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Customer Energy Efficiency Program
Measurement and Evaluation Program

REALIZATION STUDY OF 1995 POWER SAVINGS PARTNERS PROGRAM: COMMERCIAL SECTOR INDUSTRIAL SECTOR RESIDENTIAL SECTOR

PG&E Study ID number:
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Building Energy Management Section
Pacific Gas and Electric Company
San Francisco, California

Disclaimer of Warranties and Limitation of Liabilities

As part of its Customer Energy Efficiency Programs, Pacific Gas and Electric Company (PG&E) has engaged consultants to conduct a series of studies designed to increase the certainty of and confidence in the energy savings delivered by the programs. This report describes one of those studies. It represents the findings and views of the consultant employed to conduct the study and not of PG&E itself.

Furthermore, the results of the study may be applicable only to the unique geographic, meteorological, cultural, and social circumstances existing within PG&E's service area during the time frame of the study. PG&E and its employees expressly disclaim any responsibility or liability for any use of the report or any information, method, process, results or similar item contained in the report for any circumstances other than the unique circumstances existing in PG&E's service area and any other circumstances described within the parameters of the study.

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1. Executive Summary

The following evaluation documents savings measured in program year 1995 for Pacific Gas & Electric's PowerSaving Partners (PSP) Program. This study verifies both kWh and kW savings for the end uses installed in 1995 and claimed in the 1995 AEAP Earnings Claim, specifically:

- Commercial Lighting
- Industrial Process
- Residential Lighting

This study documents the original claim, how it was constructed and the results of a thorough and rigorous monitoring study made by each of the PSP Partners and evaluated by PG&E. PSP Partners are required to sample and meter all sites where measures are installed in order to receive payment for energy savings. This report tabulates the results of their findings and presents the basis for each realization rate claim.

For PSP 1995 program accomplishments, PG&E claimed 5,473 kW and 37,942 mWh of annual energy savings. These accomplishments were included in the residential and commercial portfolios. Table 1-1 lists the results of the Measurement and Verification for these contracts by program end use.

PACIFIC GAS AND ELECTRIC COMPANY
TABLE 1-1
PSP REALIZATION RATES

Sector	Claimed KW Savings	Claimed kWh Savings	Measured Peak kW	Measured kWh	kW Realization Rate	kWh Realization Rate
Commercial Lighting	5,039	34,306,685	4,453	33,697,749	0.88	0.98
Industrial Process	310	2,673,308	309	2,709,286	0.99	1.01
Residential Lighting	121	961,726	126	943,114	1.04	0.98
Program	**5,472**	**37,941,719**	**4,889**	**37,350,150**	**0.89**	**0.98**

2. Background

In March 1992, the CPUC mandated that PG&E implement a bidding pilot program of DSM resources (D.92-03-038). In good faith, PG&E conducted an auction and announced a short list of wining bidders April 1993. The CPUC found all contracts to be reasonable in Decisions 93-11-067, 94-04-039 and 95-10-037. Energy savings from the bidding pilot were included in PG&E 1995 AEAP earnings claim and approved in Decision 95-12-054.

All contracts are based on pay-for -performance over a contract life of 10 years. the Powersaving Partners (PSP or Partners) perform the measurement and verification, and savings are verified annually. The implementation period is 36 months with specific reporting requirements. Payments are based on savings projections and then reconciled according to actual verified savings after one year. If savings are not achieved, payments are modified and savings projections are reduced. A method for collecting overpayments, should they occur, is contained in each contract.

The M&V plans are consistent with the Measurement and Evaluation (M&E) protocols adopted by the Commission. The commission emphasized in Decision 93-05-063, p. 75:

> Payments to winning bidders do not need to be linked to the completion of specific ex-post measurement studies in the same manner as utility earnings. The utilities are expected to apply the basic concepts....., but to allow reasonable differences between these protocols and bidders' measurement plans and payment schedules.

PG&E has fully complied with the Commission ruling and actually created a rigorous energy verification plan as accurate for site-specific savings measurement as the Protocols used for utility programs.

3. Measurement & Verification Methodology

A short discussion of the existing M&V requirement for each of the PSP partners will assist in explaining the methodology for this realization report.

PG&E developed the PSP DSM Measurement and Verification Procedures Manual (Manual) following the directions in Appendix H of the Measurement Protocols adopted in D. 94-05-063. That is, the 1993 NAESCO protocols were adapted to California conditions (e.g. use of Title 24 baselines where appropriate) and made more rigorous. It is included as Appendix E of this filing. The Manual was reviewed and in its final form agreed to by all the Partners. It was adopted in its entirety for the PSP contract with the State of California. The Manual covers all aspects of M&V of savings.

For the purpose of simplifying the M&V Procedures Manual (Appendix D), the following list outlines the topics covered in detail:

- Common requirements and definitions;
- Submittal requirements for each project;
- M&V procedures for lighting efficiency and controls measures;
- M&V procedures for constant load motors;
- M&V procedures for variable load motors and HVAC measures;
- Maintenance and management plans; and
- Sample forms and report outlines.

Here is a short summary of the measurement strategy base on end use/control group.

a. Lighting Efficiency Measures

Starting with the most basic lighting efficiency retrofits, the verification strategy would be as follows: The Partner surveys the existing (baseline) and new (post-installation) conditions to include exact fixture count, lamps and ballast types and the identification of usage areas. Usage areas must be defined in a way that groups together areas that have similar lighting requirements (i.e., areas of comparable average operating hours as determined by the proportion of lights in operation during each of PG&E five costing periods). PG&E inspects both the existing and the new conditions for accuracy of fixture count and type and identification of usage areas. The measurement techniques employed for this measure after installation would be to use a table of standard wattage's to determine the kW per fixture for the pre- and post-installation conditions, as well as the determination of operating hours. The operating hours are determined by short-term metering of fixture on-time in the various costing periods. The short-term metering length is determined by market segment and ranges from one to four months. The required sample sizes for the metering are for 90 percent confidence and 10 percent precision. The majority of the measure installed by PSP in 1995 were lighting efficiency retrofits and the M&V followed by each and every Partner is as described above.

b Lighting Controls and Constant Load Motors

The next category of projects are constant load and variable hour projects, such as lighting controls or motor efficiency retrofits. The verification strategies involve the survey of the existing measure for the load served, including a kW or horsepower measurement and a typical operating schedule. This verification survey includes spot-metering to determine actual demand, and possibly short-term metering of a sample to verify constant load and to normalize spot metering. The post-installation verification included spot metering to determine demand. The ongoing measurement activities for these types of measure include short-term metering for demand and run-hours. Again, the short-term metering length is determined by market segment and ranges from one to four months.

c. Variable Load Projects

The last type of projects are those that have variable loads and variable operating hours, including seasonal variation. For both verification and measurement, a comprehensive approach is necessary for variable load measure, multiple measures or measure that interact. In these cases, end-use measurements are difficult to isolate or are cost-prohibitive. A project-specific approach is necessary, including a variety of acceptable approaches from continuous metering to billing analysis. The Manual outlines both a continuous metering approach as well as pre- and post installation billing analysis.

4. Realization Methodology

The 1995 PG&E savings claim was comprised of savings from a total of 136 Application Codes or Sites. These Sites were aggregated by end use/sector and reported in the 1995 E tables (Appendix D). The following tables document each iteration used in calculating the actual measured savings for each Site.

1995 Realization Rate by Site

Table 1-2, "1995 Realization Rate by Site," lists a code that represents each customer site as indicated in the report Attachments, Sector, kW and kWh savings as reported in the 1995 AEAP claim, measured kW and kWh as determined in this report through analyzing metering and monitoring data, kWh realization rate, and a reference source. The Source column in Table 1-2 refers to the set of tables in Attachment A which contain the results from metering and monitoring data analysis for each partner.

Attachment A

Table 1 in this attachment lists the capacity savings as reported by each partner in their Site tables. Partners are required to submit these tables at the completion of each installation. After submittal of this information, at the request of PG&E, a third party inspects each site for accuracy. If the installation is approved, the Site tables are entered into PG&E's data files and a kW savings is recorded for each usage group as shown in Table 1.

Table 2 contains the results of the hours of operation monitoring study for each Partner by usage group for each of PG&E's costing periods. This information is based on the tabulation of actual monitored data from data loggers installed at each site or representative sample of a site.

Table 3 contains the total measured savings by usage group and site. This table was calculated by multiplying the maximum capacity savings from Table 1 by the appropriate operating hours from Table 2. These totals by site are used in calculating the kWh realization rate by Site.

Table 4 contains the calculated peak period kW savings. This table was calculated by multiplying the max. kW savings (table 1) by the measured peak period hours (table 2) and dividing by 774 hours (the maximum hours in a peak period).

Attachment B
This attachment contains the Site tables that were used to produce Table 1 in Attachment A. These tables are submitted by each Partner and verified by PG&E's inspectors after the measures are installed.

Attachment C
This attachment contains the documentation for the monitoring data analysis performed for each customer group. Data analysis methods are as described in this attachment.

5. Summary

PG&E has adhered to or exceeded the basic concepts of ex post measurement protocols by implementing the adjusted NAESCO standards for the first set of DSM bidding contracts. The kW and kWh realization rates in this report link the savings measured at about 140 sites to the values reported in the E-tables filed in support of PG&E's 1995 Earnings claim.

Table 1-2
1995 REALIZATION RATE BY SITE

CODE	Sector	Claimed KW Savings	Claimed kWh Savings	Measured Peak kW	Measured kWh	kWh Realization Rate	Source
PALAALABOT	Commercial	24.93	80,941	25.898	96,847	1.20	Attachment A - 2
PALAALAUVY	Commercial	94.79	475,364	86.931	451,717	0.95	Attachment A - 2
PALAALAROS	Commercial	14.84	46,788	15.399	56,352	1.20	Attachment A - 2
PALASRIA01	Commercial	7.86	49,660	4.775	37,302	0.75	Attachment A - 2
PALASRIA07	Commercial	8.48	50,866	5.082	38,495	0.76	Attachment A - 2
PALASRIA23	Commercial	7.43	54,895	4.242	33,238	0.61	Attachment A - 2
PALASRIA24	Commercial	8.81	54,811	7.149	51,388	0.94	Attachment A - 2
PALASRIA34	Commercial	10.44	73,521	9.905	69,858	0.95	Attachment A - 2
PALASRIA35	Commercial	10.37	73,517	9.943	69,739	0.95	Attachment A - 2
PALASRI09B	Commercial	3.88	25,722	3.767	27,670	1.08	Attachment A - 2
PALASRISVC	Commercial	13.64	138,665	12.440	86,258	0.62	Attachment A - 2
PCCCCCCRAW	Commercial	4.69	39,156	4.725	37,995	0.97	Attachment A - 3
PPROKAIAIR	Commercial	39.26	178,762	34.551	170,528	0.95	Attachment A - 8
PPROKAIONT	Commercial	24.36	113,146	22.181	111,842	0.99	Attachment A - 8
PPROKAISNO	Commercial	88.62	402,633	78.865	447,734	1.11	Attachment A - 8
PPROKAIAK1	Commercial	280.7	1,483,732	259.934	1,675,424	1.13	Attachment A - 8
PPROKAILEA	Commercial	57.93	267,655	51.670	252,513	0.94	Attachment A - 8
PPROKAIEDW	Commercial	29.74	132,876	26.673	133,799	1.01	Attachment A - 8
PPROKAIESA	Commercial	377.8	1,813,707	349.693	2,095,893	1.16	Attachment A - 8
PPROKAINDS	Commercial	20.22	93,249	18.117	91,776	0.98	Attachment A - 8
PPROKAIALL	Commercial	155.5	724,200	140.438	808,831	1.12	Attachment A - 8
PNORNOBB06	Commercial	49.07	318,760	48.941	381,487	1.20	Attachment A - 4
PNORNOBB14	Commercial	49.73	332,013	50.122	390,645	1.18	Attachment A - 4
PNORNOBB18	Commercial	53.4	342,528	52.542	406,730	1.19	Attachment A - 4
PNORNOBB19	Commercial	39.57	256,633	39.040	303,298	1.18	Attachment A - 4
PNORNOBB20	Commercial	17.59	111,214	17.254	134,822	1.21	Attachment A - 4
PNORNOBB21	Commercial	29.25	190,377	28.856	222,484	1.17	Attachment A - 4
PNORNOBB23	Commercial	59.33	387,737	59.110	458,537	1.18	Attachment A - 4
PNORNOBB24	Commercial	33.74	223,235	33.362	262,964	1.18	Attachment A - 4
PNORNOBB25	Commercial	24.95	170,637	25.802	208,074	1.22	Attachment A - 4
PNORNOBB26	Commercial	55.06	356,634	54.268	418,354	1.17	Attachment A - 4
PPDCAUTWAY	Commercial	77.76	340,478	71.676	345,140	1.01	Attachment A - 6
PPDCAUTLEY	Commercial	18.94	83,807	16.784	91,524	1.09	Attachment A - 6
PPDCAUTENS	Commercial	27.07	147,040	25.023	143,636	0.98	Attachment A - 6
PPDCNAPACL	Commercial	559.7	2,181,039	112.129	480,009	0.22	Attachment A - 7
PNORSAF108	Commercial	25.98	215,109	25.625	216,242	1.01	Attachment A - 5
PNORSAF110	Commercial	47.14	394,654	46.556	396,191	1.00	Attachment A - 5
PNORSAF192	Commercial	45.28	380,950	44.939	385,560	1.01	Attachment A - 5
PNORSAF195	Commercial	49.56	415,278	48.912	416,497	1.00	Attachment A - 5
PNORSAF197	Commercial	53.5	462,227	53.477	463,269	1.00	Attachment A - 5
PNORSAF204	Commercial	28.91	244,526	28.619	245,583	1.00	Attachment A - 5
PNORSAF211	Commercial	44.44	373,592	43.919	374,737	1.00	Attachment A - 5
PNORSAF224	Commercial	47.87	398,676	47.376	400,169	1.00	Attachment A - 5
PNORSAF232	Commercial	27.66	228,272	27.157	229,110	1.00	Attachment A - 5
PNORSAF234	Commercial	46.8	386,868	46.191	388,059	1.00	Attachment A - 5
PNORSAF245	Commercial	39.69	326,875	39.093	328,263	1.00	Attachment A - 5
PNORSAF258	Commercial	44.36	371,514	43.859	372,556	1.00	Attachment A - 5
PNORSAF259	Commercial	54.96	459,118	54.434	460,545	1.00	Attachment A - 5
PNORSAF264	Commercial	56.01	472,572	55.467	473,723	1.00	Attachment A - 5
PNORSAF265	Commercial	43.6	360,695	42.980	362,029	1.00	Attachment A - 5
PNORSAF293	Commercial	42.61	354,990	42.058	356,565	1.00	Attachment A - 5
PNORSAF159	Commercial	32.22	272,234	31.839	272,167	1.00	Attachment A - 5
PNORSAF300	Commercial	22.12	184,452	21.796	185,235	1.00	Attachment A - 5

Table 1-2
1995 REALIZATION RATE BY SITE

CODE	Sector	Claimed KW Savings	Claimed kWh Savings	Measured Peak kW	Measured kWh	kWh Realization Rate	Source
PNORSAF308	Commercial	19.47	167,128	19.265	167,624	1.00	Attachment A - 5
PNORSAF309	Commercial	28.6	240,231	30.421	258,316	1.08	Attachment A - 5
PNORSAF128	Commercial	49.87	413,306	49.541	416,627	1.01	Attachment A - 5
PNORSAF313	Commercial	26.66	217,758	26.257	218,699	1.00	Attachment A - 5
PNORSAF315	Commercial	28.22	241,396	24.775	222,570	0.92	Attachment A - 5
PNORSAF465	Commercial	22.61	219,255	23.353	218,213	1.00	Attachment A - 5
PNORSAF568	Commercial	38.15	353,036	38.894	351,462	1.00	Attachment A - 5
PNORSAF592	Commercial	25.34	212,801	26.880	230,486	1.08	Attachment A - 5
PNORSAF636	Commercial	29.97	241,641	29.267	242,340	1.00	Attachment A - 5
PNORSAF638	Commercial	21.15	190,646	21.382	190,396	1.00	Attachment A - 5
PNORSAF641	Commercial	22.25	191,872	22.139	192,040	1.00	Attachment A - 5
PNORSAF661	Commercial	27.27	229,590	27.002	230,448	1.00	Attachment A - 5
PNORSAF667	Commercial	42.23	359,008	41.576	359,115	1.00	Attachment A - 5
PNORSAF668	Commercial	25.78	227,983	25.815	228,061	1.00	Attachment A - 5
PNORSAF669	Commercial	38.28	321,831	37.867	323,385	1.00	Attachment A - 5
PNORSAF676	Commercial	25.59	234,035	27.833	249,232	1.06	Attachment A - 5
PNORSAF687	Commercial	31.81	272,732	27.601	238,658	0.88	Attachment A - 5
PNORSAF694	Commercial	41.93	366,919	41.693	366,340	1.00	Attachment A - 5
PNORSAF695	Commercial	20.47	168,783	20.008	169,215	1.00	Attachment A - 5
PNORSAF709	Commercial	34.44	294,837	34.109	295,148	1.00	Attachment A - 5
PNORSAF711	Commercial	39.5	329,922	38.842	330,511	1.00	Attachment A - 5
PNORSAF712	Commercial	28.48	248,759	28.302	248,832	1.00	Attachment A - 5
PNORSAF714	Commercial	27.2	231,819	26.872	231,995	1.00	Attachment A - 5
PNORSAF715	Commercial	21.49	195,381	21.519	194,482	1.00	Attachment A - 5
PNORSAF732	Commercial	45.11	400,531	45.227	400,024	1.00	Attachment A - 5
PNORSAF737	Commercial	22.8	197,600	22.647	197,648	1.00	Attachment A - 5
PNORSAF739	Commercial	31.37	270,087	30.909	269,701	1.00	Attachment A - 5
PNORSAF746	Commercial	29.5	254,954	29.293	255,591	1.00	Attachment A - 5
PNORSAF747	Commercial	25.79	218,572	25.482	218,566	1.00	Attachment A - 5
PNORSAF751	Commercial	39.87	338,022	39.403	338,386	1.00	Attachment A - 5
PNORSAF762	Commercial	24.09	218,236	24.111	216,952	0.99	Attachment A - 5
PNORSAF768	Commercial	30.77	258,924	30.318	259,746	1.00	Attachment A - 5
PNORSAF774	Commercial	25.69	217,596	25.310	217,723	1.00	Attachment A - 5
PNORSAF788	Commercial	20.69	200,809	21.178	198,756	0.99	Attachment A - 5
PNORSAF793	Commercial	30.8	269,216	35.185	308,250	1.14	Attachment A - 5
PNORSAF797	Commercial	35.15	298,066	34.848	298,788	1.00	Attachment A - 5
PNORSAF799	Commercial	38.33	346,863	38.823	345,989	1.00	Attachment A - 5
PNORSAF910	Commercial	37.54	327,761	37.421	327,148	1.00	Attachment A - 5
PNORSAF913	Commercial	35.55	309,106	35.460	308,718	1.00	Attachment A - 5
PNORSAF919	Commercial	29.67	250,890	29.382	251,562	1.00	Attachment A - 5
PNORSAF928	Commercial	26.78	232,364	26.505	231,634	1.00	Attachment A - 5
PNORSAF929	Commercial	27.87	234,696	27.558	235,235	1.00	Attachment A - 5
PNORSAF932	Commercial	30.22	252,835	29.771	253,016	1.00	Attachment A - 5
PNORSAF953	Commercial	37.57	317,017	37.220	317,405	1.00	Attachment A - 5
PNORSAF955	Commercial	43.83	370,402	43.311	370,736	1.00	Attachment A - 5
PNORSAF964	Commercial	24.25	196,847	26.683	221,695	1.13	Attachment A - 5
PNORSAF965	Commercial	23.13	203,592	23.243	203,363	1.00	Attachment A - 5
PNORSAF967	Commercial	25.01	209,106	22.273	189,593	0.91	Attachment A - 5
PNORSAF969	Commercial	24.23	201,168	23.877	201,876	1.00	Attachment A - 5
PNORSAF970	Commercial	20.15	159,246	19.562	159,596	1.00	Attachment A - 5
PNORSAF971	Commercial	36.5	305,808	36.113	306,873	1.00	Attachment A - 5
PNORSAF972	Commercial	35.16	302,799	34.779	302,447	1.00	Attachment A - 5
PNORSAF975	Commercial	32.21	275,590	31.984	275,210	1.00	Attachment A - 5

Table 1-2
1995 REALIZATION RATE BY SITE

CODE	Sector	Claimed KW Savings	Claimed kWh Savings	Measured Peak kW	Measured kWh	kWh Realization Rate	Source
PNORSAF976	Commercial	27.75	239,253	27.525	239,404	1.00	Attachment A - 5
PNORSAF978	Commercial	35.61	295,402	35.206	296,350	1.00	Attachment A - 5
PNORSAF983	Commercial	36.86	308,562	36.456	309,114	1.00	Attachment A - 5
PNORSAF985	Commercial	22.34	182,731	21.915	183,625	1.00	Attachment A - 5
PNORSAF987	Commercial	31.72	267,678	31.278	268,326	1.00	Attachment A - 5
PNORSAF989	Commercial	37.91	317,253	37.551	317,936	1.00	Attachment A - 5
PNORSAF993	Commercial	19.43	159,611	18.988	160,702	1.01	Attachment A - 5
PNORSAF994	Commercial	28.44	230,074	27.847	230,807	1.00	Attachment A - 5
PNORSAF999	Commercial	22.41	184,571	22.070	185,476	1.00	Attachment A - 5
PSANAIRRSE	Commercial	11.65	102,072	11.652	102,072	1.00	Attachment A - 1
PSANPSANCC	Commercial	10.45	37,746	11.534	68,349	1.81	Attachment A - 1
PSANPSANAL	Commercial	16.67	53,760	20.837	59,763	1.11	Attachment A - 1
PTAMDOMDOM	Industrial	137.9	1,208,239	107.553	942,165	0.78	Attachment A - 10
PTAMNISISS	Industrial	173	1,465,069	201.726	1,767,122	1.21	Attachment A - 9
PCCCCCCLLO	Residential	7.87	58,926	7.831	57,036	0.97	Attachment A - 3
PCCCCCCOOD	Residential	2.17	30,356	2.316	27,751	0.91	Attachment A - 3
PCCCCCCNKH	Residential	1.29	5,901	1.225	5,857	0.99	Attachment A - 3
PCCCCCCANK	Residential	2.44	23,129	2.458	22,549	0.97	Attachment A - 3
PCCCCCCRTE	Residential	4.94	68,364	5.278	63,410	0.93	Attachment A - 3
PCCCCCCL-A	Residential	8.05	56,371	8.801	55,998	0.99	Attachment A - 3
PCCCCCCL-T	Residential	6.22	47,254	6.471	46,952	0.99	Attachment A - 3
PCCCCCCLOW	Residential	6.99	72,235	7.151	67,723	0.94	Attachment A - 3
PCCCCCCTIN	Residential	21.62	151,956	23.237	147,967	0.97	Attachment A - 3
PCCCCCCLUN	Residential	8.41	62,958	8.383	63,739	1.01	Attachment A - 3
PCCCCCCILL	Residential	5.22	45,948	5.189	44,784	0.97	Attachment A - 3
PCCCCCCDGE	Residential	7.12	52,785	7.132	52,728	1.00	Attachment A - 3
PCCCCCCOSE	Residential	4.79	31,139	5.041	31,994	1.03	Attachment A - 3
PCCCCCCDAH	Residential	15.02	101,167	15.664	103,857	1.03	Attachment A - 3
PCCCCCCRYS	Residential	3.11	38,322	3.186	35,771	0.93	Attachment A - 3
PCCCCCCDEZ	Residential	16.72	114,915	16.975	115,000	1.00	Attachment A - 3
Totals		**5,472.67**	**37,941,719**	**4,889.15**	**37,350,150**	**0.98**	