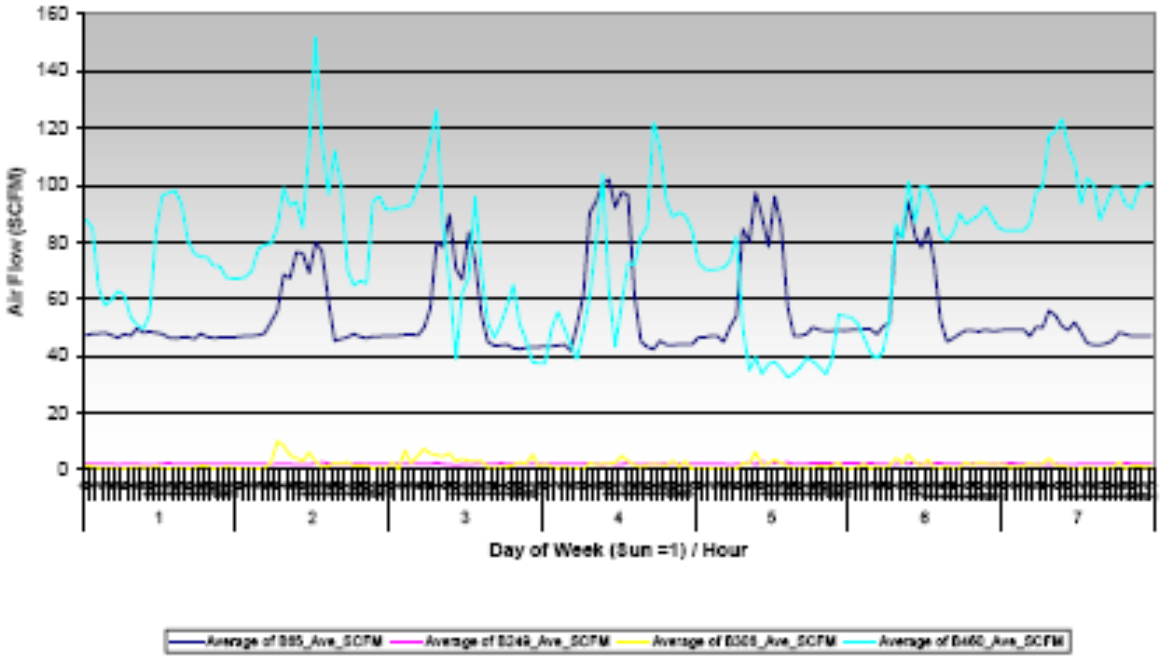


Figure 25. 4.14 Post-Retrofit Compressed Air Profiles for Buildings 35, 94, 250, 378, 379, 463, 467, 472

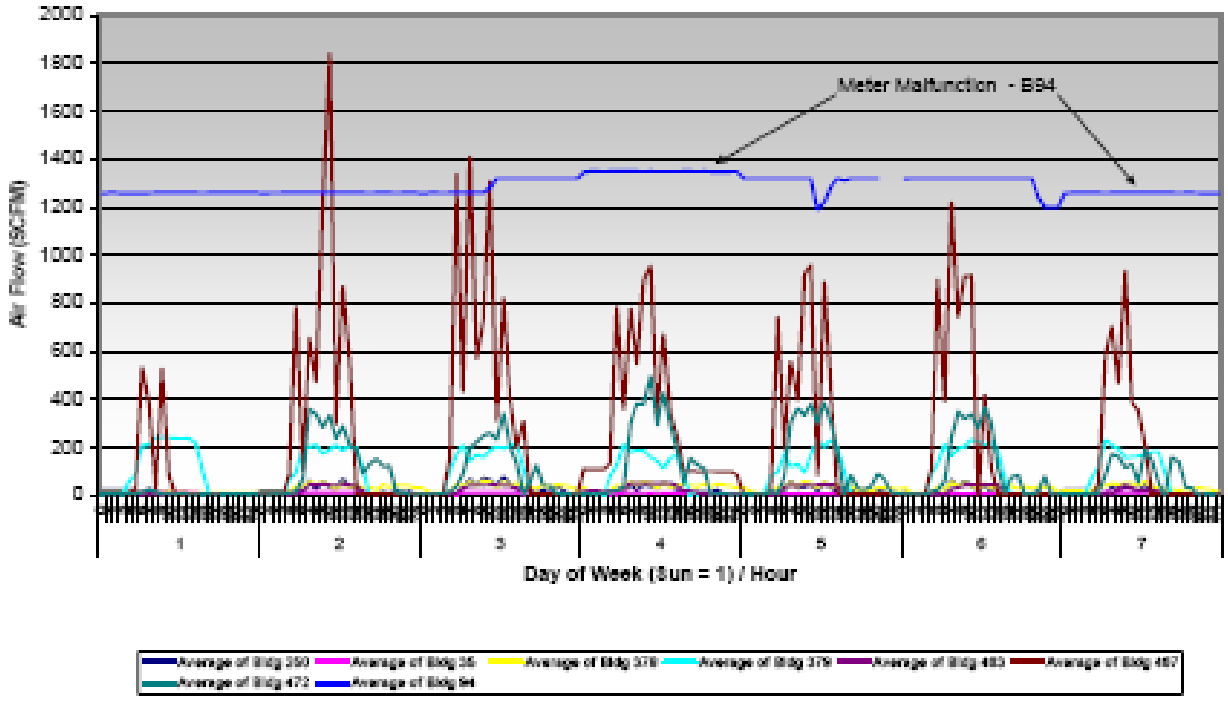


Figure 26. 4.15 Post-Retrofit Compressed Air Profiles for Building 65, 249, 306, 460

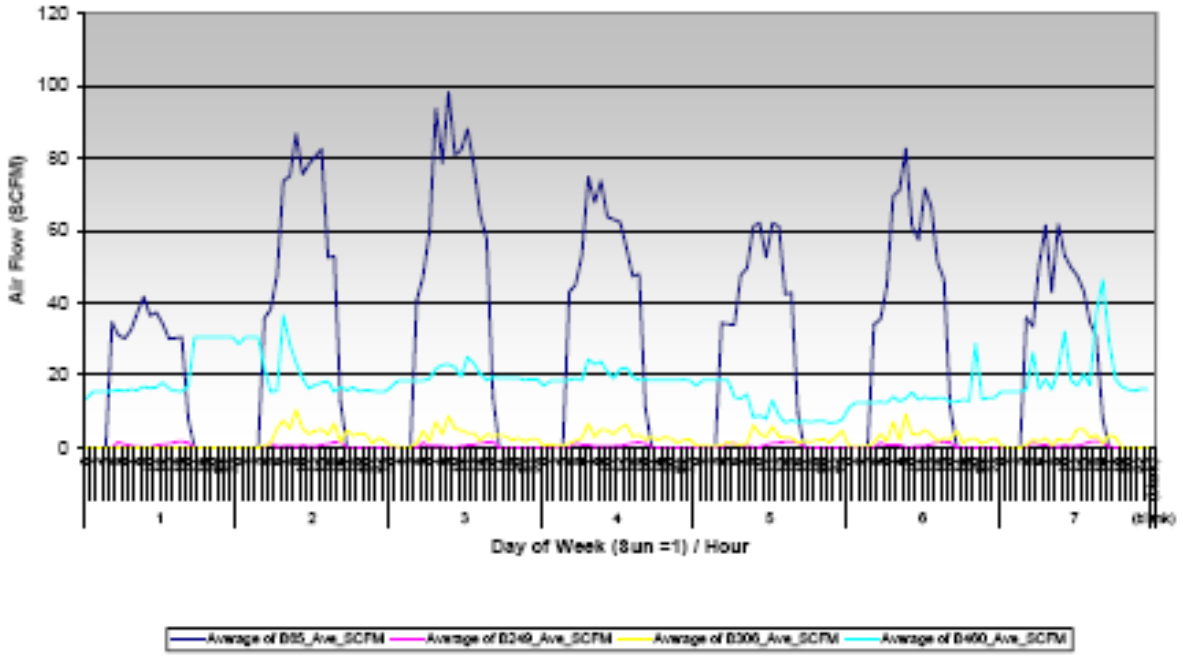
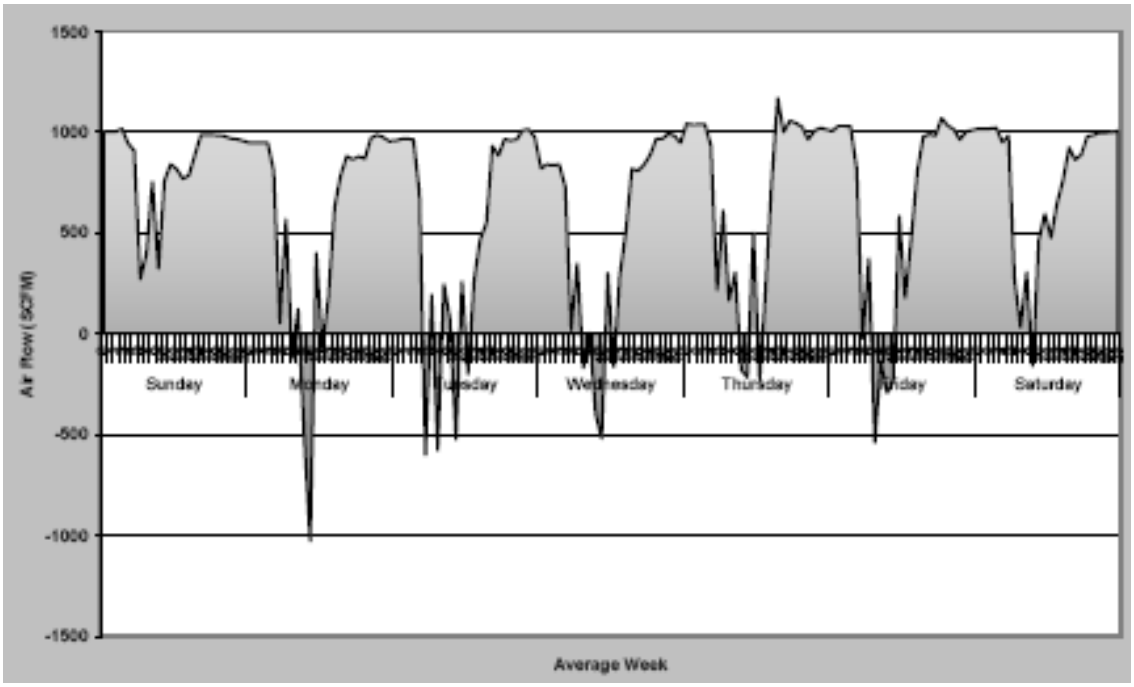


Figure 27. 4.16 Compressed Air Flow Savings Profile for All Buildings



7.9 05-04-001 – Lighting, HVAC and Computer Power Management

The Project Sponsor retrofitted a variety of energy saving measures at 22 schools in a single school district. Table 97 shows the verified savings summary for Project 05-04-001. The measures and reported savings are shown in Table 98.

Table 97. M&V Savings Summary – 05-04-001

Total Contracted kWh Savings	2,316,333
Total Reported / Invoiced kWh Savings	2,139,228
M&V Savings (kWh)	**2,035,646**
Percent of Contracted kWh Savings	92%
Percent of Reported kWh Savings	95%
Total Contracted kW Savings	270.8
Total Reported / Invoiced kW Savings	286.6
M&V Savings (kW)	**286.6**
Percent of Contracted kWh Savings	106%
Percent of Reported kW Savings	77%
Total Contracted Therm Savings	37,478
Total Reported / Invoiced Therm Savings	16,340
M&V Savings (Therm)	16,340
Percent of Contracted kWh Savings	44%
Percent of Reported Therm Savings	100%

7.9.1 Program Overview

The Project Sponsor retrofitted a combination energy efficiency measures at 22 schools in the Customer's school district. The measures and reported savings are shown in Table 98.

Table 98. Measure Summary and Reported Savings

Measure	kWh Savings	kW Savings	Therm Savings
T12 to T8 lighting	434,195	209.8	0
Replace manual thermostats with programmable thermostats	983,884	0	16,340
Install new high efficiency air-conditioners and heat pumps	121,149	76.8	0
Install computer power management software	600,000	0	0
Install variable speed control of pool pump	0	0	0
Total	2,139,228	286.6	16,340

7.9.2 Measurement and Verification (M&V) Approach

The M&V approach for each measure proposed in the project is summarized in this section. A detailed description of the methodology used to calculate savings for each measure is provided later in this report. The load impact estimation methodology complies with IPMVP Option A.

7.9.2.1 Lighting

- Use results of San Diego Gas and Electric's (SDG&E's) pre-retrofit inspections to verify existing number and type of fixtures and the estimated hours of operation.
- Perform post-retrofit inspections to verify new fixtures, quantity of fixtures, and estimated hours of operation and percent of SDG&E's peak period that the lights are on.
- The lighting detail spreadsheets provided by Innovative Energy Services accurately reflected the as-built conditions.
-

7.9.2.2 Programmable Thermostats

- The M&V effort attempted to model a couple of representative classroom buildings, but the models did not provide reasonable results for the loads on the AC. There were too many external factors such as open windows or doors, variable occupancy, etc. that introduced error. Therefore, the modeling approach planned was not used.
- The claimed savings per thermostat ranged from 1,800 to 2,400 kWh. These values were compared with other sources (utility deemed savings) and found to be reasonable in comparison. Therefore, the M&V is accepting the claimed savings for this measure.
- On-site verifications were conducted at a sample of schools. The number of thermostats installed did not match the original claims. The Project Sponsor later corrected the

claimed numbers following consultation with the installing contractor. Both the reported savings and the M&V savings reflect the adjusted quantities.

7.9.2.3 New HVAC Units

- The HVAC units installed were verified.
- The savings were compared with DEER values. DEER reports an average of 86 kWh/ton. The savings ranged between 374 kWh/ton to 1,037 kWh/ton.
- Applying the DEER values to the units installed yields 14.5% of the reported savings.
- The total M&V savings are 17,567 kWh/yr. and 11.1 Peak kW.

7.9.2.4 Computer Management Software

- Independent third party evaluations of the Verdiem computer management software have been performed. M&V involved a literature review of these studies, as well as, other published information on PC energy usage.
- The savings reported by this measure were deemed reasonable.

7.9.2.5 VSD on Pool Pump

- The VSD was not installed. No savings were reported for this measure.

7.9.3 Results

The measurement and verification of savings achieved by this project results in an estimate of 2,035,646 kWh per year and 220.9 kW peak demand reduction. This is 95% and 77% of the reported savings respectively. The M&V results are 92% of the contracted kWh savings. The M&V results are slightly less than the reported savings due to lower savings achieved by the new HVAC units. The M&V results compared with the reported savings is shown for each measure in Table 99.

Table 99. M&V Results

#	Measure	kWh M&V Savings	kWh Contracted Savings	Peak kW M&V Savings	Peak kW Contracted Savings	Therms M&V Savings	Therms Contracted Savings
1	T12 to T8 lighting	434,195	434,195	209.8	209.8	0	0
2	Replace manual thermostats with programmable thermostats	983,884	983,884	0	0	16,340	16,340
3	Install new high efficiency air-conditioners and heat pumps	17,567	121,149	11.1	76.8	0	0
4	Install computer power management software	600,000	600,000	0	0	0	0
5	Install variable speed control of pool pump	0	0	0	0	0	0
	Total	**2,035,646**	**2,139,228**	**220.9**	**286.6**	**16,340**	**16,340**

7.10 05-04-002 – HID To T-5 Fixture Retrofit

The Project Sponsor retrofitted existing HID lighting with fluorescent T5 fixtures with bi-level controls in buildings located on a single, large campus-like facility. Maintenance bays, warehouses, and gymnasiums were targeted for the new lighting. The M&V savings summary are shown in Table 100.

Table 100. M&V Savings Summary: 05-04-002

	kWh	kW
Total Contracted Savings	2,256,789	361.1
Total Reported / Invoiced Savings	829,541	343.8
M&V Savings	**686,322**	**157.7**
Percent of Reported Savings	83%	46%

The contracted savings were developed from lighting surveys and estimated hours of operation by the Project Sponsor. Table 105 provides the line item detail of the proposed project.

7.10.1 Measurement and Verification (M&V) Approach

The M&V approach for the project is summarized in this section. KSI coordinated with the Project Sponsor to perform pre and post retrofit M&V activities as described below.

- Obtain power measurements on a sample of circuits
- Perform post-retrofit inspections to verify new fixtures, quantity of fixtures, and estimated hour of operation and percent of the SDG&E's peak period that the fixtures are on.
- Installed metering equipment on select circuits of each building type. The metering data is used to determine the fixture group operating hours at high and low power. The average hours at each operating level were developed for each of the 3 building types. Operating hours of lighting groups not metered was the average of the circuits metered for that building type.
- The lighting detail spreadsheets provided by the Project Sponsor were updated with revised counts and hours of operation to determine the energy savings for the sampled fixture groups.

The load impact estimation methodology complies with IPMVP Option A.

7.10.2 Results

This section provides the results of the M&V process. The findings from the site visits and the extrapolation of the sample results to the population results are provided. Overall the M&V process estimates the savings for Project 05-04-002 as 686,322 kWh per year and 157.7 kW peak demand reduction. This is 83% and 46% of the reported savings respectively.

The M&V team was not given sufficient notice to perform pre inspections and metering. Therefore, no adjustments were made to the reported number and type of existing fixtures. There were changes to the proposed new fixture quantity and type based on post-inspections of the facilities. Those changes are reflected in Table 104.

The M&V team performed multiple post inspections of the retrofitted buildings and installed metering equipment on 20 of the 33 lighting groups. The results of the metering data were applied directly to the associated lighting group. The average hours of the metered groups within a building type were applied to the lighting groups not metered. The results of the metering are shown in Table 101. Table 102 shows the average hours of operation by building type as verified through metering.

Table 101. Metering Results

Building	Description	% High Power	Hours/Yr High Power	% Mid Power	Hours/Yr Mid Power	% Low	Hours/Yr Low Power	% Off	Hours/Yr Off	Total Op Hours
Bldg 1	Maint Bay	24.4	2,137	0	0	0.91	80	74.69	6,543	2,217
Bldg 2	Maint Bay	2.0	175	0	0	6.0	526	93.33	8,176	701
Bldg 3	Warehouse	17	1,489	0	0	16	1,402	67	5,869	2,891
Bldg 4	Maint Bay	2	175	0	0	12	1,051	86	7,534	1,226
Bldg 5	Warehouse	27.02	2,367	2.94	258	1.82	159	68.23	5,977	2,784
Bldg 6	Warehouse	3.7	324	0	0	25.34	2,220	70.96	6,216	2,544
Bldg 7	Warehouse	27.41	2,401	0.06	5	1.79	157	70.73	6,196	2,563
Bldg 8	Gym	6.48	568	1.74	152	2.31	202	89.47	7,838	922
Bldg 9	Gym	13.36	1,170	0	0	20.01	1,753	66.63	5,837	2,923
Bldg 10	Maint Bay	22.7	1,989	0	0	13.2	1,156	64	5,606	3,145
Bldg 11	Maint Bay	6	526	0	0	0	0	94	8,234	526
Bldg 12	Maint Bay	8.5	745	0	0	17	1,489	74.5	6,526	2,234
Bldg 13	Maint Bay	7	613	0	0	8	701	85	7,446	1,314
Bldg 14	Warehouse	1.6	140	1.82	159	1.01	88	95.57	8,372	388
Bldg 15	Warehouse	1.92	168	8.22	720	1.92	168	87.93	7,703	1,056
Bldg 16	Maint Bay	15	1,314	0	0	11	964	74	6,482	2,278
Bldg 17	Maint Bay	15	1,314	0	0	5	438	80	7,008	1,752
Bldg 18	Warehouse	Meter	failure							
Bldg 19	Warehouse	Meter	failure							
Bldg 20	Gym	Meter	failure							

Table 102. Average Annual Hours of Operation by Building Type

	High Power	Medium Power	Low Power	Total Hours
Warehouse	1,548	53	848	2,448
Gym	869	76	978	1,923
Maint Bay	952	0	698	1,650

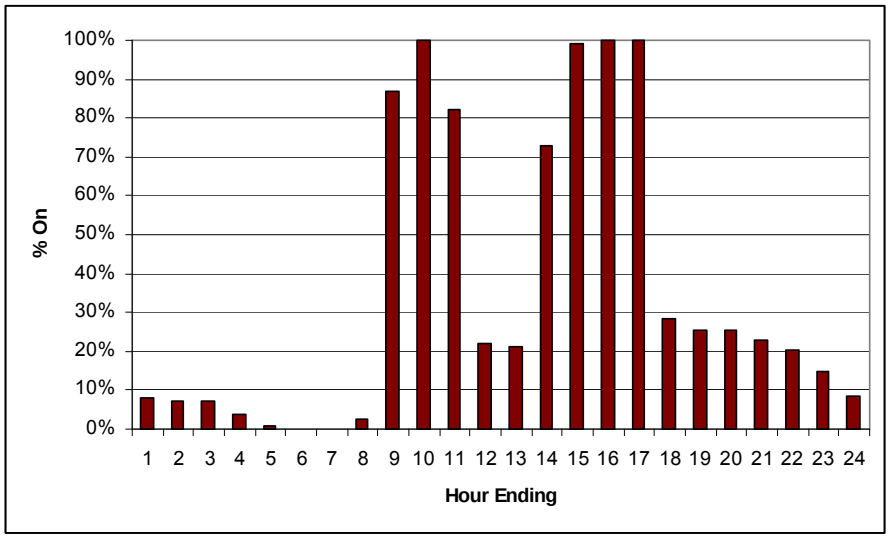
The claimed savings were based on fixtures that operated at high and low levels. Some of the installed fixtures operated at high, medium, and low levels. Table 103 contrasts the claimed hours at each power level with the results of the metering by building type.

Table 103. Comparison of Claimed Operation to Metered Results Building Type (Hours/Year)

		High	Medium	Low	Total Hours
Claimed Operation	Warehouse	2,389	N/A	N/A	2,389
Metered Operation	Warehouse	1,548	53	848	2,448
Claimed Operation	Gym	3,154	N/A	N/A	3,154
Metered Operation	Gym	869	76	978	1,923
Claimed Operation	Maint Bay	2,162	N/A	N/A	2,162
Metered Operation	Maint Bay	952	N/A	698	1,650

The total operating hours measured is lower than the hours claimed for each space type. The metered data clearly shows that most of the buildings are operating one shift only. The original claimed savings must have estimated more than one shift for many of the spaces in order to realize the operating hours presented.

Figure 28. Example of One Shift Lighting Operation - Measured Data



During the M&V inspections many of the buildings were using only daylight from the open high bay doors. Occupants expressed that this was common because the amount of daylight was often plenty of their needs. Other spaces appeared to have sporadic usage and did not have a "consistent" schedule.

Therefore the total operating hours measured by the M&V effort are lower than the claimed hours. This is the reason the M&V has determined that the achieved savings are lower than the claimed savings.

7.10.3 Conclusions

The verified energy savings and demand reduction attributed to the retrofit of HID lamps with high bay T-5 fluorescent fixtures on various buildings at the Campus were less than claimed as shown in Table 100. The fixture counts were not a factor in the discrepancy in savings. The findings suggest the discrepancies are due to:

- Verified operating hours being lower than claimed
  - ⇒ Use of daylight through high bay doors
  - ⇒ One shift that was verified through metering as compared to multiple shifts that were claimed
- Difference in how the power levels of the fixtures were used, i.e., the profile of high, medium and low power of the fixtures was verified and proved to be different from the claimed profile.

Table 104. M&V Results by Line Item

Bldg	Use Type	Pre Fixt Number	Pre Fixt. Code	Pre kW/Fixt.	Pre Operating hours	Pre kWh	Post Fixt Number	Post Fixt Code	Post kW/Fixt @ Hi Level	Post Operating hrs @ Hi Level	Post kW/Fixt @ Med Level	Post Operating hrs @ Med Level	Post kW/Fixt @ Low Level	Post Operating hours @ Low Level	Post kWh	kWh Saved
22225	GYM	30	HPS400/1	0.465	922	12,868	26	F43PHL/2	0.179	568	0.117	152	0.062	202	3,432	9,436
24079	GYM	20	HPS400/1	0.465	2,923	27,186	17	F43PHL/2	0.179	1,170	0.117	0	0.062	1,753	5,409	21,777
51919	GYM	8	MH250/1	0.295	1,923	4,538	8	F44PHL/2	0.234	869	0.117	76	0.117	978	2,613	1,925
53528	GYM	48	MH400/1	0.458	1,923	42,271	48	F44PHL/2	0.234	869	0.117	76	0.117	978	15,679	26,592
620411	GYM	22	MH400/1	0.458	1,923	19,374	22	F44PHL/2	0.234	869	0.117	76	0.117	978	7,186	12,188
13026	Maint Bay	17	HPS250/1	0.295	2,217	11,119	17	F43PHL/2	0.179	2,137	0.117	0	0.062	80	6,588	4,531
214026	Maint Bay	74	MH400/1	0.458	1,226	41,565	60	F44PHL/2	0.234	175	0.117	0	0.117	1,051	9,839	31,726
31907	Maint Bay	100	MH1000/1	1.080	1,835	198,204	100	F46PHL/3	0.351	1,257	0.179	0	0.179	578	54,472	143,732
31908	Maint Bay	100	MH1000/1	1.080	3,145	339,643	100	F46PHL/3	0.351	1,989	0.179	0	0.179	1,156	90,495	249,148
41312	Maint Bay	27	MH400/1	0.458	526	6,500	29	F43PHL/2	0.179	526	0.117	0	0.062	0	2,728	3,771
43542	Maint Bay	30	HPS400/1	0.465	2,234	31,162	30	F43PHL/2	0.179	745	0.117	0	0.062	1,489	6,768	24,393
43542	Maint Bay	25	MH400/1	0.458	1,314	15,045	20	F43PHL/2	0.179	613	0.117	0	0.062	701	3,064	11,981
140172	Maint Bay	8	HPS400/1	0.465	1,650	6,137	8	F43PHL/2	0.179	952	0.117	0	0.062	698	1,709	4,428
210559	Maint Bay	12	HPS400/1	0.465	1,650	9,205	12	F43PHL/2	0.179	952	0.117	0	0.062	698	2,564	6,641
210840	Maint Bay	17	HPS400/1	0.465	1,650	13,041	9	F43PHL/2	0.179	952	0.117	0	0.062	698	1,923	11,118
310617	Maint Bay	33	MH400/1	0.458	1,650	24,934	33	F43PHL/2	0.179	952	0.117	0	0.062	698	7,051	17,883
33543	Maint Bay	45	HPS400/1	0.465	1,650	34,521	45	F43PHL/2	0.179	952	0.117	0	0.062	698	9,616	24,905
41408	Maint Bay	15	MH400/1	0.458	1,650	11,334	15	F44PHL/2	0.234	952	0.117	0	0.117	698	4,566	6,767
12108	Warehouse	59	HPS400/1	0.465	1,459	40,027	54	F43PHL/2	0.179	1,156	0.117	0	0.062	303	12,190	27,837
140210	Warehouse	12	HPS400/1	0.465	2,448	13,661	14	F43PHL/2	0.179	1,548	0.117	53	0.062	848	4,700	8,960
25270	Warehouse	15	HPS400/1	0.465	2,448	17,076	16	F43PHL/2	0.179	1,548	0.117	53	0.062	848	5,372	11,704
31345	Warehouse	16	MH400/1	0.458	2,448	17,940	16	F44PHL/2	0.234	1,548	0.117	53	0.117	848	7,480	10,460
52501	Warehouse	10	MH250/1	0.295	2,448	7,222	14	F43PHL/2	0.179	1,548	0.117	53	0.062	848	4,700	2,522
53667	Warehouse	16	MH400/1	0.458	2,448	17,940	18	F43PHL/2	0.179	1,548	0.117	53	0.062	848	6,043	11,897
210848	Warehouse	6	MH400/1	0.458	2,448	6,728	2	F43PHL/3	0.179	2,448		0		0	876	5,851
41252	Warehouse	4	1x8x2 FL	0.134	2,448	1,312	4	F43PHL/4	0.179	2,448		0		0	1,753	(441)
35		**1,084**				**1,288,511**	**1,020**								**276,190**	**686,322**

Table 105. Reported Savings by Line Item

		EXISTING								PROPOSED						ENERGY SAVINGS						
Building and Space	Fixture Type	Fix Qty	W per Fix	Use Factor	Hr per Day	Day per Yr	Hr per Yr	Total kW	Total kWh/Yr	Fix Type	Fix Qty	W per Fix	Use Factor	Total kW	Total kWh per Yr	Saved kW per Fix	kWh Sav per Fix	Hr per Day Daylite	kWh Sav Daylite	Hr per Day Sensor	kWh Sav per Yr Sensor	Total kW Savings
Bldg 12108																						
Warehouse	400W HPS	32	465	0.71	10	252	1,800	14.9	26,784	4F54T5 HO	20	198	0.71	4.0	7,128	10.9	19,656	7.5	1,782	10	0	21,438
Warehouse	1x8x2 FI	4	134	0.71	10	252	1,800	0.5	965	3F54T5 GW	4	176	0.71	0.7	1,267	-0.2	-302	7.5	317	10	0	14
Warehouse	400W HPS	27	465	0.71	10	252	1,800	12.6	22,599	3F54T5 GW	35	176	0.71	6.2	11,088	6.4	11,511	7.5	2,772	10	0	14,283
Bldg 12108		63	1064					28.0	50,348		59			10.8	19,483	17.1	30,865		4,871		0	35,735
Bldg 13026																						
Auto Repair	250W HPS	17	300	1.00	13	350	4,550	5.1	23,205	3F54T5 HO	17	176	0.71	3.0	9,724	2.1	13,481	9.75	2,431	13	0	15,912
Bldg 13026		17	300					5.1	23,205		17			3.0	9,724	2.1	13,481		2,431		0	15,912
Bldg 140172																						
Wood Shop	400W HPS	8	465	0.71	10	252	1,800	3.7	6,696	4F54T5 HO	8	198	0.71	1.6	2,851	2.1	3,845	10	0	10	0	3,845
Bldg 140172		8	465					3.7	6,696		8			1.6	2,851	2.1	3,845		0		0	3,845
Bldg 140210																						
Vehicle Maint.	400W HPS	20	465	1.00	10	252	2,520	9.3	23,436	4F54T5 HO	20	198	0.71	4.0	7,128	5.3	16,308	7.5	1,782	10	0	18,090
Locker Rooms	400W HPS	27	465	1.00	12	252	3,024	12.6	37,966	3F54T5 HO	14	176	0.71	2.5	5,322	10.1	32,644	12	0	6	197	32,841
Maint. Bays	250W MV	47	285	1.00	10	252	2,520	13.4	33,755	3F54T5 HO	47	176	0.71	8.3	14,890	5.1	18,866	10 [2]	0	10	0	18,866
Bldg 140210		94	1215					35.3	95,158		81			14.7	27,340	20.6	67,818		1,782		197	69,797
Bldg 214026																						
Vehicle Maint.	400W HPS	32	465	1.00	10	252	2,520	14.9	37,498	4F54T5 HO	32	198	0.71	6.3	11,405	8.5	26,093	7.5	2,851	10	0	28,944
Work Bays	400W HPS	12	465	0.71	10	252	1,800	5.6	10,044	4F54T5 HO	12	198	0.71	2.4	4,277	3.2	5,767	10	0	10	0	5,767
Storage Bays	400W HPS	16	465	1.00	12	252	3,024	7.4	22,499	4F54T5 HO	16	198	0.71	3.2	6,843	4.3	15,656	9	1,711	12	0	17,366
Whse 214021	400W HPS	16	465	1.00	10	275	2,750	7.4	20,460	4F54T5 HO	17	198	0.71	3.4	6,612	4.1	13,848	7.5	1,653	10	0	15,501
Bldg 214026		76	1860					35.3	90,500		77			15.2	29,136	20.1	61,364		6,215		0	67,579
Bldg 210559																						
Boat Storage	400W HPS	12	465	1.00	12	275	3,300	5.6	18,414	3F54T5 HO	12	176	1.00	2.1	6,970	3.5	11,444	12	0	12	0	11,444
Bldg 210559		12	465					5.6	18,414		12			2.1	6,970	3.5	11,444		0		0	11,444
Bldg 210840																						

Storage Bay	400W HPS	9	465	0.71	10	252	1,800	4.2	7,533	3F54T5 HO	9	176	0.71	1.6	2,851	2.6	4,682	10	0	10	0	4,682
Repair Bay	400W HPS	8	465	1.00	10	252	2,520	3.7	9,374	4F54T5 HO	8	198	1.00	1.6	3,992	2.1	5,383	10	0	10	0	5,383
Machine Shop	1x8x2 FI	45	134	0.71	12	252	2,160	6.0	13,025	1x8x2 FI	45	134	0.71	6.0	13,025	0.0	0	12	0	12	0	0
Work Bay East	1x8x2 FI	48	134	0.71	10	252	1,800	6.4	11,578	1x8x2 FI	48	134	0.71	6.4	11,578	0.0	0	10	0	10	0	0
Work Bay West	400W HPS	3	465	0.71	10	252	1,800	1.4	2,511	4F54T5 HO	3	198	0.71	0.6	1,069	0.8	1,442	10	0	10	0	1,442
Receiving	400W HPS	1	465	0.71	12	252	2,160	0.5	1,004	3F54T5 HO	1	176	0.71	0.2	380	0.3	624	12	0	12	0	624
Small Shops	1x8x2 FI	30	134	0.71	10	252	1,800	4.0	7,236	1x8x2 FI	30	134	0.71	4.0	7,236	0.0	0	10	0	10	0	0
Bldg 210840		144	2262					26.2	52,261		144			20.4	40,131	5.8	12,131		0		0	12,131
Bldg 210848																						
Dyno Room 1	400W HPS	6	465	0.71	12	252	2,160	2.8	6,026	3F54T5 HO	2	176	0.71	0.4	760	2.4	5,266	12	0	12	0	5,266
Dyno Room 2	1x8x2 FI	4	134	1.00	10	252	2,520	0.5	1,351	3F54T5 HO	4	176	1.00	0.7	1,774	-0.2	-423	10	0	10	0	-423
Dyno Room 3	1x8x2 FI	5	134	0.71	10	252	1,800	0.7	1,206	1x8x2 FI	5	134	0.71	0.7	1,206	0.0	0	10	0	10	0	0
Bldg 210848		15	733					4.0	8,583		11			1.7	3,740	2.3	4,843		0		0	4,843
Bldg 22225																						
Vehicle Maint.	400W HPS	29	465	0.71	10	252	1,800	13.5	24,273	3F54T5 HO	25	176	0.71	4.4	7,920	9.1	16,353	7.5	1,980	10	0	18,333
	400W HPS	1	465	0.71	10	252	1,800	0.5	837	3F54T5 EB	1	176	0.71	0.2	317	0.3	520	10	0	10	0	520
Bldg 22225		30	465					14.0	25,110		26			4.6	8,237	9.4	16,873		1,980		0	18,853
Bldg 24079																						
Fitness Center	250W HPS	20	300	1.00	16	360	5,760	6.0	34,560	3F54T5 GW	17	176	0.71	3.0	12,310	3.0	22,250	12	3,077	16	0	25,328
Fitness Center	84W CF	12	84	1.00	16	360	5,760	1.0	5,806	Delamp CF	12	0	0.00	0.0	0	1.0	5,806	16	0	16	0	5,806
Bldg 24079		32	384					7.0	40,366		29			3.0	12,310	4.0	28,056		3,077		0	31,134
Bldg 25270																						
Warehouse	400W HPS	15	465	0.71	10	252	1,800	7.0	12,555	3F54T5 HO	17	176	0.71	3.0	5,386	4.0	7,169	10	0	10	0	7,169
Bldg 25270		15	465					7.0	12,555		17			3.0	5,386	4.0	7,169		0		0	7,169
Bldg 31345																						
Warehouse	400W HPS	15	465	0.71	10	252	1,800	7.0	12,555	4F54T5 HO	15	198	0.71	3.0	5,346	4.0	7,209	10	0	10	0	7,209
Bldg 31345		15	465					7.0	12,555		15			3.0	5,346	4.0	7,209		0		0	7,209
Bldg 310617																						
Warehouse	400W HPS	33	465	0.71	10	252	1,800	15.3	27,621	3F54T5 HO	33	176	0.71	5.8	10,454	9.5	17,167	7.5	2,614	10	0	19,780
Bldg 310617		33	465					15.3	27,621		33			5.8	10,454	9.5	17,167		2,614		0	19,780
Bldg 31907																						
Repair Bay	1000W HPS	100	1,100	0.71	10	252	1,800	110.0	198,000	6F54T5 HO	100	352	0.71	35.2	63,360	74.8	134,640	10 [2]	0	10	0	134,640

Bldg 31907		100	1100					110.0	198,000		100			35.2	63,360	74.8	134,640		0		0	134,640
Bldg 31908																							
Repair Bay	1000W HPS	100	1,100	0.71	10	252	1,800	110.0	198,000	6F54T5 HO	100	352	0.71	35.2	63,360	74.8	134,640	10 [2]	0	10	0	134,640
Bldg 31908		100	1100					110.0	198,000		100			35.2	63,360	74.8	134,640		0		0	134,640
Bldg 33543																							
Vehicle Maint 1	400W HPS	10	465	0.71	10	252	1,800	4.7	8,370	4F54T5 HO	10	198	0.71	2.0	3,564	2.7	4,806	10	0	10	0	4,806
Vehicle Maint 2	400W HPS	25	465	1.00	10	252	2,520	11.6	29,295	4F54T5 HO	25	198	1.00	5.0	12,474	6.7	16,821	10	0	10	0	16,821
Vehicle Maint 3	400W HPS	10	465	0.71	10	252	1,800	4.7	8,370	4F54T5 HO	10	198	0.71	2.0	3,564	2.7	4,806	10	0	10	0	4,806
Bldg 33543		45	1395					20.9	46,035		45			8.9	19,602	12.0	26,433		0		0	26,433
Bldg 41252																							
Storage Bay	400W HPS	15	465	0.71	10	252	1,800	7.0	12,555	3F54T5 HO	15	176	0.71	2.6	4,752	4.3	7,803	10	0	10	0	7,803
Bldg 41252		15	465					7.0	12,555		15			2.6	4,752	4.3	7,803		0		0	7,803
Bldg 41408																							
Vehicle Maint.	400W HPS	15	465	0.71	10	252	1,800	7.0	12,555	4F54T5 HO	15	198	0.71	3.0	5,346	4.0	7,209	10	0	10	0	7,209
Bldg 41408		15	465					7.0	12,555		15			3.0	5,346	4.0	7,209		0		0	7,209
Bldg 41312																							
Maint. Bays	750W MH	16	815	1.00	9	252	2,268	13.0	29,575	3F54T5 HO	16	176	1.00	2.8	6,387	10.2	23,188	9	0	9	0	23,188
Work Bays	400W HPS	13	465	0.25	10	252	630	6.0	3,808	3F54T5 HO	12	176	0.25	2.1	1,331	3.9	2,478	10	0	10	0	2,478
Bldg 41312		29	1280					19.1	33,383		28			4.9	7,717	14.2	25,666		0		0	25,666
Bldg 43542																							
Vehicle Maint.	400W HPS	30	465	1.00	10	252	2,520	14.0	35,154	3F54T5 HO	30	176	0.71	5.3	9,504	8.7	25,650	7.5	2,376	10	0	28,026
Welding Bay	400W HPS	20	465	0.71	10	252	1,800	9.3	16,740	3F54T5 HO	20	176	0.71	3.5	6,336	5.8	10,404	7.5	1,584	10	0	11,988
Bldg 43542		50	930					23.3	51,894		50			8.8	15,840	14.5	36,054		3,960		0	40,014
Bldg 51919																							
Gym	750W MH	8	815	0.71	12	175	1,500	6.5	9,780	4F54T5 HO	8	198	0.71	1.6	2,376	4.9	7,404	12	0	12	0	7,404
Bldg 51919		8	815					6.5	9,780		8			1.6	2,376	4.9	7,404		0		0	7,404
Bldg 52501																							
Warehouse	400W HPS	12	465	0.71	10	252	1,800	5.6	10,044	3F54T5 HO	14	176	0.71	2.5	4,435	3.1	5,609	10	0	10	0	5,609
Bldg 52501		12	465					5.6	10,044		14			2.5	4,435	3.1	5,609		0		0	5,609
Bldg 53528																							
Fitness Center	400W HPS	48	465	0.71	16	360	4,114	22.3	91,831	3F54T5 HO	48	176	0.71	8.4	34,757	13.9	57,073	16	0	16	0	57,073

Bldg 53528		48	465					22.3	91,831		48			8.4	34,757	13.9	57,073		0		0	57,073
Bldg 53667																							
Warehouse	400W HPS	18	465	1.00	10	252	2,520	8.4	21,092	3F54T5 HO	18	176	0.71	3.2	5,702	5.2	15,390	7.5	1,426	5	475	17,291
Work Bays	1x8x2 FI	20	134	0.71	10	252	1,800	2.7	4,824	1x8x2 FI	20	134	0.71	2.7	4,824	0.0	0	10	0	10	0	0
Bldg 53667		38	599					11.1	25,916		38			5.8	10,526	5.2	15,390		1,426		475	17,291
Bldg 620411																							
Fitness Center	750W MH	22	815	0.71	16	360	4,114	17.9	73,769	4F54T5 HO	22	198	0.71	4.4	17,922	13.6	55,847	12	4,480	16	0	60,328
Bldg 620411		22	815					17.9	73,769		22			4.4	17,922	13.6	55,847		4,480		0	60,328
Total		**1036**						**554.1**	**1,227,135**		**1012**			**210.286**	**431,102**	**343.8**	**796,032**		**32,836**		**672**	**829,541**

7.11 05-04-003 and 05-05-008 – Commercial Refrigeration and Lighting Measures

The program implemented by the Project Sponsor provides information, technical assistance, and financial incentives for grocers to purchase and install energy efficient lighting, HVAC, and refrigeration systems. Energy efficiency incentives are used to buy-down the cost of the project.

The Project Sponsor provides customers with:

- A store walk-through and audit,
- An energy savings report, and
- Incentives

The Project Sponsor has applied for three projects under the CESB program. The project offering is the same, but with different sites and a different timeline for each project. This M&V report applies to projects A and C (Project #05-04-003 and 05-05-008). Project B (# 05-04-004) will be submitted separately. The Project Sponsor reported the following savings by measure for Projects A and C.

Table 106. M&V Savings Summary – 05-04-003 and 05-05-008

	A (05-04-003)	C (05-05-008)
Total Contracted Savings (kWh)	5,493,898	11,552,276
Total Reported / Invoiced Savings (kWh)	5,541,918	4,313,126
M&V Savings (kWh)	**5,405,659**	**4,318,587**
Percent of Reported kWh Savings	97.5%	100.1%
Total Contracted Savings (kW)	444.3	1250.0
Total Reported / Invoiced Savings (kW)	744.8	524.9
M&V Savings (kW)	726.1	525.4
Percent of Reported kW Savings	97.5%	100.1%

Table 107. Project A (CESB #05-04-003) - Reported Savings By Measure

Measure (Project A)	Total kWh Savings	Peak kW Reduction
Cases - Low Temp Reach-in to High Efficiency Reach-in	57,721	13.5
Cases - Medium Temp Open Case to New High Efficiency Open Case	81,854	10.3
Controls - Anti-Sweat Heat (Low Temp)	1,486,881	200.8
Evap motors: shaded pole to ECM/SSC	1,904,355	250.8
Evap motors: shaded pole to PSC	11,943	1.7
Lighting - 8 ft T-8 fluorescent fixture (per lamp) for Walk-in - High Output Lamps	54,988	14.4
Multiplex - Controls - Floating head pressure - air cooled condenser	137,834	9.5
Multiplex - Controls - Floating head pressure - evaporative condenser	773,263	45.6
Multiplex - Controls - Floating suction pressure - air cooled condenser	56,899	6.5
Multiplex - Controls - Floating suction pressure - evaporative condenser	324,047	37.0
Premium T8/T5 lamp & electronic ballast 2ft (from T12) One Lamp	4,160	0.5
Premium T8/T5 lamp & electronic ballast 2ft (from T12) Two Lamp	680	0.2
Premium T8/T5 lamp & electronic ballast 3ft (from T12) One Lamp	352	0.0
Premium T8/T5 lamp & electronic ballast 3ft (from T12) Two Lamp	1,408	0.4
Premium T8/T5 lamp & electronic ballast 3ft and 2ft (from T12) - Two Lamp	4,134	1.1
Premium T8/T5 lamp & electronic ballast 4ft (from T12) - One Lamps	10,240	1.3
Premium T8/T5 lamp & electronic ballast 4ft (from T12) Two Lamp	216,846	56.8
Premium T8/T5 lamp & electronic ballast 8ft (from T12) - One Lamp	35,462	9.3
Premium T8/T5 lamp & electronic ballast 8ft (from T12) - Two Lamps	285,012	74.4
Walk-in Evap motors: shaded pole to ECM/SSC	93,840	10.7
Grand Total	**5,541,918**	**745**

Table 108. Project C (Project #05-05-008) - Reported Savings By Measure

Measure (Project C)	Total kWh Savings	Peak kW Reduction
Controls - Anti-Sweat Heat (Low Temp)	458,482	62
Evap motors: shaded pole to ECM/SSC	1,933,640	256
Lighting - 8 ft T-8 fluorescent fixture (per lamp) for Walk-in - High Output Lamps	20,772	5
Multiplex - Controls - Floating head pressure - evaporative condenser	1,090,430	63
Multiplex - Controls - Floating suction pressure - evaporative condenser	442,484	51
Premium T8/T5 lamp & electronic ballast 2ft (from T12) One Lamp	650	0
Premium T8/T5 lamp & electronic ballast 2ft (from T12) Two Lamp	1,496	0
Premium T8/T5 lamp & electronic ballast 3ft (from T12) One Lamp	2,464	0
Premium T8/T5 lamp & electronic ballast 3ft (from T12) Two Lamp	528	0
Premium T8/T5 lamp & electronic ballast 4ft (from T12) - One Lamps	8,160	1
Premium T8/T5 lamp & electronic ballast 4ft (from T12) Three Lamp	1,890	0
Premium T8/T5 lamp & electronic ballast 4ft (from T12) Two Lamp	109,872	29
Premium T8/T5 lamp & electronic ballast 8ft (from T12) - One Lamp	14,453	4
Premium T8/T5 lamp & electronic ballast 8ft (from T12) - Two Lamps	179,046	47
Walk-in Evap motors: shaded pole to ECM/SSC	48,760	6
Grand Total	**4,313,126**	**525**

Table 109. Stores and Contract Number as Submitted by the Project Sponsor

Project	Site ID	Total kWh Savings
A	A01	121,439
A	A02	161,421
A	A03	164,260
A	A04	428,600
A	A05	654,851
A	A06	186,535
A	A07	452,293
A	A08	476,725
A	A09	464,201
A	A10	273,015
A	A11	482,174
A	A12	552,648
A	A13	454,795
A	A14	483,958
A	A15	107,589
A	A16	59,566
A	A17	17,846
	Subtotal-A	**5,541,918**
C	C01	375,565
C	C02	215,025
C	C03	222,713
C	C04	231,726
C	C05	133,169
C	C06	269,707
C	C07	427,218
C	C08	241,150
C	C09	259,478
C	C10	376,173
C	C11	251,307
C	C12	309,026
C	C13	359,017
C	C14	280,933
C	C15	353,821
C	C16	7,098
	Subtotal-C	**4,313,126**
	Total	**9,855,044**

7.11.1 Measurement and Verification (M&V) Approach

The M&V approach for the project is summarized in this section. KSI coordinated with the Project Sponsor to perform pre and post-retrofit M&V activities to support the tasks described below.

1. The Project Sponsor built a detailed model for the similar program that simulates energy use and predicts the impacts of retrofits and changes. The initial M&V activity was to review the model for accuracy and completeness. The model was reviewed with the Project Sponsor's engineering consultant who was previously hired to review the model as an independent third party.

   It was concluded that the model is an accurate tool for predicting the energy savings resulting from the measures implemented. Therefore, the savings estimated by the model, on a per unit basis, were accepted and the M&V mainly involved verification of the model inputs.

   Ultimately, the model was not used to predict the savings from lighting retrofits. The savings was calculated using a simple spreadsheet model. Project Sponsor and KSI jointly determined appropriate per fixture wattages for the various lamp/ballast configurations encountered.

2. For each store the Project Sponsor submitted an audit report to KSI and SDG&E prior to installation of measures or changes to the operation at the site. The audit report clearly identified the site-specific inputs to the savings model and measure recommended. KSI visited a sample of sites and verified some, or all, of the model inputs as well as site equipment and conditions.

3. Following the completion of the project the Project Sponsor submitted a list of the measures implemented at each location.

4. A sample of sites was drawn to represent the total population of stores and measures reported. Site visits were made to each store in the sample and the savings evaluated. The M&V results of the sample are extrapolated to the population on a measure-by-measure basis.

   Table 110 shows the 19 sample sites, whether a pre-retrofit visit was completed (12 of 19 sites), and the total reported savings associated with these sites. The M&V sample was drawn from a population submitted by the Project Sponsor that included sites in Projects A, B, and C. Subsequently, Project B was removed from the submittal. However, the mix of store types and the measures was the same in all three projects.

The sample results are applied to the population by measure. Project B sites in the sample does not affect the results of Projects A and C.

Table 110. Stores and Project In Sample

Project	Site ID	Total	Pre
A	A04	428,600	Y
A	A05	654,851	Y
A	A08	476,725	Y
A	A09	464,201	
A	A11	482,174	
A	A12	552,648	
A	A13	454,795	
B	B05	324,410	
B	B08	364,811	
B	B11	368,678	Y
B	B12	368,810	Y
B	B13	412,512	Y
C	C01	375,565	Y
C	C03	222,713	Y
C	C04	231,726	Y
C	C05	133,169	Y
C	C06	269,707	
C	C10	376,173	Y
C	C14	280,933	Y
Total		**7,243,204**	

5. Site inspections consisted of the following actions:
    - Verify operation of anti-sweat heater controls and linear feet of freezer doors controlled.
    - Verify installation of new refrigeration control unit.
    - Verify the controller has settings to allow floating head and suction pressure of the refrigeration plant.
    - Verify sensors on drop leg of condenser for floating head control.
    - Verify VFD operation on condenser fan(s).
    - Verify to extent possible the total compressor plant horsepower.
    - Verify T8 retrofits in walk-in boxes.

6. Site inspections did not include:
    - Verification of ECM motors installed in cases
    - Verification of ECM or SSC motors installed in evaporator cases
    - Verification of sales floor T8 lighting retrofits.

7. In addition to data collected during the site inspections KSI also received trend screen shots from 10 stores verifying the floating head and suction pressure. The data were downloaded from the control units and graphed to show how the pressures followed the ambient temperature. These graphs are provided as an attachment.

The load impact estimation methodology complies with IPMVP Option A.

7.11.2 Results

This section provides the results of the M&V process. The findings from the site visits and the extrapolation of the sample results to the population results are provided. Overall the M&V estimates the savings for Project A (CESB #05-04-003) as 5,405,659 kWh per year and 726.1 kW peak demand reduction. Project C (CESB #05-05-008) achieved 4,318,587 kWh per year and 525.4 kW peak demand reduction. This is 97.5% and 100.1% of the reported savings respectively.

For the most part, the reported measures and savings were confirmed by the M&V team. Slight discrepancies were found in the amount of anti-sweat heater (ASH) control. Two of the stores, C01 and A13, that had reported savings from this measure do not have functioning ASH controls.* A third store, A05, only has 96 out of 148 doors with functioning ASH controls. Each of these locations was visited on multiple occasions to confirm the lack of ASH control.

**Addendum: C01 controls were not working at the time of our visits because of failed circuit breaker. The part was on order and has now been installed. We visited the store again and the ASH controls are functioning fully. Project Sponsor was given full savings credit for this store.*

In addition, some sites have doors that do not have functional ASH and thus control savings cannot be achieved. This is a minor discrepancy- less than 1% of savings. With the exception of the three stores mentioned above, 2,701 of the 2,734 doors were verified to have functioning ASHs and controls.

Savings due to the ECM motor retrofits on refrigeration cases were only verified by equipment and labor invoices. Project Sponsor was conservative in the claimed number of installations. The M&V assessment of the number of installations is slightly more. The realization rate for the ECM measure is 103.5%.

There is a less than 2% discrepancy in the number of installations of “Lighting - 8 ft T-8 fluorescent fixture (per lamp) for Walk-in - High Output Lamps”. During our pre-inspection one

location had fewer T12 fixtures than claimed. However, this measure contributed less than 1% of the total reported savings and the discrepancy is lost in the noise.

The following tables present the results of the M&V sample, then the results applied to Project A and Project C.

Table 111. M&V Sample Results

Measure	Reported kWh Savings	M&V kWh Savings	Ratio
Controls - Anti-Sweat Heat (Low Temp)	1,912,381	1,651,670	86.4%
Evap motors: shaded pole to ECM/SSC	2,665,912	2,760,022	103.5%
Lighting - 8 ft T-8 fluorescent fixture (per lamp) for Walk-in - High Output Lamps	65,508	64,576	98.6%
Multiplex - Controls - Floating head pressure – air cooled condenser	244,790	244,790	100.0%
Multiplex - Controls - Floating head pressure - evaporative condenser	1,100,165	1,100,165	100.0%
Multiplex - Controls - Floating suction pressure - air cooled condenser	90,213	90,213	100.0%
Multiplex - Controls - Floating suction pressure - evaporative condenser	446,964	446,964	100.0%
Premium T8/T5 lamp & electronic ballast 2ft (from T12) One Lamp	3,380	3,380	100.0%
Premium T8/T5 lamp & electronic ballast 2ft (from T12) Two Lamp	1,768	1,768	100.0%
Premium T8/T5 lamp & electronic ballast 3ft (from T12) One Lamp	1,408	1,408	100.0%
Premium T8/T5 lamp & electronic ballast 3ft (from T12) Two Lamp	1,760	1,760	100.0%
Premium T8/T5 lamp & electronic ballast 3ft and 2ft (from T12) - Two Lamp	2,184	2,184	100.0%
Premium T8/T5 lamp & electronic ballast 4ft (from T12) - One Lamps	11,680	11,680	100.0%
Premium T8/T5 lamp & electronic ballast 4ft (from T12) Two Lamp	222,138	222,138	100.0%
Premium T8/T5 lamp & electronic ballast 8ft (from T12) - One Lamp	41,422	41,422	100.0%
Premium T8/T5 lamp & electronic ballast 8ft (from T12) - Two Lamps	356,062	356,062	100.0%
Walk-in Evap motors: shaded pole to ECM/SSC	110,400	110,400	100.0%
Totals	**7,278,134**	**7,110,602**	**97.7%**

Table 112. Project A Results

Measure	Reported kWh Savings	Reported kW Reduction	M&V kWh & kW Ratio	M&V kWh Savings	M&V kW Savings
Cases - Low Temp Reach-in to High Efficiency Reach-in	57,721	13.5	100.00%	57,721	13.5
Cases - Medium Temp Open Case to New High Efficiency Open Case	81,854	10.3	100.00%	81,854	10.3
Controls - Anti-Sweat Heat (Low Temp)	1,486,881	200.8	86.4%	1,284,177	173.4
Evap motors: shaded pole to ECM/SSC	1,904,355	250.8	103.53%	1,971,581	259.6
Evap motors: shaded pole to PSC	11,943	1.7	100.00%	11,943	1.7
Lighting - 8 ft T-8 fluorescent fixture (per lamp) for Walk-in - High Output Lamps	54,988	14.4	98.58%	54,206	14.2
Multiplex - Controls - Floating head pressure - air cooled condenser	137,834	9.5	100.00%	137,834	9.5
Multiplex - Controls - Floating head pressure - evaporative condenser	773,263	45.6	100.00%	773,263	45.6
Multiplex - Controls - Floating suction pressure - air cooled condenser	56,899	6.5	100.00%	56,899	6.5
Multiplex - Controls - Floating suction pressure - evaporative condenser	324,047	37.0	100.00%	324,047	37.0
Premium T8/T5 lamp & electronic ballast 2ft (from T12) One Lamp	4,160	0.5	100.00%	4,160	0.5
Premium T8/T5 lamp & electronic ballast 2ft (from T12) Two Lamp	680	0.2	100.00%	680	0.2
Premium T8/T5 lamp & electronic ballast 3ft (from T12) One Lamp	352	0.0	100.00%	352	0.0
Premium T8/T5 lamp & electronic ballast 3ft (from T12) Two Lamp	1,408	0.4	100.00%	1,408	0.4
Premium T8/T5 lamp & electronic ballast 3ft and 2ft (from T12) - Two Lamp	4,134	1.1	100.00%	4,134	1.1
Premium T8/T5 lamp & electronic ballast 4ft (from T12) - One Lamps	10,240	1.3	100.00%	10,240	1.3
Premium T8/T5 lamp & electronic ballast 4ft (from T12) Two Lamp	216,846	56.8	100.00%	216,846	56.8
Premium T8/T5 lamp & electronic ballast 8ft (from T12) - One Lamp	35,462	9.3	100.00%	35,462	9.3
Premium T8/T5 lamp & electronic ballast 8ft (from T12) - Two Lamps	285,012	74.4	100.00%	285,012	74.4
Walk-in Evap motors: shaded pole to ECM/SSC	93,840	10.7	100.00%	93,840	10.7
Grand Total	5,541,918	745		5,405,659	726.1

Project A	**kWh**	**kW**
Total Contracted Savings	5,493,898	444.3
Total Reported / Invoiced Savings	5,541,918	744.8
M&V Savings	5,405,659	726.1
Percent of Reported Savings	97.5%	97.5%

Table 113. Project C Results

Measure	**Reported kWh Savings**	**Reported kW Reduction**	**M&V kWh & kW Ratio**	**M&V kWh Savings**	**M&V kW Savings**
Controls - Anti-Sweat Heat (Low Temp)	458,482	62.2	86.4%	395,978	53.75
Evap motors: shaded pole to ECM/SSC	1,933,640	256.4	103.5%	2,001,900	265.49
Lighting - 8 ft T-8 fluorescent fixture (per lamp) for Walk-in - High Output Lamps	20,772	5.5	98.6%	20,476	5.41
Multiplex - Controls - Floating head pressure - evaporative condenser	1,090,430	62.9	100.0%	1,090,430	62.88
Multiplex - Controls - Floating suction pressure - evaporative condenser	442,484	50.5	100.0%	442,484	50.51
Premium T8/T5 lamp & electronic ballast 2ft (from T12) One Lamp	650	0.1	100.0%	650	0.09
Premium T8/T5 lamp & electronic ballast 2ft (from T12) Two Lamp	1,496	0.4	100.0%	1,496	0.40
Premium T8/T5 lamp & electronic ballast 3ft (from T12) One Lamp	2,464	0.3	100.0%	2,464	0.32
Premium T8/T5 lamp & electronic ballast 3ft (from T12) Two Lamp	528	0.1	100.0%	528	0.14
Premium T8/T5 lamp & electronic ballast 4ft (from T12) - One Lamps	8,160	1.1	100.0%	8,160	1.07
Premium T8/T5 lamp & electronic ballast 4ft (from T12) Three Lamp	1,890	0.5	100.0%	1,890	0.50
Premium T8/T5 lamp & electronic ballast 4ft (from T12) Two Lamp	109,872	28.8	100.0%	109,872	28.78
Premium T8/T5 lamp & electronic ballast 8ft (from T12) - One Lamp	14,453	3.8	100.0%	14,453	3.78
Premium T8/T5 lamp & electronic ballast 8ft (from T12) - Two Lamps	179,046	46.7	100.0%	179,046	46.75
Walk-in Evap motors: shaded pole to ECM/SSC	48,760	5.6	100.0%	48,760	5.57
Grand Total	**4,313,126**	**525**		**4,318,587**	**525.42**

Project C	**kWh**	**kW**
Total Contracted Savings	11,552,276	1250.0
Total Reported / Invoiced Savings	4,313,126	524.9
M&V Savings	4,318,587	525.4
Percent of Reported Savings	100.1%	100.1%

7.12 05-04-004 - Commercial Refrigeration and Lighting Measures Project B

The program implemented by the Project Sponsor provides information, technical assistance, and financial incentives for grocers to purchase and install energy efficient lighting, HVAC, and refrigeration systems. Energy efficiency incentives are used to buy-down the cost of the project. Project Sponsor provides customers with:

- A store walk-through and audit,
- An energy savings report, and
- Incentives

The Project Sponsor has applied for several projects under the CESB program. The project offering is the same, but with different sites and a different timeline for each application. This M&V report applies to Project B (CESB #05-04-004. The M&V for Projects A and C (CESB #05-04-003 and 05-05-008) are shown in Section 7.11. Table 114 shows a summary of the M&V for this project. The Project Sponsor reported the savings by measure shown in Table 115 for Project B.

Table 114. M&V Savings Summary – 05-04-004

	Project B
Total Contracted kWh Savings	4,359,607
Total Reported / Invoiced kWh Savings	4,544,209
M&V Savings (kWh)	**4,417,003**
Percent of Reported kWh Savings	97.2%
Percent of Contracted kWh Savings	101.1%
Total Contracted kW Savings	372.0
Total Reported / Invoiced kW Savings	912.0
M&V Savings (kW)	**894.8**
Percent of Reported kW Savings	98.1%
Percent of Contracted kW Savings	240.5%

Table 115. Project B (CESB #05-04-004) - Reported Savings by Measure

Measure	Total kWh Savings	Peak kW Reduction
Cases - Medium Temp Open Case to New High Efficiency Open Case	9,523	1.12
Multiplex - Efficient/oversized water-cooled Condenser for Multiplex	46,117	175
Cases - Low Temp Reach-in to High Efficiency Reach-in	328,510	138.56
Controls - Anti-Sweat Heat (Low Temp)	1,258,378	168.33
Evap motors: shaded pole to ECM/SSC	1,278,548	168.01
Evap motors: shaded pole to PSC	14,350	1.89
Multiplex - Controls - Floating head pressure - evaporative condenser	759,466	45.41
Multiplex - Controls - Floating suction pressure - evaporative condenser	316,959	33.69
Multiplex - Controls - Floating head pressure - air cooled condenser	145,100	8.47
Multiplex - Controls - Floating suction pressure - air cooled condenser	65,559	99.19
Walk-in Evap motors: shaded pole to ECM/SSC	71,760	8.19
Premium T8/T5 lamp & electronic ballast 8ft (from T12) - Two Lamps	127,078	33.18
Premium T8/T5 lamp & electronic ballast 8ft (from T12) - One Lamp	9,089	2.38
Premium T8/T5 lamp & electronic ballast 4ft (from T12) Two Lamp	45,864	12.01
Premium T8/T5 lamp & electronic ballast 4ft (from T12) - One Lamps	6,560	0.86
Premium T8/T5 lamp & electronic ballast 3ft (from T12) Two Lamp	704	0.18
Premium T8/T5 lamp & electronic ballast 3ft (from T12) One Lamp	704	0.09
Lighting - 8 ft T-8 fluorescent fixture (per lamp) for Walk-in - High Output Lamps	58,250	15.25
Premium T8/T5 lamp & electronic ballast 2ft (from T12) One Lamp	1,690	0.22
Total	**4,544,209**	**912.02**

Table 116. Reported Savings by Store for 05-04-004

Project	Store ID	kWh Savings
B	B01	287,544
B	B02	21,119
B	B03	103,027
B	B04	261,345
B	B05	324,410
B	B06	365,881
B	B07	33,359
B	B08	364,811
B	B09	133,871
B	B10	403,740
B	B11	368,678
B	B12	368,810
B	B13	412,512
B	B14	394,065
B	B15	286,965
B	B16	414,069
B	**Total**	**4,544,209**

7.12.1 Measurement and Verification (M&V) Approach

The M&V approach for the project is summarized in this section. KSI coordinated with the Project Sponsor to perform pre and post-retrofit M&V activities to support the tasks described below.

1. The Project Sponsor built a detailed model for the similar program that simulates energy use and predicts the impacts of retrofits and changes. The initial M&V activity was to review the model for accuracy and completeness. The model was reviewed with the Project Sponsor's engineering consultant who was previously hired to review the model as an independent third party.

   It was concluded that the model is an accurate tool for predicting the energy savings resulting from the measures implemented. Therefore, the savings estimated by the model, on a per unit basis, were accepted and the M&V mainly involved verification of the model inputs.

   Ultimately, the model was not used to predict the savings from lighting retrofits. The savings was calculated using a simple spreadsheet model. The Project Sponsor and KSI jointly determined appropriate per fixture wattages for the various lamp/ballast configurations encountered.

1. For each store the Project Sponsor submitted an audit report to KSI and SDG&E prior to installation of measures or changes to the operation at the site. The audit report clearly identified the site-specific inputs to the savings model and measure recommended. KSI visited a sample of sites and verified some, or all, of the model inputs as well as site equipment and conditions.
2. Following the completion of the project the Project Sponsor submitted a list of the measures implemented at each location.
3. A sample of sites was drawn to represent the total population of stores and measures reported. Site visits were made to each store in the sample and the savings evaluated. The M&V results of the sample are extrapolated to the population on a measure-by-measure basis.

   Table 117 shows the 19 sample sites, whether a pre-retrofit visit was completed (12 of 19 sites), and the total reported savings associated with these sites. The M&V sample was drawn from a population submitted by the Project Sponsor that included sites in Projects A, B, and C. The mix of store types and the measures is the same in all three projects. The sample results are applied to the population by measure. Project A and C sites in the sample do not affect the results of Project B.

Table 117. M&V Sample

Project	Site ID	Total	Pre
A	A04	428,600	Y
A	A05	654,851	Y
A	A08	476,725	Y
A	A09	464,201	
A	A11	482,174	
A	A12	552,648	
A	A13	454,795	
B	B05	324,410	
B	B08	364,811	
B	B11	368,678	Y
B	B12	368,810	Y
B	B13	412,512	Y
C	C01	375,565	Y
C	C03	222,713	Y
C	C04	231,726	Y
C	C05	133,169	Y
C	C06	269,707	
C	C10	376,173	Y
C	C14	280,933	Y
Total		**7,243,204**	

4. Site inspections consisted of the following actions:
    - Verify operation of anti-sweat heater controls and linear feet of freezer doors controlled.
    - Verify installation of new refrigeration control unit.
    - Verify the controller has settings to allow floating head and suction pressure of the refrigeration plant.
    - Verify sensors on drop leg of condenser for floating head control.
    - Verify VFD operation on condenser fan(s).
    - Verify to extent possible the total compressor plant horsepower.
    - Verify T8 retrofits in walk-in boxes.

5. Site inspections did not include:
    - Verification of ECM motors installed in cases
    - Verification of ECM or SSC motors installed in evaporator cases
    - Verification of sales floor T8 lighting retrofits.

6. In addition to data collected during the site inspections KSI also received trend screen shots from 10 stores verifying the floating head and suction pressure. The data were

downloaded from the control units and graphed to show how the pressures followed the ambient temperature. These graphs are provided as an attachment.

The load impact estimation methodology complies with IPMVP Option A.

7.12.2 Results

This section provides the results of the M&V process. The findings from the site visits and the extrapolation of the sample results to the population results are provided. Overall the M&V results of the savings for Project B (CESB #05-04-004) is 4,417,003 kWh per year and 894.8 kW peak demand reduction. This is 97.2% and 101.1% of the reported savings respectively. The reported savings of 4,544,209 kWh per year was higher than the contracted savings**.**

The contracted savings was 4,359,607 kWh which is less than the M&V results. Therefore the payment should be based on 100% of the contracted savings. The incentives SDG&E provides are based on the energy savings approved by their engineering group. Although the total incentive amount is based on the M&V results, SDG&E does not provide incentives greater than the contracted energy savings shown in the incentive agreement. The incentive amount paid can vary between zero and 100 percent of the contracted amount.

Based on the M&V results of measures evaluated under Projects A, B, and C, a realization ratio was developed for each measure category. This ratio was then applied to the reported savings by measure for Project B to determine the total project results.

For the most part, the reported measures and savings were confirmed by the M&V team. Slight discrepancies were found in the amount of anti-sweat heater (ASH) control. Two of the stores, C01 and A13, that had reported savings from this measure do not have functioning ASH controls.* A third store, A05, only has 96 out of 148 doors with functioning ASH controls. Each of these locations was visited on multiple occasions to confirm the lack of ASH control.

In addition, some sites have doors that do not have functional ASH and thus control savings cannot be achieved. This is a minor discrepancy- less than 1% of savings. With the exception of the three stores mentioned above, 2,701 of the 2,734 doors were verified to have functioning ASHs and controls.

Savings due to the ECM motor retrofits on refrigeration cases were only verified by equipment and labor invoices. The Project Sponsor was conservative in the claimed number of installations. The M&V assessment of the number of installations is slightly more. The realization rate for the ECM measure is 103.5%.

There is a less than 2% discrepancy in the number of installations of "Lighting - 8 ft T-8 fluorescent fixture (per lamp) for Walk-in - High Output Lamps". During our pre-inspection one location had fewer T12 fixtures than claimed. However, this measure contributed less than 1% of the total reported savings and the discrepancy is lost in the noise.

The following tables present the results of the M&V. The resulting realization rates were applied to Project B.

Table 118. M&V Sample Results

Measure	Reported kWh Savings	M&V kWh Savings	Realization Rate
Controls - Anti-Sweat Heat (Low Temp)	1,912,381	1,651,670	86.4%
Evap motors: shaded pole to ECM/SSC	2,665,912	2,760,022	103.5%
Lighting - 8 ft T-8 fluorescent fixture (per lamp) for Walk-in - High Output Lamps	65,508	64,576	98.6%
Multiplex - Controls - Floating head pressure - air cooled condenser	244,790	244,790	100.0%
Multiplex - Controls - Floating head pressure - evaporative condenser	1,100,165	1,100,165	100.0%
Multiplex - Controls - Floating suction pressure - air cooled condenser	90,213	90,213	100.0%
Multiplex - Controls - Floating suction pressure - evaporative condenser	446,964	446,964	100.0%
Premium T8/T5 lamp & electronic ballast 2ft (from T12) One Lamp	3,380	3,380	100.0%
Premium T8/T5 lamp & electronic ballast 2ft (from T12) Two Lamp	1,768	1,768	100.0%
Premium T8/T5 lamp & electronic ballast 3ft (from T12) One Lamp	1,408	1,408	100.0%
Premium T8/T5 lamp & electronic ballast 3ft (from T12) Two Lamp	1,760	1,760	100.0%
Premium T8/T5 lamp & electronic ballast 3ft and 2ft (from T12) - Two Lamp	2,184	2,184	100.0%
Premium T8/T5 lamp & electronic ballast 4ft (from T12) - One Lamps	11,680	11,680	100.0%
Premium T8/T5 lamp & electronic ballast 4ft (from T12) Two Lamp	222,138	222,138	100.0%
Premium T8/T5 lamp & electronic ballast 8ft (from T12) - One Lamp	41,422	41,422	100.0%
Premium T8/T5 lamp & electronic ballast 8ft (from T12) - Two Lamps	356,062	356,062	100.0%
Walk-in Evap motors: shaded pole to ECM/SSC	110,400	110,400	100.0%
Totals	7,278,134	7,110,602	97.7%

Table 119. Verified Savings for Project B

Measure	Reported kWh Savings	Reported kW Reduction	M&V kWh & kW Ratio	M&V kWh Savings	M&V kW Savings
Cases - Medium Temp Open Case to New High Efficiency Open Case	9,523	1.12	100%	9,523	1.12
Multiplex - Efficient/oversized water-cooled Condenser for Multiplex	46,117	175.00	100%	46,117	175.00
Cases - Low Temp Reach-in to High Efficiency Reach-in	328,510	138.56	100%	328,510	138.56
Controls - Anti-Sweat Heat (Low Temp)	1,258,378	168.33	86%	1,087,239	145.44
Evap motors: shaded pole to ECM/SSC	1,278,548	168.01	104%	1,323,297	173.89
Evap motors: shaded pole to PSC	14,350	1.89	100%	14,350	1.89
Multiplex - Controls - Floating head pressure - evaporative condenser	759,466	45.41	100%	759,466	45.41
Multiplex - Controls - Floating suction pressure - evaporative condenser	316,959	33.69	100%	316,959	33.69
Multiplex - Controls - Floating head pressure - air cooled condenser	145,100	8.47	100%	145,100	8.47
Multiplex - Controls - Floating suction pressure - air cooled condenser	65,559	99.19	100%	65,559	99.19
Walk-in Evap motors: shaded pole to ECM/SSC	71,760	8.19	100%	71,760	8.19
Premium T8/T5 lamp & electronic ballast 8ft (from T12) - Two Lamps	127,078	33.18	100%	127,078	33.18
Premium T8/T5 lamp & electronic ballast 8ft (from T12) - One Lamp	9,089	2.38	100%	9,089	2.38
Premium T8/T5 lamp & electronic ballast 4ft (from T12) Two Lamp	45,864	12.01	100%	45,864	12.01
Premium T8/T5 lamp & electronic ballast 4ft (from T12) - One Lamps	6,560	0.86	100%	6,560	0.86
Premium T8/T5 lamp & electronic ballast 3ft (from T12) Two Lamp	704	0.18	100%	704	0.18
Premium T8/T5 lamp & electronic ballast 3ft (from T12) One Lamp	704	0.09	100%	704	0.09
Lighting - 8 ft T-8 fluorescent fixture (per lamp) for Walk-in - High Output Lamps	58,250	15.25	99%	57,435	15.04
Premium T8/T5 lamp & electronic ballast 2ft (from T12) One Lamp	1,690	0.22	100%	1,690	0.22
Grand Total	**4,544,209**	**912.02**		**4,417,003**	**894.79**

Project B	kWh	kW
Total Contracted Savings	4,359,607	372.0
Total Reported / Invoiced Savings	4,544,209	912.0
M&V Savings	**4,417,003**	**894.8**
Percent of Reported Savings	97.2%	98.1%
Percent of Contracted Savings	101.3%	240.5

7.13 05-04-006 – CFL Retrofit

This project was a lighting retrofit of incandescent lamps replaced by compact fluorescent lamps (CFL). This project was an aggregation project with the measures installed in hotel, military barracks and movie theater facilities. Table 120 shows a summary of the M&V.

Table 120. M&V Savings Summary 05-04-006

CONTRACTED	
Energy Savings (kWh)	
Total Invoiced Savings (kWh)	5,802,645.24 kWh
M&V Savings (kWh)	4,055,644.84 kWh
Realization Rate (kWh)	70%
Demand Reduction (kW)	
Total Invoiced Savings (kW)	2,597.63 kW
M&V Savings (kW)	2,452.80 kW
Realization Rate	94%

7.13.1.1 MEASURE DESCRIPTION

Install energy efficient CFL's in place of incandescent lamps in hotels, barracks, and a movie theater.

7.13.1.1.1 Pre-Retrofit Conditions

- 12 sites, hotels, naval barracks, and a movie theater.
- Common Areas, guest rooms, and hallways.
- Incandescent lamps.

7.13.1.1.2 Post-Retrofit Conditions

- CFLs

7.13.2 Measurement and Verification (M&V) Approach

The M&V approach used for the project is summarized in this section. KSI coordinated with the Project Sponsor to perform pre and post-retrofit M&V activities to support the tasks described below.

7.13.2.1 Load Impact Verification Methodology

The load impact estimation methodology described in this plan complies with IPMVP Option A. Site inspections were employed to verify key M&V parameters.

7.13.2.2 Analysis Approach for Verified Savings

The basic equation used to estimate the energy savings of this project is shown in Equation 1.

(Eq. 1) kWh savings = verified kWh $_{Pre}$ – verified kWh $_{Post}$

Where:

verified kWh $_{Pre}$ =(# Fixtures $_{Pre}$) × (Fixture Wattage $_{Pre}$/1000) × (Hours of Operation $_{Pre}$);

verified kWh $_{Post}$=(# Fixtures $_{Post}$) × (Fixture Wattage $_{Post}$/1000) × (Hours of Operation $_{Post}$).

The key parameters of Equation 1 are shown in Table 121.

Table 121. Key M&V Parameters

Parameter	M&V Activity
Fixture Counts	Fixture counts were verified through on-site inspection. Fixture counts were based on detailed worksheets provided by the Project Sponsor.
Fixture Wattage $_{Pre}$ and Fixture Wattage $_{Post}$	Verified pre- and post- fixture types and fixture wattage values.
Hours of Operation	The hours of operation used for guestrooms, were based on the results from a monitoring program done in Hawaii, of hotel guestrooms. Common area hours of operation were verified through on site interviews with facility contacts.

7.13.2.3 On-Site Verification Inspections

On-site inspections were conducted to verify the equipment types, quantities, and lamp wattages. Site inspections consisted of the following activities:

- Verify base case equipment types and wattages.
- Verify the operating hours through interviews with on-site contacts.
- Verification of the installation of new lighting equipment, including
    - fixture wattage, and
    - fixture counts

The verification was based on as-built documentation provided to KSI by the Project Sponsor.

7.13.3 Results

This section provides the results of the M&V process. Table 122 and Table 123 show the proposed savings and verified data and savings, respectively.

Table 122. Proposed Savings – 05-04-006

Proposed													
Site ID	Pre Qty of fixtures	Current Fixture Type	Watts per fixture	Post Qty of fixtures	Proposed Fixture Type	Watts per NEW fixture	Annual Hours	Proposed kW pre	Proposed kWh pre	Proposed kW post	Proposed kWh post	Proposed kW Reduced	Proposed Annual KWh Savings
Site 01	32	Interior-Concess	100	32	CFL	14	2,000	3.2	6,400	0.45	896	2.75	5,504
	149	Interior-Lobby,R	75	149	CFL	14	2,000	11.175	22,350	2.09	4,172	9.09	18,178
Site 02	900	Guest room entr	65	900	CFL	16	2,000	58.50	117,000	14.40	28,800	44.10	88,200
	65	Lobby	75	65	CFL	16	8,760	4.88	42,705	1.04	9,110	3.84	33,595
	1,350	Bedside, living r	100	1,350	CFL	27	2,000	135.00	270,000	36.45	72,900	98.55	197,100
	900	desk lamp	75	900	CFL	27	2,000	67.50	135,000	24.30	48,600	43.20	86,400
	1,350	floor lamp	60	1,350	CFL	15	2,000	81.00	162,000	20.25	40,500	60.75	121,500
Site 03	1,181	Restroom,entry,	50	1,181	CFL	16	2,000	59.05	118,100	18.90	37,792	40.15	80,308
	108	Vanity mirror	67	108	CFL	14	2,000	7.24	14,472	1.51	3,024	5.72	11,448
	282	guest room vani	90	282	CFL	27	2,000	25.38	50,760	7.61	15,228	17.77	35,532
	310	wall sconces, ha	**67**	310	CFL	15	2,000	20.77	41,540	4.65	9,300	16.12	32,240
	240	2&3 bay suites,	**60**	240	CFL	15	2,000	14.40	28,800	3.60	7,200	10.80	21,600
	300	chanheliers	25	300	CFL	3	8,760	7.50	65,700	0.90	7,884	6.60	57,816
Site 04	900		60	900	CFL	14	2,000	54.00	108,000	12.60	25,200	41.40	82,800
Site 05	1,190	Nightstand,Desk	100	1,190	CFL	42	2,000	119.00	238,000	49.98	99,960	69.02	138,040
	467	Floor Lamp	150	467	CFL	33	2,000	70.05	140,100	15.41	30,822	54.64	109,278
	918	Entry Cans, Res	100	918	CFL	27	2,000	91.80	183,600	24.79	49,572	67.01	134,028
	850	Vanity restroom	60	850	CFL	14	2,000	51.00	102,000	11.90	23,800	39.10	78,200
Site 06	4,874	bathroom	60	4,874	CFL	14	2,000	292.44	584,880	68.24	136,472	224.20	448,408
	808	Parch & Patio	60	808	CFL	14	3,640	48.48	176,467	11.31	41,176	37.17	135,292
	546	Personal Lamps	100	546	CFL	27	2,000	54.60	109,200	14.74	29,484	39.86	79,716
Site 07	173	Dinning	100	173	CFL	14	2,000	17.30	34,600	2.42	4,844	14.88	29,756
	279	Personal Lamps	100	279	CFL	27	2,000	27.90	55,800	7.53	15,066	20.37	40,734
	1,060	Entryway,bedroo	60	1,060	CFL	14	2,000	63.60	127,200	14.84	29,680	48.76	97,520
	274	Porch & Patio	60	274	CFL	14	3,640	16.44	59,842	3.84	13,963	12.60	45,879
Site 08	284	Lamp Floors	150	284	CFL	55	2,000	42.60	85,200	15.62	31,240	26.98	53,960
	180	Lobby Chandelie	40	180	CFL	5	8,760	7.20	63,072	0.90	7,884	6.30	55,188
	766	Bedside, Desk	90	766	CFL	30	2,000	68.94	137,880	22.98	45,960	45.96	91,920
	15	Hall Lamps	60	15	CFL	14	8,760	0.90	7,884	0.21	1,840	0.69	6,044
	32	Grand Ballroom	50	32	CFL	4	8,760	1.60	14,016	0.13	1,121	1.47	12,895
Site 09	173	Living Room	60	173	CFL	23	2,000	10.38	20,760	3.98	7,958	6.40	12,802
	58	Ceiling Fans	60	58	CFL	23	2,000	3.48	6,960	1.33	2,668	2.15	4,292
	231	Bedroom	75	231	CFL	23	2,000	17.33	34,650	5.31	10,626	12.01	24,024
	58	Restroom Fans	60	58	CFL	23	2,000	3.48	6,960	1.33	2,668	2.15	4,292
Site 10	20	Exterior	65	20	CFL	16	4,380	1.30	5,694	0.32	1,402	0.98	4,292
	200	Barracks 864	100	200	CFL	27	2,000	20.00	40,000	5.40	10,800	14.60	29,200
	150	Barracks 783	60	150	CFL	27	3,640	9.00	32,760	4.05	14,742	4.95	18,018
	430	864,783,778	60	430	CFL	14	2,000	25.80	51,600	6.02	12,040	19.78	39,560
	80	F Troop	100	80	CFL	14	2,000	8.00	16,000	1.12	2,240	6.88	13,760
	180	Piers	100	180	CFL	14	4,380	18.00	78,840	2.52	11,038	15.48	67,802
Site 11	5,952	bathroom	60	5,989	CFL	14	2,000	357.12	714,240	83.85	167,692	273.27	546,548
	1,392	Personal Lamps	100	869	CFL	27	2,000	139.20	278,400	23.46	46,926	115.74	231,474
	1,803	Living,dinning, b	60	1,313	CFL	14	2,000	108.18	216,360	18.38	36,764	89.80	179,596
	1,180	Porch & Patio	60	232	CFL	14	3,640	70.80	257,712	3.25	11,823	67.55	245,889
Site 12	748	Dinning	100	748	CFL	15	2,000	74.80	149,600	11.22	22,440	63.58	127,160
	4,992	Bathrooms	60	4,992	CFL	15	2,000	299.52	599,040	74.88	149,760	224.64	449,280
	1,913	Personal Lamps	100	1,913	CFL	27	2,000	191.30	382,600	51.65	103,302	139.65	279,298
	5,528	Entryway,bedroo	60	5,528	CFL	14	2,000	331.68	663,360	77.39	154,784	254.29	508,576
	2,244	Porch & Patio	60	2,244	CFL	14	3,640	134.64	490,090	31.42	114,354	103.22	375,735
Site 13	1,536	Interior Concess	60	1,536	CFL	14	3,000	92.16	276,480	21.504	64,512	70.656	211,968
Total	**49,651**			**47,727**				**3439.601**	**7,624,673**	**841.974**	**1,822,028**	**2597.627**	**5,802,645**

Table 123. Verified Savings – 05-04-006

Site ID	Verified Pre Qty	Current Fixture Type	Watts Per Lamp	Hrs Per Day	Days Per Week	Annual Hours	Pre kW	Pre kWh	Verified Post Qty	New Lamp Type	Watts per NEW Lamp	Annual Hours	Post kW	Post kWh	kW Reduced	kWh Savings
Site 01	32	Interior-Concession	100			2,000	3.20	6400	32	CFL	14	2,000	0.448	896	2.752	5504
	149	Interior-Lobby,Restrooms	75			2,000	11.18	22350	149	CFL	14	2,000	2.086	4172	9.089	18178
Site 02	900	Guest room entry & restroom	65	8	5	1,400	58.50	81,900	900	CFL	16	1,400	14.40	20,160	44.10	61,740
	65	Lobby	75	24	7	8,569	4.88	41,774	65	CFL	16	8,569	1.04	8,912	3.84	32,862
	1,350	Bedside, living room	100	8	5	1,400	135.00	189,000	1,350	CFL	27	1,400	36.45	51,030	98.55	137,970
	900	desk lamp	75	8	5	1,400	67.50	94,500	900	CFL	27	1,400	24.30	34,020	43.20	60,480
	1,350	floor lamp	60	8	5	1,400	81.00	113,400	1,350	CFL	15	1,400	20.25	28,350	60.75	85,050
Site 03	1,181	Restroom,entry,wet bar	50	8	5	1,400	59.05	82,670	1,181	CFL	16	1,400	18.90	26,454	40.15	56,216
	108	Vanity mirror	67	8	5	1,400	7.24	10,130	108	CFL	14	1,400	1.51	2,117	5.72	8,014
	282	guest room vanity	90	8	5	1,400	25.38	35,532	282	CFL	27	1,400	7.61	10,660	17.77	24,872
	310	wall sconces, hanging fixture	67	8	5	1,400	20.77	29,078	310	CFL	15	1,400	4.65	6,510	16.12	22,568
	240	2&3 bay suites, restrooms	60	8	5	1,400	14.40	20,160	240	CFL	15	1,400	3.60	5,040	10.80	15,120
	300	chanheliers	25	24	7	8,569	7.50	64,268	300	CFL	3	8,569	0.90	7,712	6.60	56,555
Site 04	900		60	8	5	1,400	54.00	75,600	900	CFL	14	1,400	12.60	17,640	41.40	57,960
Site 05	1,190	Nightstand,Desk,Parlor	100	8	5	1,400	119.00	166,600	1,190	CFL	42	1,400	49.98	69,972	69.02	96,628
	467	Floor Lamp	150	8	5	1,400	70.05	98,070	467	CFL	33	1,400	15.41	21,575	54.64	76,495
	918	Entry Cans, Restrooms	100	8	5	1,400	91.80	128,520	918	CFL	27	1,400	24.79	34,700	67.01	93,820
	850	Vanity restroom	60	8	5	1,400	51.00	71,400	850	CFL	14	1,400	11.90	16,660	39.10	54,740
Site 06	4,874	bathroom	60	8	5	1,400	292.44	409,416	4,874	CFL	14	1,400	68.24	95,530	224.20	313,886
	808	Parch & Patio	60	8	5	3,640	48.48	176,467	808	CFL	14	3,640	11.31	41,176	37.17	135,292
	546	Personal Lamps	100	12	6	1,400	54.60	76,440	546	CFL	27	1,400	14.74	20,639	39.86	55,801
Site 07	173	Dinning	100	8	5	1,400	17.30	24,220	173	CFL	14	1,400	2.42	3,391	14.88	20,829
	279	Personal Lamps	100	8	5	1,400	27.90	39,060	279	CFL	27	1,400	7.53	10,546	20.37	28,514
	1,060	Entryway,bedroom,halls	60	8	5	1,400	63.60	89,040	1,060	CFL	14	1,400	14.84	20,776	48.76	68,264
	274	Porch & Patio	60	12	6	3,640	16.44	59,842	274	CFL	14	3,640	3.84	13,963	12.60	45,879
Site 08	284	Lamp Floors	150	8	5	1,400	42.60	59,640	284	CFL	55	1,400	15.62	21,868	26.98	37,772
	0	Lobby Chandeliers	40	24	7	8,569	0.00	0	0	CFL	5	8,569	0.00	0	0.00	0
	766	Bedside, Desk	90	8	5	1,400	68.94	96,516	766	CFL	30	1,400	22.98	32,172	45.96	64,344
	0	Hall Lamps	60	24	7	8,569	0.00	0	0	CFL	14	8,569	0.00	0	0.00	0
	0	Grand Ballroom Foyer	50	24	7	8,569	0.00	0	0	CFL	4	8,569	0.00	0	0.00	0
Site 09	173	Living Room	60	8	5	1,400	10.38	14,532	173	CFL	23	1,400	3.98	5,571	6.40	8,961
	58	Ceiling Fans	60	8	5	1,400	3.48	4,872	58	CFL	23	1,400	1.33	1,868	2.15	3,004
	231	Bedroom	75	8	5	1,400	17.33	24,255	231	CFL	23	1,400	5.31	7,438	12.01	16,817
	58	Restroom Fans	60	8	5	1,400	3.48	4,872	58	CFL	23	1,400	1.33	1,868	2.15	3,004
Site 10	20	Exterior	65	12	7	4,380	1.30	5,694	20	CFL	16	4,380	0.32	1,402	0.98	4,292
	200	Barracks 864	100	8	5	1,400	20.00	28,000	200	CFL	27	1,400	5.40	7,560	14.60	20,440
	150	Barracks 783	60	12	6	3,640	9.00	32,760	150	CFL	27	3,640	4.05	14,742	4.95	18,018
	430	864,783,778	60	8	5	1,400	25.80	36,120	430	CFL	14	1,400	6.02	8,428	19.78	27,692
	80	F Troop	100	8	5	1,400	8.00	11,200	80	CFL	14	1,400	1.12	1,568	6.88	9,632
	180	Piers	100	12	7	4,380	18.00	78,840	180	CFL	14	4,380	2.52	11,038	15.48	67,802
Site 11	5,989	bathroom	60	8	5	1,400	359.34	503,076	5,989	CFL	14	1,400	83.85	117,384	275.49	385,692
	869	Personal Lamps	100	8	5	1,400	86.90	121,660	869	CFL	27	1,400	23.46	32,848	63.44	88,812
	1,313	Living,dinning, bedroom	60	8	5	1,400	78.78	110,292	1,313	CFL	14	1,400	18.38	25,735	60.40	84,557
	232	Porch & Patio	60	12	6	3,640	13.92	50,669	232	CFL	14	3,640	3.25	11,823	10.67	38,846
Site 12	748	Dinning	100	8	5	1,400	74.80	104,720	748	CFL	15	1,400	11.22	15,708	63.58	89,012
	4,992	Bathrooms	60	8	5	1,400	299.52	419,328	4,992	CFL	15	1,400	74.88	104,832	224.64	314,496
	1,913	Personal Lamps	100	8	5	1,400	191.30	267,820	1,913	CFL	27	1,400	51.65	72,311	139.65	195,509
	5,528	Entryway,bedroom,halls	60	8	5	1,400	331.68	464,352	5,528	CFL	14	1,400	77.39	108,349	254.29	356,003
	2,244	Porch & Patio	60	12	6	3,640	134.64	490,090	2,244	CFL	14	3,640	31.42	114,354	103.22	375,735
Site 13	1,536	Interior Concession	60			3,000	92.16	276,480	1,536	CFL	14	3,000	21.50	64,512	70.66	211,968
Total	**47,500**						**3,293.54**	**5,411,624**	**47,500**				**840.74**	**1,355,979**	**2,452.81**	**4,055,645**

7.13.3.1 Fixture Types and wattages

The pre- and post-inspections were based on worksheets of the measures provided by the Project Sponsor. KSI verified basecase and postcase lamp wattages for all sites.

7.13.3.2 Verified Fixture Counts

The fixture counts on the project completion request forms submitted by the Project Sponsor represented the as-built quantities for each project. This was the basis for the verification of fixture counts. Pre-inspection and post-inspection visits were made to all sites. Fixture counts and wattages from the pre-inspection were used to adjust the basecase. Thus, the as-built counts were used for the final verification of fixture quantities, since the claimed savings were based on these values. At the Site 11, there was a discrepancy in the fixture counts; the verified number of fixtures was less than the proposed number of fixtures. At Site 8 there were fixtures that had been proposed for retrofit that were not retrofit due to customer preference and aesthetic considerations.

7.13.3.3 Hours of Operation

The hours of operation were verified through on site interviews with the facility contact. No monitoring was preformed due to the physical design of the light fixtures. Light loggers would not be aesthetically pleasing to the atmosphere of the hotels. The proposed hours for guestrooms were in question.

KSI monitored guestroom light fixtures as part of an evaluation of the Hawaiian Electric Co.'s DSM programs from 1996 to 2003. The monitoring resulted in an average of 1,400 hours per year for guestrooms. The Project Sponsor proposed 2,000 hours for guestrooms. The M&V used 1,400 operating hours for the hotel guestrooms participating in this program. For all other areas, proposed operating hours were used in the analysis. These hours of operation are supported by scoping study[2] by LBNL where lighting usage in hotel guestrooms was monitored. In this study the following fixtures were monitored in a small number of rooms: bathrooms, torchieres, desk lamps, bed lamps, and floor lamps. Average hours per day were estimated. A

[2] LBNL. Results From A Scoping Study At The Redondo Beach Crown Plaza, Lawarence Berkeley National Laboratory: Energy Efficient Fixtures Program.

simple average of the hours across all fixtures was 1,314 hours. This was only a scoping study with a limited sample but the figures support the use of 1,400 hours for this M&V.

7.13.3.4 Load Impacts

This section presents the verified load impacts and realization rate for the project.

7.13.3.4.1 Verified kW and kWh

For all 13 sites listed in the Project Sponsor's invoice, wattages and quantities were verified through on-site inspections. Basecase and postcase kW was calculated to show annual kW reduced. The invoice shows pre and post fixture wattage, total fixture quantity, annual hours of operation, pre and proposed kW, and pre and proposed kWh for each site. The kW reduced and the annual kWh savings was calculated by KSI and is shown for each facility in the results spreadsheet.

In addition, KSI verified fixture type's pre and post retrofit. The results spreadsheet also shows KSI's verified pre and post fixture counts; pre and post fixture wattage; hours of operation; pre and post kW; and verified annual kWh savings for each site. The kW reduced and kWh savings was calculated by KSI and compared to what was invoiced.

7.13.3.4.2 Realization Rate

The realization rate was calculated to compare how the invoiced kW reduced and kWh savings submitted by the Project Sponsor compared with the verified kW reduced and kWh savings for each. If the realization rate is equal to 100 % then the invoiced impacts match the verified impacts exactly. If the rate is less than 100 % then the verified impacts are less than the invoiced impacts, and if the rate is greater than 100 % then the verified savings are greater than invoiced.

A realization rate was calculated to compare how the invoiced kW reduced and kWh savings submitted by the Project Sponsor compared with the verified kW reduced and kWh savings for each site. Table 124 shows that the overall realization rate is lower than 100%. Thus the verified impacts are lower than the invoiced. This is due to the lower fixture counts found at two sites as well as lower hours of operation verified and used for all guestrooms throughout the sites.

Table 124. Realization Rate

	Proposed		Verified	
Site ID	kW Reduced Per Site	kWh Savings Per Site	kW Reduced Per Site	kWh Savings Per Site
Site 01	11.84	23,682.00	11.84	23,682
Site 02	250.44	526,794.60	250.44	378,102
Site 03	97.16	238,944.00	97.16	183,345
Site 04	41.40	82,800.00	41.40	57,960
Site 05	229.77	459,546.00	229.77	321,682
Site 06	301.23	663,415.52	301.23	504,978
Site 07	96.61	213,888.56	96.61	163,486
Site 08	81.40	220,007.12	72.94	102,116
Site 09	22.71	45,410.00	22.71	31,787
Site 10	62.67	172,632.80	62.67	147,877
Site 11	546.36	1,203,507.28	410.00	597,907
Site 12	785.38	1,740,049.36	785.38	1,330,755
Site 13	70.66	211,968.00	70.66	211,968
Total	**2,597.63**	**5,802,645.24**	**2,452.80**	**4,055,645**
Realization Rate			**94%**	**70%**

7.14 05-05-001 – ECM Motors in Cooler Evaporators

Evaporators are part of commercial refrigeration and freezer systems. Fans in evaporators usually operate 24-hours, 7-days a week. The replacement of standard motors with electronically commutated motors ("ECM") can provide energy savings of 40 percent or more. Recent monitoring studies have shown savings in excess of two-thirds of basecase motor consumption. This project was a retrofit of evaporator fan motors with ECMs in the Customer's grocery stores located throughout SDG&E's service area. Energy savings are achieved through efficiencies gained through a DC motor and the advanced control of the motor when compared to shaded pole motors. Table 125 shows the verified savings summary for the project.

Table 125. M&V Savings Summary – 05-05-001

CONTRACTED	
Energy Savings (kWh)	
Total Contracted Savings (kWh)	803,818 kWh
Total Reported / Invoiced Savings (kWh)	423,984.2 kWh
M&V Savings (kWh)	**466,032.2 kWh**
Realization Rate (kWh)	**1.10**
Demand Reduction (kW)	
Total Contracted Savings (kW)	91.8 kW
Total Reported / Invoiced Savings (kW)	48.40 kW
M&V Savings (kW)	**53.20**
Realization Rate	**1.10**

Table 126 provides a list of stores retrofit and the associated invoiced load impacts.

Table 126. Invoiced Measures and Savings, ECM Retrofit

	Invoiced				
Site ID	Invoiced Qty	Savings per Motor	kW per Motor	kWh Savings	kW Reduced
Site 01	18	700.80	0.08	12,614.4	1.44
Site 02	28	700.80	0.08	19,622.4	2.24
Site 03	36	700.80	0.08	25,228.8	2.88
Site 04	21	700.80	0.08	14,716.8	1.68
Site 05	36	700.80	0.08	25,228.8	2.88
Site 06	8	700.80	0.08	5,606.4	0.64
Site 07	40	700.80	0.08	28,032.0	3.20
Site 08	12	700.80	0.08	8,409.6	0.96
Site 09	20	700.80	0.08	14,016.0	1.60
Site 10	16	700.80	0.08	11,212.8	1.28
Site 11	29	700.80	0.08	20,323.2	2.32
Site 12	23	700.80	0.08	16,118.4	1.84
Site 13	33	700.80	0.08	23,126.4	2.64
Site 14	22	700.80	0.08	15,417.6	1.76
Site 15	20	700.80	0.08	14,016.0	1.60
Site 16	6	700.80	0.08	4,204.8	0.48
Site 17	39	700.80	0.08	27,331.2	3.12
Site 18	11	700.80	0.08	7,708.8	0.88
Site 19	2	700.80	0.08	1,401.6	0.16
Site 20	51	700.80	0.08	35,740.8	4.08
Site 21	28	700.80	0.08	19,622.4	2.24
Site 22	6	700.80	0.08	4,204.8	0.48
Site 23	18	700.80	0.08	12,614.4	1.44
Site 24	38	700.80	0.08	26,630.4	3.04
Site 25	21	700.80	0.08	14,716.8	1.68
Site 26	21	700.80	0.08	14,716.8	1.68
Site 27	2	700.80	0.08	1,401.6	0.16
	605			**423,984.0**	**48.40**

7.14.1 Measurement and Verification (M&V) Approach

The M&V approach used for the project is summarized in this section. KSI conducted pre- and post-installation inspections to ascertain basecase motor and ECM installation, as well as quantities of motors. Unit savings values were compiled from several sources and evaluated. The load impact estimation methodology complies with IPMVP Option A.

7.14.1.1 Load Impact Verification Methodology

Site inspections were employed to verify key M&V parameters shown in Table 127.

7.14.1.2 Analysis Approach

The basic equation used to estimate the energy savings of this project is shown in Equation 1.

(Eq. 1) kWh savings = [kWh savings per unit] × [number of motors]

The key parameters of Equation 1 are shown in Table 127.

Table 127. Key M&V Parameters

Parameter	M&V Activity
Motor Counts	Motor counts were verified through on-site inspection. Leveraged pre-inspections by SDG&E program staff.
$Motor_{Pre}$ and $Motor_{Post}$	Type of motor pre- and post- used to verify unit motor savings.
Hours of Operation	Uncontrolled evaporator fan motors run continuously 8,760 hours per year.

7.14.1.3 On-Site Verification Inspections

On-site inspections were conducted to verify the motor types and quantities on a sample of sites. Site inspections consisted of the following activities:

- Verification of the basecase and postcase motor type
- Verify the quantity of motors installed

The verification was based on as-built documentation provided to KSI.

Through the inspections it was determined that:

- Pre-inspection: no ECM motors were installed and basecase motors were shaded-pole motors.
- Post-retrofit: Verified ECM motor counts were higher than invoiced.

Table 128 shows the motor counts from the post-inspections.

Table 128. Post-Inspection Motor Quantities

Site ID	Invoiced Qty (Inspected Sites)	Verified Qty
Site 05	36	36
Site 07	40	43
Site 08	12	10
Site 11	29	29
Site 12	23	25
Site 13	33	33
Site 15	20	32
Site 20	51	64
Site 24	38	39
	282	**311**
Quantity Adjustment Factor		**1.10**

A Quantity Adjustment Factor was developed based on the findings of the inspections, as shown in Table 128, to account for the additional motors. The Quantity Adjustment Factor was calculated as shown in Equation 2. The Verified Adjusted Motor Quantity was calculated by multiplying the Quantity Adjustment Factor by the Total Motors Invoiced, as shown in Eq. 3.

(Eq. 2) $$\text{Quantity Adjustment Factor} = \frac{\text{Verified Motor Quantity}}{\text{Invoiced Motor Quantity of Surveyed Sites}}$$

(Eq. 3) $$\text{Verified Adjusted Motor Quantity} = \text{Quantity Adjustment Factor} \times \text{Total Motors Invoiced}$$

Table 129. Verified Motor Quantity and Quantity Adjustment Factor

Total Motors Invoiced	605
Invoiced Motor Quantity of Surveyed Sites	282
Verified Motor Quantity	311
Quantity Adjustment Factor	**1.10**
Verified Adjusted Motor Quantity	**665**

7.14.1.4 Unit Motor Savings

Two studies[3,4] where energy usage in evaporator motors was monitored showed that savings from ECMs in evaporators approached 70% of basecase motor usage. As shown in Table 130 one study showed annual savings from the motor retrofit were estimated to be 801.5 kWh in energy savings and peak load reduction of 0.091 kW, while the other study showed savings of 687.66 kWh and . These savings were 67% of the basecase motor usage. The invoiced impacts were based on 700.8 kWh per motor and 0.08 peak kW per motor. These savings are attributed to the retrofit of the motor only; it does not account any savings due to reduced heating load from the motors.

Table 130. Monitoring Studies of ECM Savings

	PG&E/Fisher-Nickel[1]	Plugloads.com[2]
Shaded pole	135.5	112.5
ECM	44	34
Watts Reduced	91.5	78.5
%-Reduction	67.5%	69.8%
Hours	8,760	8,760
Annual kWh Savings	801.54	687.66

(1) Karos, A. GE ECM Evaporator Fan Motor Energy Monitoring, PG&E Food Service Technology Center Report #5011.05.13, July 2006.

(2) Wood, R. Motor Retrofits in Grocery Walk-In Coolers, Advance Information, www.plugloads.com, 2004.

The Karas study also estimated energy savings from reduced cooling load resulting from the more efficient ECMs. These additional savings were 45.8 watts per fan motor replaced for refrigeration.

Based on this assessment, the load impact values used in the invoice were acceptable and were likely conservative, and were used to estimate the verified impacts for this project.

DEER does not have an EMC motor replacement based on a motor-for-motor replacement.

[3] Karas, A. FSTC Report # 5011.05.13, *GE ECM Evaporator Fan Motor Energy Monitoring*, Fisher-Nickel for Pacific Gas & Electric Company, July 2006.
[4] Wood, R.S. *Motor Retrofits in Grocery Walk-in Coolers*, www.Plugloads.com, 2004.

7.14.2 Results

This section provides the results of the M&V process. Table 131 shows a summary of the M&V findings compared to the invoiced load impacts.

Some of the key findings are:

- **Realization Rates:** The realization rates are 1.10 for both kWh savings and kW reduced. The reason for this discrepancy is attributed to the greater number of fixtures verified than was invoiced.
- **Hours of Operation:** No controls were installed on the evaporator motors, thus, the verified hours of operation was 8,760, the same as the basecase.
- **Quantity of Retrofits Performed:** As discussed previously a Quantity Adjustment Factor was calculated and used to adjust invoiced motor quantities to account for differences between verified and invoiced counts.
- **Unit Savings:** The invoiced unit savings for kWh savings and kW reduction were used after a review of prior monitoring studies confirmed that the savings of 700.80 kWh per motor and kW reduction of 0.08 kW per motor were consistent with monitored data and were somewhat conservative, in that they did not take into account savings from reduced refrigeration load.

Table 131. Summary of M&V of ECM Retrofit – 05-05-001

		Invoiced		Verified		
	Impact per Motor	Qty	Impacts	Qty	Impacts	Realization Rate
kWh Savings	700.80	605	423,984	665	466,032	1.10
kW Reduced	0.08	605	48.40	665	53.20	1.10

7.15 05-05-002 – Air Conditioner Tune-ups and CFL

This project was an aggregation project comprising multiple customers and was targeted at small commercial customers. The proposed program measures included:

- Lighting retrofits (CFL and T-8)
- A/C Diagnostic
- Duct Testing and Sealing
- Pre-Rinse Spray Nozzles for electric water heat

The M&V comprised two interim reports. The first interim report presented in Section 7.15.1 and the second interim report is presented in Section 7.15.2. Table 132 shows the summary of M&V savings for the entire project. Table 133 summarizes the M&V for the first interim report and Table 134 the summary of the second interim report.

Table 132. M&V Savings Summary – Overall Project – 05-05-002

Overall Project Invoices A, B, C, D	
Energy Savings (kWh)	
Total Contracted Savings (kWh)	15,724,420
Total Reported / Invoiced Savings (kWh)	15,528,063
M&V Savings (kWh)	**11,360,053**
Realization Rate (kWh)	**73.2%**
Demand Reduction (kW)	
Total Contracted Savings (kW)	1,681.52
Total Reported / Invoiced Savings (kW)	3,216.30
M&V Savings (kW)	**3,264.82**
Realization Rate	**104.4%**
Natural Gas Savings (therms)	
Total Contracted Savings (therms)	96,000
Total Reported / Invoiced Savings (therms)	19,153
M&V Savings (therms)	**19,153**
Realization Rate	**100.0%**

Table 133. M&V Savings Summary for First Interim M&V – 05-05-002

First Interim M&V (Invoice A)	
Energy Savings (kWh)	
Total Contracted Savings (kWh)	15,724,420
Total Reported / Invoiced Savings (kWh)	9,833,484
M&V Savings (kWh)	**6,921,900**
Realization Rate (kWh)	**70.4%**
Demand Reduction (kW)	
Total Contracted Savings (kW)	1,681.52
Total Reported / Invoiced Savings (kW)	2,743.94
M&V Savings (kW)	**2,113.40**
Realization Rate	**77.0%**
Natural Gas Savings (therms)	
Total Contracted Savings (therms)	96,000
Total Reported / Invoiced Savings (therms)	14,096
M&V Savings (therms)	**14,096**
Realization Rate	**100.0%**

Table 134. M&V Savings Summary – Second Interim M&V – 05-05-001

Second Interim M&V (Invoices B, C, D)	
Energy Savings (kWh)	
Total Contracted Savings (kWh)	15,724,420
Total Reported / Invoiced Savings (kWh)	5,694,578
M&V Savings (kWh)	**4,438,153**
Realization Rate (kWh)	**0.78**
Demand Reduction (kW)	
Total Contracted Savings (kW)	1,681.52
Total Reported / Invoiced Savings (kW)	382.36
M&V Savings (kW)	**1,151.42**
Realization Rate	**3.01**
Natural Gas Savings (therms)	
Total Contracted Savings (therms)	96,000
Total Reported / Invoiced Savings (therms)	5,057
M&V Savings (therms)	**5,057**
Realization Rate	**100.0%**

The proposed savings and costs for the first M&V are shown in Table 135. Table 136 shows the percentage share of costs and savings by measure. As can be seen in Table 136,

approximately 60% of the kWh savings was to be obtained through lighting measures and 40% through non-lighting measures.

Table 135. Proposed Measures and Savings for Total Project – 05-05-002

MEASURE / ACTIVITY NAME	Quantity	Measure Cost Per Unit	kWh Savings Per Unit	kW Reduction Per Unit	(kWh) Price Per	Total (kWh)	Total Measure Cost	Total kWh Savings	Total kW Reduction	Total Therms Savings	Weighted Average Cost/Incentive Per kWh
Screw-in cfl's 5-13 Watt	1,000	$9.95	186.75	0.0365	$ 0.05	$ 53.28	$9,950.00	186,750	36.50	0	$0.05
Screw-in cfl's 14-26 Watts	12,000	$9.95	236.55	0.0462	$ 0.04	$ 504.76	$119,400.00	2,838,600	554.40	0	$0.04
Screw-in cfl's >27 Watts	17,500	$9.95	286.35	0.0559	$ 0.03	$ 608.08	$174,125.00	5,011,125	978.25	0	$0.03
6 plus ton AC Diagnostic	500	$145.00	988.00	0.1500	$ 0.15	$ 73.38	$72,500.00	494,000	75.00	0	$0.15
1.5 to 5 ton AC Diagnostic	2,000	$145.00	988.00	0.1500	$ 0.15	$ 293.52	$290,000.00	1,976,000	300.00	0	$0.15
Commercial Duct Test and Seal	2,000	$295.00	768.00	0.2000	$ 0.38	$ 768.23	$590,000.00	1,536,000	400.00	96,000	$0.38
Pre-Rinse Spray Nozzel-Electric	300	$175.00	7,635.00	2.0000	$ 0.02	$ 6.88	$52,500.00	2,290,500	600.00	0	$0.02
2nd Gen. (4) 48" T-8 Lamp with Elec. Bal.	6,000	$59.50	182.72	0.0390	$ 0.33	$ 1,953.86	$357,000.00	1,096,290	234.00	0	$0.33
2nd Gen. (2) 48" T-8 Lamp with Elec. Bal.	3,500	$59.50	84.33	0.0180	$ 0.71	$ 2,469.47	$208,250.00	295,155	63.00	0	$0.71
Total Program							**$1,873,725.00**	**15,724,420**	**3,241.15**	**96,000**	**$0.119**

Table 136. Proposed %-Savings and %-Cost by Measure

MEASURE / ACTIVITY NAME	Quantity	Total Measure Cost	Total kWh Savings	Total kW Reduction	Total Therms Savings	%-Cost/Incentive by Measure	%-kWh Savings by Measure	%-kW Red. by Measure	%-Therm Savings by Measure	Weighted Average Cost/Incentive Per kWh
Screw-in cfl's 5-13 Watt	1,000	$9,950	186,750	36.50	0	1%	1%	1%	0%	$0.05
Screw-in cfl's 14-26 Watts	12,000	$119,400	2,838,600	554.40	0	6%	18%	17%	0%	$0.04
Screw-in cfl's >27 Watts	17,500	$174,125	5,011,125	978.25	0	9%	32%	30%	0%	$0.03
2nd Gen. (4) 48" T-8 Lamp with Elec. Bal	6,000	$357,000	1,096,290	234.00	0	19%	7%	7%	0%	$0.33
2nd Gen. (2) 48" T-8 Lamp with Elec. Bal	3,500	$208,250	295,155	63.00	0	11%	2%	2%	0%	$0.71
Total Lighting		**$868,725**	**9,427,920**	**1,866.15**	**0**	**46%**	**60%**	**58%**	**0%**	
1.5 to 5 ton AC Diagnostic	2,000	$290,000	1,976,000	300.00	0	15%	13%	9%	0%	$0.15
6 plus ton AC Diagnostic	500	$72,500	494,000	75.00	0	4%	3%	2%	0%	$0.15
Commercial Duct Test and Seal	2,000	$590,000	1,536,000	400.00	96,000	31%	10%	12%	100%	$0.38
Pre-Rinse Spray Nozzel-Electric	300	$52,500	2,290,500	600.00	0	3%	15%	19%	0%	$0.02
Total Non-Lighting		**$1,005,000**	**6,296,500**	**1,375.00**	**96,000**	**54%**	**40%**	**42%**	**100%**	
Total Program		**$1,873,725**	**15,724,420**	**3,241.15**	**96,000**	**100%**	**100%**	**100%**	**100%**	**$0.119**

7.15.1 05-05-002: First Interim M&V

This M&V is the first of two M&V done for this project. The two M&V were conducted due to the length of time between invoicing for this aggregation project. This section presents the results for the first interim M&V. Table 137 shows the M&V summary for the first interim M&V, while Table 138 shows verified savings by measure.

Table 137. M&V Savings Summary – First M&V – 05-05-002

M&V Savings Summary - First M&V	
Energy Savings (kWh)	
Total Contracted Savings (kWh)	15,724,420
Total Reported / Invoiced Savings (kWh)	9,833,484
M&V Savings (kWh)	**6,921,900**
Realization Rate (kWh)	**70.4%**
Demand Reduction (kW)	
Total Contracted Savings (kW)	1,681.52
Total Reported / Invoiced Savings (kW)	2,743.94
M&V Savings (kW)	**2,113.40**
Realization Rate	**77.0%**
Natural Gas Savings (therms)	
Total Contracted Savings (therms)	96,000
Total Reported / Invoiced Savings (therms)	14,096
M&V Savings (therms)	**14,096**
Realization Rate	**100.0%**

Table 138. Invoiced and Verified Savings By Measure – 05-05-002 First Interim Report

	Invoiced				Verified				
Measure	No.	kWh Savings	kW Reduction	Therm Savings	kWh Savings	kW Reduction	Therm Savings	kWh Realization Rate	kW Realization Rate
A/C Diagnostic	2,970	4,368,971	2,312.06	0	3,238,376	1,681.52		74.1%	72.7%
Duct Test & Seal	500	615,951	431.88	14,096	615,951	431.88	14,096	100.0%	100.0%
CFL Retrofit	192	4,848,563	0	0	3,067,573			63.3%	
Program Total		**9,833,484**	**2,743.94**	**14,096**	**6,921,900**	**2,113.40**		**70.4%**	**77.0%**

The program was marketed by the program sponsor using a door-to-door solicitation approach. In addition, SDG&E facilitated implementation by introducing the program sponsor with several major customers. Once a customer was solicited and agreed to participate an implementation crew was dispatched to the site. One or more of three distinct types of measures were implemented at any given site:

- CFL retrofits;
- AC diagnostic and tune-up; and
- Duct test and seal.

It was not required that all measures be implemented at all sites. As of this M&V report (projects implemented through February 2006) no other measures have been implemented. No

tubular fluorescent lamps nor pre-rinse spray nozzles that were originally proposed were installed.

The core of the program is an AC diagnostic system known hereafter as the "technical platform." This system utilizes a series of data acquisition units and a laptop PC to gather and analyze data on AC system condition and operation before and after corrective actions are performed. These data are stored in the laptop and are secured, thus, cannot be changed by the technician. Ultimately, the data are uploaded to the database of the technical platform for retention and reporting. The data are tamper-proof and cannot be manipulated once they are entered into the system. Thus, the measured values and savings estimates calculated and retained by the technical platform have a high level of integrity, thus eliminating the possibility of "gaming" by the implementer or other parties. This tamper-proof attribute forms the core of the M&V, where the M&V relies on the basic operational data gathered through the system for the savings calculations for AC measures implemented.

The proposed AC diagnostic and tune-up process included:

- Measurement of the baseline operation and refrigerant charge level of the a/c unit;
- Determination of system condition and corrective action needed;
- Cleaning condenser coils;
- Adjusting refrigerant charge level, if necessary;
- Measurement of adjusted system performance;
- Determine if system is within specifications and adjust as necessary;
- Measurement of optimized system performance;
- Upload measurement data (baseline and optimized) to the Enalasys database via Internet.

The proposed duct test and seal process included:

- Install measurement hood/blower to a register;
- Seal all other registers with adhesive masking material;
- Run leakage test;
- Laptop records basecase measurements;
- If test shows leakage exceeds a specified level, find leaks and seal until leakage is at the specified level;
- Laptop records final measurements and calculates savings; and
- Upload measurement data to the technical platform database via Internet.

The only lighting retrofits installed were screw-in compact fluorescent lamps. Two main types were used, standard 14 watt CFL and 19 watt CFL floodlamps. In some cases the implementer installed the CFLs while for other projects the CFLs were left in shipping cartons to be installed by the customer. Through the invoice period of the M&V no other types of lighting was installed.

7.15.1.1 Measurement and Verification (M&V) Approach

The M&V approach used for the project is summarized in this section. KSI coordinated with the Project Sponsor to perform post-retrofit M&V activities to support the tasks described below.

The load impact estimation methodology described in this plan complies with IPMVP Option A (engineering calculations using short-term or continuous post-retrofit measurements and/or stipulations). The measurements were gathered by the technical platform during the tune-up process. The following document contains a detailed description of how the technical platform software calculates kWh and peak demand savings:

7.15.1.1.1 CFL: Load Impact Verification Methodology

The load impact estimation methodology described in this section complies with IPMVP Option A. Site inspections were employed to verify key M&V parameters.

7.15.1.1.1.1 Savings Calculations: CFL

The basic equation used to estimate the energy savings for CFL installations is shown in (Eq. 1).

(Eq. 1)

$$\text{kWh Savings} = (\text{kWh per unit}) \times (\#\,\text{Fixtures}),$$

where :

$$\text{kWh per unit} = \text{from DEER by wattage; and}$$

$$\#\,\text{Fixtures} = \text{verified counts from inspections.}$$

7.15.1.1.1.2 Verification: CFL

The key parameters of Equation 1 are shown in Table 139.

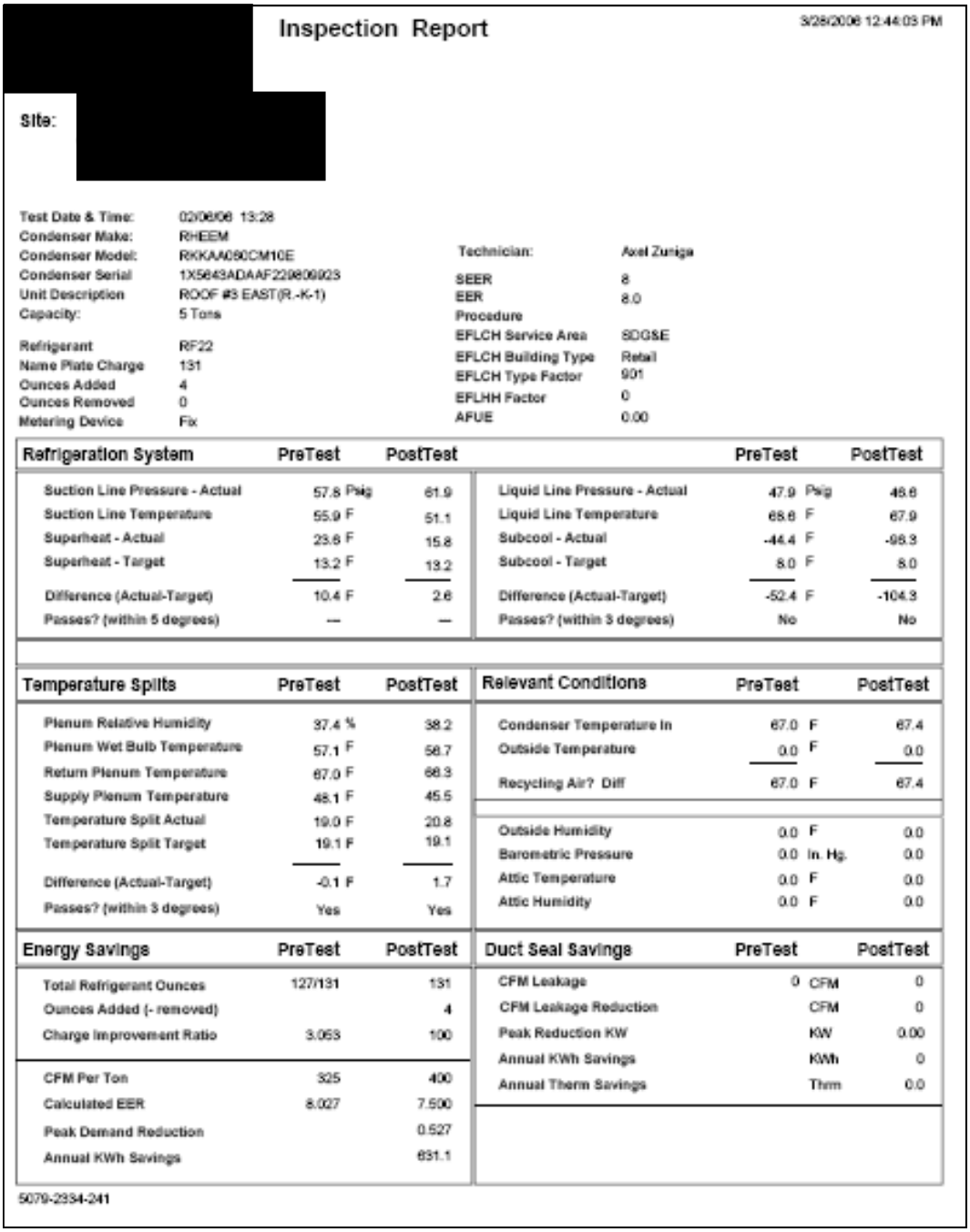
Table 139. Key M&V Parameters for CFL Retrofits

Parameter	M&V Activity
Fixture Counts	Leverage pre-inspections by SDG&E program staff. Post fixture counts were verified through on-site inspection on a sample of sites.
Fixture Wattage	Installed wattage values verified on a sample of sites.

7.15.1.1.2 HVAC Diagnostic and Tune-up, and Duct Test and Seal: M&V Methodology

HVAC package units were tested for duct tightness and refrigerant charge level by Project Sponsor. If there are any units that fail these tests appropriate corrective actions were taken per the program design. The "pre-" and "post-" conditions for CFM leakage and/or the amount of refrigerant added/removed were recorded using the technical platform. Energy savings are calculated using a methodology that had been reviewed previously by KSI. The savings calculations appeared to be consistent with those used in the industry. Once the tests are conducted and the systems are optimized, the pre and post data are uploaded to the Enalasys database via the Internet. Once in the technical platform database these data cannot be altered. The contents of the database are provided to KSI by Project Sponsor via hard copies of the "Inspection Report" for each project invoiced, as well as through an extract of the database that was the basis for the Project Sponsor's invoice. As can be seen in Figure 29, an Enalasys Inspection Report contains the bulk of the data elements in the technical platform database, Pre- and Post-test measurements for diagnostic and refrigerant charge adjustment and duct test and seal, as well as calculated savings from these measures.

Figure 29. Inspection Report



Inspection Report

3/28/2006 12:44:03 PM

Site: [redacted]

Test Date & Time:	02/06/06 13:28		
Condenser Make:	RHEEM		
Condenser Model:	RKKAA060CM10E	Technician:	Axel Zuniga
Condenser Serial	1X5643ADAAF220606023	SEER	8
Unit Description	ROOF #3 EAST(R.-K-1)	EER	8.0
Capacity:	5 Tons	Procedure	
		EFLCH Service Area	SDG&E
Refrigerant	RF22	EFLCH Building Type	Retail
Name Plate Charge	131	EFLCH Type Factor	901
Ounces Added	4	EFLHH Factor	0
Ounces Removed	0	AFUE	0.00
Metering Device	Fix		

Refrigeration System	PreTest	PostTest		PreTest	PostTest
Suction Line Pressure - Actual	57.8 Psig	61.9	Liquid Line Pressure - Actual	47.9 Psig	48.6
Suction Line Temperature	55.9 F	51.1	Liquid Line Temperature	68.6 F	67.9
Superheat - Actual	23.6 F	15.8	Subcool - Actual	-44.4 F	-98.3
Superheat - Target	13.2 F	13.2	Subcool - Target	8.0 F	8.0
Difference (Actual-Target)	10.4 F	2.6	Difference (Actual-Target)	-52.4 F	-104.3
Passes? (within 5 degrees)	—	—	Passes? (within 3 degrees)	No	No

Temperature Splits	PreTest	PostTest	Relevant Conditions	PreTest	PostTest
Plenum Relative Humidity	37.4 %	38.2	Condenser Temperature In	67.0 F	67.4
Plenum Wet Bulb Temperature	57.1 F	58.7	Outside Temperature	0.0 F	0.0
Return Plenum Temperature	67.0 F	68.3	Recycling Air? Diff	67.0 F	67.4
Supply Plenum Temperature	48.1 F	48.5			
Temperature Split Actual	19.0 F	20.8	Outside Humidity	0.0 F	0.0
Temperature Split Target	19.1 F	19.1	Barometric Pressure	0.0 In. Hg.	0.0
Difference (Actual-Target)	-0.1 F	1.7	Attic Temperature	0.0 F	0.0
Passes? (within 3 degrees)	Yes	Yes	Attic Humidity	0.0 F	0.0

Energy Savings	PreTest	PostTest	Duct Seal Savings	PreTest	PostTest
Total Refrigerant Ounces	127/131	131	CFM Leakage	0 CFM	0
Ounces Added (- removed)		4	CFM Leakage Reduction	CFM	0
Charge Improvement Ratio	3.053	100	Peak Reduction KW	KW	0.00
			Annual KWh Savings	KWh	0
CFM Per Ton	325	400	Annual Therm Savings	Thm	0.0
Calculated EER	8.027	7.500			
Peak Demand Reduction		0.527			
Annual KWh Savings		631.1			

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7.15.1.1.2.1 Savings Estimation Methodology - A/C Diagnostics

The load impact estimation methodology described in this section complies with IPMVP Option B (engineering calculations using short term or continuous measurements).

Generally, the energy savings for the a/c diagnostic are calculated as follows.

- A "power use" equation is used to calculate Pre- and Post- kW demand based on the measurements taken through the technical platform;
- *Peak kW* reduced, is calculated by taking the difference between the Pre- and Post-kW values; and
- Annual *kWh savings* is calculated by applying equivalent full-load cooling hours.

The step-by-step procedure is described below.

(1) The AC diagnostic test collects a variety of data including:

   a. **AC Unit Refrigerant Capacity (ounces)**(e.g. 6.5 lbs converted to ounces)

   b. **Refrigerant Added/Removed** (ounces) (e.g. 12 oz.)

   c. **AC Unit Tonnage** (e.g. 4 ton system)

(2) Data Assumptions:

   a. **A/C Unit EER rating** (In all cases, convert SEER using the following equation: EER = SEER x 0.9). If nameplate data is not available, SEER of 8 is used units that are 5-tons or smaller. For this program SEER of 8 was used.

   b. **Equivalent full load cooling hours** (EFLCH) used values shown in Table 140.

   c. **Pre flow rate (CFM) and Post flow rate (CFM):** Actual airflow readings are not taken. The technician generally cleans coils, changes filters, and opens registers, if needed, prior to A/C diagnostic tests. In lieu of actual airflow readings an average increase in airflow of 75 CFM (from 325 cfm to 400 cfm) was assumed based on the findings of Proctor etal[5].

(3) Calculate the pre- and post- refrigerant charge percentage of capacity *(PerChrg$_{Pre}$* and *PerChrg$_{Post}$)* using (Eq. 2) and (Eq. 3)

(Eq. 2) $$\text{PerChrg}_{\text{Pre}} = \frac{(\text{Refrigerant Capacity}) \pm (\text{Refrigerant Added/Removed})}{(\text{Refrigerant Capacity})}$$

(Eq. 3) $$\text{PerChrg}_{\text{Post}} = \frac{(\text{Refrigerant Capacity})}{(\text{Refrigerant Capacity})}$$

[5] "Innovative Peak Load Reduction Program CheckMe!® Commercial and Residential AC Tune-Up Project", Proctor Engineering Group, Prepared for the California Energy Commission, November 6, 2003, p. 36.

(4) Calculate the ratio between the Pre- and Post- airflow rates *(PerFlo2$_{Pre}$, PerFlo3$_{Pre}$, PerFlo2$_{Post}$,* and *PerFlo3$_{Post}$).* Since the pre- and post-airflow rates are assumed to be 325 cfm and 400 cfm, respectively, as discussed previously, these values will essentially be constants.

(Eq. 4) $$\text{PerFlow2}_{\text{Pre}} = \frac{\text{Flow Rate}_{\text{Pre}}}{\text{Flow Rate}_{\text{Post}}} = \frac{325}{400} = 0.8125$$

(Eq. 5) $$\text{PerFlow3}_{\text{Pre}} = \frac{\text{Flow Rate}_{\text{Post}}}{\text{Flow Rate}_{\text{Post}}} = \frac{400}{400} = 1.00$$

(Eq. 6) $$\text{PerFlow2}_{\text{Post}} = \frac{\text{Flow Rate}_{\text{Post}}}{\text{Flow Rate}_{\text{Post}}} = \frac{400}{400} = 1.00$$

(Eq. 7) $$\text{PerFlow3}_{\text{Post}} = \frac{\text{Flow Rate}_{\text{Post}}}{\text{Flow Rate}_{\text{Post}}} = \frac{400}{400} = 1.00$$

(5) Calculate the ratio between unit EER at measured charge and unit EER at correct charge, pre and post refrigerant charge *(EERnorm1$_{Pre}$* and *EERnorm1$_{Post}$*).

(Eq. 8) $$\text{EERnorm1}_{\text{Pre}} = 5.082403 - (4.10056 \times \text{PerChrg}_{\text{Pre}}) + (4.619659 \times \text{LN}(\text{PerChrg}_{\text{Pre}}))$$

(Eq. 9)
$$\begin{aligned}\text{EERnorm1}_{\text{Post}} &= 5.082403 \\ &\quad - (4.10056 \times \text{PerChrg}_{\text{Post}}) \\ &\quad + (4.619659 \times \text{LN}(\text{PerChrg}_{\text{Post}}))\end{aligned}$$

(6) The ratio between unit EER at 325 cfm and unit EER at 400 cfm *(EERnorm2pre, EERnorm3pre, EERnorm2post, and EERnorm3post)*[6] is calculated below.

(Eq. 10)
$$\text{EERnorm2}_{\text{Pre}} = 0.65 + (0.35 \times \text{PerFlo2}_{\text{Pre}})$$

(Eq. 11)
$$\text{EERnorm3}_{\text{Pre}} = 0.65 + (0.35 \times \text{PerFlo3}_{\text{Pre}})$$

(Eq. 12)
$$\text{EERnorm2}_{\text{Post}} = 0.65 + (0.35 \times \text{PerFlo2}_{\text{Post}})$$

(Eq. 13)
$$\text{EERnorm3}_{\text{Post}} = 0.65 + (0.35 \times \text{PerFlo3}_{\text{Post}})$$

(7) Calculate *Pre-* and *Post- KW Demand.*

(Eq. 14)
$$\text{kW}_{\text{p}} = \frac{\text{CDF} \times 12 \times \text{Tons}}{\frac{\text{EER} \times \text{EERnorm1}_{\text{p}} \times \text{EERnorm2}_{\text{p}}}{\text{EERnorm3}_{\text{p}}}},$$

where:

p = Pre- or Post- measurements,

CDF = Coincident Diversity Factor from Table 5,

Tons =# tons of a/c unit from nameplate, and

EER = EER from nameplate.

(8) Calculate kW demand reduction (Eq. 15) and kWh savings (Eq. 16).

[6] ASHRAE Standard 152-2004, "Method of Test for Determining the Design and Seasonal Efficiencies of Residential Thermal Distribution Systems"

(Eq. 15) $$\text{kW Reduction} = \text{kW}_{\text{Pre}} - \text{kW}_{\text{Pre}}$$

(Eq. 16) $$\text{kWh Savings} = (\text{kW Reduction}) \times \text{EFLCH}$$

where :

EFLCH = Equivalent full load cooling hours from Table 4.

1.1.1.1.1.1.1. Assumptions Used In AC Diagnostic Savings Calculations

This section discusses some assumptions and/or simplifications used in the AC diagnostic savings calculations.

Air Flow Improvement

Actual air flow measurements were not taken during the test. It was assumed that cleaning of coils provided 75 cfm improvement in airflow, from 325 cfm to 400 cfm, based on data from Proctor Engineering Group[7]

Equivalent Full Load Cooling Hours (EFLCH)

Equivalent Full Load Cooling Hours (EFLCH) by building type shown in Table 140 were taken from Table A-1 of the "California Statewide Commercial Sector Energy Efficiency Potential Study, Study ID #SW039A, Final Report, Appendix A", XENERGY, Inc, July 9, 2002.

Table 140. Equivalent Full Load Cooling Hours (EFLCH) By Building Type

	Equivalent Full Load Cooling Hours		
Building Type	**PG&E**	**SCE**	**SDG&E**
Office	1,113	1,508	1,225
Restaurant	1,292	1,643	1,420
Retail	850	1,212	901
Food Store	1,672	2,049	1,801
Warehouse	515	687	558
School	677	706	739
College	682	910	770

[7] Innovative Peak Load Reduction Program CheckMe! Commercial and Residential AC Tune-Up Project", Proctor Engineering Group, Prepared for the California Energy Commission, November 6, 2003

Hospital	1,847	2,210	2,062
Hotel	928	1,150	1,034
Miscellaneous	1,635	1,875	1,822

Coincident Diversity Factor (CDF)

The coincident diversity factors by building type used in the calculations are shown in Table 141. These factors were taken from the "Evaluation of Pacific Gas & Electric Company's 1995 Nonresidential Energy Efficiency Incentives Program for Commercial Sector HVAC Technologies, Protocol", Quantum Consulting, Inc, March 6, 1997, Table 11.

Table 141. Coincident Diversity Factors for HVAC Technologies

Market Sector	HVAC CDF
Office	0.87
Retail	0.85
University	0.73
School	0.24
Grocery	0.83
Restaurant	0.86
Health Care/Hospital	0.89
Hotel/Motel	0.77
Warehouse	0.80
Process Industrial	0.75
Assembly Industrial	0.75
All Other	0.78

7.15.1.1.3 Duct Test and Seal Savings Calculations

The duct test and sealing process included the measurement of pre- and post-sealing leakage rate in cubic feet per minute (CFM) leakage using a Duct Blaster (or similar equipment). The leakage readings from the Duct Blaster are gathered by a laptop and ultimately retained in the Enalasys database system. The reduction in CFM (ΔCFM) was calculated and the amount of energy associated with cooling the ΔCFM was calculated. The measurements retained in Enalasys are the basis for the M&V, since:

- Industry-accepted equipment such as the Duct Blaster is used to take the measurements; and

- Enalasys retains the measured pre- and post- data and calculated savings in a tamper-proof database system.

The specific steps are:

1. Install measurement equipment and seal registers and grills.
2. Initial duct leakage is determined at 25 Pascals using a Duct Blaster.
3. Ducts are sealed using Title 24 accepted mastic, butyl tape, and other Title 24 accepted materials.
4. Post-duct leakage is measured after sealing. Duct leakage reduced (ΔCFM) is calculated by subtracting Post- duct leakage from Pre-duct leakage. The goal is 15% or lower leakage (based on 400 cfm/ton).
5. Peak kW reduction during the cooling season is calculated using (Eq. 17)

(Eq. 17)
$$\Delta kW_{\text{Abated Leaks}} = \frac{\text{CDF} \times 12{,}000 \text{ Btu/ton} \times \frac{\Delta CFM}{400 \text{ CFM/ton}}}{\text{unit EER Btu/W} \times 1000 \text{ W/kW}},$$

where:

$\Delta kW_{\text{Abated Leaks}}$ = Peak kW reduction,

CDF = Coincident diversity factor for cooling from Table 5,

ΔCFM = Duct leakage abated by sealing in CFM,

EER = EER from nameplate.

6. Annual energy savings for the cooling season (kWh $\text{Saved}_{\text{Abated Leaks}}$) is shown in (Eq. 18).

(Eq. 18)

$$\text{kWh Saved}_{\text{Abated Leaks}} = \text{kW Reduced}_{\text{Abated Leaks}} \times \text{EFLCH},$$

where:

$\text{kW Reduced}_{\text{Abated Leaks}}$ = Calculated in Eq.16, and

EFLCH = Equivalent full load cooling hours from Table 4.

7.15.1.1.4 Natural Gas Savings Calculations

Originally a similar method to the cooling energy saved calculation was proposed for gas savings. Unfortunately values for Equivalent Full Load Heating Hours (EFLHH) could not be located. Therefore, a relationship between annual gas energy use intensities (EUI) by building type and HVAC unit size was developed. Annual gas energy use intensities by building type and by major climate zone were obtained from "Commercial Building Survey Report", PG&E, 1999. Assuming an average of 300 sq ft/ton, (Eq. 19) was developed to calculate natural gas savings from duct sealing.

(Eq. 19)

$$\text{Therms Saved}_{\text{Abated Leaks}} = \frac{\text{CDF} \times \text{C}ZCF \times \text{EUI} \times 300\,\text{sq ft/ton} \times \frac{\Delta\text{CFM}}{400\,\text{CFM/ton}}}{100\,\text{kBtu/therm}},$$

where:

$\text{Therms Saved}_{\text{Abated Leaks}}$ = Therms saved due to sealed leaks,

EUI = Natural gas energy use intensity for space heating by building type, and

CZCF = Climate zone correction factor.

CZCF is a climate zone correction factor taken from "Commercial Building Survey Report", PG&E, 1999, Table 22.

7.15.1.1.5 On-Site Verification Inspections

This section summarizes the inspection process.

7.15.1.1.5.1 Inspection Protocols

The post-inspections were conducted according to the following protocols.

AC diagnostic test were confirmed through the following observations:

- Holes drilled and plugged/sealed in supply and return ducts, typically at the condensing unit.
- New brass caps with o-ring gaskets on refrigerant fittings.
- An “Inspection Report” from the technical platform was provided by Project Sponsor.
- The refrigerant charge must have been adjusted, either removed or added. If this condition was not met, the project did not pass verification.

CFL inspections used the following criteria for confirming the installation of CFLs:

- CFLs had to be installed in a fixture. CFLs that were removed were not verified.
- Fixture had to be a “permanent” fixture with an intended life at the site of five (5) years, per the ESB contract. Display lamps, such as those at furniture stores that are ultimately intended for sale did not pass verification.
- CFLs remaining in boxes, uninstalled did not pass verification.

Duct test and seal projects were verified by:

- Review of the “Inspection Report” to verify the air flow measurements taken, and that kWh savings were generated.
- The ducts were inspected for signs of duct sealing activity using approved methods.

7.15.1.1.5.2 Post-Inspection Process

Post-inspections were conducted using one of several methods depending on the nature of the facility. The most common was the single site, either large or small, where the inspector went to the site directly and conducted the inspection. The method was to have the program implementer provide an escort to facilitate the inspections. This approach was used for the four campuses. The escort arranged the inspections with their facility contact. Once at the site, the facility operator also provided an escort. As many projects as possible were inspected during the course of one day at the site.

7.15.1.1.6 M&V Assessment

The Project Sponsor commenced work during June 2005. This M&V addresses projects invoiced through February 2006.

7.15.1.1.6.1 Assessment of Initial Set of Invoices

The Project Sponsor provided invoice data to KSI for work performed from June 2005 through October 2005 during the early 2006. KSI received electronic versions of these invoices. Table 142 provides a summary of these invoices.

Table 142. First Round of Invoices Submitted Early 2006, June 2005-October 2005

Period	Measure	Qty Sites	kW Reduced	kWh Savings	Therm Savings	# CFL
June-July	A/C Diagnostics	97	124.72	154,388		
	Duct Test & Seal	89	78.70	101,007	2,564	
	CFLs	47	13.49	69,073		292
	Total	**121**	**216.91**	**324,468**	**2,564**	
August	A/C Diagnostics	216	247.15	404,082		
	Duct Test & Seal	180	153.06	250,253	4,987	
	CFLs	44	308.47	925,402		3,258
	TOTAL	**309**	**708.67**	**1,579,738**	**4,987**	
September	A/C Diagnostics	431	346.83	567,066		
	Duct Test & Seal	182	160.54	262,477	5,231	
	CFLs	37	230.74	692,205		2,437
	Total	**487**	**738.10**	**1,521,749**	**5,231**	
October	A/C Diagnostics	397	627.27	1,025,590		
	Duct Test & Seal	3	3.88	6,347	126	
	CFLs	68	683.80	2,051,337		7,222
	Total	**462**	**1,314.95**	**3,083,274**	**126**	
TOTAL			**2,978.64**	**6,509,228**	**12,909**	**13,209**

An assessment of the savings shown on the invoices for June through October 2005 was performed. It was found that some projects had extraordinarily high kWh savings. The savings equations seemed to be appropriate for the "mid-range" AC charge conditions, but provided high savings for units that required large amounts of refrigerant to be added or removed. The extent was such that some 3 and 4 ton a/c units had calculated savings that were in the hundreds of thousands of kWh per year; where the total consumption possible may have been less than 10,000 kWh per year.

7.15.1.1.6.2 Examination of AC Diagnostic Savings Calculations

As a result of this assessment, the Project Sponsor was advised that the savings calculations needed to be evaluated and diagnosed. Project Sponsor retained Field Diagnostic Services, Inc. (Field) to review the savings calculations and provide recommendation on improving the calculations. Field has in-depth experience in the AC diagnostic and tune-up area and is well qualified to provide this review. The findings of the Field review are contained in the attached document. Field ran a simulation model called Honeywell Savings Estimator, an hourly building simulation model that uses TMY data. The AC operation of a small office building was modeled to determine its operating characteristics under various conditions and used other models to better understand equipment performance under a variety of fault conditions, i.e., when the system is out of adjustment. Among the findings of this report are (subject to modeling constraints and assumption):

- There are approximately 3,300 hours of a year where there is some cooling.
- There are approximately 1,000 full load equivalent cooling hours.
- With faults (out of tune) in the AC system (e.g., incorrect charge and airflow) the capacity of the unit is decreased, thus, increasing runtime to keep up with cooling. This increased runtime could be over 3 times the expected runtime, i.e., 3,300 hours. The greatest increase in runtime is expected at lower outside temperatures, as opposed to high temperatures where AC load factor would normally be fairly high.
- The savings from Project Sponsor's savings model were similar to those estimated by the simulation model.
- A review of a report by Proctor found that Proctor suggested placing limits or caps on the equation for cases of extremely low or high refrigerant charge that was not included in the Project Sponsor's savings calculation.
- The Project Sponsor's peak demand reduction estimates are overstated, since the units are already running most of each hour on the hottest days and undercharged units draw slightly less power when they are on.

7.15.1.1.6.3 KEMA Service's Recommendation On AC Diagnostic Savings Calculations

The Field report made the following recommendations:

- Modify the Project Sponsor's savings model to include the caps suggested by Proctor (i.e., EERnorm1 shall be 0.36 for all units with less than 0.65 of the correct charge and EERnorm1 shall be 0.50 for all units with more than 1.8 times the correct charge).

- Modify the peak demand reduction used in the Project Sponsor's savings model using the "Part Load Model" described in the report.

After discussion between Field and KSI we have the following observations:

- The report by Field confirms our previously stated position that the Project Sponsor's savings model, based on Proctor's equations, did a good job of estimating kWh savings for mid-range refrigerant charge conditions.
- Field describes why energy consumption increases when refrigerant charge is incorrect, i.e., the reduced capacity of the a/c unit requires longer runtimes to get to required temperature.
- However, the assumption that runtimes will be over 3 times the expected runtime will likely overstate the true runtime. This is due to the following:
    - Assumes the AC unit will be turned on during lower temperature conditions. This is a requirement in order to achieve 3 times the runtime.
    - Assumes businesses participating in the program are open and the A/C unit is turned on a sufficient number of hours to achieve runtimes that are 3.3 times the expected. If the expected hours is full-load equivalent run hours (i.e., 1,635 hours/year from invoices), then the savings would based on 3.3 times 1,635 (i.e., 5,396 hours per year) which would be unreasonable for the operating hours for a most of these customers.
    - Ignores the most likely AC operating patterns at the facility.

KSI made the following recommendations and the Project Sponsor adopted them in calculating load impacts due to A/C diagnostic and tune-up.

- kWh Savings Calculation: Make the changes in the basic set of equations recommended by Field and set caps where Pre-Charge % is equal to or less than 0.70 and greater than or equal to 1.70, as shown in page 10 of the Field report.
- kW Reduction Calculation: Adopt the "Part Load Model" suggested by Field on page 10 of the Field report.

The ultimate outcome of this assessment of the initial set of invoices was that the Project Sponsor revised the savings calculations and re-submitted their invoices with the adjustments included.

7.15.1.1.6.4 Assessment of Re-Submitted Second Invoice

The Project Sponsor submitted a revised invoice for projects completed during June 2005 and February 2006. The savings calculations were to have included the modifications recommended in Section 7.15.1.1.6.3.

7.15.1.2 Summary of Second Invoice

A summary of the second invoice is shown in Table 143. As can be seen CFL's account for 49% of the savings, while A/C diagnostics account for 44% of the kWh savings. Duct test and seal projects accounted for only 6.5% of the savings.

Table 143. Second Invoice Submitted March 2006
June 2005-February 2006

Summary	# Records	kW Reduced	kWh Savings	Therm Savings	# CFL
A/C Diagnostics	2,970	2,312.06	4,368,971		
Duct Sealing	500	161.67	615,951	14,096	
CFL's	192		4,848,563		17,070
Total	**3,162**	**2,473.73**	**9,833,484**	**14,096**	

The documentation accompanying the invoice included:

- An Excel worksheet titled "SDG&E plat form savings 3-28-07," that contained database extracts from the technical platform database; and
- Hard copy and electronic PDF files of "Inspection Reports" from the technical platform showing details of the A/C diagnostics and duct test and sealing.

The records of the worksheet were reviewed and the following observations:

- No identification key, such as contract number or electric account number was provided in the worksheet.
- There was no consistent naming convention for projects at a given site, e.g., San Marco High School may have been named "s.m.h.s.", "San Marcos High.", or simply "High School."
- Records for A/C diagnostic sites can be categorized as campuses or individual sites.
- A large number of A/C diagnostic records had zero "0" charge adjustment, as indicated by a "0" in the column "Ref/Var" on the worksheet.
- A large number of A/C diagnostic records had a zero "0" reference charge, indicating there was no target charge level for the tuneup.
- Large numbers of CFLs were installed at a small number of sites. Many of these CFL sites were CFL-only, where no A/C diagnostic or duct testing was performed.

7.15.1.2.1.1 Review of Savings Calculations

The savings calculations were reviewed and found to be generally satisfactory. A few records appeared to have savings values that were out of range.

7.15.1.2.1.2 Sampling

The findings from the assessment of the invoice indicated that sampling could increase the efficiency of performing the M&V.

The AC diagnostic category was segmented to campuses (with multiple projects per site) and individual projects. Campuses were defined as facilities where numerous AC units on multiple buildings were subjected to the diagnostic test. As shown in Table 144 four campuses accounted for over 50% of the kWh savings for AC diagnostics projects. Similarly, 15 project accounts for 50% of the cfl savings. This subsection describes the stratification of the participants for sampling purposes.

Table 144. Category and Cumulative Savings For Selected Large Customers

Category		No. Records	kWh Savings	Cum. Records	Cum. kWh Savings	%-Cum. Savings
A/C Diagnostic		**2,970**	**4,368,971**			
	Campus 1	333	608,726	333	608,726	13.9%
	Campus 3	416	468,924	749	1,077,650	24.7%
	Campus 2	204	226,655	953	1,304,305	29.9%
	Campus 4	498	977,794	1,451	2,282,099	52.2%
CFL		**192**	**4,848,563**			
	Individual 1	1	841,042	1	841,042	17.3%
	Individual 2	1	218,143	2	1,059,185	21.8%
	Individual 3	1	182,638	3	1,241,823	25.6%
	Individual 4	1	143,156	4	1,384,979	28.6%
	Individual 5	3	112,764	7	1,497,743	30.9%
	Individual 6	1	110,776	8	1,608,519	33.2%
	Individual 7	1	103,675	9	1,712,193	35.3%
	Individual 8	1	103,391	10	1,815,584	37.4%
	Individual 9	1	102,538	11	1,918,122	39.6%
	Individual 10	2	102,254	13	2,020,377	41.7%
	Individual 11	2	97,710	15	2,118,086	43.7%
	Individual 12	1	88,052	16	2,206,139	45.5%
	Individual 13	1	86,632	17	2,292,771	47.3%
	Individual 14	1	77,259	18	2,370,030	48.9%
	Individual 15	1	75,839	19	2,445,868	50.4%

7.15.1.2.1.3 Stratification of Projects

The 3,162 records in the workbook submitted with the invoice were reviewed to determine common characteristics and to enable the aggregation to site or campus levels. No data key was on the data provided to KSI by the program implementer, thus, it was impossible to aggregate projects to a customer from the raw data. KSI reviewed the data and inserted a data key based on customer name and address that identified the record to a customer site. This process resulted in the 3,162 records being represented by 312 separate sites or campuses.

The projects were divided into the following strata for the M&V:

- CFL
- A/C Diagnostic
- Duct Test and Seal

The effect of campuses on the concentration of AC diagnostics is shown in Table 145, where 56 percent of the kWh savings for all AC diagnostics is represented by four customers/campuses. These four campuses comprise 1,329 of the 2,468 AC diagnostics performed. Similarly, the table shows that over 50 percent of the kWh savings from CFLs were installed at the facilities of 14 customers.

Table 145. Cumulative kWh Savings per Strata For Aggregated Records To Site or Campus Level

Site ID	Strata	No. Records	kWh Savings	Cum kWh per Strata	%-Cum kWh per Strata
Campus 3	A/C Diag	420	481,417	481,417	12.80%
Campus 1	A/C Diag	275	540,256	1,021,673	27.20%
Campus 2	A/C Diag	204	226,655	1,248,328	33.20%
Campus 4	A/C Diag	430	849,680	2,098,008	55.90%
Campus 5	A/C Diag	138	73,420	2,171,428	57.80%
Campus 6	A/C Diag	172	258,061	2,429,489	64.70%
Campus 7	A/C Diag	132	151,511	2,581,000	68.70%
Campus 8	A/C Diag	48	28,869	2,609,869	69.50%
Individual 1	CFL	1	841,042	841,042	17.30%
Individual 2	CFL	1	218,143	1,059,185	21.80%
Individual 12	CFL	2	198,828	1,258,013	25.90%
Individual 3	CFL	1	182,638	1,440,651	29.70%
Individual 4	CFL	1	143,156	1,583,807	32.70%
Campus 1	CFL	3	112,764	1,696,571	35.00%
Individual 7	CFL	1	103,675	1,800,246	37.10%
Individual 8	CFL	1	103,391	1,903,636	39.30%
Individual 9	CFL	1	102,538	2,006,175	41.40%
Individual 10	CFL	2	102,254	2,108,429	43.50%
Individual 11	CFL	2	97,710	2,206,139	45.50%
Individual 13	CFL	1	86,632	2,292,771	47.30%
Individual 14	CFL	1	77,259	2,370,030	48.90%
Individual 15	CFL	1	75,839	2,445,868	50.40%
Individual 16	CFL	1	64,193	2,510,061	51.80%
Individual 17	CFL	1	61,353	2,571,414	53.00%
Individual 18	CFL	1	60,501	2,631,915	54.30%
Individual 19	CFL	1	58,512	2,690,427	55.50%
Individual 20	CFL	1	58,228	2,748,655	56.70%
Individual 21	CFL	1	55,104	2,803,759	57.80%
Individual 22	CFL	1	54,820	2,858,579	59.00%

Given this information we further stratified the sample to gain economies of scale. Table 146 shows the sample design for the M&V. Using this sample framework we inspected projects that directly represented over 50 percent of the invoiced kWh savings for AC diagnostics.

The sample design for the project is shown in Table 146. These figures represent the minimum number of units that were to be inspected. As can be seen the minimum sample sizes were exceeded, largely due to the fact that the individual sites for AC diagnostics usually included multiple AC units so these units were inspected, and, for CFL retrofits, oversampling was done for the All Other sites to account for potential discrepancies that were being found.

Table 146. M&V Sample Design

Strata	Invoiced		Sample	
	N (No. of Records on Invoice)	kWh Savings	Sample Size (n) (Sites or Campuses)	# Inspected
CFL-only	192	4,848,563		
Large	19	2,660,319	14	14
All Others	173	2,188,244	20	55
A/C Diagnostic	2,970	4,368,971		
Campus	1,451	2,282,099	4	4
Individual site	1,519	2,086,872	20	169
A/C Diagnostic and Duct T	500	615,951	20	22
Total		**9,833,485**		

7.15.1.2.1.4 Realization Rates and Extrapolation To Invoiced Savings

Realization rates were calculated for each of the substrata. Verified savings and load impacts were estimated by multiplying the realization rate by the invoiced savings for each substratum.

7.15.1.3 M&V Results

This section presents the verified savings determined through the M&V. These findings are the result of the assessment of the invoices and post-inspections conducted on-site.

7.15.1.3.1 Savings Summary

Table 147. Program Verified Savings Summary

Measure	Invoiced				Verified				
	No.	kWh Savings	kW Reduction	Therm Savings	kWh Savings	kW Reduction	Therm Savings	kWh Realization Rate	kW Realization Rate
A/C Diagnostic	2,970	4,368,971	2,312.06	0	3,238,376	1,681.52		74.1%	72.7%
Duct Test & Seal	500	615,951	431.88	14,096	615,951	431.88	14,096	100.0%	100.0%
CFL Retrofit	192	4,848,563	0	0	3,067,573			63.3%	
Program Total		**9,833,484**	**2,743.94**	**14,096**	**6,921,900**	**2,113.40**		**70.4%**	**77.0%**

7.15.1.3.2 Discussion

This section provides a discussion of the M&V findings for each measure.

7.15.1.3.2.1 CFL Retrofit

The verified savings associated with CFL retrofits is shown in Table 148. This table shows the two strata used in the M&V: census and non-census. A total of 31 records were included in the census stratum. The verified savings for this stratum were calculated directly based on the verified CFL quantities and the DEER savings per CFL based on verified CFL wattage. The total non-census stratum comprised 161 records. A sample of 41 records was inspected. A realization rate (verified kWh/invoiced kWh) was calculated for the sample. The verified savings for the non-census stratum used DEER unit savings for CFL based on the verified wattage of the CFL. The verified savings for the stratum was estimated by multiplying the realization rate times the invoiced kWh for the stratum. The total verified kWh savings for CFL retrofits was the sum of the verified savings for the census and non-census strata.

Table 148. Verified Savings, CFL Retrofit

Strata	Survey Status	No. of Sites with CFL	Proposed CFL Qty	Proposed kWh Savings per CFL	Proposed kWh Savings	Verified CFL Qty	Verified kWh Savings per CFL	Verified kWh Savings (Surveyed)	Realization Rate per Strata (kWh Savings)	Verified kWh Savings (Not Surveyed)	Verified Total kWh Savings
Census	Surveyed	31	9,985	284.04	2,836,139	7,928	236.55	1,875,368	66.1%		1,875,368
Sample	Surveyed	41	1,171	284.04	332,611	833	236.55	197,046	59.2%		197,046
	Not Surveyed	120	5,914	284.04	1,679,813					995,159	995,159
Total		**192**			**4,848,563**						**3,067,573**
									Overall Realization Rate=		**63.3%**

Among the reasons for the lower verified savings were:

- CFLs not installed by contractor
  - No more fixtures available for CFLs
  - Incandescent lamps found in fixtures
  - CFLs in boxes left as spares
- Non-dimmable CFLs were installed in fixtures on dimmers and were removed
- Incorrect unit savings used to calculate savings on the invoice

Unit Savings for CFL. Three CFL wattage ranges were used in the Project Sponsor's Form C-2 (submitted during the application/contracting phase) is shown in Table 149. A value of 284 kWh per CFL installed was used to prepare the invoice. CFLs found during post-inspections

were a mix of 14 watt spirals and 19 watt floodlamps. Both of these lamps fall in the 14-26 watt category, thus, savings should be calculated using 236.55 kWh per CFL installed instead of 284.04 kWh per CFL.

Table 149. CFL Unit Wattage Used For Planning and Invoicing

Measure Description	kWh Savings Per Unit
Screw-in CFL's 5 – 13 Watts	186.75
Screw-in CFL's 14 – 26 Watts	236.55
Screw-in CFL's >27 Watts	286.35
Invoiced (for all CFL)	284.04
Verified CFLs (14w and 19w)	236.35

7.15.1.3.2.2 AC Diagnostic

The verified savings for AC diagnostics is shown in Table 150. As can be seen in the table the overall realization rate for kWh savings for this measure was 74 percent. The two strata are shown, the campuses and individual sites. Each of the four campuses were subjected to verification inspections, while a sample of the individual site stratum (n=169) was inspected.

Among the reasons for the realization rate be less than 100 percent include:

- Physical evidence (1/2-inch holes drilled and properly sealed in the supply and return ducts adjacent to the condensing unit, and/or new brass valve caps with neoprene seals on refrigerant lines) that the diagnostic test took place could not be observed
- Zero refrigerant charge adjustment indicated on the technical platform Inspection reports and/or data included with the invoice.
- No reference charge on the data included with the invoice.

Table 150. Summary of Verified Savings, AC Diagnostics

	Invoiced			Verified			
Strata	No.	kWh Savings	kW Reduction	kWh Savings	kW Reduction	kWh Realization Rate	kW Realization Rate
Campus	1,451	2,282,099	1,076.81	1,413,378	587.62	61.9%	54.6%
Individual Sites	1,519	2,086,872	1,235.25	1,824,997	1,093.90	87.5%	88.6%
Total	**2,970**	**4,368,971**	**2,312.06**	**3,238,376**	**1,681.52**	**74.1%**	**72.7%**

1.1.1.1.1.1.2. Projects on Campus Facilities

Records for four facilities were aggregated into four campus facilities. These four campuses were each inspected, with as many units inspected as possible in one day. KSI staff worked with the Project Sponsor's staff that, in turn, coordinated with the site personnel.

Two campuses, Campus 2 and Campus 4 facilities, had virtually every AC diagnostic test verified, however, Campus 1 and Campus 3 had low realization rates, 57% and 23%, respectively. It appears that quality control may have been an issue at Campus 1. Campus 3 had a number of units that had zero refrigerant charge adjustment. This campus also appeared to have a number of newer AC units installed. It's conceivable that when these units were installed they were properly charged, resulting in diagnostics where no adjustment was made.

Table 151 shows a summary of the verified savings for campus facilities, while Table 152 through Table 155 shows the verified savings for each of the four campuses.

Table 151. Summary of Verified Savings, AC Diagnostics At Four Campus Facilities

	Description	No.	kWh Savings	kW Reduction
Four Campus Summary	All Records	1,451	2,282,099	1,076.81
	Zero RCA	482	429,667	281.16
	No Reference Charge	92	76,941	50.12
	Adjusted Ex Ante Savings (Total less: zero RCA, no ref. charge, duplicate)	877	1,775,491	745.53
	Survey Result			
	Pass	367	721,013	292.71
	Fail	81	112,220	49.86
	Access Problems	2	4,302	1.68
	Not Surveyed	425	936,916	400.60
	Unit Not Found	2	1,040	0.68
	Realization Rate		61.9%	54.6%
	Verified Savings		**1,413,378**	**587.62**

Table 152. Verified Savings, AC Diagnostics At Campus Facilities, Campus 1

Campus ID	Description	No.	kWh Savings	kW Reduction
Campus 1	All Records	333	608,726	300.89
	Zero RCA	133	128,459	84.13
	No Reference Charge	17	15,670	10.19
	Adjusted Ex Ante Savings (Total less: zero RCA, no ref. charge, duplicate)	183	464,597	206.57
	Survey Result			
	Pass	28	99,652	40.94
	Fail	48	74,723	32.86
	Access Problems	0	0	0.00
	Not Surveyed	105	289,182	132.09
	Unit Not Found	2	1,040	0.68
	Realization Rate		57.1%	55.5%
	Verified Savings		265,508	114.59

Table 153. Verified Savings, AC Diagnostics At Campus Facilities, Campus 2

Campus ID	Description	No.	kWh Savings	kW Reduction
Campus 2	Total	204	226,655	112.85
	Zero RCA	41	30,361	19.90
	No Reference Charge	33	21,371	14.10
	Adjusted Ex Ante Savings Total kWh less: zero RCA, no ref. charge, duplicate)	130	174,923	78.85
	Survey Result			
	Pass	130	174,923	78.85
	Fail	0	0	0.00
	Access Problems	0	0	0.00
	Not Surveyed	0	0	0.00
	Unit Not Found	0	0	0.00
			100.0%	100%
	Verified Savings		174,923	78.85

Table 154. Verified Savings, AC Diagnostics At Campus Facilities, Campus 3

Campus ID	Description	No.	kWh Savings	kW Reduction
Campus 3	Total	416	468,924	254.06
	Zero RCA	262	232,988	152.06
	No Reference Charge	25	26,810	17.32
	Adjusted Ex Ante Savings (Total less: zero RCA, no ref. charge, duplicate)	129	209,126	84.68
	Survey Result			
	Pass	11	11,010	5.02
	Fail	32	36,277	16.58
	Access Problems	2	4,302	1.68
	Not Surveyed	84	157,537	61.40
	Unit Not Found	0	0	0.00
	Realization Rate		23.3%	23.2%
	Verified Savings		48,692	19.68

Table 155. Verified Savings, AC Diagnostics At Campus Facilities, Campus 4

Campus ID	Description	No.	kWh Savings	kW Reduction
Campus 4	Total	498	977,794	409.01
	Zero RCA	46	37,859	25.07
	No Reference Charge	17	13,090	8.51
	Adjusted Ex Ante Savings (Total less: zero RCA, no ref. charge, duplicate)	435	926,845	375.43
	Survey Result			
	Pass	198	435,428	167.90
	Fail	1	1,220	0.42
	Access Problems	0	0	
	Not Surveyed	236	490,197	207.11
	Unit Not Found	0	0	
	Realization Rate		99.7%	99.8%
	Verified Savings		924,255	374.49

1.1.1.1.1.1.3. Projects at Individual Sites

The verified savings for the individual facilities is shown in Table 156. Individual facilities had a 90 percent realization rate for kWh savings.

Table 156. Verified Savings, AC Diagnostics At Individual Facilities

		No.	kWh Savings	kW Reduction
Individual Sites	All Records	1519	2,086,872	1,235.25
	Zero RCA	53	29,491	26.04
	No Reference Charge	45	25,299	24.73
	Duplicate Records	6	3,519	4.11
	Adjusted Ex Ante Savings (Total less: zero RCA, no ref. charge, duplicate)	1,415	2,028,563	1,180.37
	Survey Result			
	Pass	139	211,201	155.35
	Fail	4	23,558	12.28
	Access Problems	25	38,418	23.42
	Not Surveyed	1,247	1,755,356	988.39
	Realization Rate (Surveyed Sites)		90.0%	92.7%
	Verified Savings		1,824,997	1,093.90

7.15.1.3.2.3 Duct Seal

The Project Sponsor and the technical platform made the recommended adjustments to their system to improve the savings calculations. The Project Sponsor then submitted a revised invoice that included projects from the first invoice (June through October 2005), as well as additional projects completed through February 2006. Table 157 shows a summary of the savings from the invoice. Duct test and sealing represent only six percent (6%) of the kWh savings and 16 percent of the records.

Table 157. Verified Savings, Duct Test & Seal

	Invoiced				Verified				
Strata	**No.**	**kWh Savings**	**kW Reduction**	**Therm Savings**	**kWh Savings**	**kW Reduction**	**Therm Savings**	**kWh Realization Rate**	**kW Realization Rate**
Invoiced	500	615,951	431.88	14,096					
Surveyed	22	24,071	19.66	641	24,071	19.66	641	100.0%	100.0%
Verified Savings - Duct Test and Seal					**615,951**	**431.88**	**14,096**		

The data supporting the invoice was provided in spreadsheet format with selected data fields from the technical platform database. In addition, the Project Sponsor provided hard copy and electronic copies of the technical platform's Inspection Report for each record on the invoice.

7.15.2 Second Interim M&V

This M&V is the second of two M&V done for this project. The two M&V were conducted due to the length of time between invoicing for this aggregation project. This section presents the results for the first interim M&V. Table 158 shows the M&V summary for the second interim M&V.

Table 158. M&V Savings Summary – Second Interim M&V

Invoices B, C, D	
Energy Savings (kWh)	
Total Contracted Savings (kWh)	15,724,420
Total Reported / Invoiced Savings (kWh)	5,694,578
M&V Savings (kWh)	**4,438,153**
Realization Rate (kWh)	**0.78**
Demand Reduction (kW)	
Total Contracted Savings (kW)	1,681.52
Total Reported / Invoiced Savings (kW)	382.36
M&V Savings (kW)	**1,151.42**
Realization Rate	**3.01**
Natural Gas Savings (therms)	
Total Contracted Savings (therms)	96,000
Total Reported / Invoiced Savings (therms)	5,057
M&V Savings (therms)	**5,057**
Realization Rate	**100.0%**

7.15.2.1 Overview

This M&V is the second of two M&V reports for this project. A total of four invoices, A, B, C, and D, were submitted for payment. The first interim M&V report addressed measures implemented in Invoice A and is discussed in Section 7.15.1. This M&V addresses the measures installed under Invoices B, C and D. For full discussion of the methodology refer to the first M&V report.

The mesaures of the three invoices included:

- Lighting retrofits (CFL)
- Refrigerant Charge and Airflow
- Duct Testing and Sealing

The proposed AC diagnostic and tune-up process included:

- Measurement of the baseline operation and refrigerant charge level of the a/c unit;
- Determination of system condition and corrective action needed;
- Cleaning condenser coils;
- Adjusting refrigerant charge level, if necessary;
- Measurement of adjusted system performance;
- Determine if system is within specifications and adjust as necessary;
- Measurement of optimized system performance;
- Upload measurement data (baseline and optimized) to the Enalasys database via Internet.

The proposed duct test and seal process included:

- Install measurement hood/blower to a register;
- Seal all other registers with adhesive masking material;
- Run leakage test;
- Laptop records basecase measurements;
- If test shows leakage exceeds a specified level, find leaks and seal until leakage is at the specified level;
- Laptop records final measurements and calculates savings; and
- Upload measurement data to the Enalasys database via Internet.

7.15.2.2 Measurement and Verification (M&V) Approach

The M&V approach used for the invoices B, C and D is summarized in this section and is consistent with the approach used for the M&V for Invoice A. Information from the first M&V report for Invoice A was used extensively in this M&V.

7.15.2.2.1 On-Site Verification Inspections

On-site verifications were used extensively to verify the implementation of the measures. This section summarizes the inspection process.

7.15.2.2.1.1 Inspection Protocols

The post-inspections were conducted according to the following protocols.

AC diagnostic tests were confirmed through the following observations:

- Holes drilled and plugged/sealed in supply and return ducts, typically at the condensing unit.
- New brass caps with o-ring gaskets on refrigerant fittings.
- An "Inspection Report" for each AC test was provided from the technical platform by the Project Sponsor.
- The refrigerant charge must have been adjusted, either removed or added. If this condition was not met, the project did not pass verification.

SDG&E conducted on-site inspections to verify measure installation for most measures. This M&V leveraged those inspections for diagnostic tests performed at Campus 1 due to logistics.

CFL inspections used the following criteria for confirming the installation of CFLs:

- CFLs had to be installed in a fixture. CFLs that were removed were not verified.
- CFLs remaining in boxes, uninstalled did not pass verification.

Duct test and seal projects were verified by:

- Review of the "Inspection Report" to verify the air flow measurements taken, and that kWh savings were generated.
- The ducts were inspected for signs of duct sealing activity using approved methods.

7.15.2.3 M&V For Invoices B, C, D

The Project Sponsor commenced work during June 2005. This M&V addresses sites indentified in Invoices B, C and D where measures were implemented.

7.15.2.3.1 Assessment of Invoices B, C and D

The Project Sponsor provided test data to KSI for Invoices B, C and D. KSI received electronic versions of these data. Table 142 provides a summary of these invoices. It should be noted that kW impacts were not shown on Invoices B and C. This resulted in high realization rates for kW reduction.

Table 159. Invoices B, C and D – 05-05-001

		Invoiced					
Invoice	Measure	Qty	Unit Savings kWh	Unit Savings kW	kWh	kW	Thm
B	CFL	6,092	284.04		1,730,372		
	DTS	2			710		0
	RCA	275			616,642		174
C	CFL	2,992	284.04		849,848		
	DTS	0			0	0	0
	RCA	161			319,688		
D	CFL	4,867	236.55	0.046	1,151,289	224.86	
	DTS	177		0.200	248,022	35.40	5,057
	RCA	814		0.150	778,008	122.10	
Total	CFL	13,951			3,731,508	224.86	0
	DTS	179			248,732	35	5,057
	RCA	1249.91			1,714,338	122.10	174
	Total	**15,380**			**5,694,578**	**382.36**	**5,231**

7.15.2.3.2 CFLs

7.15.2.3.2.1 Verified Savings From CFLs

The installation of almost 14,000 CFLs were reported on Invoices B, C and D. The proposed quantities and savings for each invoice are shown in Table 160. These CFLs were installed in 88 sites. These sites were stratified into two strata: census and sample.

Table 160. CFLs on Invoices B, C, D

		Invoiced					
Invoice	Measure	Qty	Unit Savings kWh	Unit Savings kW	kWh	kW	Thm
B	CFL	6,092	284.04		1,730,372		
C	CFL	2,992	284.04		849,848		
D	CFL	4,867	236.55	0.046	1,151,289	224.86	
Total	**CFL**	**13,951**			**3,731,508**	**224.86**	**0**

The method of extrapolating the survey findings to the total invoiced level is described in Table 161.

Table 161. Extrapolation of Sample to the Total Invoiced, CFL

Stratum	Total Qty CFLs	Surveyed CFL	Extrapolation Method
Census	7,247	All	By definition the surveyed sites of the census represents the census stratum.
Sample	6,704	1,600	A installation rate is calculated for surveyed sites and applied to the quantities instal

As shown in Table 162 a total of 31 sites were inspected representing 72 percent of the CFLs invoiced. The Census stratum had an *installation rate* for CFL quantity of 0.77 while the

Sample stratum was 0.94. This means that the installation of 94 percent of the invoiced fixtures was verified in the Sample stratum. Since the Census stratum was a census the verified quantity was what was inspected. The verified quantity for the Sample stratum was calculated by multiplying the verification rate by the quantity invoiced for the stratum.

Table 162. Sample and Inspection Results for CFL

Stratum	Sites	Qty	kWh	kW	Sites	Invoiced Qty	kWh	kW	Verified Qty	Installation Rate
Census	15	7,247	1,942,562	112.73	15	7,247	1,942,562	112.73	5,584	0.77
Sample	73	6,704	1,788,946	112.13	16	1,600	432,381	21.48	1,499	0.94
Total	88	13,951	3,731,508	224.86	31	8,847	2,374,943	134.21	7,083	

The unit kWh savings for Invoice B and C were 284.04 kWh/CFL. Per the first M&V the unit savings was determined to be 236.55 kWh/CFL. The verified quantities and unit savings were used to estimate the verified savings for CFLs shown in Table 163.

Table 163. Verified Savings CFLs, Invoices B, C, D

	Qty	Unit kWh Savings	Unit kW Reduction	kWh Savings	kW Reduction
Invoiced (Inv B)	6,092	284.04		1,730,372	
(Inv C)	2,992	284.04		849,848	
(Inv D)	4,867	236.55	0.0462	1,151,289	224.86
Total - Invoiced	**13,951**			**3,731,508**	**224.86**
Verified	**11,865**		**0.15**	**2,806,621**	**547.32**
Delta				924,887	
Realization Rate				0.75	2.43

7.15.2.3.2.2 Discussion - CFLs

The realization rate for kWh savings was 0.75. This was the result of:

- Verified quantities less than invoiced
- Lower unit savings for Invoices B and C (236.55 kWh/CFL versus 284.04 kWh/CFL)

The realization rate for kW reduction was 2.43 which is very high. This is due to not having reported kW reduction on Invoices B and C rather than an installation situation.

The detailed data used for this M&V can be opened in Section 5 References, Item 2.

7.15.2.3.2.3 Verified Savings - RCA

An overview of the Refrigerant Charge and Airflow (RCA) measures implemented in Invoices B, C, D is shown in Table 164.

Table 164. Refrigerant Charge and Airflow Measure, Data From Invoices, Invoices B, C, D

		Invoiced			
Invoice	**Measure**	**Qty**	**kWh**	**kW**	**Thm**
B	RCA	275	616,642		174
C	RCA	161	319,688		
D	RCA	814	778,008	122.10	
Total	**RCA**	**1,250**	**1,714,338**	**122.10**	**174**

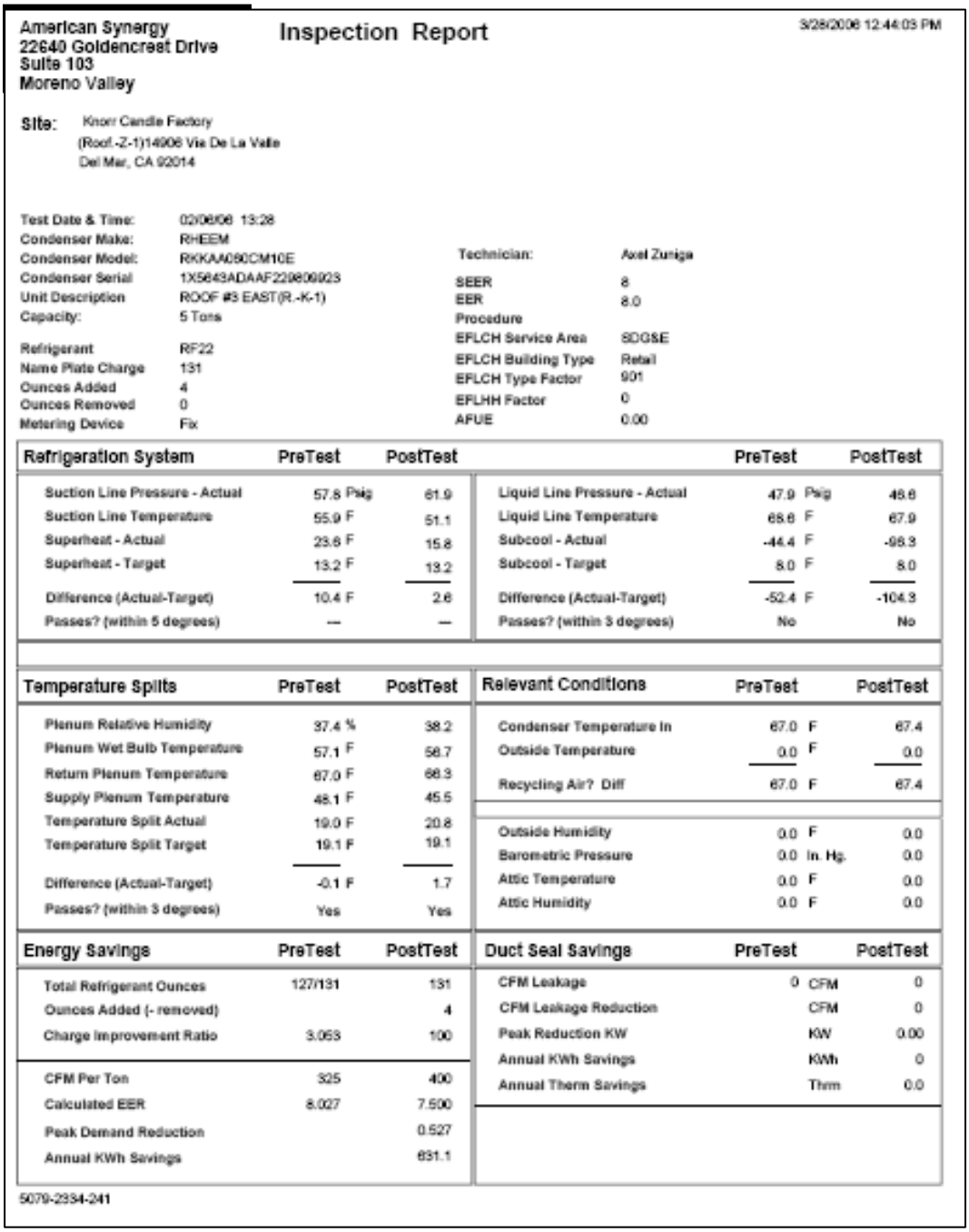
RCA measures were verified through direct inspection and through SDG&E inspection staff, as well as a detailed review of the current and past invoices and inspectiton reports provided by the Project Sponsor. This step was used to determine if a measure was a duplicate from another invoice. Figure 30 shows an inspection report. It contains information that allowed the specific identification of an air conditioner.

For this process the supporting documentation (Excel spreadsheet) for each invoice was combined to provide a consistent set of data for the analysis. Records were compared among Invoices A, B, C, and D. Any duplicates were flagged. If a duplicate was one of the current invoices the record in the earliest invoice would be retained and the second one eliminated from the verification. There were 181 duplicate records of the 1,250 total records.

Per the first M&V, records that show zero refrigerant charge adjustment were removed from the verification, as there would be no savings attributed to charge adjustment. A total of 207 records were removed from the verification due to zero charge adjustment.

The remaining measures were verified to be installed by either KSI staff or SDG&E inspectors.

Figure 30. Enalasys Inspection Report



American Synergy
22640 Goldencrest Drive
Suite 103
Moreno Valley

Inspection Report

3/28/2006 12:44:03 PM

Site: Knorr Candle Factory
(Roof.-Z-1)14906 Via De La Valle
Del Mar, CA 92014

Test Date & Time:	02/06/06 13:28		
Condenser Make:	RHEEM		
Condenser Model:	RKKAA060CM10E	Technician:	Axel Zuniga
Condenser Serial	1X5643ADAAF2206060923	SEER	8
Unit Description	ROOF #3 EAST(R.-K-1)	EER	8.0
Capacity:	5 Tons	Procedure	
		EFLCH Service Area	SDGSE
Refrigerant	RF22	EFLCH Building Type	Retail
Name Plate Charge	131	EFLCH Type Factor	901
Ounces Added	4	EFLHH Factor	0
Ounces Removed	0	AFUE	0.00
Metering Device	Fix		

Refrigeration System	PreTest	PostTest		PreTest	PostTest
Suction Line Pressure - Actual	57.8 Psig	61.9	Liquid Line Pressure - Actual	47.9 Psig	46.6
Suction Line Temperature	55.9 F	51.1	Liquid Line Temperature	68.6 F	67.9
Superheat - Actual	23.6 F	15.8	Subcool - Actual	-44.4 F	-98.3
Superheat - Target	13.2 F	13.2	Subcool - Target	8.0 F	8.0
Difference (Actual-Target)	10.4 F	2.6	Difference (Actual-Target)	-52.4 F	-104.3
Passes? (within 5 degrees)	—	—	Passes? (within 3 degrees)	No	No

Temperature Splits	PreTest	PostTest	Relevant Conditions	PreTest	PostTest
Plenum Relative Humidity	37.4 %	38.2	Condenser Temperature In	67.0 F	67.4
Plenum Wet Bulb Temperature	57.1 F	58.7	Outside Temperature	0.0 F	0.0
Return Plenum Temperature	67.0 F	68.3	Recycling Air? Diff	67.0 F	67.4
Supply Plenum Temperature	48.1 F	45.5			
Temperature Split Actual	19.0 F	20.8	Outside Humidity	0.0 F	0.0
Temperature Split Target	19.1 F	19.1	Barometric Pressure	0.0 In. Hg.	0.0
Difference (Actual-Target)	-0.1 F	1.7	Attic Temperature	0.0 F	0.0
Passes? (within 3 degrees)	Yes	Yes	Attic Humidity	0.0 F	0.0

Energy Savings	PreTest	PostTest	Duct Seal Savings	PreTest	PostTest
Total Refrigerant Ounces	127/131	131	CFM Leakage	0 CFM	0
Ounces Added (- removed)		4	CFM Leakage Reduction	CFM	0
Charge Improvement Ratio	3.053	100	Peak Reduction KW	KW	0.00
			Annual KWh Savings	KWh	0
CFM Per Ton	325	400	Annual Therm Savings	Thrm	0.0
Calculated EER	8.027	7.500			
Peak Demand Reduction		0.527			
Annual KWh Savings		831.1			

5079-2334-241

Table 165 shows the verified savings for RCA measures. The realization rate of 0.81 for kWh savings is attributed to duplicate records and zero refrigerant charge.

The detailed data used for this M&V can be opened in Section 5 References, Item 3.

Table 165. Verified Refrigerant Charge and Air Flow Impacts, Invoices B, C, D

	Qty	kWh	kW
Invoiced (Inv B)	275	616,642	
(Inv C)	161	319,688	
(Inv D)	814	778,008	122.10
Total - Invoiced	**1,250**	**1,714,338**	**122.10**
Verified	**850**	**1,385,859**	**422.78**
Delta		328,478	
Realization Rate		0.81	3.46
Duplicates With Other Invoices	181	190,056	29.27
Zero Refrig Charge	207	138,422	104.82

7.15.2.3.3 Duct Test and Seal

Table 166 shows the summary data from Invoices B, C, D. The verification of these measures included a review of current and past invoices, a sample of inspections by KSI staff.

Table 166. Duct Test and Seal Measure, Data From Invoices, Invoices B, C, D

Invoice	Measure	Qty	kWh	kW	Thm
B	DTS	2	710		0
C	DTS	0	0	0	0
D	DTS	177	248,022	35.40	5,057
Total	**DTS**	**179**	**248,732**	**35**	**5,057**

By comparing records among invoices, five records were identified as duplicates with records from Invoice A. These records were eliminated from the verification. Inspections revealed no discrepancy. Table 167 shows the verified duct test and seal measure impacts from Invoices B, C, D.

Table 167. Verified Duct Test and Seal Impacts, Invoices B, C, D

	Qty	kWh Savings	kW Reduction	Therm Savings
Invoiced (Inv B)	2	710	not reported	0
(Inv C)	0	0	0.00	0
(Inv D)	177	248,022	35.40	5,057
Total - Invoiced	**179**	**248,732**	**35.40**	**5,057**
Verified	**174**	**245,673**	**181.32**	**4,979**
Delta		3,059		
Realization Rate		0.99	5.12	0.98
Duplicates With Other Invoices		3,059	2.37	77

7.15.2.3.3.1 Discussion – Duct Test and Seal

The realization rate for kWh is close to one. The reason for the discrepancy is the duplicate records from Invoice A. The realization rate for kW reduction is large, 5.12. This is the result of kW impacts not reported invoices B and C.

7.15.2.4 M&V Summary

This section presents the verified savings determined through the M&V. These findings are the result of the assessment of the invoices and post-inspections conducted on-site. Table 168 shows the savings for the three measures (CFLs, RCA and DTS) for Invoices B, C, D.

Table 168. Verified Savings, Invoices B, C, D

	Invoiced				Verified			
M&V Summary Invoices B, C, D	**Qty**	**kWh Savings**	**kW Reduction**	**Therm Savings**	**Qty**	**kWh Savings**	**kW Reduction**	**Therm Savings**
CFL	13,951	3,731,508	225		11,865	2,806,621	547.32	
RCA	1,250	1,714,338	122.10		850	1,385,859	422.78	
DTS	179	248,732	35.40	5,057	174	245,673	181.32	5,057
Total	**15,380**	**5,694,578**	**382.36**	**5,057**	**12,889**	**4,438,153**	**1,151.42**	**5,057**
Realization Rate						**0.78**	**3.01**	**1.00**

7.15.2.5 References

1. SDG&E Energy Savings Bid (ESB) Program, Measurement and Evaluation Report, Project ID #05-05-002, Subproject #05-05-028.

2. CFL verified savings worksheet.

Table 169. Verified CFL Savings Worksheet

Obs	Invoice Letter	Test Date	Survey Sample	Real. Rate CFL Qty	Invoice Qty	Verified Qty	Verified Unit CFL kWh Savings	Verified Unit CFL kW Red.	Verified kWh Savings	Verfied kW Red.	Invoiced kWh Savings	Invoiced kW Red.
135	C	7/13/06	Census		375	390	236.55	0.046	92,255	18.02	106,515	0.00
139	C	6/28/06	Census		123	123	236.55	0.046	29,096	6	34,937	0.00
140	C	6/29/06	Census		158	158	236.55	0.046	37,375	7	44,878	0.00
141	C	6/30/06	Census		401	401	236.55	0.046	94,857	19	113,900	0.00
142	C	7/5/06	Census		862	862	236.55	0.046	203,906	40	244,842	0.00
212	C	7/13/06	Census		342	342	236.55	0.046	80,900	16	97,142	0.00
281	D	8/1/06	Census		1,134	1,134	236.55	0.046	268,248	52	268,248	52.39
793	D	7/26/06	Census		353	353	236.55	0.046	83,502	16	83,502	16.31
1014	D	7/27/06	Census		953	953	236.55	0.046	225,432	44	225,432	44.03
1118	B	1/19/06	Census		120	120	236.55	0.046	28,386	5.52	34,085	0.00
1120	B	1/23/06	Census		360	35	236.55	0.046	8,279	1.61	102,254	0.00
1152	B	4/11/06	Census		394	245	236.55	0.046	57,955	11	111,912	0.00
1434	B	5/18/06	Census		480	468	236.55	0.046	110,705	22	136,339	0.00
1433	B	5/20/06	Census		219	0	236.55	0.046	0	0.00	62,205	0.00
1435	B	5/19/06	Census		973	0	236.55	0.046	0	0.00	276,371	0.00
Subtotal Census Stratum					**7,247**	**5,584**			**1,320,895**	**257.81**	**1,942,562**	**112.73**
136	C	7/13/06	Sample	0.94	126	118	236.55	0.046	27,924	5.45	35,789	0.00
143	C	6/28/06	Sample	0.94	135	126	236.55	0.046	29,918	5.84	38,345	0.00
144	C	6/28/06	Sample	0.94	135	126	236.55	0.046	29,918	5.84	38,345	0.00
145	C	6/29/06	Sample	0.94	293	275	236.55	0.046	64,934	12.68	83,224	0.00
702	D	7/27/06	Sample	0.94	72	67	236.55	0.046	15,956	3.12	17,032	3.33
808	D	8/14/06	Sample	0.94	138	129	236.55	0.046	30,583	5.97	32,644	6.38
809	D	8/14/06	Sample	0.94	138	129	236.55	0.046	30,583	5.97	32,644	6.38
810	D	8/1/06	Sample	0.94	117	110	236.55	0.046	25,929	5.06	27,676	5.41
1112	B	1/3/06	Sample	0.94	65	61	236.55	0.046	14,405	2.80	18,463	0.00
1113	B	1/6/06	Sample	0.94	57	53	236.55	0.046	12,632	2.46	16,190	0.00
1121	B	2/7/06	Sample	0.94	30	28	236.55	0.046	6,649	1.29	8,521	0.00
1125	B	2/13/06	Sample	0.94	36	34	236.55	0.046	7,978	1.55	10,225	0.00
1129	B	2/22/06	Sample	0.94	55	52	236.55	0.046	12,189	2.37	15,622	0.00
1142	B	3/9/06	Sample	0.94	52	49	236.55	0.046	11,524	2.24	14,770	0.00
1154	B	5/5/06	Sample	0.94	19	18	236.55	0.046	4,211	0.82	5,397	0.00
1431	B	5/23/06	Sample	0.94	132	124	236.55	0.046	29,254	5.69	37,493	0.00
Subtotal Random Sample Stratum					**1,600**	**1,499**	**RR_Qty= 0.94**		**354,588**	**69.17**	**432,381**	**21.48**
226	C	6/7/06	not surveyed	0.94	42	39	236.55	0.046	9,308	1.82	11,930	0.00
677	D	7/24/06	not surveyed	0.94	173	162	236.55	0.046	38,340	7.49	40,923	7.99
701	D	7/28/06	not surveyed	0.94	165	155	236.55	0.046	36,567	7.14	39,031	7.62
703	D	7/25/06	not surveyed	0.94	106	99	236.55	0.046	23,491	4.59	25,074	4.90
704	D	7/25/06	not surveyed	0.94	101	95	236.55	0.046	22,383	4.37	23,892	4.67
705	D	7/28/06	not surveyed	0.94	107	100	236.55	0.046	23,713	4.63	25,311	4.94
739	D	8/3/06	not surveyed	0.94	57	53	236.55	0.046	12,632	2.47	13,483	2.63
792	D	7/31/06	not surveyed	0.94	180	169	236.55	0.046	39,891	7.79	42,579	8.32
811	D	8/2/06	not surveyed	0.94	282	264	236.55	0.046	62,496	12.21	66,707	13.03
919	D	8/3/06	not surveyed	0.94	48	45	236.55	0.046	10,638	2.08	11,354	2.22
921	D	8/3/06	not surveyed	0.94	57	53	236.55	0.046	12,632	2.47	13,483	2.63
922	D	8/1/06	not surveyed	0.94	119	111	236.55	0.046	26,373	5.15	28,149	5.50
950	D	8/1/06	not surveyed	0.94	26	24	236.55	0.046	5,762	1.13	6,150	1.20
1013	D	7/26/06	not surveyed	0.94	140	131	236.55	0.046	31,026	6.06	33,117	6.47
1015	D	8/1/06	not surveyed	0.94	40	37	236.55	0.046	8,865	1.73	9,462	1.85
1058	D	8/1/06	not surveyed	0.94	186	174	236.55	0.046	41,221	8.05	43,998	8.59
1059	D	8/1/06	not surveyed	0.94	175	164	236.55	0.046	38,783	7.57	41,396	8.09
1111	B	1/2/06	not surveyed	0.94	78	73	236.55	0.046	17,286	3.36	22,155	0.00
1114	B	1/8/06	not surveyed	0.94	27	25	236.55	0.046	5,984	1.16	7,669	0.00
1115	B	1/12/06	not surveyed	0.94	24	22	236.55	0.046	5,319	1.03	6,817	0.00
1116	B	1/18/06	not surveyed	0.94	58	54	236.55	0.046	12,854	2.50	16,474	0.00
1117	B	1/18/06	not surveyed	0.94	144	135	236.55	0.046	31,913	6.21	40,902	0.00
1119	B	1/20/06	not surveyed	0.94	240	225	236.55	0.046	53,188	10.34	68,170	0.00
1122	B	2/7/06	not surveyed	0.94	72	67	236.55	0.046	15,956	3.10	20,451	0.00
1123	B	2/10/06	not surveyed	0.94	32	30	236.55	0.046	7,092	1.38	9,089	0.00
1124	B	2/10/06	not surveyed	0.94	84	79	236.55	0.046	18,616	3.62	23,859	0.00
1126	B	2/13/06	not surveyed	0.94	36	34	236.55	0.046	7,978	1.55	10,225	0.00
1127	B	2/17/06	not surveyed	0.94	180	169	236.55	0.046	39,891	7.76	51,127	0.00
1128	B	2/21/06	not surveyed	0.94	36	34	236.55	0.046	7,978	1.55	10,225	0.00
1130	B	2/23/06	not surveyed	0.94	56	52	236.55	0.046	12,411	2.41	15,906	0.00
1131	B	2/24/06	not surveyed	0.94	7	7	236.55	0.046	1,551	0.30	1,988	0.00
1132	B	3/1/06	not surveyed	0.94	25	23	236.55	0.046	5,540	1.08	7,101	0.00
1133	B	3/1/06	not surveyed	0.94	46	43	236.55	0.046	10,194	1.98	13,066	0.00
1134	B	3/1/06	not surveyed	0.94	48	45	236.55	0.046	10,638	2.07	13,634	0.00
1135	B	3/1/06	not surveyed	0.94	50	47	236.55	0.046	11,081	2.15	14,202	0.00
1136	B	3/2/06	not surveyed	0.94	48	45	236.55	0.046	10,638	2.07	13,634	0.00
1137	B	3/6/06	not surveyed	0.94	132	124	236.55	0.046	29,254	5.69	37,493	0.00
1138	B	3/6/06	not surveyed	0.94	304	285	236.55	0.046	67,372	13.10	86,348	0.00
1139	B	3/7/06	not surveyed	0.94	32	30	236.55	0.046	7,092	1.38	9,089	0.00
1140	B	3/7/06	not surveyed	0.94	72	67	236.55	0.046	15,956	3.10	20,451	0.00
1141	B	3/8/06	not surveyed	0.94	98	92	236.55	0.046	21,719	4.22	27,836	0.00
1143	B	3/10/06	not surveyed	0.94	78	73	236.55	0.046	17,286	3.36	22,155	0.00
1144	B	3/15/06	not surveyed	0.94	174	163	236.55	0.046	38,561	7.50	49,423	0.00
1145	B	3/16/06	not surveyed	0.94	195	183	236.55	0.046	43,215	8.40	55,388	0.00
1146	B	3/30/06	not surveyed	0.94	15	14	236.55	0.046	3,324	0.65	4,261	0.00
1147	B	3/30/06	not surveyed	0.94	42	39	236.55	0.046	9,308	1.81	11,930	0.00
1148	B	3/30/06	not surveyed	0.94	45	42	236.55	0.046	9,973	1.94	12,782	0.00
1149	B	4/2/06	not surveyed	0.94	12	11	236.55	0.046	2,659	0.52	3,408	0.00
1150	B	4/4/06	not surveyed	0.94	20	19	236.55	0.046	4,432	0.86	5,681	0.00
1151	B	4/6/06	not surveyed	0.94	12	11	236.55	0.046	2,659	0.52	3,408	0.00
1153	B	5/4/06	not surveyed	0.94	64	60	236.55	0.046	14,184	2.76	18,179	0.00
1155	B	5/5/06	not surveyed	0.94	120	112	236.55	0.046	26,594	5.17	34,085	0.00
1156	B	5/10/06	not surveyed	0.94	164	154	236.55	0.046	36,345	7.07	46,583	0.00
1428	B	5/18/06	not surveyed	0.94	3	3	236.55	0.046	665	0.13	852	0.00
1429	B	5/16/06	not surveyed	0.94	16	15	236.55	0.046	3,546	0.69	4,545	0.00
1430	B	5/25/06	not surveyed	0.94	76	71	236.55	0.046	16,843	3.28	21,587	0.00
1432	B	5/18/06	not surveyed	0.94	135	126	236.55	0.046	29,918	5.82	38,345	0.00
1418	**B**		**Subtotal - Not Surveyed Stratum**						**1,131,137**	**220.34**	**1,356,565**	**90.64**

2. RCA verified savings worksheet.

Table 170. Verified RCA Savings Worksheet

Obs	Invoice Letter	Test Date	EFLCH	Man EER	Ton	A/C Qty	Ref/Var	Ref Cap	Ref Adj.	RCA Site Flag	RCA Chg Adj	Invoiced RCA kWh	Invoiced RCA kW	Duplication Code	Reason for Dupe	Notes	RCA Charge = 0 (if chg=0 then =0)	RCA Dupe (if not a dupe then =1)	RCA Verification Multiplier (Charge x	Verified RCA kWh	Verified RCA kW	RCA kWh Dupes	RCA kW Dupes	RCA kWh Zeroes	RCA kW Zeroes	sum of verified, dupes, zeroes	Verified RCA kW
246	D	1/10/06	1635	8	4	1	16/120	120	16	1.00	16.00	1,993	0.15	A-Dupe	1 unit per portable		1	0	0	0	0.00	1,993	0.15			1,993	0.15
247	D	1/10/06	1635	8	4	1	24/120	120	24	1.00	24.00	818	0.15	A-Dupe	1 unit per portable		1	0	0	0	0.00	818	0.15			818	0.15
1060	D	6/30/05	1225	8	2	1	-26/90	90	-26	1.00	-26.00	296	0.15	A-Dupe	DTS & Same Model and Readings	A-2931	1	0	0	0	0.00	296	0.15			296	0.15
1054	D	9/15/05	850	8	2.5	1	-50/66	66	-50	1.00	-50.00	425	0.15	A-Dupe	DTS & Same Refrigerant Adjustme	A-2601	1	0	0	0	0.00	425	0.15			425	0.15
961	D	1/31/06	1635	8	4	1	12/152	152	12	1.00	12.00	1,275	0.15	A-Dupe	Identical Readings		1	0	0	0	0.00	1,275	0.15			1,275	0.15
992	D	2/1/06	1635	8	4	1	5/59.2	59.2	5	1.00	5.00	1,335	0.15	A-Dupe	Identical Readings		1	0	0	0	0.00	1,335	0.15			1,335	0.15
1006	D	1/24/06	1635	8	4	1	-10/200	200	-10	1.00	-10.00	457	0.15	A-Dupe	Identical Readings		1	0	0	0	0.00	457	0.15			457	0.15
1009	D	1/24/06	1635	8	4	1	8/200	200	8	1.00	8.00	921	0.15	A-Dupe	Identical Readings		1	0	0	0	0.00	921	0.15			921	0.15
785	D	1/18/06	1635	8	3	1	21/112	112	21	1.00	21.00	2,318	0.15	A-Dupe	Model/Room Match		1	0	0	0	0.00	2,318	0.15			2,318	0.15
786	D	1/18/06	1635	8	3	1	20/112	112	20	1.00	20.00	2,156	0.15	A-Dupe	Model/Room Match		1	0	0	0	0.00	2,156	0.15			2,156	0.15
236	D	1/9/06	1635	8	4	1	10/120	120	10	1.00	10.00	1,322	0.15	A-Dupe	S/N Match		1	0	0	0	0.00	1,322	0.15			1,322	0.15
237	D	1/9/06	1635	8	4	1	16/120	120	16	1.00	16.00	1,993	0.15	A-Dupe	S/N Match		1	0	0	0	0.00	1,993	0.15			1,993	0.15
238	D	1/9/06	1635	8	4	1	8/120	120	8	1.00	8.00	1,151	0.15	A-Dupe	S/N Match		1	0	0	0	0.00	1,151	0.15			1,151	0.15
240	D	1/9/06	1635	8	4	1	11/153	153	11	1.00	11.00	1,202	0.15	A-Dupe	S/N Match		1	0	0	0	0.00	1,202	0.15			1,202	0.15
241	D	1/9/06	1635	8	4	1	13/172	172	13	1.00	13.00	1,240	0.15	A-Dupe	S/N Match		1	0	0	0	0.00	1,240	0.15			1,240	0.15
242	D	1/9/06	1635	8	4	1	30/172	172	30	1.00	30.00	2,780	0.15	A-Dupe	S/N Match	Make, Model, Serial, Unit Description, Capacity, and RCA all match	1	0	0	0	0.00	2,780	0.15			2,780	0.15
250	D	1/6/06	1635	8	4	1	112/144	144	112	1.00	112.00	1,308	0.15	A-Dupe	S/N Match		1	0	0	0	0.00	1,308	0.15			1,308	0.15
351	D	10/27/05	1635	8	10	1	39/185	185	39	1.00	39.00	818	0.15	A-Dupe	S/N Match	On Invoice A	1	0	0	0	0.00	818	0.15			818	0.15
352	D	10/27/05	1635	8	10	1	37/327	327	37	1.00	37.00	818	0.15	A-Dupe	S/N Match	On Invoice A	1	0	0	0	0.00	818	0.15			818	0.15
358	D	10/31/05	1635	8	3	1	-3/83	83	-3	1.00	-3.00	376	0.15	A-Dupe	S/N Match	On Invoice A	1	0	0	0	0.00	376	0.15			376	0.15
372	D	9/27/05	1635	8	5	1	-10/109	109	-10	1.00	-10.00	462	0.15	A-Dupe	S/N Match	On Invoice A	1	0	0	0	0.00	462	0.15			462	0.15
373	D	9/27/05	1635	8	5	1	-6/109	109	-6	1.00	-6.00	553	0.15	A-Dupe	S/N Match	On Invoice A	1	0	0	0	0.00	553	0.15			553	0.15
374	D	9/27/05	1635	8	5	1	-5/109	109	-5	1.00	-5.00	587	0.15	A-Dupe	S/N Match	On Invoice A	1	0	0	0	0.00	587	0.15			587	0.15
375	D	9/27/05	1635	8	5	1	3/109	109	3	1.00	3.00	1,038	0.15	A-Dupe	S/N Match	On Invoice A	1	0	0	0	0.00	1,038	0.15			1,038	0.15
376	D	9/27/05	1635	8	10	1	-6/140	140	-6	1.00	-6.00	1,198	0.15	A-Dupe	S/N Match	On Invoice A	1	0	0	0	0.00	1,198	0.15			1,198	0.15
377	D	9/27/05	1635	8	5	1	7/109	109	7	1.00	7.00	1,410	0.15	A-Dupe	S/N Match	On Invoice A	1	0	0	0	0.00	1,410	0.15			1,410	0.15
378	D	9/27/05	1635	8	5	1	8/109	109	8	1.00	8.00	1,522	0.15	A-Dupe	S/N Match	On Invoice A	1	0	0	0	0.00	1,522	0.15			1,522	0.15
453	D	5/8/06	1635	8	3.5	1	-20/96	96	-20	1.00	-20.00	403	0.15	A-Dupe	S/N Match	On Invoice A	1	0	0	0	0.00	403	0.15			403	0.15
463	D	10/19/05	1635	8	2.5	1	24/68	68	24	1.00	24.00	818	0.15	A-Dupe	S/N Match	On Invoice A	1	0	0	0	0.00	818	0.15			818	0.15
464	D	10/19/05	1635	8	4	1	8/88	88	8	1.00	8.00	1,408	0.15	A-Dupe	S/N Match	On Invoice A	1	0	0	0	0.00	1,408	0.15			1,408	0.15
465	D	10/19/05	1635	8	5	1	14/128	128	14	1.00	14.00	2,049	0.15	A-Dupe	S/N Match	On Invoice A	1	0	0	0	0.00	2,049	0.15			2,049	0.15
466	D	10/20/05	1635	8	2.5	1	-7/54	54	-7	1.00	-7.00	217	0.15	A-Dupe	S/N Match	On Invoice A	1	0	0	0	0.00	217	0.15			217	0.15
467	D	10/20/05	1635	8	2.5	1	-4/66	66	-4	1.00	-4.00	267	0.15	A-Dupe	S/N Match	On Invoice A	1	0	0	0	0.00	267	0.15			267	0.15
468	D	10/20/05	1635	8	2.5	1	11/68	68	11	1.00	11.00	1,568	0.15	A-Dupe	S/N Match	On Invoice A	1	0	0	0	0.00	1,568	0.15			1,568	0.15
515	D	5/12/06	1635	8	8	1	8/152	152	8	1.00	8.00	2,048	0.15	A-Dupe	S/N Match	On Invoice A	1	0	0	0	0.00	2,048	0.15			2,048	0.15
555	D	10/26/05	1635	8	4	1	16/157	157	16	1.00	16.00	1,542	0.15	A-Dupe	S/N Match	On Invoice A	1	0	0	0	0.00	1,542	0.15			1,542	0.15
556	D	10/26/05	1635	8	10	1	-7/156	156	-7	1.00	-7.00	1,181	0.15	A-Dupe	S/N Match	On Invoice A	1	0	0	0	0.00	1,181	0.15			1,181	0.15
558	D	10/26/05	1635	8	10	1	8/166	166	8	1.00	8.00	2,466	0.15	A-Dupe	S/N Match	On Invoice A	1	0	0	0	0.00	2,466	0.15			2,466	0.15
560	D	10/31/05	1635	8	3.5	1	6/106	106	6	1.00	6.00	926	0.15	A-Dupe	S/N Match	On Invoice A	1	0	0	0	0.00	926	0.15			926	0.15
561	D	10/31/05	1635	8	3	1	14/90	90	14	1.00	14.00	1,790	0.15	A-Dupe	S/N Match	On Invoice A	1	0	0	0	0.00	1,790	0.15			1,790	0.15
770	D	1/13/06	1635	8	4	1	5/83	83	5	1.00	5.00	1,091	0.15	A-Dupe	S/N Match	On Invoice A	1	0	0	0	0.00	1,091	0.15			1,091	0.15
771	D	1/13/06	1635	8	4	1	4/88	88	4	1.00	4.00	964	0.15	A-Dupe	S/N Match	On Invoice A	1	0	0	0	0.00	964	0.15			964	0.15
772	D	1/13/06	1635	8	4	1	5/88	88	5	1.00	5.00	1,060	0.15	A-Dupe	S/N Match	On Invoice A	1	0	0	0	0.00	1,060	0.15			1,060	0.15
773	D	1/13/06	1635	8	4	1	5/59	59	5	1.00	5.00	1,338	0.15	A-Dupe	S/N Match	On Invoice A	1	0	0	0	0.00	1,338	0.15			1,338	0.15
774	D	1/13/06	1635	8	4	1	6/88	88	6	1.00	6.00	1,166	0.15	A-Dupe	S/N Match	On Invoice A	1	0	0	0	0.00	1,166	0.15			1,166	0.15
775	D	1/13/06	1635	8	3	1	-8/83	83	-8	1.00	-8.00	273	0.15	A-Dupe	S/N Match	On Invoice A	1	0	0	0	0.00	273	0.15			273	0.15
779	D	1/19/06	1635	8	4	1	8/150.4	150.4	8	1.00	8.00	1,029	0.15	A-Dupe	S/N Match	On Invoice A	1	0	0	0	0.00	1,029	0.15			1,029	0.15
780	D	1/19/06	1635	8	4	1	-8/160.1	160.1	-8	1.00	-8.00	457	0.15	A-Dupe	S/N Match	On Invoice A	1	0	0	0	0.00	457	0.15			457	0.15
790	D	1/18/06	1635	8	3.5	1	-14/140	140	-14	1.00	-14.00	315	0.15	A-Dupe	S/N Match	On Invoice A	1	0	0	0	0.00	315	0.15			315	0.15
812	D	12/19/05	1635	8	4	1	8/200	200	8	1.00	8.00	921	0.15	A-Dupe	S/N Match	A-1148	1	0	0	0	0.00	921	0.15			921	0.15
813	D	12/20/05	1635	8	4	1	40/154	154	40	1.00	40.00	818	0.15	A-Dupe	S/N Match	A-1147	1	0	0	0	0.00	818	0.15			818	0.15
814	D	12/20/05	1635	8	4	1	48/122	122	48	1.00	48.00	818	0.15	A-Dupe	S/N Match	A-1146	1	0	0	0	0.00	818	0.15			818	0.15
815	D	12/20/05	1635	8	4	1	8/130	130	8	1.00	8.00	1,103	0.15	A-Dupe	S/N Match	A-1145	1	0	0	0	0.00	1,103	0.15			1,103	0.15
816	D	12/20/05	1635	8	4	1	12/88	88	12	1.00	12.00	2,043	0.15	A-Dupe	S/N Match	A-1144	1	0	0	0	0.00	2,043	0.15			2,043	0.15
817	D	12/19/05	1635	8	4	1	-10/88	88	-10	1.00	-10.00	351	0.15	A-Dupe	S/N Match	A-1149	1	0	0	0	0.00	351	0.15			351	0.15
818	D	12/19/05	1635	8	4	1	6/152	152	6	1.00	6.00	917	0.15	A-Dupe	S/N Match	A-1150	1	0	0	0	0.00	917	0.15			917	0.15
819	D	12/19/05	1635	8	4	1	24/122	122	24	1.00	24.00	818	0.15	A-Dupe	S/N Match	A-1154	1	0	0	0	0.00	818	0.15			818	0.15
820	D	12/19/05	1635	8	4	1	40/130	130	40	1.00	40.00	818	0.15	A-Dupe	S/N Match	A-1153	1	0	0	0	0.00	818	0.15			818	0.15
821	D	12/19/05	1635	8	4	1	18/130	130	18	1.00	18.00	2,078	0.15	A-Dupe	S/N Match	A-1152	1	0	0	0	0.00	2,078	0.15			2,078	0.15
822	D	12/19/05	1635	8	4	1	48/122	122	48	1.00	48.00	818	0.15	A-Dupe	S/N Match	A-1156	1	0	0	0	0.00	818	0.15			818	0.15
823	D	12/19/05	1635	8	4	1	44/130	130	44	1.00	44.00	818	0.15	A-Dupe	S/N Match	A-1155	1	0	0	0	0.00	818	0.15			818	0.15
824	D	12/15/05	1635	8	4	1	10/160	160	10	1.00	10.00	1,112	0.15	A-Dupe	S/N Match	A-1157	1	0	0	0	0.00	1,112	0.15			1,112	0.15
850	D	12/19/05	1635	8	4	1	-6/160	160	-6	1.00	-6.00	497	0.15	A-Dupe	S/N Match	A-1135	1	0	0	0	0.00	497	0.15			497	0.15
851	D	12/19/05	1635	8	4	1	6/160	160	6	1.00	6.00	902	0.15	A-Dupe	S/N Match	A-1134	1	0	0	0	0.00	902	0.15			902	0.15

Obs	Invoice Letter	Test Date	EFLCH	Man EER	Ton	A/C Qty	Ref/Var	Ref Cap	Ref Adj.	RCA Site Flag	RCA Chg Adj	Invoiced RCA kWh	Invoiced RCA kW	Duplication Code	Reason for Dupe	Notes	RCA Charge = 0 (if chg=0 then =0)	RCA Dupe (if not a dupe then =1)	RCA Verification Multiplier (Charge x	Verified RCA kWh	Verified RCA kW	RCA kWh Dupes	RCA kW Dupes	RCA kWh Zeroes	RCA kW Zeroes	sum of verified, dupes, zeroes	Verified RCA kW
852	D	12/19/05	1635	8	4	1	7/153.6	153.6	7	1.00	7.00	965	0.15	A-Dupe	S/N Match	A-1133	1	0	0	0	0.00	965	0.15			965	0.15
853	D	12/14/05	1635	8	4	1	21/152	152	21	1.00	21.00	2,073	0.15	A-Dupe	S/N Match	A-1103	1	0	0	0	0.00	2,073	0.15			2,073	0.15
854	D	12/14/05	1635	8	4	1	-10/162	162	-10	1.00	-10.00	425	0.15	A-Dupe	S/N Match	A-1106	1	0	0	0	0.00	425	0.15			425	0.15
855	D	12/14/05	1635	8	4	1	-23/160	160	-23	1.00	-23.00	353	0.15	A-Dupe	S/N Match	A-1107	1	0	0	0	0.00	353	0.15			353	0.15
857	D	12/14/05	1635	8	4	1	15/162	162	15	1.00	15.00	1,428	0.15	A-Dupe	S/N Match	A-1113	1	0	0	0	0.00	1,428	0.15			1,428	0.15
858	D	12/14/05	1635	8	4	1	15/162	162	15	1.00	15.00	1,428	0.15	A-Dupe	S/N Match	A-1114	1	0	0	0	0.00	1,428	0.15			1,428	0.15
860	D	12/14/05	1635	8	4	1	-20/160	160	-20	1.00	-20.00	348	0.15	A-Dupe	S/N Match	A-1102	1	0	0	0	0.00	348	0.15			348	0.15
861	D	12/14/05	1635	8	4	1	10/152	152	10	1.00	10.00	1,143	0.15	A-Dupe	S/N Match	A-1101	1	0	0	0	0.00	1,143	0.15			1,143	0.15
862	D	12/14/05	1635	8	4	1	3/152	152	3	1.00	3.00	778	0.15	A-Dupe	S/N Match	A-1100	1	0	0	0	0.00	778	0.15			778	0.15
864	D	12/14/05	1635	8	4	1	5/160	160	5	1.00	5.00	856	0.15	A-Dupe	S/N Match	A-1109	1	0	0	0	0.00	856	0.15			856	0.15
865	D	12/14/05	1635	8	4	1	10/160	160	10	1.00	10.00	1,112	0.15	A-Dupe	S/N Match	A-1111	1	0	0	0	0.00	1,112	0.15			1,112	0.15
866	D	12/14/05	1635	8	4	1	10/162	162	10	1.00	10.00	1,105	0.15	A-Dupe	S/N Match	A-1104	1	0	0	0	0.00	1,105	0.15			1,105	0.15
867	D	12/15/05	1635	8	4	1	12/128	128	12	1.00	12.00	1,441	0.15	A-Dupe	S/N Match	A-1096	1	0	0	0	0.00	1,441	0.15			1,441	0.15
868	D	12/15/05	1635	8	4	1	15/162	162	15	1.00	15.00	1,428	0.15	A-Dupe	S/N Match	A-1097	1	0	0	0	0.00	1,428	0.15			1,428	0.15
869	D	12/15/05	1635	8	4	1	5/128	128	5	1.00	5.00	914	0.15	A-Dupe	S/N Match	A-1098/s-787	1	0	0	0	0.00	914	0.15			914	0.15
872	D	12/15/05	1635	8	4	1	5/160	160	5	1.00	5.00	856	0.15	A-Dupe	S/N Match	A-1093	1	0	0	0	0.00	856	0.15			856	0.15
873	D	12/15/05	1635	8	4	1	37/160	160	37	1.00	37.00	818	0.15	A-Dupe	S/N Match	A-1092	1	0	0	0	0.00	818	0.15			818	0.15
874	D	12/15/05	1635	8	4	1	21/160	160	21	1.00	21.00	1,960	0.15	A-Dupe	S/N Match	A-738	1	0	0	0	0.00	1,960	0.15			1,960	0.15
875	D	12/15/05	1635	8	4	1	37/160	160	37	1.00	37.00	818	0.15	A-Dupe	S/N Match	A-1090	1	0	0	0	0.00	818	0.15			818	0.15
877	D	12/15/05	1635	8	4	1	15/162	162	15	1.00	15.00	1,428	0.15	A-Dupe	S/N Match	A-1095	1	0	0	0	0.00	1,428	0.15			1,428	0.15
878	D	12/19/05	1635	8	4	1	10/160	160	10	1.00	10.00	1,112	0.15	A-Dupe	S/N Match	A-1083	1	0	0	0	0.00	1,112	0.15			1,112	0.15
879	D	12/19/05	1635	8	4	1	16/122	122	16	1.00	16.00	1,958	0.15	A-Dupe	S/N Match	A-1089	1	0	0	0	0.00	1,958	0.15			1,958	0.15
881	D	12/19/05	1635	8	4	1	14/154	154	14	1.00	14.00	1,408	0.15	A-Dupe	S/N Match	A-1087	1	0	0	0	0.00	1,408	0.15			1,408	0.15
882	D	12/19/05	1635	8	4	1	21/170	170	21	1.00	21.00	1,840	0.15	A-Dupe	S/N Match	A-1088	1	0	0	0	0.00	1,840	0.15			1,840	0.15
884	D	12/19/05	1635	8	4	1	21/170	170	21	1.00	21.00	1,840	0.15	A-Dupe	S/N Match	A-1084	1	0	0	0	0.00	1,840	0.15			1,840	0.15
914	D	12/19/05	1635	8	4	1	-10/161.1	161.1	-10	1.00	-10.00	424	0.15	A-Dupe	S/N Match	A-601	1	0	0	0	0.00	424	0.15			424	0.15
937	D	1/12/06	1635	8	3.5	1	14/140	140	14	1.00	14.00	1,328	0.15	A-Dupe	S/N Match		1	0	0	0	0.00	1,328	0.15			1,328	0.15
946	D	1/12/06	1635	8	3.5	1	-10/140	140	-10	1.00	-10.00	353	0.15	A-Dupe	S/N Match		1	0	0	0	0.00	353	0.15			353	0.15
947	D	1/12/06	1635	8	4	1	8/85	85	8	1.00	8.00	1,446	0.15	A-Dupe	S/N Match		1	0	0	0	0.00	1,446	0.15			1,446	0.15
948	D	1/12/06	1635	8	4	1	10/85	85	10	1.00	10.00	1,754	0.15	A-Dupe	S/N Match		1	0	0	0	0.00	1,754	0.15			1,754	0.15
997	D	2/1/06	1635	8	4	1	15/200	200	15	1.00	15.00	1,234	0.15	A-Dupe	S/N Match		1	0	0	0	0.00	1,234	0.15			1,234	0.15
1001	D	1/31/06	1635	8	4	1	5/144	144	5	1.00	5.00	881	0.15	A-Dupe	S/N Match		1	0	0	0	0.00	881	0.15			881	0.15
1003	D	1/31/06	1635	8	4	1	36/130	130	36	1.00	36.00	818	0.15	A-Dupe	S/N Match		1	0	0	0	0.00	818	0.15			818	0.15
1004	D	1/31/06	1635	8	4	1	-6/140	140	-6	1.00	-6.00	479	0.15	A-Dupe	S/N Match		1	0	0	0	0.00	479	0.15			479	0.15
1023	D	12/5/05	1635	8	4	1	20/71	71	20	1.00	20.00	818	0.15	A-Dupe	S/N Match		1	0	0	0	0.00	818	0.15			818	0.15
1024	D	12/5/05	1635	8	4	1	20/71	71	20	1.00	20.00	818	0.15	A-Dupe	S/N Match		1	0	0	0	0.00	818	0.15			818	0.15
1025	D	12/5/05	1635	8	4	1	4/88	88	4	1.00	4.00	964	0.15	A-Dupe	S/N Match		1	0	0	0	0.00	964	0.15			964	0.15
1026	D	12/5/05	1635	8	4	1	7/88	88	7	1.00	7.00	1,281	0.15	A-Dupe	S/N Match		1	0	0	0	0.00	1,281	0.15			1,281	0.15
1034	D	11/30/05	1635	8	4	1	9/71	71	9	1.00	9.00	1,889	0.15	A-Dupe	S/N Match		1	0	0	0	0.00	1,889	0.15			1,889	0.15
1035	D	11/30/05	1635	8	4	1	9/71	71	9	1.00	9.00	1,889	0.15	A-Dupe	S/N Match		1	0	0	0	0.00	1,889	0.15			1,889	0.15
1052	D	12/5/05	1635	8	4	1	-8/49	49	-8	1.00	-8.00	371	0.15	A-Dupe	S/N Match		1	0	0	0	0.00	371	0.15			371	0.15
1053	D	12/5/05	1635	8	4	1	-6.25/71	71	-6.25	1.00	-6.25	374	0.15	A-Dupe	S/N Match		1	0	0	0	0.00	374	0.15			374	0.15
642	D	1/17/06	1635	8	4	1	20/88	88	20	1.00	20.00	818	0.15	A-Dupe	Same Charge Adjustment		1	0	0	0	0.00	818	0.15			818	0.15
643	D	1/17/06	1635	8	6	1	30/160	160	30	1.00	30.00	818	0.15	A-Dupe	Same Charge Adjustment		1	0	0	0	0.00	818	0.15			818	0.15
645	D	1/17/06	1635	8	4	1	33/88	88	33	1.00	33.00	1,145	0.15	A-Dupe	Same Charge Adjustment		1	0	0	0	0.00	1,145	0.15			1,145	0.15
688	D	1/5/06	1635	8	4	1	11/160	160	11	1.00	11.00	1,171	0.15	A-Dupe	Same Charge Adjustment		1	0	0	0	0.00	1,171	0.15			1,171	0.15
689	D	1/5/06	1635	8	4	1	5/128	128	5	1.00	5.00	914	0.15	A-Dupe	Same Charge Adjustment		1	0	0	0	0.00	914	0.15			914	0.15
690	D	1/5/06	1635	8	4	1	7/160	160	7	1.00	7.00	951	0.15	A-Dupe	Same Charge Adjustment		1	0	0	0	0.00	951	0.15			951	0.15
691	D	1/5/06	1635	8	4	1	-11/160	160	-11	1.00	-11.00	409	0.15	A-Dupe	Same Charge Adjustment		1	0	0	0	0.00	409	0.15			409	0.15
935	D	1/12/06	1635	8	4	1	6/144	144	6	1.00	6.00	934	0.15	A-Dupe	Same Charge Adjustment		1	0	0	0	0.00	934	0.15			934	0.15
975	D	1/24/06	1635	8	4	1	32/152	152	32	1.00	32.00	818	0.15	A-Dupe	Same Charge Adjustment		1	0	0	0	0.00	818	0.15			818	0.15
982	D	1/24/06	1635	8	4	1	32/152	152	32	1.00	32.00	818	0.15	A-Dupe	Same Charge Adjustment		1	0	0	0	0.00	818	0.15			818	0.15
1005	D	1/24/06	1635	8	4	1	-12/200	200	-12	1.00	-12.00	429	0.15	A-Dupe	Same Charge Adjustment		1	0	0	0	0.00	429	0.15			429	0.15
1010	D	1/24/06	1635	8	4	1	16/170	170	16	1.00	16.00	1,446	0.15	A-Dupe	Same Charge Adjustment		1	0	0	0	0.00	1,446	0.15			1,446	0.15
1016	D	6/29/05	1225	8	2	1	-48/86	86	-48	1.00	-48.00	1,471	0.15	A-Dupe	Same Charge Adjustment		1	0	0	0	0.00	1,471	0.15			1,471	0.15
1017	D	6/29/05	1225	8	5	1	-4/136	136	-4	1.00	-4.00	494	0.15	A-Dupe	Same Charge Adjustment		1	0	0	0	0.00	494	0.15			494	0.15
825	D	12/15/05	1635	8	4	1	16/122	122	16	1.00	16.00	1,958	0.15	A-Dupe	U/N and Charge Adjustment	A-2199	1	0	0	0	0.00	1,958	0.15			1,958	0.15
826	D	12/15/05	1635	8	4	1	16/130	130	16	1.00	16.00	1,833	0.15	A-Dupe	U/N and Charge Adjustment	A-1158	1	0	0	0	0.00	1,833	0.15			1,833	0.15
835	D	12/15/05	1635	8	4	1	12/160	160	12	1.00	12.00	1,234	0.15	A-Dupe	U/N and Charge Adjustment	A-2201	1	0	0	0	0.00	1,234	0.15			1,234	0.15
836	D	12/15/05	1635	8	4	1	8/161	161	8	1.00	8.00	999	0.15	A-Dupe	U/N and Charge Adjustment	A-2203	1	0	0	0	0.00	999	0.15			999	0.15
837	D	12/15/05	1635	8	4	1	-10/161	161	-10	1.00	-10.00	424	0.15	A-Dupe	U/N and Charge Adjustment	A-2202	1	0	0	0	0.00	424	0.15			424	0.15
838	D	12/15/05	1635	8	4	1	-24/161	161	-24	1.00	-24.00	356	0.15	A-Dupe	U/N and Charge Adjustment	A-2204	1	0	0	0	0.00	356	0.15			356	0.15
839	D	12/15/05	1635	8	4	1	12/161	161	12	1.00	12.00	1,229	0.15	A-Dupe	U/N and Charge Adjustment	A-2205	1	0	0	0	0.00	1,229	0.15			1,229	0.15
840	D	12/15/05	1635	8	4	1	48/160	160	48	1.00	48.00	818	0.15	A-Dupe	U/N and Charge Adjustment	A-2206	1	0	0	0	0.00	818	0.15			818	0.15
841	D	12/15/05	1635	8	4	1	10/160	160	10	1.00	10.00	1,112	0.15	A-Dupe	U/N and Charge Adjustment	A-2200	1	0	0	0	0.00	1,112	0.15			1,112	0.15
856	D	12/14/05	1635	8	4	1	10/162	162	10	1.00	10.00	1,105	0.15	A-Dupe	U/N and Charge Adjustment	A-1112	1	0	0	0	0.00	1,105	0.15			1,105	0.15
863	D	12/14/05	1635	8	4	1	7/160	160	7	1.00	7.00	951	0.15	A-Dupe	U/N and Charge Adjustment	A-1108	1	0	0	0	0.00	951	0.15			951	0.15
883	D	12/19/05	1635	8	4	1	5/154	154	5	1.00	5.00	865	0.15	A-Dupe	U/N and Charge Adjustment		1	0	0	0	0.00	865	0.15			865	0.15
952	D	12/13/05	1635	8	2	1	20/88	88	20	1.00	20.00	2,142	0.15	A-Dupe	Unit Desc Match		1	0	0	0	0.00	2,142	0.15			2,142	0.15
953	D	12/13/05	1635	8	4	1	-8/173	173	-8	1.00	-8.00	468	0.15	A-Dupe	Unit Desc Match		1	0	0	0	0.00	468	0.15			468	0.15

Obs	Invoice Letter	Test Date	EFLCH	Man EER	Ton	A/C Qty	Ref/Var	Ref Cap	Ref Adj.	RCA Site Flag	RCA Chg Adj	Invoiced RCA kWh	Invoiced RCA kW	Duplication Code	Reason for Dupe	Notes	RCA Charge = 0 (if chg=0 then =0)	RCA Dupe (if not a dupe then =1)	RCA Verification Multiplier (Charge x	Verified RCA kWh	Verified RCA kW	RCA kWh Dupes	RCA kW Dupes	RCA kWh Zeroes	RCA kW Zeroes	sum of verified, dupes, zeroes	Verified RCA kW
954	D	12/13/05	1635	8	4	1	12/173	173	12	1.00	12.00	1,177	0.15	A-Dupe	Unit Desc Match		1	0	0	0	0.00	1,177	0.15			1,177	0.15
976	D	1/24/06	1635	8	4	1	16/152	152	16	1.00	16.00	1,585	0.15	A-Dupe	Unit Desc Match		1	0	0	0	0.00	1,585	0.15			1,585	0.15
977	D	1/24/06	1635	8	4	1	12/152	152	12	1.00	12.00	1,275	0.15	A-Dupe	Unit Desc Match		1	0	0	0	0.00	1,275	0.15			1,275	0.15
996	D	1/24/06	1635	8	4	1	18/170	170	18	1.00	18.00	1,593	0.15	A-Dupe	Unit Desc Match		1	0	0	0	0.00	1,593	0.15			1,593	0.15
998	D	2/1/06	1635	8	4	1	-10/152	152	-10	1.00	-10.00	416	0.15	A-Dupe	Unit Desc Match		1	0	0	0	0.00	416	0.15			416	0.15
1000	D	2/1/06	1635	8	4	1	18/168	168	18	1.00	18.00	1,609	0.15	A-Dupe	Unit Desc Match		1	0	0	0	0.00	1,609	0.15			1,609	0.15
781	D	1/19/06	1635	8	3	1	-32/112	112	-32	1.00	-32.00	579	0.15	A-Dupe	Unit Desc/Model Match		1	0	0	0	0.00	579	0.15			579	0.15
782	D	1/19/06	1635	8	3	1	18/70	70	18	1.00	18.00	818	0.15	A-Dupe	Unit Desc/Model Match		1	0	0	0	0.00	818	0.15			818	0.15
784	D	1/19/06	1635	8	3	1	7/112	112	7	1.00	7.00	834	0.15	A-Dupe	Unit Desc/Model Match		1	0	0	0	0.00	834	0.15			834	0.15
248	D	1/10/06	1635	8	4	1	20/160	160	20	1.00	20.00	1,862	0.15	A-Dupe			1	0	0	0	0.00	1,862	0.15			1,862	0.15
717	D	4/20/06	1635	8	3.5	1	19/140	140	19	1.00	19.00	1,778	0.15	B_Dupe AW	Same Charge Adjustment		1	0	0	0	0.00	1,778	0.15			1,778	0.15
715	D	4/20/06	1635	8	3.5	1	16/140	140	16	1.00	16.00	1,493	0.15	B-Dupe	Same Charge Adjustment		1	0	0	0	0.00	1,493	0.15			1,493	0.15
716	D	4/20/06	1635	8	3.5	1	37/140	140	37	1.00	37.00	818	0.15	B-Dupe	Same Charge Adjustment		1	0	0	0	0.00	818	0.15			818	0.15
171	C	60106	1822	8.0	5.0	1	0/233	233	0	1.00	0.00	1,039	0.67	B-Dupe			1	0	0	0	0.00	1,039	0.67			1,039	0.67
21	C	62806	1822	8.0	4.0	1	10/76	76	10	1.00	10.00	2,137	0.75	C-Dupe	Identical record	couldn't find insp rpt	1	0	0	0	0.00	2,137	0.75			2,137	0.75
24	C	62906	1822	8.0	4.0	1	-8/83	83	-8	1.00	-8.00	532	0.34	C-Dupe	Identical record		1	0	0	0	0.00	532	0.34			532	0.34
25	C	62906	1822	8.0	5.0	1	4/93	93	4	1.00	4.00	1,393	0.53	C-Dupe	Identical record		1	0	0	0	0.00	1,393	0.53			1,393	0.53
32	C	63006	1822	8.0	4.0	1	-24/140	140	-24	1.00	-24.00	550	0.36	C-Dupe	Identical record		1	0	0	0	0.00	550	0.36			550	0.36
33	C	63006	1822	8.0	4.5	1	-24/191	191	-24	1.00	-24.00	580	0.37	C-Dupe	Same Charge Adjustment		1	0	0	0	0.00	580	0.37			580	0.37
259	D	6/30/06	1635	8	4	1	-24/140	140	-24	1.00	-24.00	382	0.15	C-Dupe	Same Charge Adjustment		1	0	0	0	0.00	382	0.15			382	0.15
261	D	6/30/06	1635	8	4.5	1	-24/191	191	-24	1.00	-24.00	391	0.15	C-Dupe	Same Charge Adjustment		1	0	0	0	0.00	391	0.15			391	0.15
262	D	7/6/06	1635	8	4	1	-4/140	140	-4	1.00	-4.00	530	0.15	C-Dupe	Same Charge Adjustment		1	0	0	0	0.00	530	0.15			530	0.15
263	D	7/5/06	1635	8	4	1	-50/144	144	-50	1.00	-50.00	1,169	0.15	C-Dupe	Same Charge Adjustment		1	0	0	0	0.00	1,169	0.15			1,169	0.15
264	D	7/5/06	1635	8	3.5	1	-12.75/140	140	-12.75	1.00	-12.75	324	0.15	C-Dupe	Same Charge Adjustment		1	0	0	0	0.00	324	0.15			324	0.15
266	D	7/3/06	1635	8	3.5	1	-12.5/140	140	-12.5	1.00	-12.50	326	0.15	C-Dupe	Same Charge Adjustment		1	0	0	0	0.00	326	0.15			326	0.15
267	D	7/3/06	1635	8	3.5	1	-18.5/140	140	-18.5	1.00	-18.50	305	0.15	C-Dupe	Same Charge Adjustment		1	0	0	0	0.00	305	0.15			305	0.15
279	D	6/30/06	1635	8	5	1	9/92.8	92.8	9	1.00	9.00	1,850	0.15	C-Dupe	Same Charge Adjustment		1	0	0	0	0.00	1,850	0.15			1,850	0.15
283	D	7/25/06	1635	8	5	1	-8/126	126	-8	1.00	-8.00	526	0.15	C-Dupe	Same Charge Adjustment		1	0	0	0	0.00	526	0.15			526	0.15
284	D	7/25/06	1635	8	5	1	-27/126.4	126.4	-27	1.00	-27.00	595	0.15	C-Dupe	Same Charge Adjustment		1	0	0	0	0.00	595	0.15			595	0.15
285	D	7/25/06	1635	8	5	1	-8/126	126	-8	1.00	-8.00	526	0.15	C-Dupe	Same Charge Adjustment		1	0	0	0	0.00	526	0.15			526	0.15
286	D	7/25/06	1635	8	5	1	-26/126.4	126.4	-26	1.00	-26.00	567	0.15	C-Dupe	Same Charge Adjustment		1	0	0	0	0.00	567	0.15			567	0.15
288	D	7/24/06	1635	8	5	1	20/125	125	20	1.00	20.00	3,093	0.15	C-Dupe	Same Charge Adjustment		1	0	0	0	0.00	3,093	0.15			3,093	0.15
289	D	7/25/06	1635	8	5	1	-30/126.4	126.4	-30	1.00	-30.00	693	0.15	C-Dupe	Same Charge Adjustment		1	0	0	0	0.00	693	0.15			693	0.15
290	D	7/24/06	1635	8	5	1	-12/126	126	-12	1.00	-12.00	457	0.15	C-Dupe	Same Charge Adjustment		1	0	0	0	0.00	457	0.15			457	0.15
291	D	7/25/06	1635	8	5	1	10/126.4	126.4	10	1.00	10.00	1,596	0.15	C-Dupe	Same Charge Adjustment		1	0	0	0	0.00	1,596	0.15			1,596	0.15
292	D	7/25/06	1635	8	5	1	-28/126.4	126.4	-28	1.00	-28.00	625	0.15	C-Dupe	Same Charge Adjustment		1	0	0	0	0.00	625	0.15			625	0.15
293	D	7/25/06	1635	8	5	1	-26/126.4	126.4	-26	1.00	-26.00	567	0.15	C-Dupe	Same Charge Adjustment		1	0	0	0	0.00	567	0.15			567	0.15
294	D	7/25/06	1635	8	5	1	-25.5/126.4	126.4	-25.5	1.00	-25.50	555	0.15	C-Dupe	Same Charge Adjustment		1	0	0	0	0.00	555	0.15			555	0.15
295	D	7/25/06	1635	8	5	1	-23/126.4	126.4	-23	1.00	-23.00	500	0.15	C-Dupe	Same Charge Adjustment		1	0	0	0	0.00	500	0.15			500	0.15
730	D	7/20/06	1635	8	3.5	1	-12/150	150	-12	1.00	-12.00	339	0.15	C-Dupe	Same Charge Adjustment		1	0	0	0	0.00	339	0.15			339	0.15
732	D	7/20/06	1635	8	4	1	-24/144	144	-24	1.00	-24.00	375	0.15	C-Dupe	Same Charge Adjustment		1	0	0	0	0.00	375	0.15			375	0.15
733	D	7/20/06	1635	8	3.5	1	-18/140	140	-18	1.00	-18.00	304	0.15	C-Dupe	Same Charge Adjustment		1	0	0	0	0.00	304	0.15			304	0.15
734	D	7/20/06	1635	8	3.5	1	-22/140	140	-22	1.00	-22.00	318	0.15	C-Dupe	Same Charge Adjustment		1	0	0	0	0.00	318	0.15			318	0.15
735	D	7/20/06	1635	8	3.5	1	32/140	140	32	1.00	32.00	3,789	0.15	C-Dupe	Same Charge Adjustment		1	0	0	0	0.00	3,789	0.15			3,789	0.15
737	D	7/20/06	1635	8	3.2	1	-20.75/150	150	-20.75	1.00	-20.75	280	0.15	C-Dupe	Same Charge Adjustment		1	0	0	0	0.00	280	0.15			280	0.15
738	D	7/20/06	1635	8	3.5	1	-12.5/150	150	-12.5	1.00	-12.50	334	0.15	C-Dupe	Same Charge Adjustment		1	0	0	0	0.00	334	0.15			334	0.15
1055	D	7/7/06	1635	8	4	1	-1/118.4	118.4	-1	1.00	-1.00	619	0.15	C-Dupe	Same Charge Adjustment		1	0	0	0	0.00	619	0.15			619	0.15
271	D	6/28/06	1635	8	3.5	1	30/83.2	83.2	30	1.00	30.00	1,145	0.15	C-Dupe	Same Unit and Charge Adjustment		1	1	1	1,145	0.15					1,145	0.15
265	D	7/5/06	1635	8	3.5	1	-38.25/140	140	-38.25	1.00	-38.25	620	0.15	OK			1	1	1	620	0.15					620	0.15
829	D	12/14/05	1635	8	4	1	-22/160	160	-22	1.00	-22.00	350	0.15	OK			1	1	1	350	0.15					350	0.15
880	D	12/19/05	1635	8	4	1	16/130	130	16	1.00	16.00	1,833	0.15	OK			1	1	1	1,833	0.15					1,833	0.15
1018	D	6/29/05	1225	8	2	1	10/105	105	10	1.00	10.00	547	0.15	OK			1	1	1	547	0.15					547	0.15
437	D	12/15/05	1635	8	5	1	-3/182	182	-3	1.00	-3.00	726	0.15	OK			1	1	1	726	0.15					726	0.15
34	C	62806	1822	8.0	3.5	1	30/83	83	30	1.00	30.00	7,282	3.18	OK			1	1	1	7,282	3.18					7,282	3.18
296	D	10/28/05	1635	8	4	1	-5/153.6	153.6	-5	1.00	-5.00	515	0.15	OK			1	1	1	515	0.15					515	0.15
297	D	10/28/05	1635	8	4	1	3/88	88	3	1.00	3.00	877	0.15	OK			1	1	1	877	0.15					877	0.15
298	D	10/28/05	1635	8	4	1	8/153.6	153.6	8	1.00	8.00	1,019	0.15	OK			1	1	1	1,019	0.15					1,019	0.15
299	D	10/26/05	1635	8	3	1	42/109	109	42	1.00	42.00	1,635	0.15	OK			1	1	1	1,635	0.15					1,635	0.15
301	D	12/1/05	1635	8	5	1	9/104	104	9	1.00	9.00	1,697	0.15	OK			1	1	1	1,697	0.15					1,697	0.15
303	D	12/1/05	1635	8	5	1	16/124	124	16	1.00	16.00	2,406	0.15	OK			1	1	1	2,406	0.15					2,406	0.15
304	D	12/6/05	1635	8	5	1	17/201	201	17	1.00	17.00	1,670	0.15	OK			1	1	1	1,670	0.15					1,670	0.15
307	D	12/6/05	1635	8	4	1	6/168	168	6	1.00	6.00	889	0.15	OK			1	1	1	889	0.15					889	0.15
309	D	12/6/05	1635	8	5	1	-5/201	201	-5	1.00	-5.00	681	0.15	OK			1	1	1	681	0.15					681	0.15
310	D	12/6/05	1635	8	4	1	12/168	168	12	1.00	12.00	1,198	0.15	OK			1	1	1	1,198	0.15					1,198	0.15
311	D	12/6/05	1635	8	5	1	14/201	201	14	1.00	14.00	1,475	0.15	OK			1	1	1	1,475	0.15					1,475	0.15
313	D	9/19/05	1635	8	3	1	-10/114	114	-10	1.00	-10.00	281	0.15	OK			1	1	1	281	0.15					281	0.15
314	D	9/19/05	1635	8	3	1	8/116	116	8	1.00	8.00	880	0.15	OK			1	1	1	880	0.15					880	0.15
315	D	9/19/05	1635	8	30	1	6/480	480	6	1.00	6.00	5,498	0.15	OK			1	1	1	5,498	0.15					5,498	0.15
316	D	9/19/05	1635	8	30	1	6/480	480	6	1.00	6.00	5,498	0.15	OK			1	1	1	5,498	0.15					5,498	0.15
317	D	9/19/05	1635	8	30	1	12/480	480	12	1.00	12.00	6,097	0.15	OK			1	1	1	6,097	0.15					6,097	0.15

Obs	Invoice Letter	Test Date	EFLCH	Man EER	Ton	A/C Qty	Ref/Var	Ref Cap	Ref Adj.	RCA Site Flag	RCA Chg Adj	Invoiced RCA kWh	Invoiced RCA kW	Duplication Code	Reason for Dupe	Notes	RCA Charge = 0 (if chg=0 then =0)	RCA Dupe (if not a dupe then =1)	RCA Verification Multiplier (Charge x	Verified RCA kWh	Verified RCA kW	RCA kWh Dupes	RCA kW Dupes	RCA kWh Zeroes	RCA kW Zeroes	sum of verified, dupes, zeroes	Verified RCA kW
318	D	9/19/05	1635	8	4	1	-4/152	152	-4	1.00	-4.00	539	0.15	OK			1	1	1	539	0.15					539	0.15
319	D	9/19/05	1635	8	4	1	9/152	152	9	1.00	9.00	1,082	0.15	OK			1	1	1	1,082	0.15					1,082	0.15
320	D	9/19/05	1635	8	4	1	13/160	160	13	1.00	13.00	1,300	0.15	OK			1	1	1	1,300	0.15					1,300	0.15
321	D	9/19/05	1635	8	5	1	15/158	158	15	1.00	15.00	1,819	0.15	OK			1	1	1	1,819	0.15					1,819	0.15
322	D	9/19/05	1635	8	3.5	1	-10/118	118	-10	1.00	-10.00	332	0.15	OK			1	1	1	332	0.15					332	0.15
323	D	9/19/05	1635	8	2.5	1	5/111	111	5	1.00	5.00	601	0.15	OK			1	1	1	601	0.15					601	0.15
324	D	9/19/05	1635	8	3.5	1	13/122	122	13	1.00	13.00	1,401	0.15	OK			1	1	1	1,401	0.15					1,401	0.15
325	D	9/19/05	1635	8	1.5	1	14/60	60	14	1.00	14.00	1,690	0.15	OK			1	1	1	1,690	0.15					1,690	0.15
326	D	9/21/05	1635	8	3	1	-3/92	92	-3	1.00	-3.00	386	0.15	OK			1	1	1	386	0.15					386	0.15
327	D	9/21/05	1635	8	3	1	-3/92	92	-3	1.00	-3.00	386	0.15	OK			1	1	1	386	0.15					386	0.15
328	D	9/21/05	1635	8	4	1	4/121	121	4	1.00	4.00	869	0.15	OK			1	1	1	869	0.15					869	0.15
329	D	9/21/05	1635	8	10	1	10/300	300	10	1.00	10.00	2,178	0.15	OK			1	1	1	2,178	0.15					2,178	0.15
330	D	9/21/05	1635	8	10	1	15/300	300	15	1.00	15.00	2,504	0.15	OK			1	1	1	2,504	0.15					2,504	0.15
331	D	9/6/05	1635	8	3	1	6/83	83	6	1.00	6.00	905	0.15	OK			1	1	1	905	0.15					905	0.15
332	D	9/6/05	1635	8	4	1	8/115	115	8	1.00	8.00	1,179	0.15	OK			1	1	1	1,179	0.15					1,179	0.15
333	D	9/23/05	1635	8	4	1	4/131	131	4	1.00	4.00	851	0.15	OK			1	1	1	851	0.15					851	0.15
334	D	9/23/05	1635	8	5	1	-16/148	148	-16	1.00	-16.00	442	0.15	OK			1	1	1	442	0.15					442	0.15
335	D	9/23/05	1635	8	5	1	-16/148	148	-16	1.00	-16.00	442	0.15	OK			1	1	1	442	0.15					442	0.15
336	D	9/23/05	1635	8	2	1	-4/40	40	-4	1.00	-4.00	180	0.15	OK			1	1	1	180	0.15					180	0.15
337	D	9/23/05	1635	8	2	1	-4/85	85	-4	1.00	-4.00	233	0.15	OK			1	1	1	233	0.15					233	0.15
338	D	9/23/05	1635	8	1.5	1	-16/54	54	-16	1.00	-16.00	312	0.15	OK			1	1	1	312	0.15					312	0.15
339	D	9/27/05	1635	8	3	1	-9/86	86	-9	1.00	-9.00	267	0.15	OK			1	1	1	267	0.15					267	0.15
340	D	9/26/05	1635	8	4	1	-4/147	147	-4	1.00	-4.00	536	0.15	OK			1	1	1	536	0.15					536	0.15
341	D	9/28/05	1635	8	5	1	-8/142	142	-8	1.00	-8.00	549	0.15	OK			1	1	1	549	0.15					549	0.15
342	D	9/30/05	1635	8	1.5	1	-11/68	68	-11	1.00	-11.00	138	0.15	OK			1	1	1	138	0.15					138	0.15
343	D	9/29/05	1635	8	4	1	-6/39	39	-6	1.00	-6.00	361	0.15	OK			1	1	1	361	0.15					361	0.15
344	D	9/29/05	1635	8	1.5	1	-7/88	88	-7	1.00	-7.00	145	0.15	OK			1	1	1	145	0.15					145	0.15
345	D	9/29/05	1635	8	1.5	1	2/88	88	2	1.00	2.00	299	0.15	OK			1	1	1	299	0.15					299	0.15
346	D	10/3/05	1635	8	5	1	-11/102	102	-11	1.00	-11.00	442	0.15	OK			1	1	1	442	0.15					442	0.15
347	D	10/4/05	1635	8	5	1	-8/102	102	-8	1.00	-8.00	487	0.15	OK			1	1	1	487	0.15					487	0.15
348	D	10/4/05	1635	8	20	1	16/219	219	16	1.00	16.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
349	D	10/4/05	1635	8	17.5	1	16/219	219	16	1.00	16.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
350	D	10/4/05	1635	8	20	1	-20/229	229	-20	1.00	-20.00	1,877	0.15	OK			1	1	1	1,877	0.15					1,877	0.15
355	D	8/4/05	1635	8	10	1	-14/250	250	-14	1.00	-14.00	1,100	0.15	OK			1	1	1	1,100	0.15					1,100	0.15
356	D	8/4/05	1635	8	12	1	-18/266	266	-18	1.00	-18.00	1,234	0.15	OK			1	1	1	1,234	0.15					1,234	0.15
357	D	10/25/05	1635	8	2	1	13.5/66	66	13.5	1.00	13.50	1,776	0.15	OK			1	1	1	1,776	0.15					1,776	0.15
359	D	10/13/05	1635	8	4	1	9/96	96	9	1.00	9.00	1,441	0.15	OK			1	1	1	1,441	0.15					1,441	0.15
360	D	10/13/05	1635	8	4	1	12/91	91	12	1.00	12.00	1,969	0.15	OK			1	1	1	1,969	0.15					1,969	0.15
361	D	10/13/05	1635	8	2.5	1	-6/90	90	-6	1.00	-6.00	258	0.15	OK			1	1	1	258	0.15					258	0.15
362	D	10/13/05	1635	8	5	1	14/168	168	14	1.00	14.00	1,653	0.15	OK			1	1	1	1,653	0.15					1,653	0.15
363	D	9/23/05	1635	8	30	1	-20/862	862	-20	1.00	-20.00	4,140	0.15	OK			1	1	1	4,140	0.15					4,140	0.15
364	D	9/23/05	1635	8	30	1	-8/862	862	-8	1.00	-8.00	4,611	0.15	OK			1	1	1	4,611	0.15					4,611	0.15
365	D	10/6/05	1635	8	30	1	-7/900	900	-7	1.00	-7.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
366	D	10/6/05	1635	8	30	1	-9/900	900	-9	1.00	-9.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
367	D	9/23/05	1635	8	28	1	-16/800	800	-16	1.00	-16.00	3,959	0.15	OK			1	1	1	3,959	0.15					3,959	0.15
368	D	10/7/05	1635	8	28	1	-16/800	800	-16	1.00	-16.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
369	D	10/6/05	1635	8	4	1	-16/148	148	-16	1.00	-16.00	354	0.15	OK			1	1	1	354	0.15					354	0.15
370	D	10/6/05	1635	8	4	1	-9/148	148	-9	1.00	-9.00	427	0.15	OK			1	1	1	427	0.15					427	0.15
371	D	10/6/05	1635	8	2	1	9/72	72	9	1.00	9.00	931	0.15	OK			1	1	1	931	0.15					931	0.15
380	D	9/28/05	1635	8	2.5	1	5/114	114	5	1.00	5.00	595	0.15	OK			1	1	1	595	0.15					595	0.15
381	D	9/27/05	1635	8	4	1	23/154	154	23	1.00	23.00	2,270	0.15	OK			1	1	1	2,270	0.15					2,270	0.15
382	D	9/27/05	1635	8	4	1	21/128	128	21	1.00	21.00	2,557	0.15	OK			1	1	1	2,557	0.15					2,557	0.15
383	D	9/28/05	1635	8	4	1	-9/70	70	-9	1.00	-9.00	348	0.15	OK			1	1	1	348	0.15					348	0.15
384	D	9/28/05	1635	8	4	1	3/68	68	3	1.00	3.00	953	0.15	OK			1	1	1	953	0.15					953	0.15
385	D	9/28/05	1635	8	4	1	3/54	54	3	1.00	3.00	1,049	0.15	OK			1	1	1	1,049	0.15					1,049	0.15
386	D	9/28/05	1635	8	4	1	12/128	128	12	1.00	12.00	1,441	0.15	OK			1	1	1	1,441	0.15					1,441	0.15
387	D	9/28/05	1635	8	4	1	6/54	54	6	1.00	6.00	1,663	0.15	OK			1	1	1	1,663	0.15					1,663	0.15
388	D	10/4/05	1635	8	3	1	-6/160	160	-6	1.00	-6.00	373	0.15	OK			1	1	1	373	0.15					373	0.15
389	D	10/4/05	1635	8	3	1	-6/160	160	-6	1.00	-6.00	373	0.15	OK			1	1	1	373	0.15					373	0.15
390	D	10/4/05	1635	8	4	1	-6/122	122	-6	1.00	-6.00	459	0.15	OK			1	1	1	459	0.15					459	0.15
391	D	10/4/05	1635	8	4	1	-6/122	122	-6	1.00	-6.00	459	0.15	OK			1	1	1	459	0.15					459	0.15
392	D	9/29/05	1635	8	4	1	3/108	108	3	1.00	3.00	832	0.15	OK			1	1	1	832	0.15					832	0.15
393	D	9/29/05	1635	8	5	1	32/136	136	32	1.00	32.00	5,725	0.15	OK			1	1	1	5,725	0.15					5,725	0.15
394	D	10/7/05	1635	8	2	1	24/66	66	24	1.00	24.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
395	D	10/7/05	1635	8	3	1	51/176	176	51	1.00	51.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
396	D	10/11/05	1635	8	5	1	56/152	152	56	1.00	56.00	491	0.15	OK			1	1	1	491	0.15					491	0.15
397	D	10/11/05	1635	8	5	1	-8/152	152	-8	1.00	-8.00	562	0.15	OK			1	1	1	562	0.15					562	0.15
398	D	10/11/05	1635	8	5	1	42/152	152	42	1.00	42.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
399	D	10/11/05	1635	8	5	1	16/152	152	16	1.00	16.00	1,981	0.15	OK			1	1	1	1,981	0.15					1,981	0.15
400	D	10/11/05	1635	8	5	1	22/152	152	22	1.00	22.00	2,733	0.15	OK			1	1	1	2,733	0.15					2,733	0.15

Obs	Invoice Letter	Test Date	EFLCH	Man EER	Ton	A/C Qty	Ref/Var	Ref Cap	Ref Adj.	RCA Site Flag	RCA Chg Adj	Invoiced RCA kWh	Invoiced RCA kW	Duplication Code	Reason for Dupe	Notes	RCA Charge = 0 (if chg=0 then =0)	RCA Dupe (if not a dupe then =1)	RCA Verification Multiplier (Charge x	Verified RCA kWh	Verified RCA kW	RCA kWh Dupes	RCA kW Dupes	RCA kWh Zeroes	RCA kW Zeroes	sum of verified, dupes, zeroes	Verified RCA kW
401	D	10/12/05	1635	8	5	1	48/152	152	48	1.00	48.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
402	D	10/12/05	1635	8	5	1	32/152	152	32	1.00	32.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
403	D	10/12/05	1635	8	5	1	10/152	152	10	1.00	10.00	1,428	0.15	OK			1	1	1	1,428	0.15					1,428	0.15
404	D	10/12/05	1635	8	5	1	-59/152	152	-59	1.00	-59.00	1,895	0.15	OK			1	1	1	1,895	0.15					1,895	0.15
405	D	10/27/05	1635	8	2	1	2/67	67	2	1.00	2.00	423	0.15	OK			1	1	1	423	0.15					423	0.15
406	D	10/26/05	1635	8	15	1	20/426	426	20	1.00	20.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
409	D	10/19/05	1635	8	2.5	1	22/90	90	22	1.00	22.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
410	D	10/19/05	1635	8	5	1	70/158	158	70	1.00	70.00	1,145	0.15	OK			1	1	1	1,145	0.15					1,145	0.15
411	D	8/9/05	1635	8	5	1	6/152	152	6	1.00	6.00	1,146	0.15	OK			1	1	1	1,146	0.15					1,146	0.15
412	D	8/9/05	1635	8	5	1	56/152	152	56	1.00	56.00	1,308	0.15	OK			1	1	1	1,308	0.15					1,308	0.15
416	D	12/15/05	1635	8	3	1	6/107	107	6	1.00	6.00	790	0.15	OK			1	1	1	790	0.15					790	0.15
419	D	5/2/06	1635	8	5	1	-6/184	184	-6	1.00	-6.00	644	0.15	OK			1	1	1	644	0.15					644	0.15
422	D	12/1/05	1635	8	3	1	-2/112	112	-2	1.00	-2.00	431	0.15	OK			1	1	1	431	0.15					431	0.15
424	D	12/1/05	1635	8	3	1	7.5/112	112	7.5	1.00	7.50	866	0.15	OK			1	1	1	866	0.15					866	0.15
425	D	12/1/05	1635	8	3.5	1	10/128	128	10	1.00	10.00	1,108	0.15	OK			1	1	1	1,108	0.15					1,108	0.15
427	D	12/15/05	1635	8	3.5	1	-2/128	128	-2	1.00	-2.00	512	0.15	OK			1	1	1	512	0.15					512	0.15
428	D	12/15/05	1635	8	3	1	6/112	112	6	1.00	6.00	774	0.15	OK			1	1	1	774	0.15					774	0.15
429	D	12/1/05	1635	8	5	1	10/116	116	10	1.00	10.00	1,693	0.15	OK			1	1	1	1,693	0.15					1,693	0.15
430	D	12/1/05	1635	8	5	1	8/168	168	8	1.00	8.00	1,227	0.15	OK			1	1	1	1,227	0.15					1,227	0.15
431	D	12/15/05	1635	8	4	1	-4/144	144	-4	1.00	-4.00	533	0.15	OK			1	1	1	533	0.15					533	0.15
432	D	12/15/05	1635	8	5	1	-4/168	168	-4	1.00	-4.00	687	0.15	OK			1	1	1	687	0.15					687	0.15
433	D	12/1/05	1635	8	3	1	-2.5/86	86	-2.5	1.00	-2.50	396	0.15	OK			1	1	1	396	0.15					396	0.15
435	D	12/15/05	1635	8	5	1	-8/182	182	-8	1.00	-8.00	594	0.15	OK			1	1	1	594	0.15					594	0.15
436	D	12/15/05	1635	8	5	1	6/182	182	6	1.00	6.00	1,086	0.15	OK			1	1	1	1,086	0.15					1,086	0.15
438	D	12/15/05	1635	8	5	1	8/186	186	8	1.00	8.00	1,181	0.15	OK			1	1	1	1,181	0.15					1,181	0.15
439	D	12/15/05	1635	8	5	1	-4/186	186	-4	1.00	-4.00	699	0.15	OK			1	1	1	699	0.15					699	0.15
440	D	12/15/05	1635	8	4	1	-2.5/168	168	-2.5	1.00	-2.50	588	0.15	OK			1	1	1	588	0.15					588	0.15
443	D	12/15/05	1635	8	2.5	1	-5/90	90	-5	1.00	-5.00	276	0.15	OK			1	1	1	276	0.15					276	0.15
444	D	12/15/05	1635	8	28	1	-4.5/812	812	-4.5	1.00	-4.50	818	0.15	OK			1	1	1	818	0.15					818	0.15
445	D	12/15/05	1635	8	4	1	7/152	152	7	1.00	7.00	969	0.15	OK			1	1	1	969	0.15					969	0.15
447	D	5/5/06	1635	8	4	1	15/118	118	15	1.00	15.00	1,895	0.15	OK			1	1	1	1,895	0.15					1,895	0.15
448	D	12/15/05	1635	8	5	1	-2.5/186	186	-2.5	1.00	-2.50	744	0.15	OK			1	1	1	744	0.15					744	0.15
449	D	12/15/05	1635	8	5	1	11/186	186	11	1.00	11.00	1,351	0.15	OK			1	1	1	1,351	0.15					1,351	0.15
450	D	12/15/05	1635	8	5	1	-3/186	186	-3	1.00	-3.00	728	0.15	OK			1	1	1	728	0.15					728	0.15
451	D	12/5/05	1635	8	5	1	-7/185	185	-7	1.00	-7.00	620	0.15	OK			1	1	1	620	0.15					620	0.15
452	D	12/5/05	1635	8	5	1	-10/185	185	-10	1.00	-10.00	557	0.15	OK			1	1	1	557	0.15					557	0.15
454	D	11/21/05	1635	8	5	1	10/217	217	10	1.00	10.00	1,212	0.15	OK			1	1	1	1,212	0.15					1,212	0.15
455	D	10/14/05	1635	8	10	1	10/128	128	10	1.00	10.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
456	D	9/29/05	1635	8	3	1	-5/86	86	-5	1.00	-5.00	326	0.15	OK			1	1	1	326	0.15					326	0.15
457	D	9/29/05	1635	8	4	1	-9/115	115	-9	1.00	-9.00	390	0.15	OK			1	1	1	390	0.15					390	0.15
458	D	9/29/05	1635	8	4	1	-5/98	98	-5	1.00	-5.00	454	0.15	OK			1	1	1	454	0.15					454	0.15
459	D	9/29/05	1635	8	4	1	-3/115	115	-3	1.00	-3.00	540	0.15	OK			1	1	1	540	0.15					540	0.15
460	D	9/29/05	1635	8	5	1	-7/144	144	-7	1.00	-7.00	576	0.15	OK			1	1	1	576	0.15					576	0.15
461	D	10/14/05	1635	8	4	1	23/105	105	23	1.00	23.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
462	D	10/14/05	1635	8	10	1	7/165	165	7	1.00	7.00	2,350	0.15	OK			1	1	1	2,350	0.15					2,350	0.15
469	D	10/24/05	1635	8	2	1	6/100	100	6	1.00	6.00	544	0.15	OK			1	1	1	544	0.15					544	0.15
470	D	10/24/05	1635	8	4	1	-2/189	189	-2	1.00	-2.00	608	0.15	OK			1	1	1	608	0.15					608	0.15
471	D	10/24/05	1635	8	4	1	3/189	189	3	1.00	3.00	754	0.15	OK			1	1	1	754	0.15					754	0.15
472	D	10/24/05	1635	8	4	1	5.5/189	189	5.5	1.00	5.50	841	0.15	OK			1	1	1	841	0.15					841	0.15
473	D	10/24/05	1635	8	5	1	5/224	224	5	1.00	5.00	994	0.15	OK			1	1	1	994	0.15					994	0.15
474	D	10/25/05	1635	8	2.5	1	-8/84	84	-8	1.00	-8.00	228	0.15	OK			1	1	1	228	0.15					228	0.15
475	D	10/25/05	1635	8	4	1	-3/202	202	-3	1.00	-3.00	589	0.15	OK			1	1	1	589	0.15					589	0.15
476	D	10/25/05	1635	8	4	1	4/89	89	4	1.00	4.00	960	0.15	OK			1	1	1	960	0.15					960	0.15
477	D	10/25/05	1635	8	2	1	-7/105	105	-7	1.00	-7.00	207	0.15	OK			1	1	1	207	0.15					207	0.15
478	D	10/25/05	1635	8	4	1	6.1/89	89	6.1	1.00	6.10	1,169	0.15	OK			1	1	1	1,169	0.15					1,169	0.15
479	D	10/25/05	1635	8	4	1	2/116	116	2	1.00	2.00	762	0.15	OK			1	1	1	762	0.15					762	0.15
480	D	10/25/05	1635	8	10	1	37/152	152	37	1.00	37.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
481	D	10/25/05	1635	8	10	1	17/176	176	17	1.00	17.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
482	D	10/25/05	1635	8	4	1	27/152	152	27	1.00	27.00	2,853	0.15	OK			1	1	1	2,853	0.15					2,853	0.15
483	D	10/25/05	1635	8	10	1	32/176	176	32	1.00	32.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
484	D	10/26/05	1635	8	5	1	3/224	224	3	1.00	3.00	923	0.15	OK			1	1	1	923	0.15					923	0.15
489	D	12/15/05	1635	8	3	1	-2.5/102	102	-2.5	1.00	-2.50	410	0.15	OK			1	1	1	410	0.15					410	0.15
497	D	10/5/05	1635	8	30	1	20/768	768	20	1.00	20.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
498	D	10/5/05	1635	8	30	1	17/768	768	17	1.00	17.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
500	D	12/15/05	1635	8	4	1	-5/144	144	-5	1.00	-5.00	507	0.15	OK			1	1	1	507	0.15					507	0.15
501	D	12/15/05	1635	8	4	1	11/144	144	11	1.00	11.00	1,248	0.15	OK			1	1	1	1,248	0.15					1,248	0.15
505	D	12/15/05	1635	8	5	1	6.5/182	182	6.5	1.00	6.50	1,111	0.15	OK			1	1	1	1,111	0.15					1,111	0.15
506	D	5/3/06	1635	8	3	1	7/86	86	7	1.00	7.00	976	0.15	OK			1	1	1	976	0.15					976	0.15
511	D	5/8/06	1635	8	2	1	8/84	84	8	1.00	8.00	730	0.15	OK			1	1	1	730	0.15					730	0.15
512	D	5/9/06	1635	8	4	1	-18/148	148	-18	1.00	-18.00	348	0.15	OK			1	1	1	348	0.15					348	0.15

Obs	Invoice Letter	Test Date	EFLCH	Man EER	Ton	A/C Qty	Ref/Var	Ref Cap	Ref Adj.	RCA Site Flag	RCA Chg Adj	Invoiced RCA kWh	Invoiced RCA kW	Duplication Code	Reason for Dupe	Notes	RCA Charge = 0 (if chg=0 then =0)	RCA Dupe (if not a dupe then =1)	RCA Verification Multiplier (Charge x	Verified RCA kWh	Verified RCA kW	RCA kWh Dupes	RCA kW Dupes	RCA kWh Zeroes	RCA kW Zeroes	sum of verified, dupes, zeroes	Verified RCA kW
513	D	5/9/06	1635	8	2	1	2/76	76	2	1.00	2.00	411	0.15	OK			1	1	1	411	0.15					411	0.15
514	D	5/12/06	1635	8	10	1	16/153	153	16	1.00	16.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
517	D	4/18/06	1635	8	3	1	6/107	107	6	1.00	6.00	790	0.15	OK			1	1	1	790	0.15					790	0.15
518	D	4/18/06	1635	8	3	1	10/107	107	10	1.00	10.00	1,078	0.15	OK			1	1	1	1,078	0.15					1,078	0.15
519	D	4/19/06	1635	8	3	1	-8/107	107	-8	1.00	-8.00	297	0.15	OK			1	1	1	297	0.15					297	0.15
520	D	4/19/06	1635	8	3	1	-10/107	107	-10	1.00	-10.00	276	0.15	OK			1	1	1	276	0.15					276	0.15
521	D	4/19/06	1635	8	3	1	-10/107	107	-10	1.00	-10.00	276	0.15	OK			1	1	1	276	0.15					276	0.15
522	D	4/19/06	1635	8	3	1	-10/107	107	-10	1.00	-10.00	276	0.15	OK			1	1	1	276	0.15					276	0.15
523	D	4/19/06	1635	8	3	1	8/100	100	8	1.00	8.00	965	0.15	OK			1	1	1	965	0.15					965	0.15
524	D	4/20/06	1635	8	3	1	-10/107	107	-10	1.00	-10.00	276	0.15	OK			1	1	1	276	0.15					276	0.15
525	D	5/5/06	1635	8	3	1	-13/100	100	-13	1.00	-13.00	261	0.15	OK			1	1	1	261	0.15					261	0.15
526	D	5/5/06	1635	8	3	1	6/100	100	6	1.00	6.00	817	0.15	OK			1	1	1	817	0.15					817	0.15
527	D	5/4/06	1635	8	3	1	-10/100	100	-10	1.00	-10.00	270	0.15	OK			1	1	1	270	0.15					270	0.15
528	D	5/4/06	1635	8	3	1	5/100	100	5	1.00	5.00	751	0.15	OK			1	1	1	751	0.15					751	0.15
529	D	5/4/06	1635	8	3	1	8/100	100	8	1.00	8.00	965	0.15	OK			1	1	1	965	0.15					965	0.15
530	D	5/4/06	1635	8	3	1	10/100	100	10	1.00	10.00	1,138	0.15	OK			1	1	1	1,138	0.15					1,138	0.15
536	D	10/28/05	1635	8	4	1	18/150	150	18	1.00	18.00	1,788	0.15	OK			1	1	1	1,788	0.15					1,788	0.15
537	D	10/28/05	1635	8	4	1	27/150	150	27	1.00	27.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
538	D	10/28/05	1635	8	4	1	21.25/150	150	21.25	1.00	21.25	2,133	0.15	OK			1	1	1	2,133	0.15					2,133	0.15
539	D	10/28/05	1635	8	4	1	10.25/150	150	10.25	1.00	10.25	1,167	0.15	OK			1	1	1	1,167	0.15					1,167	0.15
540	D	9/22/05	1635	8	4	1	-8/110	110	-8	1.00	-8.00	401	0.15	OK			1	1	1	401	0.15					401	0.15
542	D	12/15/05	1635	8	3	1	4/84	84	4	1.00	4.00	736	0.15	OK			1	1	1	736	0.15					736	0.15
545	D	12/15/05	1635	8	3	1	5/84	84	5	1.00	5.00	813	0.15	OK			1	1	1	813	0.15					813	0.15
547	D	12/15/05	1635	8	3	1	-4/84	84	-4	1.00	-4.00	348	0.15	OK			1	1	1	348	0.15					348	0.15
551	D	12/15/05	1635	8	3	1	4/84	84	4	1.00	4.00	736	0.15	OK			1	1	1	736	0.15					736	0.15
563	D	12/12/05	1635	8	3.5	1	3/140	140	3	1.00	3.00	690	0.15	OK			1	1	1	690	0.15					690	0.15
564	D	12/12/05	1635	8	3.5	1	-5/140	140	-5	1.00	-5.00	441	0.15	OK			1	1	1	441	0.15					441	0.15
565	D	12/12/05	1635	8	3.5	1	-4/140	140	-4	1.00	-4.00	464	0.15	OK			1	1	1	464	0.15					464	0.15
568	D	12/12/05	1635	8	3.5	1	2/140	140	2	1.00	2.00	651	0.15	OK			1	1	1	651	0.15					651	0.15
570	D	12/12/05	1635	8	3.5	1	8/140	140	8	1.00	8.00	930	0.15	OK			1	1	1	930	0.15					930	0.15
574	D	12/12/05	1635	8	3.5	1	-4/150	150	-4	1.00	-4.00	471	0.15	OK			1	1	1	471	0.15					471	0.15
576	D	12/12/05	1635	8	3.5	1	5/140	140	5	1.00	5.00	778	0.15	OK			1	1	1	778	0.15					778	0.15
577	D	4/24/06	1635	8	4	1	11/100	100	11	1.00	11.00	1,647	0.15	OK			1	1	1	1,647	0.15					1,647	0.15
578	D	11/21/05	1635	8	10	1	10/288	288	10	1.00	10.00	2,204	0.15	OK			1	1	1	2,204	0.15					2,204	0.15
579	D	10/26/05	1635	8	3	1	3/102	102	3	1.00	3.00	632	0.15	OK			1	1	1	632	0.15					632	0.15
580	D	10/26/05	1635	8	3	1	8.3/102	102	8.3	1.00	8.30	976	0.15	OK			1	1	1	976	0.15					976	0.15
581	D	10/26/05	1635	8	3.5	1	2.4/112	112	2.4	1.00	2.40	690	0.15	OK			1	1	1	690	0.15					690	0.15
582	D	10/26/05	1635	8	2	1	-2/96	96	-2	1.00	-2.00	281	0.15	OK			1	1	1	281	0.15					281	0.15
583	D	10/26/05	1635	8	3	1	9/102	102	9	1.00	9.00	1,033	0.15	OK			1	1	1	1,033	0.15					1,033	0.15
589	D	12/13/05	1635	8	3	1	2/84	84	2	1.00	2.00	604	0.15	OK			1	1	1	604	0.15					604	0.15
590	D	12/13/05	1635	8	3.5	1	-3/191	191	-3	1.00	-3.00	512	0.15	OK			1	1	1	512	0.15					512	0.15
591	D	12/13/05	1635	8	3.5	1	-6/144	144	-6	1.00	-6.00	423	0.15	OK			1	1	1	423	0.15					423	0.15
592	D	12/13/05	1635	8	3	1	3/84	84	3	1.00	3.00	667	0.15	OK			1	1	1	667	0.15					667	0.15
594	D	12/13/05	1635	8	3.5	1	-3/150	150	-3	1.00	-3.00	495	0.15	OK			1	1	1	495	0.15					495	0.15
595	D	12/13/05	1635	8	2.5	1	10/98	98	10	1.00	10.00	965	0.15	OK			1	1	1	965	0.15					965	0.15
596	D	12/13/05	1635	8	3.5	1	-4/150	150	-4	1.00	-4.00	471	0.15	OK			1	1	1	471	0.15					471	0.15
597	D	12/13/05	1635	8	3.5	1	10/191	191	10	1.00	10.00	894	0.15	OK			1	1	1	894	0.15					894	0.15
598	D	12/13/05	1635	8	3.5	1	9/150	150	9	1.00	9.00	953	0.15	OK			1	1	1	953	0.15					953	0.15
601	D	12/14/05	1635	8	3	1	-5.5/112	112	-5.5	1.00	-5.50	345	0.15	OK			1	1	1	345	0.15					345	0.15
602	D	12/14/05	1635	8	3	1	-2/140	140	-2	1.00	-2.00	443	0.15	OK			1	1	1	443	0.15					443	0.15
603	D	12/14/05	1635	8	3.5	1	-3/144	144	-3	1.00	-3.00	492	0.15	OK			1	1	1	492	0.15					492	0.15
605	D	12/14/05	1635	8	3	1	11/112	112	11	1.00	11.00	1,122	0.15	OK			1	1	1	1,122	0.15					1,122	0.15
610	D	12/15/05	1635	8	3.5	1	-8.5/140	140	-8.5	1.00	-8.50	374	0.15	OK			1	1	1	374	0.15					374	0.15
611	D	12/15/05	1635	8	3.5	1	-3/191	191	-3	1.00	-3.00	512	0.15	OK			1	1	1	512	0.15					512	0.15
612	D	12/15/05	1635	8	3.5	1	11/191	191	11	1.00	11.00	934	0.15	OK			1	1	1	934	0.15					934	0.15
614	D	12/15/05	1635	8	3.5	1	12/140	140	12	1.00	12.00	1,180	0.15	OK			1	1	1	1,180	0.15					1,180	0.15
615	D	1/17/06	1635	8	4	1	4/88	88	4	1.00	4.00	964	0.15	OK			1	1	1	964	0.15					964	0.15
616	D	1/17/06	1635	8	4	1	3/160	160	3	1.00	3.00	772	0.15	OK			1	1	1	772	0.15					772	0.15
617	D	1/17/06	1635	8	4	1	6/88	88	6	1.00	6.00	1,166	0.15	OK			1	1	1	1,166	0.15					1,166	0.15
618	D	1/17/06	1635	8	4	1	6/88	88	6	1.00	6.00	1,166	0.15	OK			1	1	1	1,166	0.15					1,166	0.15
619	D	1/17/06	1635	8	4	1	4/88	88	4	1.00	4.00	964	0.15	OK			1	1	1	964	0.15					964	0.15
620	D	1/17/06	1635	8	4	1	2/54.4	54.4	2	1.00	2.00	897	0.15	OK			1	1	1	897	0.15					897	0.15
621	D	1/17/06	1635	8	4	1	8/88	88	8	1.00	8.00	1,408	0.15	OK			1	1	1	1,408	0.15					1,408	0.15
622	D	1/17/06	1635	8	4	1	8/88	88	8	1.00	8.00	1,408	0.15	OK			1	1	1	1,408	0.15					1,408	0.15
623	D	1/17/06	1635	8	4	1	32/88	88	32	1.00	32.00	1,145	0.15	OK			1	1	1	1,145	0.15					1,145	0.15
624	D	1/17/06	1635	8	4	1	4/88	88	4	1.00	4.00	964	0.15	OK			1	1	1	964	0.15					964	0.15
625	D	1/17/06	1635	8	4	1	8/88	88	8	1.00	8.00	1,408	0.15	OK			1	1	1	1,408	0.15					1,408	0.15
626	D	1/17/06	1635	8	4	1	12/148	148	12	1.00	12.00	1,298	0.15	OK			1	1	1	1,298	0.15					1,298	0.15
627	D	1/17/06	1635	8	4	1	24/160	160	24	1.00	24.00	2,282	0.15	OK			1	1	1	2,282	0.15					2,282	0.15
628	D	1/17/06	1635	8	4	1	24/152	152	24	1.00	24.00	2,432	0.15	OK			1	1	1	2,432	0.15					2,432	0.15

Obs	Invoice Letter	Test Date	EFLCH	Man EER	Ton	A/C Qty	Ref/Var	Ref Cap	Ref Adj.	RCA Site Flag	RCA Chg Adj	Invoiced RCA kWh	Invoiced RCA kW	Duplication Code	Reason for Dupe	Notes	RCA Charge = 0 (if chg=0 then =0)	RCA Dupe (if not a dupe then =1)	RCA Verification Multiplier (Charge x	Verified RCA kWh	Verified RCA kW	RCA kWh Dupes	RCA kW Dupes	RCA kWh Zeroes	RCA kW Zeroes	sum of verified, dupes, zeroes	Verified RCA kW
629	D	1/17/06	1635	8	4	1	8/88	88	8	1.00	8.00	1,408	0.15	OK			1	1	1	1,408	0.15					1,408	0.15
630	D	1/17/06	1635	8	4	1	32/152	152	32	1.00	32.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
631	D	1/17/06	1635	8	4	1	24/148	148	24	1.00	24.00	2,518	0.15	OK			1	1	1	2,518	0.15					2,518	0.15
632	D	1/17/06	1635	8	3	1	26/63	63	26	1.00	26.00	1,308	0.15	OK			1	1	1	1,308	0.15					1,308	0.15
633	D	1/17/06	1635	8	3	1	-18/63	63	-18	1.00	-18.00	579	0.15	OK			1	1	1	579	0.15					579	0.15
634	D	1/23/06	1635	8	4	1	12/140	140	12	1.00	12.00	1,349	0.15	OK			1	1	1	1,349	0.15					1,349	0.15
635	D	1/23/06	1635	8	4	1	17/140	140	17	1.00	17.00	1,809	0.15	OK			1	1	1	1,809	0.15					1,809	0.15
636	D	1/23/06	1635	8	4	1	11/150	150	11	1.00	11.00	1,217	0.15	OK			1	1	1	1,217	0.15					1,217	0.15
637	D	1/23/06	1635	8	4	1	16/150	150	16	1.00	16.00	1,603	0.15	OK			1	1	1	1,603	0.15					1,603	0.15
638	D	1/23/06	1635	8	4	1	48/140	140	48	1.00	48.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
639	D	1/23/06	1635	8	4	1	11/140	140	11	1.00	11.00	1,271	0.15	OK			1	1	1	1,271	0.15					1,271	0.15
640	D	1/23/06	1635	8	4	1	11/140	140	11	1.00	11.00	1,271	0.15	OK			1	1	1	1,271	0.15					1,271	0.15
641	D	1/17/06	1635	8	4	1	24/88	88	24	1.00	24.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
644	D	1/17/06	1635	8	4	1	4.4/88	88	4.4	1.00	4.40	1,002	0.15	OK			1	1	1	1,002	0.15					1,002	0.15
646	D	1/17/06	1635	8	5	1	6/128	128	6	1.00	6.00	1,220	0.15	OK			1	1	1	1,220	0.15					1,220	0.15
647	D	1/17/06	1635	8	4	1	8/88	88	8	1.00	8.00	1,408	0.15	OK			1	1	1	1,408	0.15					1,408	0.15
648	D	1/17/06	1635	8	4	1	37/88	88	37	1.00	37.00	1,472	0.15	OK			1	1	1	1,472	0.15					1,472	0.15
649	D	1/17/06	1635	8	4	1	10/88	88	10	1.00	10.00	1,697	0.15	OK			1	1	1	1,697	0.15					1,697	0.15
650	D	1/17/06	1635	8	4	1	10/88	88	10	1.00	10.00	1,697	0.15	OK			1	1	1	1,697	0.15					1,697	0.15
651	D	1/17/06	1635	8	7	1	14/154	154	14	1.00	14.00	2,464	0.15	OK			1	1	1	2,464	0.15					2,464	0.15
692	D	1/5/06	1635	8	4	1	13/128	128	13	1.00	13.00	1,537	0.15	OK			1	1	1	1,537	0.15					1,537	0.15
693	D	1/4/06	1635	8	5	1	-48/128	128	-48	1.00	-48.00	1,746	0.15	OK			1	1	1	1,746	0.15					1,746	0.15
694	D	1/4/06	1635	8	5	1	8/128	128	8	1.00	8.00	1,390	0.15	OK			1	1	1	1,390	0.15					1,390	0.15
695	D	1/4/06	1635	8	5	1	7/128	128	7	1.00	7.00	1,302	0.15	OK			1	1	1	1,302	0.15					1,302	0.15
696	D	1/4/06	1635	8	5	1	-16/128	128	-16	1.00	-16.00	435	0.15	OK			1	1	1	435	0.15					435	0.15
697	D	1/4/06	1635	8	5	1	7/128	128	7	1.00	7.00	1,302	0.15	OK			1	1	1	1,302	0.15					1,302	0.15
698	D	1/4/06	1635	8	3	1	9/70	70	9	1.00	9.00	1,438	0.15	OK			1	1	1	1,438	0.15					1,438	0.15
699	D	1/4/06	1635	8	5	1	5/128	128	5	1.00	5.00	1,142	0.15	OK			1	1	1	1,142	0.15					1,142	0.15
707	D	3/27/06	1635	8	4	1	16/172	172	16	1.00	16.00	1,433	0.15	OK			1	1	1	1,433	0.15					1,433	0.15
708	D	3/27/06	1635	8	4	1	24/172	172	24	1.00	24.00	2,096	0.15	OK			1	1	1	2,096	0.15					2,096	0.15
709	D	3/27/06	1635	8	4	1	16/172	172	16	1.00	16.00	1,433	0.15	OK			1	1	1	1,433	0.15					1,433	0.15
710	D	3/27/06	1635	8	4	1	24/172	172	24	1.00	24.00	2,096	0.15	OK			1	1	1	2,096	0.15					2,096	0.15
711	D	3/27/06	1635	8	4	1	24/172	172	24	1.00	24.00	2,096	0.15	OK			1	1	1	2,096	0.15					2,096	0.15
712	D	3/27/06	1635	8	4	1	12/172	172	12	1.00	12.00	1,181	0.15	OK			1	1	1	1,181	0.15					1,181	0.15
713	D	3/27/06	1635	8	4	1	8/172	172	8	1.00	8.00	973	0.15	OK			1	1	1	973	0.15					973	0.15
245	D	1/9/06	1635	8	4	1	17/190	190	17	1.00	17.00	1,391	0.15	OK			1	1	1	1,391	0.15					1,391	0.15
827	D	12/14/05	1635	8	4	1	-4/160	160	-4	1.00	-4.00	545	0.15	OK			1	1	1	545	0.15					545	0.15
828	D	12/14/05	1635	8	4	1	8/128	128	8	1.00	8.00	1,112	0.15	OK			1	1	1	1,112	0.15					1,112	0.15
830	D	12/14/05	1635	8	4	1	8/160	160	8	1.00	8.00	1,002	0.15	OK			1	1	1	1,002	0.15					1,002	0.15
831	D	12/14/05	1635	8	4	1	28/160	160	28	1.00	28.00	2,793	0.15	OK			1	1	1	2,793	0.15					2,793	0.15
832	D	12/14/05	1635	8	4	1	10/152	152	10	1.00	10.00	1,143	0.15	OK			1	1	1	1,143	0.15					1,143	0.15
833	D	12/14/05	1635	8	4	1	5/161.6	161.6	5	1.00	5.00	854	0.15	OK			1	1	1	854	0.15					854	0.15
834	D	12/14/05	1635	8	4	1	7/160	160	7	1.00	7.00	951	0.15	OK			1	1	1	951	0.15					951	0.15
842	D	12/15/05	1635	8	4	1	-6/161.6	161.6	-6	1.00	-6.00	498	0.15	OK			1	1	1	498	0.15					498	0.15
843	D	12/15/05	1635	8	4	1	8/160	160	8	1.00	8.00	1,002	0.15	OK			1	1	1	1,002	0.15					1,002	0.15
844	D	12/15/05	1635	8	4	1	10/160	160	10	1.00	10.00	1,112	0.15	OK			1	1	1	1,112	0.15					1,112	0.15
845	D	12/15/05	1635	8	4	1	14/160	160	14	1.00	14.00	1,369	0.15	OK			1	1	1	1,369	0.15					1,369	0.15
846	D	12/19/05	1635	8	4	1	4/160	160	4	1.00	4.00	813	0.15	OK			1	1	1	813	0.15					813	0.15
847	D	12/19/05	1635	8	4	1	7/153.6	153.6	7	1.00	7.00	965	0.15	OK			1	1	1	965	0.15					965	0.15
848	D	12/19/05	1635	8	4	1	5/169.6	169.6	5	1.00	5.00	844	0.15	OK			1	1	1	844	0.15					844	0.15
849	D	12/19/05	1635	8	4	1	8/153.6	153.6	8	1.00	8.00	1,019	0.15	OK			1	1	1	1,019	0.15					1,019	0.15
859	D	12/14/05	1635	8	4	1	5/128	128	5	1.00	5.00	914	0.15	OK			1	1	1	914	0.15					914	0.15
870	D	12/15/05	1635	8	4	1	5/160	160	5	1.00	5.00	856	0.15	OK			1	1	1	856	0.15					856	0.15
871	D	12/15/05	1635	8	4	1	10/160	160	10	1.00	10.00	1,112	0.15	OK			1	1	1	1,112	0.15					1,112	0.15
876	D	12/15/05	1635	8	4	1	5/160	160	5	1.00	5.00	856	0.15	OK			1	1	1	856	0.15					856	0.15
885	D	12/14/05	1635	8	4	1	-11/161.6	161.6	-11	1.00	-11.00	410	0.15	OK			1	1	1	410	0.15					410	0.15
886	D	12/14/05	1635	8	4	1	-26/106	106	-26	1.00	-26.00	585	0.15	OK			1	1	1	585	0.15					585	0.15
887	D	12/14/05	1635	8	2	1	5/65	65	5	1.00	5.00	627	0.15	OK			1	1	1	627	0.15					627	0.15
888	D	12/14/05	1635	8	4	1	31/95	95	31	1.00	31.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
889	D	12/14/05	1635	8	4	1	27/95	95	27	1.00	27.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
890	D	12/14/05	1635	8	4	1	23/106	106	23	1.00	23.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
891	D	12/14/05	1635	8	4	1	5/95	95	5	1.00	5.00	1,024	0.15	OK			1	1	1	1,024	0.15					1,024	0.15
892	D	12/14/05	1635	8	4	1	8/95	95	8	1.00	8.00	1,332	0.15	OK			1	1	1	1,332	0.15					1,332	0.15
893	D	12/14/05	1635	8	4	1	10/95	95	10	1.00	10.00	1,585	0.15	OK			1	1	1	1,585	0.15					1,585	0.15
894	D	12/14/05	1635	8	4	1	12/95	95	12	1.00	12.00	1,882	0.15	OK			1	1	1	1,882	0.15					1,882	0.15
895	D	12/15/05	1635	8	4	1	-7/83.2	83.2	-7	1.00	-7.00	380	0.15	OK			1	1	1	380	0.15					380	0.15
896	D	12/15/05	1635	8	4	1	-5/96	96	-5	1.00	-5.00	451	0.15	OK			1	1	1	451	0.15					451	0.15
897	D	12/15/05	1635	8	4	1	18/96	96	18	1.00	18.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
898	D	12/15/05	1635	8	4	1	17/96	96	17	1.00	17.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
899	D	12/15/05	1635	8	4	1	22/101	101	22	1.00	22.00	818	0.15	OK			1	1	1	818	0.15					818	0.15

Obs	Invoice Letter	Test Date	EFLCH	Man EER	Ton	A/C Qty	Ref/Var	Ref Cap	Ref Adj.	RCA Site Flag	RCA Chg Adj	Invoiced RCA kWh	Invoiced RCA kW	Duplication Code	Reason for Dupe	Notes	RCA Charge = 0 (if chg=0 then =0)	RCA Dupe (if not a dupe then =1)	RCA Verification Multiplier (Charge x	Verified RCA kWh	Verified RCA kW	RCA kWh Dupes	RCA kW Dupes	RCA kWh Zeroes	RCA kW Zeroes	sum of verified, dupes, zeroes	Verified RCA kW
900	D	12/15/05	1635	8	4	1	10/160	160	10	1.00	10.00	1,112	0.15	OK			1	1	1	1,112	0.15					1,112	0.15
901	D	12/15/05	1635	8	4	1	11/160	160	11	1.00	11.00	1,171	0.15	OK			1	1	1	1,171	0.15					1,171	0.15
902	D	12/15/05	1635	8	4	1	12/160	160	12	1.00	12.00	1,234	0.15	OK			1	1	1	1,234	0.15					1,234	0.15
903	D	12/15/05	1635	8	4	1	14/160	160	14	1.00	14.00	1,369	0.15	OK			1	1	1	1,369	0.15					1,369	0.15
904	D	12/15/05	1635	8	4	1	16/160	160	16	1.00	16.00	1,518	0.15	OK			1	1	1	1,518	0.15					1,518	0.15
905	D	12/15/05	1635	8	4	1	10/91	91	10	1.00	10.00	1,646	0.15	OK			1	1	1	1,646	0.15					1,646	0.15
906	D	12/15/05	1635	8	4	1	12/101	101	12	1.00	12.00	1,771	0.15	OK			1	1	1	1,771	0.15					1,771	0.15
907	D	12/15/05	1635	8	4	1	20/161.6	161.6	20	1.00	20.00	1,844	0.15	OK			1	1	1	1,844	0.15					1,844	0.15
908	D	12/15/05	1635	8	4	1	12/96	96	12	1.00	12.00	1,862	0.15	OK			1	1	1	1,862	0.15					1,862	0.15
909	D	12/15/05	1635	8	4	1	13/96	96	13	1.00	13.00	2,027	0.15	OK			1	1	1	2,027	0.15					2,027	0.15
910	D	12/15/05	1635	8	4	1	15/101	101	15	1.00	15.00	2,254	0.15	OK			1	1	1	2,254	0.15					2,254	0.15
911	D	12/15/05	1635	8	4	1	25/161.6	161.6	25	1.00	25.00	2,370	0.15	OK			1	1	1	2,370	0.15					2,370	0.15
912	D	12/15/05	1635	8	4	1	25/160	160	25	1.00	25.00	2,400	0.15	OK			1	1	1	2,400	0.15					2,400	0.15
913	D	12/15/05	1635	8	4	1	16/101	101	16	1.00	16.00	2,442	0.15	OK			1	1	1	2,442	0.15					2,442	0.15
915	D	12/19/05	1635	8	4	1	-10/161.6	161.6	-10	1.00	-10.00	425	0.15	OK			1	1	1	425	0.15					425	0.15
916	D	12/19/05	1635	8	4	1	6/55	55	6	1.00	6.00	1,635	0.15	OK			1	1	1	1,635	0.15					1,635	0.15
917	D	12/20/05	1635	8	4	1	11/55	55	11	1.00	11.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
955	D	12/13/05	1635	8	4	1	-5/153.6	153.6	-5	1.00	-5.00	515	0.15	OK			1	1	1	515	0.15					515	0.15
956	D	12/13/05	1635	8	4	1	4/153.6	153.6	4	1.00	4.00	820	0.15	OK			1	1	1	820	0.15					820	0.15
957	D	12/13/05	1635	8	4	1	5/153.6	153.6	5	1.00	5.00	866	0.15	OK			1	1	1	866	0.15					866	0.15
959	D	7/1/05	1225	8	2	1	-4/170	170	-4	1.00	-4.00	206	0.15	OK			1	1	1	206	0.15					206	0.15
960	D	1/31/06	1635	8	4	1	3/88	88	3	1.00	3.00	877	0.15	OK			1	1	1	877	0.15					877	0.15
962	D	1/31/06	1635	8	4	1	15/162	162	15	1.00	15.00	1,428	0.15	OK			1	1	1	1,428	0.15					1,428	0.15
963	D	1/31/06	1635	8	4	1	22/88	88	22	1.00	22.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
964	D	1/31/06	1635	8	4	1	12/152	152	12	1.00	12.00	1,275	0.15	OK			1	1	1	1,275	0.15					1,275	0.15
965	D	1/31/06	1635	8	4	1	16/152	152	16	1.00	16.00	1,585	0.15	OK			1	1	1	1,585	0.15					1,585	0.15
966	D	1/31/06	1635	8	4	1	35/162	162	35	1.00	35.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
967	D	1/31/06	1635	8	4	1	38/162	162	38	1.00	38.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
968	D	1/31/06	1635	8	4	1	20/162	162	20	1.00	20.00	1,839	0.15	OK			1	1	1	1,839	0.15					1,839	0.15
969	D	1/14/06	1635	8	4	1	24/152	152	24	1.00	24.00	2,432	0.15	OK			1	1	1	2,432	0.15					2,432	0.15
970	D	1/14/06	1635	8	4	1	16/152	152	16	1.00	16.00	1,585	0.15	OK			1	1	1	1,585	0.15					1,585	0.15
971	D	1/24/06	1635	8	4	1	32/152	152	32	1.00	32.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
972	D	1/24/06	1635	8	4	1	32/152	152	32	1.00	32.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
973	D	1/25/06	1635	8	4	1	36/152	152	36	1.00	36.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
974	D	1/25/06	1635	8	4	1	24/152	152	24	1.00	24.00	2,432	0.15	OK			1	1	1	2,432	0.15					2,432	0.15
978	D	1/24/06	1635	8	4	1	24/152	152	24	1.00	24.00	2,432	0.15	OK			1	1	1	2,432	0.15					2,432	0.15
979	D	1/25/06	1635	8	4	1	8/152	152	8	1.00	8.00	1,024	0.15	OK			1	1	1	1,024	0.15					1,024	0.15
980	D	1/25/06	1635	8	4	1	12/152	152	12	1.00	12.00	1,275	0.15	OK			1	1	1	1,275	0.15					1,275	0.15
981	D	1/25/06	1635	8	4	1	16/152	152	16	1.00	16.00	1,585	0.15	OK			1	1	1	1,585	0.15					1,585	0.15
983	D	1/26/06	1635	8	4	1	32/152	152	32	1.00	32.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
984	D	1/26/06	1635	8	4	1	12/152	152	12	1.00	12.00	1,275	0.15	OK			1	1	1	1,275	0.15					1,275	0.15
985	D	1/26/06	1635	8	4	1	24/152	152	24	1.00	24.00	2,432	0.15	OK			1	1	1	2,432	0.15					2,432	0.15
986	D	1/26/06	1635	8	4	1	32/152	152	32	1.00	32.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
987	D	1/25/06	1635	8	4	1	12/152	152	12	1.00	12.00	1,275	0.15	OK			1	1	1	1,275	0.15					1,275	0.15
988	D	1/15/06	1635	8	4	1	40/152	152	40	1.00	40.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
989	D	1/15/06	1635	8	4	1	50/152	152	50	1.00	50.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
990	D	1/15/06	1635	8	4	1	37/152	152	37	1.00	37.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
991	D	2/1/06	1635	8	4	1	15/59.2	59.2	15	1.00	15.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
993	D	1/24/06	1635	8	4	1	20/122	122	20	1.00	20.00	2,554	0.15	OK			1	1	1	2,554	0.15					2,554	0.15
994	D	1/24/06	1635	8	4	1	37/154	154	37	1.00	37.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
995	D	1/24/06	1635	8	4	1	7/130	130	7	1.00	7.00	1,034	0.15	OK			1	1	1	1,034	0.15					1,034	0.15
999	D	2/1/06	1635	8	4	1	10/152	152	10	1.00	10.00	1,143	0.15	OK			1	1	1	1,143	0.15					1,143	0.15
1002	D	1/31/06	1635	8	4	1	7/150	150	7	1.00	7.00	974	0.15	OK			1	1	1	974	0.15					974	0.15
1007	D	1/24/06	1635	8	4	1	5/88	88	5	1.00	5.00	1,060	0.15	OK			1	1	1	1,060	0.15					1,060	0.15
1008	D	1/24/06	1635	8	4	1	6/200	200	6	1.00	6.00	847	0.15	OK			1	1	1	847	0.15					847	0.15
1011	D	1/24/06	1635	8	4	1	38/154	154	38	1.00	38.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
1020	D	7/29/05	1635	8	4	1	-8/141	141	-8	1.00	-8.00	438	0.15	OK			1	1	1	438	0.15					438	0.15
239	D	1/9/06	1635	8	4	1	9/153	153	9	1.00	9.00	1,078	0.15	OK			1	1	1	1,078	0.15					1,078	0.15
243	D	1/9/06	1635	8	4	1	9/151	151	9	1.00	9.00	1,085	0.15	OK			1	1	1	1,085	0.15					1,085	0.15
244	D	1/9/06	1635	8	4	1	9/151	151	9	1.00	9.00	1,085	0.15	OK			1	1	1	1,085	0.15					1,085	0.15
257	D	8/23/05	1635	8	3	1	3/98	98	3	1.00	3.00	639	0.15	OK			1	1	1	639	0.15					639	0.15
5	C	70606	1822	8.0	4.0	1	-4/140	140	-4	1.00	-4.00	699	0.45	OK			1	1	1	699	0.45					699	0.45
10	C	62806	1822	8.0	3.5	1	-18/140	140	-18	1.00	-18.00	451	0.29	OK			1	1	1	451	0.29					451	0.29
11	C	62806	1822	8.0	3.5	1	-12/140	140	-12	1.00	-12.00	478	0.31	OK			1	1	1	478	0.31					478	0.31
20	C	62806	1822	8.0	4.0	1	10/76	76	10	1.00	10.00	2,137	0.75	OK			1	1	1	2,137	0.75					2,137	0.75
22	C	62906	1822	8.0	4.0	1	-8/83	83	-8	1.00	-8.00	532	0.34	OK			1	1	1	532	0.34					532	0.34
23	C	62906	1822	8.0	5.0	1	4/93	93	4	1.00	4.00	1,393	0.53	OK			1	1	1	1,393	0.53					1,393	0.53
28	C	63006	1822	8.0	4.0	1	-24/140	140	-24	1.00	-24.00	550	0.36	OK			1	1	1	550	0.36					550	0.36
29	C	63006	1822	8.0	4.5	1	-24/191	191	-24	1.00	-24.00	580	0.37	OK			1	1	1	580	0.37					580	0.37
35	C	62806	1822	8.0	5.0	1	9/92	92	9	1.00	9.00	2,078	0.53	OK			1	1	1	2,078	0.53					2,078	0.53

Obs	Invoice Letter	Test Date	EFLCH	Man EER	Ton	A/C Qty	Ref/Var	Ref Cap	Ref Adj.	RCA Site Flag	RCA Chg Adj	Invoiced RCA kWh	Invoiced RCA kW	Duplication Code	Reason for Dupe	Notes	RCA Charge = 0 (if chg=0 then =0)	RCA Dupe (if not a dupe then =1)	RCA Verification Multiplier (Charge x	Verified RCA kWh	Verified RCA kW	RCA kWh Dupes	RCA kW Dupes	RCA kWh Zeroes	RCA kW Zeroes	sum of verified, dupes, zeroes	Verified RCA kW
272	D	6/29/06	1635	8	4	1	-8/83	83	-8	1.00	-8.00	364	0.15	OK			1	1	1	364	0.15					364	0.15
273	D	6/29/06	1635	8	5	1	4/93	93	4	1.00	4.00	1,181	0.15	OK			1	1	1	1,181	0.15					1,181	0.15
276	D	6/28/06	1635	8	4	1	10/76	76	10	1.00	10.00	1,965	0.15	OK			1	1	1	1,965	0.15					1,965	0.15
43	C	72406	1822	8.0	5.0	1	20/126	126	20	1.00	20.00	3,278	1.31	OK			1	1	1	3,278	1.31					3,278	1.31
45	C	72406	1822	8.0	5.0	1	-12/126	126	-12	1.00	-12.00	667	0.43	OK			1	1	1	667	0.43					667	0.43
47	C	72506	1822	8.0	5.0	1	-8/126	126	-8	1.00	-8.00	737	0.48	OK			1	1	1	737	0.48					737	0.48
48	C	72506	1822	8.0	5.0	1	-8/126	126	-8	1.00	-8.00	737	0.48	OK			1	1	1	737	0.48					737	0.48
51	C	72506	1822	8.0	5.0	1	-26/126	126	-26	1.00	-26.00	779	0.50	OK			1	1	1	779	0.50					779	0.50
52	C	72506	1822	8.0	5.0	1	10/126	126	10	1.00	10.00	1,813	0.53	OK			1	1	1	1,813	0.53					1,813	0.53
53	C	72506	1822	8.0	5.0	1	-27/126	126	-27	1.00	-27.00	807	0.52	OK			1	1	1	807	0.52					807	0.52
54	C	72506	1822	8.0	5.0	1	-26/126	126	-26	1.00	-26.00	779	0.50	OK			1	1	1	779	0.50					779	0.50
55	C	72506	1822	8.0	5.0	1	-26/126	126	-26	1.00	-26.00	779	0.50	OK			1	1	1	779	0.50					779	0.50
57	C	72506	1822	8.0	5.0	1	10/126	126	10	1.00	10.00	1,813	0.53	OK			1	1	1	1,813	0.53					1,813	0.53
58	C	72506	1822	8.0	5.0	1	-30/126	126	-30	1.00	-30.00	906	0.59	OK			1	1	1	906	0.59					906	0.59
60	C	72106	1822	8.0	5.0	1	-23/126	126	-23	1.00	-23.00	711	0.46	OK			1	1	1	711	0.46					711	0.46
353	D	10/27/05	1635	8	10	1	33/327	327	33	1.00	33.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
354	D	8/4/05	1635	8	5	1	77/208	208	77	1.00	77.00	981	0.15	OK			1	1	1	981	0.15					981	0.15
379	D	9/27/05	1635	8	3	1	20/72	72	20	1.00	20.00	4,965	0.15	OK			1	1	1	4,965	0.15					4,965	0.15
407	D	11/1/05	1635	8	5	1	28/150	150	28	1.00	28.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
408	D	11/7/05	1635	8	2	1	10/49	49	10	1.00	10.00	1,769	0.15	OK			1	1	1	1,769	0.15					1,769	0.15
554	D	10/26/05	1635	8	3	1	-32/115	115	-32	1.00	-32.00	550	0.15	OK			1	1	1	550	0.15					550	0.15
557	D	10/26/05	1635	8	10	1	-7/170	170	-7	1.00	-7.00	1,212	0.15	OK			1	1	1	1,212	0.15					1,212	0.15
559	D	10/27/05	1635	8	10	1	-6/154	154	-6	1.00	-6.00	1,230	0.15	OK			1	1	1	1,230	0.15					1,230	0.15
584	D	11/16/05	1635	8	3	1	17/65	65	17	1.00	17.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
585	D	11/16/05	1635	8	3	1	18/181	181	18	1.00	18.00	1,133	0.15	OK			1	1	1	1,133	0.15					1,133	0.15
687	D	1/4/06	1635	8	4	1	9/162	162	9	1.00	9.00	1,049	0.15	OK			1	1	1	1,049	0.15					1,049	0.15
721	D	8/23/05	1635	8	4	1	6/80	80	6	1.00	6.00	1,234	0.15	OK			1	1	1	1,234	0.15					1,234	0.15
724	D	2/8/06	1635	8	4	1	4/224	224	4	1.00	4.00	766	0.15	OK			1	1	1	766	0.15					766	0.15
725	D	2/8/06	1635	8	4	1	56/76	76	56	1.00	56.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
726	D	2/8/06	1635	8	4	1	48/166.4	166.4	48	1.00	48.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
146	C	72006	1822	8.0	4.0	1	-12/150	150	-12	1.00	-12.00	555	0.36	OK			1	1	1	555	0.36					555	0.36
149	C	72006	1822	8.0	4.0	1	-24/144	144	-24	1.00	-24.00	543	0.35	OK			1	1	1	543	0.35					543	0.35
150	C	72006	1822	8.0	3.5	1	-18/140	140	-18	1.00	-18.00	451	0.29	OK			1	1	1	451	0.29					451	0.29
151	C	72006	1822	8.0	3.5	1	-22/140	140	-22	1.00	-22.00	465	0.30	OK			1	1	1	465	0.30					465	0.30
152	C	72006	1822	8.0	3.5	1	32/140	140	32	1.00	32.00	3,944	1.76	OK			1	1	1	3,944	1.76					3,944	1.76
154	C	72006	1822	8.0	3.5	1	-21/150	150	-21	1.00	-21.00	454	0.29	OK			1	1	1	454	0.29					454	0.29
158	C	72106	1822	8.0	4.0	1	80/160	160	80	1.00	80.00	8,322	3.63	OK			1	1	1	8,322	3.63					8,322	3.63
159	C	72106	1822	8.0	3.5	1	0/124	124	0	1.00	0.00	727	0.47	RefAdj=0			0	1	0	0	0.00			727	0.47	727	0.47
160	C	72106	1822	8.0	3.5	1	0/124	124	0	1.00	0.00	727	0.47	RefAdj=0			0	1	0	0	0.00			727	0.47	727	0.47
161	C	72106	1822	8.0	4.0	1	0/160	160	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
731	D	7/20/06	1635	8	3.5	1	-10/150	150	-10	1.00	-10.00	362	0.15	OK			1	1	1	362	0.15					362	0.15
736	D	7/20/06	1635	8	3.5	1	-45/150	150	-45	1.00	-45.00	746	0.15	OK			1	1	1	746	0.15					746	0.15
769	D	1/13/06	1635	8	3	1	-8/83	83	-8	1.00	-8.00	273	0.15	OK			1	1	1	273	0.15					273	0.15
776	D	1/13/06	1635	8	3	1	-16/83	83	-16	1.00	-16.00	317	0.15	OK			1	1	1	317	0.15					317	0.15
777	D	1/13/06	1635	8	4	1	-5/70.4	70.4	-5	1.00	-5.00	404	0.15	OK			1	1	1	404	0.15					404	0.15
778	D	1/13/06	1635	8	3	1	8/150	150	8	1.00	8.00	772	0.15	OK			1	1	1	772	0.15					772	0.15
783	D	1/18/06	1635	8	3	1	-12/112	112	-12	1.00	-12.00	266	0.15	OK			1	1	1	266	0.15					266	0.15
787	D	1/18/06	1635	8	3	1	-10/112	112	-10	1.00	-10.00	280	0.15	OK			1	1	1	280	0.15					280	0.15
788	D	1/18/06	1635	8	3	1	10/112	112	10	1.00	10.00	1,042	0.15	OK			1	1	1	1,042	0.15					1,042	0.15
789	D	1/18/06	1635	8	2	1	-10/82	82	-10	1.00	-10.00	174	0.15	OK			1	1	1	174	0.15					174	0.15
791	D	1/18/06	1635	8	3.5	1	-4/140	140	-4	1.00	-4.00	464	0.15	OK			1	1	1	464	0.15					464	0.15
923	D	7/29/05	1635	8	3	1	24/102	102	24	1.00	24.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
924	D	7/29/05	1635	8	3.5	1	15/102	102	15	1.00	15.00	1,949	0.15	OK			1	1	1	1,949	0.15					1,949	0.15
925	D	7/29/05	1635	8	3.5	1	8/126	126	8	1.00	8.00	981	0.15	OK			1	1	1	981	0.15					981	0.15
926	D	7/29/05	1635	8	2	1	9/74	74	9	1.00	9.00	906	0.15	OK			1	1	1	906	0.15					906	0.15
927	D	7/29/05	1635	8	2	1	10/74	74	10	1.00	10.00	1,011	0.15	OK			1	1	1	1,011	0.15					1,011	0.15
1030	D	11/30/05	1635	8	4	1	3.5/71	71	3.5	1.00	3.50	996	0.15	OK			1	1	1	996	0.15					996	0.15
216	C	70706	1822	8.0	4.0	1	-1/118	118	-1	1.00	-1.00	788	0.51	OK			1	1	1	788	0.51					788	0.51
1418	B	51606	901	8.0	4.0	1	0/102	102	0	1.00	0.00	411	0.54	RefAdj=0			0	1	0	0	0.00			411	0.54	411	0.54
1392	B	42406	1635	8.0	0.0	1	0/0	0	0	1.00	0.00	466	0.34	RefAdj=0			0	1	0	0	0.00			466	0.34	466	0.34
1393	B	42406	901	8.0	3.0	1	-20/0	0	-20	1.00	-20.00	308	0.40	OK			1	1	1	308	0.40					308	0.40
1394	B	42406	901	8.0	2.0	1	0/98	98	0	1.00	0.00	206	0.27	RefAdj=0			0	1	0	0	0.00			206	0.27	206	0.27
249	D	1/6/06	1635	8	4	1	7/153.6	153.6	7	1.00	7.00	965	0.15	OK			1	1	1	965	0.15					965	0.15
251	D	1/11/06	1635	8	3	1	-4/72	72	-4	1.00	-4.00	331	0.15	OK			1	1	1	331	0.15					331	0.15
252	D	1/11/06	1635	8	4	1	-8/178	178	-8	1.00	-8.00	472	0.15	OK			1	1	1	472	0.15					472	0.15
253	D	1/12/06	1635	8	4	1	-4/178	178	-4	1.00	-4.00	555	0.15	OK			1	1	1	555	0.15					555	0.15
254	D	1/12/06	1635	8	4	1	9/178	178	9	1.00	9.00	1,006	0.15	OK			1	1	1	1,006	0.15					1,006	0.15
255	D	7/25/05	1225	8	5	1	-4/160	160	-4	1.00	-4.00	510	0.15	OK			1	1	1	510	0.15					510	0.15
256	D	8/5/05	1635	8	2.5	1	4/54	54	4	1.00	4.00	765	0.15	OK			1	1	1	765	0.15					765	0.15
1	C	70306	1822	8.0	4.0	1	32/140	140	32	1.00	32.00	4,508	2.01	OK			1	1	1	4,508	2.01					4,508	2.01

Obs	Invoice Letter	Test Date	EFLCH	Man EER	Ton	A/C Qty	Ref/Var	Ref Cap	Ref Adj.	RCA Site Flag	RCA Chg Adj	Invoiced RCA kWh	Invoiced RCA kW	Duplication Code	Reason for Dupe	Notes	RCA Charge = 0 (if chg=0 then =0)	RCA Dupe (if not a dupe then =1)	RCA Verification Multiplier (Charge x	Verified RCA kWh	Verified RCA kW	RCA kWh Dupes	RCA kW Dupes	RCA kWh Zeroes	RCA kW Zeroes	sum of verified, dupes, zeroes	Verified RCA kW
2	C	70306	1822	8.0	4.0	1	-4/140	140	-4	1.00	-4.00	699	0.45	OK			1	1	1	699	0.45					699	0.45
3	C	70306	1822	8.0	4.0	1	0/140	140	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
4	C	70606	1822	8.0	4.0	1	0/140	140	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
6	C	70606	1822	8.0	4.0	1	0/140	140	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
7	C	70606	1635	8.0	4.0	1	0/140	140	0	1.00	0.00	746	0.54	RefAdj=0			0	1	0	0	0.00			746	0.54	746	0.54
8	C	70606	1635	8.0	4.0	1	0/140	140	0	1.00	0.00	746	0.54	RefAdj=0			0	1	0	0	0.00			746	0.54	746	0.54
9	C	62806	1822	8.0	3.5	1	5/140	140	5	1.00	5.00	926	0.37	OK			1	1	1	926	0.37					926	0.37
12	C	62806	1822	8.0	3.5	1	0/149	149	0	1.00	0.00	727	0.47	RefAdj=0			0	1	0	0	0.00			727	0.47	727	0.47
13	C	70506	1822	8.0	4.0	1	-50/144	144	-50	1.00	-50.00	1,337	0.86	OK			1	1	1	1,337	0.86					1,337	0.86
14	C	70506	1822	8.0	3.5	1	-13/140	140	-13	1.00	-13.00	469	0.30	OK			1	1	1	469	0.30					469	0.30
15	C	70506	1822	8.0	4.0	1	-38/140	140	-38	1.00	-38.00	868	0.56	OK			1	1	1	868	0.56					868	0.56
16	C	70506	1822	8.0	4.5	1	0/191	191	0	1.00	0.00	935	0.60	RefAdj=0			0	1	0	0	0.00			935	0.60	935	0.60
17	C	70606	1822	8.0	4.5	1	0/191	191	0	1.00	0.00	935	0.60	RefAdj=0			0	1	0	0	0.00			935	0.60	935	0.60
18	C	70606	1822	8.0	3.5	1	-36/140	140	-36	1.00	-36.00	702	0.45	OK			1	1	1	702	0.45					702	0.45
19	C	70606	1822	8.0	3.5	1	-17/140	140	-17	1.00	-17.00	452	0.29	OK			1	1	1	452	0.29					452	0.29
26	C	63006	1822	8.0	4.0	1	-12/140	140	-12	1.00	-12.00	546	0.35	OK			1	1	1	546	0.35					546	0.35
27	C	63006	1822	8.0	4.5	1	0/191	191	0	1.00	0.00	935	0.60	RefAdj=0			0	1	0	0	0.00			935	0.60	935	0.60
30	C	63006	1822	8.0	4.0	1	-12/140	140	-12	1.00	-12.00	546	0.35	OK			1	1	1	546	0.35					546	0.35
31	C	63006	1822	8.0	4.5	1	0/191	191	0	1.00	0.00	935	0.60	RefAdj=0			0	1	0	0	0.00			935	0.60	935	0.60
36	C	62806	1822	8.0	2.0	1	7/41	41	7	1.00	7.00	1,436	0.59	OK			1	1	1	1,436	0.59					1,436	0.59
37	C	62806	1822	8.0	5.0	1	6/75	75	6	1.00	6.00	1,821	0.53	OK			1	1	1	1,821	0.53					1,821	0.53
38	C	62906	1635	8.0	5.0	1	-7/92	92	-7	1.00	-7.00	631	0.45	OK			1	1	1	631	0.45					631	0.45
39	C	62906	1635	8.0	2.0	1	6/41	41	6	1.00	6.00	1,072	0.45	OK			1	1	1	1,072	0.45					1,072	0.45
40	C	62906	1635	8.0	5.0	1	42/75	75	42	1.00	42.00	9,335	4.54	OK			1	1	1	9,335	4.54					9,335	4.54
41	C	62906	1822	8.0	3.5	1	-32/140	140	-32	1.00	-32.00	605	0.39	OK			1	1	1	605	0.39					605	0.39
42	C	62906	1822	8.0	4.5	1	0/191	191	0	1.00	0.00	935	0.60	RefAdj=0			0	1	0	0	0.00			935	0.60	935	0.60
258	D	6/30/06	1635	8	3.5	1	-12/140	140	-12	1.00	-12.00	331	0.15	OK			1	1	1	331	0.15					331	0.15
260	D	6/30/06	1635	8	3.5	1	-32/140	140	-32	1.00	-32.00	458	0.15	OK			1	1	1	458	0.15					458	0.15
268	D	7/3/06	1635	8	3.5	1	4.5/140	140	4.5	1.00	4.50	755	0.15	OK			1	1	1	755	0.15					755	0.15
269	D	7/3/06	1635	8	4	1	-4/140	140	-4	1.00	-4.00	530	0.15	OK			1	1	1	530	0.15					530	0.15
270	D	7/3/06	1635	8	4	1	32/140	140	32	1.00	32.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
274	D	6/29/06	1635	8	2	1	6/41.6	41.6	6	1.00	6.00	1,089	0.15	OK			1	1	1	1,089	0.15					1,089	0.15
275	D	6/30/06	1635	8	4	1	6.25/75.2	75.2	6.25	1.00	6.25	1,320	0.15	OK			1	1	1	1,320	0.15					1,320	0.15
277	D	6/30/06	1635	8	4	1	41.5/75.2	75.2	41.5	1.00	41.50	1,308	0.15	OK			1	1	1	1,308	0.15					1,308	0.15
278	D	6/30/06	1635	8	3	1	7.85/41.6	41.6	7.85	1.00	7.85	2,341	0.15	OK			1	1	1	2,341	0.15					2,341	0.15
280	D	6/29/06	1635	8	4	1	-7/92.8	92.8	-7	1.00	-7.00	395	0.15	OK			1	1	1	395	0.15					395	0.15
1408	B	50106	901	8.0	3.0	1	8/125	125	8	1.00	8.00	481	0.32	OK			1	1	1	481	0.32					481	0.32
1409	B	50106	901	8.0	2.0	1	-4/92	92	-4	1.00	-4.00	160	0.21	OK			1	1	1	160	0.21					160	0.21
282	D	11/14/05	1635	8	4	1	-10/120	120	-10	1.00	-10.00	382	0.15	OK			1	1	1	382	0.15					382	0.15
44	C	72406	1822	8.0	5.0	1	0/126	126	0	1.00	0.00	1,039	0.67	RefAdj=0			0	1	0	0	0.00			1,039	0.67	1,039	0.67
46	C	72406	1822	8.0	5.0	1	0/126	126	0	1.00	0.00	1,039	0.67	RefAdj=0			0	1	0	0	0.00			1,039	0.67	1,039	0.67
49	C	72506	1822	8.0	5.0	1	0/126	126	0	1.00	0.00	1,039	0.67	RefAdj=0			0	1	0	0	0.00			1,039	0.67	1,039	0.67
50	C	72506	1822	8.0	5.0	1	0/126	126	0	1.00	0.00	1,039	0.67	RefAdj=0			0	1	0	0	0.00			1,039	0.67	1,039	0.67
56	C	72506	1822	8.0	5.0	1	-28/126	126	-28	1.00	-28.00	838	0.54	OK			1	1	1	838	0.54					838	0.54
59	C	72106	1822	8.0	5.0	1	0/126	126	0	1.00	0.00	1,039	0.67	RefAdj=0			0	1	0	0	0.00			1,039	0.67	1,039	0.67
287	D	7/25/06	1635	8	5	1	-10/126.4	126.4	-10	1.00	-10.00	486	0.15	OK			1	1	1	486	0.15					486	0.15
61	C	71706	1822	8.0	4.0	1	11/128	128	11	1.00	11.00	1,522	0.42	OK			1	1	1	1,522	0.42					1,522	0.42
62	C	71706	1822	8.0	4.0	1	0/128	128	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
63	C	71706	1822	8.0	4.0	1	0/128	128	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
64	C	71706	1822	8.0	3.0	1	-12/88	88	-12	1.00	-12.00	388	0.25	OK			1	1	1	388	0.25					388	0.25
65	C	71706	1822	8.0	4.0	1	3/128	128	3	1.00	3.00	972	0.42	OK			1	1	1	972	0.42					972	0.42
66	C	71706	1822	8.0	4.0	1	11/128	128	11	1.00	11.00	1,522	0.42	OK			1	1	1	1,522	0.42					1,522	0.42
67	C	71706	1822	8.0	4.0	1	13/128	128	13	1.00	13.00	1,709	0.45	OK			1	1	1	1,709	0.45					1,709	0.45
68	C	71706	1822	8.0	4.0	1	4/128	128	4	1.00	4.00	1,026	0.42	OK			1	1	1	1,026	0.42					1,026	0.42
69	C	71706	1822	8.0	4.0	1	8/128	128	8	1.00	8.00	1,282	0.42	OK			1	1	1	1,282	0.42					1,282	0.42
70	C	71706	1822	8.0	3.0	1	0/44	44	0	1.00	0.00	624	0.40	RefAdj=0			0	1	0	0	0.00			624	0.40	624	0.40
71	C	71706	1822	8.0	4.0	1	4/128	128	4	1.00	4.00	1,026	0.42	OK			1	1	1	1,026	0.42					1,026	0.42
72	C	71706	1822	8.0	4.0	1	0/128	128	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
73	C	71706	1822	8.0	4.0	1	0/128	128	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
74	C	71706	1822	8.0	4.0	1	8/128	128	8	1.00	8.00	1,282	0.42	OK			1	1	1	1,282	0.42					1,282	0.42
75	C	71706	1822	8.0	4.0	1	12/128	128	12	1.00	12.00	1,613	0.42	OK			1	1	1	1,613	0.42					1,613	0.42
76	C	71706	1822	8.0	4.0	1	50/128	128	50	1.00	50.00	8,322	3.63	OK			1	1	1	8,322	3.63					8,322	3.63
77	C	71706	1822	8.0	5.0	1	4/160	160	4	1.00	4.00	1,228	0.53	OK			1	1	1	1,228	0.53					1,228	0.53
78	C	71706	1822	8.0	3.0	1	0/88	88	0	1.00	0.00	624	0.40	RefAdj=0			0	1	0	0	0.00			624	0.40	624	0.40
79	C	71706	1822	8.0	4.0	1	16/128	128	16	1.00	16.00	2,035	0.68	OK			1	1	1	2,035	0.68					2,035	0.68
80	C	71706	1822	8.0	4.0	1	15/128	128	15	1.00	15.00	1,919	0.60	OK			1	1	1	1,919	0.60					1,919	0.60
81	C	71706	1822	8.0	4.0	1	5/128	128	5	1.00	5.00	1,084	0.42	OK			1	1	1	1,084	0.42					1,084	0.42
82	C	71806	1822	8.0	7.0	1	0/122	122	0	1.00	0.00	1,455	0.94	RefAdj=0			0	1	0	0	0.00			1,455	0.94	1,455	0.94
83	C	71806	1822	8.0	7.0	1	0/130	130	0	1.00	0.00	1,455	0.94	RefAdj=0			0	1	0	0	0.00			1,455	0.94	1,455	0.94
84	C	71806	1822	8.0	2.0	1	-8/56	56	-8	1.00	-8.00	260	0.17	OK			1	1	1	260	0.17					260	0.17

Obs	Invoice Letter	Test Date	EFLCH	Man EER	Ton	A/C Qty	Ref/Var	Ref Cap	Ref Adj.	RCA Site Flag	RCA Chg Adj	Invoiced RCA kWh	Invoiced RCA kW	Duplication Code	Reason for Dupe	Notes	RCA Charge = 0 (if chg=0 then =0)	RCA Dupe (if not a dupe then =1)	RCA Verification Multiplier (Charge x	Verified RCA kWh	Verified RCA kW	RCA kWh Dupes	RCA kW Dupes	RCA kWh Zeroes	RCA kW Zeroes	sum of verified, dupes, zeroes	Verified RCA kW
85	C	71806	1822	8.0	2.0	1	-4/56	56	-4	1.00	-4.00	286	0.18	OK			1	1	1	286	0.18					286	0.18
86	C	71806	1822	8.0	4.0	1	16/128	128	16	1.00	16.00	2,035	0.68	OK			1	1	1	2,035	0.68					2,035	0.68
87	C	71806	1822	8.0	5.0	1	0/160	160	0	1.00	0.00	1,039	0.67	RefAdj=0			0	1	0	0	0.00			1,039	0.67	1,039	0.67
88	C	71806	1822	8.0	4.0	1	8/128	128	8	1.00	8.00	1,282	0.42	OK			1	1	1	1,282	0.42					1,282	0.42
89	C	71806	1822	8.0	2.0	1	0/56	56	0	1.00	0.00	416	0.27	RefAdj=0			0	1	0	0	0.00			416	0.27	416	0.27
90	C	71806	1822	8.0	2.0	1	0/56	56	0	1.00	0.00	416	0.27	RefAdj=0			0	1	0	0	0.00			416	0.27	416	0.27
91	C	71806	1822	8.0	2.0	1	0/56	56	0	1.00	0.00	416	0.27	RefAdj=0			0	1	0	0	0.00			416	0.27	416	0.27
92	C	71806	1822	8.0	5.0	1	16/160	160	16	1.00	16.00	2,111	0.55	OK			1	1	1	2,111	0.55					2,111	0.55
93	C	71806	1822	8.0	6.0	1	48/153	153	48	1.00	48.00	14,237	5.45	OK			1	1	1	14,237	5.45					14,237	5.45
94	C	71806	1822	8.0	4.0	1	-14/128	128	-14	1.00	-14.00	521	0.34	OK			1	1	1	521	0.34					521	0.34
95	C	71806	1822	8.0	4.0	1	36/128	128	36	1.00	36.00	7,014	3.01	OK			1	1	1	7,014	3.01					7,014	3.01
96	C	71806	1822	8.0	6.0	1	46/153	153	46	1.00	46.00	12,557	5.20	OK			1	1	1	12,557	5.20					12,557	5.20
97	C	71806	1822	8.0	3.0	1	0/88	88	0	1.00	0.00	624	0.40	RefAdj=0			0	1	0	0	0.00			624	0.40	624	0.40
98	C	71806	1822	8.0	6.0	1	16/153	153	16	1.00	16.00	2,621	0.72	OK			1	1	1	2,621	0.72					2,621	0.72
99	C	71806	1822	8.0	4.0	1	30/126	126	30	1.00	30.00	4,868	2.17	OK			1	1	1	4,868	2.17					4,868	2.17
100	C	71806	1822	8.0	4.0	1	1/132	132	1	1.00	1.00	873	0.42	OK			1	1	1	873	0.42					873	0.42
101	C	52706	1225	8.0	4.0	1	0/118	118	0	1.00	0.00	559	0.54	RefAdj=0			0	1	0	0	0.00			559	0.54	559	0.54
102	C	61606	1225	8.0	3.0	1	-7/96	96	-7	1.00	-7.00	287	0.28	OK			1	1	1	287	0.28					287	0.28
103	C	61606	1225	8.0	3.0	1	0/112	112	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
104	C	61606	1225	8.0	3.0	1	0/112	112	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
105	C	61606	1225	8.0	3.0	1	0/78	78	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
106	C	61606	1225	8.0	3.0	1	0/112	112	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
107	C	61606	1225	8.0	3.0	1	0/96	96	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
108	C	61606	1225	8.0	3.0	1	0/78	78	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
109	C	61606	1225	8.0	3.0	1	0/96	96	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
110	C	61606	1225	8.0	3.0	1	0/112	112	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
111	C	61606	1225	8.0	3.0	1	0/112	112	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
112	C	61606	1225	8.0	3.0	1	0/96	96	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
113	C	61606	1225	8.0	4.0	1	0/160	160	0	1.00	0.00	559	0.54	RefAdj=0			0	1	0	0	0.00			559	0.54	559	0.54
114	C	61606	1225	8.0	4.0	1	0/160	160	0	1.00	0.00	559	0.54	RefAdj=0			0	1	0	0	0.00			559	0.54	559	0.54
115	C	61606	1225	8.0	4.0	1	0/89	89	0	1.00	0.00	559	0.54	RefAdj=0			0	1	0	0	0.00			559	0.54	559	0.54
116	C	60506	1225	8.0	4.0	1	0/5040	5040	0	1.00	0.00	559	0.54	RefAdj=0			0	1	0	0	0.00			559	0.54	559	0.54
117	C	60506	1225	8.0	4.0	1	0/3552	3552	0	1.00	0.00	559	0.54	RefAdj=0			0	1	0	0	0.00			559	0.54	559	0.54
118	C	60506	1225	8.0	3.0	1	0/0	0	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
119	C	60506	1420	8.0	4.0	1	0/2560	2560	0	1.00	0.00	648	0.54	RefAdj=0			0	1	0	0	0.00			648	0.54	648	0.54
120	C	60506	1420	8.0	4.0	1	0/2560	2560	0	1.00	0.00	648	0.54	RefAdj=0			0	1	0	0	0.00			648	0.54	648	0.54
121	C	52706	1225	8.0	4.0	1	0/176	176	0	1.00	0.00	559	0.54	RefAdj=0			0	1	0	0	0.00			559	0.54	559	0.54
122	C	52706	1225	8.0	4.0	1	0/176	176	0	1.00	0.00	559	0.54	RefAdj=0			0	1	0	0	0.00			559	0.54	559	0.54
123	C	52706	1225	8.0	4.0	1	0/176	176	0	1.00	0.00	559	0.54	RefAdj=0			0	1	0	0	0.00			559	0.54	559	0.54
124	C	52706	1225	8.0	4.0	1	0/176	176	0	1.00	0.00	559	0.54	RefAdj=0			0	1	0	0	0.00			559	0.54	559	0.54
125	C	61506	1225	8.0	5.0	1	0/224	224	0	1.00	0.00	699	0.67	RefAdj=0			0	1	0	0	0.00			699	0.67	699	0.67
126	C	61906	1225	8.0	4.0	1	0/202	202	0	1.00	0.00	559	0.54	RefAdj=0			0	1	0	0	0.00			559	0.54	559	0.54
127	C	61906	1225	8.0	4.0	1	0/192	192	0	1.00	0.00	559	0.54	RefAdj=0			0	1	0	0	0.00			559	0.54	559	0.54
128	C	61606	1225	8.0	5.0	1	0/160	160	0	1.00	0.00	699	0.67	RefAdj=0			0	1	0	0	0.00			699	0.67	699	0.67
129	C	61606	1225	8.0	5.0	1	0/160	160	0	1.00	0.00	699	0.67	RefAdj=0			0	1	0	0	0.00			699	0.67	699	0.67
413	D	3/21/06	1635	8	5	1	8/168	168	8	1.00	8.00	1,227	0.15	OK			1	1	1	1,227	0.15					1,227	0.15
516	D	6/16/06	1635	8	3	1	-7/96	96	-7	1.00	-7.00	300	0.15	OK			1	1	1	300	0.15					300	0.15
531	D	4/3/06	1635	8	3	1	6/107	107	6	1.00	6.00	790	0.15	OK			1	1	1	790	0.15					790	0.15
532	D	4/6/06	1635	8	3	1	10/107	107	10	1.00	10.00	1,078	0.15	OK			1	1	1	1,078	0.15					1,078	0.15
533	D	4/11/06	1635	8	3	1	12/83	83	12	1.00	12.00	1,638	0.15	OK			1	1	1	1,638	0.15					1,638	0.15
534	D	4/11/06	1635	8	3	1	3/107	107	3	1.00	3.00	625	0.15	OK			1	1	1	625	0.15					625	0.15
535	D	4/11/06	1635	8	3	1	15/107	107	15	1.00	15.00	1,580	0.15	OK			1	1	1	1,580	0.15					1,580	0.15
588	D	12/13/05	1635	8	3.5	1	-5/191	191	-5	1.00	-5.00	472	0.15	OK			1	1	1	472	0.15					472	0.15
1157	B	40306	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1158	B	40306	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1159	B	40306	1225	8.0	3.0	1	6/107	107	6	1.00	6.00	617	0.32	OK			1	1	1	617	0.32					617	0.32
1160	B	40306	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1161	B	40306	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1186	B	40606	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1187	B	40606	1225	8.0	3.0	1	10/107	107	10	1.00	10.00	811	0.32	OK			1	1	1	811	0.32					811	0.32
1188	B	40606	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1189	B	40606	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1225	B	41106	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1226	B	41106	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1227	B	41106	1225	8.0	3.0	1	12/83	83	12	1.00	12.00	1,188	0.67	OK			1	1	1	1,188	0.67					1,188	0.67
1228	B	41106	1225	8.0	3.0	1	3/107	107	3	1.00	3.00	506	0.32	OK			1	1	1	506	0.32					506	0.32
1229	B	41106	1225	8.0	3.0	1	15/107	107	15	1.00	15.00	1,150	0.63	OK			1	1	1	1,150	0.63					1,150	0.63
1230	B	41106	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1254	B	41206	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1255	B	41206	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40

Obs	Invoice Letter	Test Date	EFLCH	Man EER	Ton	A/C Qty	Ref/Var	Ref Cap	Ref Adj.	RCA Site Flag	RCA Chg Adj	Invoiced RCA kWh	Invoiced RCA kW	Duplication Code	Reason for Dupe	Notes	RCA Charge = 0 (if chg=0 then =0)	RCA Dupe (if not a dupe then =1)	RCA Verification Multiplier (Charge x	Verified RCA kWh	Verified RCA kW	RCA kWh Dupes	RCA kW Dupes	RCA kWh Zeroes	RCA kW Zeroes	sum of verified, dupes, zeroes	Verified RCA kW
1256	B	41206	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1257	B	41206	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1279	B	41806	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1280	B	41806	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1281	B	41806	1225	8.0	3.0	1	8/107	107	8	1.00	8.00	707	0.32	OK			1	1	1	707	0.32					707	0.32
1282	B	41806	1225	8.0	5.0	1	0/137	137	0	1.00	0.00	699	0.67	RefAdj=0			0	1	0	0	0.00			699	0.67	699	0.67
1283	B	41806	1225	8.0	3.0	1	6/107	107	6	1.00	6.00	617	0.32	OK			1	1	1	617	0.32					617	0.32
1284	B	41806	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1285	B	41806	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1286	B	41806	1635	8.0	3.0	1	0/107	107	0	1.00	0.00	560	0.40	RefAdj=0			0	1	0	0	0.00			560	0.40	560	0.40
1287	B	41806	1635	8.0	3.0	1	3/107	107	3	1.00	3.00	675	0.32	OK			1	1	1	675	0.32					675	0.32
1288	B	41806	1635	8.0	3.0	1	0/107	107	0	1.00	0.00	560	0.40	RefAdj=0			0	1	0	0	0.00			560	0.40	560	0.40
1289	B	41806	1635	8.0	3.0	1	10/107	107	10	1.00	10.00	1,083	0.32	OK			1	1	1	1,083	0.32					1,083	0.32
1290	B	41806	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1291	B	41806	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1292	B	41806	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1293	B	41806	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1294	B	41806	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1295	B	41806	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1313	B	41906	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1314	B	41906	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1315	B	41906	1225	8.0	3.0	1	8/107	107	8	1.00	8.00	707	0.32	OK			1	1	1	707	0.32					707	0.32
1316	B	41906	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1317	B	41906	1225	8.0	3.0	1	10/107	107	10	1.00	10.00	811	0.32	OK			1	1	1	811	0.32					811	0.32
1318	B	41906	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1319	B	41906	1225	8.0	3.0	1	10/107	107	10	1.00	10.00	811	0.32	OK			1	1	1	811	0.32					811	0.32
1320	B	41906	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1321	B	41906	1225	8.0	3.0	1	10/107	107	10	1.00	10.00	811	0.32	OK			1	1	1	811	0.32					811	0.32
1322	B	41906	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1323	B	41906	1225	8.0	3.0	1	0/100	100	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1324	B	41906	1225	8.0	3.0	1	12/100	100	12	1.00	12.00	988	0.47	OK			1	1	1	988	0.47					988	0.47
1325	B	41906	1225	8.0	3.0	1	8/100	100	8	1.00	8.00	735	0.32	OK			1	1	1	735	0.32					735	0.32
1326	B	41906	1225	8.0	3.0	1	9/100	100	9	1.00	9.00	791	0.32	OK			1	1	1	791	0.32					791	0.32
1327	B	41906	1225	8.0	3.0	1	7/100	100	7	1.00	7.00	683	0.32	OK			1	1	1	683	0.32					683	0.32
1354	B	42006	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1355	B	42006	1225	8.0	3.0	1	6/107	107	6	1.00	6.00	617	0.32	OK			1	1	1	617	0.32					617	0.32
1356	B	42006	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1357	B	42006	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1358	B	42006	1225	8.0	3.0	1	0/100	100	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1359	B	42006	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1360	B	42006	1225	8.0	3.0	1	0/100	100	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1361	B	42006	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1362	B	42006	1225	8.0	3.0	1	0/100	100	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1363	B	42006	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1364	B	42006	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1365	B	42006	1225	8.0	3.0	1	10/107	107	10	1.00	10.00	811	0.32	OK			1	1	1	811	0.32					811	0.32
1366	B	42006	1225	8.0	3.0	1	4/107	107	4	1.00	4.00	540	0.32	OK			1	1	1	540	0.32					540	0.32
1367	B	42006	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1368	B	42006	1225	8.0	3.0	1	0/94	94	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1380	B	42106	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1381	B	42106	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1382	B	42106	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1383	B	42106	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1384	B	42106	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1385	B	42106	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1386	B	42106	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1387	B	42106	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1388	B	42106	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1389	B	42106	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1390	B	42106	1225	8.0	3.0	1	0/107	107	0	1.00	0.00	419	0.40	RefAdj=0			0	1	0	0	0.00			419	0.40	419	0.40
1395	B	42406	1225	8.0	4.0	1	11/100	100	11	1.00	11.00	1,223	0.53	OK			1	1	1	1,223	0.53					1,223	0.53
1396	B	42406	1225	8.0	4.0	1	0/100	100	0	1.00	0.00	559	0.54	RefAdj=0			0	1	0	0	0.00			559	0.54	559	0.54
1397	B	42406	1225	8.0	4.0	1	0/100	100	0	1.00	0.00	559	0.54	RefAdj=0			0	1	0	0	0.00			559	0.54	559	0.54
652	D	8/4/06	1635	8	4	1	-31/151	151	-31	1.00	-31.00	453	0.15	OK			1	1	1	453	0.15					453	0.15
653	D	8/4/06	1635	8	3.5	1	-36/140	140	-36	1.00	-36.00	555	0.15	OK			1	1	1	555	0.15					555	0.15
654	D	8/3/06	1635	8	3.5	1	-15.75/140	140	-15.75	1.00	-15.75	307	0.15	OK			1	1	1	307	0.15					307	0.15
655	D	8/1/06	1635	8	3.5	1	18/140	140	18	1.00	18.00	1,678	0.15	OK			1	1	1	1,678	0.15					1,678	0.15
656	D	8/1/06	1635	8	3.5	1	-33/140	140	-33	1.00	-33.00	480	0.15	OK			1	1	1	480	0.15					480	0.15
657	D	8/3/06	1635	8	3.5	1	8/140	140	8	1.00	8.00	930	0.15	OK			1	1	1	930	0.15					930	0.15
658	D	8/4/06	1635	8	3.5	1	-35.75/140	140	-35.75	1.00	-35.75	548	0.15	OK			1	1	1	548	0.15					548	0.15

Obs	Invoice Letter	Test Date	EFLCH	Man EER	Ton	A/C Qty	Ref/Var	Ref Cap	Ref Adj.	RCA Site Flag	RCA Chg Adj	Invoiced RCA kWh	Invoiced RCA kW	Duplication Code	Reason for Dupe	Notes	RCA Charge = 0 (if chg=0 then =0)	RCA Dupe (if not a dupe then =1)	RCA Verification Multiplier (Charge x	Verified RCA kWh	Verified RCA kW	RCA kWh Dupes	RCA kW Dupes	RCA kWh Zeroes	RCA kW Zeroes	sum of verified, dupes, zeroes	Verified RCA kW
659	D	8/4/06	1635	8	3.5	1	-40/150	150	-40	1.00	-40.00	592	0.15	OK			1	1	1	592	0.15					592	0.15
660	D	8/2/06	1635	8	4	1	4/151	151	4	1.00	4.00	823	0.15	OK			1	1	1	823	0.15					823	0.15
661	D	8/2/06	1635	8	4	1	6/151	151	6	1.00	6.00	919	0.15	OK			1	1	1	919	0.15					919	0.15
662	D	8/4/06	1635	8	4	1	15.5/151	151	15.5	1.00	15.50	1,551	0.15	OK			1	1	1	1,551	0.15					1,551	0.15
663	D	8/4/06	1635	8	4	1	-38/151	151	-38	1.00	-38.00	611	0.15	OK			1	1	1	611	0.15					611	0.15
664	D	8/6/06	1635	8	3	1	-2/68	68	-2	1.00	-2.00	395	0.15	OK			1	1	1	395	0.15					395	0.15
665	D	8/6/06	1635	8	4	1	-10/112	112	-10	1.00	-10.00	373	0.15	OK			1	1	1	373	0.15					373	0.15
666	D	8/15/06	1635	8	5	1	8/152	152	8	1.00	8.00	1,280	0.15	OK			1	1	1	1,280	0.15					1,280	0.15
667	D	8/15/06	1635	8	2	1	4/59	59	4	1.00	4.00	581	0.15	OK			1	1	1	581	0.15					581	0.15
668	D	8/15/06	1635	8	3	1	4/88	88	4	1.00	4.00	723	0.15	OK			1	1	1	723	0.15					723	0.15
669	D	8/15/06	1635	8	4	1	20/99.2	99.2	20	1.00	20.00	3,467	0.15	OK			1	1	1	3,467	0.15					3,467	0.15
670	D	8/15/06	1635	8	4	1	-21/126.4	126.4	-21	1.00	-21.00	375	0.15	OK			1	1	1	375	0.15					375	0.15
671	D	8/15/06	1635	8	4	1	-22/132.8	132.8	-22	1.00	-22.00	374	0.15	OK			1	1	1	374	0.15					374	0.15
672	D	8/16/06	1635	8	4	1	-40/200	200	-40	1.00	-40.00	439	0.15	OK			1	1	1	439	0.15					439	0.15
673	D	8/16/06	1635	8	2	1	-21/59.2	59.2	-21	1.00	-21.00	614	0.15	OK			1	1	1	614	0.15					614	0.15
674	D	8/16/06	1635	8	2	1	15/59.2	59.2	15	1.00	15.00	2,670	0.15	OK			1	1	1	2,670	0.15					2,670	0.15
130	C	71106	1822	8.0	4.0	1	0/150	150	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
131	C	71106	1822	8.0	4.0	1	0/140	140	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
132	C	71106	1822	8.0	4.0	1	0/140	140	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
133	C	71106	1822	8.0	4.0	1	0/126	126	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
134	C	71106	1822	8.0	4.0	1	-16/131	131	-16	1.00	-16.00	516	0.33	OK			1	1	1	516	0.33					516	0.33
1190	B	40606	1822	8.0	4.0	1	42/150	150	42	1.00	42.00	6,937	2.99	OK			1	1	1	6,937	2.99					6,937	2.99
1191	B	40606	1822	8.0	5.0	1	49/168	168	49	1.00	49.00	9,629	4.06	OK			1	1	1	9,629	4.06					9,629	4.06
1192	B	40606	1822	8.0	4.0	1	48/150	150	48	1.00	48.00	10,103	3.63	OK			1	1	1	10,103	3.63					10,103	3.63
1193	B	40606	1822	8.0	5.0	1	36/168	168	36	1.00	36.00	5,030	2.23	OK			1	1	1	5,030	2.23					5,030	2.23
1194	B	40606	1822	8.0	5.0	1	35/168	168	35	1.00	35.00	4,800	2.11	OK			1	1	1	4,800	2.11					4,800	2.11
1195	B	40606	1822	8.0	3.0	1	32/105	105	32	1.00	32.00	6,527	2.67	OK			1	1	1	6,527	2.67					6,527	2.67
1196	B	40606	1822	8.0	5.0	1	40/168	168	40	1.00	40.00	6,085	2.71	OK			1	1	1	6,085	2.71					6,085	2.71
1197	B	40606	1822	8.0	4.0	1	38/150	150	38	1.00	38.00	5,519	2.44	OK			1	1	1	5,519	2.44					5,519	2.44
1198	B	40606	1822	8.0	3.0	1	-13/105	105	-13	1.00	-13.00	387	0.25	OK			1	1	1	387	0.25					387	0.25
1199	B	40606	1822	8.0	4.0	1	39/150	150	39	1.00	39.00	5,836	2.57	OK			1	1	1	5,836	2.57					5,836	2.57
1200	B	40606	1822	8.0	4.0	1	33/150	150	33	1.00	33.00	4,210	1.87	OK			1	1	1	4,210	1.87					4,210	1.87
1201	B	40606	1822	8.0	4.0	1	16/110	110	16	1.00	16.00	2,372	0.90	OK			1	1	1	2,372	0.90					2,372	0.90
1202	B	40606	1822	8.0	4.0	1	0/110	110	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
1203	B	40606	1822	8.0	4.0	1	8/110	110	8	1.00	8.00	1,381	0.42	OK			1	1	1	1,381	0.42					1,381	0.42
1204	B	40606	1822	8.0	4.0	1	32/110	110	32	1.00	32.00	7,650	3.23	OK			1	1	1	7,650	3.23					7,650	3.23
1205	B	40606	1822	8.0	4.0	1	12/110	110	12	1.00	12.00	1,807	0.53	OK			1	1	1	1,807	0.53					1,807	0.53
1206	B	40606	1822	8.0	4.0	1	24/110	110	24	1.00	24.00	4,149	1.84	OK			1	1	1	4,149	1.84					4,149	1.84
1207	B	40606	1822	8.0	4.0	1	12/110	110	12	1.00	12.00	1,807	0.53	OK			1	1	1	1,807	0.53					1,807	0.53
1208	B	40606	1822	8.0	4.0	1	14/110	110	14	1.00	14.00	2,070	0.71	OK			1	1	1	2,070	0.71					2,070	0.71
1209	B	40606	1822	8.0	4.0	1	8/110	110	8	1.00	8.00	1,381	0.42	OK			1	1	1	1,381	0.42					1,381	0.42
1210	B	40606	1822	8.0	4.0	1	32/110	110	32	1.00	32.00	7,650	3.23	OK			1	1	1	7,650	3.23					7,650	3.23
1211	B	40606	1822	8.0	4.0	1	24/110	110	24	1.00	24.00	4,149	1.84	OK			1	1	1	4,149	1.84					4,149	1.84
1218	B	41006	1822	8.0	5.0	1	32/168	168	32	1.00	32.00	4,178	1.80	OK			1	1	1	4,178	1.80					4,178	1.80
1219	B	41006	1822	8.0	4.0	1	29/150	150	29	1.00	29.00	3,417	1.48	OK			1	1	1	3,417	1.48					3,417	1.48
1220	B	41006	1822	8.0	4.0	1	43/150	150	43	1.00	43.00	7,362	3.13	OK			1	1	1	7,362	3.13					7,362	3.13
1221	B	41006	1822	8.0	4.0	1	0/140	140	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
1222	B	41006	1822	8.0	4.0	1	10/144	144	10	1.00	10.00	1,349	0.42	OK			1	1	1	1,349	0.42					1,349	0.42
1223	B	41006	1822	8.0	4.0	1	11/140	140	11	1.00	11.00	1,442	0.42	OK			1	1	1	1,442	0.42					1,442	0.42
1224	B	41006	1822	8.0	4.0	1	0/140	140	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
683	D	8/16/05	1635	8	3	1	15/88	88	15	1.00	15.00	2,019	0.15	OK			1	1	1	2,019	0.15					2,019	0.15
684	D	7/27/05	1822	8	5	1	-8.75/131	131	-8.75	1.00	-8.75	576	0.15	OK			1	1	1	576	0.15					576	0.15
1258	B	41206	1822	8.0	4.0	1	12/151	151	12	1.00	12.00	1,451	0.42	OK			1	1	1	1,451	0.42					1,451	0.42
1265	B	41306	1822	8.0	4.0	1	12/151	151	12	1.00	12.00	1,451	0.42	OK			1	1	1	1,451	0.42					1,451	0.42
1266	B	41306	1822	8.0	4.0	1	32/151	151	32	1.00	32.00	3,949	1.75	OK			1	1	1	3,949	1.75					3,949	1.75
1267	B	41306	1822	8.0	4.0	1	12/151	151	12	1.00	12.00	1,451	0.42	OK			1	1	1	1,451	0.42					1,451	0.42
1268	B	41306	1822	8.0	4.0	1	8/151	151	8	1.00	8.00	1,197	0.42	OK			1	1	1	1,197	0.42					1,197	0.42
1269	B	41306	1822	8.0	4.0	1	32/140	140	32	1.00	32.00	4,508	2.01	OK			1	1	1	4,508	2.01					4,508	2.01
1270	B	41306	1822	8.0	4.0	1	0/140	140	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
1271	B	41306	1822	8.0	4.0	1	0/140	140	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
1272	B	41306	1822	8.0	4.0	1	11/140	140	11	1.00	11.00	1,442	0.42	OK			1	1	1	1,442	0.42					1,442	0.42
1273	B	41306	1822	8.0	4.0	1	0/140	140	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
1274	B	41306	1822	8.0	5.0	1	32/150	150	32	1.00	32.00	4,992	2.21	OK			1	1	1	4,992	2.21					4,992	2.21
1275	B	41306	1822	8.0	4.0	1	31/140	140	31	1.00	31.00	4,258	1.89	OK			1	1	1	4,258	1.89					4,258	1.89
1276	B	41306	1822	8.0	4.0	1	23/140	140	23	1.00	23.00	2,735	1.11	OK			1	1	1	2,735	1.11					2,735	1.11
1277	B	41306	1822	8.0	4.0	1	15/140	140	15	1.00	15.00	1,781	0.51	OK			1	1	1	1,781	0.51					1,781	0.51
1278	B	41306	1822	8.0	4.0	1	12/140	140	12	1.00	12.00	1,520	0.42	OK			1	1	1	1,520	0.42					1,520	0.42
686	D	7/28/05	1635	8	4	1	7/141	141	7	1.00	7.00	999	0.15	OK			1	1	1	999	0.15					999	0.15
1108	B	33006	1822	8.0	4.5	1	12/172	172	12	1.00	12.00	1,521	0.47	OK			1	1	1	1,521	0.47					1,521	0.47
1109	B	33006	1822	8.0	4.5	1	-8/172	172	-8	1.00	-8.00	716	0.46	OK			1	1	1	716	0.46					716	0.46

Obs	Invoice Letter	Test Date	EFLCH	Man EER	Ton	A/C Qty	Ref/Var	Ref Cap	Ref Adj.	RCA Site Flag	RCA Chg Adj	Invoiced RCA kWh	Invoiced RCA kW	Duplication Code	Reason for Dupe	Notes	RCA Charge = 0 (if chg=0 then =0)	RCA Dupe (if not a dupe then =1)	RCA Verification Multiplier (Charge x	Verified RCA kWh	Verified RCA kW	RCA kWh Dupes	RCA kW Dupes	RCA kWh Zeroes	RCA kW Zeroes	sum of verified, dupes, zeroes	Verified RCA kW
1110	B	33006	1822	8.0	4.5	1	16/172	172	16	1.00	16.00	1,804	0.47	OK			1	1	1	1,804	0.47					1,804	0.47
1162	B	40306	1822	8.0	4.0	1	32/150	150	32	1.00	32.00	3,994	1.77	OK			1	1	1	3,994	1.77					3,994	1.77
1163	B	40306	1822	8.0	4.0	1	36/150	150	36	1.00	36.00	4,944	2.20	OK			1	1	1	4,944	2.20					4,944	2.20
1164	B	40306	1822	8.0	4.0	1	16/150	150	16	1.00	16.00	1,775	0.50	OK			1	1	1	1,775	0.50					1,775	0.50
1165	B	40306	1822	8.0	5.0	1	30/168	168	30	1.00	30.00	3,812	1.61	OK			1	1	1	3,812	1.61					3,812	1.61
1166	B	40306	1822	8.0	7.5	1	0/152	152	0	1.00	0.00	1,559	1.01	RefAdj=0			0	1	0	0	0.00			1,559	1.01	1,559	1.01
1167	B	40306	1822	8.0	7.5	1	0/152	152	0	1.00	0.00	1,559	1.01	RefAdj=0			0	1	0	0	0.00			1,559	1.01	1,559	1.01
1168	B	40306	1822	8.0	5.0	1	0/172	172	0	1.00	0.00	1,039	0.67	RefAdj=0			0	1	0	0	0.00			1,039	0.67	1,039	0.67
1169	B	40306	1822	8.0	5.0	1	10/172	172	10	1.00	10.00	1,553	0.53	OK			1	1	1	1,553	0.53					1,553	0.53
1170	B	40306	1822	8.0	4.0	1	0/172	172	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
1171	B	40306	1822	8.0	4.0	1	16/172	172	16	1.00	16.00	1,604	0.42	OK			1	1	1	1,604	0.42					1,604	0.42
1172	B	40306	1822	8.0	4.0	1	8/172	172	8	1.00	8.00	1,143	0.42	OK			1	1	1	1,143	0.42					1,143	0.42
1173	B	40306	1822	8.0	4.0	1	-8/172	172	-8	1.00	-8.00	636	0.41	OK			1	1	1	636	0.41					636	0.41
1174	B	40306	1822	8.0	4.0	1	-8/172	172	-8	1.00	-8.00	636	0.41	OK			1	1	1	636	0.41					636	0.41
1175	B	40306	1822	8.0	4.0	1	4/172	172	4	1.00	4.00	971	0.42	OK			1	1	1	971	0.42					971	0.42
1176	B	40306	1822	8.0	4.0	1	0/152	152	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
1177	B	40406	1822	8.0	4.0	1	10/172	172	10	1.00	10.00	1,242	0.42	OK			1	1	1	1,242	0.42					1,242	0.42
1178	B	40406	1822	8.0	4.0	1	-10/172	172	-10	1.00	-10.00	603	0.39	OK			1	1	1	603	0.39					603	0.39
1179	B	40406	1822	8.0	4.0	1	-8/172	172	-8	1.00	-8.00	636	0.41	OK			1	1	1	636	0.41					636	0.41
1180	B	40406	1822	8.0	4.0	1	4/172	172	4	1.00	4.00	971	0.42	OK			1	1	1	971	0.42					971	0.42
1181	B	40406	1822	8.0	7.5	1	0/172	172	0	1.00	0.00	1,559	1.01	RefAdj=0			0	1	0	0	0.00			1,559	1.01	1,559	1.01
1182	B	40406	1822	8.0	7.5	1	12/172	172	12	1.00	12.00	2,535	0.79	OK			1	1	1	2,535	0.79					2,535	0.79
1183	B	40506	1822	8.0	4.0	1	0/150	150	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
1184	B	40506	1822	8.0	4.0	1	0/150	150	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
1185	B	40506	1822	8.0	4.0	1	21/150	150	21	1.00	21.00	2,277	0.84	OK			1	1	1	2,277	0.84					2,277	0.84
1212	B	40906	1822	8.0	5.0	1	36/168	168	36	1.00	36.00	5,030	2.23	OK			1	1	1	5,030	2.23					5,030	2.23
1213	B	40906	1822	8.0	4.0	1	33/150	150	33	1.00	33.00	4,210	1.87	OK			1	1	1	4,210	1.87					4,210	1.87
1214	B	40906	1822	8.0	4.0	1	34/150	150	34	1.00	34.00	4,439	1.98	OK			1	1	1	4,439	1.98					4,439	1.98
1215	B	40906	1822	8.0	4.0	1	7/150	150	7	1.00	7.00	1,144	0.42	OK			1	1	1	1,144	0.42					1,144	0.42
1216	B	40906	1822	8.0	6.0	1	8/185	185	8	1.00	8.00	1,675	0.63	OK			1	1	1	1,675	0.63					1,675	0.63
1217	B	40906	1822	8.0	5.0	1	17/168	168	17	1.00	17.00	2,130	0.56	OK			1	1	1	2,130	0.56					2,130	0.56
1296	B	41806	901	8.0	3.5	1	0/122	122	0	1.00	0.00	360	0.47	RefAdj=0			0	1	0	0	0.00			360	0.47	360	0.47
706	D	7/14/05	1635	8	4	1	-8/120	120	-8	1.00	-8.00	414	0.15	OK			1	1	1	414	0.15					414	0.15
1231	B	41106	1822	8.0	4.0	1	56/150	150	56	1.00	56.00	8,322	3.63	OK			1	1	1	8,322	3.63					8,322	3.63
1232	B	41106	1822	8.0	4.0	1	53/150	150	53	1.00	53.00	8,322	3.63	OK			1	1	1	8,322	3.63					8,322	3.63
1233	B	41106	1822	8.0	4.0	1	58/150	150	58	1.00	58.00	8,322	3.63	OK			1	1	1	8,322	3.63					8,322	3.63
1234	B	41106	1822	8.0	4.0	1	58/150	150	58	1.00	58.00	8,322	3.63	OK			1	1	1	8,322	3.63					8,322	3.63
1235	B	41106	1822	8.0	5.0	1	55/168	168	55	1.00	55.00	13,621	4.54	OK			1	1	1	13,621	4.54					13,621	4.54
1236	B	41106	1822	8.0	5.0	1	19/168	168	19	1.00	19.00	2,327	0.71	OK			1	1	1	2,327	0.71					2,327	0.71
1237	B	41106	1822	8.0	5.0	1	52/168	168	52	1.00	52.00	11,388	4.54	OK			1	1	1	11,388	4.54					11,388	4.54
1238	B	41106	1822	8.0	5.0	1	49/168	168	49	1.00	49.00	9,629	4.06	OK			1	1	1	9,629	4.06					9,629	4.06
1239	B	41106	1822	8.0	5.0	1	49/168	168	49	1.00	49.00	9,629	4.06	OK			1	1	1	9,629	4.06					9,629	4.06
1240	B	41106	1822	8.0	4.0	1	14/150	150	14	1.00	14.00	1,608	0.42	OK			1	1	1	1,608	0.42					1,608	0.42
1241	B	41106	1822	8.0	4.0	1	51/150	150	51	1.00	51.00	12,477	3.63	OK			1	1	1	12,477	3.63					12,477	3.63
1242	B	41106	1822	8.0	4.0	1	55/150	150	55	1.00	55.00	8,322	3.63	OK			1	1	1	8,322	3.63					8,322	3.63
1243	B	41106	1822	8.0	4.0	1	60/150	150	60	1.00	60.00	8,322	3.63	OK			1	1	1	8,322	3.63					8,322	3.63
1244	B	41106	1822	8.0	3.0	1	0/105	105	0	1.00	0.00	624	0.40	OK			0	1	0	0	0.00			624	0.40	624	0.40
1245	B	41106	1822	8.0	5.0	1	64/168	168	64	1.00	64.00	10,402	4.54	OK			1	1	1	10,402	4.54					10,402	4.54
1246	B	41106	1822	8.0	5.0	1	60/168	168	60	1.00	60.00	10,402	4.54	OK			1	1	1	10,402	4.54					10,402	4.54
1247	B	41106	1822	8.0	5.0	1	59/168	168	59	1.00	59.00	10,402	4.54	OK			1	1	1	10,402	4.54					10,402	4.54
1248	B	41106	1822	8.0	5.0	1	61/168	168	61	1.00	61.00	10,402	4.54	OK			1	1	1	10,402	4.54					10,402	4.54
1249	B	41106	1822	8.0	5.0	1	37/168	168	37	1.00	37.00	5,272	2.34	OK			1	1	1	5,272	2.34					5,272	2.34
1250	B	41106	1822	8.0	5.0	1	13/168	168	13	1.00	13.00	1,787	0.53	OK			1	1	1	1,787	0.53					1,787	0.53
1251	B	41106	1822	8.0	5.0	1	0/168	168	0	1.00	0.00	1,039	0.67	RefAdj=0			0	1	0	0	0.00			1,039	0.67	1,039	0.67
1252	B	41106	1822	8.0	5.0	1	41/168	168	41	1.00	41.00	6,388	2.84	OK			1	1	1	6,388	2.84					6,388	2.84
1253	B	41106	1822	8.0	5.0	1	49/168	168	49	1.00	49.00	9,629	4.06	OK			1	1	1	9,629	4.06					9,629	4.06
1259	B	41206	1822	8.0	4.0	1	21/140	140	21	1.00	21.00	2,455	0.95	OK			1	1	1	2,455	0.95					2,455	0.95
1260	B	41206	1822	8.0	4.0	1	0/140	140	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
1261	B	41206	1822	8.0	4.0	1	0/140	140	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
1262	B	41206	1822	8.0	6.0	1	44/179	179	44	1.00	44.00	7,778	3.46	OK			1	1	1	7,778	3.46					7,778	3.46
1263	B	41206	1822	8.0	5.0	1	17/168	168	17	1.00	17.00	2,130	0.56	OK			1	1	1	2,130	0.56					2,130	0.56
1264	B	41206	1822	8.0	5.0	1	53/168	168	53	1.00	53.00	12,071	4.54	OK			1	1	1	12,071	4.54					12,071	4.54
137	C	70606	901	8.0	0.0	1	0/0	0	0	1.00	0.00	257	0.34	RefAdj=0			0	1	0	0	0.00			257	0.34	257	0.34
138	C	70606	901	8.0	3.5	1	42/115	115	42	1.00	42.00	3,601	3.18	OK			1	1	1	3,601	3.18					3,601	3.18
1369	B	42006	1822	8.0	3.5	1	0/140	140	0	1.00	0.00	727	0.47	RefAdj=0			0	1	0	0	0.00			727	0.47	727	0.47
1370	B	42006	1822	8.0	3.5	1	0/140	140	0	1.00	0.00	727	0.47	RefAdj=0			0	1	0	0	0.00			727	0.47	727	0.47
1371	B	42006	1822	8.0	3.5	1	16/140	140	16	1.00	16.00	1,643	0.50	OK			1	1	1	1,643	0.50					1,643	0.50
1372	B	42006	1822	8.0	3.5	1	37/140	140	37	1.00	37.00	5,296	2.33	OK			1	1	1	5,296	2.33					5,296	2.33
1373	B	42006	1822	8.0	3.5	1	19/140	140	19	1.00	19.00	1,929	0.69	OK			1	1	1	1,929	0.69					1,929	0.69
1374	B	42006	1822	8.0	3.5	1	0/140	140	0	1.00	0.00	727	0.47	RefAdj=0			0	1	0	0	0.00			727	0.47	727	0.47

Obs	Invoice Letter	Test Date	EFLCH	Man EER	Ton	A/C Qty	Ref/Var	Ref Cap	Ref Adj.	RCA Site Flag	RCA Chg Adj	Invoiced RCA kWh	Invoiced RCA kW	Duplication Code	Reason for Dupe	Notes	RCA Charge = 0 (if chg=0 then =0)	RCA Dupe (if not a dupe then =1)	RCA Verification Multiplier (Charge x	Verified RCA kWh	Verified RCA kW	RCA kWh Dupes	RCA kW Dupes	RCA kWh Zeroes	RCA kW Zeroes	sum of verified, dupes, zeroes	Verified RCA kW
714	D	3/27/06	1635	8	4	1	12/172	172	12	1.00	12.00	1,181	0.15	OK			1	1	1	1,181	0.15					1,181	0.15
1424	B	51906	1420	8.0	4.0	1	0/104	104	0	1.00	0.00	648	0.54	RefAdj=0			0	1	0	0	0.00			648	0.54	648	0.54
1419	B	51606	1225	8.0	4.0	1	0/150	150	0	1.00	0.00	559	0.54	RefAdj=0			0	1	0	0	0.00			559	0.54	559	0.54
1420	B	51606	1225	8.0	4.0	1	0/150	150	0	1.00	0.00	559	0.54	RefAdj=0			0	1	0	0	0.00			559	0.54	559	0.54
727	D	7/25/05	1635	8	2.5	1	-10/98	98	-10	1.00	-10.00	224	0.15	OK			1	1	1	224	0.15					224	0.15
728	D	7/25/05	1635	8	2.5	1	4/98	98	4	1.00	4.00	580	0.15	OK			1	1	1	580	0.15					580	0.15
729	D	7/25/05	1420	8	2.5	1	22/98	98	22	1.00	22.00	2,272	0.15	OK			1	1	1	2,272	0.15					2,272	0.15
147	C	72006	1822	8.0	4.0	1	-16/150	150	-16	1.00	-16.00	523	0.34	OK			1	1	1	523	0.34					523	0.34
148	C	72006	1822	8.0	4.0	1	0/150	150	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
153	C	72006	1822	8.0	3.5	1	-6/150	150	-6	1.00	-6.00	575	0.37	OK			1	1	1	575	0.37					575	0.37
155	C	72006	1822	8.0	3.5	1	0/150	150	0	1.00	0.00	727	0.47	RefAdj=0			0	1	0	0	0.00			727	0.47	727	0.47
156	C	72006	1822	8.0	3.5	1	-8/150	150	-8	1.00	-8.00	539	0.35	OK			1	1	1	539	0.35					539	0.35
157	C	72006	1822	8.0	3.5	1	-12/150	150	-12	1.00	-12.00	486	0.31	OK			1	1	1	486	0.31					486	0.31
740	D	7/31/06	1635	8	3.5	1	-30/140	140	-30	1.00	-30.00	418	0.15	OK			1	1	1	418	0.15					418	0.15
741	D	7/31/06	1635	8	3.5	1	-20/140	140	-20	1.00	-20.00	308	0.15	OK			1	1	1	308	0.15					308	0.15
742	D	7/31/06	1635	8	4	1	-26/144	144	-26	1.00	-26.00	397	0.15	OK			1	1	1	397	0.15					397	0.15
743	D	7/31/06	1635	8	5	1	-14/152	152	-14	1.00	-14.00	461	0.15	OK			1	1	1	461	0.15					461	0.15
744	D	7/31/06	1635	8	5	1	-30/152	152	-30	1.00	-30.00	541	0.15	OK			1	1	1	541	0.15					541	0.15
745	D	7/31/06	1635	8	5	1	-26/152	152	-26	1.00	-26.00	477	0.15	OK			1	1	1	477	0.15					477	0.15
746	D	7/27/06	1635	8	4	1	-15/128	128	-15	1.00	-15.00	349	0.15	OK			1	1	1	349	0.15					349	0.15
747	D	7/28/06	1635	8	4	1	-12/128	128	-12	1.00	-12.00	367	0.15	OK			1	1	1	367	0.15					367	0.15
748	D	7/26/06	1635	8	4	1	12/128	128	12	1.00	12.00	1,441	0.15	OK			1	1	1	1,441	0.15					1,441	0.15
749	D	7/27/06	1635	8	5	1	-14/160	160	-14	1.00	-14.00	469	0.15	OK			1	1	1	469	0.15					469	0.15
750	D	7/31/06	1635	8	5	1	-10.5/152	152	-10.5	1.00	-10.50	510	0.15	OK			1	1	1	510	0.15					510	0.15
751	D	7/26/06	1635	8	5	1	-32/160	160	-32	1.00	-32.00	549	0.15	OK			1	1	1	549	0.15					549	0.15
752	D	7/26/06	1635	8	4	1	14/128	128	14	1.00	14.00	1,639	0.15	OK			1	1	1	1,639	0.15					1,639	0.15
753	D	7/28/06	1635	8	5	1	24/160	160	24	1.00	24.00	2,852	0.15	OK			1	1	1	2,852	0.15					2,852	0.15
754	D	7/26/06	1635	8	5	1	-16/160	160	-16	1.00	-16.00	450	0.15	OK			1	1	1	450	0.15					450	0.15
755	D	7/31/06	1635	8	5	1	-30/152	152	-30	1.00	-30.00	541	0.15	OK			1	1	1	541	0.15					541	0.15
756	D	7/31/06	1635	8	6	1	4/153	153	4	1.00	4.00	1,231	0.15	OK			1	1	1	1,231	0.15					1,231	0.15
757	D	7/31/06	1635	8	6	1	8/153	153	8	1.00	8.00	1,531	0.15	OK			1	1	1	1,531	0.15					1,531	0.15
758	D	7/27/06	1635	8	7	1	12/122	122	12	1.00	12.00	2,620	0.15	OK			1	1	1	2,620	0.15					2,620	0.15
759	D	7/31/06	1635	8	5	1	-20/152	152	-20	1.00	-20.00	435	0.15	OK			1	1	1	435	0.15					435	0.15
760	D	7/27/06	1635	8	4	1	-12/331	331	-12	1.00	-12.00	502	0.15	OK			1	1	1	502	0.15					502	0.15
761	D	7/27/06	1635	8	4	1	-14/190	190	-14	1.00	-14.00	399	0.15	OK			1	1	1	399	0.15					399	0.15
762	D	8/11/06	1635	8	4	1	-35/144	144	-35	1.00	-35.00	576	0.15	OK			1	1	1	576	0.15					576	0.15
763	D	8/11/06	1635	8	4	1	-22/151	151	-22	1.00	-22.00	354	0.15	OK			1	1	1	354	0.15					354	0.15
764	D	8/11/06	1635	8	3.5	1	-34/140	140	-34	1.00	-34.00	503	0.15	OK			1	1	1	503	0.15					503	0.15
765	D	8/11/06	1635	8	3.5	1	18/118	118	18	1.00	18.00	2,038	0.15	OK			1	1	1	2,038	0.15					2,038	0.15
766	D	8/14/06	1635	8	3.5	1	-35/140	140	-35	1.00	-35.00	528	0.15	OK			1	1	1	528	0.15					528	0.15
767	D	8/14/06	1635	8	3.5	1	-19/140	140	-19	1.00	-19.00	305	0.15	OK			1	1	1	305	0.15					305	0.15
768	D	8/14/06	1635	8	4	1	4/118	118	4	1.00	4.00	875	0.15	OK			1	1	1	875	0.15					875	0.15
1410	B	50906	901	8.0	3.0	1	35/67	67	35	1.00	35.00	3,086	2.72	OK			1	1	1	3,086	2.72					3,086	2.72
162	C	53106	1822	8.0	5.0	1	7/233	233	7	1.00	7.00	1,272	0.53	OK			1	1	1	1,272	0.53					1,272	0.53
163	C	53106	1822	8.0	5.0	1	9/152	152	9	1.00	9.00	1,565	0.53	OK			1	1	1	1,565	0.53					1,565	0.53
164	C	53106	1822	8.0	5.0	1	5/131	131	5	1.00	5.00	1,346	0.53	OK			1	1	1	1,346	0.53					1,346	0.53
165	C	53106	1822	8.0	5.0	1	4/131	131	4	1.00	4.00	1,276	0.53	OK			1	1	1	1,276	0.53					1,276	0.53
166	C	53106	1822	8.0	4.0	1	0/102	102	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
167	C	53106	1822	8.0	5.0	1	-27/122	122	-27	1.00	-27.00	834	0.54	OK			1	1	1	834	0.54					834	0.54
168	C	53106	1822	8.0	5.0	1	-20/112	112	-20	1.00	-20.00	702	0.45	OK			1	1	1	702	0.45					702	0.45
169	C	53106	1822	8.0	5.0	1	0/112	112	0	1.00	0.00	1,039	0.67	RefAdj=0			0	1	0	0	0.00			1,039	0.67	1,039	0.67
170	C	60106	1822	8.0	5.0	1	0/112	112	0	1.00	0.00	1,039	0.67	RefAdj=0			0	1	0	0	0.00			1,039	0.67	1,039	0.67
172	C	60106	1822	8.0	5.0	1	0/112	112	0	1.00	0.00	1,039	0.67	RefAdj=0			0	1	0	0	0.00			1,039	0.67	1,039	0.67
173	C	60106	1822	8.0	5.0	1	0/133	133	0	1.00	0.00	1,039	0.67	RefAdj=0			0	1	0	0	0.00			1,039	0.67	1,039	0.67
174	C	60106	1822	8.0	5.0	1	0/122	122	0	1.00	0.00	1,039	0.67	RefAdj=0			0	1	0	0	0.00			1,039	0.67	1,039	0.67
175	C	60106	1822	8.0	4.0	1	0/106	106	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
176	C	60106	1822	8.0	4.0	1	0/106	106	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
177	C	60106	1822	8.0	5.0	1	0/133	133	0	1.00	0.00	1,039	0.67	RefAdj=0			0	1	0	0	0.00			1,039	0.67	1,039	0.67
794	D	5/31/06	1635	8	5	1	21/133	133	21	1.00	21.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
795	D	5/31/06	1635	8	4	1	6/112	112	6	1.00	6.00	1,032	0.15	OK			1	1	1	1,032	0.15					1,032	0.15
796	D	5/31/06	1635	8	5	1	4/112	112	4	1.00	4.00	1,111	0.15	OK			1	1	1	1,111	0.15					1,111	0.15
797	D	5/31/06	1635	8	5	1	5/133	133	5	1.00	5.00	1,129	0.15	OK			1	1	1	1,129	0.15					1,129	0.15
798	D	5/31/06	1635	8	5	1	7/158	158	7	1.00	7.00	1,194	0.15	OK			1	1	1	1,194	0.15					1,194	0.15
799	D	5/31/06	1635	8	5	1	9/157	157	9	1.00	9.00	1,331	0.15	OK			1	1	1	1,331	0.15					1,331	0.15
800	D	6/1/06	1635	8	4	1	-13/106	106	-13	1.00	-13.00	348	0.15	OK			1	1	1	348	0.15					348	0.15
801	D	6/1/06	1635	8	5	1	-16/133	133	-16	1.00	-16.00	435	0.15	OK			1	1	1	435	0.15					435	0.15
802	D	6/1/06	1635	8	5	1	-18/112	112	-18	1.00	-18.00	460	0.15	OK			1	1	1	460	0.15					460	0.15
803	D	6/1/06	1635	8	5	1	18/112	112	18	1.00	18.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
804	D	6/1/06	1635	8	5	1	6/133	133	6	1.00	6.00	1,202	0.15	OK			1	1	1	1,202	0.15					1,202	0.15
805	D	6/1/06	1635	8	5	1	7/112	112	7	1.00	7.00	1,390	0.15	OK			1	1	1	1,390	0.15					1,390	0.15

Obs	Invoice Letter	Test Date	EFLCH	Man EER	Ton	A/C Qty	Ref/Var	Ref Cap	Ref Adj.	RCA Site Flag	RCA Chg Adj	Invoiced RCA kWh	Invoiced RCA kW	Duplication Code	Reason for Dupe	Notes	RCA Charge = 0 (if chg=0 then =0)	RCA Dupe (if not a dupe then =1)	RCA Verification Multiplier (Charge x	Verified RCA kWh	Verified RCA kW	RCA kWh Dupes	RCA kW Dupes	RCA kWh Zeroes	RCA kW Zeroes	sum of verified, dupes, zeroes	Verified RCA kW
806	D	6/1/06	1635	8	4	1	10/106	106	10	1.00	10.00	1,448	0.15	OK			1	1	1	1,448	0.15					1,448	0.15
807	D	6/1/06	1635	8	5	1	16/158	158	16	1.00	16.00	1,917	0.15	OK			1	1	1	1,917	0.15					1,917	0.15
1391	B	42106	1822	8.0	5.0	1	0/233	233	0	1.00	0.00	1,039	0.67	RefAdj=0			0	1	0	0	0.00			1,039	0.67	1,039	0.67
1421	B	51606	901	8.0	2.5	1	0/76	76	0	1.00	0.00	257	0.34	RefAdj=0			0	1	0	0	0.00			257	0.34	257	0.34
1328	B	41906	1822	8.0	4.0	1	18/150	150	18	1.00	18.00	1,960	0.63	OK			1	1	1	1,960	0.63					1,960	0.63
1329	B	41906	1822	8.0	4.0	1	17/150	150	17	1.00	17.00	1,865	0.57	OK			1	1	1	1,865	0.57					1,865	0.57
1330	B	41906	1822	8.0	4.0	1	26/150	150	26	1.00	26.00	2,930	1.22	OK			1	1	1	2,930	1.22					2,930	1.22
1331	B	41906	1822	8.0	4.0	1	21/150	150	21	1.00	21.00	2,277	0.84	OK			1	1	1	2,277	0.84					2,277	0.84
1332	B	41906	1822	8.0	4.0	1	22/150	150	22	1.00	22.00	2,394	0.91	OK			1	1	1	2,394	0.91					2,394	0.91
1333	B	41906	1822	8.0	4.0	1	32/150	150	32	1.00	32.00	3,994	1.77	OK			1	1	1	3,994	1.77					3,994	1.77
1334	B	41906	1822	8.0	4.0	1	29/150	150	29	1.00	29.00	3,417	1.48	OK			1	1	1	3,417	1.48					3,417	1.48
1335	B	41906	1822	8.0	4.0	1	32/150	150	32	1.00	32.00	3,994	1.77	OK			1	1	1	3,994	1.77					3,994	1.77
1336	B	41906	1822	8.0	4.0	1	37/150	150	37	1.00	37.00	5,222	2.32	OK			1	1	1	5,222	2.32					5,222	2.32
1337	B	41906	1822	8.0	4.0	1	41/150	150	41	1.00	41.00	6,543	2.84	OK			1	1	1	6,543	2.84					6,543	2.84
1338	B	41906	1822	8.0	4.0	1	39/150	150	39	1.00	39.00	5,836	2.57	OK			1	1	1	5,836	2.57					5,836	2.57
1339	B	41906	1822	8.0	4.0	1	43/150	150	43	1.00	43.00	7,362	3.13	OK			1	1	1	7,362	3.13					7,362	3.13
1340	B	41906	1822	8.0	4.0	1	19/150	150	19	1.00	19.00	2,060	0.70	OK			1	1	1	2,060	0.70					2,060	0.70
1341	B	41906	1822	8.0	4.0	1	20/150	150	20	1.00	20.00	2,166	0.77	OK			1	1	1	2,166	0.77					2,166	0.77
1342	B	41906	1822	8.0	4.0	1	0/150	150	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
1343	B	41906	1822	8.0	4.0	1	33/150	150	33	1.00	33.00	4,210	1.87	OK			1	1	1	4,210	1.87					4,210	1.87
1344	B	41906	1822	8.0	4.0	1	0/150	150	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
1345	B	41906	1822	8.0	4.0	1	15/150	150	15	1.00	15.00	1,689	0.44	OK			1	1	1	1,689	0.44					1,689	0.44
1346	B	41906	1822	8.0	4.0	1	46/150	150	46	1.00	46.00	8,863	3.61	OK			1	1	1	8,863	3.61					8,863	3.61
1347	B	41906	1822	8.0	7.0	1	0/134	134	0	1.00	0.00	1,455	0.94	RefAdj=0			0	1	0	0	0.00			1,455	0.94	1,455	0.94
1348	B	41906	1822	8.0	4.0	1	0/150	150	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
1349	B	41906	1822	8.0	4.0	1	16/150	150	16	1.00	16.00	1,775	0.50	OK			1	1	1	1,775	0.50					1,775	0.50
1350	B	41906	1822	8.0	4.0	1	13/150	150	13	1.00	13.00	1,530	0.42	OK			1	1	1	1,530	0.42					1,530	0.42
1351	B	41906	1822	8.0	4.0	1	47/150	150	47	1.00	47.00	9,455	3.63	OK			1	1	1	9,455	3.63					9,455	3.63
1352	B	41906	1822	8.0	7.0	1	0/148	148	0	1.00	0.00	1,455	0.94	RefAdj=0			0	1	0	0	0.00			1,455	0.94	1,455	0.94
1425	B	52506	1822	8.0	4.0	1	-19/150	150	-19	1.00	-19.00	516	0.33	OK			1	1	1	516	0.33					516	0.33
1426	B	52506	1822	8.0	4.0	1	-20/150	150	-20	1.00	-20.00	516	0.33	OK			1	1	1	516	0.33					516	0.33
1427	B	52506	1822	8.0	4.0	1	-8/160	160	-8	1.00	-8.00	625	0.40	OK			1	1	1	625	0.40					625	0.40
1436	B	52506	1822	8.0	4.0	1	-3/160	160	-3	1.00	-3.00	740	0.48	OK			1	1	1	740	0.48					740	0.48
930	D	1/8/06	1635	8	3	1	7/118	118	7	1.00	7.00	812	0.15	OK			1	1	1	812	0.15					812	0.15
178	C	71306	1822	8.0	5.0	1	13/128	128	13	1.00	13.00	2,136	0.57	OK			1	1	1	2,136	0.57					2,136	0.57
179	C	71306	1822	8.0	4.0	1	10/128	128	10	1.00	10.00	1,437	0.42	OK			1	1	1	1,437	0.42					1,437	0.42
180	C	71306	1822	8.0	4.0	1	25/128	128	25	1.00	25.00	3,469	1.51	OK			1	1	1	3,469	1.51					3,469	1.51
181	C	71306	1822	8.0	5.0	1	15/160	160	15	1.00	15.00	2,016	0.53	OK			1	1	1	2,016	0.53					2,016	0.53
182	C	71306	1822	8.0	5.0	1	16/160	160	16	1.00	16.00	2,111	0.55	OK			1	1	1	2,111	0.55					2,111	0.55
183	C	71306	1822	8.0	4.0	1	10/128	128	10	1.00	10.00	1,437	0.42	OK			1	1	1	1,437	0.42					1,437	0.42
184	C	71306	1822	8.0	4.0	1	8/128	128	8	1.00	8.00	1,282	0.42	OK			1	1	1	1,282	0.42					1,282	0.42
185	C	71306	1822	8.0	4.0	1	0/128	128	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
186	C	71306	1822	8.0	4.0	1	8/128	128	8	1.00	8.00	1,282	0.42	OK			1	1	1	1,282	0.42					1,282	0.42
187	C	71306	1822	8.0	5.0	1	0/160	160	0	1.00	0.00	1,039	0.67	RefAdj=0			0	1	0	0	0.00			1,039	0.67	1,039	0.67
188	C	71306	1822	8.0	4.0	1	30/128	128	30	1.00	30.00	4,723	2.10	OK			1	1	1	4,723	2.10					4,723	2.10
189	C	71306	1822	8.0	6.0	1	24/153	153	24	1.00	24.00	3,878	1.54	OK			1	1	1	3,878	1.54					3,878	1.54
190	C	71306	1822	8.0	6.0	1	22/153	153	22	1.00	22.00	3,514	1.32	OK			1	1	1	3,514	1.32					3,514	1.32
191	C	71306	1822	8.0	6.0	1	33/153	153	33	1.00	33.00	6,102	2.70	OK			1	1	1	6,102	2.70					6,102	2.70
192	C	71306	1822	8.0	6.0	1	30/153	153	30	1.00	30.00	5,235	2.27	OK			1	1	1	5,235	2.27					5,235	2.27
193	C	71406	1822	8.0	4.5	1	56/191	191	56	1.00	56.00	8,788	3.70	OK			1	1	1	8,788	3.70					8,788	3.70
194	C	71406	1822	8.0	4.0	1	-9/140	140	-9	1.00	-9.00	587	0.38	OK			1	1	1	587	0.38					587	0.38
195	C	71406	1822	8.0	4.0	1	-16/140	140	-16	1.00	-16.00	518	0.33	OK			1	1	1	518	0.33					518	0.33
196	C	71406	1822	8.0	4.0	1	-25/140	140	-25	1.00	-25.00	562	0.36	OK			1	1	1	562	0.36					562	0.36
197	C	71406	1822	8.0	4.0	1	-16/82	82	-16	1.00	-16.00	595	0.38	OK			1	1	1	595	0.38					595	0.38
198	C	71406	1822	8.0	4.0	1	0/82	82	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
199	C	71406	1822	8.0	4.0	1	-32/82	82	-32	1.00	-32.00	1,704	1.10	OK			1	1	1	1,704	1.10					1,704	1.10
200	C	71406	1822	8.0	4.0	1	16/82	82	16	1.00	16.00	3,464	1.50	OK			1	1	1	3,464	1.50					3,464	1.50
201	C	71406	1822	8.0	4.0	1	32/82	82	32	1.00	32.00	8,322	3.63	OK			1	1	1	8,322	3.63					8,322	3.63
202	C	71106	1822	8.0	4.0	1	0/121	121	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
203	C	71106	1822	8.0	4.0	1	0/129	129	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
204	C	71106	1822	8.0	4.0	1	0/88	88	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
205	C	71106	1822	8.0	4.0	1	23/160	160	23	1.00	23.00	2,342	0.88	OK			1	1	1	2,342	0.88					2,342	0.88
206	C	71206	1822	8.0	2.5	1	31/56	56	31	1.00	31.00	5,201	2.27	OK			1	1	1	5,201	2.27					5,201	2.27
207	C	71206	1822	8.0	4.0	1	-48/128	128	-48	1.00	-48.00	1,565	1.01	OK			1	1	1	1,565	1.01					1,565	1.01
208	C	71206	1822	8.0	4.0	1	0/128	128	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
209	C	71206	1822	8.0	4.0	1	0/160	160	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
210	C	71206	1822	8.0	4.0	1	4/160	160	4	1.00	4.00	983	0.42	OK			1	1	1	983	0.42					983	0.42
211	C	71206	1822	8.0	4.0	1	12/160	160	12	1.00	12.00	1,405	0.42	OK			1	1	1	1,405	0.42					1,405	0.42
931	D	1/12/05	1635	8	4	1	10/140	140	10	1.00	10.00	1,198	0.15	OK			1	1	1	1,198	0.15					1,198	0.15
932	D	1/12/05	1635	8	4	1	8/140	140	8	1.00	8.00	1,063	0.15	OK			1	1	1	1,063	0.15					1,063	0.15

Obs	Invoice Letter	Test Date	EFLCH	Man EER	Ton	A/C Qty	Ref/Var	Ref Cap	Ref Adj.	RCA Site Flag	RCA Chg Adj	Invoiced RCA kWh	Invoiced RCA kW	Duplication Code	Reason for Dupe	Notes	RCA Charge = 0 (if chg=0 then =0)	RCA Dupe (if not a dupe then =1)	RCA Verification Multiplier (Charge x	Verified RCA kWh	Verified RCA kW	RCA kWh Dupes	RCA kW Dupes	RCA kWh Zeroes	RCA kW Zeroes	sum of verified, dupes, zeroes	Verified RCA kW
933	D	1/12/06	1635	8	3.5	1	-4/150	150	-4	1.00	-4.00	471	0.15	OK			1	1	1	471	0.15					471	0.15
934	D	1/12/06	1635	8	3.5	1	16/150	150	16	1.00	16.00	1,403	0.15	OK			1	1	1	1,403	0.15					1,403	0.15
936	D	1/12/06	1635	8	3.5	1	10/140	140	10	1.00	10.00	1,048	0.15	OK			1	1	1	1,048	0.15					1,048	0.15
938	D	1/10/06	1635	8	4	1	-4/88	88	-4	1.00	-4.00	471	0.15	OK			1	1	1	471	0.15					471	0.15
939	D	1/10/06	1635	8	4	1	3/88	88	3	1.00	3.00	877	0.15	OK			1	1	1	877	0.15					877	0.15
940	D	1/10/06	1635	8	4	1	-6/88	88	-6	1.00	-6.00	410	0.15	OK			1	1	1	410	0.15					410	0.15
941	D	1/10/06	1635	8	4	1	16/56	56	16	1.00	16.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
942	D	1/10/06	1635	8	4	1	6/88	88	6	1.00	6.00	1,166	0.15	OK			1	1	1	1,166	0.15					1,166	0.15
943	D	1/10/06	1635	8	4	1	-10/88	88	-10	1.00	-10.00	351	0.15	OK			1	1	1	351	0.15					351	0.15
944	D	1/10/06	1635	8	4	1	-8/88	88	-8	1.00	-8.00	371	0.15	OK			1	1	1	371	0.15					371	0.15
945	D	1/10/06	1635	8	4	1	3/88	88	3	1.00	3.00	877	0.15	OK			1	1	1	877	0.15					877	0.15
1297	B	41806	1822	8.0	3.5	1	0/140	140	0	1.00	0.00	727	0.47	RefAdj=0			0	1	0	0	0.00			727	0.47	727	0.47
1298	B	41806	1822	8.0	3.5	1	17/140	140	17	1.00	17.00	1,733	0.57	OK			1	1	1	1,733	0.57					1,733	0.57
1299	B	41806	1822	8.0	3.5	1	19/140	140	19	1.00	19.00	1,929	0.69	OK			1	1	1	1,929	0.69					1,929	0.69
1300	B	41806	1822	8.0	3.5	1	0/140	140	0	1.00	0.00	727	0.47	RefAdj=0			0	1	0	0	0.00			727	0.47	727	0.47
1301	B	41806	1822	8.0	4.0	1	0/72	72	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
1302	B	41806	1822	8.0	4.0	1	0/128	128	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
1303	B	41806	1822	8.0	4.0	1	4/0	0	4	1.00	4.00	831	0.54	OK			1	1	1	831	0.54					831	0.54
1304	B	41806	1822	8.0	4.0	1	8/0	0	8	1.00	8.00	831	0.54	OK			1	1	1	831	0.54					831	0.54
1305	B	41806	1822	8.0	4.0	1	12/0	0	12	1.00	12.00	831	0.54	OK			1	1	1	831	0.54					831	0.54
1306	B	41806	1822	8.0	4.0	1	0/0	0	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
1307	B	41806	1822	8.0	4.0	1	14/0	0	14	1.00	14.00	831	0.54	OK			1	1	1	831	0.54					831	0.54
1308	B	41806	1822	8.0	4.0	1	0/0	0	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
1309	B	41806	1822	8.0	4.0	1	0/0	0	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
1310	B	41806	1822	8.0	4.0	1	0/0	0	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
1311	B	41806	1822	8.0	4.0	1	31/150	150	31	1.00	31.00	3,790	1.67	OK			1	1	1	3,790	1.67					3,790	1.67
1312	B	41806	1822	8.0	4.0	1	33/150	150	33	1.00	33.00	4,210	1.87	OK			1	1	1	4,210	1.87					4,210	1.87
1375	B	42006	1822	8.0	4.0	1	12/140	140	12	1.00	12.00	1,520	0.42	OK			1	1	1	1,520	0.42					1,520	0.42
1376	B	42006	1822	8.0	4.0	1	0/140	140	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
1377	B	42006	1822	8.0	4.0	1	16/140	140	16	1.00	16.00	1,878	0.58	OK			1	1	1	1,878	0.58					1,878	0.58
1378	B	42006	1822	8.0	4.0	1	0/140	140	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
1379	B	42006	1822	8.0	4.0	1	32/140	140	32	1.00	32.00	4,508	2.01	OK			1	1	1	4,508	2.01					4,508	2.01
1398	B	42406	1822	8.0	4.0	1	0/140	140	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
1399	B	42406	1822	8.0	4.0	1	0/140	140	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
1400	B	42406	1822	8.0	4.0	1	4/140	140	4	1.00	4.00	1,007	0.42	OK			1	1	1	1,007	0.42					1,007	0.42
1401	B	42406	1822	8.0	4.0	1	0/140	140	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
1402	B	42406	1822	8.0	4.0	1	0/140	140	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
1403	B	42406	1822	8.0	3.5	1	32/140	140	32	1.00	32.00	3,944	1.76	OK			1	1	1	3,944	1.76					3,944	1.76
1404	B	42406	1822	8.0	3.5	1	0/140	140	0	1.00	0.00	727	0.47	RefAdj=0			0	1	0	0	0.00			727	0.47	727	0.47
1405	B	42406	1822	8.0	3.5	1	0/140	140	0	1.00	0.00	727	0.47	RefAdj=0			0	1	0	0	0.00			727	0.47	727	0.47
1406	B	42406	1822	8.0	4.0	1	0/140	140	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
1407	B	42406	1822	8.0	3.5	1	0/140	140	0	1.00	0.00	727	0.47	RefAdj=0			0	1	0	0	0.00			727	0.47	727	0.47
1353	B	41906	1822	8.0	2.5	1	0/85	85	0	1.00	0.00	520	0.34	RefAdj=0			0	1	0	0	0.00			520	0.34	520	0.34
1411	B	51006	901	8.0	3.5	1	-36/102	102	-36	1.00	-36.00	598	0.78	OK			1	1	1	598	0.78					598	0.78
1412	B	51006	901	8.0	3.5	1	9/102	102	9	1.00	9.00	670	0.37	OK			1	1	1	670	0.37					670	0.37
1413	B	51006	901	8.0	4.0	1	0/208	208	0	1.00	0.00	411	0.54	RefAdj=0			0	1	0	0	0.00			411	0.54	411	0.54
1414	B	51206	901	8.0	4.0	1	0/128	128	0	1.00	0.00	411	0.54	RefAdj=0			0	1	0	0	0.00			411	0.54	411	0.54
1415	B	51206	901	8.0	4.0	1	0/128	128	0	1.00	0.00	411	0.54	RefAdj=0			0	1	0	0	0.00			411	0.54	411	0.54
1416	B	51206	901	8.0	4.0	1	0/128	128	0	1.00	0.00	411	0.54	RefAdj=0			0	1	0	0	0.00			411	0.54	411	0.54
1417	B	51206	901	8.0	4.0	1	0/128	128	0	1.00	0.00	411	0.54	RefAdj=0			0	1	0	0	0.00			411	0.54	411	0.54
1021	D	8/11/05	1635	8	4	1	-44/144	144	-44	1.00	-44.00	885	0.15	OK			1	1	1	885	0.15					885	0.15
1022	D	12/13/05	1635	8	4	1	6/132	132	6	1.00	6.00	964	0.15	OK			1	1	1	964	0.15					964	0.15
1027	D	11/30/05	1635	8	4	1	2/71	71	2	1.00	2.00	835	0.15	OK			1	1	1	835	0.15					835	0.15
1028	D	11/30/05	1635	8	4	1	2/71	71	2	1.00	2.00	835	0.15	OK			1	1	1	835	0.15					835	0.15
1029	D	11/30/05	1635	8	4	1	3/71	71	3	1.00	3.00	939	0.15	OK			1	1	1	939	0.15					939	0.15
1031	D	11/30/05	1635	8	4	1	4/71	71	4	1.00	4.00	1,056	0.15	OK			1	1	1	1,056	0.15					1,056	0.15
1032	D	11/30/05	1635	8	4	1	5/71	71	5	1.00	5.00	1,188	0.15	OK			1	1	1	1,188	0.15					1,188	0.15
1033	D	11/30/05	1635	8	4	1	8/71	71	8	1.00	8.00	1,684	0.15	OK			1	1	1	1,684	0.15					1,684	0.15
1036	D	12/1/05	1635	8	4	1	-16/71	71	-16	1.00	-16.00	512	0.15	OK			1	1	1	512	0.15					512	0.15
1037	D	12/1/05	1635	8	4	1	16/71	71	16	1.00	16.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
1038	D	12/1/05	1635	8	4	1	2/71	71	2	1.00	2.00	835	0.15	OK			1	1	1	835	0.15					835	0.15
1039	D	12/1/05	1635	8	4	1	2/71	71	2	1.00	2.00	835	0.15	OK			1	1	1	835	0.15					835	0.15
1040	D	12/1/05	1635	8	4	1	4/71	71	4	1.00	4.00	1,056	0.15	OK			1	1	1	1,056	0.15					1,056	0.15
1041	D	12/1/05	1635	8	4	1	5/71	71	5	1.00	5.00	1,188	0.15	OK			1	1	1	1,188	0.15					1,188	0.15
1042	D	12/1/05	1635	8	4	1	5/71	71	5	1.00	5.00	1,188	0.15	OK			1	1	1	1,188	0.15					1,188	0.15
1043	D	12/1/05	1635	8	4	1	5/71	71	5	1.00	5.00	1,188	0.15	OK			1	1	1	1,188	0.15					1,188	0.15
1044	D	12/1/05	1635	8	4	1	11/71	71	11	1.00	11.00	2,375	0.15	OK			1	1	1	2,375	0.15					2,375	0.15
1045	D	12/5/05	1635	8	4	1	3/75	75	3	1.00	3.00	921	0.15	OK			1	1	1	921	0.15					921	0.15
1046	D	12/5/05	1635	8	4	1	5/78	78	5	1.00	5.00	1,127	0.15	OK			1	1	1	1,127	0.15					1,127	0.15
1047	D	12/5/05	1635	8	4	1	5/75	75	5	1.00	5.00	1,151	0.15	OK			1	1	1	1,151	0.15					1,151	0.15

Obs	Invoice Letter	Test Date	EFLCH	Man EER	Ton	A/C Qty	Ref/Var	Ref Cap	Ref Adj.	RCA Site Flag	RCA Chg Adj	Invoiced RCA kWh	Invoiced RCA kW	Duplication Code	Reason for Dupe	Notes	RCA Charge = 0 (if chg=0 then =0)	RCA Dupe (if not a dupe then =1)	RCA Verification Multiplier (Charge x	Verified RCA kWh	Verified RCA kW	RCA kWh Dupes	RCA kW Dupes	RCA kWh Zeroes	RCA kW Zeroes	sum of verified, dupes, zeroes	Verified RCA kW
1048	D	12/5/05	1635	8	4	1	6/75	75	6	1.00	6.00	1,286	0.15	OK			1	1	1	1,286	0.15					1,286	0.15
1049	D	12/5/05	1635	8	4	1	11/120	120	11	1.00	11.00	1,417	0.15	OK			1	1	1	1,417	0.15					1,417	0.15
1050	D	12/5/05	1635	8	4	1	10/88	88	10	1.00	10.00	1,697	0.15	OK			1	1	1	1,697	0.15					1,697	0.15
1051	D	12/5/05	1635	8	4	1	16/120	120	16	1.00	16.00	1,993	0.15	OK			1	1	1	1,993	0.15					1,993	0.15
213	C	70706	1822	8.0	4.0	1	0/112	112	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
214	C	70706	1822	8.0	4.0	1	-10/92	92	-10	1.00	-10.00	521	0.34	OK			1	1	1	521	0.34					521	0.34
215	C	70706	1822	8.0	4.0	1	3/118	118	3	1.00	3.00	985	0.42	OK			1	1	1	985	0.42					985	0.42
217	C	71006	1822	8.0	2.5	1	-16/68	68	-16	1.00	-16.00	447	0.29	OK			1	1	1	447	0.29					447	0.29
218	C	71006	1822	8.0	4.0	1	-12/88	88	-12	1.00	-12.00	517	0.33	OK			1	1	1	517	0.33					517	0.33
219	C	71006	1822	8.0	4.0	1	-19/65	65	-19	1.00	-19.00	976	0.63	OK			1	1	1	976	0.63					976	0.63
220	C	71006	1822	8.0	4.0	1	0/65	65	0	1.00	0.00	831	0.54	RefAdj=0			0	1	0	0	0.00			831	0.54	831	0.54
221	C	71006	1822	88.0	4.0	1	-26/65	65	-26	1.00	-26.00	163	0.11	OK			1	1	1	163	0.11					163	0.11
222	C	71006	1822	8.0	4.0	1	-20/65	65	-20	1.00	-20.00	1,066	0.69	OK			1	1	1	1,066	0.69					1,066	0.69
223	C	71006	1635	8.0	7.0	1	20/112	112	20	1.00	20.00	4,790	2.25	OK			1	1	1	4,790	2.25					4,790	2.25
224	C	71006	1635	8.0	7.0	1	0/93	93	0	1.00	0.00	1,306	0.94	RefAdj=0			0	1	0	0	0.00			1,306	0.94	1,306	0.94
225	C	71006	1635	8.0	4.0	1	0/118	118	0	1.00	0.00	746	0.54	RefAdj=0			0	1	0	0	0.00			746	0.54	746	0.54
1056	D	7/7/06	1635	8	4	1	3/188.4	188.4	3	1.00	3.00	754	0.15	OK			1	1	1	754	0.15					754	0.15
1057	D	7/7/06	1635	8	4	1	-10/42.8	42.8	-10	1.00	-10.00	541	0.15	OK			1	1	1	541	0.15					541	0.15
1064	D	7/3/05	1225	8	5	1	-36/166	166	-36	1.00	-36.00	455	0.15	OK			1	1	1	455	0.15					455	0.15
1065	D	7/8/05	1635	8	3	1	-24/115	115	-24	1.00	-24.00	346	0.15	OK			1	1	1	346	0.15					346	0.15
1073	D	12/8/05	1635	8	4	1	5/160	160	5	1.00	5.00	856	0.15	OK			1	1	1	856	0.15					856	0.15
1074	D	12/12/05	1635	8	4	1	7/154	154	7	1.00	7.00	964	0.15	OK			1	1	1	964	0.15					964	0.15
1075	D	12/12/05	1635	8	4	1	5/126.4	126.4	5	1.00	5.00	918	0.15	OK			1	1	1	918	0.15					918	0.15
1076	D	12/12/05	1635	8	4	1	10/132.8	132.8	10	1.00	10.00	1,237	0.15	OK			1	1	1	1,237	0.15					1,237	0.15
1077	D	12/12/05	1635	8	4	1	8/133	133	8	1.00	8.00	1,090	0.15	OK			1	1	1	1,090	0.15					1,090	0.15
1078	D	12/6/05	1635	8	4	1	5/88	88	5	1.00	5.00	1,060	0.15	OK			1	1	1	1,060	0.15					1,060	0.15
1079	D	12/7/05	1635	8	4	1	5/170	170	5	1.00	5.00	843	0.15	OK			1	1	1	843	0.15					843	0.15
1080	D	12/7/05	1635	8	4	1	5/36	36	5	1.00	5.00	2,085	0.15	OK			1	1	1	2,085	0.15					2,085	0.15
1081	D	12/7/05	1635	8	4	1	10/154	154	10	1.00	10.00	1,135	0.15	OK			1	1	1	1,135	0.15					1,135	0.15
1082	D	12/8/05	1635	8	4	1	-10/160	160	-10	1.00	-10.00	423	0.15	OK			1	1	1	423	0.15					423	0.15
1083	D	12/7/05	1635	8	4	1	-8/140	140	-8	1.00	-8.00	437	0.15	OK			1	1	1	437	0.15					437	0.15
1084	D	12/7/05	1635	8	3.5	1	-6/140	140	-6	1.00	-6.00	419	0.15	OK			1	1	1	419	0.15					419	0.15
1085	D	12/8/05	1635	8	4	1	-5/128	128	-5	1.00	-5.00	492	0.15	OK			1	1	1	492	0.15					492	0.15
1086	D	12/8/05	1635	8	4	1	5/160	160	5	1.00	5.00	856	0.15	OK			1	1	1	856	0.15					856	0.15
1087	D	12/12/05	1635	8	4	1	5/126.4	126.4	5	1.00	5.00	918	0.15	OK			1	1	1	918	0.15					918	0.15
1088	D	12/6/05	1635	8	4	1	6/128	128	6	1.00	6.00	976	0.15	OK			1	1	1	976	0.15					976	0.15
1089	D	12/6/05	1635	8	4	1	6/128	128	6	1.00	6.00	976	0.15	OK			1	1	1	976	0.15					976	0.15
1090	D	12/7/05	1635	8	3.5	1	6/140	140	6	1.00	6.00	826	0.15	OK			1	1	1	826	0.15					826	0.15
1091	D	12/8/05	1635	8	4	1	6/160	160	6	1.00	6.00	902	0.15	OK			1	1	1	902	0.15					902	0.15
1092	D	12/7/05	1635	8	4	1	7/96	96	7	1.00	7.00	1,213	0.15	OK			1	1	1	1,213	0.15					1,213	0.15
1093	D	12/6/05	1635	8	4	1	8/128	128	8	1.00	8.00	1,112	0.15	OK			1	1	1	1,112	0.15					1,112	0.15
1094	D	12/6/05	1635	8	4	1	10/160	160	10	1.00	10.00	1,112	0.15	OK			1	1	1	1,112	0.15					1,112	0.15
1095	D	12/8/05	1635	8	4	1	10/160	160	10	1.00	10.00	1,112	0.15	OK			1	1	1	1,112	0.15					1,112	0.15
1096	D	12/12/05	1635	8	4	1	10/132.8	132.8	10	1.00	10.00	1,237	0.15	OK			1	1	1	1,237	0.15					1,237	0.15
1097	D	12/8/05	1635	8	4	1	12/160	160	12	1.00	12.00	1,234	0.15	OK			1	1	1	1,234	0.15					1,234	0.15
1098	D	12/8/05	1635	8	4	1	14/160	160	14	1.00	14.00	1,369	0.15	OK			1	1	1	1,369	0.15					1,369	0.15
1099	D	12/8/05	1635	8	4	1	17/160	160	17	1.00	17.00	1,598	0.15	OK			1	1	1	1,598	0.15					1,598	0.15
1100	D	12/7/05	1635	8	4	1	26/140	140	26	1.00	26.00	818	0.15	OK			1	1	1	818	0.15					818	0.15
227	C	70606	901	8.0	3.5	1	16/113	113	16	1.00	16.00	997	0.75	OK			1	1	1	997	0.75					997	0.75
228	C	70606	901	8.0	3.5	1	-5/115	115	-5	1.00	-5.00	279	0.36	OK			1	1	1	279	0.36					279	0.36
229	C	70606	901	8.0	3.5	1	-10/115	115	-10	1.00	-10.00	236	0.31	OK			1	1	1	236	0.31					236	0.31
1422	B	51806	1034	8.0	4.0	1	39/150	150	39	1.00	39.00	3,312	2.57	OK			1	1	1	3,312	2.57					3,312	2.57
1423	B	51806	1034	8.0	4.0	1	11/150	150	11	1.00	11.00	787	0.42	OK			1	1	1	787	0.42					787	0.42
1102										1.00	0.00			RefAdj=0			0	1	0	0	0.00			0	0.00	0	0.00
										1,238.00		1,714,337.53	556.87	1,255			207	181	850	1,385,859	422.78	190,056	29	138,422	105	1,714,338	557
																	Qty with Zero	Qty Dupes w/ Ver Savings									

4. DTS verified savings worksheet

Table 171. DTS Verified Savings Worksheet

Obs	Invoice Letter	Test Date	DTS Pre	DTS Post	D/S Qty	DTS CFM Red	DTS Peak kW	DTS kWh	DTS kW	DTS Thrm	DTS Flag	Invoiced DTS kWh	Invoiced DTS kW	Invoiced DTS Therm	Verified DTS kWh	Verified DTS kW	Verified DTS Therm	Dupe DTS kWh	Dupe DTS kW	Dupe DTS Therm
1060	D	6/30/05	210	144	1		0.234	286	0.20	7.6	1	286	0.23	7.62				286	0.23	7.62
1054	D	9/15/05	323	196	1		0.450	382	0.20	14.7	1	382	0.45	14.66				382	0.45	14.66
1070	D	8/8/05	421	197	1		0.793	1297	0.20	25.8	1	1,297	0.79	25.85				1,297	0.79	25.85
1016	D	6/29/05	363	193	1		0.602	738	0.20	19.6	1	738	0.60	19.62				738	0.60	19.62
1017	D	6/29/05	242	160	1		0.290	356	0.20	9.5	1	356	0.29	9.46				356	0.29	9.46
1018	D	6/29/05	261	186	1		0.266	325	0.20	8.7	1	325	0.27	8.66	325.39	0.27	8.66			
959	D	7/1/05	360	185	1		0.620	759	0.20	20.2	1	759	0.62	20.20	759.24	0.62	20.20			
1020	D	7/29/05	378	188	1		0.673	1100	0.20	21.9	1	1,100	0.67	21.93	1,100.22	0.67	21.93			
958	D	6/29/05	370	198	1		0.609	746	0.20	19.8	1	746	0.61	19.85	746.23	0.61	19.85			
1019	D	9/15/05	730	308	1		1.495	2122	0.20	48.7	1	2,122	1.49	48.70	2,122.31	1.49	48.70			
675	D	2/17/06	758.0	307	1		1.597	2612	0.20	52.0	1	2,612	1.60	52.05	2,611.57	1.60	52.05			
676	D	2/17/06	1,010.0	118	1		3.159	5165	0.20	102.9	1	5,165	3.16	102.94	5,165.24	3.16	102.94			
700	D	7/25/05	572	255	1		1.123	1375	0.20	36.6	1	1,375	1.12	36.58	1,375.32	1.12	36.58			
722	D	8/2/05	690	160	1		1.877	2299	0.20	61.2	1	2,299	1.88	61.16	2,299.43	1.88	61.16			
723	D	8/2/05	725	211	1		1.820	2976	0.20	59.3	1	2,976	1.82	59.32	2,976.38	1.82	59.32			
918	D	7/22/05	551	218	1		1.179	1928	0.20	38.4	1	1,928	1.18	38.43	1,928.28	1.18	38.43			
928	D	7/22/05	495	83	1		1.459	2386	0.20	47.5	1	2,386	1.46	47.55	2,385.74	1.46	47.55			
929	D	7/22/05	858	205	1		2.313	3781	0.20	75.4	1	3,781	2.31	75.36	3,781.28	2.31	75.36			
1061	D	7/4/05	825	255	1		2.019	3301	0.20	65.8	1	3,301	2.02	65.78	3,300.66	2.02	65.78			
1062	D	7/8/05	675	290	1		1.364	2229	0.20	44.4	1	2,229	1.36	44.43	2,229.39	1.36	44.43			
1063	D	7/4/05	471	285	1		0.659	1077	0.20	21.5	1	1,077	0.66	21.46	1,077.06	0.66	21.46			
1066	D	9/15/05	813	412	1		1.420	1740	0.20	46.3	1	1,740	1.42	46.28	1,739.76	1.42	46.28			
1067	D	7/29/05	782	298	1		1.714	2803	0.20	55.9	1	2,803	1.71	55.85	2,802.66	1.71	55.85			
1068	D	8/2/05	602	281	1		1.137	1859	0.20	37.0	1	1,859	1.14	37.04	1,858.79	1.14	37.04			
1069	D	7/25/05	602	361	1		0.854	1606	0.20	27.8	1	1,606	0.85	27.81	1,606.37	0.85	27.81			
1071	D	8/8/05	417	155	1		0.928	1517	0.20	30.2	1	1,517	0.93	30.24	1,517.14	0.93	30.24			
1072	D	8/8/05	701	255	1		1.580	2583	0.20	51.5	1	2,583	1.58	51.47	2,582.62	1.58	51.47			
1012	D	7/27/05	474	133	1		1.208	1027	0.20	39.4	1	1,027	1.21	39.35	1,026.55	1.21	39.35			
434	D	12/15/05	393	241	1		0.538	880	0.20	17.5	1	880	0.54	17.54	880.18	0.54	17.54			
300	D	10/26/05	841	205	1		2.253	3683	0.20	73.4	1	3,683	2.25	73.40	3,682.84	2.25	73.40			
302	D	12/1/05	413	218	1		0.691	1129	0.20	22.5	1	1,129	0.69	22.50	1,129.17	0.69	22.50			
305	D	12/6/05	400	227	1		0.613	1002	0.20	20.0	1	1,002	0.61	19.96	1,001.78	0.61	19.96			
306	D	12/6/05	406	248	1		0.560	915	0.20	18.2	1	915	0.56	18.23	914.92	0.56	18.23			
308	D	12/6/05	403	197	1		0.730	1193	0.20	23.8	1	1,193	0.73	23.77	1,192.87	0.73	23.77			
312	D	12/6/05	411	247	1		0.581	950	0.20	18.9	1	950	0.58	18.93	949.66	0.58	18.93			
414	D	12/15/05	442	149	1		1.038	1697	0.20	33.8	1	1,697	1.04	33.81	1,696.65	1.04	33.81			
415	D	12/15/05	525	172	1		1.250	2044	0.20	40.7	1	2,044	1.25	40.74	2,044.09	1.25	40.74			
417	D	12/15/05	555	169	1		1.367	2235	0.20	44.5	1	2,235	1.37	44.55	2,235.18	1.37	44.55			
418	D	12/15/05	662	190	1		1.672	2733	0.20	54.5	1	2,733	1.67	54.47	2,733.18	1.67	54.47			
420	D	12/15/05	376	198	1		0.630	1031	0.20	20.5	1	1,031	0.63	20.54	1,030.73	0.63	20.54			
421	D	12/1/05	293	174	1		0.421	689	0.20	13.7	1	689	0.42	13.73	689.08	0.42	13.73			
423	D	12/1/05	287	161	1		0.446	730	0.20	14.5	1	730	0.45	14.54	729.62	0.45	14.54			
426	D	12/15/05	277	151	1		0.446	730	0.20	14.5	1	730	0.45	14.54	729.62	0.45	14.54			
441	D	12/15/05	182	99	1		0.294	481	0.20	9.6	1	481	0.29	9.58	480.62	0.29	9.58			
442	D	12/15/05	228	116	1		0.397	649	0.20	12.9	1	649	0.40	12.92	648.55	0.40	12.92			
446	D	12/15/05	368	194	1		0.616	1008	0.20	20.1	1	1,008	0.62	20.08	1,007.57	0.62	20.08			
485	D	12/15/05	196	104	1		0.326	533	0.20	10.6	1	533	0.33	10.62	532.74	0.33	10.62			
486	D	12/15/05	285	142	1		0.506	828	0.20	16.5	1	828	0.51	16.50	828.06	0.51	16.50			
487	D	12/15/05	291	136	1		0.549	898	0.20	17.9	1	898	0.55	17.89	897.55	0.55	17.89			
488	D	12/15/05	305	128	1		0.627	1025	0.20	20.4	1	1,025	0.63	20.43	1,024.94	0.63	20.43			
490	D	12/15/05	421	237	1		0.652	1065	0.20	21.2	1	1,065	0.65	21.23	1,065.48	0.65	21.23			
491	D	12/15/05	515	236	1		0.988	1616	0.20	32.2	1	1,616	0.99	32.20	1,615.58	0.99	32.20			
492	D	12/15/05	572	261	1		1.101	1801	0.20	35.9	1	1,801	1.10	35.89	1,800.88	1.10	35.89			
493	D	12/15/05	571	256	1		1.116	1824	0.20	36.4	1	1,824	1.12	36.35	1,824.05	1.12	36.35			
494	D	12/15/05	598	195	1		1.427	2334	0.20	46.5	1	2,334	1.43	46.51	2,333.62	1.43	46.51			
495	D	12/15/05	618	205	1		1.463	2392	0.20	47.7	1	2,392	1.46	47.66	2,391.53	1.46	47.66			
496	D	12/15/05	631	218	1		1.463	2392	0.20	47.7	1	2,392	1.46	47.66	2,391.53	1.46	47.66			
499	D	12/15/05	349	201	1		0.524	857	0.20	17.1	1	857	0.52	17.08	857.01	0.52	17.08			
502	D	12/15/05	513	203	1		1.098	1795	0.20	35.8	1	1,795	1.10	35.77	1,795.09	1.10	35.77			
503	D	12/15/05	412	227	1		0.655	1071	0.20	21.3	1	1,071	0.66	21.35	1,071.27	0.66	21.35			
504	D	12/15/05	446	241	1		0.726	1187	0.20	23.7	1	1,187	0.73	23.66	1,187.08	0.73	23.66			
507	D	12/15/05	447	252	1		0.691	1129	0.20	22.5	1	1,129	0.69	22.50	1,129.17	0.69	22.50			
508	D	12/5/05	156	79	1		0.273	446	0.20	8.9	1	446	0.27	8.89	445.88	0.27	8.89			
509	D	12/5/05	189	83	1		0.375	614	0.20	12.2	1	614	0.38	12.23	613.81	0.38	12.23			
510	D	12/5/05	326	239	1		0.308	504	0.20	10.0	1	504	0.31	10.04	503.78	0.31	10.04			
541	D	12/16/05	272.0	127	1		0.514	840	0.20	16.7	1	840	0.51	16.73	839.64	0.51	16.73			
543	D	12/15/05	409.0	157	1		0.893	1459	0.20	29.1	1	1,459	0.89	29.08	1,459.24	0.89	29.08			
544	D	12/15/05	429.0	159	1		0.956	1563	0.20	31.2	1	1,563	0.96	31.16	1,563.47	0.96	31.16			
546	D	12/15/05	284.0	119	1		0.584	955	0.20	19.0	1	955	0.58	19.04	955.45	0.58	19.04			
548	D	12/14/05	333.0	146	1		0.662	1083	0.20	21.6	1	1,083	0.66	21.58	1,082.85	0.66	21.58			
549	D	12/16/05	319.0	111	1		0.737	1204	0.20	24.0	1	1,204	0.74	24.00	1,204.45	0.74	24.00			
550	D	12/15/05	309.0	132	1		0.627	1025	0.20	20.4	1	1,025	0.63	20.43	1,024.94	0.63	20.43			
552	D	12/15/05	348.0	137	1		0.747	1222	0.20	24.3	1	1,222	0.75	24.35	1,221.82	0.75	24.35			
553	D	12/15/05	341.0	149	1		0.680	1112	0.20	22.2	1	1,112	0.68	22.16	1,111.80	0.68	22.16			
562	D	12/12/05	406.0	162	1		0.864	1413	0.20	28.2	1	1,413	0.86	28.16	1,412.91	0.86	28.16			
566	D	12/12/05	304.0	155	1		0.528	863	0.20	17.2	1	863	0.53	17.19	862.80	0.53	17.19			
567	D	12/12/05	347.0	161	1		0.659	1077	0.20	21.5	1	1,077	0.66	21.46	1,077.06	0.66	21.46			
569	D	12/12/05	415.0	163	1		0.893	1459	0.20	29.1	1	1,459	0.89	29.08	1,459.24	0.89	29.08			
571	D	12/12/05	356.0	167	1		0.669	1094	0.20	21.8	1	1,094	0.67	21.81	1,094.43	0.67	21.81			
572	D	12/12/05	475.0	160	1		1.116	1824	0.20	36.4	1	1,824	1.12	36.35	1,824.05	1.12	36.35			
573	D	12/12/05	486.0	171	1		1.116	1824	0.20	36.4	1	1,824	1.12	36.35	1,824.05	1.12	36.35			
575	D	12/12/05	417.0	165	1		0.893	1459	0.20	29.1	1	1,459	0.89	29.08	1,459.24	0.89	29.08			
586	D	12/13/05	287.0	146	1		0.499	816	0.20	16.3	1	816	0.50	16.27	816.48	0.50	16.27			
587	D	12/13/05	343.0	174	1		0.599	979	0.20	19.5	1	979	0.60	19.50	978.62	0.60	19.50			
593	D	12/13/05	362.0	127	1		0.832	1361	0.20	27.1	1	1,361	0.83	27.12	1,360.80	0.83	27.12			
599	D	12/14/05	276.0	129	1		0.521	851	0.20	17.0	1	851	0.52	16.96	851.22	0.52	16.96			
600	D	12/14/05	314.0	168	1		0.517	845	0.20	16.8	1	845	0.52	16.85	845.43	0.52	16.85			
604	D	12/14/05	381.0	149	1		0.822	1343	0.20	26.8	1	1,343	0.82	26.77	1,343.43	0.82	26.77			
606	D	12/14/05	605.0	261	1		1.218	1992	0.20	39.7	1	1,992	1.22	39.70	1,991.98	1.22	39.70			
607	D	12/14/05	589.0	240	1		1.236	2021	0.20	40.3	1	2,021	1.24	40.28	2,020.93	1.24	40.28			

Obs	Invoice Letter	Test Date	DTS Pre	DTS Post	D/S Qty	DTS CFM Red	DTS Peak kW	DTS kWh	DTS kW	DTS Thrm	DTS Flag	Invoiced DTS kWh	Invoiced DTS kW	Invoiced DTS Therm	Verified DTS kWh	Verified DTS kW	Verified DTS Therm	Dupe DTS kWh	Dupe DTS kW	Dupe DTS Therm
608	D	12/15/05	278.0	174	1		0.368	602	0.20	12.0	1	602	0.37	12.00	602.23	0.37	12.00			
609	D	12/15/05	287.0	172	1		0.407	666	0.20	13.3	1	666	0.41	13.27	665.92	0.41	13.27			
613	D	12/15/05	412.0	175	1		0.839	1372	0.20	27.4	1	1,372	0.84	27.35	1,372.38	0.84	27.35			
437	D	12/15/05	572	229	1		1.215	1986	0.20	39.6	1	1,986	1.21	39.58	1,986.18	1.21	39.58			
299	D	10/26/05	436	181	1		0.903	1477	0.20	29.4	1	1,477	0.90	29.43	1,476.61	0.90	29.43			
301	D	12/1/05	398	242	1		0.553	903	0.20	18.0	1	903	0.55	18.00	903.34	0.55	18.00			
303	D	12/1/05	467	239	1		0.808	1320	0.20	26.3	1	1,320	0.81	26.31	1,320.26	0.81	26.31			
304	D	12/6/05	382	236	1		0.517	845	0.20	16.8	1	845	0.52	16.85	845.43	0.52	16.85			
307	D	12/6/05	389	201	1		0.666	1089	0.20	21.7	1	1,089	0.67	21.70	1,088.64	0.67	21.70			
309	D	12/6/05	436	244	1		0.680	1112	0.20	22.2	1	1,112	0.68	22.16	1,111.80	0.68	22.16			
310	D	12/6/05	391	188	1		0.719	1175	0.20	23.4	1	1,175	0.72	23.43	1,175.50	0.72	23.43			
311	D	12/6/05	481	241	1		0.850	1390	0.20	27.7	1	1,390	0.85	27.70	1,389.75	0.85	27.70			
416	D	12/15/05	502	186	1		1.119	1830	0.20	36.5	1	1,830	1.12	36.47	1,829.84	1.12	36.47			
422	D	12/1/05	284	137	1		0.521	851	0.20	17.0	1	851	0.52	16.96	851.22	0.52	16.96			
424	D	12/1/05	311	150	1		0.570	932	0.20	18.6	1	932	0.57	18.58	932.29	0.57	18.58			
425	D	12/1/05	402	176	1		0.800	1309	0.20	26.1	1	1,309	0.80	26.08	1,308.68	0.80	26.08			
427	D	12/15/05	323	172	1		0.535	874	0.20	17.4	1	874	0.53	17.43	874.38	0.53	17.43			
428	D	12/15/05	381	148	1		0.825	1349	0.20	26.9	1	1,349	0.83	26.89	1,349.22	0.83	26.89			
429	D	12/1/05	432	244	1		0.666	1089	0.20	21.7	1	1,089	0.67	21.70	1,088.64	0.67	21.70			
430	D	12/1/05	418	252	1		0.588	961	0.20	19.2	1	961	0.59	19.16	961.24	0.59	19.16			
431	D	12/15/05	422	199	1		0.790	1291	0.20	25.7	1	1,291	0.79	25.73	1,291.31	0.79	25.73			
432	D	12/15/05	473	244	1		0.811	1326	0.20	26.4	1	1,326	0.81	26.43	1,326.05	0.81	26.43			
435	D	12/15/05	531	247	1		1.006	1645	0.20	32.8	1	1,645	1.01	32.77	1,644.54	1.01	32.77			
436	D	12/15/05	521	252	1		0.953	1558	0.20	31.0	1	1,558	0.95	31.04	1,557.68	0.95	31.04			
438	D	12/15/05	437	246	1		0.676	1106	0.20	22.0	1	1,106	0.68	22.04	1,106.01	0.68	22.04			
439	D	12/15/05	526	249	1		0.981	1604	0.20	32.0	1	1,604	0.98	31.97	1,604.00	0.98	31.97			
443	D	12/15/05	256	107	1		0.528	863	0.20	17.2	1	863	0.53	17.19	862.80	0.53	17.19			
444	D	12/15/05	2137	1369	1		2.720	4447	0.20	88.6	1	4,447	2.72	88.63	4,447.20	2.72	88.63			
448	D	12/15/05	457	251	1		0.730	1193	0.20	23.8	1	1,193	0.73	23.77	1,192.87	0.73	23.77			
449	D	12/15/05	468	245	1		0.790	1291	0.20	25.7	1	1,291	0.79	25.73	1,291.31	0.79	25.73			
450	D	12/15/05	487	248	1		0.846	1384	0.20	27.6	1	1,384	0.85	27.58	1,383.96	0.85	27.58			
451	D	12/5/05	417	249	1		0.595	973	0.20	19.4	1	973	0.60	19.39	972.83	0.60	19.39			
452	D	12/5/05	442	201	1		0.854	1396	0.20	27.8	1	1,396	0.85	27.81	1,395.54	0.85	27.81			
489	D	12/15/05	321	129	1		0.680	1112	0.20	22.2	1	1,112	0.68	22.16	1,111.80	0.68	22.16			
500	D	12/15/05	397	201	1		0.694	1135	0.20	22.6	1	1,135	0.69	22.62	1,134.96	0.69	22.62			
501	D	12/15/05	392	200	1		0.680	1112	0.20	22.2	1	1,112	0.68	22.16	1,111.80	0.68	22.16			
505	D	12/15/05	426	248	1		0.630	1031	0.20	20.5	1	1,031	0.63	20.54	1,030.73	0.63	20.54			
542	D	12/15/05	287.0	139	1		0.524	857	0.20	17.1	1	857	0.52	17.08	857.01	0.52	17.08			
545	D	12/15/05	355.0	143	1		0.751	1228	0.20	24.5	1	1,228	0.75	24.47	1,227.61	0.75	24.47			
547	D	12/15/05	443.0	162	1		0.995	1627	0.20	32.4	1	1,627	1.00	32.43	1,627.17	1.00	32.43			
551	D	12/15/05	294.0	138	1		0.553	903	0.20	18.0	1	903	0.55	18.00	903.34	0.55	18.00			
563	D	12/12/05	348.0	159	1		0.669	1094	0.20	21.8	1	1,094	0.67	21.81	1,094.43	0.67	21.81			
564	D	12/12/05	372.0	164	1		0.737	1204	0.20	24.0	1	1,204	0.74	24.00	1,204.45	0.74	24.00			
565	D	12/12/05	427.0	170	1		0.910	1488	0.20	29.7	1	1,488	0.91	29.66	1,488.19	0.91	29.66			
568	D	12/12/05	385.0	159	1		0.800	1309	0.20	26.1	1	1,309	0.80	26.08	1,308.68	0.80	26.08			
570	D	12/12/05	370.0	158	1		0.751	1228	0.20	24.5	1	1,228	0.75	24.47	1,227.61	0.75	24.47			
574	D	12/12/05	364.0	153	1		0.747	1222	0.20	24.3	1	1,222	0.75	24.35	1,221.82	0.75	24.35			
576	D	12/12/05	300.0	171	1		0.457	747	0.20	14.9	1	747	0.46	14.89	746.99	0.46	14.89			
589	D	12/13/05	325.0	150	1		0.620	1013	0.20	20.2	1	1,013	0.62	20.20	1,013.36	0.62	20.20			
590	D	12/13/05	357.0	164	1		0.684	1118	0.20	22.3	1	1,118	0.68	22.27	1,117.59	0.68	22.27			
591	D	12/13/05	384.0	173	1		0.747	1222	0.20	24.3	1	1,222	0.75	24.35	1,221.82	0.75	24.35			
592	D	12/13/05	305.0	122	1		0.648	1060	0.20	21.1	1	1,060	0.65	21.12	1,059.68	0.65	21.12			
594	D	12/13/05	417.0	177	1		0.850	1390	0.20	27.7	1	1,390	0.85	27.70	1,389.75	0.85	27.70			
595	D	12/13/05	301.0	119	1		0.645	1054	0.20	21.0	1	1,054	0.64	21.00	1,053.89	0.64	21.00			
596	D	12/13/05	437.0	168	1		0.953	1558	0.20	31.0	1	1,558	0.95	31.04	1,557.68	0.95	31.04			
597	D	12/13/05	423.0	170	1		0.896	1465	0.20	29.2	1	1,465	0.90	29.20	1,465.03	0.90	29.20			
598	D	12/13/05	507.0	170	1		1.194	1951	0.20	38.9	1	1,951	1.19	38.89	1,951.44	1.19	38.89			
601	D	12/14/05	343.0	148	1		0.691	1129	0.20	22.5	1	1,129	0.69	22.50	1,129.17	0.69	22.50			
602	D	12/14/05	337.0	151	1		0.659	1077	0.20	21.5	1	1,077	0.66	21.46	1,077.06	0.66	21.46			
603	D	12/14/05	381.0	167	1		0.758	1239	0.20	24.7	1	1,239	0.76	24.70	1,239.19	0.76	24.70			
605	D	12/14/05	372.0	173	1		0.705	1152	0.20	23.0	1	1,152	0.70	22.96	1,152.33	0.70	22.96			
610	D	12/15/05	317.0	166	1		0.535	874	0.20	17.4	1	874	0.53	17.43	874.38	0.53	17.43			
611	D	12/15/05	328.0	171	1		0.556	909	0.20	18.1	1	909	0.56	18.12	909.13	0.56	18.12			
612	D	12/15/05	289.0	167	1		0.432	706	0.20	14.1	1	706	0.43	14.08	706.46	0.43	14.08			
614	D	12/15/05	393.0	169	1		0.793	1297	0.20	25.8	1	1,297	0.79	25.85	1,297.10	0.79	25.85			
257	D	8/23/05	367	232	1		0.478	782	0.20	15.6	1	782	0.48	15.58	781.73	0.48	15.58			
721	D	8/23/05	410	204	1		0.730	1193	0.20	23.8	1	1,193	0.73	23.77	1,192.87	0.73	23.77			
925	D	7/29/05	680	242	1		1.551	2536	0.20	50.5	1	2,536	1.55	50.55	2,536.29	1.55	50.55			
255	D	7/25/05	780	322	1		1.622	1987	0.20	52.9	1	1,987	1.62	52.85	1,987.05	1.62	52.85			
256	D	8/5/05	578	216	1		1.282	2096	0.20	41.8	1	2,096	1.28	41.78	2,096.21	1.28	41.78			
1408	B	50106	231	174	1	57		164	6.6	0	1	164	6.6	0	164.00	6.60	0.00			
1409	B	50106	284	94	1	190		546	21.9	0	1	546	21.9	0	546.00	21.90	0.00			
588	D	12/13/05	365.0	177	1		0.666	1089	0.20	21.7	1	1,089	0.67	21.70	1,088.64	0.67	21.70			
683	D	8/16/05	512	200	1		1.105	1807	0.20	36.0	1	1,807	1.11	36.01	1,806.68	1.11	36.01			
706	D	7/14/05	411	198	1		0.754	1233	0.20	24.6	1	1,233	0.75	24.58	1,233.40	0.75	24.58			
1065	D	7/8/05	551	197	1		1.254	2050	0.20	40.9	1	2,050	1.25	40.85	2,049.88	1.25	40.85			
235	D	8/17/05	312	174	1		0.489	799	0.20	15.9	1	799	0.49	15.93	799.11	0.49	15.93			
678	D	7/28/05	701	452	1		0.882	1442	0.20	28.7	1	1,442	0.88	28.74	1,441.87	0.88	28.74			
679	D	7/21/05	243	190	1		0.188	307	0.20	6.1	1	307	0.19	6.12	306.90	0.19	6.12			
680	D	7/21/05	317	175	1		0.503	822	0.20	16.4	1	822	0.50	16.39	822.27	0.50	16.39			
681	D	7/21/05	477	150	1		1.158	1894	0.20	37.7	1	1,894	1.16	37.74	1,893.53	1.16	37.74			
682	D	7/21/05	496	145	1		1.243	2033	0.20	40.5	1	2,033	1.24	40.51	2,032.51	1.24	40.51			
685	D	8/8/05	792	375	1		1.477	2415	0.20	48.1	1	2,415	1.48	48.12	2,414.69	1.48	48.12			
718	D	7/26/05	515	210	1		1.080	1766	0.20	35.2	1	1,766	1.08	35.20	1,766.14	1.08	35.20			
719	D	7/26/05	580	250	1		1.169	1911	0.20	38.1	1	1,911	1.17	38.08	1,910.91	1.17	38.08			
720	D	7/26/05	640	220	1		1.488	2432	0.20	48.5	1	2,432	1.49	48.47	2,432.06	1.49	48.47			
920	D	7/5/05	442	210	1		0.822	1343	0.20	26.8	1	1,343	0.82	26.77	1,343.43	0.82	26.77			
949	D	3/1/06	938.0	423	1		1.824	2982	0.20	59.4	1	2,982	1.82	59.43	2,982.17	1.82	59.43			
951	D	7/25/05	680	165	1		1.824	2234	0.20	59.4	1	2,234	1.82	59.43	2,234.35	1.82	59.43			
					179		155.19				179	248,732	183.69	5,056.67	245,673	181.32	4,979.47	3,059	2.37	77
														179	174	174	174	5	5	5

7.16 05-05-004 – Lighting Retrofit Project At A Single Site

This project was a lighting retrofit at shopping mall. All fixtures in common areas, offices, back halls, food court and parking garages were retrofitted. Table 172 summarizes the M&V for this project.

Table 172. M&V Savings Summary – 05-05-004

Energy Savings (kWh)	
Total Contracted/Invoiced Savings (kWh)	1,415,768 kWh
M&V Savings (kWh)	**1,404,809 kWh**
Realization Rate to Contracted (kWh)	99%
Demand Reduction (kW)	
Total Contracted/Invoiced Savings (kW)	332.53 kW
M&V Savings (kW)	**241.74 kW**
Realization Rate to contracted (kW)	73%

7.16.1 Measurement and Verification (M&V) Approach

The M&V approach used for the project is summarized in this section. KSI coordinated with the Project Sponsor to perform pre- and post-retrofit M&V activities to support the tasks described below.

7.16.1.1 Load Impact Verification Methodology

The load impact estimation methodology described in this plan complies with IPMVP Option A. Site inspections were employed to verify key M&V parameters. Light loggers were installed throughout the facility to verify hours of operation.

7.16.1.2 Analysis Approach

The basic equation used to estimate the energy savings of this project is shown in Equation 1.

(Eq. 1) $kWh\ savings = kWh_{Pre} - kWh_{Post}$

where:

$kWh_{Pre} = (\#\ Fixures_{Pre}) \times (Fixture\ Wattage_{Pre}/1000) \times (Hours\ of\ Operation_{Pre})$; and

$kWh_{Post} = (\#\ Fixures_{Post}) \times (Fixture\ Wattage_{Post}/1000) \times (Hours\ of\ Operation_{Post})$.

The key parameters of Equation 1 are shown in Table 173.

Table 173. Key M&V Parameters

Parameter	M&V Activity
Fixture Counts	Fixture counts were verified through on-site inspection. KSI performed a complete lighting audit on counts and location.
Fixture $Wattage_{Pre}$ and Fixture $Wattage_{Post}$	Verified pre- and post- fixture types and fixture wattage values.
Hours of Operation	Hours of operation were verified through the installation of light loggers through out the facility. A realization rate was calculated and compared statistically to the proposed hours.

7.16.1.3 On-Site Verification Inspections

On-site inspections were conducted to verify pre and post equipment types and quantities. Site inspections consisted of the following activities:

- Verification of the installation of lighting equipment, including
  - Fixture wattage, and
  - Counts
- Verification of fixtures by location

7.16.1.4 Verification of Operating Hours

The hours of operation were verified through the installation of light loggers in areas throughout the facility. To capture the diversity of usage by type of location the facility was stratified into four space types:

- **Common Area**, including adjoining walkways and food court ;
- **Offices**, facility operations and administration;
- **Back Hall,** security hallways and delivery areas; and
- **Parking Structures,** two large covered parking structures with multiple levels.

These space types were selected as they best represented the diversity of lighting usage in the facility. However, in the Common Area, there were four different types of fixtures wattages. Loggers were installed in space type and in each fixture type in the Common Areas for eight (8)

weeks. Weighted averages of monitored data for each space type were calculated with weights based on fixture wattage.

7.16.2 M&V Results

This section provides the results of the M&V process. The attached spreadsheet workbook contains the data collected to perform the analysis.

Table 174 shows the proposed and verified hours of operation. Table 175 provides a list of measures and savings invoiced by the Project Sponsor. Table 176 shows the verified measures and savings.

Table 174. Hours of Operation

	Proposed	Verified
Common Area	3,100	3,567
Back Hall	8,760	8,760
Parking Elevator	4,380	4,380
Office Areas	2,190	3,345
Parking Garage	4,380	6,565

Table 175. Invoiced Measures and Savings, 05-05-004

Location	Qty	Fixture Type	Watts	Proposed Fixture Type	Watts Per New Fixture	Total kW Reduced	Annual Hours	Total kWh Savings
Common Area	620	100W Metal Halide	120	2x 32W Compact/New	68	32.24	3,100	99,944
Common Area	134	32W Metal Halide	40	18W Compact/New	20	2.68	3,100	8,308
Common Area	187	70W Metal Halide	95	2x 26W Compact/New	56	7.29	3,100	22,608
Food Court	334	90W Halogen Lamp	90	32W Compact/New	34	18.70	3,100	57,982
Parking elevators	72	50W Incandescent	50	15W Compact/New	15	2.52	4,380	11,038
Back Hall	644	1L4' EE/STD	50	1L4' T8 30W/ELEC/EE	28	14.17	8,760	124,112
Offices	192	4L4' T8/ELIG	112	2L4' T8 30W/ELEC/EE/RFL	53	11.33	2,190	24,808
Parking Garage	1680	175W Metal Halide	205	8'-2L4' T8/ELEC NEW	60	243.60	4,380	1,066,968
Total	**3,863**					**332.53**		**1,415,768**

Table 176. Verified Measures and Savings, 05-05-004

Location	Qty	Fixture Type	Watts	Proposed Fixture Type	Watts Per New Fixture	Total kW Reduced	Annual Hours	Total kWh Savings
Common Area	658	100W Metal Halide	120	2x 32W Compact/New	68	34.22	3,567	122,048
Common Area	124	32W Metal Halide	40	18W Compact/New	20	2.48	5,193	12,879
Common Area	48	70W Metal Halide	95	2x 26W Compact/New	56	1.87	3,100	5,803
Food Court	362	90W Halogen Lamp	90	32W Compact/New	34	20.27	3,460	70,141
Parking elevators	72	50W Incandescent	50	15W Compact/New	**14**	2.59	4,380	11,353
Back Hall	644	1L4' EE/STD	50	1L4' T8 30W/ELEC/EE	**25**	16.10	8,760	141,036
Offices	192	4L4' T8/ELIG	112	2L4' T8 30W/ELEC/EE/RFL	53	11.33	3,345	37,892
Parking Garage	1,680	175W Metal Halide	205	8'-**4**L4' T8/ELEC NEW	**114**	152.88	6,565	1,003,657
Total	**3,780**					**241.74**		**1,404,810**

Some of the key findings are:

- **Fixture Wattages:** The reported New Fixture Wattages in the parking garages were proposed at 60 watts. The post inspection verified the new fixtures to be 114 watts. The 114 watts were also confirmed by invoices from the manufacturer submitted by the Project Sponsor.
- **Quantity of Fixtures Retrofit:** The basis for the quantity of fixtures retrofitted, were invoices submitted by the Project Sponsor to KSI. Verified fixture quantity was less than invoiced. Table 176 shows verified quantities.
- **Hours of Operation:** The proposed hours of operation were verified through the installation of light loggers throughout the facility to gather operating data by space type. The verified hours were used to calculate the verified kWh savings.

KSI verified the as-built fixture counts and fixture types as shown in Table 177.

7.16.2.1 Hours of Operation – Light Loggers

The hours of operation used to estimate the savings for invoicing was separated by space types. Light loggers were used to verify the hours of operation as described in Section 7.18.1.4. The data from the loggers were used to calculate annual hours for each Fixture Type. 70W

Metal Halide fixtures and Parking Elevators fixtures were not logged, and proposed annual hours were used for the M&V. The verified hours of operation are shown in Table 177.

Table 177. Verified Hours of Operation

Logger Location	Fixture Type	Hrs. On	Percent On	Avg Hrs/wk	wks/yr	Verified Hrs	proposed Hrs
Common Area	70W Metal Halide						3,100
Common Area	100W Metal Halide	342.03	40.70	68.41	52.14	3,567	3,100
Common Area	32W Metal Halide	497.94	59.30	99.59	52.14	5,193	3,100
Common Area	90W Halogen Lamp	331.78	39.50	66.36	52.14	3,460	3,100
Back Hall	1L 4' EE/STD	840.00	100.00	168.00	52.14	8,760	8,760
Back Hall	1L 4' EE/STD	840.00	100.00	168.00	52.14	8,760	8,760
Back Hall	1L 4' EE/STD	840.00	100.00	168.00	52.14	8,760	8,760
Back Hall	1L 4' EE/STD	840.00	100.00	168.00	52.14	8,760	8,760
Parking Elevators	50W Incandescent						4,380
Office Area 1	4L 4' T8/ELIG	245.33	29.20	49.07	52.14	3,345	2,190
Office Area 2	4L 4' T8/ELIG	379.38	26.40	75.88	52.14	3,345	2,190
Parking Garage	175W Metal Halide	629.6	75	125.92	52.14	6,565	4,380
Parking Garage	175W Metal Halide	629.59	75	125.918	52.14	6,565	4,380
Parking Garage	175W Metal Halide	629.6	75	125.92	52.14	6,565	4,380
Parking Garage	175W Metal Halide	629.6	75	125.92	52.14	6,565	4,380
Parking Garage	175W Metal Halide	629.59	75	125.918	52.14	6,565	4,380

7.16.2.2 Verified Savings / Load Impact

KSI verified pre and post fixture types and fixture counts, pre and post fixture wattage, hours of operations, post kW reduced and post annual kWh savings.

The kW reduced and kWh savings were calculated by KSI and compared to what was proposed. Table 175 shows proposed Load Impacts, including fixture quantities, fixture wattages, kW reduced, annual hours, and kWh savings. The verified savings are shown in Table 175. Table 176 shows verified Load Impacts, including fixture quantities, fixture wattages, kW reduced, annual hours, and kWh savings.

7.16.2.3 Realization Rate

The realization rate was calculated to compare how the invoiced kW reduced and kWh savings submitted by the Project Sponsor compared with the verified kW reduced and kWh savings. If the realization rate is equal to 100% then the invoiced impacts match the verified impacts

exactly. If the rate is less than 100% then the verified impacts are less than the invoiced impacts, and if the rate is greater than 100% then the verified savings are greater than invoiced.

The realization rate for the M&V for the verified kW reduced is 73%. KSI verified fixture quantities to be fewer than proposed. Also, the proposed new fixture wattage for the parking garages was proposed at 60 Watts and verified to be 114 Watts. This resulted in a realization rate of 73% for the kW reduced.

Monitored data from the light loggers showed higher operating hours than proposed. The verified operating hours were multiplied by the verified kW resulting in a 99% realization rate for the kWh savings. Table 178 shows invoiced savings compared to verified M&V savings.

Table 178. Realization Rates

Energy Savings kWh	
Total Invoiced Savings	1,415,768
M&V Savings kWh	1,404,810
Realization Rate Invoiced	99%
Demand Reducting kW	
Total Invoiced Savings	333
M&V Savings kW	242
Realization Rate Invoiced	73%

7.17 05-05-006 – Lighting Retrofit in Multiple Locations for a Single Customer

This was a self-sponsored project for the delivery of energy and /or demand savings resulting from the installation of energy-efficiency measures at seven retail stores of a single Project Sponsor. A preliminary list of nine sites was submitted by the Project Sponsor to SDG&E, however, two sites were cancelled.

Table 179. M&V Savings Summary – 05-05-006

Energy Savings (kWh)	
Total Reported / Invoiced Savings (kWh)	**2,113,997.29**
M&V verified Savings (kWh)	**2,203,837.81**
Realization Rate (kWh)	**104%**
Demand Reductions (kW)	
Total Reported / Invoiced Savings (kW)	**300.03**
M&V verified Savings (kW)	**320.47**
Realization Rate (kW)	**107%**

7.17.1.1 MEASURE DESCRIPTION

Install energy efficient six lamp T-5 High Output fluorescent lighting fixtures in place of 400W Metal Halide fixtures in seven Project Sponsor sites. This was a fixture for fixture replacement.

7.17.1.1.1 Pre-Retrofit Conditions

- Warehouses with aisles, open ceilings.
- 400 Watt Metal Halide fixtures with a ballast factor of 458 watts

7.17.1.1.2 Post-Retrofit Conditions

The following describes the post-retrofit fixture components.

- Energy efficient fluorescent fixture.
- Lithonia Lighting T5 Fluorescent High Bay fixture – Louver #MS5HB
- 6 Lamp T-5 High Power Output rated at 351 watts

7.17.2 Measurement and Verification (M&V) Approach

The M&V approach used for the project is summarized in this section. KSI coordinated to perform post-retrofit M&V activities to support the tasks described below.

7.17.2.1 Load Impact Verification Methodology

The load impact estimation methodology described in this plan complies with IPMVP Option A. Site inspections were employed to verify key M&V parameters.

7.17.2.2 Analysis Approach

The basic equation used to estimate the energy savings of this project is shown in Equation 1.

(Equation 5) $kWh\ savings = kWh_{Pre} - kWh_{Post}$

Where:

$kWh_{Pre} = (\#\ Fixtures_{Pre}) \times (Fixture\ Wattage_{Pre}/1000) \times (Hours\ of\ Operation_{Pre})$; and

$kWh_{Post} = (\#\ Fixtures_{Post}) \times (Fixture\ Wattage_{Post}/1000) \times (Hours\ of\ Operation_{Post})$.

The M&V activities for the key parameters of equation 1 are shown in Table 180.

Table 180. Key M&V Parameters

Parameter	M&V Activity
Fixture Counts	Fixture counts were verified through on-site post inspection.
Fixture Wattage $_{Pre}$ and Fixture Wattage $_{Post}$	Stipulated wattage values on verification of fixtures.
Hours of Operation	Hours of operation was verified with installation of light loggers and interviews with on site managers.

7.17.2.3 On-Site Verification Inspections

On-site inspections were conducted to verify the equipment types, quantities and operating hours. Site inspections consisted of the following activities:

- Verification of the installation of lighting equipment, including
  - new fixture types, and
  - new fixture quantities.
- Light loggers were installed to verify operating hours for the light fixtures.

The verification was based on as-built documentation provided to KSI by SDG&E.

7.17.3 Results

This section provides the results of the M&V process. The attached spreadsheet workbook is the analysis of this M&V.

Some of the key findings are:

- **Hours of Operation:** The proposed hours of operation were verified through an interview with a contact person on site. Light loggers were installed to verify hours of operation. Logger data shows an average of 6,877 annual hours and proposed hours are 7,046 annual hours.
- **Quantity of Fixtures Retrofit:** The basis for the quantity of fixtures retrofit was provided by Project Sponsor and was submitted to SDG&E. KSI was contracted to perform the M&V after the retrofit was completed. KSI did not do any pre inspections and assumed post fixture counts as a one to one fixture replacement.
- **Fixture Wattages:** Fixture wattages were taken from manufacturer fixture specification sheets.
- **Realization Rates:** The realization rate compares invoiced/proposed kW reduced and kWh savings to the verified kW reduced and kWh savings.

7.17.3.1 Verified Hours of Operation

The proposed hours of operation was obtained through interviews of on site personnel. Light loggers were installed in five of the seven participating stores. The proposed hours of operation for each facility, was 7,046 hours a year. The M&V calculation used the KSI's verified hours of operation (6,877 hours) to show the annual kWh savings for all proposed sites. The average hours of operation based on monitored data was 6,877 hours per year.

7.17.3.2 Verified Fixture Quantities

The fixture quantity for the retrofit was verified during the post inspection, this was a one to one fixture replacement. Fixture quantities were found to be greater at each store than the proposed fixture quantities. The M&V reported pre quantities same as post quantities in the verified

calculations. Table 181 shows Proposed Quantities and Table 181 show verified fixture quantities.

7.17.3.3 Verified Fixture Wattage

Lithonia Lighting is the manufacturer of the fixtures installed. A specification cut sheet by Lithonia Lighting was submitted. The 6-lamp T-5 High Power Output fixtures are rated at 351 watts per fixture. These fixtures were verified to be installed at each store.

Table 181. Proposed Load Impacts

Site ID	Proposed Qty	Basecase Fixture Type	Basecase Watts	Base Case kW	Base Case kWh	New Fixture Type	New Fixture Watts	Proposed Annual Hours	Postcase kW	Postcase kWh	kW Reduction	kWh Savings
Site 01	400	400 W HID	458	183.20	1,290,827	6-Lamp T-5 HO	351	7,046	140.40	989,258	42.80	301,569
Site 02	402	400 W HID	458	184.12	1,297,281	6-Lamp T-5 HO	351	7,046	141.10	994,205	43.01	303,077
Site 03	400	400 W HID	458	183.20	1,290,827	6-Lamp T-5 HO	351	7,046	140.40	989,258	42.80	301,569
Site 04	400	400 W HID	458	183.20	1,290,827	6-Lamp T-5 HO	351	7,046	140.40	989,258	42.80	301,569
Site 05	400	400 W HID	458	183.20	1,290,827	6-Lamp T-5 HO	351	7,046	140.40	989,258	42.80	301,569
Site 06	400	400 W HID	458	183.20	1,290,827	6-Lamp T-5 HO	351	7,046	140.40	989,258	42.80	301,569
Site 07	402	400 W HID	458	184.12	1,297,281	6-Lamp T-5 HO	351	7,046	141.10	994,205	43.01	303,077
Total	**2,804**			**1,284.23**	**9,048,699**				**984.20**	**6,934,701**	**300.03**	**2,113,997**

Table 182. Verified Load Impacts

Site ID	Verified Qty	Basecase Fixture Type	Basecase Watts	Basecase kW	Basecase kWh	New Fixture Type	New Fixture Watts	Verified Annual Hours	Postcase kW	Postcase kWh	kW Reduction	kWh Savings
Site 01	420	400 W HID	458	192.36	1,322,860	6-Lamp T-5 HO	351	6,877	147.42	1,013,807	44.94	309,052
Site 02	411	400 W HID	458	188.24	1,294,513	6-Lamp T-5 HO	351	6,877	144.26	992,083	43.98	302,430
Site 03	421	400 W HID	458	192.82	1,326,009	6-Lamp T-5 HO	351	6,877	147.77	1,016,221	45.05	309,788
Site 04	415	400 W HID	458	190.07	1,307,111	6-Lamp T-5 HO	351	6,877	145.67	1,001,738	44.41	305,373
Site 05	443	400 W HID	458	202.89	1,395,302	6-Lamp T-5 HO	351	6,877	155.49	1,069,325	47.40	325,977
Site 06	429	400 W HID	458	196.48	1,351,207	6-Lamp T-5 HO	351	6,877	150.58	1,035,532	45.90	315,675
Site 07	456	400 W HID	458	208.85	1,436,248	6-Lamp T-5 HO	351	6,877	160.06	1,100,705	48.79	335,543
Total	**2,995**			**1,371.71**	**9,433,250**				**1,051.25**	**7,229,412**	**320.47**	**2,203,838**

7.17.3.4 Verified kW and kWh

KSI verified installed fixture types, wattages, fixture counts, and hours of operation for each site. The kW reduced and kWh savings were calculated by KSI and compared to what was invoiced. Refer to section "2.2 Analysis Approach" for KSI's equation to estimate energy savings. Table 181 and Table 182 show the proposed and verified load impacts, respectively.

7.17.3.5 Realization Rate

The realization rate was calculated to compare the invoiced kW reduced and kWh savings submitted by the Project Sponsor with the verified kW reduced and kWh savings. The realization rates are shown in Table 183.

The realization rate for the M&V for kW reduced is 107% and for kWh savings is 104%. The greater savings was due to the greater number of fixtures that were verified. Table 183 shows invoice and verified kWh savings and kW reduction.

Table 183. Realization Rate

Energy Savings (kWh)	
Total Reported / Invoiced Savings (kWh)	**2,113,997.29**
M&V verified Savings (kWh)	**2,203,837.81**
Realization Rate (kWh)	**104%**
Demand Reductions (kW)	
Total Reported / Invoiced Savings (kW)	**300.03**
M&V verified Savings (kW)	**320.47**
Realization Rate (kW)	**107%**

7.18 05-05-007 – Lighting Retrofit at a Single Facility

This project was a lighting retrofit conducted in leased office areas in a large office building complex comprised of two buildings of approximately 160,000 to 170,000 square feet each. Table 184 shows a summary of the M&V for this project.

Table 184. M&V Savings Summary – 05-05-007

Energy Savings (kWh)	
Total Contracted Savings (kWh)	1,175,295 kWh
Total Report / Invoice Savings (kWh)	916,012 kWh
M&V Savings (kWh)	**916,012 kWh**
Realization Rate to Contracted (kWh)	78%
Realization Rate to Invoiced (kWh)	**100%**
Demand Reduction (kW)	
Total Contracted Savings (kW)	259.7 kW (Corrected value = 262.16 kW, a text note was written in the cell for kW saved in contract documents.)
Total Invoiced Savings (kW)	200.27 kW
M&V Savings (kW)	**200.27 kW**
Realization Rate to contracted (kW)	76%
Realization Rate to Invoiced (kW)	**100%**

Table 185 provides a list of measures contracted for installation by the Project Sponsor.

Table 185. Contracted Measures and Savings, 05-05-007

		EXISTING FIXTURE		PROPOSED FIXTURE						
Location	Fixture Quantity	Fixture Description	Watts per Fixture	Fixture Description	Watts per Fixture	Total kW Reduced	Weekly Hours	Weeks per Year	Annual Hours	kWh Savings
Office Recessed 150 watt	14	150 watt incandescents	150	Delray Hort 42 watt fluorescent	42	1.51	86	52.14	4,484	6,780
Office Recessed 75 watt	490	75 watt incandescents	75	Delray Hort 13 watt fluorescent	13	30.38	86	52.14	4,484	136,225
Exterior Recessed 70 HPS	111	70 watt HPS Recessed	91	Retrofit Existing 50 MH (Exterior)	69	2.44	84	52.14	4,380	10,695
Office 2X4 3L	3,997	2X4 3L F34T12 ES Mag	115	2X4 3L F32T8 25 watt LW	58	227.83	86	52.14	4,484	1,021,594
Total	**4,612**					**262.16**				**1,175,295**

7.18.1 Measurement and Verification (M&V) Approach

The M&V approach used for the project is summarized in this section. KSI coordinated with the Project Sponsor to perform pre- and post-retrofit M&V activities to support the tasks described below.

7.18.1.1 Load Impact Verification Methodology

The load impact estimation methodology described in this plan complies with IPMVP Option A. Site inspections were employed to verify key M&V parameters.

7.18.1.2 Analysis Approach

The basic equation used to estimate the energy savings of this project is shown in Equation 1.

(Eq. 1) kWh savings = $kWh_{Pre} - kWh_{Post}$

where:

kWh_{Pre} = (# $Fixures_{Pre}$) × (Fixture $Wattage_{Pre}$/1000) × (Hours of $Operation_{Pre}$); and

kWh_{Post} = (# $Fixures_{Post}$) × (Fixture $Wattage_{Post}$/1000) × (Hours of $Operation_{Post}$).

The key parameters of Equation 1 are shown in Table 186.

Table 186. Key M&V Parameters

Parameter	M&V Activity
Fixture Counts	Fixture counts were verified through on-site inspection. Fixture counts were based on detailed worksheets provided by the Irvine Company.
Fixture $Wattage_{Pre}$ and Fixture $Wattage_{Post}$	Verified pre- and post- fixture types and fixture wattage values.
Hours of Operation	The lighting fixture retrofits had a form of timeclock control. The lights are allowed be turned on when needed. The controls were programmed to turnoff at 7 pm, unless an override button was pressed in each area. The override period was one hour and can be pressed again for another hour, thus ensuring lights are not on for excessively long periods of time when not needed. Light loggers were used to verify actual usage.

7.18.1.3 On-Site Verification Inspections

On-site inspections were conducted to verify the equipment types, fixture wattages and quantities. Light loggers were used to verify operating hours. Site inspections consisted of the verification of the installation of lighting equipment, including the verification of fixture types and wattages, and fixture counts.

The verification was based on as-built documentation provided to KSI by the Project Sponsor.

7.18.1.4 Verification of Operating Hours With Light Loggers

The hours of operation were verified through the installation of light loggers in a sample of rooms throughout the facility. To capture the diversity of usage by type of room the facility was stratified into two strata:

- **Open office**, including adjoining lobby and hallways; and
- **Private office**, where the office is separated from other space by a door and the office typically has a small number of light fixtures.

These strata were selected as they best represented the diversity of lighting usage in the facility. The light loggers were installed for a minimum of three (3) weeks. The data for each logger were cleaned and annualized. The hours of operation for the facility were estimated by taking a weighted average between the hours for open office and private office space. The weight was based on the number of fixtures in each office type.

7.18.2 M&V Results

This section provides the results of the M&V process.

7.18.2.1 Hours of Operation – Light Loggers

The hours of operation used to estimate the savings for contracting was 4,484 hours per year. Light loggers were used to verify the hours of operation as described in Section 7.18.1.4. The verified hours of operation are shown in Table 187. The data from the loggers were used to calculate average annual hours for private offices and open offices. A weighted average based on the number of fixtures in private offices and open offices was calculated. The weighted average was 4,574 hours per year. This is estimate is approximately two percent higher than the contracted value.

Table 187. Weighted Average Hours of Operation, 05-05-007

Office Type	# Offices	Fixtures per Office	Total # T8 Fixtures	% (Weight)	Logged Hours	Part Weight
Private	290	2	580	0.2	2,206.9	412.5
Open			2,523	0.8	5,118.3	4,161.6
Total			**3,103**		**Weighted Average**	**4,574.1**

7.18.2.2 Fixture Types, Wattages and Quantities

The pre-inspection verified all tubular fluorescent fixtures had T12's lamps, and that all recessed can fixtures had incandescent lamps. However, fixture counts did not match contracted quantities and it was determined that they would be verified during the post-inspection. The post-inspection was based on a project completion "as-built" audit provided by the Project Sponsor. The fixture types and counts in the audit were different from those in the contract documents. The total number of fixtures was 4,612 and 3,567 for the contracted and as-built, respectively. KSI verified the as-built fixture counts and fixture types. Table 188 shows the contracted and verified fixture types and counts. As can be seen, the types and quantities of fixtures contracted are different from those that were verified. The 3,997 contracted 4-ft 3-lamp T12 fixtures were actually 3,383 tubular fluorescent fixtures of different lamp configurations, including 4-ft T12 with 1, 2 and 4 lamps, 3-ft and 2-ft T12 with 1 and 2 lamps, and 8-ft T12 with 2 lamps.

The wattage for the 4-ft 3-lamp T12 fixtures was a weighted average of 115 watts or 134 watts per fixture, depending on the type of ballast, either standard magnetic ballast (134 W) or energy efficient magnetic ballast (115 W). Approximately, 80 percent of the ballasts were standard magnetic and 20 percent were energy efficient magnetic. The wattage used in calculating energy savings was a weighted average of the wattage of the two ballasts, with the weights based on the share of ballasts. The weighted average was 130 watts per fixture.

Table 188. Verified Fixture Counts, Types and Wattages, 05-05-007

Contracted								
Fixture Type				Savings				
Basecase	Basecase kW	Retrofit	Retrofit kW	Delta kW	Qty	Op. Hours	Total Delta kW	Total kWh Savings
4-ft 3L T12 34w	0.115	4-ft 3L T8 25w	0.058	0.057	3,997	4,484	227.83	1,021,594
75w inc recessed cans	0.075	13w fluorescent	0.013	0.062	490	4,484	30.38	136,225
150w HID	0.150	42w fluorescent	0.042	0.108	14	4,484	1.51	6,780
70W HPS	0.091	50 MH	0.069	0.022	111	4,380	2.44	10,695
							262.16	**1,175,295**

Verified Savings									
Fixture Type					Savings				
Basecase	Contractor Fixture code	Basecase Watts (Note 1)	Retrofit	Retrofit kW	Delta kW	Qty	Op. Hours	Total Delta kW	Total kWh Savings
4-ft 3L T12 34w	F43EIS	0.130	4-ft 3L T8 28w GE-UltraMax/N	0.072	0.058	2,695	4,574	156.85	717,427
75w inc recessed cans	I75/1	0.075	20w CFL	0.020	0.055	0	4,574	0.00	0
75w inc recessed cans	I75/1	0.075	13w CFL	0.013	0.062	148	4,574	9.18	41,971
75w inc recessed cans	I75/1	0.075	26w CFL	0.026	0.049	36	4,574	1.76	8,069
150w HID			Not retrofitted		0.000		4,574	0.00	0
70W HPS		0.090	50 MH	0.061	0.029	0	4,574	0.00	0
4-ft 4L T12 34w	F44EIS	0.168	4-ft 4L T8 28w GE-UltraMax/N	0.080	0.088	109	4,574	9.59	43,874
4-ft 2L T12 34w	F42EIS	0.084	4-ft 2L T8 28w GE-UltraMax/N	0.049	0.035	215	4,574	7.53	34,419
4-ft 2L T12 UT 34w	FU2EIS	0.084	2-ft 2L T8 28w GE-UltraMax/N	0.033	0.051	189	4,574	9.64	44,089
4-ft 1L T12 34w	F41EIS	0.051	4-ft 1L T8 28w GE-UltraMax/L	0.022	0.029	119	4,574	3.45	15,785
3-ft 2L T12 30w	F32EIS	0.081	3-ft 2L T8 28w GE-UltraMax/N	0.046	0.035	17	4,574	0.60	2,722
3-ft 1L T12 30w	F31EIS	0.046	3-ft 1L T8 28w GE-UltraMax/L	0.020	0.026	21	4,574	0.55	2,497
2-ft 2L T12 20w	F22EIS	0.056	2-ft 2L T8 28w GE-UltraMax/L	0.033	0.023	10	4,574	0.23	1,052
2-ft 1L T12 20w	F21EIS	0.028	2-ft 1L T8 28w GE-UltraMax/L	0.020	0.008	2	4,574	0.02	73
8-ft 2L T12 95w	F82EIS	0.227	4-ft 4L T8 28w GE-UltraMax/N	0.080	0.147	6	4,574	0.88	4,034
						3,567		**200.27**	**916,012**
						Realization Rate=		**76%**	**78%**

Note 1: For 4-ft 3L T12 Fixture a weighted average for wattage was taken to account for the mix of Standard Magnetic Ballast and EE Magnetic Ballast. 80% of fixtures were Standard Magnetic Ballast (134W per fixture) and 20% were Energy Saving ballast (115W per fixture).

7.18.2.3 Verified Savings

The verified savings as calculated per Equation 1 are shown in Table 188.

Some of the key findings are:

- **Realization Rates:** The realization rates are 78% for kWh savings and 76% for kW reduced. This means that the verified kWh savings were 78% of kWh savings reported through the contracted documents. And the verified kWh savings were 100% of kWh savings through the invoiced documents.
- **Quantity of Retrofits and Fixture Wattage:** (1) The 3,997 tube fluorescent lighting fixtures proposed for retrofit were 3-lamp T12 34W fixtures. The retrofit fixtures were actually a mix of 1, 2 and 3-lamp fixtures, as well as 2-lamp U-tube fixtures. The total number of fluorescent fixtures retrofit was 3,383 fixtures rather than 3,997. (2) 14 -150W metal halide fixtures were not retrofitted. (3) 490 -75W incandescent lamps in recessed cans were proposed, however, 184 were retrofitted. (4)111 -70W HPS also in recessed cans were proposed and were not retrofitted.
- **Hours of Operation:** The proposed hours of operation were 4,484 hours per year. The verified hours of operation were 4,574 hours per year based on monitored data.

The single largest factor for the 78% realization rate was the lower number of T12 fixtures retrofit. Approximately 614 fixtures that were in the total contract were not retrofit. All fixtures that could be retrofitted were retrofitted as part of this project.

7.19 05-05-008 - Project C – Commercial Refrigeration and Lighting Measures

Findings were presented in Section 7.11, 05-04-003 and 05-05-008 – Commercial Refrigeration and Lighting Measures.

7.20 05-06-001 – Refrigeration and Lighting Measures In Refrigerated Warehouses

This project was intended to be a aggregation of multiple customers. The project had one site.

The project site was a refrigerated warehouse that distributes frozen and fresh goods. The facility had operations 24/7 Monday through Saturday. Recently the owner added ice cream to their distribution. Ice cream requires a freezer temperature of -10°F or lower for storage. The entire facility was controlled by one refrigeration system and thus the entire cooled storage area had to be set to -10°F. For most of the storage this is much cooler than needed. Most of the product requires on a 0°F storage. The ice cream storage was only 360 sq. ft. of the total 8,760 sq. ft. This resulted in excessive refrigeration system energy consumption.

The project involved isolating the ice cream section with partitions and installing a dedicated refrigeration system. This system could maintain the -10°F for the 360 sq. ft. of ice cream storage and the remainder of the storage area could be refrigerated at 0°F.

Energy savings results from a reduction in the compressor lift and the differential pressure between the suction and discharge of the main refrigeration system. The system will operate at a better efficiency when at a lower lift.

In addition to the refrigeration retrofit a large lighting upgrade was also done. Throughout the storage area 175 Metal Halide fixtures (400 watt) were replaced with 4-lamp T5 fixtures. Six 4-lamp T12 fixtures were replaced with T8 fixtures. Most of the fixtures operate about 7,000 hours per year.

Table 189. M&V Savings Summary – 05-05-00

Total Contracted kWh Savings	618,625
Total Reported / Invoiced kWh Savings	618,625
M&V Savings (kWh)	**651,221**
Percent of Reported kWh Savings	105%
Percent of Contracted kWh Savings	105%
Total Contracted kW Savings	97.0
Total Reported / Invoiced kW Savings	97.0
M&V Savings (kW)	**92.3**
Percent of Reported kW Savings	95%
Percent of Contracted kW Savings	95%

7.20.1 Measurement and Verification (M&V) Approach

The load impact estimation methodology complies with IPMVP Option A.

7.20.1.1 Refrigeration

A pre/post direct measurement methodology was used to determine the energy savings achieved by the refrigeration changes. Data loggers were installed on both the main refrigeration and the new ice cream refrigeration units. Energy consumption was recorded with the building in its new 0°F configuration for 24 days. The system was setback to -10°F for 6 days while energy consumption was recorded. Both the baseline and new periods included weekdays and weekends. The average consumption was developed for baseline weekdays and weekends and new weekdays and weekends. The savings are shown in Table 190.

Table 190. Verified Refrigeration Savings

	Avg kW	Hours	kWh/yr	Total
Avg. Base kW Weekend	209.5	2496	522,802	1,864,320
Avg. Base kW Weekday	215.0	6240	1,341,518	
Avg. New kW Weekend	178.4	2496	445,365	1,662,895
Avg. New kW Weekday	195.1	6240	1,217,531	
kWh/yr Savings				**201,425**

7.20.1.2 Lighting

The lighting retrofit savings are shown in Table 191.

Table 191. Verified Lighting Savings

Area	Pre Fixt #	Pre Watts	Post Fixt #	Post Watts	kW Saved	Hours	Lighting kWh Saved
Freezer Dock	11	458	11	234	2.464	7,000	17,248
Freezer	80	458	80	234	17.92	7,000	125,440
Freezer	18	458	18	234	4.032	7,000	28,224
Battery Charger Room	5	123	5	90	0.165	1,000	165
Switchgear Alcove	1	123	1	90	0.033	7,000	231
Cooler	11	458	12	234	2.23	7,000	15,610
Back cooler	12	458	12	234	2.688	7,000	18,816
Produce Cooler	15	458	15	234	3.36	7,000	23,520
Produce Cooler	8	458	8	234	1.792	7,000	12,544
Cooler	12	458	12	234	2.688	7,000	18,816
Cooler Dock	7	458	7	234	1.568	7,000	10,976
Total							271,590

Given that the facility is a refrigerated warehouse, the reduction of heat gains due to the upgraded lighting is a significant factor. The interactive savings on the refrigeration system are calculated using a method published by ASHRAE.

Source: Rundquist, R. 1993. "Calculating lighting and HVAC interactions." ASHRAE Transactions. Atlanta, Georgia. Vol.

The savings calculation using this method is shown Table 192.

Table 192. Verified Savings Attributed To Interaction of Lighting With Cooling

Area	System MCOP (est.)	kW/ton	Fraction of Lighting Savings to Cooling	Electrical Savings		Refrigeration Interactive Savings	
				(kW)	(kWh)	kW	kWh
Freezer	1.16	3.04	0.76	24.5	170,912	21.1	112,309
Cooler	1.47	2.39	0.76	14.4	100,282	12.4	65,897
Total				**38.9**	**271,194**	**33.5**	**178,206**

7.20.2 Results

The measurement and verification of savings achieved by this project results in an estimate of 651,221 kWh per year and 92.3 kW peak demand reduction. This is 105% and 95% of the contracted kWh and kW savings, respectively. The M&V results compared with the contracted savings is shown for each measure in Table 193.

Table 193. M&V Savings Summary – 05-06-001

		kWh		Peak kW	
#	Measure	M&V Savings	Contracted Savings	M&V Savings	Contracted Savings
1	Lighting	271,590	271,590	38.9	38.9
2	Refrigeration	201,425	347,035	19.9	58.1
3	Interactive savings	178,206	0	33.5	0
Total		**651,221**	**618,625**	**92.3**	**97.0**
Realization Rate			**105%**		**95%**

7.21 05-06-004

M&V not completed. Savings not included in verified savings.

7.22 05-06-005 – Lighting Retrofit at Multiple Sites of a Single Customer

This project was a lighting retrofit program conducted in four of the Project Sponsor's retail stores within the San Diego Gas & Electric service area. The facilities are located at:

The measures installed through this project were 6-Lamp and 7-Lamp T8 fixtures. These fixtures replaced 400-watt metal halide fixtures. The fixtures installed were not one-for-one replacements. More 400-watt metal halide fixtures were removed than T8 fixtures installed. This fixture removal further reduced connected lighting load. The fixtures employed were:

- SpecLite 7-lamp (6 down, 1 side) T8, 180-watt
- SpecLite 6-lamp T8, 160-watt

Table 194 shows the M&V summary for this project.

Table 194. M&V Savings Summary – 05-06-005

Energy Savings (kWh)	
Total Contracted Savings (KWh)	655,207 kWh
Total Reported / Invoiced Savings (kWh)	655,207 kWh
M&V Savings (kWh)	693,723 kWh
Realization Rate (kWh)	104.22%
Demand Reduction (kW)	
Total Contracted Savings (kW)	88.9 kW
Total Reported / Invoiced Savings (kW)	88.9 kW
M&V kW Reduction (kW)	88.9 kW
Realization Rate	100.00%

7.22.1 Measurement and Verification (M&V) Approach

The M&V approach used for the project is summarized in this section. KSI coordinated with onsite personnel to perform pre- and post-retrofit M&V activities to support the tasks described below.

7.22.1.1 Load Impact Verification Methodology

The load impact estimation methodology described in this plan complies with IPMVP Option A. Site inspections were employed to verify key M&V parameters.

7.22.1.1.1 Review of Program Documents

A review of the program documents, found that the savings calculation in the program application documents were incorrect. The supporting documents to the application used the incorrect formulas the 6-Lamp and 7-Lamp fixtures. These errors resulted in understated savings as shown in Table 195.

Table 195. Corrected Proposed Savings

Store	Proposed kWh Savings	Corrected Proposed
Capistrano	158,869	162,180
Vista	180,048	181,918
San Diego	154,690	157,183
Encinitas	161,600	164,338
Total kWh Savings	655,207	665,619

7.22.1.1.2 Analysis Approach

The basic equation used to estimate the energy savings of this project is shown in (Equation 6).

(Equation 6) $kWh\ savings = kWh_{Pre} - kWh_{Post}$

where:

$kWh_{Pre} = (\#\ Fixures_{Pre}) \times (Fixture\ Wattage_{Pre}/1000) \times (Hours\ of\ Operation_{Pre})$; and

$kWh_{Post} = (\#\ Fixures_{Post}) \times (Fixture\ Wattage_{Post}/1000) \times (Hours\ of\ Operation_{Post})$.

The key parameters of (Equation 6) and the M&V activity associated with each are shown in Table 196.

Table 196. Key M&V Parameters

Parameter	M&V Activity
Fixture Counts	Fixture counts were verified through on-site inspection. Leverage pre-inspections by SDG&E program staff.
Fixture $Wattage_{Pre}$ and Fixture $Wattage_{Post}$	Stipulated wattage values on verification of fixture types. Leverage pre-inspections by SDG&E program staff.
Hours of Operation	The proposed hours of operation were verified through the use of light loggers. Three of the four stores were logged. The verified hours of operation for the three stores was used directly for each store. The proposed hours for the fourth store, San Juan Capistrano, were multiplied by the average realization rate for hours for the other three stores.

7.22.1.1.3 On-Site Verification Inspections

On-site inspections were conducted to verify the equipment types, quantities and operating hours. Site inspections consisted of the following activities:

- Verification of the installation of lighting equipment, including
  - fixture wattage, and
  - counts.
- Verify the operation of lighting controls, i.e., time clocks.
- Verify hours of operation for lighting by obtaining lighting schedules and/or reviewing settings on time clocks, as well as installing light loggers to collect time of use data.

The verification was based on as-built documentation provided to KSI.

7.22.2 Results

This section provides the results of the M&V process. Table 198 shows the results of the monitoring of the hours of operation. Table 197 shows a summary of the M&V results.

Table 197. Verified Hours of Operation

Site ID	Proposed Hours	Logged Hours	Adjustment Factor For Hours	Verified Hours
Site 02	7,696	8,760	1.14	8,760
Site 03	7,696	6,552	0.85	6,552
Site 03	7,800	8,760	1.12	8,760
Weighted Average Adjustment Factor			1.04	

Table 198. Summary of M&V

Site ID	Proposed kWh Savings	Corrected Proposed	Verified	Realization Rate
Site 01	158,869	162,180	168,272	
Site 02	180,048	181,918	207,069	
Site 03	154,690	157,183	133,818	
Site 04	161,600	164,338	184,564	
kWh Savings	**655,207**	**665,619**	**693,723**	**104.22%**
kW Reduced	**88.94**		**88.94**	**100.00%**

Table 199 shows the details of the verified savings analysis.

The key findings are:

- **Realization Rates:** The realization rates are 104.22% for kWh savings and 100.00% for the peak demand kW reduced. This means that the verified kWh savings were 104.22% of kWh savings reported through the as-built documentation.
- **Hours of Operation:** The proposed hours of operation were analyzed against the schedules of the time clocks, information provided by the on-site store managers, and data collected by time of use light loggers, in three of the four sites.
    - **Site 04:** The verified hours of operation for this store are greater than proposed. The store manager indicated that the time clock has been set for 24-hours a day ever since the retrofit took place and that the lights never go off. Data collected from the loggers indicates that these fixtures are being operated 24-hours per day, 7-days a week (8,760 hours annually).
    - **Site 02:** The verified hours of operation for this store are greater than proposed. The store manager indicated that the time clock has been set for 24-hours a day ever since the retrofit took place and that the lights never go off. The data collected from the loggers indicates that these fixtures are being operated 24-hours per day, 7-days a week (8,760 hours annually).

- **Site 03:** The verified hours of operation for this store are similar to the scheduled hours provided by the Project Sponsor, however they are less that the calculated hours provided by the Project Sponsor. The fixtures in this store are being operated by time clocks. The hours were verified by installing light loggers in fixtures on the sales floor. The data collected average 18 hours per day (6,552 hours annually).
- **Site 01:** The hours of operation for this site was estimated by applying the proposed hours by the Average Adjustment Factor.

- **Quantity of Retrofits Performed:** Reported fixture quantities were verified and found to be consistent with the reported quantity of fixtures.
- **Fixture Wattages:** Reported fixture wattages were verified to be consistent with the installed fixtures.

Table 199. M&V Results

	Basecase						Postcase								
Site ID	Fixture Type	Qty	Fixture Wattage	Hours	Total kW	kWh	Qty	Fixture Type	Fixture Wattage	Hours	Total kW	kWh (per Line Item)	kWh (for Store)	kWh Savings	kW Reduced
Site 01							48	6-Lamp T8	160	7,068	7.68	54,281			
							30	7-Lamp T8	187	7,068	5.61	39,651			
	400w MH	81	458	7,068	37.10	262,204							93,932	168,272	23.81
Site 02							41	6-Lamp T8	160	8,760	6.56	57,466			
							32	7-Lamp T8	187	8,760	5.98	52,420			
	400w MH	79	458	8,760	36.18	316,954							109,885	207,069	23.64
Site 03							40	6-Lamp T8	160	6,552	6.40	41,933			
							28	7-Lamp T8	187	6,552	5.24	34,306			
	400w MH	70	458	6,552	32.06	210,057							76,239	133,818	20.42
Site 04							40	6-Lamp T8	160	8,760	6.40	56,064			
							27	7-Lamp T8	187	8,760	5.05	44,229			
	400w MH	71	458	8,760	32.52	284,858							100,293	184,564	21.07
Total					**137.86**	**1,074,073**					**48.92**		**380,350**	**693,723**	**88.94**

7.23 05-07-003 – Lighting Retrofit in Parking Garages

This project was an aggregation project conducted on a large number of sites consisting of individual SDG&E customers. A preliminary list of 35 parking structure sites was provided in the project application in August 2004. This list was subject to customer acceptance of terms and conditions and subsequent marketing efforts to other customers. Table 200 shows a summary of the M&V for this project.

Table 200. M&V Savings Summary

Energy Savings (kWh)	
Total Reported / Invoiced Savings (kWh)	**3,945,822**
M&V Verified Savings (kWh)	**3,958,530**
Realization Rate (kWh)	**100.32%**
Demand Reductions (kW)	
Total Reported / Invoiced Reduction (kW)	**477.09**
M&V Verified Reduction (kW)	**477.32**
Realization Rate (kW)	**100.05%**

7.23.1 MEASURE DESCRIPTION

Install energy efficient fluorescent lighting fixtures in place of 250W, 175W, 150W, 100W, 90W, 70W Metal Halide, and 2 Lamp – 8ft T12 fixtures in primarily parking garage facilities.

7.23.1.1 Pre-Retrofit Conditions

- Parking Garage facilities.
- 250W, 175W, 150W, 100W, 90W, 70W Metal Halide, and 2 Lamp – 8ft T12 fixtures
- Fixture wattage uses stipulated values of 295, 185, 136, 128, and 95 watts per fixture depending on the specific installed fixture.
- All sites were parking garage facilities with light fixtures operating 24 hours a day, 7 days a week.

7.23.1.2 Post-Retrofit Conditions

The following describes the post-retrofit fixture components.

- Energy efficient fluorescent fixture.
- Ballast and Lamps: GE Pro Line or GE Ultra Max
- 3-Lamp T8 LP rated at 72 watts

- 2-Lamp T8 HP rated at 66 watts
- 2-Lamp T8 NP rated at 60 watts
- 2-Lamp T8 LP rated at 44 watts
- 1-Lamp T8 LP rated at 25 watts

7.23.2 Measurement and Verification (M&V) Approach

The M&V approach used for the project is summarized in this section. KSI coordinated with the Project Sponsor to perform pre- and post-retrofit M&V activities to support the tasks described below.

7.23.2.1 Load Impact Verification Methodology

The load impact estimation methodology described in this plan complies with IPMVP Option A. Site inspections were employed to verify key M&V parameters.

7.23.2.2 Analysis Approach

The basic equation used to estimate the energy savings of this project is shown in Equation 1.

(Equation 7) $\text{kWh savings} = \text{kWh}_{\text{Pre}} - \text{kWh}_{\text{Post}}$

Where:

$\text{kWh}_{\text{Pre}} = (\#\ \text{Fixtures}_{\text{Pre}}) \times (\text{Fixture Wattage}_{\text{Pre}}/1000) \times (\text{Hours of Operation}_{\text{Pre}})$; and

$\text{kWh}_{\text{Post}} = (\#\ \text{Fixtures}_{\text{Post}}) \times (\text{Fixture Wattage}_{\text{Post}}/1000) \times (\text{Hours of Operation}_{\text{Post}})$.

The M&V activities for the key parameters of Equation 1 are shown in Table 201.

Table 201. Key M&V Parameters

Parameter	M&V Activity
Fixture Counts	Fixture counts were verified through on-site inspection. Leverage inspections by SDG&E program staff.
Fixture Wattage $_{Pre}$ and Fixture Wattage $_{Post}$	Stipulated wattage values on verification of fixtures.
Hours of Operation	Due to security and underground structures, all parking garage facilities have light fixtures that operate 24 hours a day, seven days a week.

7.23.2.3 On-Site Verification Inspections

On-site inspections were conducted to verify the equipment types, quantities and operating hours. Site inspections consisted of the following activities:

- Verification of the installation of lighting equipment, including
  - pre and post fixture wattage, and
  - pre and post fixture quantities.
- Typically, parking garage lights operate 24-hours a day, 7-days a week, however, the operating hours for the light fixtures were confirmed by interviews with the site contact.

The verification was based on as-built documentation provided to KSI by the Project Sponsor.

7.23.3 Results

This section provides the results of the M&V process. The attached spreadsheet workbook is the analysis of this M&V.

Some of the key findings are:

- **Realization Rates:** The realization rates are 100.32% for kWh savings and 100.05% for kW reduced.
- **Hours of Operation:** The proposed hours of operation were verified through the confirmation of the contact person on site. All light fixtures in underground parking garages are on 24 hours a day, seven days a week.

- **Quantity of Fixtures Retrofit:** The basis for the quantity of fixtures retrofit, were submitted by the Project Sponsor to SDG&E. These forms also included fixture wattages.
- **Fixture Wattages:** Reported fixture wattages were verified to be consistent with the installed fixtures.

7.23.3.1 Verified Hours of Operation

The hours of operation were verified to be 24-hours per day, seven days per week, through interviews of on site personnel and verification that the lights were turned on at the time of the pre and post-inspection. There were five sites where the fixtures operated on set schedules and were controlled by time clocks. KSI verified time clocks and time clock schedule through interviews with site contacts. Site 01 had a section of 230 fixtures that operated 12 hours a day, seven days a week. Site 10 and Site 23 operated 17 hours a day, seven days a week. Site 12 fixtures operated 15 hours a day, seven days a week. And Site 27 had an area with 24 fixtures that operated at 10 hours a day, seven days week.

7.23.3.2 Verified Fixture Wattage

The base case fixtures were verified to be 250W, 175W, 150W, 100W, 90W, 70W Metal Halide, and 2 Lamp – 8ft T12 fixtures. Fixture wattage uses stipulated values of 295, 185, 136, 128, and 95 watts per fixture depending on the specific installed fixture.

7.23.3.3 Verified Fixture Quantities

The fixture counts on the project completion request forms submitted by the Project Sponsor represented the as-built quantities for each project. This was the basis for the verification of the number of fixtures. Pre-inspection and post-inspection visits were made to all sites. Fixture quantities and wattages from the pre-inspection were used to adjust the base case, as appropriate. It was not unusual for the pre- and post- counts to differ. Usually the contractor adjusted their counts when advised by the KSI inspector. The as-built counts were used for the final verification of fixture quantities, since the claimed savings were based on these values.

7.23.3.4 Proposed kW and kWh

The As-Built for each site shows kW reduction and kWh savings, as well as the fixture quantities, base case fixture type and the wattages. The proposed new fixture type shows new fixture wattage. Hours per day is shown with days per week.

- The Project Sponsor calculates the kW Reduced through the following equation:

kW Reduced = ((Watts $_{Pre}$ – Watts $_{Post}$) / 1000) x (Fixture Quantity)

where:

Watts $_{Pre}$ = Watts per fixture for base case

Watts $_{Post}$ = Watts per fixture for post case

Fixture Quantity = Number of fixtures

- Proposed kWh savings were calculated using the following equation

kWh Savings = (kW Reduced) x (Operating Hours)

where:

Operating Hours = (Hours per Day) x (Days per Week) x (52 weeks per year)

Table 203 shows the proposed data and the associated load impacts.

7.23.3.5 Verified kW and kWh Impacts

KSI verified pre and post fixture types and fixture counts, pre and post fixture wattage, hours of operation, post kW and annual kWh savings for each site. Fixture counts and wattages from the pre-inspection were used to adjust the proposed base case. The kW reduced and kWh savings were calculated by KSI and compared to what was invoiced. KSI uses 52.14 weeks per year in the calculations, or 8,760 annual hours.

Table 204 shows the verified facility data and associated verified load impacts.

7.23.3.6 Realization Rate for Total Project

The realization rate for the M&V for the verified kW reduced is 100.05 % and for the kWh savings is 100.32 %. As-built were submitted by the Project Sponsor and were used as the basis for KSI's post-inspections.

Due to the adjustments of fixture counts and wattages, and the proposed savings based on 52 weeks (8,736 annual hours) instead of the 52.14 weeks (8,760 annual hours) used by for the M&V, the realization rate for kWh savings is 100.32%. Table 202 shows invoice and verified kWh savings and kW reduction.

Table 202. Realization Rate – 05-07-003

Energy Savings (kWh)	
Total Reported / Invoiced Savings (kWh)	3,945,822
M&V Verified Savings (kWh)	3,958,530
Realization Rate (kWh)	100.32%
Demand Reductions (kW)	
Total Reported / Invoiced Reduction (kW)	477.09
M&V Verified Reduction (kW)	477.32
Realization Rate (kW)	100.05%

Table 203. Proposed Savings Calculations – 05-07-003

	Proposed Basecase								Proposed Postcase							
Site ID	Current Fixture Type	Watts per fixture	Qty of Fixtures	Hrs Per Day	Days Per Week	Annual Hours	kW pre	kWh pre	New Fixture Type	Watts Per NEW Fixture	Qty of Fixtures	Annual Hours	kW post	kWh post	kW Reduced	Annual KWh Savings
Site 01	70W Metal Halide	95	55	24	7	8,736	5.23	45,646	1Lamp T8 F28	25	55	8,736	1.38	12,012	3.85	33,634
Site 02	90W Metal Halide	**185**	230	12	7	4,368	42.55	185,858	1Lamp T8 F28	25	230	4,368	5.75	25,116	36.80	160,742
Site 03	150W Metal Halide	185	52	24	7	8,736	9.62	84,040	2Lamp T8 F28	66	52	8,736	3.43	29,982	6.19	54,058
Site 04	150W Metal Halide	185	47	24	7	8,736	8.70	75,960	2Lamp T8 F28	66	47	8,736	3.10	27,099	5.59	48,860
Site 05	175 W Metal Halide	215	46	24	7	8,736	9.89	86,399	2lamp T8 HP F28	66	46	8,736	3.04	26,522	6.85	59,877
Site 06	70W Metal Halide	95	23	24	7	8,736	2.19	19,088	1lamp T8 F28	25	23	8,736	0.58	5,023	1.61	14,065
Site 07	175W Metal Halide	215	84	24	7	8,736	18.06	157,772	2Lamp T8 F28	66	84	8,736	5.54	48,432	12.52	109,340
Site 08	70W Metal Halide	95	14	24	7	8,736	1.33	11,619	1Lamp T8 F28	25	14	8,736	0.35	3,058	0.98	8,561
Site 09	150 W Metal Halide	185	24	24	7	8,736	4.44	38,788	2Lamp T8 F28	66	24	8,736	1.58	13,838	2.86	24,950
Site 10	250W Metal Halide	295	67	24	7	8,736	19.77	172,667	3Lamp T8 LPB1	72	67	8,736	4.82	42,142	14.94	130,525
Site 11	100W Metal Halide	128	38	17	7	6,188	4.86	30,098	2Lamp LO T8 F28	44	38	6,188	1.67	10,346	3.19	19,752
Site 12	150W Metal Halide	185	66	15	7	5,460	12.21	66,667	2Lamp T8 F28	66	66	5,460	4.36	23,784	7.85	42,883
Site 13	50W Metal Halide	85	86	24	7	8,736	7.31	63,860	1lamp T8 HP F28	33	86	8,736	2.84	24,793	4.47	39,067
Site 14	175W Metal Halide	215	97	24	7	8,736	20.86	182,189	2lamp T8 HP F28	66	97	8,736	6.40	55,928	14.45	126,261
Site 15	100W Metal Halide	128	19	24	7	8,736	2.43	21,246	2Lamp LO T8 F28	44	19	8,736	0.84	7,303	1.60	13,943
Site 16	150W Metal Halide	185	17	24	7	8,736	3.15	27,475	2Lamp T8 F28	66	17	8,736	1.12	9,802	2.02	17,673
Site 17	150 W Metal Halide	185	290	24	7	8,736	53.65	468,686	2Lamp T8 F28	66	290	8,736	19.14	167,207	34.51	301,479
Site 18	175W Metal Halide	215	56	24	7	8,736	12.04	105,181	2Lamp T8 F28	66	56	8,736	3.70	32,288	8.34	72,893
Site 19	150W Metal Halide	185	52	24	7	8,736	9.62	84,040	2Lamp T8 F28	66	52	8,736	3.43	29,982	6.19	54,058
Site 20	70W Metal Halide	130	80	24	7	8,736	10.40	90,854	1Lamp T8 F28	33	80	8,736	2.64	23,063	7.76	67,791
Site 21	70W Metal Halide	95	70	24	7	8,736	6.65	58,094	1Lamp T8 F28	33	70	8,736	2.31	20,180	4.34	37,914
Site 22	100W Metal Halide	128	692	24	7	8,736	88.58	773,800	2Lamp LO T8 F28	44	692	8,736	30.45	265,994	58.13	507,806
Site 23	100W Metal Halide	128	60	17	7	6,188	7.68	47,524	2Lamp LO T8 F28	44	60	6,188	2.64	16,336	5.04	31,188
Site 24	175 Metal Halide	215	280	24	7	8736	60.2	525,907	3Lamp T8 LPB1	65	280	8736	18.2	158,995	42.00	366,912
Site 25	150W Metal Halide	185	31	24	7	8,736	5.74	50,101	2Lamp T8 F28	66	31	8,736	2.05	17,874	3.69	32,227
Site 26	150W Metal Halide	185	171	24	7	8,736	31.64	276,363	2Lamp T8 F28	66	171	8,736	11.29	98,594	20.35	177,769
Site 27	150W Metal Halide	185	71	24	7	8,736	13.14	114,747	2Lamp T8 F28	66	71	8,736	4.69	40,937	8.45	73,810
Site 28	150W Metal Halide	185	24	10	7	3,640	4.44	16,162	2Lamp T8 F28	66	24	3,640	1.58	5,766	2.86	10,396
Site 29	150W Metal Halide	185	52	24	7	8,736	9.62	84,040	2Lamp T8 F28	66	52	8,736	3.43	29,982	6.19	54,058
Site 30	150W Metal Halide	185	39	24	7	8,736	7.22	63,030	2Lamp T8 F28	66	39	8,736	2.57	22,486	4.64	40,544
Site 31	100W Metal Halide	128	32	24	7	8,736	4.10	35,783	2Lamp LO T8 F28	44	32	8,736	1.41	12,300	2.69	23,482
Site 32	175W Metal Halide	215	30	24	7	8,736	6.45	56,347	2Lamp T8 F28	66	30	8,736	1.98	17,297	4.47	39,050
Site 33	175W Metal Halide	215	189	24	7	8,736	40.64	354,987	2Lamp T8 F28	66	189	8,736	12.47	108,973	28.16	246,014
Site 34	150W Metal Halide	185	210	24	7	8,736	38.85	339,394	2Lamp T8 F28	**49**	210	8,736	10.29	89,893	28.56	249,500
Site 35	175W Metal Halide	215	438	24	7	8,736	94.17	822,669	2Lamp T8 F28	66	438	8,736	28.91	252,540	65.26	570,129
Site 36	175W Metal Halide	215	65	24	7	8,736	13.98	122,086	2Lamp T8 F28	66	65	8,736	4.29	37,477	9.69	84,608
Total							**691.35**	**5,759,169**					**214.26**	**1,813,348**	**477.09**	**3,945,822**

Table 204. Verified Savings Calculations – 05-07-003

	Verified Basecase								Verified Postcase									
Site ID	Current Fixture Type	Watts per fixture	Verified Pre Qty	Hrs Per Day	Days Per Week	Annual Hours	kW pre	kWh pre	Fixture Type	Watts Per NEW Fixture	Verified Post Qty of Fixtures	Hrs Per Day	Days Per Week	Annual Hours	kW post	kWh post	kW Reduced	Annual KWh Savings
Site 01	70W Metal Halide	95	55	24	7	8,760	5.23	45,768	1Lamp T8 F28	25	55	24	7	8,760	1.38	12,044	3.85	33,724
Site 02	90W Metal Halide	185	230	12	7	4,380	42.55	186,359	1Lamp T8 F28	25	230	12	7	4,380	5.75	25,184	36.80	161,175
Site 03	150W Metal Halide	185	52	24	7	8,760	9.62	84,267	2Lamp T8 F28	66	52	24	7	8,760	3.43	30,063	6.19	54,204
Site 04	150W Metal Halide	185	47	24	7	8,760	8.70	76,164	2Lamp T8 F28	66	47	24	7	8,760	3.10	27,172	5.59	48,992
Site 05	175 W Metal Halide	215	46	24	7	8,760	9.89	86,632	2lamp T8 HP F28	66	46	24	7	8,760	3.04	26,594	6.85	60,038
Site 06	70W Metal Halide	95	23	24	7	8,760	2.19	19,140	1lamp T8 F28	25	23	24	7	8,760	0.58	5,037	1.61	14,103
Site 07	175W Metal Halide	215	84	24	7	8,760	18.06	158,197	2Lamp T8 F28	66	84	24	7	8,760	5.54	48,563	12.52	109,634
Site 08	70W Metal Halide	95	14	24	7	8,760	1.33	11,650	1Lamp T8 F28	25	14	24	7	8,760	0.35	3,066	0.98	8,584
Site 09	150 W Metal Halide	185	24	24	7	8,760	4.44	38,892	2Lamp T8 F28	66	24	24	7	8,760	1.58	13,875	2.86	25,017
Site 10	250W Metal Halide	295	67	24	7	8,760	19.77	173,132	3Lamp T8 LPB1	72	67	24	7	8,760	4.82	42,256	14.94	130,876
Site 11	100W Metal Halide	128	38	17	7	6,205	4.86	30,179	2Lamp LO T8 F28	44	38	17	7	6,205	1.67	10,374	3.19	19,805
Site 12	150W Metal Halide	185	66	15	7	5,475	12.21	66,846	2Lamp T8 F28	66	66	15	7	5,475	4.36	23,848	7.85	42,998
Site 13	50W Metal Halide	85	86	24	7	8,760	7.31	64,032	1lamp T8 HP F28	33	86	24	7	8,760	2.84	24,860	4.47	39,173
Site 14	175W Metal Halide	215	97	24	7	8,760	20.86	182,680	2lamp T8 HP F28	66	97	24	7	8,760	6.40	56,078	14.45	126,601
Site 15	100W Metal Halide	128	19	24	7	8,760	2.43	21,303	2Lamp LO T8 F28	44	19	24	7	8,760	0.84	7,323	1.60	13,980
Site 16	150W Metal Halide	185	17	24	7	8,760	3.15	27,549	2Lamp T8 F28	66	17	24	7	8,760	1.12	9,828	2.02	17,721
Site 17	150 W Metal Halide	185	290	24	7	8,760	53.65	469,948	2Lamp T8 F28	66	290	24	7	8,760	19.14	167,657	34.51	302,291
Site 18	175W Metal Halide	215	56	24	7	8,760	12.04	105,465	2Lamp T8 F28	66	56	24	7	8,760	3.70	32,375	8.34	73,089
Site 19	150W Metal Halide	185	52	24	7	8,760	9.62	84,267	2Lamp T8 F28	66	52	24	7	8,760	3.43	30,063	6.19	54,204
Site 20	70W Metal Halide	130	80	24	7	8,760	10.40	91,099	1Lamp T8 F28	33	80	24	7	8,760	2.64	23,125	7.76	67,974
Site 21	70W Metal Halide	95	70	24	7	8,760	6.65	58,251	1Lamp T8 F28	33	70	24	7	8,760	2.31	20,234	4.34	38,016
Site 22	100W Metal Halide	128	692	24	7	8,760	88.58	775,883	2Lamp LO T8 F28	44	692	24	7	8,760	30.45	266,710	58.13	509,173
Site 23	100W Metal Halide	128	60	17	7	6,205	7.68	47,652	2Lamp LO T8 F28	44	60	17	7	6,205	2.64	16,380	5.04	31,271
Site 24	175W Metal Halide	215	280	24	7	8760	60.2	527,323	3Lamp T8 LPB1	65	280	24	7	8760	18.2	159,423	42.00	367,900
Site 25	150W Metal Halide	185	31	24	7	8,760	5.74	50,236	2Lamp T8 F28	66	31	24	7	8,760	2.05	17,922	3.69	32,314
Site 26	150W Metal Halide	185	171	24	7	8,760	31.64	277,107	2Lamp T8 F28	66	171	24	7	8,760	11.29	98,860	20.35	178,247
Site 27	150W Metal Halide	185	73	24	7	8,760	13.51	118,297	2Lamp T8 F28	66	73	24	7	8,760	4.82	42,203	8.69	76,094
Site 28	150W Metal Halide	185	24	10	7	3,650	4.44	16,205	2Lamp T8 F28	66	24	10	7	3,650	1.58	5,781	2.86	10,424
Site 29	150W Metal Halide	185	52	24	7	8,760	9.62	84,267	2Lamp T8 F28	66	52	24	7	8,760	3.43	30,063	6.19	54,204
Site 30	150W Metal Halide	185	39	24	7	8,760	7.22	63,200	2Lamp T8 F28	66	39	24	7	8,760	2.57	22,547	4.64	40,653
Site 31	100W Metal Halide	128	32	24	7	8,760	4.10	35,879	2Lamp LO T8 F28	44	32	24	7	8,760	1.41	12,333	2.69	23,546
Site 32	175W Metal Halide	215	30	24	7	8,760	6.45	56,499	2Lamp T8 F28	66	30	24	7	8,760	1.98	17,344	4.47	39,155
Site 33	175W Metal Halide	215	189	24	7	8,760	40.64	355,943	2Lamp T8 F28	66	189	24	7	8,760	12.47	109,266	28.16	246,677
Site 34	150W Metal Halide	185	210	24	7	8,760	38.85	340,307	2Lamp T8 F28	**49**	210	24	7	8,760	10.29	90,135	28.56	250,172
Site 35	175W Metal Halide	215	438	24	7	8,760	94.17	824,884	2Lamp T8 F28	66	438	24	7	8,760	28.91	253,220	65.26	571,664
Site 36	175W Metal Halide	215	65	24	7	8,760	13.98	122,414	2Lamp T8 F28	66	65	24	7	8,760	4.29	37,578	9.69	84,836
Total							**691.72**	**5,777,916**							**214.39**	**1,819,386**	**477.32**	**3,958,530**

7.24 05-07-004 – Upgrades of a Central Chiller Plant

Variable frequency drives have been installed on chillers, chilled water pumps, condensing water pumps, cooling tower spray pump, hot water pumps, and three air handlers (7 (back up), 8 and 9). In addition, upgraded controls based on airflow requirements rather than static pressure have been installed for in-use air handlers 1, 2, 4, 7, 8, 9, 10, & 11.

Existing plant consisted of constant speed chillers and pumps. The chiller upgrades were paid rebates through the 2005 SPC program and, therefore, were not part of this package.

Table 205. M&V Savings Summary – 05-07-004

Total Contracted kWh Savings	521,908
M&V Savings (kWh)	**698,480**
Percent of Contracted kWh Savings	134%
Total Contracted kW Savings	34.8
M&V Savings (kW)	**53.6**
Percent of Contracted kW Savings	155%

Table 206 summarizes the rebated upgrades.

Table 206. List of Equipment Basecase and Retrofit

Meas	Baseline	New
1,2,6,7	(4) Chilled water pumps (two 25-hp and two 30-hp, constant speed)	(4) Chilled water pumps (two 25-hp each and two 30-hp, variable speed)
3,4	(2) Condenser pumps, 15 hp each, constant speed	(2) Condenser pumps, 15 hp each, variable speed
5	(1) Cooling Tower Spray pump, 7.5 hp, constant speed	(1) Cooling tower spray pump, 7.5 hp, variable speed
8	(2) Hot water pumps, 3.0 hp each, constant speed	(2) Hot water pumps, 3.0 hp each, variable speed
9	Air Handlers 8 and 9, 30 hp and 40 hp, both constant speed, 8,760 hours per year (AHU 7 is backup to 8 & 9)	Air Handlers 7, 8 and 9, 30 hp and 40 hp, variable speed, 8,760 hours per year
	Air Handlers 1-4, 25, 30, 20, 25 hp respectively, all variable speed VAV controlled by static pressure, estimated 3,250 hours per year	Air Handlers 1, 2 & 4, 25, 30, 25 hp respectively, all variable speed VAV controlled by airflow required, estimated 3,250 hours per year. (AH-1 has a return fan at 7.5 HP running on the same VFD as the supply fan. AH-2 has a return fan at 7.5 HP running on the same VFD as the supply fan. AH-4 has a return fan at 10 HP running on the same VFD as the supply fan).

7.24.1 Measurement and Verification (M&V) Approach

The energy savings is calculated as the sum of the measured energy consumption of all the post-modification equipment subtracted from the sum of the measured or calculated energy consumption of the baseline equipment at the loads measured. Pump and fan operating data, VFD % speed and/or kW, was trended for 138 days between March and August 2006. The method for estimating the baseline and new equipment energy consumption is outlined below for each measure. The load impact estimation methodology complies with IPMVP Option A.

7.24.1.1 Measures 1,2,6 & 7- Chilled Water Pumping Savings

The savings due to installing VFDs on the chilled water pumps were estimated by trending the profile of the VFD pumps to determine the postcase energy consumption. The basecase consumption was estimated by taking spot measurements of the original pump power and then using the trending data to determine the runtime of the pumps. Only the two 25-hp pumps were measured; we were not able to get trend data for the 30-hp air cooled chiller pumps. The contracted savings estimation using the SPC software was accepted for this measure. The M&V results of the other chilled water pumps produced savings 143% more than the estimated savings. Therefore, the savings for the 30-hp pumps is likely conservative.

7.24.1.1.1 VFD Pumping Energy Consumption

The output signal, % speed, was recorded via the EMS in 15-minute intervals for 138 days (2/28/06-3/24/06, 3/30/06-4/30/06, and 6/1/06-8/24/06). The % speed was converted to kW using the affinity laws as shown below.

$$kW_{op.} = (\%speed)^3 * kW_{100\%speed}$$

where:

$kW_{op.}$ = Power for the interval

%speed = Direct measurement for the interval

$kW_{100\%speed}$ = Power draw of motor at 100% speed

7.24.1.1.2 Baseline Pumps Energy Consumption

The baseline chilled water pumps were spot measured to draw 11.9 kW. The annual basecase operating hours were estimated at 7800 (pump 5) and 4008 (pump 6) based on the runtime of the VFDs.

7.24.1.1.3 Chilled Water Pumping Energy Savings

Both of the two 25-hp chilled water pumps run at the same speed and operate with an associated chiller. Typical operation is one chiller; however, pumps 5 & 6 run at the same time when both chillers are in demand. The kWh is calculated using the hours of operation shown by the measured data. The measured data shows that the two pumps operate together approximately 35% of the time. The pre and post energy consumption for the 25-hp pumps is shown in Table 207.

Table 207. Pre and Post Energy Consumption of CHW Pumps

	Pump 5 kWh	Pump 6 kWh)	**Total kWh**
Baseline	92,830	47,695	140,525
New	18,722	12,505	31,227
Savings	74,108	35,190	**109,298**

Chilled Water Pumping Savings = 140,525 kWh – 31,227 kWh
= 109,298 kWh

The total evaluated energy savings of 109,298 kWh is substantial because the pumps operate at an average of only 61.8% of full speed.

Demand savings were evaluated to be 8.78 kW using the same approach.

7.24.1.2 Measures 3 & 4 - Condenser Water Pumps

The condenser pump analysis is similar to the chilled water pump analysis. The savings due to installing VFDs on the condenser water pumps was estimated by trending the profile of the pumps with the VFD to determine the post-case energy consumption. The basecase consumption was estimated by taking spot measurement of the original pump power and then using the trending data to determine the runtime of the pumps.

7.24.1.2.1 VFD Condenser Pump Energy Consumption

The output signal, % speed, was recorded via the EMS in 15-minute intervals for 176 days (2/28/06--8/24/06). The % speed was converted to kW using the affinity laws as shown below.

$$kW_{op.} = (\%speed)^3 * kW_{100\%speed}$$

where:

$kW_{op.}$ = Power for the interval
%speed = Direct measurement for the interval
$kW_{100\%speed}$ = Power draw of motor at 100% speed

7.24.1.2.2 Baseline Pumps Energy Consumption

The baseline condenser water pumps were spot measured to draw 5.1 kW. The annual basecase operating hours were estimated at 6,187 (pump 9) and 5,563 (pump 10) based on the runtime of the VFDs.

7.24.1.2.3 Condenser Water Pumping Energy Savings

There are two 15-horsepower condenser water pumps. The kWh is calculated using the hours of operation shown by the measured data. The % speed and associate energy consumption of the pumps is shown in Table 208 and Table 209. The data developed from the measurement period is assumed to be representative of annual conditions.

Table 208. Average % Speed – Condenser Water Pumps

Unit	Average % Speed
8	65
9	63.5

Table 209. Energy Savings – Condenser Water Pumps

	CDWP 9 kWh	CDWP 10 kWh	Total
Baseline	31,556	28,371	59,927
New	9,096	8,845	17,941
Savings	22,461	19,526	**41,987**

Condenser Water Pumping Savings = 59,927 kWh – 17,941 kWh
= 41,987 kWh

The total energy savings of 41,987 kWh is expected based on the average operating speeds of the VFDs.

Evaluated demand savings were 3.82 kW.

7.24.1.3 Measure 5 - Cooling Tower Spray Pump Savings

As with previous measures, the savings due to installing VFDs on the cooling tower spray pump were estimated by trending the profile of the pump with the VFD to determine the postcase energy consumption. The base case consumption was estimated by taking spot measurements of the original pump power and then using the trending data to determine the runtime of the pump.

7.24.1.3.1 VFD Pumping Energy Consumption

The output signal, % speed, was recorded via the EMS in 15-minute intervals for 138 days (2/28/06-3/24/06, 3/30/06-4/30/06, and 6/1/06-8/24/06). The % speed was converted to kW using the affinity laws as shown in the following equation.

$$kW_{op.} = (\%speed)^3 * kW_{100\%speed}$$

where:

$kW_{op.}$ = Power for the interval

%speed = Direct measurement for the interval

$kW_{100\%speed}$ = Power draw of motor at 100% speed

7.24.1.3.2 Baseline Pumps Energy Consumption

The baseline cooling tower spray pumps were spot measured to draw 6 kW. The annual basecase operating hours were estimated at 6,135 hours per year based on the runtime of the VFD.

7.24.1.3.3 Cooling Tower Spray Pump Energy Savings

There is one 7.5-horsepower cooling tower spray pump. The kWh is calculated using the hours of operation shown by the measured data. The cooling tower spray pump operates at an average % speed of 74.3%. Energy consumption of the pump is shown in Table 210. The data developed from the measurement period is assumed to be representative of annual conditions.

Table 210. Energy Savings – Cooling Tower Spray Pump

	kWh
Baseline	36,813
New	16,136
Savings	**20,677**

Cooling Tower Spray Pump Savings = 36,816 kWh – 16,136 kWh
= 20,677 kWh

The total energy savings of 20,677 kWh is expected with a pump that operates at an average of 74.3% speed.

Demand savings were evaluated to be 3.81 kW.

7.24.1.4 Measure 8- VFD Hot Water Pumping Savings

The calculated savings in the CESB application for this measure were reviewed. No measurement was performed because the M&V took place in the summer when the hot water pumps are not used. The savings due to this measure accounts for only a small percentage of the total savings and the contracted savings of 15,190 kWh and 2.6 peak kW are reasonable.

7.24.1.5 Measure 9 – VFD Air Handler Savings

Air handlers 1, 2, 4, 10 & 11 were controlled by VFDs prior to the overhaul of the HVAC. These fans were providing for the VAV system serving the office space and make-up air in the case of 10 & 11 to the laboratory. The VFDs controlled the system to maintain 1.8 inches of static pressure. The new control, TRAV system, regulates the VFD to maintain terminal VAV box airflow requirements. An energy evaluation of these air handlers would have required us to simulate the baseline by changing the control point back to static pressure and trending the fan kW for up to one month. Then the control would have been changed back to the TRAV system and the kW trended. The TRAV evaluation would have been both time and labor intensive and the VFD energy savings from Air Handlers 7,8 and 9 exceed the total contracted energy savings for all air handlers including the TRAV measure; therefore, the TRAV evaluation would not have affected rebate results.

For Air handlers 7, 8 & 9, the energy usage was estimated by trending the profile of the air handler with the VFD to determine the post-case energy consumption. Energy savings were calculated as the sum of the measured energy consumption of the post-retrofit fans subtracted

from the sum of the calculated energy consumption of the baseline equipment. The method for estimating the baseline and new equipment energy consumption is outlined below.

7.24.1.6 Baseline Pumps Energy Consumption

The baseline energy usage for the air handlers was calculated based on the rated horsepower of the equipment. The annual baseline operating hours for AH 8 and AH 9 were essentially 8760 hours each based on the runtime of the VFDs. AH 7 serves as a back up to 8 and 9 and operates less than 5 hours per year.

7.24.1.7 VFD Air Handler Energy Consumption

As with previous measures, the output signal for the air handlers, % speed, was recorded via the EMS in 15-minute intervals for 138 days (2/28/06-3/24/06, 3/30/06-4/30/06, 6/1/06-8/24/06). The % speed was converted to kW using the affinity laws as shown below.

$$kW_{op.} = (\%speed)^3 * kW_{100\%speed}$$

where:

$kW_{op.}$ = Power for the interval
%speed = Direct measurement for the interval
$kW_{100\%speed}$ = Power draw of motor at 100% speed

The % speed and energy consumption of the air handlers is shown Table 211 and Table 212, respectively. The data developed from the measurement period was assumed to be representative of annual conditions.

Table 211. Average % Speed – VFD on Air Handler

Unit	Average % Speed
AH 7	0.01
AH 8	34.02
AH 9	34.03

Table 212. Energy Savings – VFD on Air Handler

	AH 7 kWh	AH 8 kWh	AH 9 kWh	Total kWh
Baseline	45	176,280	235,099	411,424
New	4	7,417	9,895	17,316
Savings	41	168,863	225,204	**394,108**

Air Handler 7, 8, & 9 Saving s = 411,424 kWh –17,316 kWh
= 394,108 kWh

The total energy savings of 394,108 kWh is large because post-retrofit air handlers 8 & 9 operate at an average of only 34% of full speed.

Demand savings were evaluated to be 19.21 kW.

7.24.2 Results

The measurement and verification of savings achieved by this project results in an estimate of 698,480 kWh saved per year. The corresponding contracted savings are 521,908 kWh which results in a realization ratio of 134%. The difference in savings estimates is primarily because the air handlers and chilled water pumps are operating at a lower than expected speed, thus consuming less energy. The M&V results compared with the contracted savings are shown for each measure in Table 213.

Table 213. Verified Savings – 05-07-004

	kWh			Peak kW		
Meaure	**Contracted Savings**	**M&V Savings**	**Ratio**	**Contracted Demand Savings**	**M & V Demand Savings**	**Ratio**
Chilled Water Pumps (25 hp)	76,302	109,298	143%	9.7	8.78	91%
Chilled Water Pumps (30 hp)	117,220	117,220	100%	15.4	15.4	100%
Condenser Water Pumps	33,277	41,987	126%	4.4	3.82	87%
Cooling Tower Spray Pump	30,380	20,677	68%	2.6	3.81	147%
Hot Water Pump	15,190	15,190	100%	2.6	2.6	100%
Air Handlers 7,8 & 9	249,538	394,108	158%	0	19.21	-
Total	**521,908**	**698,480**	**134%**	**34.7**	**53.62**	**155%**

7.25 05-07-006 – Modification of Chilled Water HVAC System

This was a self-M&V project.

7.25.1 Project Summary

This was a self-sponsored project with energy efficiency improvements made to a chilled water cooling system.

7.25.1.1 Baseline Chilled Water Central Plant and Cooling Water Distribution System

The Project Sponsor's baseline central cooling plant consisted of two 1,250-ton Trane Centravac water-cooled chillers and five non-operating absorption chillers. Chilled water pumping was a primary/secondary system with two constant speed 25-hp primary pumps and two constant speed 250-hp secondary pumps. Piping and control problems created a low temperature differential distribution system that required the two centrifugal chillers to run together inefficiently while the chilled water distribution system pumping flow rates were excessive.

7.25.1.2 Improved Chilled Water Central Plant and Cooling Water Distribution System

The central plant was replaced with two new 600-ton electric chillers with VFDs and over-sized heat exchangers, one new 1,200 ton electric chiller with a VFD and over-sized heat exchanger, VFDs on Primary Chiller Water Pumps, VFD on Condensing Water Pumps & Cooling Tower fans and a new load Secondary CHW Pump with VFD.

7.25.2 M&V

The retrofit was completed at the end of March 2006 and commissioning was completed June 1, 2006. In late December 2006 the two 600-ton chillers refrigerant charge level was increased, bring their performance to design. The post M&V period began March 2007 following the refrigerant charge adjustment. The baseline monitoring period used for comparison began in March 2005. In 2005 the absorption chillers had failed and all cooling was provided by electric chillers. A billing analysis was performed for this project to verify savings.

The load impact estimation methodology complies with IPMVP Option B.

7.25.2.1 Site Measurements

Five electric billing meters served the baseline chiller plant and the same meters serve current plant. The metering serves chillers, pumps, and cooling towers for the central plant. Pre and post period metering were compared to determine system energy savings.

Chilled water tonnage monitoring began in June 2005 to define building cooling loads. During the ongoing monitoring the chilled water flow meter was relocated once and on another instance the flow meter paddle was cleared of debris. While tonnage metering provided useful data for sizing the equipment in the new plant, subsequent changes in metering location and problems with the flow meter reduced the reliability of chilled water monitoring during portions of the post installation period. Using the chilled water flow to compare pre and post loads was excluded as an option for the M&V.

Compilation of energy consumption data from site utility electric meters was examined starting in March 2003. Three years data prior to the start of the project provides a more solid baseline period, however, the annual consumption from March 2005 to February 2006 increased significantly compared to the two previous years. Examining the natural gas consumption, the increase was due to the fact the absorption chillers operated from 2003 until 2005, offsetting some of the electric chiller load. To capture the all–electric baseline period, March 2005 to February 2006 was selected. The post installation period selected was March 2007 to February 2008.

Table 214 and Table 215 shows the consumption and demand billing data for the central chiller facility.

Table 214. Billing Consumption Data For Central Plant

Site label	A	B	C2 (CB)	F (CA)	H	
Account	[redacted]					Total
Meter #						Energy, kWh
2/26/2008	46366	833825	261346	88677	27626	1257840
1/27/2008	47043	969463	299939	102188	32577	1451210
12/26/2007	22942	761052	254816	79441	28428	1146679
11/26/2007	104331	942065	284568	88566	28700	1448230
10/24/2007	171849	1029278	284015	91967	11871	1588980
9/25/2007	204075	972496	253722	62056	50335	1542684
8/26/2007	317102	1387489	303806	101702	133405	2243504
7/26/2007	192731	1267555	320094	97908	113763	1992051
6/25/2007	141023	1141738	288158	109768	42731	1723418
5/24/2007	154231	1069144	266842	93633	30541	1614391
4/25/2007	88129	815553	241595	68689	17182	1231148
3/27/2007	128493	1031529	283099	102113	30529	1575763
						18815898

Pre

2/27/2006	68478	1161186	343657	123166	76458	1772945
1/26/2006	56389	1112333	312328	123689	59890	1664629
12/27/2005	17328	703071	241080	62943	57382	1081804
11/27/2005	33166	1043184	269872	102038	210044	1658304
10/26/2005	64453	1155742	262190	103044	283648	1869077
9/27/2005	77316	1213285	267005	78542	299208	1935356
8/28/2005	109623	1391417	256059	88980	439500	2285579
7/28/2005	121707	1466913	276266	129587	382346	2376819
6/28/2005	101622	1331526	300020	140213	281196	2154577
5/26/2005	73016	1083057	266801	102772	231454	1757100
4/27/2005	42911	951825	264818	99910	149500	1508964
3/29/2005	34521	944858	256786	98387	144002	1478554
						21543708

Table 215. Billing Demand Data For Central Plant

Post Site label	A	B	C2 (CB)	F (CA)	H			
Account	[redacted]					Total		
Meter #						Max Demand		
2/26/2008	822	3465.8	853.2	502.8	148.2	5792		
1/27/2008	895.2	4713.1	890.4	472.8	771	7742.5		
12/26/2007	538.8	3104	642	349.2	844.2	5478.2		
11/26/2007	856.8	4761.4	840	435.6	1692.6	8586.4		
10/24/2007	835.2	4162.1	927.6	540	47.4	6512.3		
9/25/2007	949.2	4669	882	326.4	838.2	7664.8		
8/26/2007	1035.6	6666.1	951.6	642	1668.6	10963.9		
7/26/2007	1045.2	6668.4	973.2	628.8	1662.6	10978.2		
6/25/2007	918	4574.3	848.4	511.2	860.4	7712.3		
5/24/2007	937.2	4541	751.2	410.4	957.6	7597.4	max =	10978.2
4/25/2007	801.6	3481.6	620.4	379.2	67.2	5350		
3/27/2007	841.2	4422	952.8	535.2	775.8	7527		
Pre								
2/27/2006	906	5706.6	1033.2	703.2	1028.4	9377.4		
1/26/2006	825.6	4168.2	909.6	562.8	1200	7666.2		
12/27/2005	578	2983.1	625.2	438	969.6	5593.9		
11/27/2005	156	4467.9	609.6	534	1642.8	7410.3		
10/26/2005	417.6	4989.4	712.8	510	1970.4	8600.2		
9/27/2005	378	4954	626.4	490.8	2010.6	8459.8		
8/28/2005	601.2	4760.3	642	482.4	1930.2	8416.1		
7/28/2005	520.8	5730.2	720	573.6	1960.8	9505.4		
6/28/2005	600	5967.3	729.6	650.4	1982.4	9929.7		
5/26/2005	538.8	4784.2	661.2	429.6	1944	8357.8	max =	9930
4/27/2005	525.6	4663.4	633.6	523.2	1850.4	8196.2		
3/29/2005	248.4	4909.1	625.2	508.8	1610.4	7901.9		

The measured energy savings is shown in Table 216. As shown in Table 217 there was no demand savings.

Table 216. Measured Energy Savings

Measured baseline usage	21,543,708 kWh
Measured post – install usage:	18,815,898 kWh
Energy Savings	2,727,810 kWh

Table 217. Measured Demand Savings

Measured Max Demand	9,930 kW
Measured post – install Demand	10,978 kW
Demand Savings	-

7.26 05-04-007 – Lighting Retrofit at Multiple Sites for a Single Customer

The project sponsor retrofit existing lighting with lower wattage lighting in retail stores of a single customer. Retrofits included replacing incandescent fixtures with compact fluorescent, metal halide or halogen lamps and replacing T12 fixtures with T8 or T5 fixtures. Retail space and "backroom" areas (storage, office, restrooms, etc.) were retrofit. Table 218 shows a summary of the M&V for this project.

Table 218. M&V Savings Summary – 05-04-007

	kWh Savings	kW Reduced
Total Contracted Savings	853,919	179
Total Reported / Invoiced Savings	853,919	179
M&V Savings	**1,027,792**	**177.2**
Percent of Reported Savings	120%	99%

7.26.1 Measurement and Verification (M&V) Approach

The M&V approach for the project is summarized in this section. KSI coordinated with the Project Sponsor to perform pre and post retrofit M&V activities. These activities included:

- Pre-retrofit inspections at a sample of stores.
- Post-retrofit inspections to verify new fixtures, quantity of fixtures, and estimated hour of operation.
- Installation of monitoring equipment on select circuits at a sample of stores. The monitored data was used to determine the fixture group operating hours. The average lighting operating hours for retail (sales) areas and back of house areas was determined from these data. Fixtures were divided into fixture groups which were groups of fixtures with homogeneous usage patterns. Operating hours were estimated for each fixture group.
- The lighting detail spreadsheets provided by the Project Sponsor were updated with verified counts and hours of operation to determine the energy savings for the sampled stores.
- The energy savings estimated by the M&V for the sampled stores was compared to the claimed energy savings for the same stores to develop a realization rate. The realization

rate was applied to the claimed savings for all stores to estimate the verified project energy savings.

The load impact estimation methodology complies with IPMVP Option A.

7.26.2 Results

This section provides the results of the M&V process. The findings from the site visits and the extrapolation of the sample results to the population results are provided. Overall the M&V process estimates the savings for 05-04-007 as 1,027,792 kWh per year and 177.2 kW peak demand reduction. This is 120% and 99% of the claimed savings respectively.

The M&V inspections found there were few discrepancies in the number and type of fixtures. The results of the monitoring indicated higher operating hours than claimed by the Project Sponsor. The claimed operation was 4,745 hours per year for all fixtures retrofit. The monitoring data showed an average of 5,799 hour per year for sales areas and 5,212 hour per year for backroom areas.

Table 219. Monitoring Results

Store #	Location and Description	Annual Hours
4501058	Back Stock Room	6,482
100629	Back Room which has an occupancy sensor	3,504
100629	Sales Floor	4,993
500478	Stock Room	6,570
500478	Sales Floor	6,570
4200445	Sales Floor	4,555
200445	Sales Floor	7,183
500719	Sales Floor	5,694
Avg Backroom Hours		5,212
Avg Sales Floor Hours		5,799
Overall Average		5,538

7.26.2.1 M&V Sample

Table 220 shows a summary of the M&V savings. Detailed analyses of the claimed savings and verified (M&V) savings may be found in Table 221 and Table 222, respectitvely.

Table 220. M&V Summary – 05-04-007

	kWh Savings	kW Reduced
Claimed Savings for Sample Sites	271,362	56.85
M&V Savings for Sample Sites	326,616	56.34
Realization Rate	**120%**	**99%**
Claimed Savings for All Stores	853,919	178.79
M&V Savings for All Stores	1,027,792	177.17

7.26.2.2 Claimed Savings – Sample

Table 221 shows the claimed savings for the M&V sample. These savings were compared with the verified savings for the sample from Table 222 to estimate the realization rate that were applied to the entire savings claim to estimate the verified project savings.

Table 221. Claimed Savings - Sample

	Area of Site		Exisiting					Retrofit					Savings		Hours	
Site ID	ID	Description	EFixture Description	EQty	EWattage/Fixture	Exist kW	Exist kWh	Fixture Description	Qty	Wattage/Fixture	Retrofit kW	Retrofit kWh	kW Savings	kWh Savings	Exisiting	Retrofit
100629	1.00	Outside	REC CAN 60PAR38	2	60	0.12	569.4	GN	2	55	0.11	521.95	0.01	47	4745	4745
100629	1.10	Left Window #1	TRACK 60PAR38	3	60	0.18	854.1	G8H	2	44	0.088	417.56	0.092	437	4745	4745
100629	1.11	Left Window #1	TRACK 60PAR38	2	60	0.12	569.4	G4H	1	24	0.024	113.88	0.096	456	4745	4745
100629	1.20	Left Window #2	TRACK 60PAR38	4	60	0.24	1138.8	G8H	3	44	0.132	626.34	0.108	512	4745	4745
100629	1.21	Left Window #2	TRACK 60PAR38	4	60	0.24	1138.8	G4H	2	24	0.048	227.76	0.192	911	4745	4745
100629	1.30	Right Window #1	TRACK 60PAR38	3	60	0.18	854.1	G8H	2	44	0.088	417.56	0.092	437	4745	4745
100629	1.31	Right Window #1	TRACK 60PAR38	2	60	0.12	569.4	G4H	1	24	0.024	113.88	0.096	456	4745	4745
100629	1.40	Right Window #2	TRACK 60PAR38	4	60	0.24	1138.8	G8H	3	44	0.132	626.34	0.108	512	4745	4745
100629	1.41	Right Window #2	TRACK 60PAR38	4	60	0.24	1138.8	G4H	2	24	0.048	227.76	0.192	911	4745	4745
100629	1.50	Right Window #3	TRACK 60PAR38	3	60	0.18	854.1	G8H	3	44	0.132	626.34	0.048	228	4745	4745
100629	1.51	Right Window #3	TRACK 60PAR38	2	60	0.12	569.4	G4H	2	24	0.048	227.76	0.072	342	4745	4745
100629	1.60	Entrance Track	TRACK 60PAR38	5	60	0.3	1423.5	GN	5	55	0.275	1304.875	0.025	119	4745	4745
100629	1.80	Sales Track	TRACK 60PAR38	37	60	2.22	10533.9	GN	37	55	2.035	9656.075	0.185	878	4745	4745
100629	1.90	Cabinet	REC CAN 50PAR20	100	50	5	23725	GQ	100	21	2.1	9964.5	2.9	13,761	4745	4745
100629	2.00	Sconce	SCONCE 150W QUARTZ	2	150	0.3	1423.5	Sconce 32W	2	32	0.064	303.68	0.236	1,120	4745	4745
100629	2.10	Rear Sq Cove	4'S1L-T12	6	43	0.258	1224.21	GF-T4 Cove	6	24	0.144	683.28	0.114	541	4745	4745
100629	2.20	Rear Sq Cove	4'S1L-T12	4	43	0.172	816.14	GF-T3 Cove	4	24	0.096	455.52	0.076	361	4745	4745
100629	2.30	Rear Sq Cove	2'S1L-T12	2	21	0.042	199.29	GD-T4 Cove	2	15	0.03	142.35	0.012	57	4745	4745
100629	2.40	Rear Sq Cove	2'S1L-T12	2	21	0.042	199.29	GD-T3 Cove	2	15	0.03	142.35	0.012	57	4745	4745
100629	2.50	Left Side Cove	4'S1L-T12	16	43	0.688	3264.56	GF-T4 Cove	16	24	0.384	1822.08	0.304	1,442	4745	4745
100629	2.60	Left Side Cove	4'S1L-T12	3	43	0.129	612.105	GF-T3 Cove	3	24	0.072	341.64	0.057	270	4745	4745
100629	2.70	Right Sq Cove	4'S1L-T12	14	43	0.602	2856.49	GF-T4 Cove	14	24	0.336	1594.32	0.266	1,262	4745	4745
100629	2.80	Right Sq Cove	4'S1L-T12	2	43	0.086	408.07	GF-T2 Cove	2	24	0.048	227.76	0.038	180	4745	4745
100629	2.90	Sales Eyeball	REC CAN ADJ 50PAR30	101	50	5.05	23962.25	GL	101	50	5.05	23962.25	0	0	4745	4745
100629	3.00	Right Dressing	REC CAN 60PAR38	21	60	1.26	5978.7	G1V-B	21	24	0.504	2391.48	0.756	3,587	4745	4745
100629	3.10	Left Dressing	REC CAN 60PAR38	13	60	0.78	3701.1	G1V-B	13	24	0.312	1480.44	0.468	2,221	4745	4745
100629	3.20	Mirror	REC CAN 60PAR38	2	60	0.12	569.4	GN	2	55	0.11	521.95	0.01	47	4745	4745
100629	3.30	Sales Can	REC CAN 60PAR38	117	60	7.02	33309.9	G1V-B	117	24	2.808	13323.96	4.212	19,986	4745	4745
100629	3.40	Indv Heads	TRACK 50MR16	11	50	0.55	2609.75	GS	11	50	0.55	2609.75	0	0	4745	4745
100629	3.50	Office	4'W4L-T12	1	156	0.156	740.22	GJ	1	92	0.092	436.54	0.064	304	4745	4745
100629	3.60	Office	4'S1L-T12	2	43	0.086	408.07	GF-T2	2	24	0.048	227.76	0.038	180	4745	4745
100629	3.70	BOH T1	4'S1L-T12	4	43	0.172	816.14	GF	4	24	0.096	455.52	0.076	361	4745	4745
100629	3.80	BOH T2	4'S1L-T12	6	43	0.258	1224.21	GF-T2	6	24	0.144	683.28	0.114	541	4745	4745
100629	3.90	BOH T3	4'S1L-T12	15	43	0.645	3060.525	GF-T3	15	24	0.36	1708.2	0.285	1,352	4745	4745
100629	4.00	BOH T4	4'S1L-T12	4	43	0.172	816.14	GF-T4	4	24	0.096	455.52	0.076	361	4745	4745

Table 221. Claimed Savings - Sample (con't)

	Area of Site		Exisiting					Retrofit					Savings		Hours	
Site ID	ID	Description	EFixture Description	EQty	EWattage/Fixture	Exist kW	Exist kWh	Fixture Description	Qty	Wattage/Fixture	Retrofit kW	Retrofit kWh	kW Savings	kWh Savings	Exisiting	Retrofit
100629	4.10	RR	4'W2L-T12	2	78	0.156	740.22	GG	2	46	0.092	436.54	0.064	304	4745	4745
100629	8.10	BOH Exit	EXIT/EMERG INC	2	40	0.08	700.8	X3	2	4	0.008	70.08	0.072	631	8760	8760
200445	1.00	Entrance Tracks Over Door	TRACK 50MR16	5	50	0.25	1186.25	GS	5	50	0.25	1186.25	0	0	4745	4745
200445	1.01	Entrance Tracks Over Door	TRACK 50MR16	5	50	0.25	1186.25	GS	5	50	0.25	1186.25	0	0	4745	4745
200445	1.02	Entrance Tracks Over Door	TRACK 50MR16	3	50	0.15	711.75	GS	3	50	0.15	711.75	0	0	4745	4745
200445	1.10	Left Window #1	TRACK 50MR16	3	50	0.15	711.75	G8H	3	44	0.132	626.34	0.018	85	4745	4745
200445	1.11	Left Window #1	TRACK 50MR16	2	50	0.1	474.5	G4H	2	24	0.048	227.76	0.052	247	4745	4745
200445	1.20	Left Window #2	TRACK 50MR16	1	50	0.05	237.25	G8H	3	44	0.132	626.34	-0.082	-389	4745	4745
200445	1.21	Left Window #2	TRACK 50MR16	1	50	0.05	237.25	G4H	2	24	0.048	227.76	0.002	9	4745	4745
200445	1.30	Left Window #3	TRACK 50MR16	2	50	0.1	474.5	G8H	2	44	0.088	417.56	0.012	57	4745	4745
200445	1.31	Left Window #3	TRACK 50MR16	2	50	0.1	474.5	G4H	1	24	0.024	113.88	0.076	361	4745	4745
200445	1.40	Right Track #1	TRACK 50MR16	4	50	0.2	949	GS	4	50	0.2	949	0	0	4745	4745
200445	1.41	Right Track #1	TRACK 50MR16	5	50	0.25	1186.25	G4H	2	24	0.048	227.76	0.202	958	4745	4745
200445	1.50	Right Track #2	TRACK 50MR16	2	50	0.1	474.5	GS	2	50	0.1	474.5	0	0	4745	4745
200445	1.51	Right Track #2	TRACK 50MR16	3	50	0.15	711.75	G4H	1	24	0.024	113.88	0.126	598	4745	4745
200445	1.60	Right Track #3	TRACK 50MR16	8	50	0.4	1898	GS	8	50	0.4	1898	0	0	4745	4745
200445	1.61	Right Track #3	TRACK 50MR16	7	50	0.35	1660.75	G4H	4	24	0.096	455.52	0.254	1,205	4745	4745
200445	1.70	Right Track #4 Rear	TRACK 50MR16	4	50	0.2	949	GS	4	50	0.2	949	0	0	4745	4745
200445	1.71	Right Track #4 Rear	TRACK 50MR16	2	50	0.1	474.5	G4H	1	24	0.024	113.88	0.076	361	4745	4745
200445	1.80	Right Track #5	TRACK 50MR16	3	50	0.15	711.75	GS	4	50	0.2	949	-0.05	-237	4745	4745
200445	1.81	Right Track #5	TRACK 50MR16	1	50	0.05	237.25	G4H	1	24	0.024	113.88	0.026	123	4745	4745
200445	1.90	Right Track Jean #6	TRACK 50MR16	4	50	0.2	949	GAH	1	82	0.082	389.09	0.118	560	4745	4745
200445	2.00	Right Track Jean #7	TRACK 50MR16	10	50	0.5	2372.5	GAH	5	82	0.41	1945.45	0.09	427	4745	4745
200445	2.10	Left Track #1	TRACK 50MR16	4	50	0.2	949	GS	4	50	0.2	949	0	0	4745	4745
200445	2.11	Left Track #1	TRACK 50MR16	2	50	0.1	474.5	G4H	2	24	0.048	227.76	0.052	247	4745	4745
200445	2.20	Left Track #2	TRACK 50MR16	6	50	0.3	1423.5	GS	6	50	0.3	1423.5	0	0	4745	4745
200445	2.21	Left Track #2	TRACK 50MR16	8	50	0.4	1898	G4H	3	24	0.072	341.64	0.328	1,556	4745	4745
200445	2.30	Left Track #3	TRACK 50MR16	2	50	0.1	474.5	GS	2	50	0.1	474.5	0	0	4745	4745
200445	2.31	Left Track #3	TRACK 50MR16	2	50	0.1	474.5	G4H	1	24	0.024	113.88	0.076	361	4745	4745
200445	2.40	Left Track #4	TRACK 50MR16	2	50	0.1	474.5	GS	2	50	0.1	474.5	0	0	4745	4745
200445	2.41	Left Track #4	TRACK 50MR16	1	50	0.05	237.25	G4H	1	24	0.024	113.88	0.026	123	4745	4745
200445	2.50	Register Track	TRACK 50MR16	3	50	0.15	711.75	GS	4	50	0.2	949	-0.05	-237	4745	4745
200445	2.51	Register Track	TRACK 50MR16	1	50	0.05	237.25	G4H	2	24	0.048	227.76	0.002	9	4745	4745
200445	2.60	Chandelier	SCONCE 40W CAND BASE	12	40	0.48	2277.6	GU	12	25	0.3	1423.5	0.18	854	4745	4745
200445	2.70	L cove Center	TRACK 50MR16	6	50	0.3	1423.5	GS	6	50	0.3	1423.5	0	0	4745	4745
200445	2.80	Cabinet	4'S1L-T12	1	43	0.043	204.035	GF Cove	1	24	0.024	113.88	0.019	90	4745	4745
200445	2.90	Cabinet	3'S1L-T12	3	40	0.12	569.4	GE Cove	3	21	0.063	298.935	0.057	270	4745	4745
200445	3.00	Cabinet	REC CAN 50PAR20	39	50	1.95	9252.75	GQ	39	21	0.819	3886.155	1.131	5,367	4745	4745
200445	3.05	Register Cove	4'S2L-T12	6	78	0.468	2220.66	GG-T2 Cove	0	46	0	0	0.468	2,221	4745	#DIV/0!
200445	3.06	Register Cove	4'S2L-T12	1	78	0.078	370.11	GG Cove	1	46	0.046	218.27	0.032	152	4745	4745

Table 221. Claimed Savings - Sample (con't)

	Area of Site		Exisiting					Retrofit					Savings		Hours	
Site ID	ID	Description	EFixture Description	EQty	EWattage/Fixture	Exist kW	Exist kWh	Fixture Description	Qty	Wattage/Fixture	Retrofit kW	Retrofit kWh	kW Savings	kWh Savings	Exisiting	Retrofit
200445	3.10	Right Side Cove	4'S2L-T12	3	78	0.234	1110.33	GG Cove	3	46	0.138	654.81	0.096	456	4745	4745
200445	3.11	Right Side Cove	4'S2L-T12	8	78	0.624	2960.88	GG-T2 Cove	8	46	0.368	1746.16	0.256	1,215	4745	4745
200445	3.12	Right Side Cove	2'S2L-T12	1	35	0.035	166.075	GD2 Cove	1	28	0.028	132.86	0.007	33	4745	4745
200445	3.20	Right Dressing	REC CAN 60PAR38	26	60	1.56	7402.2	G1V-B	26	24	0.624	2960.88	0.936	4,441	4745	4745
200445	3.30	Mirror	REC CAN 60PAR38	2	60	0.12	569.4	GN	2	55	0.11	521.95	0.01	47	4745	4745
200445	3.40	Center Sq Cove	4'S2L-T12	2	78	0.156	740.22	GG Cove	2	46	0.092	436.54	0.064	304	4745	4745
200445	3.41	Center Sq Cove	2'S2L-T12	4	35	0.14	664.3	GD2-T2 Cove	4	28	0.112	531.44	0.028	133	4745	4745
200445	3.50	L Cove Rear	TRACK 50MR16	3	50	0.15	711.75	GS	3	50	0.15	711.75	0	0	4745	4745
200445	3.60	Right Rear Jean Cove	4'S2L-T12	13	78	1.014	4811.43	GG-T2 Cove	13	46	0.598	2837.51	0.416	1,974	4745	4745
200445	3.62	Right Rear Jean Cove	3'S2L-T12	2	70	0.14	664.3	GE2 Cove	2	40	0.08	379.6	0.06	285	4745	4745
200445	3.63	Right Rear Jean Cove	3'S2L-T12	1	70	0.07	332.15	GE2-T2 Cove	1	40	0.04	189.8	0.03	142	4745	4745
200445	3.70	Rear Dressing	REC CAN 60PAR38	22	60	1.32	6263.4	G1V-B REM	22	24	0.528	2505.36	0.792	3,758	4745	4745
200445	3.80	Sales Can	REC CAN 60PAR38	47	60	2.82	13380.9	G1H-B	47	26	1.222	5798.39	1.598	7,583	4745	4745
200445	3.80	Sales Can	REC CAN 60PAR38	62	60	3.72	17651.4	G1V-B	62	24	1.488	7060.56	2.232	10,591	4745	4745
200445	3.90	Indv Heads	TRACK 50MR16	8	50	0.4	1898	GS	8	50	0.4	1898	0	0	4745	4745
200445	4.00	BOH T1	4'S1L-T12	5	43	0.215	1020.175	GF	5	24	0.12	569.4	0.095	451	4745	4745
200445	4.10	BOH T2	4'S1L-T12	10	43	0.43	2040.35	GF-T2	10	24	0.24	1138.8	0.19	902	4745	4745
200445	4.20	BOH T3	4'S1L-T12	12	43	0.516	2448.42	GF-T3	12	24	0.288	1366.56	0.228	1,082	4745	4745
200445	4.30	BOH T4	4'S1L-T12	4	43	0.172	816.14	GF-T4	4	24	0.096	455.52	0.076	361	4745	4745
200445	4.40	RR	4'S1L-T12	3	43	0.129	612.105	GF	3	24	0.072	341.64	0.057	270	4745	4745
200445	4.50	RR & sales	REC CAN 65R30	12	65	0.78	3701.1	GN	12	55	0.66	3131.7	0.12	569	4745	4745
200445	5.00	BOH Exit	EXIT/EMERG INC	4	40	0.16	1401.6	X3	4	4	0.016	140.16	0.144	1,261	8760	8760
500478	1.00	Outside	REC CAN 50PAR20	13	50	0.65	3084.25	GQ	13	21	0.273	1295.385	0.377	1,789	4745	4745
500478	1.10	Entrance Track	TRACK 50MR16	8	50	0.4	1898	GS	8	50	0.4	1898	0	0	4745	4745
500478	1.20	Left Window	TRACK 50MR16	4	50	0.2	949	G8H	3	44	0.132	626.34	0.068	323	4745	4745
500478	1.21	Left Window	TRACK 50MR16	4	50	0.2	949	G4H	2	24	0.048	227.76	0.152	721	4745	4745
500478	1.30	Right Window	TRACK 50MR16	3	50	0.15	711.75	G8H	3	44	0.132	626.34	0.018	85	4745	4745
500478	1.31	Right Window	TRACK 50MR16	3	50	0.15	711.75	G4H	2	24	0.048	227.76	0.102	484	4745	4745
500478	1.40	Cabinet	REC CAN 50PAR20	135	50	6.75	32028.75	GQ	135	21	2.835	13452.075	3.915	18,577	4745	4745
500478	1.50	Eyeball & Other MR16	REC CAN ADJ 50MR16	194	50	9.7	46026.5	GS	194	50	9.7	46026.5	0	0	4745	4745
500478	1.60	Sales Cans	REC CAN 60PAR38	169	60	10.14	48114.3	G1V-B	169	24	4.056	19245.72	6.084	28,869	4745	4745
500478	1.70	Dressing	REC CAN 60PAR38	16	60	0.96	4555.2	G1V-B	16	24	0.384	1822.08	0.576	2,733	4745	4745
500478	1.80	Dressing Sconce	SCONCE 40W CAND BASE	6	40	0.24	1138.8	GU	6	25	0.15	711.75	0.09	427	4745	4745
500478	1.90	Front Cove	4'S1L-T8	5	32	0.16	759.2	4'S1L-T8	5	32	0.16	759.2	0	0	4745	4745
500478	2.00	Front Cove	3'S1L-T8	2	27	0.054	256.23	3'S1L-T8	2	27	0.054	256.23	0	0	4745	4745
500478	2.10	Middle Left Cove	4'S1L-T8	7	32	0.224	1062.88	4'S1L-T8	7	32	0.224	1062.88	0	0	4745	4745
500478	2.20	Middle Left Cove	3'S1L-T8	2	27	0.054	256.23	3'S1L-T8	2	27	0.054	256.23	0	0	4745	4745
500478	2.30	Register Cove	4'S1L-T8	7	32	0.224	1062.88	4'S1L-T8	7	32	0.224	1062.88	0	0	4745	4745
500478	2.40	Register Cove	3'S1L-T8	2	27	0.054	256.23	3'S1L-T8	2	27	0.054	256.23	0	0	4745	4745
500478	2.50	Back Register	4'S1L-T8	9	32	0.288	1366.56	4'S1L-T8	9	32	0.288	1366.56	0	0	4745	4745

Table 221. Claimed Savings - Sample (con't)

	Area of Site		Exisiting					Retrofit					Savings		Hours	
Site ID	ID	Description	EFixture Description	EQty	EWattage/Fixture	Exist kW	Exist kWh	Fixture Description	Qty	Wattage/Fixture	Retrofit kW	Retrofit kWh	kW Savings	kWh Savings	Exisiting	Retrofit
500478	2.60	Back Sign	REC CAN 60PAR38	7	60	0.42	1992.9	G1V-B	7	24	0.168	797.16	0.252	1,196	4745	4745
500478	2.70	BOH	4'S1L-T8	49	32	1.568	7440.16	4'S1L-T8	49	32	1.568	7440.16	0	0	4745	4745
500478	2.80	RR & Office	4'W2L-T8	3	58	0.174	825.63	4'W2L-T8	3	58	0.174	825.63	0	0	4745	4745
500478	2.90	RR	REC CAN 60PAR38	2	60	0.12	569.4	GN	2	55	0.11	521.95	0.01	47	4745	4745
500719	1.00	Right Window #1	TRACK 50MR16	2	50	0.1	474.5	G8H	2	44	0.088	417.56	0.012	57	4745	4745
500719	1.01	Right Window #1	TRACK 50MR16	2	50	0.1	474.5	G4H	1	24	0.024	113.88	0.076	361	4745	4745
500719	1.20	Right Window #2	TRACK 50MR16	3	50	0.15	711.75	G8H	3	44	0.132	626.34	0.018	85	4745	4745
500719	1.21	Right Window #2	TRACK 50MR16	3	50	0.15	711.75	G4H	2	24	0.048	227.76	0.102	484	4745	4745
500719	1.30	Left Window #1	TRACK 50MR16	2	50	0.1	474.5	G8H	2	44	0.088	417.56	0.012	57	4745	4745
500719	1.31	Left Window #1	TRACK 50MR16	3	50	0.15	711.75	G4H	1	24	0.024	113.88	0.126	598	4745	4745
500719	1.40	Entrance Track	TRACK 50MR16	6	50	0.3	1423.5	GS	6	50	0.3	1423.5	0	0	4745	4745
500719	1.50	Side Window #1	TRACK 50MR16	2	50	0.1	474.5	G8H	2	44	0.088	417.56	0.012	57	4745	4745
500719	1.51	Side Window #1	TRACK 50MR16	3	50	0.15	711.75	G4H	1	24	0.024	113.88	0.126	598	4745	4745
500719	1.60	Side Window #2	TRACK 50MR16	3	50	0.15	711.75	G8H	3	44	0.132	626.34	0.018	85	4745	4745
500719	1.61	Side Window #2	TRACK 50MR16	5	50	0.25	1186.25	G4H	2	24	0.048	227.76	0.202	958	4745	4745
500719	1.70	Side Hidden Window	TRACK 50MR16	3	50	0.15	711.75	G8H	2	44	0.088	417.56	0.062	294	4745	4745
500719	1.71	Side Hidden Window	TRACK 50MR16	3	50	0.15	711.75	G4H	1	24	0.024	113.88	0.126	598	4745	4745
500719	1.72	Side Hidden Window	REC CAN 60PAR38	3	60	0.18	854.1	G1V-B	3	24	0.072	341.64	0.108	512	4745	4745
500719	1.80	Cabinet	REC CAN 50PAR20	99	50	4.95	23487.75	GQ	99	21	2.079	9864.855	2.871	13,623	4745	4745
500719	1.90	Sales Eyeball	REC CAN ADJ 50MR16	195	50	9.75	46263.75	GS	195	50	9.75	46263.75	0	0	4745	4745
500719	2.00	Sales Cans	REC CAN 60PAR38	111	60	6.66	31601.7	G1V-B	111	24	2.664	12640.68	3.996	18,961	4745	4745
500719	2.10	Dressing	REC CAN 60PAR38	20	60	1.2	5694	G1V-B	20	24	0.48	2277.6	0.72	3,416	4745	4745
500719	2.20	Dressing Sconce	SCONCE 40W CAND BASE	12	40	0.48	2277.6	GU	12	25	0.3	1423.5	0.18	854	4745	4745
500719	2.30	Sales Sconce	SCONCE 40A	8	40	0.32	1518.4	GX	8	25	0.2	949	0.12	569	4745	4745
500719	2.40	Front Cove	4'S1L-T12	5	43	0.215	1020.175	GF Cove	5	24	0.12	569.4	0.095	451	4745	4745
500719	2.50	Front Cove	3'S1L-T12	2	40	0.08	379.6	GE Cove	2	21	0.042	199.29	0.038	180	4745	4745
500719	2.60	Register Cove	4'S1L-T12	9	43	0.387	1836.315	GF Cove	9	24	0.216	1024.92	0.171	811	4745	4745
500719	2.70	BOH T1	4'S1L-T12	12	43	0.516	2448.42	GF	12	24	0.288	1366.56	0.228	1,082	4745	4745
500719	2.80	BOH T2	4'S1L-T12	15	43	0.645	3060.525	GF-T2	15	24	0.36	1708.2	0.285	1,352	4745	4745
500719	2.90	BOH T3	4'S1L-T12	6	43	0.258	1224.21	GF-T3	6	24	0.144	683.28	0.114	541	4745	4745
500719	3.00	Office & RR	4'W2L-T12	3	78	0.234	1110.33	GG	3	46	0.138	654.81	0.096	456	4745	4745
500719	3.10	RR	REC CAN 60PAR38	2	60	0.12	569.4	GN	2	55	0.11	521.95	0.01	47	4745	4745
500719	5.10	BOH Exit	EXIT/EMERG INC	4	40	0.16	1401.6	X3	4	4	0.016	140.16	0.144	1,261	8760	8760
4200445	1.00	Right Window	TRACK 50MR16	3	50	0.15	711.75	GS	3	50	0.15	711.75	0	0	4745	4745
4200445	1.01	Right Window	TRACK 50MR16	2	50	0.1	474.5	G5H	2	24	0.048	227.76	0.052	247	4745	4745
4200445	1.10	Left Window	TRACK 50MR16	3	50	0.15	711.75	GS	3	50	0.15	711.75	0	0	4745	4745
4200445	1.11	Left Window	TRACK 50MR16	2	50	0.1	474.5	G5H	2	24	0.048	227.76	0.052	247	4745	4745
4200445	1.20	Right Gooseneck	GOOSENECK 135A	6	135	0.81	3843.45	GT	6	90	0.54	2562.3	0.27	1,281	4745	4745
4200445	1.21	Right Gooseneck	GOOSENECK 135A	5	135	0.675	3202.875	GY	5	32	0.16	759.2	0.515	2,444	4745	4745
4200445	1.30	Right Metal Shade	RLM PENDANT 15WG30	3	15	0.045	213.525	GZ	3	32	0.096	455.52	-0.051	-242	4745	4745

Table 221. Claimed Savings - Sample (con't)

	Area of Site		Exisiting					Retrofit					Savings		Hours	
Site ID	ID	Description	EFixture Description	EQty	EWattage/Fixture	Exist kW	Exist kWh	Fixture Description	Qty	Wattage/Fixture	Retrofit kW	Retrofit kWh	kW Savings	kWh Savings	Exisiting	Retrofit
4200445	1.40	Left Gooseneck	GOOSENECK 135A	8	135	1.08	5124.6	GT	8	90	0.72	3416.4	0.36	1,708	4745	4745
4200445	1.41	Left Gooseneck	GOOSENECK 135A	8	135	1.08	5124.6	GY	8	32	0.256	1214.72	0.824	3,910	4745	4745
4200445	1.50	Back Sign	TRACK 50MR16	4	50	0.2	949	GS	4	50	0.2	949	0	0	4745	4745
4200445	1.51	Back Sign	TRACK 50MR16	3	50	0.15	711.75	G4H	2	24	0.048	227.76	0.102	484	4745	4745
4200445	1.60	Back Sign Strip	4'S2L-T12	4	78	0.312	1480.44	GG-T2 Cove	4	46	0.184	873.08	0.128	607	4745	4745
4200445	1.61	Back Sign Strip	4'S2L-T12	2	78	0.156	740.22	GG Cove	2	46	0.092	436.54	0.064	304	4745	4745
4200445	1.62	Back Sign Strip	3'S2L-T12	4	70	0.28	1328.6	GE2-T2 Cove	4	40	0.16	759.2	0.12	569	4745	4745
4200445	1.70	Sales Can	REC CAN 90PAR38	4	90	0.36	1708.2	G1H	4	32	0.128	607.36	0.232	1,101	4745	4745
4200445	1.70	Sales Can	REC CAN 90PAR38	70	90	6.3	29893.5	G1V	70	32	2.24	10628.8	4.06	19,265	4745	4745
4200445	1.80	Track to Express	TRACK 50MR16	4	50	0.2	949	GS	4	50	0.2	949	0	0	4745	4745
4200445	1.90	BOH T1	4'S1L-T12	3	43	0.129	612.105	GF	3	24	0.072	341.64	0.057	270	4745	4745
4200445	1.91	BOH T3	4'S1L-T12	3	43	0.129	612.105	GF-T3	3	24	0.072	341.64	0.057	270	4745	4745
4200445	1.92	BOH T4	4'S1L-T12	4	43	0.172	816.14	GF-T4	4	24	0.096	455.52	0.076	361	4745	4745
4200445	1.93	Office	4'S1L-T12	2	43	0.086	408.07	GF	2	24	0.048	227.76	0.038	180	4745	4745
4200445	4.00	BOH Exit	EXIT/EMERG INC	1	40	0.04	350.4	X3	1	4	0.004	35.04	0.036	315	8760	8760
4501058	1.00	Outside	REC CAN 50PAR20	13	50	0.65	3084.25	GQ	13	21	0.273	1295.385	0.377	1,789	4745	4745
4501058	1.10	Left Window	TRACK 50MR16	1	50	0.05	237.25	G8H	1	44	0.044	208.78	0.006	28	4745	4745
4501058	1.20	Right Window #1	TRACK 50MR16	0	50	0	0	G8H	1	44	0.044	208.78	-0.044	-209	#DIV/0!	4745
4501058	1.30	Right Window #2	TRACK 50MR16	1	50	0.05	237.25	G8H	3	44	0.132	626.34	-0.082	-389	4745	4745
4501058	1.31	Right Window #2	TRACK 50MR16	1	50	0.05	237.25	G4H	2	24	0.048	227.76	0.002	9	4745	4745
4501058	1.40	Right Window #3	TRACK 50MR16	5	50	0.25	1186.25	G8H	5	44	0.22	1043.9	0.03	142	4745	4745
4501058	1.41	Right Window #3	TRACK 50MR16	8	50	0.4	1898	G4H	4	24	0.096	455.52	0.304	1,442	4745	4745
4501058	1.50	Sales Eyeball	REC CAN ADJ 50MR16	37	50	1.85	8778.25	GS	37	50	1.85	8778.25	0	0	4745	4745
4501058	1.60	Back track	TRACK 50MR16	4	50	0.2	949	GS	4	50	0.2	949	0	0	4745	4745
4501058	1.70	Back track	TRACK 50MR16	1	50	0.05	237.25	G4H	2	24	0.048	227.76	0.002	9	4745	4745
4501058	1.80	Hanging Shade	SCONCE 90A	3	90	0.27	1281.15	GT	3	90	0.27	1281.15	0	0	4745	4745
4501058	1.90	Behind Curtain	REC CAN 50MR16	60	50	3	14235	GS	60	50	3	14235	0	0	4745	4745
4501058	2.00	Sales Can	REC CAN 90PAR38	91	90	8.19	38861.55	G1V	91	32	2.912	13817.44	5.278	25,044	4745	4745
4501058	2.10	Lamp	SCONCE 90A	1	90	0.09	427.05	GT	1	90	0.09	427.05	0	0	4745	4745
4501058	2.20	BOH	4'S1L-T8	6	32	0.192	911.04	4'S1L-T8	6	32	0.192	911.04	0	0	4745	4745
4501058	2.21	BOH	4'S1L-T8	5	32	0.16	759.2	4'S1L-T8	5	32	0.16	759.2	0	0	4745	4745
4501058	2.30	RR	4'W2L-T8	1	58	0.058	275.21	4'W2L-T8	1	58	0.058	275.21	0	0	4745	4745
4501058	2.40	RR	REC CAN 90PAR38	1	90	0.09	427.05	GN	1	55	0.055	260.975	0.035	166	4745	4745
Total - Claimed for Sample													**56.854**	**271,362**		

7.26.2.3 Verified Savings – Sample

Table 222 shows the verified savings for the M&V sample. These savings were compared with the claimed savings for the sample from Table 221 to estimate the realization rate that were applied to the entire savings claim to estimate the verified project savings.

Table 222. Verified Savings - Sample

Site Information	Area		Exisiting					Retrofit					Savings		Hours	
Site ID	ID	Description	EFixture Description	Qty	Watts per Fixture	Exist kW	Exist kWh	Fixture Description	Qty	Watts per Fixture	Retrofit kW	Retrofit kWh	Kw Savings	kWh Savings	Exisiting	Retrofit
100629	1.00	Outside	REC CAN 60PAR38	2	60	0.12	696	GN	2	55	0.11	638	0.01	58	5799	5799
100629	1.10	Left Window #1	TRACK 60PAR38	3	60	0.18	1,044	G8H	2	44	0.09	510	0.09	534	5799	5799
100629	1.11	Left Window #1	TRACK 60PAR38	2	60	0.12	696	G4H	1	24	0.02	139	0.10	557	5799	5799
100629	1.20	Left Window #2	TRACK 60PAR38	4	60	0.24	1,392	G8H	3	44	0.13	765	0.11	626	5799	5799
100629	1.21	Left Window #2	TRACK 60PAR38	4	60	0.24	1,392	G4H	2	24	0.05	278	0.19	1,113	5799	5799
100629	1.30	Right Window #1	TRACK 60PAR38	3	60	0.18	1,044	G8H	2	44	0.09	510	0.09	534	5799	5799
100629	1.31	Right Window #1	TRACK 60PAR38	2	60	0.12	696	G4H	1	24	0.02	139	0.10	557	5799	5799
100629	1.40	Right Window #2	TRACK 60PAR38	4	60	0.24	1,392	G8H	3	44	0.13	765	0.11	626	5799	5799
100629	1.41	Right Window #2	TRACK 60PAR38	4	60	0.24	1,392	G4H	2	24	0.05	278	0.19	1,113	5799	5799
100629	1.50	Right Window #3	TRACK 60PAR38	3	60	0.18	1,044	G8H	3	44	0.13	765	0.05	278	5799	5799
100629	1.51	Right Window #3	TRACK 60PAR38	2	60	0.12	696	G4H	2	24	0.05	278	0.07	418	5799	5799
100629	1.60	Entrance Track	TRACK 60PAR38	5	60	0.30	1,740	GN	5	55	0.28	1,595	0.03	145	5799	5799
100629	1.80	Sales Track	TRACK 60PAR38	37	60	2.22	12,874	GN	37	55	2.04	11,801	0.19	1,073	5799	5799
100629	1.90	Cabinet	REC CAN 50PAR20	94	50	4.70	27,255	GQ	94	21	1.97	11,447	2.73	15,808	5799	5799
100629	2.00	Sconce	SCONCE 150W QUARTZ	2	150	0.30	1,740	Sconce 32W	2	32	0.06	371	0.24	1,369	5799	5799
100629	2.10	Rear Sq Cove	4'S1L-T12	6	43	0.26	1,496	GF-T4 Cove	6	24	0.14	835	0.11	661	5799	5799
100629	2.20	Rear Sq Cove	4'S1L-T12	4	43	0.17	997	GF-T3 Cove	4	24	0.10	557	0.08	441	5799	5799
100629	2.30	Rear Sq Cove	2'S1L-T12	2	21	0.04	244	GD-T4 Cove	2	15	0.03	174	0.01	70	5799	5799
100629	2.40	Rear Sq Cove	2'S1L-T12	2	21	0.04	244	GD-T3 Cove	2	15	0.03	174	0.01	70	5799	5799
100629	2.50	Left Side Cove	4'S1L-T12	16	43	0.69	3,990	GF-T4 Cove	16	24	0.38	2,227	0.30	1,763	5799	5799
100629	2.60	Left Side Cove	4'S1L-T12	3	43	0.13	748	GF-T3 Cove	3	24	0.07	418	0.06	331	5799	5799
100629	2.70	Right Sq Cove	4'S1L-T12	14	43	0.60	3,491	GF-T4 Cove	14	24	0.34	1,948	0.27	1,543	5799	5799
100629	2.80	Right Sq Cove	4'S1L-T12	2	43	0.09	499	GF-T2 Cove	2	24	0.05	278	0.04	220	5799	5799
100629	2.90	Sales Eyeball	REC CAN ADJ 50PAR30	85	50	4.25	24,646	GL	85	50	4.25	24,646	0.00	0	5799	5799
100629	3.00	Right Dressing	REC CAN 60PAR38	21	60	1.26	7,307	G1V-B	21	24	0.50	2,923	0.76	4,384	5799	5799
100629	3.10	Left Dressing	REC CAN 60PAR38	13	60	0.78	4,523	G1V-B	13	24	0.31	1,809	0.47	2,714	5799	5799
100629	3.20	Mirror	REC CAN 60PAR38	2	60	0.12	696	GN	2	55	0.11	638	0.01	58	5799	5799
100629	3.30	Sales Can	REC CAN 60PAR38	117	60	7.02	40,709	G1V-B	117	24	2.81	16,284	4.21	24,425	5799	5799
100629	3.40	Indv Heads	TRACK 50MR16	9	50	0.45	2,610	GS	9	50	0.45	2,610	0.00	0	5799	5799
100629	3.50	Office	4'W4L-T12	1	156	0.16	813	GJ	1	92	0.09	480	0.06	334	5212	5212
100629	3.60	Office	4'S1L-T12	2	43	0.09	448	GF-T2	2	24	0.05	250	0.04	198	5212	5212
100629	3.70	BOH T1	4'S1L-T12	1	43	0.04	224	GF	1	24	0.02	125	0.02	99	5212	5212
100629	3.80	BOH T2	4'S1L-T12	3	43	0.13	672	GF-T2	3	24	0.07	375	0.06	297	5212	5212
100629	3.90	BOH T3	4'S1L-T12	5	43	0.22	1,121	GF-T3	5	24	0.12	625	0.10	495	5212	5212
100629	4.00	BOH T4	4'S1L-T12	2	43	0.09	448	GF-T4	2	24	0.05	250	0.04	198	5212	5212
100629	4.10	RR	4'W2L-T12	2	78	0.16	813	GG	2	46	0.09	480	0.06	334	5212	5212
100629	8.10	BOH Exit	EXIT/EMERG INC	2	40	0.08	701	X3	2	4	0.01	70	0.07	631	8760	8760

Table 222. Verified Savings - Sample (con't)

Site Information	Area		Exisiting					Retrofit					Savings		Hours	
Site ID	ID	Description	EFixture Description	Qty	Watts per Fixture	Exist kW	Exist kWh	Fixture Description	Qty	Watts per Fixture	Retrofit kW	Retrofit kWh	Kw Savings	kWh Savings	Exisiting	Retrofit
200445	1.00	Entrance Tracks Over Door	TRACK 50MR16	5	50	0.25	1,450	GS	5	50	0.25	1,450	0.00	0	5799	5799
200445	1.01	Entrance Tracks Over Door	TRACK 50MR16	5	50	0.25	1,450	GS	5	50	0.25	1,450	0.00	0	5799	5799
200445	1.02	Entrance Tracks Over Door	TRACK 50MR16	3	50	0.15	870	GS	3	50	0.15	870	0.00	0	5799	5799
200445	1.10	Left Window #1	TRACK 50MR16	3	50	0.15	870	G8H	3	44	0.13	765	0.02	104	5799	5799
200445	1.11	Left Window #1	TRACK 50MR16	2	50	0.10	580	G4H	2	24	0.05	278	0.05	302	5799	5799
200445	1.20	Left Window #2	TRACK 50MR16	1	50	0.05	290	G8H	3	44	0.13	765	-0.08	-476	5799	5799
200445	1.21	Left Window #2	TRACK 50MR16	1	50	0.05	290	G4H	2	24	0.05	278	0.00	12	5799	5799
200445	1.30	Left Window #3	TRACK 50MR16	2	50	0.10	580	G8H	2	44	0.09	510	0.01	70	5799	5799
200445	1.31	Left Window #3	TRACK 50MR16	2	50	0.10	580	G4H	1	24	0.02	139	0.08	441	5799	5799
200445	1.40	Right Track #1	TRACK 50MR16	4	50	0.20	1,160	GS	4	50	0.20	1,160	0.00	0	5799	5799
200445	1.41	Right Track #1	TRACK 50MR16	5	50	0.25	1,450	G4H	2	24	0.05	278	0.20	1,171	5799	5799
200445	1.50	Right Track #2	TRACK 50MR16	2	50	0.10	580	GS	2	50	0.10	580	0.00	0	5799	5799
200445	1.51	Right Track #2	TRACK 50MR16	3	50	0.15	870	G4H	1	24	0.02	139	0.13	731	5799	5799
200445	1.60	Right Track #3	TRACK 50MR16	8	50	0.40	2,320	GS	8	50	0.40	2,320	0.00	0	5799	5799
200445	1.61	Right Track #3	TRACK 50MR16	7	50	0.35	2,030	G4H	4	24	0.10	557	0.25	1,473	5799	5799
200445	1.70	Right Track #4 Rear	TRACK 50MR16	4	50	0.20	1,160	GS	4	50	0.20	1,160	0.00	0	5799	5799
200445	1.71	Right Track #4 Rear	TRACK 50MR16	2	50	0.10	580	G4H	1	24	0.02	139	0.08	441	5799	5799
200445	1.80	Right Track #5	TRACK 50MR16	3	50	0.15	870	GS	4	50	0.20	1,160	-0.05	-290	5799	5799
200445	1.81	Right Track #5	TRACK 50MR16	1	50	0.05	290	G4H	1	24	0.02	139	0.03	151	5799	5799
200445	1.90	Right Track Jean #6	TRACK 50MR16	4	50	0.20	1,160	GAH	1	82	0.08	476	0.12	684	5799	5799
200445	2.00	Right Track Jean #7	TRACK 50MR16	10	50	0.50	2,900	GAH	5	82	0.41	2,378	0.09	522	5799	5799
200445	2.10	Left Track #1	TRACK 50MR16	4	50	0.20	1,160	GS	4	50	0.20	1,160	0.00	0	5799	5799
200445	2.11	Left Track #1	TRACK 50MR16	2	50	0.10	580	G4H	2	24	0.05	278	0.05	302	5799	5799
200445	2.20	Left Track #2	TRACK 50MR16	6	50	0.30	1,740	GS	6	50	0.30	1,740	0.00	0	5799	5799
200445	2.21	Left Track #2	TRACK 50MR16	8	50	0.40	2,320	G4H	3	24	0.07	418	0.33	1,902	5799	5799
200445	2.30	Left Track #3	TRACK 50MR16	2	50	0.10	580	GS	2	50	0.10	580	0.00	0	5799	5799
200445	2.31	Left Track #3	TRACK 50MR16	2	50	0.10	580	G4H	1	24	0.02	139	0.08	441	5799	5799
200445	2.40	Left Track #4	TRACK 50MR16	2	50	0.10	580	GS	2	50	0.10	580	0.00	0	5799	5799
200445	2.41	Left Track #4	TRACK 50MR16	1	50	0.05	290	G4H	1	24	0.02	139	0.03	151	5799	5799
200445	2.50	Register Track	TRACK 50MR16	3	50	0.15	870	GS	4	50	0.20	1,160	-0.05	-290	5799	5799
200445	2.51	Register Track	TRACK 50MR16	1	50	0.05	290	G4H	2	24	0.05	278	0.00	12	5799	5799
200445	2.60	Chandelier	SCONCE 40W CAND BASE	12	40	0.48	2,784	GU	12	25	0.30	1,740	0.18	1,044	5799	5799
200445	2.70	L cove Center	TRACK 50MR16	6	50	0.30	1,740	GS	6	50	0.30	1,740	0.00	0	5799	5799
200445	2.80	Cabinet	4'S1L-T12	1	43	0.04	249	GF Cove	1	24	0.02	139	0.02	110	5799	5799
200445	2.90	Cabinet	3'S1L-T12	3	40	0.12	696	GE Cove	3	21	0.06	365	0.06	331	5799	5799
200445	3.00	Cabinet	REC CAN 50PAR20	39	50	1.95	11,308	GQ	39	21	0.82	4,749	1.13	6,559	5799	5799
200445	3.05	Register Cove	4'S2L-T12	6	78	0.47	2,714	GG-T2 Cove	0	46	0.00	0	0.47	2,714	5799	5799
200445	3.06	Register Cove	4'S2L-T12	1	78	0.08	452	GG Cove	1	46	0.05	267	0.03	186	5799	5799
200445	3.10	Right Side Cove	4'S2L-T12	3	78	0.23	1,357	GG Cove	3	46	0.14	800	0.10	557	5799	5799
200445	3.11	Right Side Cove	4'S2L-T12	8	78	0.62	3,619	GG-T2 Cove	8	46	0.37	2,134	0.26	1,485	5799	5799
200445	3.12	Right Side Cove	2'S2L-T12	1	35	0.04	203	GD2 Cove	1	28	0.03	162	0.01	41	5799	5799
200445	3.20	Right Dressing	REC CAN 60PAR38	26	60	1.56	9,046	G1V-B	26	24	0.62	3,619	0.94	5,428	5799	5799
200445	3.30	Mirror	REC CAN 60PAR38	2	60	0.12	696	GN	2	55	0.11	638	0.01	58	5799	5799
200445	3.40	Center Sq Cove	4'S2L-T12	2	78	0.16	905	GG Cove	2	46	0.09	534	0.06	371	5799	5799
200445	3.41	Center Sq Cove	2'S2L-T12	4	35	0.14	812	GD2-T2 Cove	4	28	0.11	649	0.03	162	5799	5799
200445	3.50	L Cove Rear	TRACK 50MR16	3	50	0.15	870	GS	3	50	0.15	870	0.00	0	5799	5799
200445	3.60	Right Rear Jean Cove	4'S2L-T12	13	78	1.01	5,880	GG-T2 Cove	13	46	0.60	3,468	0.42	2,412	5799	5799
200445	3.62	Right Rear Jean Cove	3'S2L-T12	2	70	0.14	812	GE2 Cove	2	40	0.08	464	0.06	348	5799	5799
200445	3.63	Right Rear Jean Cove	3'S2L-T12	1	70	0.07	406	GE2-T2 Cove	1	40	0.04	232	0.03	174	5799	5799

Table 222. Verified Savings - Sample (con't)

Site Information	Area		Exisiting					Retrofit					Savings		Hours	
Site ID	ID	Description	EFixture Description	Qty	Watts per Fixture	Exist kW	Exist kWh	Fixture Description	Qty	Watts per Fixture	Retrofit kW	Retrofit kWh	Kw Savings	kWh Savings	Exisiting	Retrofit
200445	3.70	Rear Dressing	REC CAN 60PAR38	22	60	1.32	7,655	G1V-B REM	22	24	0.53	3,062	0.79	4,593	5799	5799
200445	3.80	Sales Can	REC CAN 60PAR38	47	60	2.82	16,353	G1H-B	47	26	1.22	7,086	1.60	9,267	5799	5799
200445	3.80	Sales Can	REC CAN 60PAR38	62	60	3.72	21,572	G1V-B	62	24	1.49	8,629	2.23	12,943	5799	5799
200445	3.90	Indv Heads	TRACK 50MR16	8	50	0.40	2,320	GS	8	50	0.40	2,320	0.00	0	5799	5799
200445	4.00	BOH T1	4'S1L-T12	5	43	0.22	1,121	GF	5	24	0.12	625	0.10	495	5212	5212
200445	4.10	BOH T2	4'S1L-T12	10	43	0.43	2,241	GF-T2	10	24	0.24	1,251	0.19	990	5212	5212
200445	4.20	BOH T3	4'S1L-T12	12	43	0.52	2,689	GF-T3	12	24	0.29	1,501	0.23	1,188	5212	5212
200445	4.30	BOH T4	4'S1L-T12	4	43	0.17	896	GF-T4	4	24	0.10	500	0.08	396	5212	5212
200445	4.40	RR	4'S1L-T12	3	43	0.13	672	GF	3	24	0.07	375	0.06	297	5212	5212
200445	4.50	RR & sales	REC CAN 65R30	12	65	0.78	4,065	GN	12	55	0.66	3,440	0.12	625	5212	5212
200445	5.00	BOH Exit	EXIT/EMERG INC	4	40	0.16	1,402	X3	4	4	0.02	140	0.14	1,261	8760	8760
500478	1.00	Outside	REC CAN 50PAR20	13	50	0.65	3,769	GQ	13	21	0.27	1,583	0.38	2,186	5799	5799
500478	1.10	Entrance Track	TRACK 50MR16	8	50	0.40	2,320	GS	8	50	0.40	2,320	0.00	0	5799	5799
500478	1.20	Left Window	TRACK 50MR16	4	50	0.20	1,160	G8H	3	44	0.13	765	0.07	394	5799	5799
500478	1.21	Left Window	TRACK 50MR16	4	50	0.20	1,160	G4H	2	24	0.05	278	0.15	881	5799	5799
500478	1.30	Right Window	TRACK 50MR16	3	50	0.15	870	G8H	3	44	0.13	765	0.02	104	5799	5799
500478	1.31	Right Window	TRACK 50MR16	3	50	0.15	870	G4H	2	24	0.05	278	0.10	591	5799	5799
500478	1.40	Cabinet	REC CAN 50PAR20	135	50	6.75	39,143	GQ	135	21	2.84	16,440	3.92	22,703	5799	5799
500478	1.50	Eyeball & Other MR16	REC CAN ADJ 50MR16	194	50	9.70	56,250	GS	194	50	9.70	56,250	0.00	0	5799	5799
500478	1.60	Sales Cans	REC CAN 60PAR38	169	60	10.14	58,802	G1V-B	169	24	4.06	23,521	6.08	35,281	5799	5799
500478	1.70	Dressing	REC CAN 60PAR38	16	60	0.96	5,567	G1V-B	16	24	0.38	2,227	0.58	3,340	5799	5799
500478	1.80	Dressing Sconce	SCONCE 40W CAND BASE	6	40	0.24	1,392	GU	6	25	0.15	870	0.09	522	5799	5799
500478	1.90	Front Cove	4'S1L-T8	5	32	0.16	928	4'S1L-T8	5	32	0.16	928	0.00	0	5799	5799
500478	2.00	Front Cove	3'S1L-T8	2	27	0.05	313	3'S1L-T8	2	27	0.05	313	0.00	0	5799	5799
500478	2.10	Middle Left Cove	4'S1L-T8	7	32	0.22	1,299	4'S1L-T8	7	32	0.22	1,299	0.00	0	5799	5799
500478	2.20	Middle Left Cove	3'S1L-T8	2	27	0.05	313	3'S1L-T8	2	27	0.05	313	0.00	0	5799	5799
500478	2.30	Register Cove	4'S1L-T8	7	32	0.22	1,299	4'S1L-T8	7	32	0.22	1,299	0.00	0	5799	5799
500478	2.40	Register Cove	3'S1L-T8	2	27	0.05	313	3'S1L-T8	2	27	0.05	313	0.00	0	5799	5799
500478	2.50	Back Register	4'S1L-T8	9	32	0.29	1,670	4'S1L-T8	9	32	0.29	1,670	0.00	0	5799	5799
500478	2.60	Back Sign	REC CAN 60PAR38	7	60	0.42	2,436	G1V-B	7	24	0.17	974	0.25	1,461	5799	5799
500478	2.70	BOH	4'S1L-T8	49	32	1.57	8,172	4'S1L-T8	49	32	1.57	8,172	0.00	0	5212	5212
500478	2.80	RR & Office	4'W2L-T8	3	58	0.17	907	4'W2L-T8	3	58	0.17	907	0.00	0	5212	5212
500478	2.90	RR	REC CAN 60PAR38	2	60	0.12	625	GN	2	55	0.11	573	0.01	52	5212	5212
500719	1.00	Right Window #1	TRACK 50MR16	2	50	0.10	580	G8H	2	44	0.09	510	0.01	70	5799	5799
500719	1.01	Right Window #1	TRACK 50MR16	2	50	0.10	580	G4H	1	24	0.02	139	0.08	441	5799	5799
500719	1.20	Right Window #2	TRACK 50MR16	3	50	0.15	870	G8H	3	44	0.13	765	0.02	104	5799	5799
500719	1.21	Right Window #2	TRACK 50MR16	3	50	0.15	870	G4H	2	24	0.05	278	0.10	591	5799	5799
500719	1.30	Left Window #1	TRACK 50MR16	2	50	0.10	580	G8H	2	44	0.09	510	0.01	70	5799	5799
500719	1.31	Left Window #1	TRACK 50MR16	3	50	0.15	870	G4H	1	24	0.02	139	0.13	731	5799	5799
500719	1.40	Entrance Track	TRACK 50MR16	6	50	0.30	1,740	GS	6	50	0.30	1,740	0.00	0	5799	5799
500719	1.50	Side Window #1	TRACK 50MR16	2	50	0.10	580	G8H	2	44	0.09	510	0.01	70	5799	5799
500719	1.51	Side Window #1	TRACK 50MR16	3	50	0.15	870	G4H	1	24	0.02	139	0.13	731	5799	5799
500719	1.60	Side Window #2	TRACK 50MR16	3	50	0.15	870	G8H	3	44	0.13	765	0.02	104	5799	5799
500719	1.61	Side Window #2	TRACK 50MR16	5	50	0.25	1,450	G4H	2	24	0.05	278	0.20	1,171	5799	5799
500719	1.70	Side Hidden Window	TRACK 50MR16	3	50	0.15	870	G8H	2	44	0.09	510	0.06	360	5799	5799
500719	1.71	Side Hidden Window	TRACK 50MR16	3	50	0.15	870	G4H	1	24	0.02	139	0.13	731	5799	5799
500719	1.72	Side Hidden Window	REC CAN 60PAR38	3	60	0.18	1,044	G1V-B	3	24	0.07	418	0.11	626	5799	5799
500719	1.80	Cabinet	REC CAN 50PAR20	99	50	4.95	28,705	GQ	99	21	2.08	12,056	2.87	16,649	5799	5799
500719	1.90	Sales Eyeball	REC CAN ADJ 50MR16	195	50	9.75	56,540	GS	195	50	9.75	56,540	0.00	0	5799	5799

Table 222. Verified Savings - Sample (con't)

Site Information	Area		Exisiting					Retrofit					Savings		Hours	
Site ID	ID	Description	EFixture Description	Qty	Watts per Fixture	Exist kW	Exist kWh	Fixture Description	Qty	Watts per Fixture	Retrofit kW	Retrofit kWh	Kw Savings	kWh Savings	Exisiting	Retrofit
500719	2.00	Sales Cans	REC CAN 60PAR38	111	60	6.66	38,621	G1V-B	111	24	2.66	15,449	4.00	23,173	5799	5799
500719	2.10	Dressing	REC CAN 60PAR38	20	60	1.20	6,959	G1V-B	20	24	0.48	2,784	0.72	4,175	5799	5799
500719	2.20	Dressing Sconce	SCONCE 40W CAND BASE	12	40	0.48	2,784	GU	12	25	0.30	1,740	0.18	1,044	5799	5799
500719	2.30	Sales Sconce	SCONCE 40A	8	40	0.32	1,856	GX	8	25	0.20	1,160	0.12	696	5799	5799
500719	2.40	Front Cove	4'S1L-T12	5	43	0.22	1,247	GF Cove	5	24	0.12	696	0.10	551	5799	5799
500719	2.50	Front Cove	3'S1L-T12	2	40	0.08	464	GE Cove	2	21	0.04	244	0.04	220	5799	5799
500719	2.60	Register Cove	4'S1L-T12	9	43	0.39	2,244	GF Cove	9	24	0.22	1,253	0.17	992	5799	5799
500719	2.70	BOH T1	4'S1L-T12	12	43	0.52	2,689	GF	12	24	0.29	1,501	0.23	1,188	5212	5212
500719	2.80	BOH T2	4'S1L-T12	15	43	0.65	3,362	GF-T2	15	24	0.36	1,876	0.29	1,485	5212	5212
500719	2.90	BOH T3	4'S1L-T12	6	43	0.26	1,345	GF-T3	6	24	0.14	751	0.11	594	5212	5212
500719	3.00	Office & RR	4'W2L-T12	3	78	0.23	1,220	GG	3	46	0.14	719	0.10	500	5212	5212
500719	3.10	RR	REC CAN 60PAR38	2	60	0.12	625	GN	2	55	0.11	573	0.01	52	5212	5212
500719	5.10	BOH Exit	EXIT/EMERG INC	4	40	0.16	1,402	X3	4	4	0.02	140	0.14	1,261	8760	8760
4200445	1.00	Right Window	TRACK 50MR16	3	50	0.15	870	GS	3	50	0.15	870	0.00	0	5799	5799
4200445	1.01	Right Window	TRACK 50MR16	2	50	0.10	580	G5H	2	24	0.05	278	0.05	302	5799	5799
4200445	1.10	Left Window	TRACK 50MR16	3	50	0.15	870	GS	3	50	0.15	870	0.00	0	5799	5799
4200445	1.11	Left Window	TRACK 50MR16	2	50	0.10	580	G5H	2	24	0.05	278	0.05	302	5799	5799
4200445	1.20	Right Gooseneck	GOOSENECK 135A	6	135	0.81	4,697	GT	6	90	0.54	3,131	0.27	1,566	5799	5799
4200445	1.21	Right Gooseneck	GOOSENECK 135A	5	135	0.68	3,914	GY	5	32	0.16	928	0.52	2,986	5799	5799
4200445	1.30	Right Metal Shade	RLM PENDANT 15WG30	3	15	0.05	261	GZ	3	32	0.10	557	-0.05	-296	5799	5799
4200445	1.40	Left Gooseneck	GOOSENECK 135A	8	135	1.08	6,263	GT	8	90	0.72	4,175	0.36	2,088	5799	5799
4200445	1.41	Left Gooseneck	GOOSENECK 135A	8	135	1.08	6,263	GY	8	32	0.26	1,485	0.82	4,778	5799	5799
4200445	1.50	Back Sign	TRACK 50MR16	4	50	0.20	1,160	GS	4	50	0.20	1,160	0.00	0	5799	5799
4200445	1.51	Back Sign	TRACK 50MR16	3	50	0.15	870	G4H	2	24	0.05	278	0.10	591	5799	5799
4200445	1.60	Back Sign Strip	4'S2L-T12	4	78	0.31	1,809	GG-T2 Cove	4	46	0.18	1,067	0.13	742	5799	5799
4200445	1.61	Back Sign Strip	4'S2L-T12	2	78	0.16	905	GG Cove	2	46	0.09	534	0.06	371	5799	5799
4200445	1.62	Back Sign Strip	3'S2L-T12	4	70	0.28	1,624	GE2-T2 Cove	4	40	0.16	928	0.12	696	5799	5799
4200445	1.70	Sales Can	REC CAN 90PAR38	4	90	0.36	2,088	G1H	4	32	0.13	742	0.23	1,345	5799	5799
4200445	1.70	Sales Can	REC CAN 90PAR38	70	90	6.30	36,534	G1V	70	32	2.24	12,990	4.06	23,544	5799	5799
4200445	1.80	Track to Express	TRACK 50MR16	4	50	0.20	1,160	GS	4	50	0.20	1,160	0.00	0	5799	5799
4200445	1.90	BOH T1	4'S1L-T12	3	43	0.13	672	GF	3	24	0.07	375	0.06	297	5212	5212
4200445	1.91	BOH T3	4'S1L-T12	3	43	0.13	672	GF-T3	3	24	0.07	375	0.06	297	5212	5212
4200445	1.92	BOH T4	4'S1L-T12	4	43	0.17	896	GF-T4	4	24	0.10	500	0.08	396	5212	5212
4200445	1.93	Office	4'S1L-T12	2	43	0.09	448	GF	2	24	0.05	250	0.04	198	5212	5212
4200445	4.00	BOH Exit	EXIT/EMERG INC	1	40	0.04	350	X3	1	4	0.00	35	0.04	315	8760	8760
4501058	1.00	Outside	REC CAN 50PAR20	13	50	0.65	3,769	GQ	13	21	0.27	1,583	0.38	2,186	5799	5799
4501058	1.10	Left Window	TRACK 50MR16	1	50	0.05	290	G8H	1	44	0.04	255	0.01	35	5799	5799
4501058	1.20	Right Window #1	TRACK 50MR16	0	50	0.00	0	G8H	1	44	0.04	255	-0.04	-255	5799	5799
4501058	1.30	Right Window #2	TRACK 50MR16	1	50	0.05	290	G8H	3	44	0.13	765	-0.08	-476	5799	5799
4501058	1.31	Right Window #2	TRACK 50MR16	1	50	0.05	290	G4H	2	24	0.05	278	0.00	12	5799	5799
4501058	1.40	Right Window #3	TRACK 50MR16	5	50	0.25	1,450	G8H	5	44	0.22	1,276	0.03	174	5799	5799
4501058	1.41	Right Window #3	TRACK 50MR16	8	50	0.40	2,320	G4H	4	24	0.10	557	0.30	1,763	5799	5799
4501058	1.50	Sales Eyeball	REC CAN ADJ 50MR16	36	50	1.80	10,438	GS	36	50	1.80	10,438	0.00	0	5799	5799
4501058	1.60	Back track	TRACK 50MR16	4	50	0.20	1,160	GS	4	50	0.20	1,160	0.00	0	5799	5799
4501058	1.70	Back track	TRACK 50MR16	1	50	0.05	290	G4H	2	24	0.05	278	0.00	12	5799	5799
4501058	1.80	Hanging Shade	SCONCE 90A	3	90	0.27	1,566	GT	3	90	0.27	1,566	0.00	0	5799	5799
4501058	1.90	Behind Curtain	REC CAN 50MR16	60	50	3.00	17,397	GS	60	50	3.00	17,397	0.00	0	5799	5799

Table 222. Verified Savings - Sample (con't)

Site Information	Area		Exisiting					Retrofit					Savings		Hours	
Site ID	ID	Description	EFixture Description	Qty	Watts per Fixture	Exist kW	Exist kWh	Fixture Description	Qty	Watts per Fixture	Retrofit kW	Retrofit kWh	Kw Savings	kWh Savings	Exisiting	Retrofit
4501058	2.00	Sales Can	REC CAN 90PAR38	91	90	8.19	47,494	G1V	91	32	2.91	16,887	5.28	30,607	5799	5799
4501058	2.10	Lamp	SCONCE 90A	1	90	0.09	522	GT	1	90	0.09	522	0.00	0	5799	5799
4501058	2.20	BOH	4'S1L-T8	6	32	0.19	1,001	4'S1L-T8	6	32	0.19	1,001	0.00	0	5212	5212
4501058	2.21	BOH	4'S1L-T8	5	32	0.16	834	4'S1L-T8	5	32	0.16	834	0.00	0	5212	5212
4501058	2.30	RR	4'W2L-T8	1	58	0.06	302	4'W2L-T8	1	58	0.06	302	0.00	0	5212	5212
4501058	2.40	RR	REC CAN 90PAR38	1	90	0.09	469	GN	1	55	0.06	287	0.04	182	5212	5212
Total						139.38	805,027				83.05	478411.06	56.34	326,616		

7.26.3 Conclusions

The verified energy savings and demand reduction attributed to the retrofit was greater than originally estimated. The fixture counts were not a factor in the discrepancy in savings. The findings suggest the discrepancies are due to the measured operating hours being higher than claimed on average.

7.27 05-08-001 – Lighting Retrofit 8-Ft T12 with T-8

This project was an aggregation project where the Project Sponsor recruited multiple customers. The project was a lighting retrofit of two-lamp eight-foot T12 fluorescent lighting fixtures with two-lamp four-foot T8 fixtures; reducing 16 linear feet of lamps to eight linear feet. Table 223 shows a summary of the M&V for this project.

Table 223. M&V Savings Summary – 05-08-001

CONTRACTED	
Energy Savings (kWh)	
Total Contracted Savings (kWh)	614,395 kWh
M&V Savings (kWh)	607,738 kWh
Realization Rate (kWh)	98.92%
Demand Reduction (kW)	
Total Contracted Savings (kW)	85.58 kW
M&V Savings (kW)	84.82 kW
Realization Rate	99.11%

7.27.1.1 MEASURE DESCRIPTION

Install energy efficient 4-foot T8 fluorescent lamps with electronic ballast in place of eight foot T12 lamps with magnetic ballast.

7.27.1.1.1 Pre-Retrofit Conditions

- Warehouse, storage, parking garages, and low-bay facilities.
- 136 Watt surface mount or suspended 8' fixtures.
- Two – eight foot T12 lamps with magnetic ballast.

7.27.1.1.2 Post-Retrofit Conditions

- Two T12 Lamps, magnetic ballast, tombstones, wires, and face plate removed.
- Eight foot conversion kit.

- Two T8 lamps with electronic ballast, tombstones, and ballast cover or reflector installed.
- Lamps used are:
  - SLI
  - 850 series T8
  - 5000°K
- Ballast used are:
  - GE-MAX/ULTRA

7.27.2 Measurement and Verification (M&V) Approach

The M&V approach used for the project is summarized in this section. KSI coordinated with the Project Sponsor to perform pre and post-retrofit M&V activities to support the tasks described below.

7.27.2.1 Load Impact Verification Methodology

The load impact estimation methodology described in this plan complies with IPMVP Option A. Site inspections were employed to verify key M&V parameters.

7.27.2.2 Analysis Approach for Verified Savings

The basic equation used to estimate the energy savings of this project is shown in Equation 1.

(Eq. 1) kWh savings = verified kWh $_{Pre}$ – verified kWh $_{Post}$

where:

verified kWh $_{Pre}$ = (# Fixtures $_{Pre}$) × (Fixture Wattage $_{Pre}$/1000) × (Hours of Operation $_{Pre}$); and

verified kWh $_{Post}$=(# Fixtures $_{Post}$) × (Fixture Wattage $_{Post}$/1000) × (Hours of Operation $_{Post}$).

The key parameters of Equation 1 are shown in Table 224.

Table 224. Key M&V Parameters

Parameter	M&V Activity
Fixture Counts	Fixture counts were verified through on-site inspection. Fixture counts were based on detailed worksheets provided by the Project Sponsor.
Fixture Wattage $_{Pre}$ and Fixture Wattage $_{Post}$	Verified pre- and post- fixture types and fixture wattage values.
Hours of Operation	Ten out of the 14 sites were underground parking garages that operate 24 hours a day, seven days a week. Two sites were operated 12 hours, seven days a week. And two sites were operated 24 hours, five days a week.

7.27.2.3 On-Site Verification Inspections

On-site inspections were conducted to verify the equipment types, quantities and operating hours. Site inspections consisted of the following activities:

- Verify base case equipment types and wattages.
- Verify the operating hours through interviews with on-site contacts.
- Verification of the installation of new lighting equipment, including
  - fixture wattage, and
  - fixture counts

The verification was based on as-built documentation provided to KSI by the Project Sponsor.

7.27.3 *M&V Results*

This section provides the results of the M&V process. The attached spreadsheet workbook contains data collected to perform the analysis.

Table 225 shows a summary of the M&V findings compared to the reported load impacts for the lighting retrofit.

Table 225. Summary of Verified Savings – 05-08-001

	Invoiced						Verified					
Site ID	Watts per fixture	Inoviced Qty of Fixtures	Watts per NEW fixture	Annual Hours	Invoiced kW Reduced	Invoiced Annual kWh Savings	Verified Pre Wattage	Verified Post Qty	Verified Post Fixture Wattage	Verified Annual Hours	Verified kW Reduced	Verified kWh savings
Site 01	136	5	60	8,760	0.38	3,329	136	5	60	8,760	0.38	3,329
Site 02	136	70	60	8,760	5.32	46,601	136	70	60	8,760	5.32	46,601
Site 03	136	32	60	8,760	2.43	21,303	136	32	60	8,760	2.43	21,303
Site 04	136	341	60	4,380	25.92	113,506	136	341	60	4,380	25.92	113,506
Site 05	136	25	60	4,745	1.90	9,015	136	25	60	4,745	1.90	9,015
Site 06	136	40	60	8,760	3.04	26,629	136	40	60	8,760	3.04	26,629
Site 07	136	21	60	8,760	1.60	13,980	136	21	60	8,760	1.60	13,980
Site 08	136	132	60	8,760	10.03	87,876	136	132	60	8,760	10.03	87,876
Site 09	136	30	60	8,760	2.28	19,972	136	30	60	8,760	2.28	19,972
Site 10	136	137	60	8,760	10.41	91,204	136	127	60	8,760	9.65	84,547
Site 11	136	9	60	6,257	0.68	4,280	136	9	60	6,257	0.68	4,280
Site 12	136	210	60	8,760	15.96	139,802	136	210	60	8,760	15.96	139,802
Site 13	136	65	60	6,257	4.94	30,909	136	65	60	6,257	4.94	30,909
Site 14	136	9	60	8,760	0.68	5,992	136	9	60	8,760	0.68	5,992
Total					85.58	614,395					84.82	607,738

The following subsections provide additional details on the project and the M&V.

7.27.3.1 Fixture Types

The pre- and post-inspections were based on worksheets of the measures provided by the Project Sponsor. All fixtures were retrofitted from two lamp, eight foot T12 fixtures to two lamp, four foot T8.

7.27.3.2 Verified Fixture Counts

The fixture counts on the project completion request forms submitted by the Project Sponsor represented the as-built quantities for each project. This was the basis for the verification of fixture counts. Pre-inspection and post-inspection visits were made to all sites. Fixture counts and wattages from the pre-inspection were used to adjust the basecase. Thus, the as-built counts were used for the final verification of fixture quantities, since the claimed savings were based on these values. There was one deviation found from the as-built quantities. Table 226 shows that the number of fixtures installed at the Solana Beach Tennis Club was 10 fixtures fewer than proposed resulting in decreased savings for this site. This is the only discrepancy in fixture counts that was found.

Table 226. Verified Fixture Counts, Types and Wattages

Invoiced						
Site ID	Basecase Fixture Type	Watts per Fixture	Pre Qty	Fixture Type	Watts per New Fixture	Post Qty
Site 01	2-8' T12	136	5	2-4' T8	60	5
Site 02	2-8' T12	136	70	2-4' T8	60	70
Site 03	2-8' T12	136	32	2-4' T8	60	32
Site 04	2-8' T12	136	341	2-4' T8	60	341
Site 05	2-8' T12	136	25	2-4' T8	60	25
Site 06	2-8' T12	136	40	2-4' T8	60	40
Site 07	2-8' T12	136	21	2-4' T8	60	21
Site 08	2-8' T12	136	132	2-4' T8	60	132
Site 09	2-8' T12	136	30	2-4' T8	60	30
Site 10	2-8' T12	136	137	2-4' T8	60	137
Site 11	2-8' T12	136	9	2-4' T8	60	9
Site 12	2-8' T12	136	210	2-4' T8	60	210
Site 13	2-8' T12	136	65	2-4' T8	60	65
Site 14	2-8' T12	136	9	2-4' T8	60	9
						1,126
Verified						
Site ID	Verified Basecase Fixture Type	Verified Pre Wattage	Verified Pre Qty	Verified Post Fixture	Verified Post Fixture Wattage	Verified Post Qty
Site 01	2-8' T12	136	5	2-4' T8	60	5
Site 02	2-8' T12	136	70	2-4' T8	60	70
Site 03	2-8' T12	136	32	2-4' T8	60	32
Site 04	2-8' T12	136	341	2-4' T8	60	341
Site 05	2-8' T12	136	25	2-4' T8	60	25
Site 06	2-8' T12	136	40	2-4' T8	60	40
Site 07	2-8' T12	136	21	2-4' T8	60	21
Site 08	2-8' T12	136	132	2-4' T8	60	132
Site 09	2-8' T12	136	30	2-4' T8	60	30
Site 10	2-8' T12	136	127	2-4' T8	60	127
Site 11	2-8' T12	136	9	2-4' T8	60	9
Site 12	2-8' T12	136	210	2-4' T8	60	210
Site 13	2-8' T12	136	65	2-4' T8	60	65
Site 14	2-8' T12	136	9	2-4' T8	60	9
						1,116

7.27.3.3 Hours of Operation

The hours of operation were verified through on site inspection and interviews with the facility contact. Ten sites were underground parking garages that operate 24 hours a day, seven days a week. Site 4 and Site 05 were two sites that operated 12 hours a day, seven days a week. Site 11 and Site 13 were two sites that operated 24 hours a day, five days a week.

7.27.3.4 Load Impacts

This section presents the verified load impacts and realization rate for the project.

7.27.3.4.1 Verified kW and kWh

Table 226 shows the 14 sites listed in the Project Sponsor's invoice. It shows pre and post fixture wattage, total fixture quantity, annual hours of operation, pre and proposed kW, pre and proposed post kWh for each site. The kW reduced and the annual kWh savings was calculated by the Project Sponsor and is shown for each facility.

KSI verified fixture type's pre and post retrofit. Table 226 also shows KSI's verified pre and post fixture counts; pre and post fixture wattage; hours of operation; pre and post kW; and verified annual kWh savings for each site. The kW reduced and kWh savings was calculated by KSI and compared to what was invoiced.

7.27.3.4.2 Realization Rate

A realization rate was calculated to compare how the invoiced kW reduced and kWh savings submitted by the Project Sponsor compared with the verified kW reduced and kWh savings for each site. Table 227 shows that the overall realization rate is slightly lower than 1.00. Thus the verified impacts are slightly lower than the invoiced. This is due to the lower fixture counts found at the Site 10.

Table 227. Realization Rate - 05-08-001

Site ID	Proposed kW Reduced	Proposed Annual kWh Savings	Verified kW Reduced	Verified kWh savings
Site 01	0.38	3,329	0.38	3,329
Site 02	5.32	46,601	5.32	46,601
Site 03	2.43	21,303	2.43	21,303
Site 04	25.92	113,506	25.92	113,506
Site 05	1.90	9,015	1.90	9,015
Site 06	3.04	26,629	3.04	26,629
Site 07	1.60	13,980	1.60	13,980
Site 08	10.03	87,876	10.03	87,876
Site 09	2.28	19,972	2.28	19,972
Site 10	10.41	91,204	9.652	84,547
Site 11	0.68	4,280	0.68	4,280
Site 12	15.96	139,802	15.96	139,802
Site 13	4.94	30,909	4.94	30,909
Site 14	0.68	5,992	0.68	5,992
	85.58	**614,395**	**84.82**	**607,738**
Realization Rate			**99.11%**	**98.92%**

7.28 05-08-002 – Commercial Refrigeration Controls and Evaporator Motor Retrofit

This is a multiple customer aggregation project where refrigeration energy cooler control system and electronically commutated motors (ECM) were installed in establishments with commercial cooling. Due to marketing related issues there was one site retrofit under this project. The technology focuses on controlling and optimizing the operation of anti-sweat door heaters (ASH) and evaporator fan motors in walk-in coolers and freezers. Table 228 shows a summary of the M&V for this project.

Table 228. M&V Savings Summary – 05-08-002

CONTRACTED	
Energy Savings (kWh)	
Total Contracted Savings (kWh)	
Total Reported / Invoiced Savings (kWh)	73,153
M&V Savings (kWh)	**70,926**
Realization Rate (kWh)	**97%**
Demand Reduction (kW)	
Total Contracted Savings (kW)	
Total Reported / Invoiced Savings (kW)	7.28
M&V Savings (kW)	**6.96**
Realization Rate	**96%**

Table 229 provides a list of measures installed by the Project Sponsor.

Table 229. Measures Installed

End Use	Basecase	Measure	How Savings Are Generated
Anti-Sweat Door Heaters (ASH) on coolers and freezers	Uncontrolled ASH operating 8,760 hours per year	Cooler Control System based on dew point	Reduce total run-hours and maximum power by pulsing ASH on-off at pulse rates determined by dew point
Evaporator fans	Uncontrolled evaporator fans operating 8,760 hours per year	Cooler Control System runs motors only when compressors run.	Reduce run-hours by allowing fans to run only when compressors run, plus a short period of time after compressor shuts down.
26 Standard shaded pole motors on evaporator fans in Dairy Cooler 1 (10 motors), Meat Cooler (6 motors) and Produce Cooler (10 motors)	26 Standard motors on evaporator fans	26 Electronically Commutated Motors (ECM)	Reduced connected motor load.
Refrigeration compressors	Compressor operation controlled by analog controls	Direct Digital Temp Controls: Reduced Compressor Runtime	Reduced operating hours due to Direct Digital Temperature Control

7.28.1 Measurement and Verification (M&V) Approach

The M&V approach used for the project is presented in this section. The Project Sponsor provided a detailed spreadsheet showing the savings estimates of the proposed project. This site-specific spreadsheet included detailed audit data including full equipment counts and connected loads. These savings estimates are shown in this report as the "Reported/Invoiced Savings." KSI conducted pre- and post-inspections to verify equipment counts and connected load, and to verify the installation of the controls and ECM. The Project Sponsor's control system is a web-based management system that enables the Project Sponsor to communicate with and download operating data from the site. The M&V used these operating data to verify the load impacts of the project. The control system was used to access logged operating data for the refrigeration system, specifically actual run-hours. The verified run-hours were entered into the verified analytic spreadsheet to calculate the verified savings.

The load impact estimation methodology used in this M&V complies with IPMVP Option A. Site inspections were employed to verify key M&V parameters.

7.28.1.1 Evaporator Fan Motor Controls

Savings for this measure are generated by a reduction in the operating hours of the evaporator fans.

Evaporator fans in uncontrolled grocery refrigeration systems operate 24-hours per day. With the control system the operation of the fans is coupled with the operation of the refrigeration compressor. The control system turns on the fans when the compressor starts to run. After the compressor shuts down, the evaporator motors run for a short period of time to take advantage of any compressed refrigerant remaining in the lines.

Energy consumption for basecase and post case conditions were calculated using Equation 1. Energy savings for the evaporator fan controls and ECM installation was the difference between basecase and postcase consumption. This approach was used to properly account for the savings attributed to the controls and ECMs simultaneously.

(Eq.1) $\text{kWh Savings}_{\text{Evaporator Fan Control}} = W \times H$,

where:

W = Connected wattage of controlled evaporator fans,

H = Operating hours of controlled evaporator fans.

Basecase connected wattage of fan motors was calculated through standard equations using amps, volts, phase, power factor and number of motors. Postcase wattage was assumed to be 60% of the basecase.

Basecase hours of operation were assumed to be 8,760 hours per year. Postcase operating hours was based on operating data downloaded from the control system database. These data utilize data collected at periodic intervals by the system similar to the way a data logger does.

Table 230 shows the verified inventory of evaporator fan motors. This inventory was verified through pre- and post-inspections.

Table 230. Evaporator Fan Motor Inventory

Cooler	Number of Fans	Amps	Volts	Phase	Power Factor	Load
Walkin Dairy Cooler Zone 1	10	1.80	115	1.00	0.80 PF	1,656 Watts
Walkin Meat Freezer	2	1.10	230	1.00	0.80 PF	405 Watts
Produce and Meat Walkin Cooler	6	0.90	115	1.00	0.80 PF	497 Watts
Produce Walkin Cooler	10	1.80	115	1.00	0.80 PF	1,656 Watts
Upstairs Freezer	1	4.00	115	1.00	0.80 PF	368 Watts
Reachin Freezers	0	0.00	0	0.00	0.80 PF	0 Watts
Total KW demand of all evaporator fan sets:						4.5816 KW

Evaporator fan run-hours was verified from operating data gathered by the control system. Percent run-time for approximately one year was captured through a query of the control system database. There were four missing values, i.e., four missing non-contiguous months where there were some technical issues with the control system. The %-run-times for these periods were interpolated to provide a full year of data. A weighted average of the %-run-times was calculated. The weighting was based on the connected fan wattage for each of the locations. The reduction in %-run-time was 62.95% (3,246 hours per year), as shown in Table 231.

Table 231. Verified Run-Hours of Evaporator Fans

Location	No. Units	Number Months	% Runtime (from Query)	Amps/fan	Watt load	Extrapolated % Runtime	Weighted Avg % Runtime (Based on Fan Load)	Verified Run Hours
Dairy Cooler	10	8	72.69%	1.80	1,656	71.81%	25.96%	
Deli Freezer	2	8	65.81%	1.10	405	65.98%	5.83%	
Meat Cooler	6	8	64.83%	0.90	497	63.52%	6.89%	
Produce Cooler	10	8	59.22%	1.80	1,656	56.96%	20.59%	
Upstairs Freezer	1	8	46.39%	4.00	368	45.88%	3.69%	
	29		Connected Watts		4,582	**Verified On Time**	**62.95%**	5,514
						Verified Off Time	**37.05%**	3,246

The reduced run-time of the evaporator motors also reduces the heat produced by the motors. This heat, since it is inside the cooler or freezer, represents a reduction in the work required by the compressor. This is calculated by using standard equations to convert kWh savings from motors to energy savings from refrigeration compressors as shown in Equation 2.

(Eq 2) $$\text{kWh}_{\text{Needed to remove heat from evap fans}} = \text{kWh}_{\text{Saved from evap fan controls}} \times 0.28 \times 2.25$$

Table 232. kWh Savings, Evaporator Fan Motor Controls

Connected Evaporator Fan Load (Watts)	4,582
Reduced Run-Hours Due To Controls	3,246
kWh Savings due to controls	14,873
kWh Savings Due to Reduced Heat From Evap Motors	9,370
Total kWh Savings From Evap Motor Controls	24,243

7.28.1.2 Installation of Electronically Commutated Motors on Evaporator Fans

The installation of electronically commutated motors (ECM) reduces energy consumption for evaporator fans by reducing motor wattage. ECMs are approximately 70% more efficient than standard shaded pole motors. A few field studies have been conducted to quantify the impact of ECM. The studies have shown savings to be approximately 65% when replacing shaded pole motors (reference available on request). The current project used a savings percentage of 60% of evaporator motor consumption. This value was used to estimate savings from ECMs for this project.

The savings from the retrofit of shaded pole evaporator motors with ECM is shown in Table 233. A total of 26 ECMs were installed in place of shaded pole motors. This was verified through pre- and post-inspections. The verified run-times were used to calculate the verified savings. The connected load of the basecase motors retrofit was calculated by multiplying the Percentage Reduction in Motor Load (60%) to estimate the connected load of ECMs. The ECM load was multiplied by the verified on-time of the evaporator fans to estimate the savings from the ECMs.

Table 233. Savings From ECM Installation In Evaporators

ANALYSIS OF REPLACING EVAPORATOR MOTORS		
	Proposed	**Verified**
Total # ECM Installed	26	26
1. Verified on time of Evaporator Fans	4,888	5,514
2. Basecase kW Load of Evaporator Fans	3.809	3.809
3. Estimated Percentage Reduction in Motor Load from ECM	60%	60%
kWh Motor Savings (line 1 x line 2 x line 3)	**11,171**	**12,601**
Savings due to reduced cooling load from evaporator fans. (kWh Motor Savings x 0.28 x 2.25)	**7,038**	**7,939**
Projected Energy Savings from Installing ECM Motors (line 5 x line 6)	**18,208**	**20,540**
Projected KW Savings from Installing ECM Motors (line 2 x line 3)	**3.725**	**3.725**

7.28.1.3 Direct Digital Temperature Control of Refrigeration Compressors

The use of direct digital temperature controls results in savings through reduced compressor run-time. The digital temperature controls provide more accurate and responsive control than standard analog controls.

Total kWh consumption through compressors was estimated using Equation 3. The results are shown in Table 234.

(Eq. 3)
$$\mathrm{kW}_{\mathrm{Compressors}} = \frac{\left[(\text{Compressor Motor Amps}) \times \text{Voltage} \times (\text{Power Factor}) \times \sqrt{\text{Phase}}\right] + \left[(\text{Condenser Fan Amps}) \times \text{Voltage} \times (\text{Power Factor}) \times \sqrt{\text{Phase}}\right]}{1000}$$

Table 234. Basecase Compressor and Condenser Fan Load

Equipment	Comp Volt	Power Factor	Comp Amp	Comp Phase	Condenser Fan Volt	Fan Amp	Fan Phase	Total KW Load
Walkin Dairy Cooler Zone 1	208	0.85	12	3	230	3.2	1	4.30
Walkin Meat Freezer	208	0.85	12	3	230	3.2	1	4.30
Produce and Meat Walkin Cooler	208	0.85	12	3	230	3.2	1	4.30
Produce Walkin Cooler	208	0.85	12	3	230	3.2	1	4.30
Upstairs Freezer	208	0.85	12	3	230	3.2	1	4.30
Reachin Freezers	0		0	0	0	0	0	0.00
TOTAL KW Load:								**21.50**

Table 235 shows the calculated basecase compressor consumption based on assumed summer and winter duty cycles.

Table 235. Basecase Compressor Consumption

Line	Description		
6a)	Percent of total Compressor Load Employed by Coolers Listed above:		1
7	Total compressor load in KW	KW	21.50
8	Compressor duty cycle during cooler months:		0.35
9	Compressor duty cycle during warmer months:		0.45
9a)	Avg. Adjusted KW Cool Months (line 7 x line 8)		7.53
9b)	Avg. Adjusted KW Remaining Months (line 7 x line 9)		9.68
10	Cooler Ambient Hours per year	Hours	1,715
11	Remaining hours per year. 8,760 - (line10)	Hours	7,045
12	Compressor energy use per year. (line 7) x ((line 8) x (line 10) + (line 9) x (line 11))	KWH/yr	81,072

Table 236 shows the calculation of impacts based on a 5% reduction in compressor run-time due to direct digital temperature controls.

Table 236. Savings From Direct Digital Temperature Controls On Compressor

Line	ANALYSIS OF SAVINGS FROM DIRECT DIGITAL TEMP CONTROLS				
15	Annual energy use by compressor. Part I (line 12) - Part I (line 16)			81,072	KWH/yr
16	Compressor savings: compressor kWh (line 15) X controller reduced run time (%)		**5.0%**	4,054	KWH/yr
17	Resulting evaporator savings: (evap load Part II line5) X (evap hours 8,760 Hr/Yr - Part II line4)			1,263	KWH/yr
	X controller reduced time				
18	Total savings from Digital Controller: (line 16) + (line 17)			**5,317**	KWH/yr
19	Demand Reduction: Estimated 70% / 10% compressor loads only	Winter	**0.000**	**0.376**	KW
	(Part I (line 9a)-(line 14a)) x 10% + (Part I (line 9b)) x 10%	Summer	**0.000**	**0.484**	KW

7.28.1.4 Anti-Sweat Door Heater Control

The installed anti-sweat door heater (ASH) controls saves energy by controlling ASH based on calculated dew point, rather than simple humidity measurements, using measured temperature and relative humidity. The control strategies include pulsing of ASH on and off at varying durations and frequencies depending on the strategy selected. The controls were set to maintain the ASH temperature 5°F above dew point.

ASH inventories were verified through pre- and post-inspections. The inventory and connected wattage of ASH are shown in Table 237 for coolers and freezers.

Table 237. Inventory of Anti-Sweat Door Heaters

Location	No. of Doors	Volts	Amps	Watts
Walkin Dairy Cooler Zone 1	23	120	0.49	1,359.6
Reach-in Freezers	15	120	1.78	3,204.0

Table 238 and Table 239 show the verified savings for ASH installed on medium temperature coolers and low temperature freezers, respectively. The savings were calculated by subtracting the controlled kWh from the basecase kWh. Run-hours for the basecase was 8,760 hours per year. The verified run-hours was 3,804 hours per year for medium temperature coolers based on operational data from the control system. Basecase energy use used Equation 4.

(Eq. 4)

$$\text{kWh}_{\text{Basecase}} = (\text{Total Load ASH}) \times (\text{Annual Run - Hours}),$$

where:

Total Load ASH = Total kW for ASH on MediumTemp Cooler or Freezer

Annual Run - Hours = 8,760 hours per year.

Energy use with the ASH controller used Equation 5. Verified run-hours were used in the calculations.

(Eq. 5)

$$\text{kWh}_{\text{Controlled Case}} = (\text{Total Load ASH}) \times (\text{Verified Run - Hours}) \times (\text{Average Power Level}),$$

where:

Total Load ASH = Total kW for ASH on MediumTemp Cooler or Freezer

Verified Run - Hours = verified hours based on data downloaded from RSM

Average Power Level = Percentage power is run to maintain door temperature at 5 deg - F above dew point

kWh savings was calculated using Equation 6.

(Eq. 6)

$$\text{kWh Savings} = \text{kWh}_{\text{Basecase}} - \text{kWh}_{\text{Controlled Case}}$$

kW Reduction was calculated using Equation 7.

(Eq. 7)

$$\text{kW Reduction} = (\text{Total kW Load}) \times (\text{Average Power Level}),$$

where:

Total kW Load = Total kW for ASH on Medium Temp Cooler of Freezer

Average Power Level = Power level required to maintain door temperature 5 deg - F above dew point

Table 238. Verified Savings Calculation, Anti-Sweat Door Heaters on Medium Temperature Coolers

Line No.		
1	Total load of Medium Temp Door Heaters	1.3596 kW
2	Door heaters annual energy use: (line 1) X 8,760 hours	11,910.10 kWh/yr
3	Verified run hours of door heaters by operating heaters to maintain 5 deg above dew point	3,804 hours
4	Estimated average power level of door heaters when operated to maintain 5 deg above dew point	50%
5	Demand reduction of door heater load: (heaters never operate above 70% power level) (0.3 * line 1)	0.4079 kW
6	Door heaters annual energy use with humidity control: (line 1 x line 3 x line 4)	2,585.96 kWh/yr
7	Annual energy savings from door heater controls: (line 2 - line 6)	9,324.14 kWh/yr

Table 239. Verified Savings Calculation Anti-Sweat Door Heaters on Low Temperature Freezers

Line No.		
1	Total load of Frozen Food Door Heaters	3.2040 KW
2	Door heaters annual energy use: (line 1) X 8,760 hours	28,067 KWH/yr
3	Estimated run hours of door heaters by operating heaters to maintain 5 deg-F above dew point	8,760 hours
4	Estimated average power level of door heaters when operated to maintain 5 deg-F above DP	0.7500
5	Demand reduction of door heater load: (heaters never operate above 80% power level)	0.6408 KW
6	Door heaters annual energy use with dew point control: (40% x line 1 x 4000 + line 1 x 4760 x line 4)	16,565 KWH/yr
7	Annual energy savings from door heater controls: (line 2 - line 6)	11,502 KWH/yr

7.29 05-08-004 – Strip Curtains on Commercial Walk-In Coolers and Freezer

This was a multiple customer aggregation project implemented by the Project Sponsor. It provides retrofits of cooler and freezer door where strip curtains were not present or damaged. Missing or damaged strip curtains increase energy use by compressors and fans in walk in coolers and freezers when the door remains open or unlatched, thus allowing cooled air to escape the contained environment. Walk in coolers and freezers in small grocery stores and liquor stores are frequently found with missing or damaged strip curtains, these facilities were targeted by the Project Sponsor for this program. A total of 408 sites participated in the project.

The Project Sponsor reported savings based on the average kWh and kW savings per square foot for strip curtains attributed in IOU work papers. Prior to the rollout of the program the Project Sponsor and SDG&E agreed to revised deemed savings values for cooler applications and freezer applications. These deemed savings values were derived from the IOU workpapers based on input from KSI. They are 0.028 kW and 241.63 kWh per square foot of strip curtain for coolers and 0.155 kW and 1,360.82 kWh per square foot of strip curtain for freezers. These values were used for estimating verified savings for this project. Table 240 shows a summary of the M&V for this project.

Table 240. M&V Savings Summary – 05-08-004

Total Contracted Savings (kWh)	10,000,000
Total Reported / Invoiced Savings (kWh)	10,008,335
M&V Savings (kWh)	**9,999,684**
Percent of Reported kWh Savings	99.9%
Total Contracted Savings (kW)	1,140
Total Reported / Invoiced Savings (kW)	1,140.7
M&V Savings (kW)	**1,139.7**
Percent of Reported kW Savings	99.9%

7.29.1 Measurement and Verification (M&V) Approach

The M&V approach for the project is summarized in this section. KSI coordinated with the Project Sponsor to perform post-retrofit M&V activities to support the tasks described below.

The load impact estimation methodology complies with IPMVP Option A.

1. Savings were calculated based on IOU workpaper savings numbers used throughout California and separated based on enclosure type. The break down of savings can be seen in Table 241.

Table 241. Unit Savings For Strip Curtains Coolers and Freezers

	kWh Savings per sq ft	Peak kW reduced per sq ft
Cooler	241.63	0.028
Freezer	1,360.82	0.155

2. For each store the Project Sponsor submitted an audit report to KSI and SDG&E prior to installation. Pre-installations inspections were conducted by SDG&E. Pre-installations inspections were conducted by SDG&E. The inspections verified that the existing conditions were either damaged strip curtains or no strip curtains.

3. Following the completion of the project the Project Sponsor submitted a list of the installations at each location. The information included square footage of each door, cooler or freezer, and savings.

4. A sample of sites was drawn to represent the total population of stores and savings reported. Site visits were made to each store in the sample and the savings evaluated. The M&V results of the sample are extrapolated to the population based on evaluation savings vs. reported savings.

   Table 242 shows the 19 sample sites post-inspected by KSI, and the total reported savings associated with these sites.

Table 242. Inspected Sites and Reported Savings

Site ID	Reported kWh Saved
Site 20	146,447
Site 29	157,401
Site 38	207,015
Site 40	61,976
Site 41	148,158
Site 43	127,005
Site 49	228,989
Site 67	4,543
Site 105	4,494
Site 115	4,494
Site 130	10,438
Site 132	4,543
Site 272	11,961
Site 331	325,436
Site 343	15,319
Site 371	14,304
	1,472,524

5. Site inspections consisted of the following actions:
   - Verify cooler or freezer operation type.
   - Verify installation of new strip curtain.
   - Verify new strip curtain was installed properly.
   - Verify measurements of installed strip curtain.

7.29.2 Results

This section provides the results of the M&V process. Overall the M&V estimates the savings for Project D (CESB #05-08-004) as 9,999,684 kWh per year and 1139.7 kW peak demand reduction. This is 99.9% of the reported savings.

For the most part, the reported measures and savings were confirmed by the M&V team. Slight discrepancies were found between the M&V measurements and reported measurements, but were well within normal margin of error for manual inspection measurements. Two strip curtains were unable to be found at Site 1023. These strip curtains were removed from the M&V savings but all other installations were credited full savings.

Table 243. Participants and Reported Savings

Site ID	Reported kWh Savings
Site 01	8,835
Site 02	9,951
Site 03	40,502
Site 04	7,812
Site 05	8,045
Site 06	6,464
Site 07	84,584
Site 08	141,081
Site 09	90,675
Site 10	94,302
Site 11	56,823
Site 12	11,114
Site 13	113,972
Site 14	84,956
Site 15	74,261
Site 16	84,723
Site 17	55,661
Site 18	82,166
Site 19	160,007
Site 20	95,093
Site 21	46,035
Site 22	75,656
Site 23	63,333
Site 24	113,832
Site 25	94,209
Site 26	165,447
Site 27	112,809
Site 28	91,559
Site 29	130,386
Site 30	65,565
Site 31	72,215
Site 32	62,171
Site 33	42,222
Site 34	78,446
Site 35	98,255
Site 36	14,927
Site 37	16,322
Site 38	124,853
Site 39	107,229
Site 40	75,330
Site 41	66,077
Site 42	132,525
Site 43	113,460
Site 44	32,643
Site 45	104,207
Site 46	120,110
Site 47	71,006
Site 48	46,268
Site 49	177,909
Site 50	7,812
Site 51	16,275
Site 52	9,068
Site 53	9,347
Site 54	16,368
Site 55	91,931
Site 56	9,114

Site 57	9,068
Site 58	7,626
Site 59	9,300
Site 60	9,068
Site 61	7,952
Site 62	8,603
Site 63	52,220
Site 64	9,254
Site 65	9,068
Site 66	18,135
Site 67	8,742
Site 68	7,394
Site 69	8,928
Site 70	9,068
Site 71	7,859
Site 72	7,859
Site 73	9,114
Site 74	8,649
Site 75	10,463
Site 76	8,556
Site 77	19,530
Site 78	9,207
Site 79	16,926
Site 80	9,114
Site 81	17,298
Site 82	8,277
Site 83	7,115
Site 84	7,673
Site 85	17,484
Site 86	7,812
Site 87	26,924
Site 88	8,417
Site 89	9,347
Site 90	17,252
Site 91	9,161
Site 92	8,231
Site 93	7,812
Site 94	9,300
Site 95	9,114
Site 96	25,389
Site 97	8,556
Site 98	16,182
Site 99	17,252
Site 100	26,180
Site 101	35,619
Site 102	9,440
Site 103	9,114
Site 104	9,207
Site 105	8,649
Site 106	8,789
Site 107	7,580
Site 108	7,905
Site 109	17,903
Site 110	7,812
Site 111	8,370
Site 112	83,886
Site 113	9,021
Site 114	17,856
Site 115	8,649
Site 116	8,231
Site 117	7,719
Site 118	26,970
Site 119	35,433

Site 120	17,996
Site 121	9,347
Site 122	7,812
Site 123	9,951
Site 124	9,207
Site 125	7,626
Site 126	7,626
Site 127	15,299
Site 128	8,556
Site 129	9,161
Site 130	20,088
Site 131	34,224
Site 132	8,742
Site 133	18,135
Site 134	7,115
Site 135	17,438
Site 136	7,766
Site 137	8,138
Site 138	27,575
Site 139	32,085
Site 140	59,148
Site 141	9,207
Site 142	7,626
Site 143	9,998
Site 144	8,417
Site 145	7,766
Site 146	9,068
Site 147	23,111
Site 148	17,438
Site 149	29,574
Site 150	40,595
Site 151	27,435
Site 152	115,971
Site 153	17,345
Site 154	9,393
Site 155	8,603
Site 156	61,845
Site 157	15,066
Site 158	9,905
Site 159	8,556
Site 160	9,254
Site 161	8,138
Site 162	7,719
Site 163	9,672
Site 164	7,487
Site 165	9,765
Site 166	7,905
Site 167	14,322
Site 168	17,112
Site 169	18,135
Site 170	7,347
Site 171	18,461
Site 172	9,765
Site 173	6,975
Site 174	9,393
Site 175	8,882
Site 176	9,393
Site 177	8,510
Site 178	19,809
Site 179	9,393
Site 180	16,787
Site 181	26,319
Site 182	17,345

Site 183	9,300
Site 184	16,461
Site 185	17,159
Site 186	9,300
Site 187	6,789
Site 188	9,393
Site 189	7,580
Site 190	15,578
Site 191	7,673
Site 192	8,696
Site 193	9,533
Site 194	7,626
Site 195	6,650
Site 196	43,989
Site 197	80,910
Site 198	15,996
Site 199	7,580
Site 200	9,347
Site 201	7,208
Site 202	9,533
Site 203	12,741
Site 204	8,045
Site 205	65,519
Site 206	9,347
Site 207	7,719
Site 208	9,068
Site 209	18,507
Site 210	9,021
Site 211	6,603
Site 212	16,740
Site 213	9,207
Site 214	55,382
Site 215	9,207
Site 216	9,021
Site 217	26,412
Site 218	8,091
Site 219	9,114
Site 220	9,021
Site 221	21,390
Site 222	22,134
Site 223	9,207
Site 224	9,068
Site 225	6,836
Site 226	6,836
Site 227	18,833
Site 228	9,068
Site 229	24,320
Site 230	17,298
Site 231	7,533
Site 232	7,487
Site 233	15,857
Site 234	14,741
Site 235	23,855
Site 236	8,835
Site 237	8,324
Site 238	17,577
Site 239	8,742
Site 240	24,459
Site 241	16,368
Site 242	9,300
Site 243	9,393
Site 244	6,557
Site 245	8,231

Site 246	7,068
Site 247	16,229
Site 248	9,905
Site 249	9,207
Site 250	9,533
Site 251	7,533
Site 252	16,508
Site 253	17,205
Site 254	27,203
Site 255	9,347
Site 256	8,556
Site 257	8,556
Site 258	9,672
Site 259	201,392
Site 260	54,080
Site 261	98,394
Site 262	7,719
Site 263	7,859
Site 264	8,370
Site 265	18,135
Site 266	9,300
Site 267	17,298
Site 268	27,807
Site 269	18,414
Site 270	9,254
Site 271	9,207
Site 272	23,018
Site 273	8,835
Site 274	9,207
Site 275	7,812
Site 276	8,603
Site 277	18,228
Site 278	9,114
Site 279	9,393
Site 280	6,882
Site 281	16,694
Site 282	15,206
Site 283	9,207
Site 284	8,649
Site 285	8,045
Site 286	9,393
Site 287	18,321
Site 288	8,696
Site 289	8,091
Site 290	7,580
Site 291	7,022
Site 292	9,393
Site 293	9,254
Site 294	16,229
Site 295	8,835
Site 296	8,742
Site 297	7,254
Site 298	9,114
Site 299	18,089
Site 300	8,835
Site 301	13,671
Site 302	17,717
Site 303	13,113
Site 304	13,392
Site 305	9,347
Site 306	33,434
Site 307	7,626
Site 308	49,709

Site 309	16,554
Site 310	32,550
Site 311	32,690
Site 312	16,415
Site 313	39,711
Site 314	9,114
Site 315	9,347
Site 316	9,300
Site 317	9,068
Site 318	8,138
Site 319	17,345
Site 320	18,135
Site 321	17,391
Site 322	17,205
Site 323	9,393
Site 324	9,905
Site 325	9,300
Site 326	37,898
Site 327	30,039
Site 328	16,508
Site 329	16,043
Site 330	8,882
Site 331	249,147
Site 332	17,159
Site 333	16,787
Site 334	8,184
Site 335	7,812
Site 336	8,231
Site 337	7,905
Site 338	14,741
Site 339	29,621
Site 340	45,663
Site 341	30,411
Site 342	44,408
Site 343	29,481
Site 344	26,087
Site 345	13,904
Site 346	9,114
Site 347	25,994
Site 348	17,438
Site 349	7,533
Site 350	18,135
Site 351	9,300
Site 352	9,068
Site 353	65,891
Site 354	8,231
Site 355	8,649
Site 356	42,594
Site 357	17,484
Site 358	9,672
Site 359	9,254
Site 360	8,928
Site 361	15,113
Site 362	14,415
Site 363	73,191
Site 364	18,228
Site 365	9,300
Site 366	15,950
Site 367	9,068
Site 368	11,439
Site 369	8,184
Site 370	7,719
Site 371	27,528

Site 372	32,597
Site 373	8,696
Site 374	16,740
Site 375	7,161
Site 376	6,603
Site 377	7,673
Site 378	34,643
Site 379	9,905
Site 380	49,290
Site 381	9,393
Site 382	17,903
Site 383	7,161
Site 384	33,620
Site 385	14,136
Site 386	9,254
Site 387	8,370
Site 388	36,410
Site 389	45,524
Site 390	15,996
Site 391	9,021
Site 392	29,574
Site 393	8,603
Site 394	31,713
Site 395	7,580
Site 396	22,553
Site 397	9,486
Site 398	9,347
Site 399	15,299
Site 400	9,207
Site 401	9,393
Site 402	16,182
Site 403	18,740
Site 404	9,114
Site 405	7,347
Site 406	7,812
Site 407	8,649
Site 408	18,600
Total Reported Savings	**10,008,425**

7.30 05-08-005 – Lighting Retrofit and Lighting Controls

This project was a lighting retrofit and lighting control installation conducted in a large office building. The building was divided into several distinct areas: large computer operations, hallways, and administrative offices. There were two measures to this project, the first measure was the lighting retrofit, all three lamp fixtures were de-lamped to two lamps, and the second measure was the installation of a new Energy Management System (EMS) that was programmed to turn off lights when an area was not occupied. Table 244 shows a summary of the M&V for this project.

Table 244. M&V Savings Summary

CONTRACTED	
Energy Savings (kWh)	
Total Contracted Savings (kWh)	1,362,806 kWh
M&V Savings (kWh)	1,557,858 kWh
Realization Rate (kWh)	114%
Demand Reduction (kW)	
Total Contracted Savings (kW)	200.608 kW
M&V Savings (kW)	200.613 kW
Realization Rate	100%

Table 245 provides a list of proposed areas where the lighting was retrofit and their associated savings. Table 246 shows the proposed savings from areas controlled by the EMS.

Table 245. Contracted Measures and Savings – 05-08-005

Line Item	Floor	Usage Group	Area Discription/Location	Pre Existing Fixture Quantity	Pre Fixture Watts	Pre Existing Operating Hours	Pre kW	Pre kWh	Proposed Fixture Quantity	Proposed Fixture Watts	Proposed Operating Hours	Proposed Post kW	Proposed Post kWh	Proposed kW Reduction	Proposed kWh Savings
1	1	A1	Computer Floor	1,116	0.115	5,475	128.34	702,661.50	1,116	0.044	5475	49.104	268,844.40	79.24	433,817.10
2	1	A2	Tape Library	80	0.115	8,760	9.20	80,592.00	80	0.044	8760	3.52	30,835.20	5.68	49,756.80
3	2	A3	EMC	40	0.115	8,760	4.60	40,296.00	40	0.044	8760	1.76	15,417.60	2.84	24,878.40
4	2	A4	Emergency Fixtures	94	0.115	8,760	10.81	94,695.60	94	0.044	8760	4.136	36,231.36	6.674	58,464.24
5	2	A5	Office Areas	1,458	0.115	5,475	167.67	917,993.25	1,458	0.044	5475	64.152	351,232.20	103.518	566,761.05
6	1	A6	Hallways/Emergency	21	0.072	8,760	1.51	13,245.12	21	0.044	8760	0.924	8,094.24	0.588	5,150.88
7	1	A7	Office Areas	74	0.072	5,475	5.33	29,170.80	74	0.044	5475	3.256	17,826.60	2.072	11,344.20
				2,883			**327.46**	**1,878,654.27**	**2,883**			**126.852**	**728,481.60**	200.61	**1,150,172.67**

Table 246. Contracted Operating Hours and Savings – 05-08-005

Line Item	Floor	Usage Group	Area Discription/Location	Proposed# Fixture Quantity	Installed kW	Pre Operating Hours	Baseline kWh	Proposed Operating Hours	Proposed kWh	Proposed kWh Savings
1	1	A1	Computer Floor	1,116	49.10	5,475	268,844.40	3,650	179,229.60	89,614.80
2	1	A2	Tape Library	80	3.52	8,760	30,835.20	8,760	30,835.20	0.00
3	2	A3	EMC	40	1.76	8,760	15,417.60	8,760	15,417.60	0.00
4	2	A4	Emergency Fixtures	94	4.14	8,760	36,231.36	8,760	36,231.36	0.00
5	2	A5	Office Areas	1,458	64.15	5,475	351,232.20	3,650	234,154.80	117,077.40
6	1	A6	Hallways/Emergency	21	0.92	8,760	8,094.24	8,760	8,094.24	0.00
7	1	A7	Office Areas	74	3.26	5,475	17,826.60	3,650	11,884.40	5,942.20
Total				**2,883**	**126.85**		**728,481.60**		**515,847.20**	**212,634.40**

7.30.1 Measurement and Verification (M&V) Approach

The M&V approach used for the project is summarized in this section. KSI coordinated with the Project Sponsor to perform a post-retrofit M&V activities to support the tasks described below.

7.30.1.1 Load Impact Verification Methodology

The load impact estimation methodology described in this plan complies with IPMVP Option A. Site inspections were employed to verify key M&V parameters. Due to the difference in contracted and verified hours of operation, the contracted kW reduced and savings are shown separately from the verified kW reduced and savings.

7.30.1.2 Analysis Approach for Verified Savings

The basic equation used to estimate the energy savings of this project is shown in Equation 1.

(Eq. 1) kWh savings = verified kWh $_{Pre}$ – verified kWh $_{Post}$

where:

verified kWh $_{Pre}$ =(# Fixtures $_{Pre}$) × (Fixture Wattage $_{Pre}$/1000) × (Hours of Operation $_{Pre}$); and

verified kWh $_{Post}$=(# Fixtures $_{Post}$) × (Fixture Wattage $_{Post}$/1000) × (Hours of Operation $_{Post}$).

The key parameters of Equation 1 are shown in Table 247.

Table 247. Key M&V Parameters

Parameter	M&V Activity
Fixture Counts	Fixture counts were verified through on-site inspection. Fixture counts were based on detailed worksheets provided by Project Sponsor.
Fixture Wattage $_{Pre}$ and Fixture Wattage $_{Post}$	Verified pre- and post- fixture types and fixture wattage values.
Hours of Operation	Project Sponsor proposed three of the seven areas will have reduced operating hours from 5,475 to 3,650 hours a year. Table 250 shows the proposed areas that were be controlled by the EMS. After the installation of the EMS, the operating hours for the entire building was controlled by the EMS, and in most areas the operating hours were reduced. Loggers were used to verify actual hours of operation.

7.30.1.3 On-Site Verification Inspections

On-site inspections were conducted to verify the equipment types and quantities. Light loggers were used to verify operating hours. Site inspections consisted of the verification of the installation of lighting equipment, including the verification of fixture types and wattages, and fixture counts.

The verification was based on as-built documentation provided to KSI by the Project Sponsor.

7.30.2 *M&V Results*

This section provides the results of the M&V process.
Table 248 shows a summary of the M&V findings compared to the reported load impacts for the lighting retrofit.

Table 248. Summary of Verified Savings – 05-08-005

Line Item	Floor	Usage Group	Area Discription/Location	Verified Pre Existing Fixture Quantity	Verified Pre Fixture Watts	Verified Pre Existing Operating Hours	Verified Pre kW	Verified Pre kWh	Verified Post Fixture Quantity	Verified Post Fixture Watts kW	Verified Post Operating Hours	Verified Post kW	Verified Post kWh	Proposed kW Reduction	Verified Savings kWh
1	1	A1	Computer Floor	712	0.115	5,475	81.88	448,293	712	0.044	1,393	31.33	43,651.20	50.552	404,641.80
2	1	A2	Tape Library	188	0.115	8,760	21.62	189,391	188	0.044	8,673	8.27	71,744.59	13.348	117,646.61
3	2	A3	EMC	55	0.115	8,760	6.33	55,407	55	0.044	4,772	2.42	11,547.25	3.905	43,859.75
4	2	A4	Emergency Fixtures	120	0.115	8,760	13.80	120,888	120	0.044	3,181	5.28	16,793.25	8.520	104,094.75
5	2	A5	Office Areas	1,704	0.115	5,475	195.96	1,072,881	1,704	0.044	2,915	74.98	218,519.76	120.984	854,361.24
6	1	A6	Hallways/Emergency	21	0.072	8,760	1.51	13,245	21	0.044	2,869	0.92	2,650.96	0.588	10,594.16
7	1	A7	Office Areas	97	0.072	5,475	6.98	38,237	97	0.044	3,650	4.27	15,578.20	2.716	22,659.20
				2,897			328.08	**1,938,343**	**2,897**			127.47	**380,485.21**	200.613	**1,557,857.51**

The following subsections provide additional details on the project and the M&V.

7.30.2.1 Fixture Types and Quantities

The pre- and post-inspections were based on worksheets of the measures provided by the Project Sponsor. All fixtures were retrofitted from first generation T8 to new fourth generation T8. The fixture counts and area description in the worksheet were different from the on site inspection. The result of the fixture quantity verification was that total proposed quantity was 14 fixtures short to the on site inspection. The proposed fixture types are shown in Table 249.

Table 249. Fixture Type and Quantities

Existing Fixture Type						Retrofitted Fixture					
Fixture Type	Basecase	Itemized Measure Code#	Fixture Code	Fixture Pre Quantities	Fixture Watts kW	Retrofit	Proposed Fixture Code Post-	Proposed Lamp Model Post-	Proposed Ballast Model	Fixture Pre Quantities	Proposed Fixture Watts kWh
2x4 recess	3-lamp T8 1st gen.	L-D3/LD-7	F43EE	2779	0.115	2-lamp T8 4th gen.	F42ILL	GE F28T8-PREM-ES	Advance IOP32LWSC	2779	0.044
2 lamp surface mount	2-lamp T8 1st gen.	L-D3	F42EE	118	0.072	2-lamp T8 4th gen.	F42ILL	GE F28T8-PREM-ES	Advance IOP32LWSC	118	0.044

7.30.2.2 Hours of Operation

The hours of operation were verified through the installation of light loggers in a sample of areas throughout the facility. To capture the diversity of usage by type of area the facility was categorized into five areas:

- Computer Floor, a large area including adjoining rooms and areas;
- Tape Library, a storage area proposed to have lights on 24-hours a day;
- Hallways, also proposed to have lights on 24-hours a day;
- EMC, a control room that analyses data and monitors the computers; and

- Office areas, administrative areas include large open areas and large rooms.

These areas were selected as they best represented the diversity of lighting usage in the facility. Each area description had its own unique usage.

7.30.2.2.1.1 Energy Management System (EMS)

The lighting fixture retrofits had a new form of time clock control installed. The EMS allowed the lights to be turned on or off as needed. The controls were programmed to turn lights off at 5:30 pm, unless an override was requested. The override period was one hour in some areas and two hours in other areas, thus ensuring lights are not on for excessively long periods of time when not needed. Table 250 shows the contracted pre hours and the proposed post hours controlled by the EMS. To verify these hours, KSI evaluated the hours of operation using light loggers.

Table 250. Proposed Hours of Operation Reduced – 05-08-005

Line Item	Floor	Usage Group	Area Discription/Location	Proposed Fixture Quantity	Pre Operating Hours	Proposed Post Operating Hours
1	1	A1	Computer Floor	1,116	5,475	3,650
2	1	A2	Tape Library	80	8,760	8,760
3	2	A3	EMC	40	8,760	8,760
4	2	A4	Emergency Fixtures	94	8,760	8,760
5	2	A5	Office Areas	1,458	5,475	3,650
6	1	A6	Hallways/Emergency	21	8,760	8,760
7	1	A7	Office Areas	74	5,475	3,650
Total				**2,883**		

7.30.2.3 3.2.2 Verification of Hours of Operation – Light Loggers

The hours of operation used to estimate the savings for contracting, were 8,760 hours per year for the Tape Library, EMC area and the hallways; and 3,650 hours per year for the office areas and computer floor. Light loggers were used to verify the hours of operation. The loggers were installed for a minimum of two (2) weeks. The data for each logger were cleaned and annualized. The annualized hours for the facility, was estimated by taking a weighted average between the hours for each area. The weight was based on the number of fixtures in each location.

The data from the loggers were used to calculate average annual hours for each area. A weighted average based on the number of fixtures in each individual area was calculated. The weighted averages varied from each area are shown in Table 251. Due to the reduced operating hours, the project savings increased from the contracted savings. The verified hours of operation are shown in Table 251.

Table 251. Verified Weighted Average Hours of Operation

Line Item	Floor	Usage Group	Area Discription/Location	Verified Fixture Quantity	Verified Pre Operating Hours	Verified Post Operating Hours
1	1	A1	Computer Floor	712	5,475	**1,393**
2	1	A2	Tape Library	188	8,760	**8,673**
3	2	A3	EMC	55	8,760	**4,772**
4	2	A4	Emergency Fixtures	120	8,760	**3,181**
5	2	A5	Office Areas	1,704	5,475	**2,915**
6	1	A6	Hallways/Emergency	21	8,760	**2,869**
7	1	A7	Office Areas	97	5,475	**3,650**
Total				**2,897**		

7.30.2.4 Verified Savings

The verified savings were calculated per Equation 1 and are shown in Table 252.

Table 252. Verified Fixture Counts, Types and Wattages

Contracted Savings												
Existing						Proposed						
Area Discription/Location	Pre Existing Fixture Quantity	Pre Fixture Watts	Pre Existing Operating Hours	Pre kW	Pre kWh	Proposed Fixture Quantity	Proposed Fixture Watts kW	Proposed Operating Hours	Proposed kW Post	Proposed kWh Post	Proposed kW Reduction	Proposed kWh Savings
Computer Floor	1,116	0.115	5,475	128.34	702,662	1,116	0.044	3,650	49.104	179,229.60	79.24	523,431.90
Tape Library	80	0.115	8,760	9.20	80,592	80	0.044	8,760	3.52	30,835.20	5.68	49,756.80
EMC	40	0.115	8,760	4.60	40,296	40	0.044	8,760	1.76	15,417.60	2.84	24,878.40
Emergency Fixtures	94	0.115	8,760	10.81	94,696	94	0.044	8,760	4.136	36,231.36	6.67	58,464.24
Office Areas	1,458	0.115	5,475	167.67	917,993	1,458	0.044	3,650	64.152	234,154.80	103.52	683,838.45
Hallways/Emergency	21	0.072	8,760	1.51	13,245	21	0.044	8,760	0.924	8,094.24	0.59	5,150.88
Office Areas	74	0.072	5,475	5.33	29,171	74	0.044	3,650	3.256	11,884.40	2.07	17,286.40
Totals	**2,883**			**327.46**	**1,878,654**	**2,883**			**126.852**	**515,847.20**	200.61	**1,362,807.07**

Verifed Savings												
Existing						Verified						
Area Discription/Location	Verified Pre Existing Fixture Quantity	Verified Pre Fixture Watts	Verified Pre Existing Operating Hours	Verified Pre kW	VerifiedPre kWh	Verified Fixture Quantity Post-	Verified Fixture Watts	Verified Operating Hours plus advoided hours	Verified kW	Verified kWh	Proposed kW Reduction	Verified kWh Savings
Computer Floor	712	0.115	5,475	81.88	448,293	712	0.044	1,393	31.328	43,651.20	50.55	404,641.80
Tape Library	188	0.115	8,760	21.62	189,391	188	0.044	8,673	8.272	71,744.59	13.35	117,646.61
EMC	55	0.115	8,760	6.33	55,407	55	0.044	4,772	2.42	11,547.25	3.91	43,859.75
Emergency Fixtures	120	0.115	8,760	13.80	120,888	120	0.044	3,181	5.28	16,793.25	8.52	104,094.75
Office Areas	1,704	0.115	5,475	195.96	1,072,881	1,704	0.044	2,915	74.976	218,519.76	120.98	854,361.24
Hallways/Emergency	21	0.072	8,760	1.51	13,245	21	0.044	2,869	0.924	2,650.96	0.59	10,594.16
Office Areas	97	0.072	5,475	6.98	38,237	97	0.044	3,650	4.268	15,578.20	2.72	22,659.20
Totals	**2,897**			**328.08**	**1,938,343**	**2,897**			**127.468**	**380,485.21**	**200.61**	**1,557,857.51**
										Realization Rate =		**114%**

Some of the key findings are:

- **Realization Rates:** The realization rate for kWh savings is 114%. A realization rate greater than 100% indicates the project is saving more energy than was proposed. The EMS was the primary reason the realization rate was greater than 100. During the on site inspection, only 14 extra fixtures were found. Only in the Hallway and Office Areas that had existing two lamp 72 watt fixtures, where the quantities changed, did we see a difference in the KWh savings for the lighting retrofit. The operating hours for the building were greater than the proposed operating hours. The verified kWh savings were 14% higher than the kWh savings reported through the as-built documentation.

- **Hours of Operation:** The EMS system was able to reduce the operating hours to levels that were far less than was proposed, thus increasing the kWh savings. Fixtures in areas

that were operating 8,760 hours a year are now reduced by the EMS. Bringing the proposed annual savings from 1,362,807 kWh to 1,557,857 kWh.

Table 253. Summary of M&V of Lighting Retrofit Projects

Verified Savings Summary		
PROPOSED	**Energy Savings (kWh)**	**Demand Reduction (kW)**
Retrofit	1,150,173	200.61
EMS	212,634	
Total Proposed	**1,362,807**	**200.61**
VERIFIED	**Energy Savings (kWh)**	**Demand Reduction (kW)**
Verified Savings	**1,557,858**	**200.61**
Realization Rate	114%	100%

7.31 05-08-007 – Improvements on Central Chiller Plant

The central plant was retrofitted to a single loop chilled water distribution with variable speed pumping, installation of chillers with variable frequency drives (VFDs) replacing the constant speed chillers, and variable speed hot water pumps. In addition, Hotel Tech guestroom energy management thermostats were installed in all guestrooms of the hotel. Table 254 shows a summary of the M&V for this project.

Table 254. M&V Savings Summary – 05-08-007

Total Contracted kWh Savings	845,091
Total Reported / Invoiced kWh Savings	45,091
M&V Savings (kWh)	**561,034**
Percent of Reported kWh Savings	66%
Percent of Contracted kWh Savings	66%
Total Contracted kW Savings	34.6
Total Reported / Invoiced kW Savings	34.6
M&V Savings (kW)	**59.3**
Percent of Reported kW Savings	171%
Percent of Contracted kW Savings	171%

Table 255 shows the basecase equipment and the new equipment installed at the site.

Table 255. Equipment Summary

Meas.	Baseline Equipment	New Equipment
1	(2) Chilled water primary pumps, 30 hp each	(2) Chilled water primary pumps equipped with VFDs, 30 hp each
2	(2) Energy efficient, centrifugal chillers, 360-tons each	(2) Centrifugal chillers equipped with VFDs, 360-tons each
3	(2) Hot water primary pumps, 10 hp each	(2) Hot water primary pumps equipped with VFDs, 10 hp each
4	Standard manual guestroom thermostats	Hotel Tech automatic fan setback thermostats

7.31.1 MEASUREMENT AND VERIFICATION (M&V) APPROACH

The energy savings is calculated as the sum of the measured energy consumption of all the postmodification equipment subtracted from the sum of the measured or calculated energy consumption of the baseline equipment at the loads measured. The method for estimating the baseline and new equipment energy consumption is outlined below. The load impact estimation methodology complies with IPMVP Option A.

7.31.1.1 Measure 1- Chilled Water Pumping Savings

The savings due to installing VFDs on the chilled water pumps was estimated by trending the profile of the pumps with the VFD to determine the post case energy consumption. The base case consumption was estimated by spot measurement of the original pump power and using the trending data to determine the runtime of the pumps.

Initially the trending took place for 126 days (4/12/06 to 8/15/06). The data showed that the pumps were operating at near full load most of the time. An initial draft of the M&V reported savings of only 10,165 kWh per year. Subsequently additional commissioning of the system was performed and it was discovered that some valves were frozen (not modulating). Repairs were made and trend data was collected again from 4/11/2007 to 5/17/2007.

7.31.1.1.1 VFD Pumping Energy Consumption

The output signal, % speed, was recorded via the EMS in 15-minute intervals. The % speed was converted to kW using the affinity laws as shown below.

$$kW_{op} = (\%\ speed)^3\ kW_{100\%\ speed}$$

where:

$kW_{op.}$ = Power for the interval
%speed = Direct measurement for the interval
$kW_{100\%speed}$ = Power draw of motor at 100% speed

The load profile, % speed, and associate energy consumption of the pumps is shown Table 256. The profile, developed from the measurement period, is assumed to be representative of annual conditions.

Table 256. Chilled Water Pump Operating Characteristics

%Speed	CHWP3 %time	CHWP4 %time	CHWP3 kW@load	CHWP4 kW@load	CHWP3 kWh	CHWP4 kWh
0	55%	35%	0	0	0	0
5	0%	0%	0	0	0	0
10	0%	0%	0	0	0	0
15	0%	0%	0	0	0	0
20	0%	0%	0	0	0	0
25	0%	0%	0	0	0	0
30	0%	0%	1	1	0	0
35	0%	0%	1	1	0	0
40	0%	10%	1	1	4	1,238
45	0%	0%	2	2	0	0
50	0%	0%	3	3	0	0
55	0%	0%	4	4	9	0
60	0%	0%	5	5	147	0
65	1%	0%	6	6	703	0
70	3%	0%	8	8	1,990	0
75	6%	0%	9	9	5,207	0
80	9%	8%	11	11	9,027	8,503
85	10%	18%	14	14	11,526	21,132
90	8%	11%	16	16	10,946	16,253
95	3%	10%	19	19	5,071	17,067
100	5%	7%	23	23	10,038	14,648
					54,669	78,841
				Total Pump kWh		133,510

7.31.1.1.2 Baseline Pumps Energy Consumption

The baseline chilled water pumps were spot measured to draw 31.9 amps. The kW was calculated as:

$$\textit{BaselineChilled Water PumpkW} = 31.9\ \textit{amps} \times 480\ \textit{volts} \times 3 \times .865\ \textit{pwrfactor} \div 1000$$
$$= 22.96\ \textit{kW}$$

There are (2) 30-horsepower chilled water pumps. Each pump operates with an associated chiller. Typical operation is one chiller. On rare occasion both chillers operate. The kWh is calculated using the hours of operation shown by the measured data. The measured data shows that only one pump operates most of the time (91.4%). Two pumps operate the remaining 8.6%. The energy consumption is shown Table 257.

Table 257. BaselineChilled Water Pump Consumption

Pumps On	% of Time	Base kWh
1	91.4%	183,891
2	8.6 %	34,549
Total		**218,440**

7.31.1.1.3 Chilled Water Pumping Energy Savings

Chilled Water Pumping Savings = 218,440 kWh – 133,510 kWh
= 84,930 kWh

The total energy savings of 84,930 kWh is a little low because the pumps are operating at a relatively high speed much of the time.

7.31.1.1.4 Chilled Water Pumping Average Peak Demand Savings

The measured data suggests that most of the peak period there is only one pump running and the average speed is 53%. Using the affinity laws, as above, results in postcase kW of 3.24 kW. The pre-case kW is 22.96 kW and the average peak demand savings is 19.72 kW.

7.31.1.2 Measure 2- VFD Chiller Savings

The chiller savings were determined by measuring the load and energy consumption of the new VFD chiller as well as outside temperature. A correlation between load and temperature was developed to extrapolate the load profile to an average annual basis. Also a correlation was developed between load and energy consumption for the chiller. This provided the annual load profile and energy consumption of the new chiller. The baseline chiller energy consumption was estimated using the same load profile and the performance of a standard constant speed chiller. The standard curve is used because baseline measurement of the original chiller was not obtained due to the timing of the project. Development of the baseline energy use is described in more detail below. The current chiller operation was measured via the EMS in 15-minute intervals for 126 days (4/12/06 to 8/15/06). Measured values included:

- Chiller Power (amps)
- Chilled Water Supply Temperature (°F)
- Chilled Water Return Temperature (°F)

- Ambient Wet Bulb and Dry Bulb Temp.
- Condenser Water Supply Temperature (°F)
- Condenser Water Return Temperature (°F)
- Performance data obtained from York shows the full load chilled water flow as 864 gpm.

7.31.1.2.1 VFD Chiller Energy Consumption

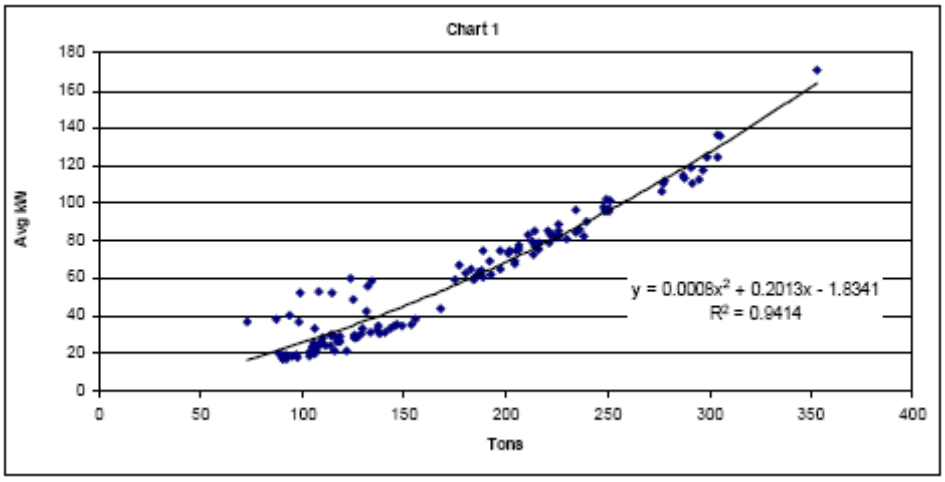
For each interval the chiller plant load, in tons, was calculated using the following formula:

Tons = [total chilled water flow
x (chilled water supply temp – chilled water return temp)
x 8.64 lbs/gal x 60 min/hr]
÷ 12000 btu/ton

Tons = [((CHWP3 %speed*864gpm)
+(CHWP4 %speed*864gpm))
*(CHW supply temp-CHW return temp)*500]
÷ 12000

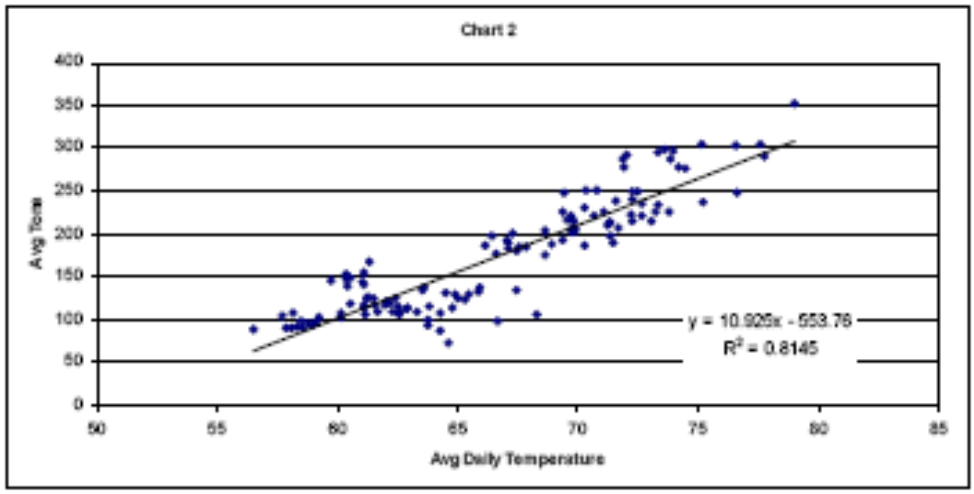
The chiller power was calculated for each interval based on the recorded chiller amps. The chiller performance curve is depicted in Figure 31.

Figure 31. Chiller Performance Curve



In order to extrapolate the chiller load to an annual basis the daily ton-hours was correlated with the average daily temperature. The correlation is shownFigure 32.

Figure 32. Correlation of Daily Ton-Hours with Average Daily Temperature



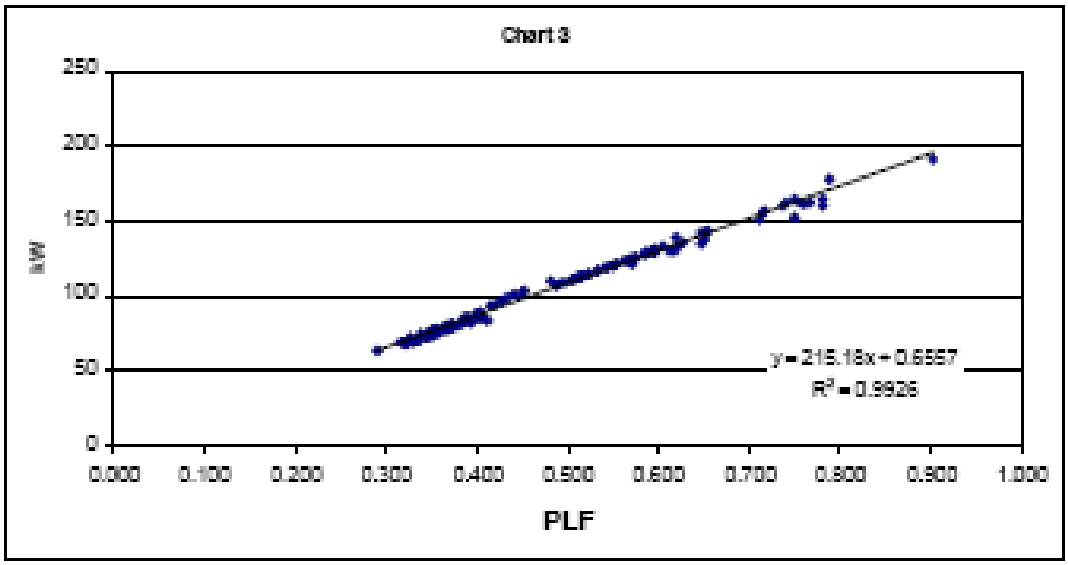
The average daily temperature for each day of a Typical Meteorological Year (TMY)1 was obtained for Climate Zone 7 (San Diego). The average daily chiller load was calculated for each day of a TMY year using the correlation of chiller load to average daily temperature shown in Figure 32. The average kW for each day was calculated using the correlation of tons vs. kW shown in Figure 31. The daily energy consumption is the average hourly kW multiplied by 24 hours per day. The annual energy consumption is the sum of the 365 days. The data is shown at the end of this report.

7.31.1.2.2 Baseline Chiller Energy Consumption

The baseline, constant speed, chiller energy consumption was developed by applying a standard chiller performance curve to the annual chiller load profile developed as described above. In essence, determining what a standard constant speed chiller would consume at the same load profile. The standard chiller curve was developed for the Standard Performance Contract program implemented by California utilities. The same performance standard is used by Title 24 compliance models. The curve is based on ARI operating temperatures of 44°F chilled water and 85°F condenser water. The capacity and performance are adjusted for non-standard operating conditions.

From the measured data, the average daily load, chilled water temperature, and condenser water temperature were input to the model to determine the baseline chiller kW. The correlation between chiller part load factor and kW is shown in Figure 33.

Figure 33. Correlation of Chiller Part Load Factor and kW



This correlation was used to calculate the baseline chiller kW for each of the TMY days of the year. The annual baseline energy consumption is the sum of the 365 days in the model. The data is shown Table 259.

7.31.1.2.3 VFD Chiller Energy Savings

The results of this approach are 325,783 kWh per year savings.

7.31.1.3 Measure 3- VFD Hot Water Pumping Savings

The calculated savings in the CESB application for this measure were reviewed. No measurement was performed because the M&V took place in the summer when the hot water pumps are not used. The savings due to this measure accounts for only 1.5% of the total. The contracted savings is reasonable.

7.31.1.4 Measure 4- Automatic Setback Guestroom Thermostats Savings

Due to the cost of measuring the savings in relation to the magnitude of savings, M&V consisted only of review of secondary sources. SDG&E performed a savings evaluation of the same

automatic setback thermostats at another property owned by this hotel chain. The results of that study were applied to this project. Based on the data available, the two properties are similar in all factors that contribute to the energy use of room HVAC. Therefore, the savings from this measure would be similar. This measure accounts for 16% of the total savings. We estimate a ±30% precision for this measure which affects the project total by only ±5%.

7.31.2 Results

The measurement and verification of savings achieved by this project results in an estimate of 561,034 kWh per year and 59.3 kW peak demand reduction. This is 66% and 171% of the contracted savings respectively. The contracted savings of 845,091 kWh per year is not being achieved mainly because the chiller savings was overestimated using the SPC software and the chilled water pumps are operating near full speed all the time. The M&V results compared with the contracted savings is shown for each measure in Table 258.

Table 258. M&V Savings By Measure

		kWh		Peak kW	
#	Measure	M&V Savings	Contracted Savings	M&V Savings	Contracted Savings
1	VFD Chiller	325,783	586,880	39.6	0
2	CHWP VFDs	84,930	107,890	19.72	34.6
3	HWP VFDs	12,274	12,274	0	0
4	Hotel Tech t-stats	138,047	138,047	0	0
	Total	561,034	845,091	59.3	34.6
			66%		171%

7.31.2.1.1 Daily Energy Savings for TMY

- Avg. Tons = 10.925*Avg TMY DBT - 553.76 [from Chart 2]
- Avg. PLF = Avg. Tons / 360 tons
- New kWh/day = (0.0008*Avg Tons^2 + 0.2013*Avg Tons - 1.8341)*24 hours [from Figure 31]
- Base kWh/day = (215.18*PLR + 0.6557)*24 hours [from Figure 33]

Table 259. Chiller kW for Each Hour of TMY

Day	Avg TMY DBT	Avg Tons	Avg PLR	New kWh/day	Base kWh/day
1/1/2006	57.4	73.1	0.203	411	1,064
1/2/2006	55.5	53	0.147	266	777
1/3/2006	58.8	88.1	0.245	530	1,279
1/4/2006	52.3	17.5	0.049	47	267
1/5/2006	49.2	0	0	0	16
1/6/2006	50.5	0	0	0	16
1/7/2006	52.5	19.3	0.054	57	293
1/8/2006	55.8	55.3	0.154	282	809
1/9/2006	57.5	74	0.205	418	1,077
1/10/2006	59.1	92.2	0.256	564	1,338
1/11/2006	58.2	81.7	0.227	479	1,188
1/12/2006	58.9	89.4	0.248	542	1,299
1/13/2006	62.3	127.2	0.353	881	1,841
1/14/2006	60.6	108.6	0.302	707	1,573
1/15/2006	61.1	113.6	0.315	752	1,645
1/16/2006	60.8	109.9	0.305	719	1,593
1/17/2006	60	102.2	0.284	650	1,482
1/18/2006	58.4	84.4	0.235	501	1,227
1/19/2006	58.7	87.6	0.243	527	1,273
1/20/2006	52.1	15.3	0.042	34	235
1/21/2006	53.6	32.1	0.089	131	476
1/22/2006	54.6	42.6	0.118	196	626
1/23/2006	56	58.5	0.162	304	855
1/24/2006	55.2	48.9	0.136	238	718
1/25/2006	56.3	61.7	0.171	327	901
1/26/2006	58.6	86.3	0.24	516	1,253
1/27/2006	55.9	56.7	0.157	291	829
1/28/2006	58.8	88.5	0.246	534	1,286
1/29/2006	58.6	86.3	0.24	516	1,253
1/30/2006	56.5	64	0.178	344	933
1/31/2006	59.2	93.1	0.259	572	1,351
2/1/2006	54.3	38.9	0.108	173	574
2/2/2006	56.8	66.7	0.185	364	972
2/3/2006	55.4	51.2	0.142	254	750
2/4/2006	55.5	52.6	0.146	263	770
2/5/2006	56.2	59.9	0.166	314	874
2/6/2006	56.5	63	0.175	337	920
2/7/2006	54.5	42.1	0.117	193	620
2/8/2006	57.8	78.1	0.217	450	1,136
2/9/2006	58.2	81.7	0.227	479	1,188
2/10/2006	57.6	75.3	0.209	429	1,096
2/11/2006	60	102.2	0.284	650	1,482
2/12/2006	59.5	96.7	0.269	603	1,403
2/13/2006	57.9	79	0.219	457	1,149
2/14/2006	55.7	54.4	0.151	276	796
2/15/2006	57	69	0.192	380	1,005
2/16/2006	56.5	63	0.175	337	920

Table 259. Chiller kW for Each Hour of TMY (con't)

Day	Avg TMY DBT	Avg Tons	Avg PLR	New kWh/day	Base kWh/day
2/17/2006	55.5	53	0.147	266	777
2/18/2006	56.6	64.9	0.18	350	946
2/19/2006	56.4	62.1	0.173	330	907
2/20/2006	56	57.6	0.16	298	842
2/21/2006	55.4	51.2	0.142	254	750
2/22/2006	56.7	65.8	0.183	357	959
2/23/2006	57	69.4	0.193	384	1,012
2/24/2006	56.3	61.2	0.17	324	894
2/25/2006	56.1	59.4	0.165	311	868
2/26/2006	54.5	42.1	0.117	193	620
2/27/2006	54.9	46.2	0.128	220	679
2/28/2006	54.7	43.9	0.122	205	646
3/1/2006	61.3	115.9	0.322	773	1,678
3/2/2006	58.8	89	0.247	538	1,292
3/3/2006	57.2	71.2	0.198	398	1,038
3/4/2006	55.8	56.2	0.156	288	822
3/5/2006	58	79.4	0.221	461	1,155
3/6/2006	57.4	73.5	0.204	415	1,070
3/7/2006	57.7	76.7	0.213	440	1,116
3/8/2006	59.8	99	0.275	623	1,436
3/9/2006	57.8	77.2	0.214	443	1,123
3/10/2006	57.5	74.9	0.208	425	1,090
3/11/2006	58	79.4	0.221	461	1,155
3/12/2006	58	79.4	0.221	461	1,155
3/13/2006	58	80.3	0.223	468	1,168
3/14/2006	59.2	92.6	0.257	568	1,345
3/15/2006	57.8	77.6	0.216	447	1,129
3/16/2006	57.1	69.9	0.194	387	1,018
3/17/2006	56.6	64.9	0.18	350	946
3/18/2006	56	57.6	0.16	298	842
3/19/2006	56.7	65.3	0.181	354	953
3/20/2006	59	91.3	0.254	557	1,325
3/21/2006	58.6	86.7	0.241	519	1,260
3/22/2006	57.5	74.9	0.208	425	1,090
3/23/2006	57.5	74	0.205	418	1,077
3/24/2006	56.6	64.9	0.18	350	946
3/25/2006	56.1	59	0.164	308	861
3/26/2006	55.7	54.9	0.152	279	803
3/27/2006	55.7	54.4	0.151	276	796
3/28/2006	54.7	43.9	0.122	205	646
3/29/2006	56.2	60.3	0.168	317	881
3/30/2006	57.4	73.5	0.204	415	1,070
3/31/2006	57.8	77.6	0.216	447	1,129
4/1/2006	60.7	109.5	0.304	715	1,586
4/2/2006	58.7	87.6	0.243	527	1,273
4/3/2006	58.9	89.4	0.248	542	1,299
4/4/2006	60.8	110.4	0.307	723	1,599
4/5/2006	60.5	107.2	0.298	695	1,554
4/6/2006	58.4	84	0.233	497	1,221
4/7/2006	58.7	87.2	0.242	523	1,266
4/8/2006	58	79.9	0.222	464	1,162
4/9/2006	59	91.3	0.254	557	1,325
4/10/2006	58.6	86.7	0.241	519	1,260
4/11/2006	59.8	99	0.275	623	1,436

Table 259. Chiller kW for Each Hour of TMY (con't)

Day	Avg TMY DBT	Avg Tons	Avg PLR	New kWh/day	Base kWh/day
4/12/2006	60.4	105.8	0.294	682	1,534
4/13/2006	60.1	103.1	0.286	658	1,495
4/14/2006	62.8	132.7	0.369	935	1,919
4/15/2006	60	101.3	0.281	642	1,469
4/16/2006	58.5	85.4	0.237	508	1,240
4/17/2006	60	101.7	0.283	646	1,475
4/18/2006	59.9	100.4	0.279	634	1,456
4/19/2006	59.2	93.1	0.259	572	1,351
4/20/2006	53.1	26.6	0.074	98	398
4/21/2006	53.6	32.1	0.089	131	476
4/22/2006	55	47.1	0.131	226	692
4/23/2006	58	79.4	0.221	461	1,155
4/24/2006	60.5	107.7	0.299	699	1,560
4/25/2006	60.9	111.3	0.309	732	1,612
4/26/2006	62.3	126.3	0.351	873	1,828
4/27/2006	60.8	110.4	0.307	723	1,599
4/28/2006	61.4	116.8	0.324	782	1,691
4/29/2006	60.8	109.9	0.305	719	1,593
4/30/2006	61.8	120.9	0.336	820	1,749
5/1/2006	61.3	116.3	0.323	778	1,684
5/2/2006	61.2	114.9	0.319	765	1,665
5/3/2006	59.9	100.4	0.279	634	1,456
5/4/2006	61.2	114.9	0.319	765	1,665
5/5/2006	62.6	130.4	0.362	913	1,887
5/6/2006	62.2	125.9	0.35	868	1,821
5/7/2006	62.1	124.5	0.346	855	1,802
5/8/2006	61.9	122.2	0.34	833	1,769
5/9/2006	61.3	115.4	0.321	769	1,671
5/10/2006	61.5	118.1	0.328	795	1,710
5/11/2006	61.6	119.5	0.332	807	1,730
5/12/2006	60.5	107.7	0.299	699	1,560
5/13/2006	62.4	127.7	0.355	886	1,847
5/14/2006	65.2	158.6	0.441	1,206	2,291
5/15/2006	66.4	171.4	0.476	1,348	2,474
5/16/2006	65.8	165.5	0.46	1,281	2,389
5/17/2006	63.2	136.8	0.38	976	1,978
5/18/2006	65.4	160.9	0.447	1,231	2,324
5/19/2006	62.6	130	0.361	908	1,880
5/20/2006	61.9	122.7	0.341	838	1,776
5/21/2006	62.3	127.2	0.353	881	1,841
5/22/2006	62	124	0.345	851	1,795
5/23/2006	60.7	109.5	0.304	715	1,586
5/24/2006	60.1	102.7	0.285	654	1,488
5/25/2006	60.8	110.8	0.308	727	1,606
5/26/2006	63.6	140.9	0.391	1,018	2,037
5/27/2006	60.9	111.3	0.309	732	1,612
5/28/2006	60.5	107.2	0.298	695	1,554
5/29/2006	62.3	126.8	0.352	877	1,834
5/30/2006	62.1	124.5	0.346	855	1,802
5/31/2006	62.9	133.1	0.37	940	1,926
6/1/2006	63.5	139.5	0.388	1,004	2,017
6/2/2006	64.8	154.1	0.428	1,156	2,226
6/3/2006	63.7	141.8	0.394	1,027	2,050
6/4/2006	63.6	141.3	0.393	1,022	2,043
6/5/2006	64.2	147.3	0.409	1,084	2,128

Table 259. Chiller kW for Each Hour of TMY (con't)

Day	Avg TMY DBT	Avg Tons	Avg PLR	New kWh/day	Base kWh/day
6/6/2006	65.4	160.5	0.446	1,226	2,318
6/7/2006	63.7	142.3	0.395	1,032	2,056
6/8/2006	64.3	148.2	0.412	1,093	2,141
6/9/2006	65.8	164.6	0.457	1,271	2,376
6/10/2006	64.7	152.7	0.424	1,142	2,207
6/11/2006	65.5	162.3	0.451	1,246	2,344
6/12/2006	63.5	139.5	0.388	1,004	2,017
6/13/2006	64.3	148.6	0.413	1,098	2,148
6/14/2006	65.3	159.1	0.442	1,211	2,298
6/15/2006	65.6	163.2	0.453	1,256	2,357
6/16/2006	64.6	151.8	0.422	1,132	2,194
6/17/2006	65.3	160	0.444	1,221	2,311
6/18/2006	65.6	162.7	0.452	1,251	2,350
6/19/2006	66.3	170.9	0.475	1,343	2,468
6/20/2006	66.5	172.8	0.48	1,364	2,494
6/21/2006	63.6	140.9	0.391	1,018	2,037
6/22/2006	64.3	148.6	0.413	1,098	2,148
6/23/2006	66.6	174.1	0.484	1,379	2,514
6/24/2006	67	178.7	0.496	1,432	2,579
6/25/2006	69	200.1	0.556	1,691	2,886
6/26/2006	67	178.2	0.495	1,427	2,572
6/27/2006	68.1	190.5	0.529	1,573	2,749
6/28/2006	67.1	179.1	0.498	1,437	2,585
6/29/2006	66.2	169.6	0.471	1,327	2,448
6/30/2006	66.3	170	0.472	1,332	2,455
7/1/2006	68.2	191	0.53	1,579	2,755
7/2/2006	67.9	187.8	0.522	1,540	2,709
7/3/2006	65.8	165.5	0.46	1,281	2,389
7/4/2006	65.4	160.5	0.446	1,226	2,318
7/5/2006	64.8	153.6	0.427	1,151	2,220
7/6/2006	64.6	151.8	0.422	1,132	2,194
7/7/2006	65.9	165.9	0.461	1,286	2,396
7/8/2006	67	178.2	0.495	1,427	2,572
7/9/2006	67.3	180.9	0.503	1,459	2,611
7/10/2006	66.9	176.8	0.491	1,411	2,553
7/11/2006	69	199.6	0.554	1,685	2,879
7/12/2006	73.1	244.7	0.68	2,287	3,526
7/13/2006	73	243.8	0.677	2,275	3,513
7/14/2006	69	200.5	0.557	1,697	2,892
7/15/2006	69.5	205.1	0.57	1,754	2,958
7/16/2006	64.9	155	0.431	1,166	2,239
7/17/2006	69.6	206.4	0.573	1,772	2,977
7/18/2006	72.5	237.8	0.661	2,191	3,428
7/19/2006	71.1	222.8	0.619	1,986	3,212
7/20/2006	69.7	207.8	0.577	1,789	2,997
7/21/2006	72.9	242.9	0.675	2,262	3,500
7/22/2006	72.7	240.1	0.667	2,223	3,460
7/23/2006	69.8	209.2	0.581	1,807	3,016
7/24/2006	69.7	207.3	0.576	1,783	2,990
7/25/2006	68.5	195.1	0.542	1,629	2,814
7/26/2006	68.9	198.7	0.552	1,674	2,866

Table 259. Chiller kW for Each Hour of TMY (con't)

Day	Avg TMY DBT	Avg Tons	Avg PLR	New kWh/day	Base kWh/day
7/27/2006	69.7	207.8	0.577	1,789	2,997
7/28/2006	69.6	206.4	0.573	1,772	2,977
7/29/2006	70	211.4	0.587	1,836	3,049
7/30/2006	71	221.9	0.616	1,974	3,199
7/31/2006	75.4	269.7	0.749	2,656	3,885
8/1/2006	68.8	198.2	0.551	1,668	2,860
8/2/2006	68.8	198.2	0.551	1,668	2,860
8/3/2006	69.2	202.3	0.562	1,720	2,918
8/4/2006	69.1	201.4	0.56	1,708	2,905
8/5/2006	68	189.1	0.525	1,557	2,729
8/6/2006	68.2	191	0.53	1,579	2,755
8/7/2006	70.7	218.3	0.606	1,925	3,147
8/8/2006	75.2	267.9	0.744	2,628	3,859
8/9/2006	71	221.5	0.615	1,968	3,193
8/10/2006	69.1	201	0.558	1,702	2,899
8/11/2006	69.2	201.9	0.561	1,714	2,912
8/12/2006	69	199.6	0.554	1,685	2,879
8/13/2006	69.8	208.7	0.58	1,801	3,010
8/14/2006	68.1	190.5	0.529	1,573	2,749
8/15/2006	73.8	252	0.7	2,392	3,630
8/16/2006	72.2	235.1	0.653	2,153	3,389
8/17/2006	71.5	227.8	0.633	2,053	3,284
8/18/2006	71.5	227.8	0.633	2,053	3,284
8/19/2006	72.6	239.7	0.666	2,217	3,454
8/20/2006	70.9	220.5	0.613	1,955	3,180
8/21/2006	70.1	211.9	0.589	1,842	3,056
8/22/2006	69	200.5	0.557	1,697	2,892
8/23/2006	68.5	194.6	0.541	1,623	2,807
8/24/2006	67.9	187.8	0.522	1,540	2,709
8/25/2006	70.1	211.9	0.589	1,842	3,056
8/26/2006	70.9	220.5	0.613	1,955	3,180
8/27/2006	70.3	213.7	0.594	1,866	3,082
8/28/2006	71.1	223.3	0.62	1,992	3,219
8/29/2006	70.4	215.5	0.599	1,889	3,108
8/30/2006	67.3	180.9	0.503	1,459	2,611
8/31/2006	69.5	205.1	0.57	1,754	2,958
9/1/2006	69	200.1	0.556	1,691	2,886
9/2/2006	68.9	199.2	0.553	1,680	2,873
9/3/2006	69.7	207.3	0.576	1,783	2,990
9/4/2006	68.8	198.2	0.551	1,668	2,860
9/5/2006	69.2	201.9	0.561	1,714	2,912
9/6/2006	68.3	192.3	0.534	1,595	2,775
9/7/2006	67.5	183.2	0.509	1,486	2,644
9/8/2006	68.6	196	0.544	1,640	2,827
9/9/2006	70.2	212.8	0.591	1,854	3,069
9/10/2006	71.7	229.2	0.637	2,072	3,304
9/11/2006	68.5	195.1	0.542	1,629	2,814
9/12/2006	71.6	228.3	0.634	2,060	3,291
9/13/2006	71	222.4	0.618	1,980	3,206
9/14/2006	71.7	229.7	0.638	2,078	3,310
9/15/2006	68.4	193.7	0.538	1,612	2,794

Table 259. Chiller kW for Each Hour of TMY (con't)

Day	Avg TMY DBT	Avg Tons	Avg PLR	New kWh/day	Base kWh/day
9/16/2006	67.1	179.1	0.498	1,437	2,585
9/17/2006	69.5	205.1	0.57	1,754	2,958
9/18/2006	70	211	0.586	1,830	3,042
9/19/2006	70.3	213.7	0.594	1,866	3,082
9/20/2006	69.3	203.7	0.566	1,737	2,938
9/21/2006	67.8	187.3	0.52	1,535	2,703
9/22/2006	68.3	192.8	0.536	1,601	2,781
9/23/2006	68.2	191.4	0.532	1,584	2,762
9/24/2006	68.6	196	0.544	1,640	2,827
9/25/2006	68.4	193.7	0.538	1,612	2,794
9/26/2006	67.2	180	0.5	1,448	2,598
9/27/2006	68	189.6	0.527	1,562	2,736
9/28/2006	67.8	186.9	0.519	1,529	2,696
9/29/2006	67.7	185.5	0.515	1,513	2,677
9/30/2006	66.6	174.1	0.484	1,379	2,514
10/1/2006	65.1	157.3	0.437	1,191	2,272
10/2/2006	65.5	162.3	0.451	1,246	2,344
10/3/2006	65.1	157.7	0.438	1,196	2,278
10/4/2006	64.6	151.8	0.422	1,132	2,194
10/5/2006	63	134.1	0.372	949	1,939
10/6/2006	64.8	154.5	0.429	1,161	2,233
10/7/2006	64.5	150.4	0.418	1,117	2,174
10/8/2006	63.3	137.2	0.381	981	1,985
10/9/2006	64.2	147.7	0.41	1,089	2,135
10/10/2006	64.5	150.9	0.419	1,122	2,180
10/11/2006	64.3	148.6	0.413	1,098	2,148
10/12/2006	66.2	169.1	0.47	1,322	2,442
10/13/2006	67.9	187.8	0.522	1,540	2,709
10/14/2006	62.5	129.1	0.358	899	1,867
10/15/2006	63.8	142.7	0.396	1,036	2,063
10/16/2006	62.7	131.3	0.365	922	1,900
10/17/2006	68.3	191.9	0.533	1,590	2,768
10/18/2006	71.8	230.1	0.639	2,084	3,317
10/19/2006	70.1	212.4	0.59	1,848	3,062
10/20/2006	65.6	163.2	0.453	1,256	2,357
10/21/2006	64.1	146.8	0.408	1,079	2,122
10/22/2006	66.1	168.2	0.467	1,312	2,429
10/23/2006	66	167.3	0.465	1,302	2,416
10/24/2006	64	145.9	0.405	1,070	2,109
10/25/2006	65	156.4	0.434	1,181	2,259
10/26/2006	65.3	160	0.444	1,221	2,311
10/27/2006	68.7	196.9	0.547	1,651	2,840
10/28/2006	70.6	217.4	0.604	1,913	3,134
10/29/2006	66.7	175	0.486	1,390	2,527
10/30/2006	69.5	206	0.572	1,766	2,971
10/31/2006	66.4	171.8	0.477	1,353	2,481
11/1/2006	59.8	99.9	0.278	630	1,449
11/2/2006	59.5	95.8	0.266	595	1,390
11/3/2006	59.2	92.6	0.257	568	1,345
11/4/2006	59.7	98.6	0.274	619	1,430
11/5/2006	62.6	130.4	0.362	913	1,887

Table 259. Chiller kW for Each Hour of TMY (con't)

Day	Avg TMY DBT	Avg Tons	Avg PLR	New kWh/day	Base kWh/day
11/6/2006	62.8	132.2	0.367	931	1,913
11/7/2006	61.7	119.9	0.333	812	1,736
11/8/2006	61	112.7	0.313	744	1,632
11/9/2006	58	79.4	0.221	461	1,155
11/10/2006	60.9	111.3	0.309	732	1,612
11/11/2006	59.6	97.2	0.27	607	1,410
11/12/2006	61.4	116.8	0.324	782	1,691
11/13/2006	61.7	119.9	0.333	812	1,736
11/14/2006	62.7	130.9	0.364	917	1,893
11/15/2006	63.5	139.5	0.388	1,004	2,017
11/16/2006	57.4	73.5	0.204	415	1,070
11/17/2006	58.1	81.3	0.226	475	1,181
11/18/2006	58.5	85.4	0.237	508	1,240
11/19/2006	59.3	93.5	0.26	576	1,358
11/20/2006	59.6	97.2	0.27	607	1,410
11/21/2006	60	102.2	0.284	650	1,482
11/22/2006	58.5	85.8	0.238	512	1,247
11/23/2006	58.8	88.5	0.246	534	1,286
11/24/2006	58.8	89	0.247	538	1,292
11/25/2006	60.1	103.1	0.286	658	1,495
11/26/2006	60.6	108.6	0.302	707	1,573
11/27/2006	59.2	92.6	0.257	568	1,345
11/28/2006	59.2	92.6	0.257	568	1,345
11/29/2006	59	90.4	0.251	549	1,312
11/30/2006	57.5	74.9	0.208	425	1,090
12/1/2006	54.7	43.9	0.122	205	646
12/2/2006	60.1	102.7	0.285	654	1,488
12/3/2006	59.7	98.1	0.272	615	1,423
12/4/2006	59.7	98.1	0.272	615	1,423
12/5/2006	61.2	114.5	0.318	761	1,658
12/6/2006	61.9	122.7	0.341	838	1,776
12/7/2006	58.4	84.4	0.235	501	1,227
12/8/2006	55.5	52.1	0.145	260	763
12/9/2006	56	57.6	0.16	298	842
12/10/2006	56.3	61.2	0.17	324	894
12/11/2006	58.4	84.4	0.235	501	1,227
12/12/2006	59.5	96.7	0.269	603	1,403
12/13/2006	59.5	96.7	0.269	603	1,403
12/14/2006	56.5	64	0.178	344	933
12/15/2006	54.7	43.9	0.122	205	646
12/16/2006	58.4	84.4	0.235	501	1,227
12/17/2006	56	58	0.161	301	848
12/18/2006	54.2	38	0.106	167	561
12/19/2006	56.7	65.3	0.181	354	953
12/20/2006	56.2	60.3	0.168	317	881
12/21/2006	55.2	49.4	0.137	241	724
12/22/2006	55	47.6	0.132	229	698
12/23/2006	55	46.7	0.13	223	685
12/24/2006	55.5	52.6	0.146	263	770

Table 259. Chiller kW for Each Hour of TMY (con't)

Day	Avg TMY DBT	Avg Tons	Avg PLR	New kWh/day	Base kWh/day
12/25/2006	54.5	41.2	0.114	188	607
12/26/2006	56.5	64	0.178	344	933
12/27/2006	52.4	18.4	0.051	52	280
12/28/2006	51.3	0	0	0	16
12/29/2006	52.7	21.6	0.06	69	326
12/30/2006	52.9	24.4	0.068	85	365
12/31/2006	54.6	42.6	0.118	196	626

7.32 05-08-010 – Lighting Retrofit at Multiple Parking Garage Facilities

This project was an aggregation project conducted of a large number of sites. A preliminary list of parking structure sites was provided in the proposal in August 2004. This list is subject to customer acceptance of terms and conditions and subsequent marketing efforts to other customers. Table 260 shows a summary of the M&V for this project.

Table 260. M&V Savings Summary

Energy Savings (kWh)	
Contracted Savings (kWh)	5,355,759 kWh
Total Reported / Invoiced Savings (kWh)	3,672,630 kWh
M&V Savings (kWh)	3,678,061 kWh
Realization Rate (kWh) Invoiced	101%
Demand Reduction (kW)	
Contracted Savings (kW)	611 kW
Total Reported / Invoiced Savings (kW)	419.25 kW
M&V Savings (kW)	419.87 kW
Realization Rate (kW) Invoiced	101%

7.32.1 MEASURE DESCRIPTION

Install energy efficient fluorescent lighting fixtures in place of 175W, 150W, and 100W Metal Halide fixtures in primarily parking garage facilities.

7.32.1.1 Pre-Retrofit Conditions

- Parking Garage facilities.
- 175W, 150W, and 100W Metal Halide lamps
- Fixture wattage uses stipulated values of 215, 188, and 138 watts per fixture depending on the specific installed fixture.
- All sites were parking garage facilities with light fixtures operating 24 hours a day, 7 days a week.

7.32.1.2 Post-Retrofit Conditions

The following describes the post-retrofit fixture components.

- Energy efficient fluorescent fixture.
- 2-lamp T8 fixture rated at 57, 53 or 48 watts per fixture, depending on the specific installed electronic ballast.
- Ballast and Lamps: GE ProLine or GE UltraMax

Table 261 shows the energy efficient fixture components and wattages used in this project.

Table 261. Energy Efficient Fixture Descriptions

Ballast	Model #	Lamp	# Lamps	Input Volts	Input Watts
GE UltraMax	GE-232-MAX-N/Ultra	F32T8	2Lamp	277v	53w
GE UltraMax	GE-232-MAX-L/Ultra	F32T8 & U	2Lamp	120/277v	48w
GE ProLine	GE-232-120-N	F32T8	2Lamp	120v	57w

7.32.2 Measurement and Verification (M&V) Approach

The M&V approach used for the project is summarized in this section. KSI coordinated with the Project Sponsor to perform pre- and post-retrofit M&V activities to support the tasks described below.

7.32.2.1 Load Impact Verification Methodology

The load impact estimation methodology described in this plan complies with IPMVP Option A. Site inspections were employed to verify key M&V parameters.

7.32.2.2 Analysis Approach

The basic equation used to estimate the energy savings of this project is shown in (Equation 8.

(Equation 8) $kWh\ savings = kWh_{Pre} - kWh_{Post}$

where:

$kWh_{Pre} = (\#\ Fixtures_{Pre}) \times (Fixture\ Wattage_{Pre}/1000) \times (Hours\ of\ Operation_{Pre})$; and

$kWh_{Post} = (\#\ Fixtures_{Post}) \times (Fixture\ Wattage_{Post}/1000) \times (Hours\ of\ Operation_{Post})$.

The M&V activities for the key parameters of (Equation 8) are shown in Table 262.

Table 262. Key M&V Parameters

Parameter	M&V Activity
Fixture Counts	Fixture counts were verified through on-site inspection. Leverage inspections by SDG&E program staff.
Fixture Wattage $_{Pre}$ and Fixture Wattage $_{Post}$	Stipulated wattage values on verification of fixtures.
Hours of Operation	Due to security and underground structures, all parking garage facilities have light fixtures that operate 24 hours a day, seven days a week. One site had a discrepancy due to construction and loggers were installed to verify operating hours.

7.32.2.3 On-Site Verification Inspections

On-site inspections were conducted to verify the equipment types, quantities and operating hours. Site inspections consisted of the following activities:

- Verification of the installation of lighting equipment, including
  - fixture wattage, and
  - counts.
- Due to residential and commercial parking structure, operating hours for the light fixtures were confirmed by interviews with the site contact.

The verification was based on as-built documentation provided to KSI by the Project Sponsor.

7.32.2.4 Verifying Fixture Quantities

The fixture counts on the project completion request forms submitted by the Project Sponsor represented the as-built quantities for each project. This was the basis for the verification of the number of fixtures. Pre-inspection and post-inspection visits were made to all sites. Fixture quantities and wattages from the pre-inspection were used to adjust the base case, as appropriate. It was not unusual for the pre- and post- counts to differ, as there were sites where fixtures were added to the project during installation. The as-built counts were used for the final verification of fixture quantities, since the claimed savings were based on these values.

7.32.3 Results

This section provides the results of the M&V process.

Site 14 was the only site during inspection to have their lights off. The lights were turned off due to construction being done on one end of the garage. Light loggers were installed after construction ended and the garage lights were verified to have 24 hour operations after construction was completed.

Some of the key findings are:

- **Realization Rates:** The realization rates are 101% for kWh savings and 101% for kW reduced.
- **Hours of Operation:** The proposed hours of operation were verified through the confirmation the contact person on site. All light fixtures in underground parking garages are on 24 hours a day, seven days a week.
- **Quantity of Fixtures Retrofit:** The basis for the quantity of fixtures retrofit, were submitted by the Project Sponsor to SDG&E. These forms also included fixture wattages.
- **Fixture Wattages:** Reported fixture wattages were verified to be consistent with the installed fixtures.

7.32.3.1 Verified Hours of Operation

The hours of operation were verified to be 24-hours per day, seven days per week, through interviews of on site personnel and verification that the lights were turned on at the time of the pre and post-inspection.

7.32.3.2 Verified Fixture Quantity and Fixture Wattage

The base case fixtures were verified to be 175-watt Metal Halide and 100-watt High Pressure Sodium. Table 263 shows the invoiced and verified fixture quantities and wattages for each site.

Table 263. Quantity and Fixture Wattage Verification

	Invoiced						Verified					
Site ID	Basecase Fixture Type	Watts per fixture	Propose Basecase Qty	Postcase Fixture Type	Watts Per Postcase Fixture	Qty of Postcase Fixtures	Verified Basecase Fixture Type	Watts per Fixture	Verified Basecase Qty	Verified Proposed Fixture Type	Verified Qty Postcase Fixtures	Watts Per Postcase Fixture
Site 01	175W Metal Halide	215	57	2 Lamp T8	57	57	175W Metal Halide	215	59	2 Lamp T8	59	57
Site 02	175W Metal Halide	215	426	2 Lamp T8	57	426	175W Metal Halide	215	426	2 Lamp T8	426	57
Site 03	175W Metal Halide	215	395	2 Lamp T8	53	395	175W Metal Halide	215	395	2 Lamp T8	395	53
Site 04	175W Metal Halide	215	140	2 Lamp T8	57	140	175W Metal Halide	215	140	2 Lamp T8	140	57
Site 05	175W Metal Halide	215	125	2 Lamp T8	57	125	175W Metal Halide	215	125	2 Lamp T8	125	57
Site 06	175W Metal Halide	215	230	2 Lamp T8	57	230	175W Metal Halide	215	230	2 Lamp T8	230	57
Site 07	150W Metal Halide	188	140	2 Lamp T8	57	140	150W Metal Halide	188	140	2 Lamp T8	140	57
Site 08	150W Metal Halide	188	230	2 Lamp T8	48	230	150W Metal Halide	188	230	2 Lamp T8	230	48
Site 09	100W Metal Halide	138	61	2 Lamp T8	48	61	100W H.P.S.	138	61	2 Lamp T8	61	48
Site 10	150W Metal Halide	188	31	2 Lamp T8	48	31	150W Metal Halide	188	31	2 Lamp T8	31	48
Site 11	150W Metal Halide	190	44	2 Lamp T8	48	44	150W Metal Halide	190	45	2 Lamp T8	45	48
Site 12	175W Metal Halide	215	104	2 Lamp T8	53	104	175W Metal Halide	215	104	2 Lamp T8	104	53
Site 13	175W Metal Halide	215	20	2 Lamp T8	53	20	175W Metal Halide	215	21	2 Lamp T8	21	53
Site 14	175W Metal Halide	215	30	2 Lamp T8	53	30	175W Metal Halide	215	30	2 Lamp T8	30	53
Site 15	175W Metal Halide	215	333	2 Lamp T8	53	333	175W Metal Halide	215	333	2 Lamp T8	333	53
Site 16	100W H.P.S.	138	241	2 Lamp T8	48	241	100W H.P.S.	138	241	2 Lamp T8	241	48
Site 17	175W Metal Halide	215	27	2 Lamp T8	53	27	175W Metal Halide	215	27	2 Lamp T8	27	53
Site 18	175W Metal Halide	215	180	2 Lamp T8	53	180	175W Metal Halide	215	180	2 Lamp T8	180	53
Total						**2,814**					**2,818**	

7.32.3.3 Verified Load Impacts

7.32.3.3.1 Invoiced kW and kWh

Table 264 shows all sites invoiced. It shows existing and new fixture type, pre and post fixture wattage, total fixture quantity, hours of operation, pre and proposed post kW, pre and proposed post kWh for each site.

Table 264. Invoiced kW Reduced and kWh Savings

	Invoiced														
Site ID	Basecase Fixture Type	Watts per fixture Basecase	Basecase Qty	Postcase Fixture Type	Watts Per Fixture Postcase	Qty of Fixtures Postcase	Hrs Per Day	Days Per Week	Annual Hours	Basecase kW	Basecase kWh	Postcase kW	Postcase kWh	kW Reduced	Annual KWh Savings
Site 01	175W Metal Halide	215	57	2 Lamp T8	57	57	24	7	8,760	12.26	107,354	3.25	28,461	9.01	78,893
Site 02	175W Metal Halide	215	426	2 Lamp T8	57	426	24	7	8,760	91.59	802,328	24.28	212,710	67.31	589,618
Site 03	175W Metal Halide	215	395	2 Lamp T8	53	395	24	7	8,760	84.93	743,943	20.94	183,391	63.99	560,552
Site 04	175W Metal Halide	215	140	2 Lamp T8	57	140	24	7	8,760	30.10	263,676	7.98	69,905	22.12	193,771
Site 05	175W Metal Halide	215	125	2 Lamp T8	57	125	24	7	8,760	26.88	235,425	7.13	62,415	20	173,010
Site 06	175W Metal Halide	215	230	2 Lamp T8	57	230	24	7	8,760	49.45	433,182	13.11	114,844	36.34	318,338
Site 07	150W Metal Halide	188	140	2 Lamp T8	57	140	24	7	8,760	26.32	230,563	7.98	69,905	18.34	160,658
Site 08	150W Metal Halide	188	230	2 Lamp T8	48	230	24	7	8,760	43.24	378,782	11.04	96,710	32.20	282,072
Site 09	100W Metal Halide	138	61	2 Lamp T8	48	61	24	7	8,760	8.42	73,742	2.93	25,649	5.49	48,092
Site 10	150W Metal Halide	188	31	2 Lamp T8	48	31	24	7	8,760	5.83	51,053	1.49	13,035	4.34	38,018
Site 11	150W Metal Halide	190	44	2 Lamp T8	48	44	24	7	8,760	8.36	73,234	2.11	18,501	6.25	54,732
Site 12	175W Metal Halide	215	104	2 Lamp T8	53	104	24	7	8,760	22.36	195,874	5.51	48,285	16.85	147,588
Site 13	175W Metal Halide	215	20	2 Lamp T8	53	20	24	7	8,760	4.30	37,668	1.06	9,286	3.24	28,382
Site 14	175W Metal Halide	215	30	2 Lamp T8	53	30	24	7	8,760	6.45	56,502	1.59	13,928	4.86	42,574
Site 15	175W Metal Halide	215	333	2 Lamp T8	53	333	24	7	8,760	71.60	627,172	17.65	154,605	53.95	472,567
Site 16	100W H.P.S.	138	241	2 Lamp T8	48	241	24	7	8,760	33.26	291,340	11.57	101,336	21.69	190,004
Site 17	175W Metal Halide	215	27	2 Lamp T8	53	27	24	7	8,760	5.81	50,852	1.43	12,536	4.37	38,316
Site 18	175W Metal Halide	215	180	2 Lamp T8	53	180	24	7	8,760	38.70	339,012	9.54	83,570	29.16	255,442
Total			**2,814**											**419.25**	**3,672,630**

7.32.3.3.2 Verified kW and kWh Savings

Table 265 shows the verified pre and post fixture types and fixture counts, pre and post fixture wattage, hours of operation, post kW and verified annual kWh savings for each site. The kW reduced and kWh savings was calculated by KSI and compared to what was invoiced. The verified kW reduced and kWh savings are higher than the invoiced due to extra fixtures installed at three facilities: Site 01, Site 11, and Site 14.

Table 265. Verified kW Reduced and kWh Savings

			Verified															
Site ID	Verified Basecase Fixture Type	Watts per Fixture	Verified Basecase Qty	Hrs Per Day	Days Per Week	Annual Hours Basecase	Verified Qty Fixtures Postcase	Verified Fixture Type Postcase	Watts Per Fixture Postcase	Post Hours Per Day	Post Days Per Week	Verified Annual Hours Postcase	Verified kW Basecase	Verified kWh Basecase	Verified kW Postcase	Verified kWh Postcase	Verified kW Reduced	Verified kWh savings
Site 01	175W Metal Halide	215	**59**	24	7	8,760	**59**	2 Lamp T8	57	24	7	8,760	12.69	111,121	3.36	29,460	9.32	81,661
Site 02	175W Metal Halide	215	426	24	7	8,760	426	2 Lamp T8	57	24	7	8,760	91.59	802,328	24.28	212,710	67.31	589,618
Site 03	175W Metal Halide	215	395	24	7	8,760	395	2 Lamp T8	53	24	7	8,760	84.93	743,943	20.94	183,391	63.99	560,552
Site 04	175W Metal Halide	215	140	24	7	8,760	140	2 Lamp T8	57	24	7	8,760	30.10	263,676	7.98	69,905	22.12	193,771
Site 05	175W Metal Halide	215	125	24	7	8,760	125	2 Lamp T8	57	24	7	8,760	26.88	235,425	7.13	62,415	19.75	173,010
Site 06	175W Metal Halide	215	230	24	7	8,760	230	2 Lamp T8	57	24	7	8,760	49.45	433,182	13.11	114,844	36.34	318,338
Site 07	150W Metal Halide	188	140	24	7	8,760	140	2 Lamp T8	57	24	7	8,760	26.32	230,563	7.98	69,905	18.34	160,658
Site 08	150W Metal Halide	188	230	24	7	8,760	230	2 Lamp T8	48	24	7	8,760	43.24	378,782	11.04	96,710	32.20	282,072
Site 09	100W H.P.S.	138	61	24	7	8,760	61	2 Lamp T8	48	24	7	8,760	8.42	73,742	2.93	25,649	5.49	48,092
Site 10	150W Metal Halide	188	31	24	7	8,760	31	2 Lamp T8	48	24	7	8,760	5.83	51,053	1.49	13,035	4.34	38,018
Site 11	150W Metal Halide	190	**45**	24	7	8,760	**45**	2 Lamp T8	48	24	7	8,760	8.55	74,898	2.16	18,922	6.39	55,976
Site 12	175W Metal Halide	215	104	24	7	8,760	104	2 Lamp T8	53	24	7	8,760	22.36	195,874	5.51	48,285	16.85	147,588
Site 13	175W Metal Halide	215	**21**	24	7	8,760	**21**	2 Lamp T8	53	24	7	8,760	4.52	39,551	1.11	9,750	3.40	29,802
Site 14	175W Metal Halide	215	30	24	7	8,760	30	2 Lamp T8	53	24	7	8,760	6.45	56,502	1.59	13,928	4.86	42,574
Site 15	175W Metal Halide	215	333	24	7	8,760	333	2 Lamp T8	53	24	7	8,760	71.60	627,172	17.65	154,605	53.95	472,567
Site 16	100W H.P.S.	138	241	24	7	8,760	241	2 Lamp T8	48	24	7	8,760	33.26	291,340	11.57	101,336	21.69	190,004
Site 17	175W Metal Halide	215	27	24	7	8,760	27	2 Lamp T8	53	24	7	8,760	5.81	50,852	1.43	12,536	4.37	38,316
Site 18	175W Metal Halide	215	180	24	7	8,760	180	2 Lamp T8	53	24	7	8,760	38.70	339,012	9.54	83,570	29.16	255,442
Total													**570.66**				**419.87**	**3,678,061**

7.32.3.4 Realization Rate

A realization rate was calculated to compare how the invoiced kW reduced and kWh savings submitted by the Project Sponsor compared with the verified kW reduced and kWh savings for each. If the realization rate is equal to 1.00 then the invoiced impacts match the verified impacts exactly. If the rate is less than 1.00 then the verified impacts are less than the invoiced impacts, and if the rate is greater than 1.00 then the verified savings are greater than invoiced. Table 266 shows the realization rate for the kW reduced and kWh savings to be 101%.

Table 266. Realization Rate – 05-08-010

	Invoiced		Verified		Realization Rate	
Site ID	Proposed kW Reduced	Proposed Annual KWh Savings	Verified kW Reduced	Verified kWh Savings	Realization Rate kW	Realization Rate kWh
Site 01	9.01	78,893	9.32	81,661	104%	104%
Site 02	67.31	589,618	67.31	589,618	100%	100%
Site 03	63.99	560,552	63.99	560,552	100%	100%
Site 04	22.12	193,771	22.12	193,771	100%	100%
Site 05	20	173,010	19.75	173,010	100%	100%
Site 06	36.34	318,338	36.34	318,338	100%	100%
Site 07	18.34	160,658	18.34	160,658	100%	100%
Site 08	32.20	282,072	32.20	282,072	100%	100%
Site 09	5.49	48,092	5.49	48,092	100%	100%
Site 10	4.34	38,018	4.34	38,018	100%	100%
Site 11	6.25	54,732	6.39	55,976	102%	102%
Site 12	16.85	147,588	16.85	147,588	100%	100%
Site 13	3.24	28,382	3.40	29,802	105%	105%
Site 14	4.86	42,574	4.86	42,574	100%	100%
Site 15	53.95	472,567	53.95	472,567	100%	100%
Site 16	21.69	190,004	21.69	190,004	100%	100%
Site 17	4.37	38,316	4.37	38,316	100%	100%
Site 18	29.16	255,442	29.16	255,442	100%	100%
	419.25	**3,672,630**	**419.87**	**3,678,061**	**101%**	**101%**