# 2009 Load Impact Evaluation of California Statewide Aggregator Demand Response Programs: *Ex Post and Ex Ante Report*

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## Abstract

This report documents the results of an ex post and ex ante load impact evaluation of aggregator demand response (DR) programs operated by the three major California investor-owned utilities (IOUs), Pacific Gas and Electric (PG&E), Southern California Edison (SCE), and San Diego Gas and Electric (SDG&E), for Program Year 2009. The scope of this evaluation covered three price-responsive programs, including the state-wide Capacity Bidding Program ("CBP") operated by all three IOUs, Aggregator Managed Portfolio ("AMP") operated by PG&E, and Demand Response Resource Contracts ("DRC"), operated by SCE. Program options of *day-ahead* (DA) and *day-of* (DO) notice were offered by each program.

In these programs, aggregators contract with commercial and industrial customers to act on their behalf with respect to all aspects of the DR program, including receiving notices from the utility, arranging for load reductions on event days, receiving incentive payments, and paying penalties (if warranted) to the utility. Each aggregator forms a "portfolio" of individual customer accounts such that their aggregated load participates in the DR programs.

Enrollment in the various programs and program types typically ranged from about 150 to 700 customer accounts. With the exception of PG&E's CBP program, enrollment in the DO program type generally exceeded that in the corresponding DA program type. The largest enrollment was in SCE's DRC day-of program, at more than 1,200 customer accounts. However, not all of them were typically nominated in any given month.

The number of events called in 2009 varied considerably across utilities and program types. Some, such as PG&E CBP and AMP, and SCE DRC were called only once or twice for test events. In contrast, SDG&E's CBP DA and DO were called 6 and 7 times respectively, and SCE's CBP DA was called twenty-six times.

Ex post hourly load impacts were estimated for each program and event, using regression analysis of hourly customer-specific load, weather, and event data. Estimated load impacts were reported at the program level for each event, for both program types (DA and DO). Load impacts for the average event were also reported by industry type and CAISO local capacity area where relevant. Ex ante load impacts for 2010 through 2020 were developed using reference load profiles and per-customer load impacts generated from the ex post load impact results, along with enrollment forecasts provided by the utilities.

Estimated *ex post* load impacts on an average hourly basis for the average event for the statewide CBP program at PG&E, SCE and SDG&E were 21.5 MW, 0.8 MW, and 10.3 MW respectively, for the DA option, and 22.4 MW, 25.4 MW, and 12.5 MW for the DO option. Average hourly load impacts for PG&E's AMP DA and DO program types were 38.5 MW and 83.9 MW, while those for SCE's DRC DA and DO program types were 3.9 MW and 63.6 MW.

Based on anticipated aggregator contract quantities and changes in enrollments, estimated average hourly *ex ante* load impacts for 2012, for a typical event day in a 1-in-2 weather

scenario, are the following: For PG&E's CBP DA and DO options – 13.8 MW and 39.7 MW; for SCE's CBP DA and DO options – 0.7 MW and 13.3 MW; and for SDG&E's CBP DA and DO options – 11.6 MW and 17.1 MW. Finally, for PG&E's AMP DA and DO options, the expected average hourly load impacts are 57.2 MW and 151.8 MW, for SCE's DRC DA and DO options – 3 MW and 131 MW, and for SDG&E's new AMP DO program type – 36.5 MW.

## Executive Summary

This report documents the results of an evaluation of aggregator demand response ("DR") programs operated by the three California investor-owned utilities (IOUs), Pacific Gas and Electric ("PG&E"), Southern California Edison ("SCE"), and San Diego Gas and Electric ("SDG&E") for Program Year 2009. In these programs, aggregators contract with commercial and industrial customers to act on their behalf with respect to all aspects of the DR program, including receiving notices from the utility, arranging for load reductions on event days, receiving incentive payments, and paying penalties (if warranted) to the utility. Each aggregator forms a "portfolio" of individual customers such that their aggregated load participates in the DR programs. Aggregators enroll and nominate customers in a mix of day-ahead ("DA") and day-of ("DO") program types.

The scope of this evaluation covers the state-wide Capacity Bidding Program ("CBP"), which is operated by all three IOUs, PG&E's Aggregator Managed Portfolio ("AMP"), and SCE's Demand Response Resource Contracts ("DRC").

The primary goals of this evaluation study were the following:

1. Estimate the *ex post* load impacts for program year 2009; and
2. Estimate *ex ante* load impacts for the programs for 2010 through 2020

### *ES.1 Program Resources*

### CBP

The statewide CBP program provides monthly capacity payments ($/kW) based on amounts of load reductions that participating aggregators elect each month, plus additional energy payments ($/kWh) based on the actual kWh reductions (relative to the program baseline) that are achieved when an event is called.[1] Participants may adjust their nomination each month, as well as their choice of available event type and window options (*e.g.*, *day-ahead* or *day-of* events, and 4-hour, 6-hour or 8-hour event lengths). CBP events may be called on non-holiday weekdays in the months of May through October, between the hours of 11 a.m. and 7 p.m. Baseline loads, which serve as the basis for calculating load reductions for settlement, are calculated on the summed loads of an aggregated group of customers, based on the "highest 3-in-10" method.

PG&E had six CBP aggregators at the time of its one test event in July. For that month, two aggregators nominated DA products only, three nominated DO products only, and one nominated both DA and DO products. Three of SCE's six aggregator contracts offer DO portfolios, two offer DA portfolios, and one aggregator offers both DA and DO portfolios. SDG&E has four CBP aggregators that offer DA products, one that offers DO products, and one that offers both types.

PG&E called one CBP event in 2009, in which both *day-ahead* and *day-of* program-types were called. SCE called twenty-six DA events, two of which were also called as DO events. SDG&E called nine events, some of which were DA only, some DO only, and for

[1] Capacity Payment Adjustments may be applied for performance of less than 100 percent of the nominated amount.

some events both program types were called. Events were also called for varying time periods.

### AMP

PG&E has five AMP aggregator contracts. Four aggregators offer DO products, while one offers DA products. Under AMP, aggregators may create their own aggregated DR program by which participating customers achieve load reductions. Up to 50 hours of events may be called each year, during the hours of 11 a.m. and 7 p.m. Three AMP events were called in 2009, but the second one was not included in the analysis because only one aggregator, with only one nominated customer account, was called. In the first and third events, both DA and DO program types were called.

### DRC

SCE has five DRC aggregators, three of which offered only DO contracts in 2009, one that offered only DA contracts, and one that offered both types. The terms of DRC are similar to those of SCE's CBP program.

### Program enrollment

Tables ES.1 through ES.4 summarize 2009 program enrollment in the DA and DO program types across all five aggregator programs at the three utilities.[2] The first two tables show enrollment in terms of number of customer service accounts (SA IDs), while the second two show enrollment in terms of megawatts (MW) of maximum demand.[3]

With the exception of PG&E's CBP program, the DO program type generally has substantially greater numbers of customer accounts and larger amounts of load than the DA program type.[4] The DA program types at several of the utilities have substantial shares of customers and load in the Manufacturing, and Offices, Hotels, Health and Services industry groups. The DO program types at each of the utilities have attracted a large number of Retail stores, and the AMP and DRC DO program types have enrolled substantial load in the Manufacturing; Wholesale, Transport and other Utilities (primarily water utilities); and Offices, Hotels, Health and Services industry groups.

[2] Determining which program type CBP customer accounts were enrolled in was only clear-cut for those who were nominated for at least one month in one of the DA or DO program options. The minority of customer accounts who were never nominated were generally assigned to the DO program type.
[3] Note that the maximum demand values are provided to illustrate the size, or scale of the total load of enrolled customers. It does not reflect "subscribed demand", which is a measure of potential load impacts.
[4] One PG&E aggregator offered the DA option to several hundred relatively small customer accounts in the San Francisco area.

**Table ES.1: Aggregator Program Enrollment – *Day-Ahead Program Types* (*Customer Accounts*)**

| Industry Type | CBP | | | AMP | DRC |
|---|---|---|---|---|---|
| | PG&E | SCE | SDG&E | PG&E | SCE |
| 1. Agriculture, Mining & Construction | 29 | 0 | | 33 | |
| 2. Manufacturing | 97 | 1 | 35 | 126 | 3 |
| 3. Wholesale, Transport, other Utilities | 50 | 0 | 9 | 20 | 25 |
| 4. Retail stores | 118 | 76 | 1 | 1 | 130 |
| 5. Offices, Hotels, Health, Services | 219 | 0 | 80 | 33 | 4 |
| 6. Schools | 57 | 0 | 2 | 45 | |
| 7. Entertainment, Other Services, Gov't | 98 | 0 | 4 | 13 | 3 |
| 8. Other/Unknown | 12 | | | 2 | |
| Total | 680 | 77 | 131 | 273 | 165 |

**Table ES.2: Aggregator Program Enrollment – *Day-Of Program Types* (*Customer Accounts*)**

| Industry Type | CBP | | | AMP | DRC |
|---|---|---|---|---|---|
| | PG&E | SCE | SDG&E | PG&E | SCE |
| 1. Agriculture, Mining & Construction | 21 | 2 | | 156 | 18 |
| 2. Manufacturing | 5 | 19 | 3 | 105 | 67 |
| 3. Wholesale, Transport, other Utilities | 22 | 25 | 24 | 112 | 707 |
| 4. Retail stores | 180 | 490 | 189 | 131 | 355 |
| 5. Offices, Hotels, Health, Services | 15 | 63 | 46 | 144 | 49 |
| 6. Schools | 10 | | 5 | 9 | 19 |
| 7. Entertainment, Other Services, Gov't | 24 | 4 | 33 | 14 | 17 |
| 8. Other/Unknown | 3 | | | 1 | |
| Total | 280 | 603 | 300 | 672 | 1232 |

**Table ES.3: Aggregator Program Enrollment – *Day-Ahead Program Types* (*MW of Maximum Demand*)**

| Industry Type | CBP | | | AMP | DRC |
|---|---|---|---|---|---|
| | PG&E | SCE | SDG&E | PG&E | SCE |
| 1. Agriculture, Mining & Construction | 8.3 | 0.0 | 0.0 | 8.7 | 0.0 |
| 2. Manufacturing | 56.9 | 1.7 | 21.6 | 161.4 | 1.8 |
| 3. Wholesale, Transport, other Utilities | 7.3 | 0.0 | 2.2 | 12.2 | 13.8 |
| 4. Retail stores | 7.7 | 7.5 | 0.0 | 0.3 | 43.2 |
| 5. Offices, Hotels, Health, Services | 44.2 | 0.0 | 23.2 | 20.9 | 1.4 |
| 6. Schools | 27.1 | 0.0 | 3.1 | 16.6 | 0.0 |
| 7. Entertainment, Other Services, Gov't | 10.1 | 0.0 | 1.1 | 10.3 | 0.8 |
| 8. Other/Unknown | 1.5 | 0.0 | 0.0 | 1.5 | 0.0 |
| Total | 163.1 | 9.2 | 51.2 | 232.0 | 61.1 |

**Table ES.4: Aggregator Program Enrollment – *Day-Of Program Types* (*MW of Maximum Demand*)**

| Industry Type | CBP | | | AMP | DRC |
|---|---|---|---|---|---|
| | PG&E | SCE | SDG&E | PG&E | SCE |
| 1. Agriculture, Mining & Construction | 25.4 | 0.6 | 0.0 | 85.4 | 6.8 |
| 2. Manufacturing | 11.3 | 6.9 | 1.8 | 101.5 | 71.6 |
| 3. Wholesale, Transport, other Utilities | 8.9 | 7.6 | 10.5 | 87.5 | 165.5 |
| 4. Retail stores | 65.4 | 138.7 | 49.9 | 61.5 | 132.6 |
| 5. Offices, Hotels, Health, Services | 6.3 | 23.8 | 17.9 | 105.5 | 33.2 |
| 6. Schools | 6.7 | 0.0 | 15.6 | 52.0 | 44.9 |
| 7. Entertainment, Other Services, Gov't | 2.3 | 1.2 | 5.8 | 10.7 | 9.0 |
| 8. Other/Unknown | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total | 126.4 | 178.8 | 101.4 | 504.1 | 463.4 |

### *ES.2 Evaluation Methodology*

Estimates of total program-level load impacts for each program were developed from the coefficients of individual customer regression equations. These equations were estimated over the summer months for 2009, using individual customer load data for all customer accounts enrolled in each program.

The regression equations were based on models of hourly loads as functions of a list of variables designed to control for factors such as:

- Seasonal and hourly time patterns (*e.g.*, month, day-of-week, and hour, plus various hour/day-type interactions)
- Weather (*e.g.*, cooling degree hours)
- Event indicators—Event indicators, which were invoked when a given customer's program type was called, were interacted with hourly indicator variables to allow estimation of hourly load impacts for each event.

The resulting equations provide the capability of measuring hourly load impacts on event days, as well as simulating hourly reference load profiles for various day-types and weather conditions. In addition, the customer-specific equations provide the capability to summarize load impacts by industry type and CAISO local capacity area, by adding across customers in any given category, and to analyze the effect of TA/TI and AutoDR participation. Finally, uncertainty-adjusted load impacts were calculated to illustrate the degree of uncertainty that exists around the estimated load impacts.

### *ES.3 Detailed Study Findings*

#### Summary of ex-post program load impacts

Table ES.5 summarizes estimates of average hourly ex post load impacts for PY 2009 for the average event for each of the three utilities' aggregator programs and program types (*e.g.*, *day-ahead* and *day-of*).

**Table ES.5: Aggregator Program Average Hourly Load Impacts (MW) – by Utility and Program Type (*2009*)**

| Program | CBP | | AMP/DRC | | Total | |
|---|---|---|---|---|---|---|
| Utility/ Program-type | DA | DO | DA | DO | DA | DO |
| PG&E | 21.5 | 22.4 | 38.5 | 83.9 | 60.0 | 106.3 |
| SCE | 0.8 | 25.4 | 3.9 | 63.6 | 4.7 | 89.0 |
| SDG&E | 10.3 | 12.5 | | | 10.3 | 12.5 |
| Total | 32.5 | 60.3 | 42.4 | 147.5 | 74.9 | 207.9 |

The utilities have asked for a summary indicator of average event-hour load impacts per enrolled customer for each program and program type. They are the following:

1. PG&E CBP DA – 32 kW
2. PG&E CBP DO – 80 kW
3. SCE CBP DA – 10 kW
4. SCE CBP DO – 42 kW

5. SDG&E CBP DA – 78 kW
6. SDG&E CBP DO – 42 kW
7. PG&E AMP DA – 141 kW
8. PG&E AMP DO – 125 kW
9. SCE DRC DA – 23 kW
10. SCE DRC DO – 52 kW.

### Effects of TA/TI and AutoDR

This evaluation included assessments of the load impacts associated with aggregator program customer accounts that participated in TA/TI or AutoDR programs. Two types of analysis were undertaken. First, we report average hourly load impacts for those service accounts that participated in TA/TI or AutoDR. Second, where sufficient numbers were available, we compared the load impacts of TA/TI and AutoDR customer accounts in specific business categories to those of non-TA/TI or AutoDR customer accounts in the same business categories (these accounts were often associated with a single customer, such as a large retailer with multiple stores). The latter comparisons were designed as the best opportunity to estimate *incremental* impacts of TA/TI and AutoDR. However, the samples of customer accounts were quite small, and the load impact comparisons were largely inconclusive due to considerable variability. In some cases, the load impacts for TA/TI and AutoDR customer accounts were greater than those of the comparison customer accounts, and in some cases they were smaller.

### Summary of ex-ante enrollment and load impacts

Ex ante forecasts of load impacts for each utility and program type were produced based on per-customer load impacts calculated from the ex post evaluation results, and applied to enrollment forecasts provided by the utilities. The ex ante results include a new AMP DO contract at SDG&E, which involves an aggregator moving from CBP DO to the new AMP contract. Figure ES.1 compares enrolled customer accounts in 2009 to enrollment forecasts for 2012. Enrollment is expected to grow relatively faster for the AMP/DRC programs than for CBP.

**Figure ES.1: Aggregator Program Enrollment (Customer Accounts) – by Utility and Program Type – *2009 and 2012***

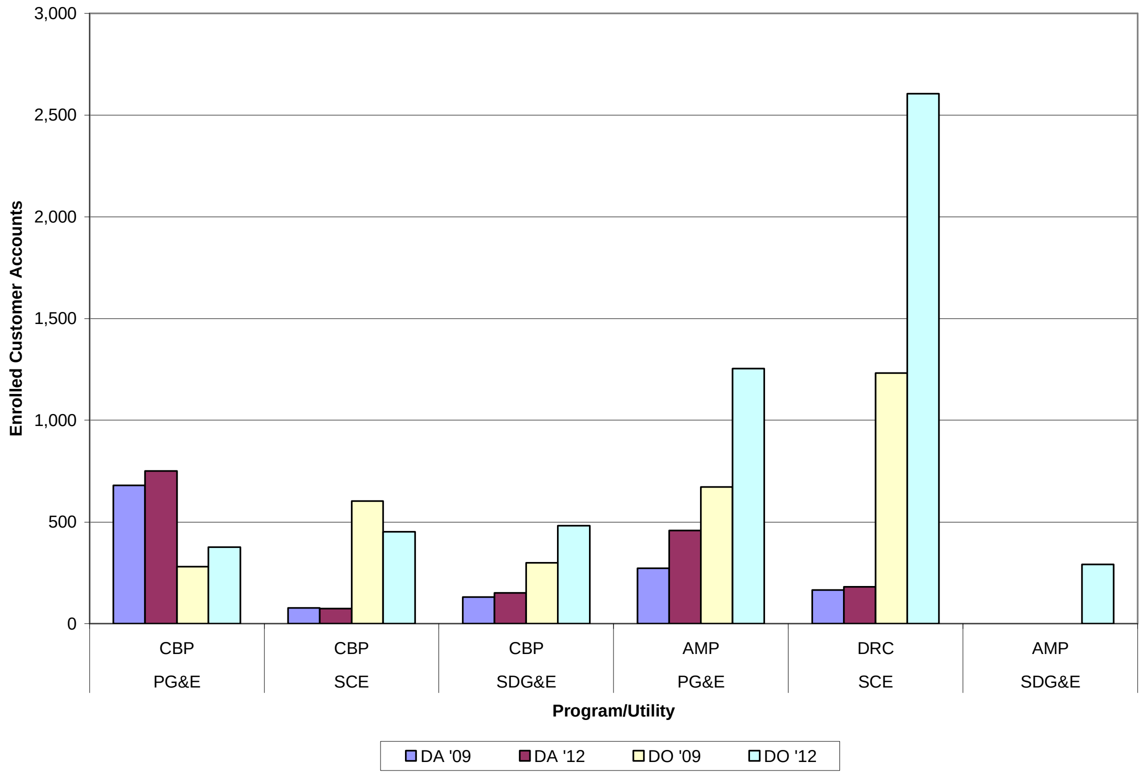
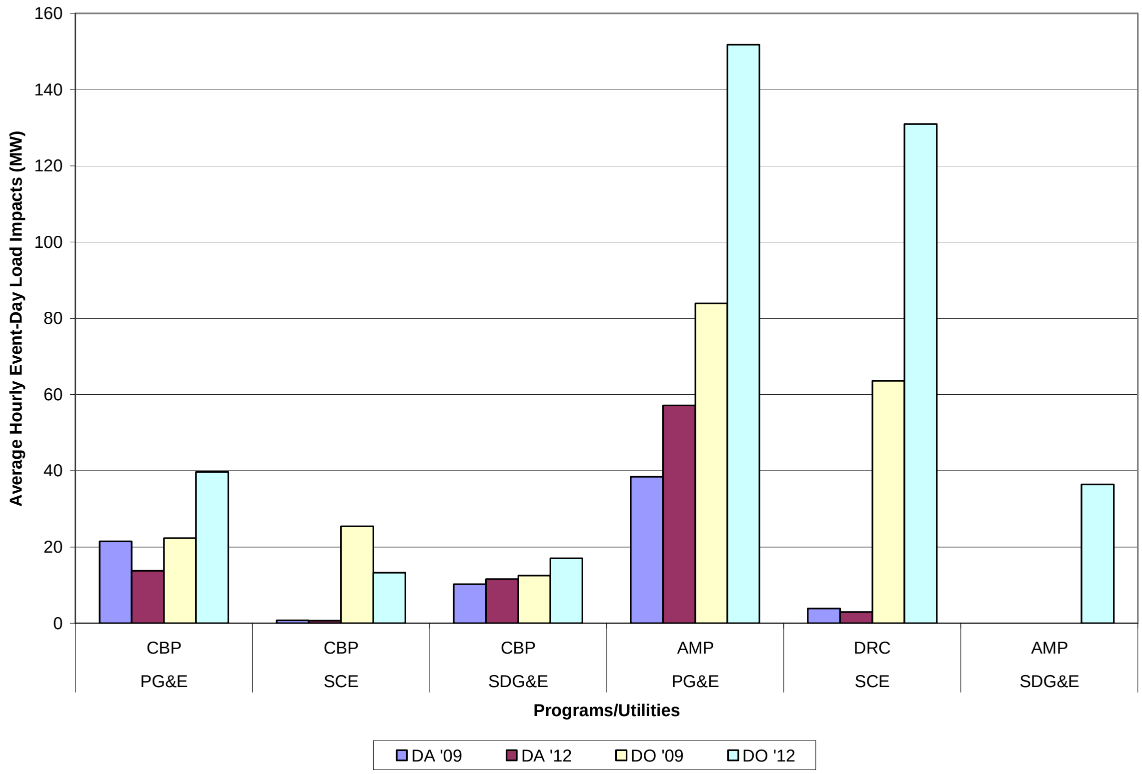



Figure ES.2 compares average hourly load impacts for a typical event day, by utility and program type, for 2009, as estimated in the ex-post evaluation, to those projected for 2012 in the 1-in-2 weather scenario of the ex-ante evaluation. Substantial growth is expected in the DO program types of PG&E and SDG&E's AMP programs, and SCE's DRC.

**Table ES.7: Average-Hourly Load Impacts (MW) – by Utility and Aggregator Program – *2009 and 2012 (Typical Event Day in 1-in-2 Weather Year)***




## *ES 4 Conclusions*

The individual customer regression equations generally worked well in developing load impact estimates and providing the capability of summing across different customer types to produce load impacts at the program level, by industry type, and by CAISO local capacity area, as well as for supporting analysis of the effects of TA/TI participation. Changes in monthly enrollments and nominations across the summer period, particularly between CBP and the aggregator contract programs presented data management and analysis complications in conducting the ex post evaluation. However, we believe that the reported results accurately characterize the aggregator program load impacts in 2009. The total average hourly load impact of all of the aggregator programs combined across the three utilities, for an average event, amounted to nearly 75 MW for the *day-ahead* program type and 208 MW for the *day-of* program type.

## 1. Introduction and Purpose of the Study

This report documents the results of an evaluation of aggregator demand response (DR) programs operated by the three California investor-owned utilities (IOUs), San Diego Gas and Electric (SDG&E), Southern California Edison (SCE), and Pacific Gas and Electric (PG&E) for Program Year 2009. In these programs, aggregators contract with non-residential customers to act on their behalf with respect to all aspects of the DR program, including receiving notices from the utility, arranging for load reductions on event days, receiving incentive payments, and paying penalties (if warranted) to the utility. Each aggregator forms a "portfolio" of individual customers such that their aggregated load participates in the DR programs. Aggregators receive both *capacity credits* for monthly nominated load reductions, and *energy payments* based on measured load reductions during events.

The scope of this evaluation covers the state-wide Capacity Bidding Program ("CBP"), which is operated by all three IOUs, PG&E's Aggregator Managed Portfolio ("AMP"), and SCE's Demand Response Resource Contracts ("DRC").

The primary goals of this evaluation study were the following:

1. Estimate the *ex post* load impacts for program year 2009; and
2. Estimate *ex ante* load impacts for the programs for 2010 through 2020

The first goal involved estimating the *hourly load impacts* for each event, for each of the utilities' aggregator programs, as well as the distribution of load impacts for a typical event across industry types and CAISO local capacity areas. Our primary approach involved estimating *individual customer regressions*, which provided a flexible basis for analyzing and reporting load impact results at various levels (*e.g.*, total program level) and by various factors (*e.g.*, by industry group and CAISO local capacity area), including participation in the AutoDR and Technical Assistance and Technology Incentives (TA/TI) programs.

The second goal involved combining the information on historical ex post load impacts with utility projections of program enrollment to produce *forecasts of load impacts* for each of the programs through 2020.

After this introductory section, Section 2 describes the aggregator programs, including the characteristics of the enrolled customer accounts. Section 3 discusses evaluation methodology. Section 4 presents ex post load impacts. Section 5 describes the ex ante forecasts of enrollment and load impacts. Section 6 discusses validity assessment, and Section 7 offers recommendations.

## 2. Description of Resources Covered in the Study

This section summarizes the aggregator programs covered in this evaluation, including the characteristics of the participants in the programs.

## 2.1 Description of the aggregator programs

### CBP

The CBP program provides monthly capacity payments ($/kW) based on amounts of load reductions that participating aggregators nominate each month, plus additional energy payments ($/kWh) based on the actual kWh reductions (relative to the program baseline) that are achieved when an event is called. Capacity penalties apply if events are called in a month and measured load reductions fall below 50 percent of nominated amounts.[5] Participants may adjust their nomination each month, as well as their choice of available event type and window options (*e.g.*, day-ahead (DA) or day-of (DO) events, and 1 to 4, 2 to 6, or 4 to 8-hour events). CBP events may be called on non-holiday weekdays in the months of May through October, between the hours of 11 a.m. and 7 p.m.

Baseline loads, which serve as the basis for calculating load reductions for settlement, are calculated on the summed loads of an aggregated group of customers, based on the "highest 3-in-10" method. That is, the hourly baseline load during the event period is the hourly average across the *three* highest energy-usage (during program hours) days for the group out of the *ten* weekdays prior to the event (excluding holidays and previous event days). The "actual" load reduction in each hour is determined for settlement purposes as the difference between the baseline load and the observed aggregated load in that hour.

PG&E had six CBP aggregators at the time of its one test event in July. For that month, two aggregators nominated DA products only, three nominated DO products only, and one nominated both DA and DO products. Three of SCE's six aggregator contracts offer DO portfolios, two offer DA portfolios, and one offers both DA and DO portfolios. SDG&E has four CBP aggregators that offer DA products, one that offers DO products, and one that offers both types.

### AMP

PG&E has five AMP aggregator contracts. Four aggregators offer DO products, while one offers DA products. Under AMP, aggregators may create their own aggregated DR program by which participating customers achieve load reductions. Up to 50 hours of events may be called each year, during the hours of 11 a.m. and 7 p.m.

### DRC

SCE has five DRC aggregators, three of which offered only DO contracts in 2009, one that offered only DA contracts, and one that offered both types. The terms of DRC are similar to those of SCE's CBP program.

## 2.2 Participant characteristics

In order to assess the extent to which load impacts differ by customer type, the customers are categorized according to seven industry types. Table 2.1 indicates the industry groups

[5] Capacity Payment Adjustments may be applied for performance of less than 100 percent of the nominated amount.

and the corresponding North American Industry Classification System (NAICS) codes.[6] The following tables summarize the characteristics of the participating customer accounts in the aggregator programs, including industry type, local capacity area, and usage characteristics.

**Table 2.1: Industry Group Definition**

| Industry Groups | NAICS Codes |
|---|---|
| 1. Agriculture, Mining & Construction | 11, 21, 23 |
| 2. Manufacturing | 31 - 33 |
| 3. Wholesale, Transport, other Utilities | 22, 42, 48 - 49 |
| 4. Retail stores | 44 - 45 |
| 5. Offices, Hotels, Health, Services | 51 - 56, 62, 72 |
| 6. Schools | 61 |
| 7. Entertainment, Other Services, Government | 71, 81, 92 |
| 8. Other/Unknown | |

### 2.2.1 CBP

Tables 2.2 through 2.7 show enrollment by industry type for the DA and DO CBP program types, for PG&E, SCE, and SDG&E respectively. For purposes of these tables, customer accounts are included in the enrollment figures if they were reported as enrolled *for any month* during May through October of 2009. For PG&E and SCE, several aggregators have customers enrolled in both CBP and either AMP or DRC, and some have both DA and DO program types. Since nominations are made monthly, both enrollments and nominations are month specific. Also, customer accounts are sometimes moved between CBP and either AMP or DRC, and between DA and DO program types. The enrollment numbers in the tables below are generally based on conditions as of the month of the last event, as accounted for in the Protocol tables. The Protocol tables that are provided along with this report show the exact numbers of enrolled, nominated, and called customer accounts for each event, and for the typical event, for each utility and program type.

The first column in the tables reports the number of customer service accounts (SAIDs) that were enrolled in CBP during summer 2009. The second column, labeled "Mean kWh," represents the sum of enrolled customers' *average hourly usage* over the summer months. The third column, labeled "Max kW," represents the sum of enrolled customers' individual average (non-coincident) *maximum demand* values over the summer months. The fourth column, labeled "Peak kW," shows average demand during non-holiday *summer weekday peak periods* (hours ending 13-18) on non-event days.[7] The final two columns indicate the share of Max kW by industry type and the average size (kW) of the customer accounts in a given industry type, measured by maximum demand.

[6] SCE provided SIC codes in place of NAICS codes. The industry groups were therefore defined according the following SIC codes: 1 = under 2000; 2 = 2000 to 3999; 3 = 4000 to 5199; 4 = 5200 to 5999; 5 = 6000 to 8199; 6 = 8200 to 8299; 7 = 8300 and higher.

[7] This statistic is designed as an approximation to the average hourly estimated reference load on event days that is reported in the Protocol tables.

The second to last columns in the enrollment tables indicate that the mix of industry types across utilities and program types varies considerably. Of note, Retail stores make up a large share of CBP DO enrolled load at each of the utilities, as well as for the DA program type at SCE. For PG&E and SDG&E DA program types, Manufacturing, and Offices, Hotels, Health and Services are important industry groups, while for SCE DO the latter is the second most important industry type. In addition, CBP customer accounts tend to be relatively small, averaging around 300 kW in maximum demand.

**Table 2.2: Enrollment by Industry group – *PG&E CBP DA***

| Industry Type | Num. of SAIDs | Mean kWh | Max kW | Peak kW | % of Max kW | Ave size |
|---|---|---|---|---|---|---|
| 1. Agriculture, Mining & Construction | 29 | 3,468 | 8,314 | 4,398 | 5% | 287 |
| 2. Manufacturing | 97 | 33,204 | 56,927 | 40,256 | 35% | 587 |
| 3. Wholesale, Transport, other Utilities | 50 | 3,301 | 7,273 | 3,351 | 4% | 145 |
| 4. Retail stores | 118 | 3,918 | 7,729 | 5,807 | 5% | 66 |
| 5. Offices, Hotels, Health, Services | 219 | 24,395 | 44,232 | 34,227 | 27% | 202 |
| 6. Schools | 57 | 13,719 | 27,056 | 17,497 | 17% | 475 |
| 7. Entertainment, Other Services, Gov't | 98 | 5,096 | 10,080 | 6,966 | 6% | 103 |
| 8. Other/Unknown | 12 | 865 | 1,460 | 1,090 | 1% | 122 |
| Total | 680 | 87,966 | 163,071 | 113,594 | 100% | 240 |

**Table 2.3: Enrollment by Industry group – *PG&E CBP DO***

| Industry Type | Num. of SAIDs | Mean kWh | Max kW | Peak kW | % of Max kW | Ave size |
|---|---|---|---|---|---|---|
| 1. Agriculture, Mining & Construction | 21 | 17,504 | 25,426 | 20,812 | 20% | 1,211 |
| 2. Manufacturing | 5 | 7,847 | 11,317 | 9,770 | 9% | 2,263 |
| 3. Wholesale, Transport, other Utilities | 22 | 3,901 | 8,890 | 4,863 | 7% | 404 |
| 4. Retail stores | 180 | 42,692 | 65,434 | 53,510 | 52% | 364 |
| 5. Offices, Hotels, Health, Services | 15 | 3,470 | 6,254 | 5,269 | 5% | 417 |
| 6. Schools | 10 | 3,205 | 6,734 | 4,588 | 5% | 673 |
| 7. Entertainment, Other Services, Gov't | 24 | 945 | 2,255 | 1,192 | 2% | 94 |
| 8. Other/Unknown | 3 | 54 | 128 | 82 | 0% | 43 |
| Total | 280 | 79,617 | 126,439 | 100,086 | 100% | 452 |

**Table 2.4: Enrollment by Industry group – *SCE CBP DA***

| Industry Type | Num. of SAIDs | Mean kWh | Max kW | Peak kW | % of Max kW | Average Size |
|---|---|---|---|---|---|---|
| 1. Agriculture, Mining & Construction | 0 | 0 | 0 | 0 | 0% | |
| 2. Manufacturing | 1 | 831 | 1,720 | 1,045 | 19% | 1,720 |
| 3. Wholesale, Transport, other Utilities | 0 | 0 | 0 | 0 | 0% | |
| 4. Retail stores | 76 | 3,925 | 7,480 | 5,865 | 81% | 98 |
| 5. Offices, Hotels, Health, Services | 0 | 0 | 0 | 0 | 0% | |
| 6. Schools | 0 | 0 | 0 | 0 | 0% | |
| 7. Entertainment, Other Services, Gov't | 0 | 0 | 0 | 0 | 0% | |
| Total | 77 | 4,756 | 9,200 | 6,910 | 100% | 119 |

**Table 2.5: Enrollment by Industry group – *SCE CBP DO***

| Industry Type | Num. of SAIDs | Mean kWh | Max kW | Peak kW | % of Max kW | Average Size |
|---|---|---|---|---|---|---|
| 1. Agriculture, Mining & Construction | 2 | 263 | 578 | 384 | 0% | 289 |
| 2. Manufacturing | 19 | 2,966 | 6,865 | 3,796 | 4% | 361 |
| 3. Wholesale, Transport, other Utilities | 25 | 4,585 | 7,571 | 4,591 | 4% | 303 |
| 4. Retail stores | 490 | 97,339 | 138,738 | 114,303 | 78% | 283 |
| 5. Offices, Hotels, Health, Services | 63 | 12,534 | 23,778 | 14,631 | 13% | 377 |
| 6. Schools | | | | | | |
| 7. Entertainment, Other Services, Gov't | 4 | 475 | 1,248 | 615 | 1% | 312 |
| Total | 603 | 118,162 | 178,778 | 138,320 | 100% | 296 |

**Table 2.6: Enrollment by Industry group – *SDG&E CBP DA***

| Industry Groups | Num. of SAIDs | Mean kWh | Max kW | Peak kW | % Max kW | Average Size |
|---|---|---|---|---|---|---|
| 1. Agriculture, Mining & Construction | | | | | | |
| 2. Manufacturing | 35 | 11,464 | 21,637 | 15,565 | 42% | 618 |
| 3. Wholesale, Transport, other Utilities | 9 | 877 | 2,161 | 614 | 4% | 240 |
| 4. Retail stores | 1 | 12 | 27 | 22 | 0% | 27 |
| 5. Offices, Hotels, Health, Services | 80 | 12,232 | 23,204 | 18,095 | 45% | 290 |
| 6. Schools | 2 | 1,629 | 3,081 | 1,767 | 6% | 1,540 |
| 7. Entertainment, Other Services, Gov't | 4 | 777 | 1,119 | 871 | 2% | 280 |
| Total | 131 | 26,992 | 51,230 | 36,933 | 100% | 391 |

**Table 2.7: Enrollment by Industry group – *SDG&E CBP DO***

| Industry Groups | Num. of SAIDs | Mean kWh | Max kW | Peak kW | % Max kW | Average Size |
|---|---|---|---|---|---|---|
| 1. Agriculture, Mining & Construction | | | | | | |
| 2. Manufacturing | 3 | 920 | 1,799 | 1,278 | 2% | 600 |
| 3. Wholesale, Transport, other Utilities | 24 | 4,084 | 10,498 | 2,779 | 10% | 437 |
| 4. Retail stores | 189 | 34,264 | 49,854 | 43,098 | 49% | 264 |
| 5. Offices, Hotels, Health, Services | 46 | 10,175 | 17,938 | 12,394 | 18% | 390 |
| 6. Schools | 5 | 3,118 | 15,553 | 3,578 | 15% | 3,111 |
| 7. Entertainment, Other Services, Gov't | 33 | 3,586 | 5,796 | 4,210 | 6% | 176 |
| Total | 300 | 56,148 | 101,438 | 67,338 | 100% | 338 |

Tables 2.8 through 2.11 show CBP DA and DO enrollment by CAISO Local Capacity Area (LCA) for PG&E and SCE.[8]

[8] The entire SDG&E service area is considered to be one local capacity area.

**Table 2.8: Enrollment by Local Capacity Area – *PG&E CBP DA***

| Local Capacity Area | Num. of SAIDs | Mean kWh | Max kW | Peak kW | % of Max kW | Ave size |
|---|---|---|---|---|---|---|
| Greater Bay Area | 524 | 48,795 | 89,510 | 65,954 | 55% | 171 |
| Greater Fresno | 24 | 7,586 | 14,008 | 9,218 | 9% | 584 |
| Humboldt | 1 | 29 | 55 | 47 | 0% | 55 |
| Kern | 1 | 36 | 69 | 56 | 0% | 69 |
| Northern Coast | 19 | 2,369 | 4,937 | 3,186 | 3% | 260 |
| Sierra | 20 | 2,209 | 6,369 | 3,528 | 4% | 318 |
| Stockton | 9 | 1,059 | 2,175 | 1,494 | 1% | 242 |
| Not in any LCA | 82 | 25,883 | 45,947 | 30,112 | 28% | 560 |
| Total | 680 | 87,966 | 163,071 | 113,594 | 100% | 240 |

**Table 2.9: Enrollment by Local Capacity Area – *PG&E CBP DO***

| Local Capacity Area | Num. of SAIDs | Mean kWh | Max kW | Peak kW | % of Max kW | Ave size |
|---|---|---|---|---|---|---|
| Greater Bay Area | 141 | 25,941 | 40,486 | 32,401 | 32% | 287 |
| Greater Fresno | 36 | 8,108 | 15,483 | 10,744 | 12% | 430 |
| Humboldt | 2 | 955 | 1,554 | 1,413 | 1% | 777 |
| Kern | 16 | 4,090 | 7,486 | 5,218 | 6% | 468 |
| Northern Coast | 16 | 4,402 | 6,703 | 5,352 | 5% | 419 |
| Sierra | 13 | 3,047 | 4,839 | 3,854 | 4% | 372 |
| Stockton | 9 | 2,951 | 5,010 | 4,140 | 4% | 557 |
| Not in any LCA | 47 | 30,124 | 44,878 | 36,965 | 35% | 955 |
| Total | 280 | 79,617 | 126,439 | 100,086 | 100% | 452 |

**Table 2.10: Enrollment by Local Capacity Area – *SCE CBP DA***

| Local Capacity Area | Num. of SAIDs | Mean kWh | Max kW | Peak kW | % of Max kW | Average Size |
|---|---|---|---|---|---|---|
| LA Basin | 60 | 3,248 | 6,178 | 4,750 | 67% | 103 |
| Outside LA Basin | 5 | 226 | 428 | 386 | 5% | 86 |
| Ventura | 12 | 1,282 | 2,594 | 1,774 | 28% | 216 |
| Total | 77 | 4,756 | 9,200 | 6,910 | 100% | 119 |

**Table 2.11: Enrollment by Local Capacity Area – *SCE CBP DO***

| Local Capacity Area | Num. of SAIDs | Mean kWh | Max kW | Peak kW | % of Max kW | Average Size |
|---|---|---|---|---|---|---|
| LA Basin | 497 | 94,772 | 144,426 | 110,621 | 81% | 291 |
| Outside LA Basin | 36 | 8,674 | 12,389 | 10,435 | 7% | 344 |
| Ventura | 70 | 14,716 | 21,963 | 17,264 | 12% | 314 |
| Total | 603 | 118,162 | 178,778 | 138,320 | 100% | 296 |

### 2.2.2 AMP and DRC

Tables 2.12 through 2.19 show comparable enrollment information for PG&E's AMP DA and DO program types, and SCE's DRC DA and DO program types. PG&E's AMP DA has a large share of Manufacturing customers, while DO enrollment is spread over several industry types. DRC DA and DO have large shares in the Wholesale, Transportation and other Utilities, and Retail industry groups.

**Table 2.12: Enrollment by Industry Group – *PG&E AMP DA***

| Industry Group | Num. of SAIDs | Mean kWh | Max kW | Peak kW | % of Max kW | Average Size |
|---|---|---|---|---|---|---|
| 1. Agriculture, Mining & Construction | 33 | 3,043 | 8,747 | 3,783 | 4% | 265 |
| 2. Manufacturing | 126 | 104,831 | 161,444 | 117,978 | 70% | 1,281 |
| 3. Wholesale, Transport, other Utilities | 20 | 5,842 | 12,198 | 5,566 | 5% | 610 |
| 4. Retail stores | 1 | 105 | 255 | 150 | 0% | 255 |
| 5. Offices, Hotels, Health, Services | 33 | 12,377 | 20,923 | 16,193 | 9% | 634 |
| 6. Schools | 45 | 7,009 | 16,644 | 10,903 | 7% | 370 |
| 7. Entertainment, Other Services, Gov't | 13 | 7,544 | 10,336 | 8,459 | 4% | 795 |
| 8. Other/Unknown | 2 | 712 | 1,488 | 816 | 1% | 744 |
| Total | 273 | 141,462 | 232,034 | 163,849 | 100% | 850 |

**Table 2.13: Enrollment by Industry Group – *PG&E AMP DO***

| Industry Group | Num. of SAIDs | Mean kWh | Max kW | Peak kW | % of Max kW | Average Size |
|---|---|---|---|---|---|---|
| 1. Agriculture, Mining & Construction | 156 | 53,185 | 85,445 | 59,903 | 17% | 548 |
| 2. Manufacturing | 105 | 55,610 | 101,510 | 67,734 | 20% | 967 |
| 3. Wholesale, Transport, other Utilities | 112 | 53,455 | 87,495 | 57,285 | 17% | 781 |
| 4. Retail stores | 131 | 38,408 | 61,483 | 48,650 | 12% | 469 |
| 5. Offices, Hotels, Health, Services | 144 | 56,830 | 105,460 | 78,544 | 21% | 732 |
| 6. Schools | 9 | 25,048 | 52,002 | 30,426 | 10% | 5,778 |
| 7. Entertainment, Other Services, Gov't | 14 | 6,862 | 10,669 | 8,387 | 2% | 762 |
| 8. Other/Unknown | 1 | 2 | 15 | 3 | 0% | 15 |
| Total | 672 | 289,401 | 504,080 | 350,930 | 100% | 750 |

**Table 2.14: Enrollment by Local Capacity Area – *PG&E AMP DA***

| Local Capacity Area | Num. of SAIDs | Mean kWh | Max kW | Peak kW | % of Max kW | Average Size |
|---|---|---|---|---|---|---|
| Greater Bay Area | 81 | 39,265 | 60,203 | 47,515 | 26% | 743 |
| Greater Fresno | 34 | 15,777 | 28,039 | 18,856 | 12% | 825 |
| Humboldt | | | | | | |
| Kern | | | | | | |
| Northern Coast | 25 | 5,919 | 11,418 | 7,456 | 5% | 457 |
| Sierra | 26 | 4,189 | 10,096 | 6,141 | 4% | 388 |
| Stockton | 11 | 8,301 | 12,349 | 9,473 | 5% | 1,123 |
| Not in any LCA | 96 | 68,011 | 109,930 | 74,406 | 47% | 1,145 |
| **Total** | 273 | 141,462 | 232,034 | 163,849 | 100% | 850 |

### Table 2.15: Enrollment by Local Capacity Area – *PG&E AMP DO*

| Local Capacity Area | Num. of SAIDs | Mean kWh | Max kW | Peak kW | % of Max kW | Average Size |
|---|---|---|---|---|---|---|
| Greater Bay Area | 226 | 84,008 | 157,930 | 115,941 | 31% | 699 |
| Greater Fresno | 152 | 46,640 | 93,495 | 53,095 | 19% | 615 |
| Humboldt | 8 | 4,113 | 7,077 | 5,342 | 1% | 885 |
| Kern | 38 | 37,118 | 49,779 | 39,631 | 10% | 1,310 |
| Northern Coast | 47 | 9,321 | 19,239 | 12,521 | 4% | 409 |
| Sierra | 21 | 9,331 | 13,912 | 10,550 | 3% | 662 |
| Stockton | 25 | 9,203 | 19,287 | 10,896 | 4% | 771 |
| Not in any LCA | 155 | 89,667 | 143,361 | 102,953 | 28% | 925 |
| **Total** | 672 | 289,401 | 504,080 | 350,930 | 100% | 750 |

### Table 2.16: Enrollment by Industry group – *SCE DRC DA*

| Industrial Group | Num. of SAIDs | Mean kW | Max kW | Peak kW | % of Max kW | Average Size |
|---|---|---|---|---|---|---|
| 1. Agriculture, Mining & Construction | | | | | | |
| 2. Manufacturing | 3 | 850 | 1,834 | 1,186 | 3% | 611 |
| 3. Wholesale, Transport, other Utilities | 25 | 8,289 | 13,833 | 7,072 | 23% | 553 |
| 4. Retail stores | 130 | 20,557 | 43,244 | 33,006 | 71% | 333 |
| 5. Offices, Hotels, Health, Services | 4 | 618 | 1,386 | 806 | 2% | 347 |
| 6. Schools | | | | | | |
| 7. Entertainment, Other Services, Gov't | 3 | 369 | 786 | 548 | 1% | 262 |
| Total | 165 | 30,683 | 61,083 | 42,619 | 100% | 370 |

### Table 2.17: Enrollment by Industry group – *SCE DRC DO*

| Industrial Group | Num. of SAIDs | Mean kW | Max kW | Peak kW | % of Max kW | Average Size |
|---|---|---|---|---|---|---|
| 1. Agriculture, Mining & Construction | 18 | 2,850 | 6,755 | 3,549 | 1% | 375 |
| 2. Manufacturing | 67 | 41,926 | 71,570 | 47,868 | 15% | 1,068 |
| 3. Wholesale, Transport, other Utilities | 707 | 100,742 | 165,475 | 91,456 | 36% | 234 |
| 4. Retail stores | 355 | 91,007 | 132,555 | 110,609 | 29% | 373 |
| 5. Offices, Hotels, Health, Services | 49 | 19,000 | 33,151 | 20,986 | 7% | 677 |
| 6. Schools | 19 | 29,902 | 44,886 | 36,136 | 10% | 2,362 |
| 7. Entertainment, Other Services, Gov't | 17 | 4,263 | 9,026 | 4,760 | 2% | 531 |
| Total | 1,232 | 289,689 | 463,418 | 315,363 | 100% | 376 |

**Table 2.18: Enrollment by LCA – *SCE DRC DA***

| Local Capacity Area | Num. of SAIDs | Mean kW | Max kW | Peak kW | % of Max kW | Average Size |
|---|---|---|---|---|---|---|
| LA Basin | 136 | 26,006 | 52,382 | 35,324 | 86% | 385 |
| Outside LA Basin | 9 | 1,161 | 2,111 | 1,964 | 3% | 235 |
| Ventura | 20 | 3,516 | 6,590 | 5,331 | 11% | 330 |
| Total | 165 | 30,683 | 61,083 | 42,619 | 100% | 370 |

**Table 2.19: Enrollment by LCA – *SCE DRC DO***

| Local Capacity Area | Num. of SAIDs | Mean kW | Max kW | Peak kW | % of Max kW | Average Size |
|---|---|---|---|---|---|---|
| LA Basin | 905 | 216,626 | 348,334 | 236,716 | 75% | 385 |
| Outside LA Basin | 212 | 23,674 | 40,055 | 22,447 | 9% | 189 |
| Ventura | 115 | 49,389 | 75,029 | 56,200 | 16% | 652 |
| Total | 1,232 | 289,689 | 463,418 | 315,363 | 100% | 376 |

## *2.3 Program events*

### 2.3.1 CBP

PG&E called one CBP event in 2009, on July 27, as shown in Table 2.20. Both *day-ahead* and *day-of* program types were called. The DA event was nominally called for hours-ending 14 to 15, while the DO event was called for hours-ending 16-18. However, one of the DA aggregators inadvertently notified its customers that the event hours were HE 15 to 16. The average-hourly and hourly load impacts reported in Section 4 below account for the actual event hours faced by each DA customer account.

**Table 2.20: PG&E CBP Events – 2009**

| Event # | Date | Type | Aggregators | Hours |
|---|---|---|---|---|
| 1 | July 27, 2009 | DA | 2 | 14 - 15 |
| | | DA | 1 | 15 - 16 |
| | | DO | 4 | 16 - 18 |

SCE called twenty-six events, as shown in Table 2.21. All included DA program types, while two were also called as DO events (one being a test event). SDG&E called nine events, as shown in Table 2.22. Some events were DA only, some DO only, and for some both program types were called. Events were also called for varying time periods, as indicated in the table.

**Table 2.21: SCE CBP Events – 2009**

| Event # | Date | Type | Event Hours | Duration |
|---|---|---|---|---|
| 1 | July 14, 2009 | DA | 15 - 17 | 3 hrs |
| 2 | July 15, 2009 | DA | 14 - 18 | 5 hrs |
| 3 | July 16, 2009 | DA | 15 - 17 | 3 hrs |
| 4 | July 17, 2009 | DA | 15 - 18 | 4 hrs |
| 5 | July 20, 2009 | DA | 15 - 17 | 3 hrs |
| 6 | July 21, 2009 | DA | 15 - 17 | 3 hrs |
| 7 | July 23, 2009 | DA | 16 | 1 hr |
| 8 | July 27, 2009 | DA | 16 | 1 hr |
| 9 | July 28, 2009 | DA | 15 - 17 | 3 hrs |
| 10 | August 4, 2009 | DA | 16 - 17 | 2 hrs |
| 11 | August 11, 2009 | DA | 16 - 17 | 2 hrs |
| 12 | August 12, 2009 | DA | 16 - 17 | 2 hrs |
| 13 | August 13, 2009 | DA | 16 - 17 | 2 hrs |
| 14 | August 14, 2009 | DA | 16 | 1 hr |
| 15 | August 17, 2009 | DA | 16 - 17 | 2 hrs |
| 16 | August 19, 2009 | DA | 16 - 17 | 2 hrs |
| 17 | August 27, 2009 | DA | 14 - 19 | 6 hrs |
| | | **DO (Test)** | 15 - 18 | 4 hrs |
| 18 | August 28, 2009 | DA | 15 - 18 | 4 hrs |
| | | **DO** | 15 - 18 | 4 hrs |
| 19 | August 31, 2009 | DA | 15 - 17 | 3 hrs |
| 20 | September 1, 2009 | DA | 14 - 18 | 5 hrs |
| 21 | September 2, 2009 | DA | 15 - 18 | 4 hrs |
| 22 | September 3, 2009 | DA | 15 - 18 | 4 hrs |
| 23 | September 4, 2009 | DA | 15 - 18 | 4 hrs |
| 24 | September 8, 2009 | DA | 15 - 18 | 4 hrs |
| 25 | September 9, 2009 | DA | 16 - 17 | 2 hrs |
| 26 | September 10, 2009 | DA | 16 - 17 | 2 hrs |

**Table 2.22: SDG&E CBP Events – 2009**

| Event | Date | Number of Contracts | | Contract Types -- Hours Ending (Num. of Contracts) | | | |
|---|---|---|---|---|---|---|---|
| | | DA | DO | DA | DO | | |
| 1 | July 21, 2009 | 0 | 9 | | 15-18 (9) | | |
| 2 | August 26, 2009 | 0 | 9 | | 14-17 (9) | | |
| 3 | August 27, 2009 | 4 | 9 | 15-18 | 15-18 (7) | 14-19 (2) | |
| 4 | August 28, 2009 | 4 | 9 | 15-18 | 15-18 (7) | 14-19 (2) | |
| 5 | September 2, 2009 | 0 | 9 | | 16-19 (9) | | |
| 6 | September 3, 2009 | 4 | 9 | 15-18 | 15-18 (4) | 14-19 (3) | 13-19 (2) |
| 7 | September 4, 2009 | 4 | 0 | 15-18 | | | |
| 8 | September 24, 2009 | 4 | 9 | 14-17 | 14-17 (4) | 13-18 (3) | 14-18 (2) |
| 9 | September 25, 2009 | 4 | 0 | 14-17 | | | |

### 2.3.2 AMP and DRC

Tables 2.23 and 2.24 list the events for PG&E's AMP and SCE's DRC programs, respectively. Three AMP events were called, all of which were test events. However, the second event was not included in the analysis because only one aggregator, with only one nominated customer account, was called. SCE called one DRC DA event and one DO event, each of which was a monitoring and evaluation (M&E) test event.

**Table 2.23: AMP (PG&E) Events (Test) – 2009**

| Event # | Date | Type | Aggregators | Hours |
|---|---|---|---|---|
| 1 | July 16, 2009 | DA | 1 | 16 - 17 |
| | | DO | 3 | 16 - 17 |
| 2 | July 27, 2009 | DO | 1 | |
| 3 | August 28, 2009 | DA | 1 | 16 - 17 |
| | | DO | 3* | 15 - 16 |

* Includes two of the three aggregators in Event 1

**Table 2.24: DRC (SCE) Events – 2009**

| Event # | Date | Type | Event Hours | Duration |
|---|---|---|---|---|
| 1 | July 14, 2009 | DA (M&E) | 15 - 17 | 3 hrs |
| 2 | September 23, 2009 | DO (M&E) | 15 - 16 | 2 hrs |

# 3. Study Methodology

## *3.1 Overview and questions addressed*

Direct estimates of total program-level ex post load impacts for each program were developed from the coefficients of individual customer regression equations. These equations were estimated over the summer months for 2009, primarily by using individual data for all customer accounts enrolled in each program. In some cases, aggregate equations were also estimated, for diagnostic purposes and cross checking of results.

The regression equations were based on models of hourly loads as functions of a list of variables designed to control for factors such as:

- Seasonal and hourly time patterns (*e.g.*, month, day-of-week, and hour, plus various hour/day-type interactions)
- Weather (*e.g.*, hourly CDH)
- Event indicators—Event indicators, combined with information on which customer accounts were nominated in each month for a program type (e.g., day-of program for two to four hours), and which program types were called for each event, were interacted with hourly indicator variables to allow estimation of hourly load impacts for each event.

The resulting equations provide the capability of simulating hourly reference load profiles for various day-types and weather conditions, as well as measuring hourly load changes on event days. The models use the *level* of hourly usage as the dependent variable and a separate equation is estimated for each enrolled and nominated customer. As a result, the coefficients on the event day/hour variables are direct estimates of the ex post load impacts. For example, a CBP hour-14 coefficient of -100 for Event 1 means that the customer reduced load by 100 kWh during hour 14 of that event day relative to its normal usage in that hour. Weekends and holidays were excluded from the estimation database.[9] Finally, uncertainty-adjusted load impacts were calculated to illustrate the degree of statistical confidence that exists around the estimated load impacts.

### *3.2 Primary regression equation specifications*

Ex post load impacts were estimated using customer-level hourly data from May through October. The primary regression model is characterized as follows:

$$\begin{aligned}
Q_t &= a + \sum_{Evt=1}^{E}\sum_{i=1}^{24}(b_{i,Evt}^{AGG} \times h_{i,t} \times AGG_t) + b^{MornLoad} \times MornLoad_t + \sum_{i=1}^{24}(b_i^{CDH} \times h_{i,t} \times CDH_t) \\
&+ \sum_{i=2}^{24}(b_i^{MON} \times h_{i,t} \times MON_t) + \sum_{i=2}^{24}(b_i^{FRI} \times h_{i,t} \times FRI_t) + \sum_{i=2}^{24}(b_i^{h} \times h_{i,t}) + \sum_{i=2}^{5}(b_i^{DTYPE} \times DTYPE_{i,t}) \\
&+ \sum_{i=6}^{10}(b_i^{MONTH} \times MONTH_{i,t}) + b_t^{Summer} \times Summer_t + \sum_{i=1}^{24}(b_i^{CDH,S} \times h_{i,t} \times Summer_t \times CDH_t) \\
&+ \sum_{i=2}^{24}(b_i^{MON,S} \times h_{i,t} \times Summer_t \times MON_t) + \sum_{i=2}^{24}(b_i^{FRI,S} \times h_{i,t} \times Summer_t \times FRI_t) \\
&+ \sum_{i=2}^{24}(b_i^{h,S} \times h_{i,t} \times Summer_t) + e_t
\end{aligned}$$

In this equation, $Q_t$ represents the demand in hour $t$ for a customer nominated in the month of the event date; the *b*'s are estimated parameters; $h_{i,t}$ is a dummy variable for hour $i$; $AGG_t$ is an indicator variable for program event days; $CDH_t$ is cooling degree hours;[10] $E$ is the number of event days that occurred during the program year; $MornLoad_t$ is a variable equal to the average of the day's load in hours 1 through 10; $MON_t$ is a dummy variable for Monday; $FRI_t$ is a dummy variable for Friday; $DTYPE_{i,t}$ is a series of dummy variables for each day of the week; $MONTH_{i,t}$ is a series of dummy variables for each month; $Summer_t$ is a variable defining summer months (defined as mid-June through mid-August)[11], which is interacted with the weather and hourly profile variables; and $e_t$ is the error term. The "morning load" variable was used in lieu of a more formal autoregressive structure in order to adjust the model to account for load levels on a particular day, particularly for customers whose daily loads vary substantially for no observable reason (such as more or less intensive than average operations on the part of manufacturing customers). Because of the

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[9] Including weekends and holidays would require the addition of variables to capture the fact that load levels and patterns on weekends and holidays can differ greatly from those of non-holiday weekdays. Because event days do not occur on weekends or holidays, the exclusion of these data does not affect the model's ability to estimate ex post load impacts.

[10] Cooling degree hours (CDH) was defined as MAX[0, Temperature – 50], where Temperature is the hourly temperature in degrees Fahrenheit. Customer-specific CDH values are calculated using data from the most appropriate weather station.

[11] This variable was initially designed to reflect the load changes that occur when schools are out of session. We have found the variable to be a useful part of the base specification, as it helps somewhat in modeling schools and does not appear to harm load impact estimates even in cases in which the customer does not change its usage level or profile substantially during the summer months.

autoregressive nature of the morning load variable, no further correction for serial correlation was performed in these models.

Separate models were estimated for each customer. The estimated load impacts, in the form of hourly event coefficients, were aggregated across customers to arrive at program-level load impacts, and results by industry group and LCA. Overall program-level and aggregator-level regressions were also estimated in some cases, primarily to provide consistency checks for the individual customer results.

### *3.3 Uncertainty-Adjusted Load Impacts*

The Load Impact Protocols require the estimation of uncertainty-adjusted load impacts. In the case of *ex post* load impacts, the parameters that constitute the load impact estimates are not estimated with certainty. Therefore, we base the uncertainty-adjusted load impacts on the variances associated with the estimated load impacts.

Specifically, we add the variances of the estimated load impacts across the customers who were nominated for the event in question. These aggregations are performed at either the program level, by industry group, or by LCA. The uncertainty-adjusted scenarios were then simulated under the assumption that each hour's load impact is normally distributed with the mean equal to the sum of the estimated load impacts and the standard deviation equal to the square root of the sum of the variances of the errors around the estimates of the load impacts. Results for the $10^{th}$, $30^{th}$, $70^{th}$, and $90^{th}$ percentile scenarios are generated from these distributions.

## 4. Detailed Study Findings

This section describes the results of our estimation of *aggregate* event-day load impacts for each utility, and for the DA and DO program types of each aggregator program (in addition, the Protocol table spreadsheet provided in conjunction with this report includes estimates of load impacts *per-enrolled customer*). For each program and program type, we summarize the load impacts estimated for 2009 at three levels of aggregation. First, using the metric of *average hourly load impacts,* we summarize loads and load impacts for each event and the average event, as well as the distribution of load impacts for the average event across industry types and local capacity areas (for PG&E and SCE).

Second, we report average event-hour load impacts *for each hour that was included in the event window for any event*, where the average is across only those customer accounts and event days for which that hour was involved in an event.[12] These tables also include load impacts *per called customer*. Finally, we provide overall examples at the level of the DA and DO program types of the formal tables required by the Protocols. These tables show estimated hourly reference loads, observed loads, and estimated load impacts for the

[12] This distinction is necessary for the aggregator programs because of the many different sets of hours that were called for some of the program types. This is in contrast, for example, to the utilities' critical-peak pricing rates, in which the same hours are called for each event.

average event, as well as uncertainty-adjusted load impacts at different probability levels.[13] Complete sets of tables are provided in an appendix. Hourly load impact results are also illustrated in figures.

We begin with CBP at each of the three utilities, and then turn to AMP (PG&E) and DRC (SCE).

## *4.1 CBP – PG&E*

### 4.1.1 Summary load impacts

Tables 4.1 and 4.2 show average hourly estimated *reference load*, *observed load*, *load impacts* and percent load impact, by industry group, for the DA and DO components respectively, of PG&E's single CBP event on July 27, 2009. The average hourly DA load impact was 21.5 MW, while the DO load impact averaged 22.4 MW. The DO load impact was averaged over hours-ending (HE) 16 – 18. For DA, the official event hours were HE 14 – 15. However, one aggregator mistakenly notified its customers that the event hours were HE 15 – 16. Table 4.1 contains results for the overlapping hour 15.

The Manufacturing industry group accounted for the largest share of DA load impacts, while the Agriculture, Mining and Construction, and Retail industry groups provided the largest share of DO load impacts. At a more detailed level, more than 40 percent of the total estimated load impacts for both the DA and DO program types were accounted for by single customer accounts, while the top 6 responders accounted for 60 percent of the total DA load impact, and the top 4 responders accounted for nearly 50 percent of the total DO load impact.

**Table 4.1: Average Hourly Load Impacts (HE 15) by Industry Group – *PG&E CBP DA***

| Industry Group | SAIDs Called | Estimated Reference Load (kW) | Observed Load (kW) | Estimated Load Impact (kW) | % LI |
|---|---|---|---|---|---|
| 1. Agriculture, Mining & Construction | 21 | 3,228 | 1,706 | 1,522 | 47% |
| 2. Manufacturing | 78 | 30,944 | 16,124 | 14,820 | 48% |
| 3. Wholesale, Transport, other Utilities | 43 | 2,859 | 1,922 | 937 | 33% |
| 4. Retail stores | 87 | 4,164 | 3,713 | 451 | 11% |
| 5. Offices, Hotels, Health, Services | 207 | 32,536 | 31,355 | 1,180 | 4% |
| 6. Schools | 52 | 17,648 | 15,183 | 2,465 | 14% |
| 7. Entertainment, Other Services, Gov't | 82 | 6,834 | 6,690 | 144 | 2% |
| 8. Other/Unknown | 11 | 977 | 1,012 | -35 | -4% |
| **Total** | **581** | **99,191** | **77,707** | **21,484** | **22%** |

[13] In these tables, average values of loads and load impacts for all 24 hours represent averages for those hours over all event days included in the definition of an average event, regardless of how many event days each hour was included in an event (*e.g.*, hour-ending 14 may have been within the event window for only 2 of 8 events for a given program).

**Table 4.2: Average Hourly Load Impacts by Industry Group – *PG&E CBP DO***

| Industry Group | SAIDs Called | Estimated Reference Load (kW) | Observed Load (kW) | Estimated Load Impact (kW) | % LI |
|---|---|---|---|---|---|
| 1. Agriculture, Mining & Construction | 8 | 18,199 | 7,502 | 10,697 | 59% |
| 2. Manufacturing | 3 | 1,388 | 751 | 637 | 46% |
| 3. Wholesale, Transport, other Utilities | 14 | 2,143 | 256 | 1,887 | 88% |
| 4. Retail stores | 160 | 51,539 | 43,040 | 8,499 | 16% |
| 5. Offices, Hotels, Health, Services | 5 | 2,593 | 2,511 | 83 | 3% |
| 6. Schools | 6 | 2,967 | 2,362 | 605 | 20% |
| 7. Entertainment, Other Services, Gov't | 2 | 160 | 157 | 3 | 2% |
| 8. Other/Unknown | | | | | |
| **Total** | **198** | **78,989** | **56,579** | **22,410** | **28%** |

Tables 4.3 and 4.4 show average hourly load impacts for DA and DO by LCA. The largest shares of the load impacts for both program types were outside of any LCA. Large impacts were also observed in the Greater Bay Area and Greater Fresno LCAs.

**Table 4.3: Average Hourly Load Impacts by LCA – *PG&E CBP DA***

| Local Capacity Area | SAIDs Called | Estimated Reference Load (kW) | Observed Load (kW) | Estimated Load Impact (kW) | % LI |
|---|---|---|---|---|---|
| Greater Bay Area | 474 | 58,878 | 55,084 | 3,794 | 6% |
| Greater Fresno | 19 | 7,278 | 5,291 | 1,987 | 27% |
| Humboldt | 0 | 0 | 0 | 0 | |
| Kern | 1 | 0 | 0 | 0 | |
| Northern Coast | 13 | 2,585 | 1,847 | 738 | 29% |
| Sierra | 14 | 2,507 | 1,703 | 804 | 32% |
| Stockton | 6 | 1,354 | 864 | 490 | 36% |
| Not in any LCA | 54 | 26,523 | 12,854 | 13,670 | 52% |
| **Total** | **581** | **99,124** | **77,643** | **21,482** | **22%** |

**Table 4.4: Average Hourly Load Impacts by LCA – *PG&E CBP DO***

| Local Capacity Area | SAIDs Called | Estimated Reference Load (kW) | Observed Load (kW) | Estimated Load Impact (kW) | % LI |
|---|---|---|---|---|---|
| Greater Bay Area | 91 | 28,664 | 24,284 | 4,381 | 15% |
| Greater Fresno | 29 | 8,508 | 5,723 | 2,785 | 33% |
| Humboldt | | | | | |
| Kern | 13 | 3,572 | 2,722 | 851 | 24% |
| Northern Coast | 14 | 5,054 | 4,006 | 1,048 | 21% |
| Sierra | 13 | 4,417 | 3,394 | 1,023 | 23% |
| Stockton | 7 | 2,830 | 2,243 | 587 | 21% |
| Not in any LCA | 30 | 25,697 | 14,013 | 11,684 | 45% |
| **Total** | **197** | **78,743** | **56,383** | **22,360** | **28%** |

### 4.1.2 Hourly load impacts

Tables 4.5 and 4.6 show average event-hour load impacts for the hours that were included in each event. In the case of PG&E CBP, the average DA and DO event is the same as the single event that was called for both program types. However, calculating average load impacts by event hour for DA is complicated due to the one aggregator's mistaken notification of the event hours. As a result, event hours 14 and 16 applied to different numbers of customer accounts, while HE 15 applied to all DA customer accounts that were called for the event. Average event-hour load impacts for DA were greatest for the overlapping hour 15 which served as the basis for the average hourly tables in the previous section. Note that the values for HE 14 and 16 in Table 4.5 differ from those shown in Protocol Table 4.7 below. This is the case because Table 4.5 includes results only for those customer accounts that were called for each hour of the event, while Table 4.7 includes results for all customer accounts called for the event, regardless of which event hours applied to them.

For DO, average event-hour load impacts for HE 16 – 18 were nearly constant, ranging from 22.3 to 22.5 MW, or about 28 percent of the reference load. Average event-hour load impacts per called customer were about 113 kW.

**Table 4.5: Average Event-Hour Load Impacts – *PG&E CBP DA***

| Hour Ending | Number of SAIDs Called | Estimated Reference Load (kWh/hr) | Observed Event-Day Load (kWh/hr) | Estimated Load Impact (kWh/hr) | Weighted Average Temp ($^{o}$F) | # of Events in which this Hour is Included | Load Impact per Called Customer (kWh/hr) | % Load Impact |
|---|---|---|---|---|---|---|---|---|
| 14 | 447 | 57,165 | 52,814 | 4,352 | 78 | 1 | 9.7 | 8% |
| 15 | 581 | 99,191 | 77,707 | 21,484 | 84 | 1 | 37.0 | 22% |
| 16 | 134 | 40,427 | 24,533 | 15,894 | 93 | 1 | 118.6 | 39% |

**Table 4.6: Average Event-Hour Load Impacts – *PG&E CBP DO***

| Hour Ending | Number of SAIDs Called | Estimated Reference Load (kWh/hr) | Observed Event-Day Load (kWh/hr) | Estimated Load Impact (kWh/hr) | Weighted Average Temp ($^{o}$F) | # of Events in which this Hour is Included | Load Impact per Called Customer (kWh/hr) | % Load Impact |
|---|---|---|---|---|---|---|---|---|
| 16 | 198 | 80,282 | 57,995 | 22,287 | 92 | 1 | 112.6 | 28% |
| 17 | 198 | 79,148 | 56,704 | 22,443 | 92 | 1 | 113.3 | 28% |
| 18 | 198 | 77,538 | 55,038 | 22,500 | 90 | 1 | 113.6 | 29% |

Tables 4.7 and 4.8 show hourly reference load, observed load, load impact, and uncertainty-adjusted load-impact values for the PG&E CBP ***DA*** and ***DO*** events respectively, in the Protocol table format. Hourly load impacts for the DA event were 22 percent of the reference load of nearly 100 MW in the one overlapping hour that applied to all customer accounts, and were 28 percent of the reference load of 80 MW for DO. The $10^{th}$ and $90^{th}$ percentile uncertainty-adjusted load impacts are estimated to be 9 percent below and above the estimated load impacts for the overlapping event hour for DA, and 5 percent for the DO event.

Figure 4.1 shows the hourly reference load, observed load, and estimated load impacts (see right axis) for the PG&E CBP DA event on July 27, 2009, while Figure 4.2 shows comparable information for the DO event on the same day.

**Table 4.7: Hourly Load Impacts – *PG&E CBP Average DA Event***

| Hour Ending | Estimated Reference Load (kWh/hr) | Observed Event-Day Load (kWh/hr) | Estimated Load Impact (kWh/hr) | Weighted Average Temperature ($^oF$) | Uncertainty Adjusted Impact (kWh/hr)- Percentiles | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 10th%ile | 30th%ile | 50th%ile | 70th%ile | 90th%ile |
| 1 | 58,236 | 57,945 | 291 | 65 | -1,666 | -510 | 291 | 1,092 | 2,248 |
| 2 | 57,365 | 57,429 | -64 | 64 | -2,021 | -865 | -64 | 737 | 1,894 |
| 3 | 56,844 | 57,075 | -231 | 63 | -2,187 | -1,031 | -231 | 569 | 1,725 |
| 4 | 57,485 | 57,964 | -480 | 61 | -2,435 | -1,280 | -480 | 320 | 1,476 |
| 5 | 59,895 | 60,780 | -886 | 61 | -2,843 | -1,687 | -886 | -85 | 1,072 |
| 6 | 64,478 | 65,687 | -1,209 | 60 | -3,162 | -2,008 | -1,209 | -409 | 745 |
| 7 | 70,693 | 72,136 | -1,443 | 60 | -3,396 | -2,242 | -1,443 | -644 | 510 |
| 8 | 79,382 | 80,584 | -1,201 | 62 | -3,161 | -2,003 | -1,201 | -399 | 759 |
| 9 | 86,429 | 87,073 | -644 | 65 | -2,605 | -1,447 | -644 | 159 | 1,317 |
| 10 | 91,654 | 91,300 | 354 | 68 | -1,611 | -450 | 354 | 1,158 | 2,319 |
| 11 | 95,922 | 94,184 | 1,738 | 72 | -223 | 935 | 1,738 | 2,540 | 3,699 |
| 12 | 97,773 | 96,015 | 1,758 | 75 | -205 | 955 | 1,758 | 2,561 | 3,720 |
| 13 | 97,699 | 92,218 | 5,481 | 79 | 3,519 | 4,678 | 5,481 | 6,283 | 7,442 |
| 14 | 99,599 | 84,817 | 14,782 | 82 | 12,819 | 13,978 | 14,782 | 15,585 | 16,745 |
| 15 | 99,191 | 77,707 | 21,484 | 84 | 19,520 | 20,680 | 21,484 | 22,288 | 23,448 |
| 16 | 97,248 | 78,360 | 18,888 | 86 | 16,923 | 18,084 | 18,888 | 19,692 | 20,853 |
| 17 | 93,411 | 81,606 | 11,805 | 86 | 9,840 | 11,001 | 11,805 | 12,609 | 13,770 |
| 18 | 86,266 | 80,595 | 5,671 | 83 | 3,707 | 4,867 | 5,671 | 6,474 | 7,634 |
| 19 | 78,830 | 73,869 | 4,961 | 80 | 2,999 | 4,158 | 4,961 | 5,764 | 6,924 |
| 20 | 75,553 | 70,889 | 4,664 | 76 | 2,700 | 3,860 | 4,664 | 5,467 | 6,627 |
| 21 | 73,364 | 69,100 | 4,264 | 72 | 2,301 | 3,461 | 4,264 | 5,067 | 6,226 |
| 22 | 72,748 | 69,830 | 2,918 | 70 | 955 | 2,115 | 2,918 | 3,721 | 4,881 |
| 23 | 69,968 | 66,490 | 3,478 | 68 | 1,514 | 2,674 | 3,478 | 4,281 | 5,441 |
| 24 | 67,508 | 64,845 | 2,663 | 67 | 698 | 1,859 | 2,663 | 3,467 | 4,628 |
| | Reference Energy Use (kWh) | Observed Event-Day Energy Use (kWh) | Change in Energy Use (kWh) | Cooling Degree Hours (Base 75 oF) | Uncertainty Adjusted Impact (kWh/hour) - Percentiles | | | | |
| | | | | | 10th | 30th | 50th | 70th | 90th |
| Daily | 1,887,539 | 1,788,499 | 99,040 | 56.9 | n/a | n/a | n/a | n/a | n/a |

**Table 4.8: Hourly Load Impacts – *PG&E CBP Average DO Event***

**Table Removed for Confidentiality Reasons.**

**Figure 4.1: Hourly Loads and Load Impacts – *PG&E CBP DA Event (July 27, 2009)***

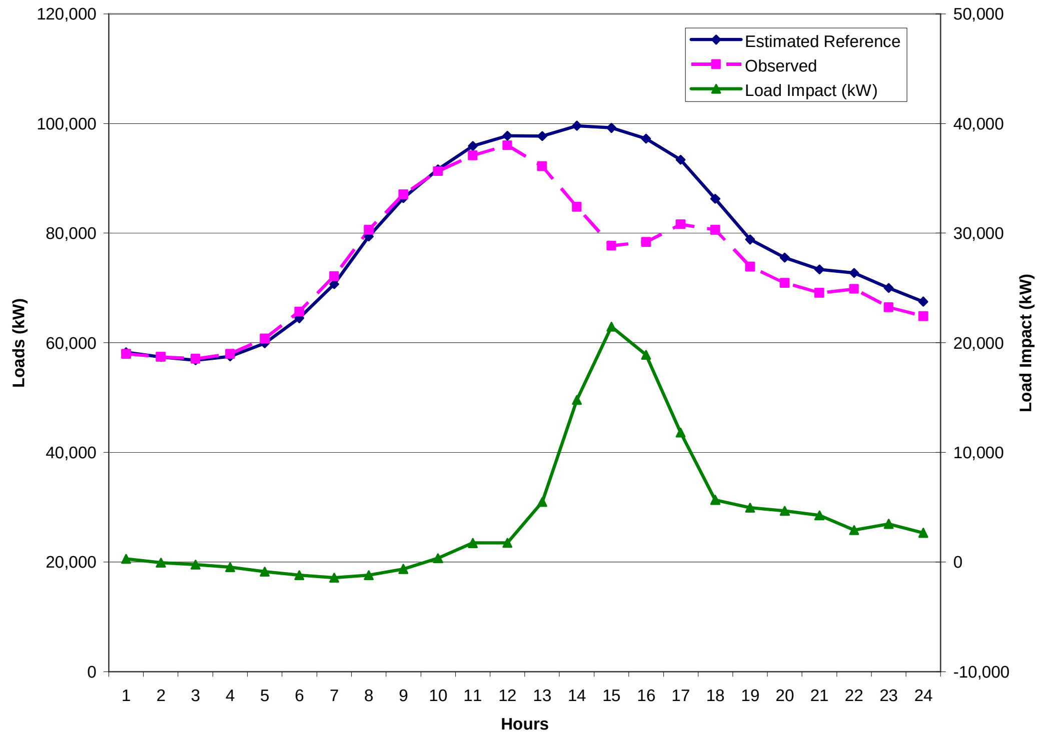



**Figure 4.2: Hourly Loads and Load Impacts – *PG&E CBP DO Event (July 27, 2009)***

**Figure Removed for Confidentiality Reasons.**

## *4.2 CBP – SCE*

### 4.2.1 Summary load impacts

Tables 4.9 and 4.10 summarize estimated *average hourly* ex post load impacts for each SCE event, for the DA and DO program types respectively, as well as for typical DA and DO events. The typical DA event was defined as the average of events 20 through 26, in which most of the DA contracts were called, including those newly nominated as of September. The typical average hourly DA load impact was 0.8 MW. The typical DO event was defined as the average of the two DO events on August 27 and 28, for which the average hourly load impact was 25.4 MW.

**Table 4.9: Average Hourly Load Impacts by Event (kW) – *SCE CBP DA***

| Event | Date | Day of Week | SAIDs Called | Estimated Reference Load (kW) | Observed Load (kW) | Estimated Load Impact (kW) | % LI |
|---|---|---|---|---|---|---|---|
| 1 | July 14, 2009 | Tuesday | 2 | 1,127 | 934 | 192 | 17% |
| 2 | July 15, 2009 | Wednesday | 2 | 1,130 | 1,036 | 94 | 8% |
| 3 | July 16, 2009 | Thursday | 2 | 1,219 | 963 | 256 | 21% |
| 4 | July 17, 2009 | Friday | 2 | 1,363 | 1,194 | 169 | 12% |
| 5 | July 20, 2009 | Monday | 2 | 1,248 | 987 | 262 | 21% |
| 6 | July 21, 2009 | Tuesday | 2 | 1,239 | 978 | 261 | 21% |
| 7 | July 23, 2009 | Thursday | 1 | 806 | 535 | 271 | 34% |
| 8 | July 27, 2009 | Monday | 1 | 833 | 537 | 296 | 36% |
| 9 | July 28, 2009 | Tuesday | 2 | 1,199 | 917 | 282 | 23% |
| 10 | August 4, 2009 | Tuesday | 3 | 2,251 | 1,998 | 253 | 11% |
| 11 | August 11, 2009 | Tuesday | 3 | 2,249 | 1,962 | 287 | 13% |
| 12 | August 12, 2009 | Wednesday | 3 | 2,321 | 1,980 | 341 | 15% |
| 13 | August 13, 2009 | Thursday | 3 | 2,211 | 2,002 | 209 | 9% |
| 14 | August 14, 2009 | Friday | 2 | 1,686 | 1,517 | 169 | 10% |
| 15 | August 17, 2009 | Monday | 3 | 2,132 | 1,802 | 330 | 15% |
| 16 | August 19, 2009 | Wednesday | 3 | 2,253 | 1,878 | 375 | 17% |
| 17 | August 27, 2009 | Thursday | 3 | 2,126 | 2,279 | -153 | -7% |
| 18 | August 28, 2009 | Friday | 3 | 2,031 | 2,199 | -167 | -8% |
| 19 | August 31, 2009 | Monday | 3 | 2,251 | 1,944 | 307 | 14% |
| 20 | September 1, 2009 | Tuesday | 77 | 8,316 | 7,538 | 778 | 9% |
| 21 | September 2, 2009 | Wednesday | 77 | 8,444 | 7,603 | 841 | 10% |
| 22 | September 3, 2009 | Thursday | 77 | 8,575 | 7,657 | 917 | 11% |
| 23 | September 4, 2009 | Friday | 77 | 8,189 | 7,529 | 660 | 8% |
| 24 | September 8, 2009 | Tuesday | 77 | 7,206 | 6,735 | 471 | 7% |
| 25 | September 9, 2009 | Wednesday | 77 | 7,442 | 6,524 | 918 | 12% |
| 26 | September 10, 2009 | Thursday | 76 | 7,533 | 6,689 | 844 | 11% |
| Typical | (Ave. of 20-26) | | 77 | 7,958 | 7,182 | 776 | 10% |
| | Standard Deviation | | | 549 | 504 | 161 | 2% |

**Table 4.10: Average Hourly Load Impacts by Event (kW) – *SCE CBP DO***

| Event | Date | Day of Week | SAIDs Called | Estimated Reference Load (kW) | Observed Load (kW) | Estimated Load Impact (kW) | % LI |
|---|---|---|---|---|---|---|---|
| 1 | 27-Aug-09 | Thursday | 417 | 122,304 | 97,223 | 25,082 | 21% |
| 2 | 28-Aug-09 | Friday | 417 | 123,819 | 98,018 | 25,801 | 21% |
| Average | | | 417 | 123,062 | 97,621 | 25,441 | 21% |

Tables 4.11 and 4.12 show average hourly estimated *reference load*, *observed load*, *load impacts* and percent load impact, by industry group, for the typical event for the DA and DO components respectively of SCE's CBP program. Retail stores provided all of the DA load impacts and most of the DO load impacts, while the Offices, Hotel, Health, and

Services industry group also provided a substantial amount of the DO load impacts.[14] The average percent load reductions across all industry types was 10 percent for DA and 21 percent for DO.

At a more detailed level, about 20 percent of the estimated DO load impacts were accounted for by a single customer account, while the top 6 responders accounted for a quarter of the total DO load impact.

**Table 4.11: Average Hourly Load Impacts by Industry Type – *SCE CBP DA***

| Industry Group | SAIDs Called | Estimated Reference Load (kW) | Observed Load (kW) | Estimated Load Impact (kW) | % LI |
|---|---|---|---|---|---|
| 1. Agriculture, Mining & Construction | | | | | |
| 2. Manufacturing | 1 | 1,100 | 1,136 | (37) | -3% |
| 3. Wholesale, Transport, other Utilities | | | | | |
| 4. Retail stores | 76 | 6,858 | 6,046 | 812 | 12% |
| 5. Offices, Hotels, Health, Services | | | | | |
| 6. Schools | | | | | |
| 7. Entertainment, Other Services, Gov't | | | | | |
| 8. Other/Unknown | | | | | |
| **Total** | **77** | **7,958** | **7,182** | **776** | **10%** |

**Table 4.12: Average Hourly Load Impacts by Industry Type – *SCE CBP DO***

| Industry Group | SAIDs Called | Estimated Reference Load (kW) | Observed Load (kW) | Estimated Load Impact (kW) | % LI |
|---|---|---|---|---|---|
| 1. Agriculture, Mining & Construction | | | | | |
| 2. Manufacturing | 2 | 764 | 347 | 417 | 55% |
| 3. Wholesale, Transport, other Utilities | 16 | 2,339 | 347 | 1,992 | 85% |
| 4. Retail stores | 383 | 113,011 | 94,730 | 18,281 | 16% |
| 5. Offices, Hotels, Health, Services | 16 | 6,948 | 2,197 | 4,751 | 68% |
| 6. Schools | | | | | |
| 7. Entertainment, Other Services, Gov't | | | | | |
| 8. Other/Unknown | | | | | |
| **Total** | **417** | **123,062** | **97,621** | **25,441** | **21%** |

Tables 4.13 and 4.14 show average hourly load impacts by LCA. Most of the DA and DO load impacts occurred in the LA Basin.

[14] Note that the negative load impact for the one manufacturing customer account in Table 4.9 implies that the regression analysis implied that this customer *increased* usage by a small amount during event hours on average. This occurs occasionally for some customers on the aggregator programs. However, it is unusual, as can be seen from the load reductions in most of the load impact tables.

**Table 4.13: Average Hourly Load Impacts by LCA – *SCE CBP DA***

| Local Capacity Area | SAIDs Called | Estimated Reference Load (kW) | Observed Load (kW) | Estimated Load Impact (kW) | % LI |
|---|---|---|---|---|---|
| LA Basin | 60 | 5,581 | 4,971 | 609 | 11% |
| Outside LA Basin | 5 | 434 | 362 | 72 | 16% |
| Ventura | 12 | 1,943 | 1,849 | 95 | 5% |
| **Total** | **77** | **7,958** | **7,182** | **776** | **10%** |

**Table 4.14: Average Hourly Load Impacts by LCA – *SCE CBP DO***

| Local Capacity Area | SAIDs Called | Estimated Reference Load (kW) | Observed Load (kW) | Estimated Load Impact (kW) | % LI |
|---|---|---|---|---|---|
| LA Basin | 333 | 95,968 | 74,853 | 21,115 | 22% |
| Outside LA Basin | 29 | 10,513 | 8,456 | 2,057 | 20% |
| Ventura | 55 | 16,581 | 14,312 | 2,269 | 14% |
| **Total** | **417** | **123,062** | **97,621** | **25,441** | **21%** |

### 4.2.2 Hourly load impacts

Tables 4.15 and 4.16 show average event-hour load impacts for SCE's CBP DA and DO program types. The average DA event was defined as the average of the seven September events, for which the number of customer accounts called reached 77. The average DO event was the average of the two late-August events. Average event-hour load impacts for DA for HE 15 – 18 ranged from 0.7 to 1.1 MW, which represented 7 to 14 percent of the reference load. Load impacts per called customer were relatively small, ranging from 7 to 14 kW.

For DO, average event-hour load impacts for HE 15 – 18 ranged from 23.2 to 28.4 MW, or 19 to 23 percent of the reference load. Average event-hour load impacts per called customer ranged from 56 to 68 kW.

**Table 4.15: Average Event-Hour Load Impacts – *SCE CBP DA***

| Hour Ending | Number of SAIDs Called | Estimated Reference Load (kWh/hr) | Observed Event-Day Load (kWh/hr) | Estimated Load Impact (kWh/hr) | Weighted Average Temp ($^oF$) | # of Events in which this Hour is Included | Load Impact per Called Customer (kWh/hr) | % Load Impact |
|---|---|---|---|---|---|---|---|---|
| 14 | 1 | 402 | 333 | 69 | 100 | 1 | 69.1 | 17% |
| 15 | 77 | 7,967 | 6,890 | 1,076 | 91 | 5 | 14.0 | 14% |
| 16 | 77 | 7,838 | 7,068 | 770 | 90 | 7 | 10.0 | 10% |
| 17 | 77 | 8,010 | 7,437 | 572 | 88 | 7 | 7.4 | 7% |
| 18 | 77 | 8,420 | 7,737 | 683 | 87 | 5 | 8.9 | 8% |

**Table 4.16: Average Event-Hour Load Impacts – *SCE CBP DO***

| Hour Ending | Number of SAIDs Called | Estimated Reference Load (kWh/hr) | Observed Event-Day Load (kWh/hr) | Estimated Load Impact (kWh/hr) | Weighted Average Temp ($^oF$) | # of Events in which this Hour is Included | Load Impact per Called Customer (kWh/hr) | % Load Impact |
|---|---|---|---|---|---|---|---|---|
| 15 | 417 | 122,005 | 93,628 | 28,377 | 98 | 2 | 68.0 | 23% |
| 16 | 417 | 123,032 | 97,277 | 25,755 | 98 | 2 | 61.8 | 21% |
| 17 | 417 | 123,520 | 99,119 | 24,400 | 97 | 2 | 58.5 | 20% |
| 18 | 417 | 123,691 | 100,458 | 23,233 | 95 | 2 | 55.7 | 19% |

Tables 4.17 and 4.18 show hourly reference load, observed load, load impact, and uncertainty-adjusted load-impact values for the average SCE CBP ***DA*** and ***DO*** events respectively. Hourly load impacts of the DA program type, while relatively small, averaged about 18 percent of the reference load. Hourly load impacts of the DO program type and averaged 20 to 23 percent of the reference load of about 122 MW. The 10$^{th}$ and 90$^{th}$ percentile uncertainty-adjusted load impacts are estimated to span a quite narrow range of less than 4 percent below and above the estimated load impacts for the typical DO event.

## Table 4.17: Hourly Load Impacts – *SCE Average CBP DA Event*

| Hour Ending | Estimated Reference Load (kWh/hr) | Observed Event-Day Load (kWh/hr) | Estimated Load Impact (kWh/hr) | Weighted Average Temperature (°F) | Uncertainty Adjusted Impact (kWh/hr)- Percentiles | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 10th%ile | 30th%ile | 50th%ile | 70th%ile | 90th%ile |
| 1 | 3,190 | 3,061 | 129 | 72 | -153 | 13 | 129 | 244 | 410 |
| 2 | 3,175 | 3,057 | 117 | 71 | -164 | 2 | 117 | 232 | 399 |
| 3 | 3,044 | 3,048 | -4 | 70 | -282 | -118 | -4 | 111 | 275 |
| 4 | 2,996 | 3,001 | -5 | 69 | -281 | -118 | -5 | 108 | 271 |
| 5 | 3,074 | 3,028 | 45 | 69 | -229 | -67 | 45 | 158 | 320 |
| 6 | 3,272 | 3,331 | -59 | 68 | -334 | -172 | -59 | 54 | 216 |
| 7 | 3,917 | 4,349 | -432 | 68 | -707 | -545 | -432 | -320 | -157 |
| 8 | 5,146 | 5,608 | -462 | 70 | -738 | -575 | -462 | -349 | -185 |
| 9 | 6,594 | 6,728 | -134 | 74 | -409 | -247 | -134 | -21 | 141 |
| 10 | 6,582 | 6,859 | -277 | 79 | -552 | -389 | -277 | -165 | -2 |
| 11 | 6,746 | 6,925 | -179 | 83 | -454 | -292 | -179 | -67 | 96 |
| 12 | 7,059 | 7,245 | -186 | 86 | -462 | -299 | -186 | -73 | 91 |
| 13 | 7,432 | 7,431 | 2 | 88 | -274 | -111 | 2 | 115 | 278 |
| 14 | 7,648 | 7,447 | 200 | 89 | -76 | 87 | 200 | 313 | 477 |
| 15 | 7,775 | 7,092 | 683 | 90 | 408 | 570 | 683 | 796 | 959 |
| 16 | 7,838 | 7,068 | 770 | 90 | 494 | 657 | 770 | 883 | 1,045 |
| 17 | 8,010 | 7,437 | 572 | 88 | 297 | 460 | 572 | 685 | 848 |
| 18 | 8,216 | 7,932 | 284 | 87 | 8 | 171 | 284 | 397 | 561 |
| 19 | 8,129 | 8,449 | -320 | 84 | -598 | -434 | -320 | -207 | -43 |
| 20 | 7,790 | 8,212 | -422 | 81 | -702 | -537 | -422 | -307 | -142 |
| 21 | 6,530 | 6,629 | -99 | 78 | -380 | -214 | -99 | 16 | 183 |
| 22 | 4,550 | 4,615 | -65 | 77 | -348 | -181 | -65 | 51 | 218 |
| 23 | 3,572 | 3,824 | -253 | 75 | -534 | -368 | -253 | -138 | 28 |
| 24 | 3,273 | 3,351 | -78 | 74 | -359 | -193 | -78 | 37 | 202 |
| | Reference Energy Use (kWh) | Observed Event-Day Energy Use (kWh) | Change in Energy Use (kWh) | Cooling Degree Hours (Base 75 oF) | Uncertainty Adjusted Impact (kWh/hour) - Percentiles | | | | |
| | | | | | 10th | 30th | 50th | 70th | 90th |
| Daily | 135,558 | 135,729 | -171 | 123.3 | n/a | n/a | n/a | n/a | n/a |

## Table 4.18: Hourly Load Impacts – *SCE Average CBP DO Event*

| Hour Ending | Estimated Reference Load (kWh/hr) | Observed Event-Day Load (kWh/hr) | Estimated Load Impact (kWh/hr) | Weighted Average Temperature (°F) | Uncertainty Adjusted Impact (kWh/hr)- Percentiles | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 10th%ile | 30th%ile | 50th%ile | 70th%ile | 90th%ile |
| **1** | 70,608 | 71,373 | -765 | 74 | -1,654 | -1,129 | -765 | -401 | 124 |
| **2** | 68,497 | 69,306 | -809 | 73 | -1,695 | -1,172 | -809 | -446 | 77 |
| **3** | 67,073 | 67,292 | -219 | 71 | -1,105 | -581 | -219 | 144 | 668 |
| **4** | 67,525 | 67,097 | 429 | 70 | -456 | 67 | 429 | 791 | 1,313 |
| **5** | 73,019 | 71,855 | 1,164 | 69 | 279 | 802 | 1,164 | 1,526 | 2,048 |
| **6** | 78,211 | 76,212 | 2,000 | 69 | 1,116 | 1,638 | 2,000 | 2,361 | 2,884 |
| **7** | 93,773 | 92,332 | 1,441 | 68 | 557 | 1,079 | 1,441 | 1,802 | 2,325 |
| **8** | 92,838 | 90,957 | 1,882 | 71 | 998 | 1,520 | 1,882 | 2,243 | 2,766 |
| **9** | 95,852 | 94,553 | 1,300 | 77 | 414 | 937 | 1,300 | 1,662 | 2,186 |
| **10** | 102,255 | 100,804 | 1,451 | 84 | 562 | 1,087 | 1,451 | 1,815 | 2,340 |
| **11** | 108,295 | 106,768 | 1,526 | 89 | 636 | 1,162 | 1,526 | 1,891 | 2,417 |
| **12** | 113,538 | 112,149 | 1,389 | 93 | 498 | 1,025 | 1,389 | 1,754 | 2,280 |
| **13** | 117,913 | 116,805 | 1,107 | 96 | 216 | 743 | 1,107 | 1,472 | 1,999 |
| **14** | 120,572 | 115,964 | 4,609 | 97 | 3,717 | 4,244 | 4,609 | 4,974 | 5,500 |
| **15** | 122,005 | 93,628 | 28,377 | 98 | 27,484 | 28,012 | 28,377 | 28,742 | 29,269 |
| **16** | 123,032 | 97,277 | 25,755 | 98 | 24,861 | 25,389 | 25,755 | 26,121 | 26,650 |
| **17** | 123,520 | 99,119 | 24,400 | 97 | 23,507 | 24,035 | 24,400 | 24,766 | 25,294 |
| **18** | 123,691 | 100,458 | 23,233 | 95 | 22,338 | 22,867 | 23,233 | 23,599 | 24,127 |
| **19** | 123,712 | 119,569 | 4,143 | 92 | 3,247 | 3,776 | 4,143 | 4,509 | 5,039 |
| **20** | 124,265 | 126,243 | -1,978 | 88 | -2,874 | -2,345 | -1,978 | -1,612 | -1,083 |
| **21** | 121,375 | 121,744 | -369 | 84 | -1,263 | -735 | -369 | -3 | 525 |
| **22** | 111,459 | 112,838 | -1,379 | 81 | -2,273 | -1,745 | -1,379 | -1,013 | -485 |
| **23** | 87,369 | 88,728 | -1,359 | 80 | -2,252 | -1,724 | -1,359 | -993 | -465 |
| **24** | 75,570 | 76,805 | -1,235 | 77 | -2,128 | -1,600 | -1,235 | -870 | -343 |
| | Reference Energy Use (kWh) | Observed Event-Day Energy Use (kWh) | Change in Energy Use (kWh) | Cooling Degree Hours (Base 75 oF) | Uncertainty Adjusted Impact (kWh/hour) - Percentiles | | | | |
| | | | | | 10th | 30th | 50th | 70th | 90th |
| **Daily** | 2,405,967 | 2,289,875 | 116,092 | 227.6 | n/a | n/a | n/a | n/a | n/a |

Figure 4.3 shows the profiles of the hourly reference load, observed load, and estimated load impacts (see right axis) for the average SCE CBP DA event. Figure 4.4 shows comparable information for the average DO event.

**Figure 4.3: Hourly Loads and Load Impacts – *SCE CBP DA Average Event***

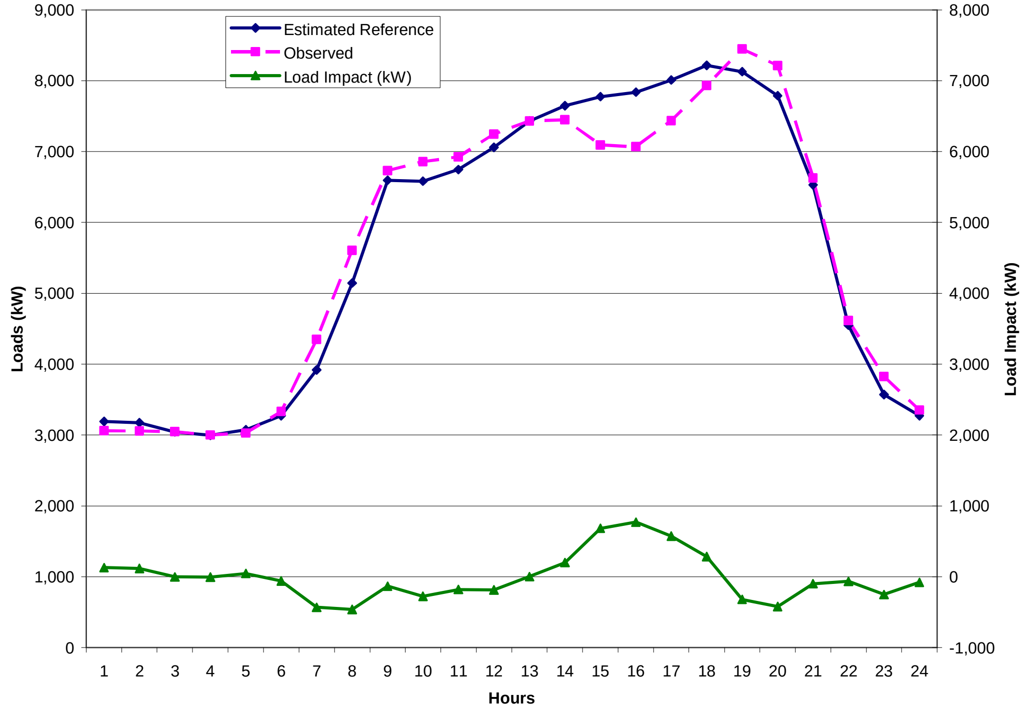
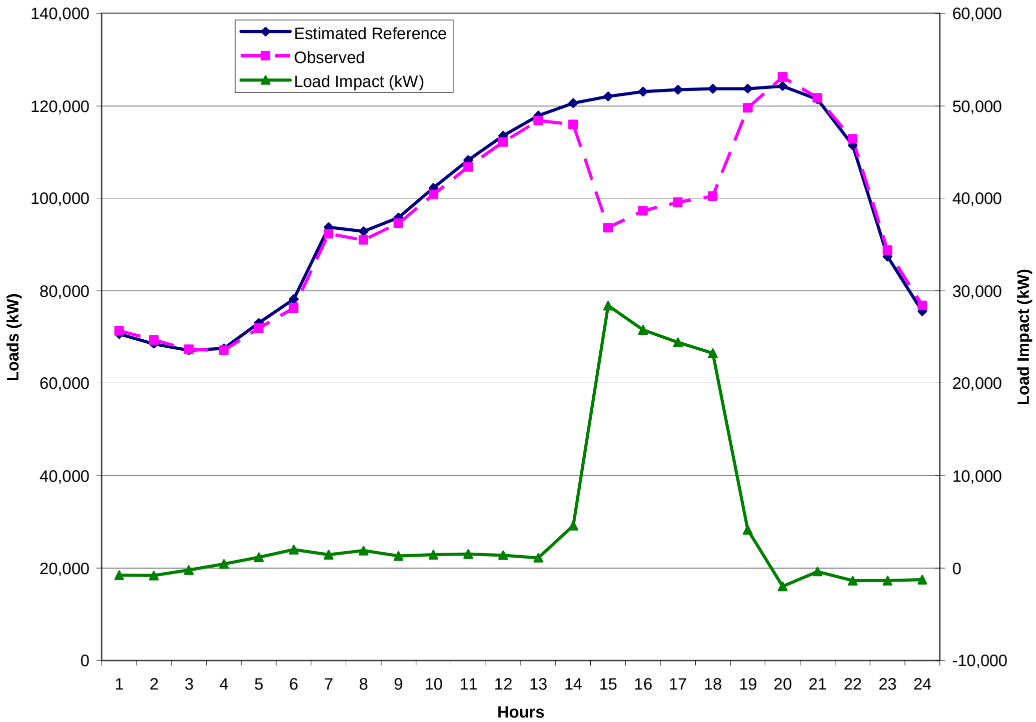


**Figure 4.4: Hourly Loads and Load Impacts – *SCE CBP DO Average Event***




### *4.3 CBP – SDG&E*

#### 4.3.1 Summary load impacts

Tables 4.19 and 4.20 summarize estimated average hourly reference loads and *ex post* load impacts for each event, and for an average event, for the DA and DO program types respectively. In these tables, estimated hourly load impacts are included in the averages only for customer accounts and hours that were included in events. For example, load impacts for hours-ending 15 – 18 are included for DA customer accounts that were called for the 7th event, while load impacts for hours-ending 14 – 17 are included for the 8th event. Average hourly load impacts were quite consistent across events for both DA and DO program types, with an average hourly load impact of 10.3 MW for the average DA event, and 12.5 for the average DO event. Those represent 26 percent of the reference load for DA, and 18 percent for DO.

**Table 4.19: Average Hourly Load Impacts (kW) by Event – *SDG&E CBP DA***

| Event | Date | Day of Week | SAIDs Called | Estimated Reference Load (kW) | Observed Load (kW) | Estimated Load Impact (kW) | % LI |
|---|---|---|---|---|---|---|---|
| 1 | July 21, 2009 | Tuesday | | | | | |
| 2 | August 26, 2009 | Wednesday | | | | | |
| 3 | August 27, 2009 | Thursday | 113 | 38,814 | 28,224 | 10,590 | 27% |
| 4 | August 28, 2009 | Friday | 113 | 38,492 | 28,322 | 10,170 | 26% |
| 5 | September 2, 2009 | Wednesday | | | | | |
| 6 | September 3, 2009 | Thursday | 127 | 41,124 | 29,486 | 11,638 | 28% |
| 7 | September 4, 2009 | Friday | 127 | 37,606 | 28,424 | 9,182 | 24% |
| 8 | September 24, 2009 | Thursday | 127 | 40,065 | 30,412 | 9,653 | 24% |
| 9 | September 25, 2009 | Friday | 127 | 38,055 | 27,761 | 10,295 | 27% |
| | Average | | 122 | 39,026 | 28,771 | 10,255 | 26% |
| | Standard Deviation | | | 1,324 | 985 | 842 | 2% |

**Table 4.20: Average Hourly Load Impacts (kW) by Event – *SDG&E CBP DO***

| Event | Date | Day of Week | SAIDs Called | Estimated Reference Load (kW) | Observed Load (kW) | Estimated Load Impact (kW) | % LI |
|---|---|---|---|---|---|---|---|
| 1 | July 21, 2009 | Tuesday | 265 | 62,728 | 52,417 | 10,311 | 16% |
| 2 | August 26, 2009 | Wednesday | 272 | 70,359 | 55,151 | 15,209 | 22% |
| 3 | August 27, 2009 | Thursday | 272 | 69,719 | 55,786 | 13,934 | 20% |
| 4 | August 28, 2009 | Friday | 272 | 68,769 | 57,140 | 11,630 | 17% |
| 5 | September 2, 2009 | Wednesday | 283 | 72,707 | 60,594 | 12,113 | 17% |
| 6 | September 3, 2009 | Thursday | 283 | 75,623 | 60,131 | 15,492 | 20% |
| 7 | September 4, 2009 | Friday | | | | | |
| 8 | September 24, 2009 | Thursday | 283 | 68,114 | 59,308 | 8,805 | 13% |
| 9 | September 25, 2009 | Friday | | | | | |
| | Average | | 276 | 69,717 | 57,218 | 12,499 | 18% |
| | Standard Deviation | | | 4,011 | 2,990 | 2,506 | 3% |

Tables 4.21 and 4.22 show average hourly program load impacts and percent load impacts by industry type, for the average DA and DO event respectively. The Manufacturing industry group provided the largest share of DA load impacts, while Retail stores provided the largest share of DO load impacts.

At a detailed level, two customer accounts made up 75 percent of the DA load impacts, and the top five responders made up 82 percent. For the DO program type, six customer accounts made up a third of the total load impact.

**Table 4.21: Average Hourly Load Impacts by Industry Type – *SDG&E CBP DA***

| Industry Group | SAIDs Called | Estimated Reference Load (kW) | Observed Load (kW) | Estimated Load Impact (kW) | % LI |
|---|---|---|---|---|---|
| 1. Agriculture, Mining & Construction | | | | | |
| 2. Manufacturing | 32 | 16,403 | 8,095 | 8,307 | 51% |
| 3. Wholesale, Transport, other Utilities | 8 | 457 | 207 | 251 | 55% |
| 4. Retail stores | 1 | 23 | 23 | 0 | |
| 5. Offices, Hotels, Health, Services | 75 | 19,259 | 18,109 | 1,150 | 6% |
| 6. Schools | 2 | 1,913 | 1,732 | 181 | 9% |
| 7. Entertainment, Other Services, Gov't | 4 | 971 | 606 | 365 | 38% |
| 8. Other/Unknown | | | | | |
| **Total** | **122** | **39,026** | **28,771** | **10,255** | **26%** |

**Table 4.22: Average Hourly Load Impacts by Industry Type – *SDG&E CBP DO***

| Industry Group | SAIDs Called | Estimated Reference Load (kW) | Observed Load (kW) | Estimated Load Impact (kW) | % LI |
|---|---|---|---|---|---|
| 1. Agriculture, Mining & Construction | | | | | |
| 2. Manufacturing | 3 | 1,590 | 1,284 | 305 | 19% |
| 3. Wholesale, Transport, other Utilities | 18 | 2,157 | 963 | 1,195 | 55% |
| 4. Retail stores | 175 | 43,971 | 37,684 | 6,286 | |
| 5. Offices, Hotels, Health, Services | 44 | 12,652 | 10,808 | 1,843 | 15% |
| 6. Schools | 4 | 4,912 | 3,466 | 1,446 | 29% |
| 7. Entertainment, Other Services, Gov't | 32 | 4,435 | 3,012 | 1,423 | 32% |
| 8. Other/Unknown | | | | | |
| **Total** | **276** | **69,717** | **57,218** | **12,499** | **18%** |

### 4.3.2 Hourly load impacts

Tables 4.23 and 4.24 show average event-hour load impacts for SDG&E's CBP DA and DO program types. The average DA event was defined as the average of the six DA events, while the average DO event was the average of the seven DO events. Average event-hour load impacts for DA ranged from 9.2 to 11.2 MW across HE 14 – 18, where the averages for HE 14 and 18 include only the event days in which those hours were included in the event window. Percentage load impacts ranged from 23 to 28 percent, and load impacts per customer ranged from 73 to 92 kW.

For DO, average event-hour load impacts range considerably across the hours that were included in the event window for any of the events. For HE 15 – 18, which were included in the event window for most or all events, event-hour load impacts ranged from 10.7 to 13.3 MW, or about 18 percent of the reference load. Average event-hour load impacts per called customer ranged from 43 to 48 kW.

Given the scheduled transition of one of the CBP DO aggregators to a new AMP contract, Table 4.25 shows average event-hour information for all CBP DO customer accounts *except* those of the new AMP aggregator. The remaining customer accounts had event-hour load impacts ranging from 8 to 10.1 MW, or about 3 MW less than the full complement of DO customer accounts. Load impacts per customer of the remaining customers were also somewhat smaller, ranging from 34 to 40 kW.

### Table 4.23: Average Event-Hour Load Impacts – *SDG&E CBP DA*

| Hour Ending | Number of SAIDs Called | Estimated Reference Load (kWh/hr) | Observed Event-Day Load (kWh/hr) | Estimated Load Impact (kWh/hr) | Weighted Average Temp (°F) | # of Events in which this Hour is Included | Load Impact per Called Customer (kWh/hr) | % Load Impact |
|---|---|---|---|---|---|---|---|---|
| 14 | 127 | 39,859 | 30,567 | 9,292 | 80 | 2 | 73.2 | 23% |
| 15 | 122 | 39,833 | 29,773 | 10,060 | 84 | 6 | 82.2 | 25% |
| 16 | 122 | 40,131 | 28,942 | 11,189 | 84 | 6 | 91.5 | 28% |
| 17 | 122 | 38,588 | 28,018 | 10,570 | 84 | 6 | 86.4 | 27% |
| 18 | 120 | 36,399 | 27,246 | 9,153 | 82 | 4 | 76.3 | 25% |

### Table 4.24: Average Event-Hour Load Impacts – *SDG&E CBP DO*

| Hour Ending | Number of SAIDs Called | Estimated Reference Load (kWh/hr) | Observed Event-Day Load (kWh/hr) | Estimated Load Impact (kWh/hr) | Weighted Average Temp (°F) | # of Events in which this Hour is Included | Load Impact per Called Customer (kWh/hr) | % Load Impact |
|---|---|---|---|---|---|---|---|---|
| 13 | 70 | 22,294 | 19,163 | 3,131 | 86 | 2 | 44.7 | 14% |
| 14 | 144 | 38,839 | 33,707 | 5,132 | 85 | 5 | 35.6 | 13% |
| 15 | 275 | 69,311 | 57,042 | 12,268 | 86 | 6 | 44.7 | 18% |
| 16 | 276 | 70,401 | 57,461 | 12,940 | 85 | 7 | 46.9 | 18% |
| 17 | 276 | 70,252 | 56,924 | 13,328 | 85 | 7 | 48.3 | 19% |
| 18 | 253 | 64,080 | 53,351 | 10,728 | 82 | 6 | 42.5 | 17% |
| 19 | 112 | 30,479 | 25,747 | 4,732 | 82 | 4 | 42.2 | 16% |

### Table 4.25: Average Event-Hour Load Impacts – *SDG&E CBP DO (less AMP)*

| Hour Ending | Number of SAIDs Called | Estimated Reference Load (kWh/hr) | Observed Event-Day Load (kWh/hr) | Estimated Load Impact (kWh/hr) | Weighted Average Temp (°F) | # of Events in which this Hour is Included | Load Impact per Called Customer (kWh/hr) | % Load Impact |
|---|---|---|---|---|---|---|---|---|
| 13 | 67 | 21,058 | 18,078 | 2,980 | 87 | 2 | 44.5 | 14% |
| 14 | 134 | 33,461 | 28,479 | 4,982 | 86 | 5 | 37.2 | 15% |
| 15 | 252 | 57,949 | 48,627 | 9,322 | 86 | 6 | 37.0 | 16% |
| 16 | 253 | 58,858 | 48,916 | 9,942 | 85 | 7 | 39.3 | 17% |
| 17 | 253 | 58,858 | 48,759 | 10,100 | 86 | 7 | 39.9 | 17% |
| 18 | 233 | 54,552 | 46,586 | 7,966 | 82 | 6 | 34.2 | 15% |
| 19 | 105 | 26,958 | 23,078 | 3,880 | 82 | 4 | 37.0 | 14% |

Tables 4.26 and 4.27 show hourly reference load, observed load, load impact, and uncertainty-adjusted load-impact values for the average SDG&E CBP ***DA*** and ***DO*** program events respectively. Hourly load impacts were 25 to 28 percent of the reference load of about 41 MW for the average DA event, and 18 percent of the reference load of 70 MW for DO. The 10$^{th}$ and 90$^{th}$ percentile uncertainty-adjusted load impacts are estimated to be about 16 percent below and above the estimated load impacts for both the average DA and DO events.

## Table 4.26: Hourly Load Impacts – *SDG&E Average CBP DA Event*

| Hour Ending | Estimated Reference Load (kWh/hr) | Observed Event-Day Load (kWh/hr) | Estimated Load Impact (kWh/hr) | Weighted Average Temperature (°F) | Uncertainty-Adjusted Impact (kWh/hr)- Percentiles | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 10th%ile | 30th%ile | 50th%ile | 70th%ile | 90th%ile |
| **1** | 22,765 | 22,719 | 46 | 72 | -1,639 | -643 | 46 | 735 | 1,730 |
| **2** | 22,450 | 22,363 | 87 | 71 | -1,593 | -600 | 87 | 774 | 1,766 |
| **3** | 22,056 | 21,968 | 89 | 70 | -1,584 | -596 | 89 | 773 | 1,762 |
| **4** | 22,272 | 21,970 | 302 | 70 | -1,373 | -383 | 302 | 987 | 1,977 |
| **5** | 23,805 | 23,418 | 387 | 69 | -1,285 | -297 | 387 | 1,071 | 2,058 |
| **6** | 27,086 | 26,602 | 484 | 69 | -1,189 | -200 | 484 | 1,169 | 2,157 |
| **7** | 31,281 | 31,159 | 122 | 69 | -1,548 | -561 | 122 | 806 | 1,792 |
| **8** | 34,399 | 33,834 | 565 | 73 | -1,125 | -127 | 565 | 1,256 | 2,255 |
| **9** | 38,107 | 37,861 | 246 | 78 | -1,460 | -452 | 246 | 945 | 1,953 |
| **10** | 41,458 | 40,177 | 1,280 | 82 | -441 | 576 | 1,280 | 1,984 | 3,001 |
| **11** | 42,264 | 40,577 | 1,687 | 84 | -26 | 986 | 1,687 | 2,388 | 3,400 |
| **12** | 43,339 | 39,755 | 3,584 | 85 | 1,872 | 2,883 | 3,584 | 4,284 | 5,296 |
| **13** | 41,321 | 35,960 | 5,361 | 84 | 3,668 | 4,668 | 5,361 | 6,054 | 7,054 |
| **14** | 41,326 | 31,944 | 9,383 | 84 | 7,696 | 8,693 | 9,383 | 10,073 | 11,069 |
| **15** | 39,833 | 29,773 | 10,060 | 84 | 8,366 | 9,367 | 10,060 | 10,753 | 11,754 |
| **16** | 40,131 | 28,942 | 11,189 | 84 | 9,492 | 10,495 | 11,189 | 11,884 | 12,886 |
| **17** | 38,588 | 28,018 | 10,570 | 84 | 8,873 | 9,875 | 10,570 | 11,265 | 12,267 |
| **18** | 35,829 | 28,133 | 7,696 | 80 | 6,017 | 7,009 | 7,696 | 8,383 | 9,375 |
| **19** | 29,232 | 25,459 | 3,773 | 78 | 2,094 | 3,086 | 3,773 | 4,460 | 5,451 |
| **20** | 26,232 | 25,840 | 392 | 75 | -1,282 | -293 | 392 | 1,077 | 2,066 |
| **21** | 25,903 | 25,406 | 498 | 74 | -1,169 | -184 | 498 | 1,179 | 2,164 |
| **22** | 25,324 | 24,600 | 725 | 73 | -947 | 41 | 725 | 1,409 | 2,396 |
| **23** | 24,124 | 23,365 | 759 | 72 | -913 | 75 | 759 | 1,443 | 2,430 |
| **24** | 22,928 | 22,254 | 674 | 71 | -998 | -10 | 674 | 1,358 | 2,346 |
| | Reference Energy Use (kWh) | Observed Event-Day Energy Use (kWh) | Change in Energy Use (kWh) | Cooling Degree Hours (Base 75 oF) | Uncertainty Adjusted Impact (kWh/hour) - Percentiles | | | | |
| | | | | | 10th | 30th | 50th | 70th | 90th |
| **Daily** | 762,056 | 692,098 | 69,958 | 82.3 | n/a | n/a | n/a | n/a | n/a |

Table 4.27: Hourly Load Impacts – *SDG&E Average CBP DO Event*

| Hour Ending | Estimated Reference Load (kWh/hr) | Observed Event-Day Load (kWh/hr) | Estimated Load Impact (kWh/hr) | Weighted Average Temperature ($^{o}$F) | Uncertainty-Adjusted Impact (kWh/hr)- Percentiles | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 10th%ile | 30th%ile | 50th%ile | 70th%ile | 90th%ile |
| 1 | 46,786 | 47,273 | -487 | 71 | -2,552 | -1,332 | -487 | 358 | 1,578 |
| 2 | 45,000 | 45,800 | -800 | 70 | -2,855 | -1,641 | -800 | 40 | 1,254 |
| 3 | 44,431 | 45,605 | -1,174 | 70 | -3,223 | -2,012 | -1,174 | -336 | 874 |
| 4 | 44,357 | 45,495 | -1,138 | 70 | -3,187 | -1,976 | -1,138 | -300 | 910 |
| 5 | 46,175 | 46,769 | -595 | 69 | -2,640 | -1,431 | -595 | 242 | 1,450 |
| 6 | 49,168 | 49,208 | -39 | 69 | -2,084 | -876 | -39 | 797 | 2,005 |
| 7 | 54,040 | 52,859 | 1,182 | 70 | -861 | 346 | 1,182 | 2,017 | 3,224 |
| 8 | 57,433 | 55,646 | 1,787 | 75 | -297 | 934 | 1,787 | 2,640 | 3,871 |
| 9 | 63,172 | 60,409 | 2,763 | 80 | 651 | 1,899 | 2,763 | 3,628 | 4,876 |
| 10 | 67,373 | 64,477 | 2,896 | 84 | 778 | 2,029 | 2,896 | 3,763 | 5,015 |
| 11 | 71,207 | 68,597 | 2,610 | 87 | 494 | 1,744 | 2,610 | 3,476 | 4,726 |
| 12 | 70,935 | 68,873 | 2,062 | 88 | -43 | 1,201 | 2,062 | 2,923 | 4,167 |
| 13 | 70,871 | 68,493 | 2,378 | 87 | 289 | 1,523 | 2,378 | 3,234 | 4,468 |
| 14 | 70,760 | 64,538 | 6,223 | 87 | 4,142 | 5,371 | 6,223 | 7,074 | 8,303 |
| 15 | 70,099 | 59,603 | 10,496 | 86 | 8,414 | 9,644 | 10,496 | 11,349 | 12,579 |
| 16 | 70,401 | 57,461 | 12,940 | 85 | 10,852 | 12,086 | 12,940 | 13,794 | 15,028 |
| 17 | 70,252 | 56,924 | 13,328 | 85 | 11,232 | 12,470 | 13,328 | 14,186 | 15,425 |
| 18 | 68,281 | 57,977 | 10,304 | 83 | 8,207 | 9,446 | 10,304 | 11,162 | 12,401 |
| 19 | 66,124 | 61,186 | 4,938 | 81 | 2,825 | 4,073 | 4,938 | 5,802 | 7,050 |
| 20 | 64,936 | 64,884 | 52 | 77 | -2,035 | -802 | 52 | 906 | 2,140 |
| 21 | 62,354 | 64,065 | -1,711 | 75 | -3,786 | -2,560 | -1,711 | -862 | 364 |
| 22 | 57,077 | 59,525 | -2,448 | 74 | -4,519 | -3,295 | -2,448 | -1,600 | -376 |
| 23 | 51,629 | 54,173 | -2,544 | 73 | -4,613 | -3,391 | -2,544 | -1,698 | -475 |
| 24 | 49,020 | 51,839 | -2,820 | 72 | -4,889 | -3,666 | -2,820 | -1,973 | -750 |
| | Reference Energy Use (kWh) | Observed Event-Day Energy Use (kWh) | Change in Energy Use (kWh) | Cooling Degree Hours (Base 75 oF) | Uncertainty Adjusted Impact (kWh/hour) - Percentiles | | | | |
| | | | | | 10th | 30th | 50th | 70th | 90th |
| Daily | 1,431,881 | 1,371,677 | 60,204 | 110.3 | n/a | n/a | n/a | n/a | n/a |

Figure 4.5 shows the hourly reference load, observed load, and estimated load impacts (see right axis) for the average SDG&E CBP DA event, while Figure 4.6 shows comparable results for the average DO event.

**Figure 4.5: Hourly Loads and Load Impacts – *SDG&E Average CBP DA Event***

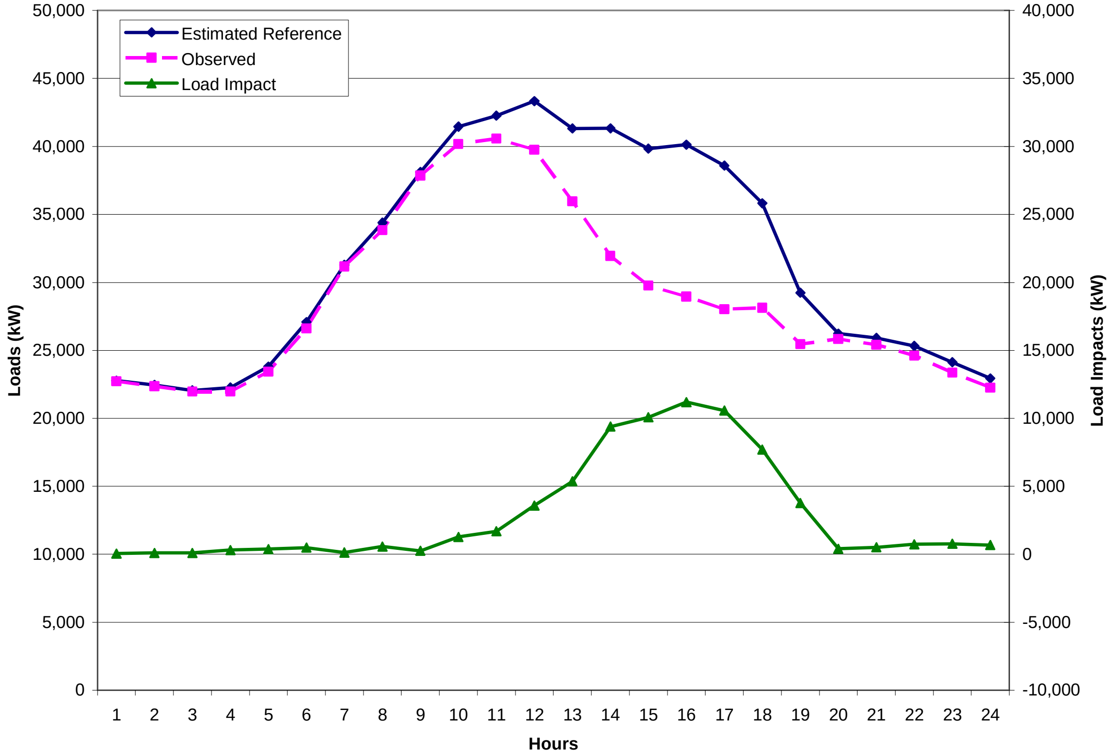
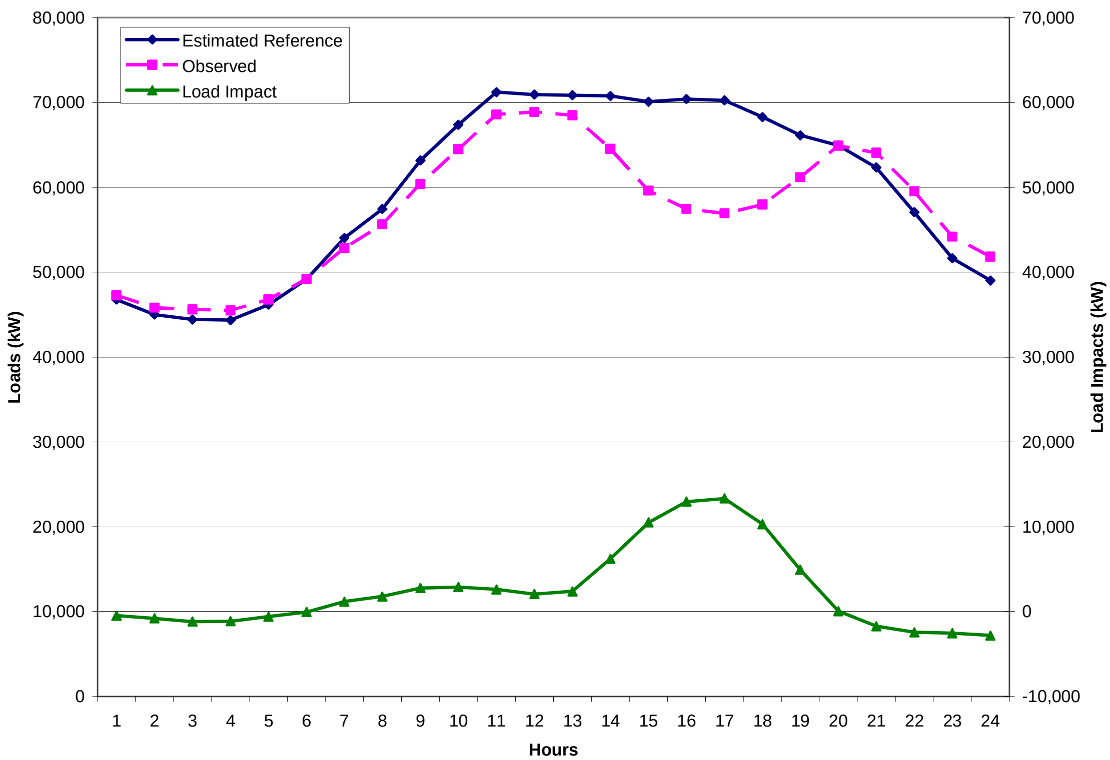



**Figure 4.6: Hourly Loads and Load Impacts – *SDG&E Average CBP DO Event***



### *4.4 AMP – PG&E*

#### 4.4.1 Summary load impacts

Tables 4.28 and 4.29 report estimated average hourly load impacts for the DA and DO program types respectively, for the first and third AMP events, and for the averages over those two events. Average hourly load impacts for the DO program type were calculated over event hours-ending 16 – 17 for the first event and 15 – 16 for the second event. Average hourly load impacts for the average DA event were 38.5 MW, which was 41 percent of the reference load of nearly 95 MW, and for the average DO event were 83.9 MW (34 percent).

**Table 4.28: Average Hourly Load Impacts by Event – *PG&E AMP DA***

| Event | Date | Day of Week | SAIDs Called | Estimated Reference Load (kW) | Observed Load (kW) | Estimated Load Impact (kW) | % LI |
|---|---|---|---|---|---|---|---|
| 1 | July 16, 2009 | Thursday | 105 | 91,755 | 55,802 | 35,953 | 39% |
| 3 | August 28, 2009 | Friday | 127 | 97,930 | 56,910 | 41,020 | 42% |
| Average | | | 116 | 94,843 | 56,356 | 38,486 | 41% |

**Table 4.29: Average Hourly Load Impacts by Event – *PG&E AMP DO***

| Event | Date | Day of Week | SAIDs Called | Estimated Reference Load (kW) | Observed Load (kW) | Estimated Load Impact (kW) | % LI |
|---|---|---|---|---|---|---|---|
| 1 | July 16, 2009 | Thursday | 447 | 274,273 | 193,228 | 81,045 | 30% |
| 3 | August 28, 2009 | Friday | 347 | 216,980 | 130,182 | 86,798 | 40% |
| Average | | | 397 | 245,626 | 161,705 | 83,921 | 34% |

Tables 4.30 and 4.31 show counts of customer accounts called, and average hourly reference and observed loads, and load impacts and percentage load impacts by industry type for the average AMP DA and DO events, where the values for DO are for the overlapping HE 16 across the two events.[15] Manufacturing made up the bulk of the DA load impacts, while Wholesale, Transportation and Other Utilities, and Agriculture, Mining and Construction comprised the majority of DO load impacts.

At a detailed level, 70 percent of the estimated DA load impacts were accounted for by the top 15 responding customer accounts, while the top 15 responders accounted for a third of

[15] Defining an average DO event for 2009 is complicated by the fact that different aggregators, and thus different customer accounts, were called for the two test events (see the fourth column in Table 4.29). As seen in the Protocol table below (Table 4.37), if we average the loads and load impacts for the two events hour by hour, the only hour that shows the full program load impact is HE 16, which was included in the event window for both events. Since this hour is most representative of the full effect of calling the total program, Tables 4.30 through 4.33 show results for HE 16, averaged across the two events, as reflected in the Protocol table. Note that the average load impact in that hour, 83.6 MW, differs slightly from the value shown in Table 4.29 (83.9 MW), because the latter value was calculated by averaging load impacts over the *four* hours that reflected the event windows in both events (*e.g.*, HE 15 –16 in event 1 and HE 16 – 17 in event 2).

the total DO load impact. The DO component of AMP had a number of large responders, with 38 customer accounts providing load reductions of at least 500 kW.

**Table 4.30: Average Hourly Load Impacts by Industry Group – *PG&E AMP DA***

| Industry Group | SAIDs Called | Estimated Reference Load (kW) | Observed Load (kW) | Estimated Load Impact (kW) | % LI |
|---|---|---|---|---|---|
| 1. Agriculture, Mining & Construction | 18 | 1,737 | 1,135 | 601 | 35% |
| 2. Manufacturing | 54 | 68,667 | 43,301 | 25,366 | 37% |
| 3. Wholesale, Transport, other Utilities | 14 | 4,975 | 2,370 | 2,605 | 52% |
| 4. Retail stores | 0 | 0 | 0 | 0 | |
| 5. Offices, Hotels, Health, Services | 13 | 6,751 | 3,611 | 3,140 | 47% |
| 6. Schools | 9 | 5,022 | 3,567 | 1,455 | 29% |
| 7. Entertainment, Other Services, Gov't | 8 | 7,334 | 2,326 | 5,007 | 68% |
| 8. Other/Unknown | 1 | 359 | 47 | 312 | 87% |
| **Total** | **117** | **94,843** | **56,356** | **38,486** | **41%** |

**Table 4.31: Average Hourly Load Impacts by Industry Group – *PG&E AMP DO***

| Industry Group | SAIDs Called | Estimated Reference Load (kW) | Observed Load (kW) | Estimated Load Impact (kW) | % LI |
|---|---|---|---|---|---|
| 1. Agriculture, Mining & Construction | 95 | 42,046 | 20,558 | 21,488 | 51% |
| 2. Manufacturing | 67 | 45,473 | 32,225 | 13,248 | 29% |
| 3. Wholesale, Transport, other Utilities | 79 | 55,720 | 23,814 | 31,906 | 57% |
| 4. Retail stores | 71 | 34,071 | 29,414 | 4,657 | 14% |
| 5. Offices, Hotels, Health, Services | 75 | 45,724 | 37,565 | 8,160 | 18% |
| 6. Schools | 4 | 18,430 | 17,379 | 1,051 | 6% |
| 7. Entertainment, Other Services, Gov't | 6 | 4,445 | 1,327 | 3,118 | 70% |
| 8. Other/Unknown | | | | | |
| **Total** | **397** | **245,909** | **162,281** | **83,627** | **34%** |

Tables 4.32 and 4.33 report average hourly load impacts by LCA. Nearly half of the load impacts took place outside of any LCA. Large shares also took place in the Greater Bay Area and Greater Fresno LCAs.

**Table 4.32: Average Hourly Load Impacts by LCA – *PG&E AMP DA***

| Local Capacity Area | SAIDs Called | Estimated Reference Load (kW) | Observed Load (kW) | Estimated Load Impact (kW) | % LI |
|---|---|---|---|---|---|
| Greater Bay Area | 28 | 21,742 | 17,111 | 4,631 | 21% |
| Greater Fresno | 16 | 14,751 | 7,573 | 7,178 | 49% |
| Humboldt | 0 | 0 | 0 | 0 | |
| Kern | 0 | 0 | 0 | 0 | |
| Northern Coast | 10 | 4,567 | 1,714 | 2,852 | 62% |
| Sierra | 11 | 2,325 | 1,536 | 788 | 34% |
| Stockton | 6 | 6,547 | 1,540 | 5,006 | 76% |
| Not in any LCA | 46 | 44,912 | 26,882 | 18,031 | 40% |
| **Total** | **117** | **94,843** | **56,356** | **38,486** | **41%** |

**Table 4.33: Average Hourly Load Impacts by LCA – *PG&E AMP DO***

| Local Capacity Area | SAIDs Called | Estimated Reference Load (kW) | Observed Load (kW) | Estimated Load Impact (kW) | % LI |
|---|---|---|---|---|---|
| Greater Bay Area | 119 | 71,712 | 61,506 | 10,205 | 14% |
| Greater Fresno | 88 | 44,428 | 28,290 | 16,138 | 36% |
| Humboldt | 7 | 1,257 | 225 | 1,032 | 82% |
| Kern | 28 | 26,420 | 16,494 | 9,926 | 38% |
| Northern Coast | 31 | 9,160 | 5,663 | 3,498 | 38% |
| Sierra | 9 | 5,894 | 4,277 | 1,617 | 27% |
| Stockton | 16 | 9,424 | 6,478 | 2,946 | 31% |
| Not in any LCA | 100 | 77,613 | 39,348 | 38,265 | 49% |
| **Total** | **398** | **245,909** | **162,281** | **83,627** | **34%** |

### 4.4.2 Hourly load impacts

Tables 4.34 and 4.35 show average event-hour load impacts for PG&E's AMP DA and DO program types. The average DA event was defined as the average of the two DA events, as was the average DO event. However, there were some differences in aggregators called for the two DO events, such that 100 fewer customer accounts were called for the second event (as reflected in the results for HE 15). Event-hour load impacts for DA averaged 38.5 MW in both event hours (HE 16 and17). Percentage load impacts were about 40 percent, and load impacts per called customer were 332 kW.

For DO, average event-hour load impacts for HE 15 – 17 ranged from 81.5 to 87 MW, representing 30 to 40 percent of the reference load. Average event-hour load impacts per called customer ranged from 182 to 251 kW.

**Table 4.34: Average Event-Hour Load Impacts – *PG&E AMP DA***

| Hour Ending | Number of SAIDs Called | Estimated Reference Load (kWh/hr) | Observed Event-Day Load (kWh/hr) | Estimated Load Impact (kWh/hr) | Weighted Average Temp (°F) | # of Events in which this Hour is Included | Load Impact per Called Customer (kWh/hr) | % Load Impact |
|---|---|---|---|---|---|---|---|---|
| 16 | 116 | 95,626 | 57,158 | 38,468 | 97 | 2 | 331.6 | 40% |
| 17 | 116 | 94,060 | 55,555 | 38,505 | 97 | 2 | 331.9 | 41% |

**Table 4.35: Average Event-Hour Load Impacts – *PG&E AMP DO***

| Hour Ending | Number of SAIDs Called | Estimated Reference Load (kWh/hr) | Observed Event-Day Load (kWh/hr) | Estimated Load Impact (kWh/hr) | Weighted Average Temp (°F) | # of Events in which this Hour is Included | Load Impact per Called Customer (kWh/hr) | % Load Impact |
|---|---|---|---|---|---|---|---|---|
| 15 | 347 | 217,929 | 130,983 | 86,946 | 96 | 1 | 250.6 | 40% |
| 16 | 397 | 245,909 | 162,281 | 83,627 | 95 | 2 | 210.6 | 34% |
| 17 | 447 | 272,758 | 191,273 | 81,485 | 95 | 1 | 182.3 | 30% |

Tables 4.36 and 4.37 show hourly reference load, observed load, load impact values, and uncertainty-adjusted load impacts for the average PG&E AMP ***DA*** and ***DO*** events respectively. Hourly load impacts were about 40 percent of the reference load of about 95 MW for DA, and were 34 percent of the reference load of about 246 MW for DO in the single hour (HE 16) in which all DO program types and events overlapped. The 10th and 90th percentile uncertainty-adjusted load impacts are estimated to be about 6 percent below and above the estimated load impacts for the average DA event, and 5 percent for the overlapping hour in the average DO event.

**Table 4.36: Hourly Load Impacts – *PG&E Average AMP DA Event***

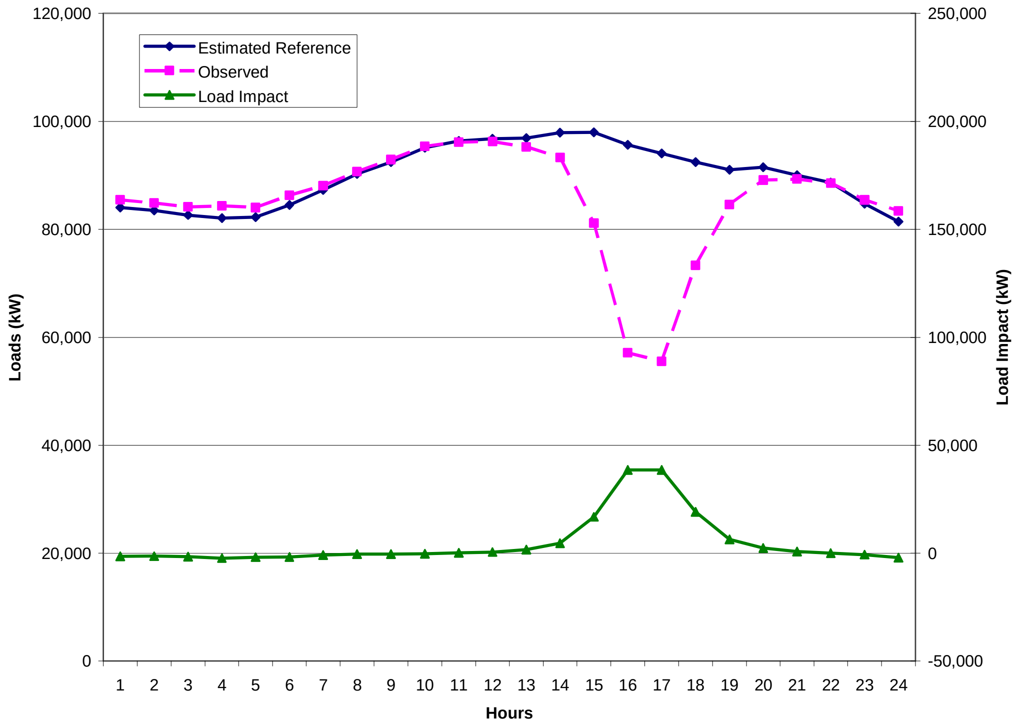
| Hour Ending | Estimated Reference Load (kWh/hr) | Observed Event-Day Load (kWh/hr) | Estimated Load Impact (kWh/hr) | Weighted Average Temperature (°F) | Uncertainty Adjusted Impact (kWh/hr)- Percentiles | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 10th%ile | 30th%ile | 50th%ile | 70th%ile | 90th%ile |
| **1** | 84,018 | 85,473 | -1,456 | 74 | -3,756 | -2,397 | -1,456 | -515 | 844 |
| **2** | 83,476 | 84,854 | -1,377 | 73 | -3,677 | -2,318 | -1,377 | -436 | 922 |
| **3** | 82,621 | 84,176 | -1,555 | 71 | -3,852 | -2,495 | -1,555 | -615 | 742 |
| **4** | 82,071 | 84,357 | -2,286 | 69 | -4,584 | -3,226 | -2,286 | -1,347 | 11 |
| **5** | 82,220 | 84,029 | -1,808 | 68 | -4,105 | -2,748 | -1,808 | -869 | 488 |
| **6** | 84,492 | 86,267 | -1,775 | 67 | -4,072 | -2,715 | -1,775 | -835 | 521 |
| **7** | 87,294 | 88,108 | -813 | 67 | -3,112 | -1,754 | -813 | 127 | 1,485 |
| **8** | 90,228 | 90,699 | -470 | 69 | -2,771 | -1,412 | -470 | 471 | 1,830 |
| **9** | 92,468 | 92,907 | -439 | 72 | -2,740 | -1,381 | -439 | 502 | 1,862 |
| **10** | 95,089 | 95,389 | -299 | 76 | -2,603 | -1,242 | -299 | 643 | 2,004 |
| **11** | 96,354 | 96,147 | 207 | 81 | -2,096 | -735 | 207 | 1,149 | 2,509 |
| **12** | 96,773 | 96,241 | 533 | 86 | -1,774 | -411 | 533 | 1,476 | 2,839 |
| **13** | 96,864 | 95,260 | 1,604 | 90 | -703 | 660 | 1,604 | 2,548 | 3,911 |
| **14** | 97,893 | 93,297 | 4,595 | 92 | 2,292 | 3,653 | 4,595 | 5,538 | 6,898 |
| **15** | 97,953 | 81,134 | 16,819 | 95 | 14,516 | 15,877 | 16,819 | 17,762 | 19,123 |
| **16** | 95,626 | 57,158 | 38,468 | 97 | 36,163 | 37,525 | 38,468 | 39,412 | 40,774 |
| **17** | 94,060 | 55,555 | 38,505 | 97 | 36,201 | 37,562 | 38,505 | 39,448 | 40,809 |
| **18** | 92,420 | 73,313 | 19,107 | 96 | 16,803 | 18,164 | 19,107 | 20,050 | 21,411 |
| **19** | 91,003 | 84,608 | 6,395 | 94 | 4,089 | 5,451 | 6,395 | 7,339 | 8,701 |
| **20** | 91,513 | 89,114 | 2,400 | 91 | 90 | 1,455 | 2,400 | 3,345 | 4,709 |
| **21** | 90,019 | 89,286 | 733 | 87 | -1,578 | -213 | 733 | 1,678 | 3,043 |
| **22** | 88,627 | 88,588 | 39 | 84 | -2,270 | -906 | 39 | 984 | 2,349 |
| **23** | 84,747 | 85,423 | -676 | 81 | -2,987 | -1,622 | -676 | 269 | 1,634 |
| **24** | 81,420 | 83,415 | -1,995 | 79 | -4,306 | -2,941 | -1,995 | -1,050 | 315 |
| | **Reference Energy Use (kWh)** | **Observed Event-Day Energy Use (kWh)** | **Change in Energy Use (kWh)** | **Cooling Degree Hours (Base 75 oF)** | **Uncertainty Adjusted Impact (kWh/hour) - Percentiles** | | | | |
| | | | | | **10th** | **30th** | **50th** | **70th** | **90th** |
| **Daily** | 2,159,250 | 2,044,798 | 114,452 | 186.0 | n/a | n/a | n/a | n/a | n/a |

**Table 4.37: Hourly Load Impacts – *PG&E Average AMP DO Event***

| Hour Ending | Estimated Reference Load (kWh/hr) | Observed Event-Day Load (kWh/hr) | Estimated Load Impact (kWh/hr) | Weighted Average Temperature (°F) | Uncertainty Adjusted Impact (kWh/hr)- Percentiles | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 10th%ile | 30th%ile | 50th%ile | 70th%ile | 90th%ile |
| **1** | 185,852 | 186,972 | -1,120 | 74 | -5,364 | -2,857 | -1,120 | 616 | 3,124 |
| **2** | 181,569 | 182,612 | -1,043 | 72 | -5,288 | -2,780 | -1,043 | 695 | 3,203 |
| **3** | 178,927 | 179,563 | -636 | 71 | -4,876 | -2,371 | -636 | 1,099 | 3,604 |
| **4** | 176,011 | 176,858 | -846 | 69 | -5,087 | -2,582 | -846 | 889 | 3,394 |
| **5** | 174,703 | 176,023 | -1,320 | 68 | -5,560 | -3,055 | -1,320 | 414 | 2,919 |
| **6** | 181,383 | 182,079 | -695 | 68 | -4,936 | -2,431 | -695 | 1,040 | 3,546 |
| **7** | 193,974 | 192,765 | 1,209 | 67 | -3,036 | -528 | 1,209 | 2,945 | 5,453 |
| **8** | 205,575 | 204,433 | 1,142 | 69 | -3,110 | -598 | 1,142 | 2,882 | 5,394 |
| **9** | 215,108 | 214,817 | 291 | 73 | -3,965 | -1,450 | 291 | 2,033 | 4,547 |
| **10** | 223,808 | 223,784 | 25 | 78 | -4,233 | -1,717 | 25 | 1,767 | 4,282 |
| **11** | 235,670 | 236,462 | -792 | 82 | -5,043 | -2,532 | -792 | 947 | 3,459 |
| **12** | 241,581 | 243,500 | -1,919 | 86 | -6,168 | -3,658 | -1,919 | -180 | 2,330 |
| **13** | 241,958 | 239,438 | 2,520 | 89 | -1,734 | 780 | 2,520 | 4,261 | 6,774 |
| **14** | 246,110 | 230,174 | 15,936 | 92 | 11,681 | 14,195 | 15,936 | 17,678 | 20,192 |
| **15** | 247,263 | 192,346 | 54,917 | 94 | 50,659 | 53,175 | 54,917 | 56,659 | 59,174 |
| **16** | 245,909 | 162,281 | 83,627 | 95 | 79,370 | 81,885 | 83,627 | 85,369 | 87,885 |
| **17** | 243,655 | 186,158 | 57,497 | 96 | 53,243 | 55,756 | 57,497 | 59,238 | 61,752 |
| **18** | 237,919 | 220,145 | 17,774 | 95 | 13,521 | 16,034 | 17,774 | 19,514 | 22,027 |
| **19** | 230,733 | 226,380 | 4,353 | 93 | 97 | 2,612 | 4,353 | 6,094 | 8,609 |
| **20** | 225,496 | 225,387 | 109 | 90 | -4,152 | -1,635 | 109 | 1,853 | 4,370 |
| **21** | 218,554 | 216,979 | 1,575 | 86 | -2,686 | -169 | 1,575 | 3,319 | 5,836 |
| **22** | 208,904 | 206,020 | 2,884 | 83 | -1,378 | 1,140 | 2,884 | 4,628 | 7,146 |
| **23** | 199,767 | 196,949 | 2,818 | 80 | -1,446 | 1,073 | 2,818 | 4,563 | 7,082 |
| **24** | 190,936 | 188,930 | 2,006 | 78 | -2,254 | 263 | 2,006 | 3,749 | 6,266 |
| | Reference Energy Use (kWh) | Observed Event-Day Energy Use (kWh) | Change in Energy Use (kWh) | Cooling Degree Hours (Base 75 oF) | Uncertainty Adjusted Impact (kWh/hour) - Percentiles | | | | |
| | | | | | 10th | 30th | 50th | 70th | 90th |
| **Daily** | 5,131,362 | 4,891,050 | 240,312 | 175.9 | n/a | n/a | n/a | n/a | n/a |

Figure 4.7 illustrates the reference load, observed load, and estimated load impacts for the average DA event, while Figure 4.8 illustrates comparable information for the average DO event. Figure 4.9 shows the estimated hourly DA and DO load impacts separately for the first (July 16) and third (August 28) events, for which both program types were called. Note that the DO program types were called for two different sets of two-hour periods, thus producing the "shifted" load impacts for the two events.

## Figure 4.7: Hourly Loads and Load Impacts – *Average AMP DA Event*




## Figure 4.8: Hourly Loads and Load Impacts – *Average AMP DO Event*

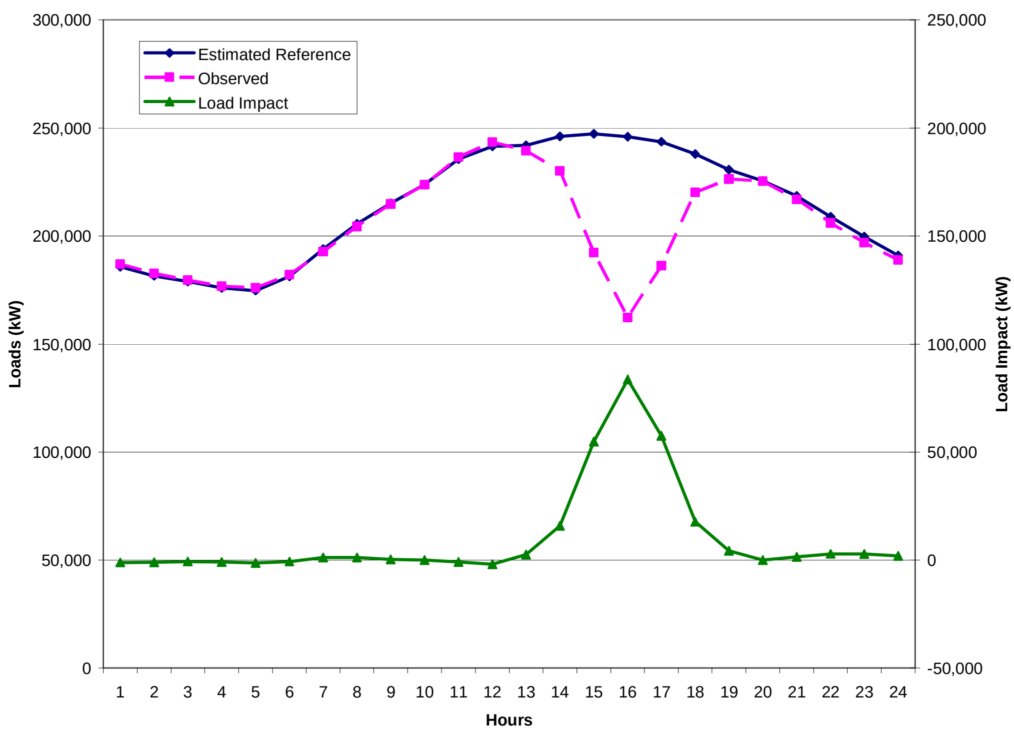
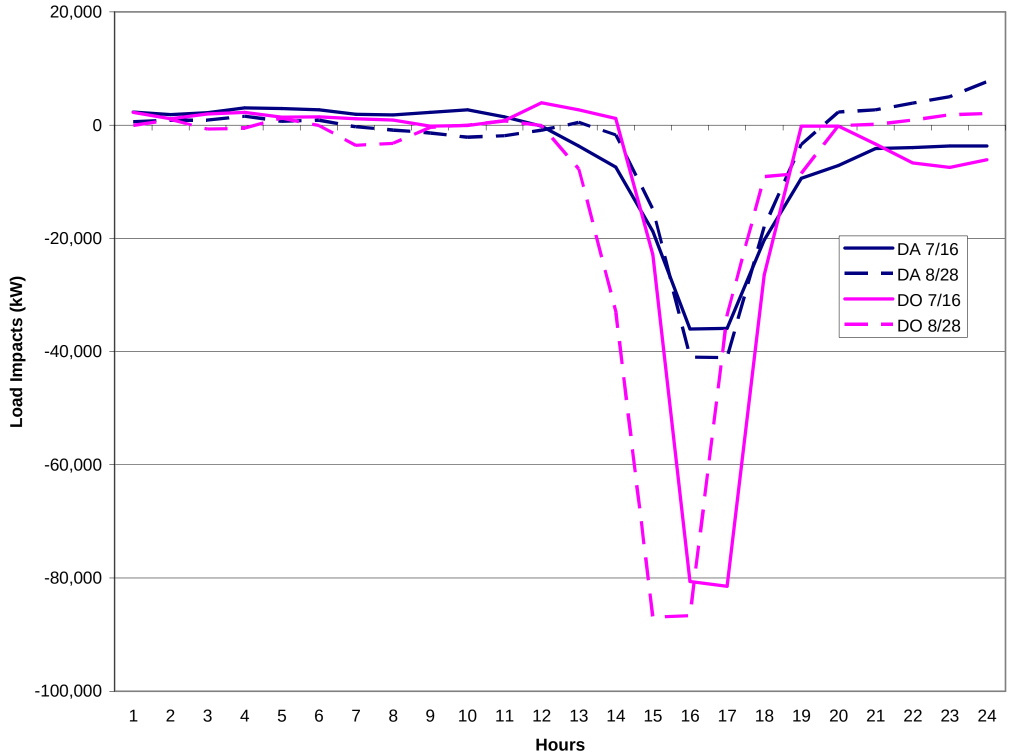


**Figure 4.9: Hourly Load Impacts – *PG&E AMP Events 1 and 3***




## *4.5 DRC – SCE*

### 4.5.1 Summary load impacts

Tables 4.38 and 4.39 report estimated *average hourly* reference loads, observed loads, and load impacts by industry group for SCE's two DRC events, the first being a DA event, and the second a DO event. The program total average hourly load impact in the last row of the table shows load reductions averaging 3.9 MW on July 14 for the DA event, 63.6 MW for the DO event on September 23. Most of the DA load impacts were provided by the Retail industry group. The largest DO load impacts were provided by the Wholesale, Transportation and Utilities, Manufacturing, and Retail industry groups.

At a detailed level, the top nine responders provided 30 percent of the total DO load impact, with each providing more than 500 kW.

**Table 4.38: Average Hourly Load Impacts by Industry Group – *SCE DRC DA***

| Industry Group | SAIDs Called | Estimated Reference Load (kW) | Observed Load (kW) | Estimated Load Impact (kW) | % LI |
|---|---|---|---|---|---|
| 1. Agriculture, Mining & Construction | | | | | |
| 2. Manufacturing | 2 | 1,069 | 310 | 759 | |
| 3. Wholesale, Transport, other Utilities | 10 | 4,888 | 4,170 | 718 | 15% |
| 4. Retail stores | 110 | 28,872 | 26,484 | 2,388 | 8% |
| 5. Offices, Hotels, Health, Services | | | | | |
| 6. Schools | | | | | |
| 7. Entertainment, Other Services, Gov't | | | | | |
| 8. Other/Unknown | | | | | |
| **Total** | **122** | **34,829** | **30,964** | **3,865** | **11%** |

**Table 4.39: Average Hourly Load Impacts by Industry Group – *SCE DRC DO***

| Industry Group | SAIDs Called | Estimated Reference Load (kW) | Observed Load (kW) | Estimated Load Impact (kW) | % LI |
|---|---|---|---|---|---|
| 1. Agriculture, Mining & Construction | 11 | 1,821 | 706 | 1,115 | 61% |
| 2. Manufacturing | 46 | 37,744 | 20,332 | 17,413 | 46% |
| 3. Wholesale, Transport, other Utilities | 272 | 47,831 | 20,678 | 27,153 | 57% |
| 4. Retail stores | 236 | 71,921 | 60,139 | 11,781 | 16% |
| 5. Offices, Hotels, Health, Services | 29 | 12,962 | 11,219 | 1,743 | 13% |
| 6. Schools | 13 | 39,458 | 35,994 | 3,463 | 9% |
| 7. Entertainment, Other Services, Gov't | 3 | 2,822 | 1,875 | 947 | 34% |
| 8. Other/Unknown | | | | | |
| **Total** | **610** | **214,558** | **150,944** | **63,615** | **30%** |

Tables 4.40 and 4.41 report average hourly load impacts by LCA for the DA and DO program types. More than two-thirds of the load impacts were in the LA Basin.

**Table 4.40: Average Hourly Load Impacts by LCA – *SCE DRC DA***

| Local Capacity Area | SAIDs Called | Estimated Reference Load (kW) | Observed Load (kW) | Estimated Load Impact (kW) | % LI |
|---|---|---|---|---|---|
| LA Basin | 95 | 28,024 | 24,685 | 3,338 | 12% |
| Outside LA Basin | 9 | 2,222 | 1,994 | 228 | 10% |
| Ventura | 18 | 4,583 | 4,285 | 298 | 7% |
| **Total** | **122** | **34,829** | **30,964** | **3,865** | **11%** |

**Table 4.41: Average Hourly Load Impacts by LCA – *SCE DRC DO***

| Local Capacity Area | SAIDs Called | Estimated Reference Load (kW) | Observed Load (kW) | Estimated Load Impact (kW) | % LI |
|---|---|---|---|---|---|
| LA Basin | 472 | 159,321 | 118,822 | 40,499 | 25% |
| Outside LA Basin | 74 | 10,766 | 4,384 | 6,382 | 59% |
| Ventura | 64 | 44,471 | 27,738 | 16,734 | 38% |
| **Total** | **610** | **214,558** | **150,944** | **63,615** | **30%** |

### 4.5.2 Hourly load impacts

Tables 4.42 and 4.43 show average event-hour load impacts for SCE's DRC DA and DO program types. The average DA event was the same as the single DA event on July 14, while the average DO event was the same as the single DO event on September 23. As a result, the load impacts shown are the same as those in the hourly Protocol tables below. Event-hour load impacts for DA ranged from 3.4 to 4.3 MW across event hours HE 15 – 17. Percentage load impacts were 10 to 12 percent, and load impacts per called customer ranged from 28 to 35 kW.

For DO, event-hour load impacts for HE 15 and 16 were 62.4 and 64.9 MW respectively, or about 30 percent of the reference load. Average event-hour load impacts per called customer were 102 to 106 kW.

**Table 4.42: Average Event-Hour Load Impacts – *SCE DRC DA***

| Hour Ending | Number of SAIDs Called | Estimated Reference Load (kWh/hr) | Observed Event-Day Load (kWh/hr) | Estimated Load Impact (kWh/hr) | Weighted Average Temp ($^oF$) | # of Events in which this Hour is Included | Load Impact per Called Customer (kWh/hr) | % Load Impact |
|---|---|---|---|---|---|---|---|---|
| 15 | 122 | 34,700 | 30,447 | 4,253 | 89 | 1 | 34.9 | 12% |
| 16 | 122 | 34,986 | 31,046 | 3,940 | 89 | 1 | 32.3 | 11% |
| 17 | 122 | 34,801 | 31,399 | 3,402 | 88 | 1 | 27.9 | 10% |

**Table 4.43: Average Event-Hour Load Impacts – *SCE DRC DO***

| Hour Ending | Number of SAIDs Called | Estimated Reference Load (kWh/hr) | Observed Event-Day Load (kWh/hr) | Estimated Load Impact (kWh/hr) | Weighted Average Temp ($^oF$) | # of Events in which this Hour is Included | Load Impact per Called Customer (kWh/hr) | % Load Impact |
|---|---|---|---|---|---|---|---|---|
| 15 | 610 | 215,866 | 153,490 | 62,376 | 94 | 1 | 102.3 | 29% |
| 16 | 610 | 213,251 | 148,398 | 64,853 | 94 | 1 | 106.3 | 30% |

Tables 4.44 and 4.45 show hourly reference load, observed load, load impact values, and uncertainty-adjusted load impacts for the average SCE DRC ***DA*** and ***DO*** events respectively. Hourly load impacts ranged from 10 to 12 percent of the reference load of about 35 MW for the DA program type, and from 29 to 30 percent of the reference load of nearly 215 MW for DO. The $10^{th}$ and $90^{th}$ percentile uncertainty-adjusted load impacts are estimated to span about 15 to 19 percent below and above the estimated load impacts for the average DA event, and were about 6 percent for the average DO event.

## Table 4.44: Hourly Load Impacts – *Average SCE DRC DA Event*

| Hour Ending | Estimated Reference Load (kWh/hr) | Observed Event-Day Load (kWh/hr) | Estimated Load Impact (kWh/hr) | Weighted Average Temperature (°F) | Uncertainty Adjusted Impact (kWh/hr)- Percentiles | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 10th%ile | 30th%ile | 50th%ile | 70th%ile | 90th%ile |
| **1** | 14,430 | 14,333 | 97 | 70 | -558 | -171 | 97 | 365 | 752 |
| **2** | 14,017 | 13,819 | 198 | 68 | -457 | -70 | 198 | 466 | 852 |
| **3** | 13,848 | 13,688 | 160 | 67 | -495 | -108 | 160 | 428 | 815 |
| **4** | 13,679 | 13,469 | 211 | 67 | -445 | -57 | 211 | 479 | 866 |
| **5** | 13,754 | 13,481 | 272 | 66 | -382 | 5 | 272 | 540 | 927 |
| **6** | 14,271 | 14,310 | -39 | 65 | -693 | -307 | -39 | 228 | 615 |
| **7** | 16,811 | 16,820 | -10 | 66 | -664 | -277 | -10 | 258 | 645 |
| **8** | 19,524 | 19,415 | 108 | 71 | -547 | -160 | 108 | 377 | 764 |
| **9** | 22,276 | 22,781 | -505 | 75 | -1,160 | -773 | -505 | -237 | 150 |
| **10** | 25,419 | 25,837 | -418 | 79 | -1,074 | -686 | -418 | -150 | 238 |
| **11** | 32,221 | 32,427 | -205 | 82 | -861 | -474 | -205 | 63 | 451 |
| **12** | 33,318 | 33,829 | -511 | 85 | -1,167 | -779 | -511 | -242 | 146 |
| **13** | 33,442 | 34,025 | -584 | 87 | -1,241 | -853 | -584 | -315 | 73 |
| **14** | 33,983 | 33,789 | 194 | 88 | -463 | -75 | 194 | 463 | 851 |
| **15** | 34,700 | 30,447 | 4,253 | 89 | 3,596 | 3,984 | 4,253 | 4,522 | 4,909 |
| **16** | 34,986 | 31,046 | 3,940 | 89 | 3,283 | 3,671 | 3,940 | 4,208 | 4,596 |
| **17** | 34,801 | 31,399 | 3,402 | 88 | 2,746 | 3,134 | 3,402 | 3,670 | 4,058 |
| **18** | 34,805 | 34,383 | 421 | 86 | -235 | 153 | 421 | 689 | 1,077 |
| **19** | 34,919 | 35,835 | -916 | 84 | -1,572 | -1,184 | -916 | -647 | -259 |
| **20** | 35,077 | 36,054 | -977 | 81 | -1,633 | -1,245 | -977 | -709 | -321 |
| **21** | 32,674 | 34,019 | -1,346 | 77 | -2,001 | -1,614 | -1,346 | -1,078 | -691 |
| **22** | 22,275 | 23,298 | -1,023 | 74 | -1,678 | -1,291 | -1,023 | -755 | -368 |
| **23** | 17,511 | 18,241 | -730 | 71 | -1,385 | -998 | -730 | -462 | -76 |
| **24** | 15,771 | 16,413 | -642 | 69 | -1,297 | -910 | -642 | -375 | 12 |
| | Reference Energy Use (kWh) | Observed Event-Day Energy Use (kWh) | Change in Energy Use (kWh) | Cooling Degree Hours (Base 75 oF) | Uncertainty Adjusted Impact (kWh/hour) - Percentiles | | | | |
| | | | | | 10th | 30th | 50th | 70th | 90th |
| **Daily** | 598,510 | 593,160 | 5,350 | 114.4 | n/a | n/a | n/a | n/a | n/a |

**Table 4.45: Hourly Load Impacts – *Average SCE DRC DO Event***

| Hour Ending | Estimated Reference Load (kWh/hr) | Observed Event-Day Load (kWh/hr) | Estimated Load Impact (kWh/hr) | Weighted Average Temperature (°F) | Uncertainty Adjusted Impact (kWh/hr)- Percentiles | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 10th%ile | 30th%ile | 50th%ile | 70th%ile | 90th%ile |
| **1** | 159,389 | 155,227 | 4,161 | 70 | 506 | 2,665 | 4,161 | 5,657 | 7,817 |
| **2** | 156,026 | 151,295 | 4,731 | 68 | 1,078 | 3,236 | 4,731 | 6,226 | 8,385 |
| **3** | 152,765 | 147,723 | 5,042 | 66 | 1,387 | 3,546 | 5,042 | 6,538 | 8,698 |
| **4** | 150,824 | 146,448 | 4,376 | 66 | 704 | 2,874 | 4,376 | 5,878 | 8,048 |
| **5** | 152,356 | 149,236 | 3,120 | 63 | -564 | 1,612 | 3,120 | 4,627 | 6,803 |
| **6** | 157,455 | 155,776 | 1,680 | 62 | -2,006 | 172 | 1,680 | 3,187 | 5,365 |
| **7** | 169,263 | 172,679 | -3,416 | 62 | -7,106 | -4,926 | -3,416 | -1,906 | 275 |
| **8** | 177,618 | 181,534 | -3,917 | 63 | -7,600 | -5,424 | -3,917 | -2,409 | -233 |
| **9** | 191,807 | 193,746 | -1,939 | 70 | -5,605 | -3,439 | -1,939 | -439 | 1,727 |
| **10** | 200,101 | 201,072 | -971 | 77 | -4,640 | -2,472 | -971 | 531 | 2,698 |
| **11** | 211,257 | 211,820 | -563 | 82 | -4,230 | -2,063 | -563 | 937 | 3,104 |
| **12** | 215,502 | 215,543 | -40 | 87 | -3,710 | -1,542 | -40 | 1,461 | 3,630 |
| **13** | 213,762 | 216,640 | -2,878 | 91 | -6,554 | -4,383 | -2,878 | -1,374 | 798 |
| **14** | 215,755 | 204,513 | 11,242 | 93 | 7,562 | 9,736 | 11,242 | 12,747 | 14,921 |
| **15** | 215,866 | 153,490 | 62,376 | 94 | 58,693 | 60,869 | 62,376 | 63,883 | 66,059 |
| **16** | 213,251 | 148,398 | 64,853 | 94 | 61,170 | 63,346 | 64,853 | 66,360 | 68,537 |
| **17** | 209,951 | 180,580 | 29,371 | 92 | 25,696 | 27,868 | 29,371 | 30,875 | 33,046 |
| **18** | 206,005 | 190,618 | 15,387 | 90 | 11,720 | 13,886 | 15,387 | 16,887 | 19,054 |
| **19** | 204,809 | 195,954 | 8,854 | 86 | 5,189 | 7,354 | 8,854 | 10,354 | 12,520 |
| **20** | 205,282 | 200,436 | 4,846 | 83 | 1,177 | 3,344 | 4,846 | 6,347 | 8,515 |
| **21** | 204,647 | 198,050 | 6,597 | 80 | 2,924 | 5,094 | 6,597 | 8,100 | 10,271 |
| **22** | 194,189 | 193,451 | 738 | 77 | -2,932 | -764 | 738 | 2,240 | 4,409 |
| **23** | 175,674 | 175,548 | 126 | 74 | -3,538 | -1,373 | 126 | 1,625 | 3,790 |
| **24** | 164,292 | 162,441 | 1,851 | 73 | -1,813 | 352 | 1,851 | 3,351 | 5,516 |
| | Reference Energy Use (kWh) | Observed Event-Day Energy Use (kWh) | Change in Energy Use (kWh) | Cooling Degree Hours (Base 75 oF) | Uncertainty Adjusted Impact (kWh/hour) - Percentiles | | | | |
| | | | | | 10th | 30th | 50th | 70th | 90th |
| **Daily** | 4,517,844 | 4,302,216 | 215,628 | 151.0 | n/a | n/a | n/a | n/a | n/a |

Figure 4.10 illustrates the reference load, observed loads, and load impacts for the average DA event, while Figure 4.11 illustrates comparable information for the average DO event.

**Figure 4.10: Hourly Loads and Load Impacts – Average SCE DRC DA Event**

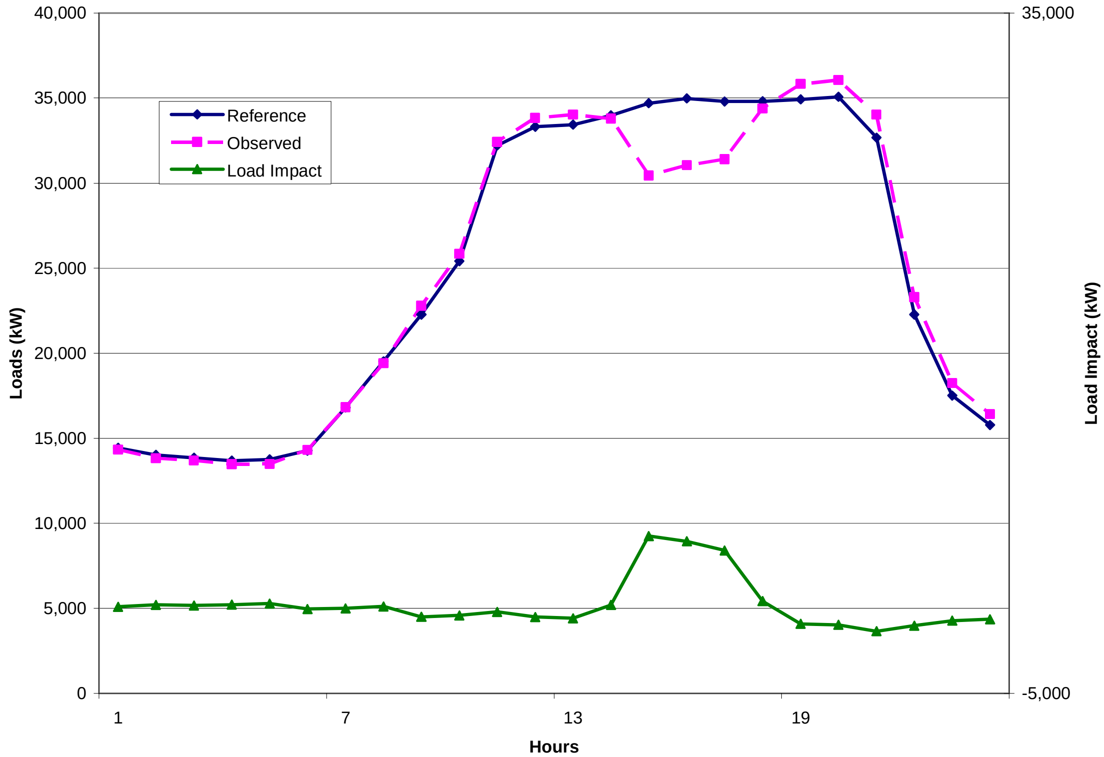
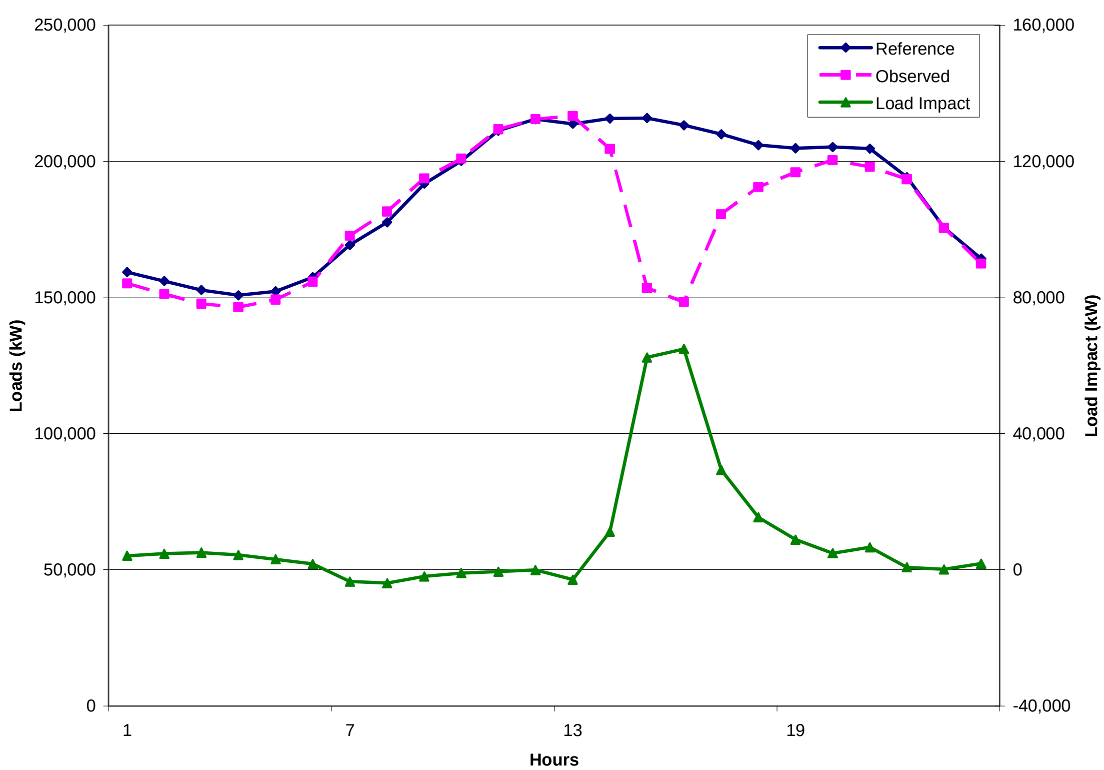



**Figure 4.11: Hourly Loads and Load Impacts – *Average SCE DRC DO Event***



### *4.6 Average Event-Hour Load Impacts per Enrolled Customer*

The utilities have asked for a summary indicator of average event-hour load impacts *per enrolled customer* for each program and program type. They are the following:

1. PG&E CBP DA – 32 kW
2. PG&E CBP DO – 80 kW
3. SCE CBP DA – 10 kW
4. SCE CBP DO – 42 kW
5. SDG&E CBP DA – 78 kW
6. SDG&E CBP DO – 42 kW
7. PG&E AMP DA – 141 kW
8. PG&E AMP DO – 125 kW
9. SCE DRC DA – 23 kW
10. SCE DRC DO – 52 kW.

### *4.7 TA/TI Impacts*

This section describes the *ex post* load impacts achieved by two demand response incentive programs: TA/TI and AutoDR.

The Technical Assistance and Technology Incentives (TA/TI) program has two parts: technical assistance in the form of energy audits, and technology incentives. The objective of the TA portion of the program is to subsidize customer energy audits so that they can identify ways to participate in DR and modify their usage patterns. The TI portion of the program then provides incentive payments for the installation of equipment or control software to support DR.

The Automated Demand Response (AutoDR) program helps customers to activate DR strategies, such as managing lighting or heating, ventilation and air conditioning (HVAC) systems, whereby electrical usage can be automatically reduced or even eliminated during times of high electricity prices or electricity system emergencies. Only SDG&E had aggregator customers participating in AutoDR.[16]

For each utility and incentive program, we present two tables of information. The first table contains the *overall load impact*s provided by those service accounts who participated in TA/TI or AutoDR. The second table compares, where possible, the percentage load impacts achieved by TA/TI or AutoDR participants to those of a relevant group of non-participating service accounts. In some cases, results for service accounts are compared to other service accounts of the same "customer." In this type of table, each row of data shows the outcome for customers within a 6-digit NAICS code or 4-digit SIC code. Where possible, we conduct comparisons of load impacts within these highly disaggregated

[16] A process evaluation conducted in conjunction with the 2008 load impact evaluation of the aggregator programs provides useful information on the operation of the programs and the perspectives of the participating customers on the enrollment process, their stated approach for responding to events, and the type of technology that they or their aggregator may have installed to facilitate responding to events called (see below). See "2008 Process Evaluation of California Statewide Aggregator Demand Response Programs," prepared by Research Into Action, August 6, 2009.

industry groups. Where a comparison at this level of disaggregation is not possible, we compare at a higher level of industry aggregation, such as 2-digit SIC codes or 3-digit NAICS codes. In some cases, the list of service accounts does not contain any reasonable basis of comparison for the participating TA/TI or AutoDR service account. (These cases are denoted as "No Comparables" in the tables.)

We note that the above comparisons do not constitute a formal evaluation of the incremental effect of AutoDR or TA/TI on customers' demand response load impacts. This is the case largely due to generally small numbers of observations and a lack of complete information. For example, we rarely observe "before and after" load responses for the same service account, because the TA/TI and AutoDR audits and installations typically took place prior to any events in 2009. In addition, enabling technology may be used by some SAIDs that did not participate in AutoDR or TA/TI. Therefore, we cannot even be certain that when we compare TA/TI and non-TA/TI accounts we are actually measuring a "with and without" technology difference.[17] However, given the available data, we believe that the comparisons made in this section are informative and the most relevant ones to provide.

### 4.7.1 PG&E

Table 4.46 shows the estimated load impact of the one TA/TI service accounts on PG&E's CBP DO program type. Table 4.47 indicated that that account had a smaller than average load impact compared to other accounts in that business type.

**Table 4.46: Total TA/TI Load Impacts by Event – *PG&E CBP DO***

| Event Date | Number of SAIDs | Estimated Reference Load (kW) | Observed Load (kW) | Estimated Load Impact (kW) | % Load Impact |
|---|---|---|---|---|---|
| 7/27/2009 | 1 | 438 | 422 | 16 | 3.7% |

**Table 4.47: *Incremental* TA/TI Load Impacts – *PG&E CBP DO***

| NAICS Code | NAICS Description | Basis of Comparison | Percentage Load Impact | | Number of Events | |
|---|---|---|---|---|---|---|
| | | | No TA/TI | TA/TI | No TA/TI | TA/TI |
| 445110 | Supermarkets and Other Grocery Stores | 6-digit NAICS, different accounts for same customer | 8.5% | 3.7% | 27 | 1 |

The following table shows total load impacts for 53 TA/TI participating service accounts in PG&E's AMP day-of program. Load impacts amounted to more than 4 MW on average.

[17] Customer surveys undertaken in the 2008 process evaluation found that 40 percent of surveyed participants reported that their facilities had an energy management or building control system prior to the enrollment with their aggregator. Fifteen percent of participants reported installing new equipment before participating, and 42 percent reported that their aggregator had installed new equipment after their enrollment (the equipment was often described as some additional metering technology designed to provide the customer or aggregator with access to timely energy usage information.

**Table 4.48: Total TA/TI Load Impacts by Event – *PG&E AMP DO***

| Event Date | Number of SAIDs | Estimated Reference Load (kW) | Observed Load (kW) | Estimated Load Impact (kW) | % Load Impact |
|---|---|---|---|---|---|
| 7/16/2009 | 53 | 27,967 | 23,331 | 4,636 | 16.6% |
| 8/28/2009 | 53 | 28,039 | 24,051 | 3,987 | 14.2% |
| **Average** | **53** | **28,003** | **23,691** | **4,312** | **15.4%** |

Table 4.49 compares percentage load impacts for TA/TI and non-TA/TI service accounts. The results are mixed, but two of the groups (NAICS 327320 and 452112 & 452910) show notably higher percentage load impacts for TA/TI accounts.

**Table 4.49: *Incremental* TA/TI Load Impacts – *PG&E AMP DO***

| NAICS Code | NAICS Description | Basis of Comparison | Percentage Load Impact | | Number of Events | |
|---|---|---|---|---|---|---|
| | | | No TA/TI | TA/TI | No TA/TI | TA/TI |
| 115114 | Postharvest Crop Activities | 6-digit NAICS | 43.3% | 32.1% | 60 | 2 |
| 327320 | Ready-Mix Concrete Manufacturing | 6-digit NAICS | 10.7% | 96.3% | 4 | 2 |
| 331511, 334516 | Iron Foundries, Analytical Laboratory Instrument Manufacturing | 2-digit NAICS | 14.8% | 11.0% | 30 | 4 |
| 452112, 452910 | Discount Department Stores, Warehouse Clubs and Supercenters | Different accounts for same customer | 9.8% | 16.4% | 18 | 96 |
| 511210 | Software Publishers | 6-digit NAICS, different accounts for same customer | 1.8% | -1.6% | 4 | 2 |

### 4.7.2 SCE

Table 4.50 shows load impacts by event for two TA/TI accounts in SCE's CBP day-ahead program, where the average hourly load impacts averaged around 0.1 MW.

**Table 4.50: Total TA/TI Load Impacts by Event – *SCE CBP DA***

| Event Date | Number of SAIDs | Estimated Reference Load (kW) | Observed Load (kW) | Estimated Load Impact (kW) | % Load Impact |
|---|---|---|---|---|---|
| 7/14/2009 | 2 | 1,127 | 934 | 192 | 17.1% |
| 7/15/2009 | 2 | 1,135 | 1,045 | 90 | 7.9% |
| 7/16/2009 | 2 | 1,219 | 963 | 256 | 21.0% |
| 7/17/2009 | 2 | 1,363 | 1,194 | 169 | 12.4% |
| 7/20/2009 | 2 | 1,248 | 987 | 262 | 21.0% |
| 7/21/2009 | 2 | 1,239 | 978 | 261 | 21.0% |
| 7/23/2009 | 1 | 806 | 535 | 271 | 33.6% |
| 7/27/2009 | 1 | 833 | 537 | 296 | 35.5% |
| 7/28/2009 | 2 | 1,195 | 912 | 283 | 23.7% |
| 8/4/2009 | 2 | 1,090 | 1,000 | 90 | 8.2% |
| 8/11/2009 | 2 | 1,036 | 886 | 149 | 14.4% |
| 8/12/2009 | 2 | 1,067 | 985 | 82 | 7.7% |
| 8/13/2009 | 2 | 1,062 | 985 | 77 | 7.3% |
| 8/14/2009 | 1 | 661 | 478 | 183 | 27.7% |
| 8/17/2009 | 2 | 990 | 817 | 173 | 17.5% |
| 8/19/2009 | 2 | 1,033 | 868 | 165 | 16.0% |
| 8/27/2009 | 2 | 1,098 | 1,031 | 68 | 6.2% |
| 8/28/2009 | 2 | 1,191 | 1,138 | 53 | 4.5% |
| 8/31/2009 | 2 | 1,077 | 1,037 | 40 | 3.7% |
| 9/1/2009 | 2 | 1,201 | 1,208 | -7 | -0.6% |
| 9/2/2009 | 2 | 1,191 | 1,306 | -115 | -9.6% |
| 9/3/2009 | 2 | 1,207 | 1,173 | 34 | 2.8% |
| 9/4/2009 | 2 | 1,241 | 1,177 | 64 | 5.2% |
| 9/8/2009 | 2 | 979 | 952 | 26 | 2.7% |
| 9/9/2009 | 2 | 979 | 1,042 | -62 | -6.4% |
| 9/10/2009 | 1 | 653 | 694 | -41 | -6.2% |
| **Average** | **2** | **1,074** | **956** | **118** | **11.0%** |

Table 4.51 shows differences in estimated percentage load impacts for the two customer accounts in the previous table compared to other non-TA/TI accounts in the same 4-digit business category (Department stores). In this case, the TA/TI accounts had smaller percentage load impacts.

**Table 4.51: Incremental TA/TI Load Impacts – *SCE CBP DA***

| SIC Code | SIC Description | Basis of Comparison | Percentage Load Impact | | Number of Events | |
|---|---|---|---|---|---|---|
| | | | No TA/TI | TA/TI | No TA/TI | TA/TI |
| 5311 | Department Stores | 4-digit SIC | 14.1% | 11.0% | 518 | 48 |

Table 4.52 reports total load impacts for 102 service accounts from SCE's day-of CBP program type that participated in TA/TI. These accounts accounted for over 4 MW of load impacts for both of the day-of events. Table 4.53 shows differences in estimated percentage load impacts for those accounts, by 4-digit business type (mostly different types of retail stores), compared to similar service accounts that did not participate in TA/TI. For

four of the five business types, the TA/TI accounts' percentage load impacts *exceeded* those of the non-TA/TI accounts.

**Table 4.52: Total TA/TI Load Impacts by Event – *SCE CBP DO***

| Event Date | Number of SAIDs | Estimated Reference Load (kW) | Observed Load (kW) | Estimated Load Impact (kW) | % Load Impact |
|---|---|---|---|---|---|
| 8/27/2009 | 102 | 38,119 | 33,907 | 4,212 | 11.0% |
| 8/28/2009 | 102 | 39,436 | 35,055 | 4,380 | 11.1% |
| **Average** | **102** | **38,777** | **34,481** | **4,296** | **11.1%** |

**Table 4.53: Incremental TA/TI Load Impacts – *SCE CBP DO***

| SIC Code | SIC Description | Basis of Comparison | Percentage Load Impact | | Number of Events | |
|---|---|---|---|---|---|---|
| | | | No TA/TI | TA/TI | No TA/TI | TA/TI |
| 5211 | Lumber Dealers | 4-digit SIC | 21.0% | 30.4% | 254 | 4 |
| 5311 | Department Stores | 4-digit, different accounts for same customer | 10.3% | 10.4% | 22 | 94 |
| 5399 | Miscellaneous General Merchandise Stores | 4-digit, different accounts for same customer | 10.4% | 12.5% | 14 | 30 |
| 5945 | Hobby, Toy, and Game Shops | 4-digit, different accounts for same customer | 12.6% | 16.4% | 4 | 52 |
| 7991 | Physical Fitness Facilities | 4-digit, different accounts for same customer | 1.8% | 0.3% | 4 | 24 |

SCE's DRC day-of program type included 37 SAIDs that participated in TA/TI, with resulting load impacts as indicated in Table 4.54 and Table 4.55. Those accounts produced 3 MW of load impacts on the one DO event. When categorized by 4-digit SIC code, and compared to other SAIDs in those business types, the results are somewhat mixed. Most of the percentage impacts for both categories of customer accounts are relatively large. In half of the cases, the percentage load impacts are larger for TA/TI accounts than for other accounts in the same business type, and in half they are smaller.

**Table 4.54: Total TA/TI Load Impacts by Event – *SCE DRC DO***

| Event Date | Number of SAIDs | Estimated Reference Load (kW) | Observed Load (kW) | Estimated Load Impact (kW) | % Load Impact |
|---|---|---|---|---|---|
| 9/23/2009 | 37 | 22,930 | 19,851 | 3,079 | 15.5% |

**Table 4.55: Incremental TA/TI Load Impacts – *SCE DRC DO***

| SIC Code | SIC Description | Basis of Comparison | Percentage Load Impact | | Number of Events | |
|---|---|---|---|---|---|---|
| | | | No TA/TI | TA/TI | No TA/TI | TA/TI |
| 723 | Crop Preparation Services | 4-digit SIC | 56.4% | 44.2% | 4 | 2 |
| 2041 | Flour Products | 2-digit SIC | 13.1% | 8.2% | 7 | 1 |
| 4222 | Refrigerated Storage | 4-digit SIC | 42.3% | 42.5% | 2 | 1 |
| 4941 | Water Supply | 4-digit SIC | 44.3% | 75.8% | 231 | 6 |
| 5141 | Groceries, General Line | 2-digit SIC | -10.1% | 15.4% | 3 | 1 |
| 5411 | Grocery Stores | 4-digit SIC | 14.9% | 8.9% | 96 | 21 |
| 7011 | Hotels and Motels | 4-digit SIC | 6.0% | -3.8% | 22 | 2 |
| 8051 | Skilled Nursing Care Facilities | No Comparables | n/a | n/a | n/a | n/a |
| 8221 | Colleges and Universities | 4-digit SIC | 3.9% | 9.9% | 3 | 1 |
| 8422 | Arboreta and Botanical or Zoological Gardens | No Comparables | n/a | n/a | n/a | n/a |

### 4.7.3 SDG&E

One service account in SDG&E's CBP DA program type participated in AutoDR, and produced estimated load impacts of about 20 kW, or 2.3 percent. The same customer had other service accounts enrolled in CBP DA that did not participate in AutoDR. These service accounts averaged a 7 percent load impact, higher than the load impact from the AutoDR account. One factor that may reduce the comparability of these load impacts is that the AutoDR account's load is significantly higher than the comparison group of non-AutoDR accounts (720 kW vs. 250 kW during the event hours).

Sixty-six service accounts from five customers in the CBP DO program type participated in AutoDR, producing the estimated load impacts shown in Table 4.56, which averaged about 0.6 MW over the seven DO events. When compared to the customers' non-AutoDR service accounts in the same business type, the differences in percentage load impacts are as shown in Table 4.57. The results are mixed, with two of the cases showing noticeably higher load impacts for AutoDR service accounts; one account showing very little effect; and one wrong-signed effect of AutoDR. Note that the AutoDR accounts were smaller than the non-AutoDR accounts for the second group (NAICS codes 451120 and 452990) and larger than the non-AutoDR accounts for the other three groups.

**Table 4.56: Total AutoDR Load Impacts by Event – *SDG&E CBP DO***

| Event Date | Number of SAIDs | Estimated Reference Load (kW) | Observed Load (kW) | Estimated Load Impact (kW) | % Load Impact |
|---|---|---|---|---|---|
| 7/21/2009 | 66 | 5,064 | 4,472 | 592 | 11.7% |
| 8/26/2009 | 66 | 5,200 | 4,763 | 437 | 8.4% |
| 8/27/2009 | 66 | 5,370 | 4,698 | 672 | 12.5% |
| 8/28/2009 | 66 | 5,391 | 4,758 | 633 | 11.7% |
| 9/2/2009 | 66 | 5,377 | 4,790 | 586 | 10.9% |
| 9/3/2009 | 66 | 5,632 | 4,879 | 753 | 13.4% |
| 9/24/2009 | 66 | 5,060 | 4,499 | 561 | 11.1% |
| **Average** | **66** | **5,299** | **4,694** | **605** | **11.4%** |

**Table 4.57: Incremental AutoDR Load Impacts – *SDG&E CBP DO***

| NAICS Code | NAICS Description | Basis of Comparison | Percentage Load Impact | | Number of Events | |
|---|---|---|---|---|---|---|
| | | | No AutoDR | AutoDR | No AutoDR | AutoDR |
| 441222 | Boat Dealers | 6-digit NAICS, different accounts for same customer | 2.0% | 10.5% | 7 | 14 |
| 451120 & 452990 | Hobby, Toy & Game Stores; All Other General Merchandise Stores | 2-digit NAICS | 9.8% | 14.4% | 250 | 238 |
| 561439 | Other Business Service Centers (including Copy Shops) | 6-digit NAICS, different accounts for same customer | 15.9% | 11.3% | 21 | 84 |
| 713940 | Fitness and Recreational Sports Centers | 6-digit NAICS, different accounts for same customer | 6.4% | 6.9% | 70 | 126 |

Table 4.58 shows that four CBP DA customer accounts participating in TA/TI produced load impacts that averaged about 0.2 MW across the six DA events, but with considerable variation across events. However, as shown in Table 4.59, the percentage load impacts were smaller than comparable customer accounts in the same business type (Financial and Real estate organizations). In this case, the TA/TI service accounts were nearly five times larger than the comparison group of non-TA/TI service accounts (approximately 1 MW vs. 215 kW).

**Table 4.58: Total TA/TI Load Impacts by Event – *SDG&E CBP DA***

| Event Date | Number of SAIDs | Estimated Reference Load (kW) | Observed Load (kW) | Estimated Load Impact (kW) | % Load Impact |
|---|---|---|---|---|---|
| 8/27/2009 | 4 | 4,141 | 3,775 | 367 | 8.9% |
| 8/28/2009 | 4 | 3,997 | 3,961 | 37 | 0.9% |
| 9/3/2009 | 4 | 4,306 | 4,013 | 293 | 6.8% |
| 9/4/2009 | 4 | 3,860 | 3,864 | -4 | -0.1% |
| 9/24/2009 | 4 | 4,100 | 4,145 | -46 | -1.1% |
| 9/25/2009 | 4 | 3,938 | 3,643 | 295 | 7.5% |
| **Average** | **4** | **4,057** | **3,900** | **157** | **3.9%** |

**Table 4.59: Incremental TA/TI Load Impacts – *SDG&E CBP DA***

| NAICS Code | NAICS Description | Basis of Comparison | Percentage Load Impact | | Number of Events | |
|---|---|---|---|---|---|---|
| | | | No AutoDR | AutoDR | No AutoDR | AutoDR |
| 525930 | Real Estate Investment Trusts | 6-digit NAICS, different accounts for same customer | 7.0% | 2.3% | 224 | 6 |

Finally, one CBP DO customer account in the R&D business area participated in TA/TI and produced load impacts averaging 23 kW, or 11.4 percent. The same customer had other service accounts enrolled in CBP DO that did not participate in TA/TI. These accounts averaged 3 percent load impacts. Unlike the other sub-programs, these TA/TI and non-TA/TI service accounts were comparable in size (200 kW for the TA/TI accounts vs. 275 kW for the non-TA/TI accounts).

## 5. Ex Ante Load Impacts

This section documents the preparation of ex ante forecasts of reference loads and load impacts for 2010 to 2020 for the aggregator demand response programs offered by PG&E, SCE, and SDG&E. These include CBP for all three utilities, AMP for PG&E and SDG&E[18], and DRC for SCE. In each case, separate load impact forecasts were developed for the *day-ahead* and *day-of* program types, where relevant.

The forecasts of load impacts were developed in two primary stages. First, estimates of reference loads and percentage load impacts, on a per-enrolled customer basis, were developed based on modified versions of the ex-post load impact regressions described in Section 4. Second, the simulated per-customer reference loads under alternative weather (*e.g.*, 1-in-2 and 1-in-10) and event-type scenarios (*e.g.*, typical event, or monthly system peak day), and the estimated percentage load impacts were combined with program enrollment forecasts from the utilities to develop alternative forecasts of aggregate load impacts. Forecasts were developed at the program and program-type (*e.g.*, DA and DO) level, and by CAISO *Local Capacity Area*. The Brattle Group provided enrollment

[18] SDG&E's AMP is a new contract-based aggregator program that split off from CBP after the summer of 2009.

forecasts for PG&E’s programs through a separate contract. SCE and SDG&E provided enrollment forecasts for their programs.

The following subsections describe the nature of the ex ante load impact forecasts required, the methods used to produce them, detailed study findings, and recommendations.

## *5.1 Ex Ante Load Impact Requirements*

The DR Load Impact Evaluation Protocols require that hourly load impact forecasts for event-based DR resources be reported for the following scenarios (in addition to the program-level and LCA breakdown noted above):

- For a typical event day in each year; and
- For the monthly system peak load day in each month for which the resource is available;

under both:

- 1-in-2 weather-year conditions, and
- 1-in-10 weather-year conditions.

at both:

- the program level (*i.e.*, in which only the program in question is called), and
- the portfolio level (*i.e.*, in which all demand response programs are called).

## *5.2 Description of Methods*

This section describes methods used to develop relevant groups of customers, to develop reference loads for the relevant customer types and event day-types, and to develop percentage load impacts for a typical event day.

### 5.2.1 Development of Customer Groups

Enrollment forecasts in the various DR programs need to account for the expanded number of customer accounts of increasingly smaller size that will become eligible as they receive interval metering equipment in future years. As a result, customer accounts were assigned to one of three size groups, in addition to the eight industry types (defined in Section 2.2), and any relevant LCA based on information provided by the utilities. The three size groups were the following:

- Small – maximum demand less than 20 kW;[19]
- Medium – maximum demand between 20 and 200 kW;
- Large – maximum demand greater than 200 kW.

The specific definition of “maximum demand” differed by utility. For PG&E and SCE, the size definition was based on the tariff on which the customer is served. For example, a tariff may require that a customer’s monthly peak demand exceeds 20kW for three out of

[19] SDG&E and SCE forecast that there will be no customers in this size group on CBP.

the previous twelve months. For SDG&E, the size definition was based on each customer's maximum summer on-peak demand.

PG&E and SCE provided the ability to associate customers with an LCA. PG&E mapped each distribution feeder to one of its seven LCAs, while SCE based its mapping on a combination of substations and zip codes.

### 5.2.2 Development of Reference Loads and Load Impacts

Reference loads and load impacts for all of the above factors were developed in the following series of steps:

1. Define data sources
2. Estimate ex ante regressions and simulate reference loads by cell and scenario
3. Calculate percentage load impacts by cell
4. Apply percentage load impacts to the reference loads
5. Scale the reference loads using enrollment forecasts

Each of these steps is described below.

1. *Define data sources*

Since no major design changes are planned for any of the aggregator programs, there is a close link between the results of the ex post analyses conducted for the 2009 program year and the ex ante load impact forecasts.[20] That is, the historical customer loads serve as the basis of the ex ante reference loads, and the historical estimated percentage load impacts serve as the basis for constructing the ex ante load impacts.

2. *Estimate and simulate reference loads*

The objective of this step is to produce average per-customer reference loads under the various scenarios required by the Protocols (*e.g.,* the typical event day in a 1-in-2 weather year) so that they may be applied to the enrollment forecasts to produce program-level results. The required level of aggregation of the reference loads depends on the level of detail of the enrollment forecasts. For example, if only total numbers of enrolled customers are provided, then we can produce a program-level reference load, where the shares of customers of each type are implicitly assumed to remain the same as in the historical year. Alternatively, if enrollment forecasts are provided by size, industry type, and LCA, as for PG&E, then we produce per-customer reference loads at that level of aggregation.

To develop the reference loads, we first re-estimate regression equations for each enrolled customer account, using data for 2009. These equations are used to simulate reference loads by customer type under the alternative scenarios. These loads are then averaged at the appropriate level to produce per-customer loads.

[20] One exception is the creation of a new AMP aggregator contract for SDG&E. However, since it consists of customers formerly enrolled in CBP, we can use their load impacts in that program to simulate load impacts for the new program.

The re-estimated regression equations are similar in design to the ex post load impact equations described in Section 3.1, differing primarily in two ways. First, the event variables are modified from the version that produced ex-post estimates of 24 hourly load impact values for *each* event, to a version that produces estimates of *average hourly event-period* load impacts across all events.[21] Second, the ex ante models exclude the morning-usage variable. While this variable is useful for improving accuracy in estimating ex post load impacts for each event, it complicates the use of the equations in ex ante simulation. That is, it would require a separate simulation of the level of the morning load.

The regression equations contain both weather variables and monthly indicator variables, which provide the capability to simulate customer loads under the different weather and monthly system peak scenarios. The definitions of the 1-in-2 and 1-in-10 weather years differed by utility, and were modified from the definitions used in the 2009 report. Basically, the utilities moved away from using weather for a particular year, to a process for identifying weather extremes on a monthly basis. Details on the development of the weather scenarios for PG&E are provided in a report by Freeman, Sullivan & Company.

The level of aggregation for the reference loads for each of the utilities and programs is as follows. For SCE's CBP and DRC programs, we developed separate load profiles at three levels of aggregation for each size category: all enrolled customers; by industry group; and by LCA. For PG&E's AMP and CBP programs, we developed per-customer load profiles for all interactions of size group, industry group, and LCA. Because of small sample sizes in some cells, we pooled all of the customer load profiles across LCAs to arrive at a set of simulation coefficients that was common to each size and industry group combination. Any differences in the ex ante reference load profiles across LCAs were thus solely due to differences in the weather conditions used in the simulations. This method conformed to the enrollment forecast developed for PG&E by The Brattle Group, which forecast the number of enrolled customers in each cell. As described below, results were ultimately rolled up across industry types to report results at the program and LCA levels.

For SDG&E's CBP program, we developed per-customer load profiles by industry group and program type (*e.g.*, combinations of notice level and event window), after removing the customer accounts for the aggregator that will offer the new AMP DO product. Each industry group was expanded at the same rate over time, corresponding to the enrollment forecast provided by SDG&E, which specified the number of enrolled customers within each program type (*e.g.*, DA and DO, and event window length), but not by industry type. A similar process was applied to the load profiles for the new AMP program type.

3. *Calculate forecast percentage load impacts*

The first step in developing the forecast percentage load impacts was to determine the definition of a "typical event day" during which the load impacts were to be measured. This was complicated by the fact that the aggregator DR program events differ somewhat from those of other DR programs, in that many of the events vary in terms of event length

[21] The equations also estimated load impacts for the hours immediately preceding and following an event (since many customers begin reducing load prior to an event and do not immediately increase load following an event), and for all remaining event-day hours.

(*e.g.*, as short as one hour, to as long as 8 hours, depending in part on the aggregator contracts), and the particular hours called. We used the following procedures to define typical events and event hours for both the historical period and the forecast period:

- *Historical period*. The procedure for developing a typical event day varied by utility and program, depending on the nature of the events called in 2009. These definitions of typical DA and DO events were described in Section 4. In all cases, average load impacts in a given hour were calculated over only those customer accounts that were called in that hour.

- *Forecast period*. Although events of several different numbers of hours were called in 2009 for the various programs, a standardized event was needed for the ex ante forecast. PG&E defined a consistent four-hour event across all DR programs, for hours-ending 15-18. SCE and SDG&E wished to characterize load impacts for the entire eight-hour period in which events may be called – hours-ending 12 to 19. We developed *average hourly percentage load impacts* as described below, and applied them to each hour of the prototypical ex ante event.

The percentage load impacts were based on the 2009 ex post load impact estimates. The amount of differentiation in the forecast percentage load impacts differed by utility and program.

- PG&E AMP and CBP: by industry group and notice level;
- SCE CBP: by industry group and notice level;
- SCE DRC: by notice level; and
- SDG&E: by notice level and allowed event duration.

We aggregated customer accounts across the relevant groups and estimated percentage load impacts during event and non-event hours. Percentage load impacts in the *ex post* evaluation were calculated relative to the reference loads of those customer accounts that were actually nominated and called on the various events. However, in the case of the *ex ante* evaluation, percentage load impacts were calculated relative to the reference loads of all *enrolled* customer accounts.[22] This was the case because the utilities provided forecasts of enrollments but not of nominations, so that our results needed to be expressed on a per enrolled customer basis. The use of enrolled loads in place of loads of customers who were actually nominated in the month of the event embeds the assumption that future nomination patterns match historical patterns, although as described below, we modified that assumption in the case of SCE's DRC program.

4. *Apply percentage load impacts to reference loads for each event scenario*.

[22] That is, in the ex post evaluation we report load impacts as percentages of the reference loads of the customers nominated in the month of an event and called for that event. In the ex ante evaluation, we divide the load impact *level* for the typical event by the reference load of all *enrolled* customers. This allows us to consistently expand the percent load impacts *per-enrolled customer* by the utilities' enrollment forecasts. For some utilities and programs, such as SDG&E CBP, there was little difference between enrolled and called customer accounts in 2009. However, for others, such as for SCE DRC DO, the number of customer accounts nominated and called was approximately half of those enrolled.

In this step, the relevant percentage load impacts per enrolled customer account were applied to the per-customer reference loads for each scenario to produce all of the required scenarios of reference loads, estimated event-day loads, and load impacts.

5. *Apply forecast enrollments to produce program-level load impacts.*

For PG&E's programs, The Brattle Group produced load impacts at the program level and by LCA by applying their enrollment forecasts to the database of *per-customer* reference loads and load impacts that CA Energy Consulting created in the previous step. The per-customer reference loads and load impacts were first scaled to match the expected *size* of customers in the enrollment forecast and then multiplied by the number of enrolled customers to obtain cell-level results. Program-level results were obtained by aggregating results across cells. We report these aggregated results in the required Protocol tables, and summarize them in Section 5.4 below.

For SCE, we scaled the results for all levels of reporting using ratios specific to each program and program type. For CBP, enrollments and load impact results were held constant at 2009 levels for the remainder of the forecast years (after adjusting for the transfer of one aggregator's customers to DRC). For DRC, we applied the following procedures:

SCE provided the following forecast data for 2010 through 2012 (to 2020):

- a forecast of contract MW by notice and year; and
- monthly forecasts of the total number of enrolled customers.

For DA, we assumed that the number of enrolled customers would grow in the same proportion as the level of contract MW across years. Implicitly, this assumes that the share of enrolled customers who are nominated stays at 2009 levels throughout the forecast.

For DO, we set the number of enrolled customers equal to the difference between SCE's *total* enrollment forecast and the enrolled customer accounts assigned to DA above. However, because contract MW grows over time at a faster rate than SCE's enrollments, we needed to take the additional step of assuming that the share of enrolled customers who are nominated increases over time. In 2009, only 47 percent of enrolled DO customers were nominated for the one DO event. After adjustment, the shares of nominated relative to enrolled customers in 2010, 2011, and 2012 are: 51.2, 59.8, and 54.4 percent, respectively. In order to simulate this effect, we changed the percentage load impacts (which were originally calculated relative to the total *enrolled* reference load) by forecast year to reflect the fact that a larger share of enrolled customers is nominated.

We assumed that the newly nominated customers provide the same average per-customer load impact as the historically nominated customers. For example, in 2009 the average event-hour percentage load impact was 13.6 percent of the reference load of enrolled customers.[23] Because of the change in the share of nominated customers, this value increases in the forecast years to 14.7, 17.2, and 15.7 percent in 2010, 2011, and 2012, respectively.

Within DA and DO, enrollments were divided across LCAs according to the shares (of customers, not load) in 2009. Values beyond 2012 were assumed to remain constant.

For SDG&E's CBP program and its new AMP program, the process of creating the program-level load impacts was similar to the one used for PG&E's programs. That is, per-customer reference loads and load impacts were scaled to program and program type using a forecast of the number of enrolled customers in each program and program type. SDG&E provided the enrollment forecast, which consisted of the monthly number of customers in each program type. The share of customers in each industry group was assumed to remain constant.

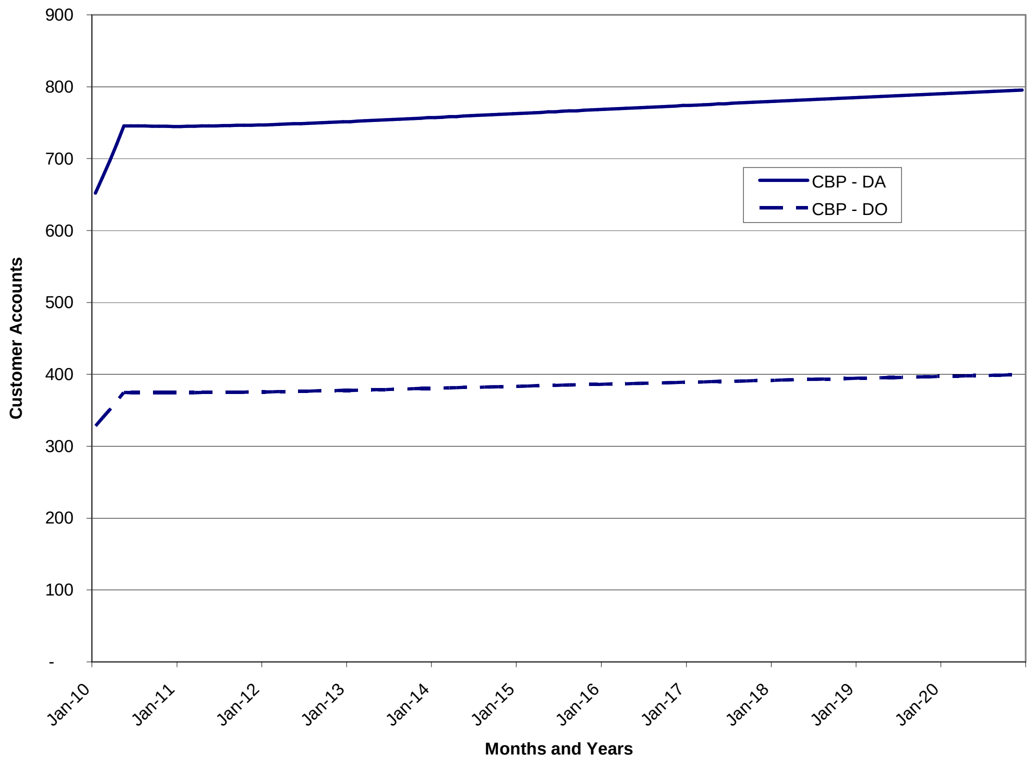
### 5.3 Enrollment Forecasts

This section summarizes the enrollment forecasts for the different program types at each utility. The following section summarizes the resulting reference loads and ex ante load impact forecasts. Detailed tables of all results required by the Protocols are provided in associated appendices.

Figure 5.1 illustrates PG&E's enrollment forecast for CBP (as developed by The Brattle Group). After an initial increase in 2010, enrollment in both program types expands at a slow rate over time.

[23] The average percentage load impact in the ex post evaluation was 26 percent of the *nominated* reference load.

**Figure 5.1: Enrollment Forecasts – PG&E CBP**




SCE anticipates that enrollment in CBP will remain stable at 75 DA and 452 DO customer accounts over the forecast horizon.[24]

Figure 5.2 shows enrollment forecasts for SDG&E's CBP DA and DO program types, as well as its new AMP program. SDG&E anticipates faster growth for the DO program type than for DA.

[24] These values reflect a migration of about 100 accounts from CBP to DRC in October 2009.

**Figure 5.2: Enrollment Forecasts – SDG&E CBP**

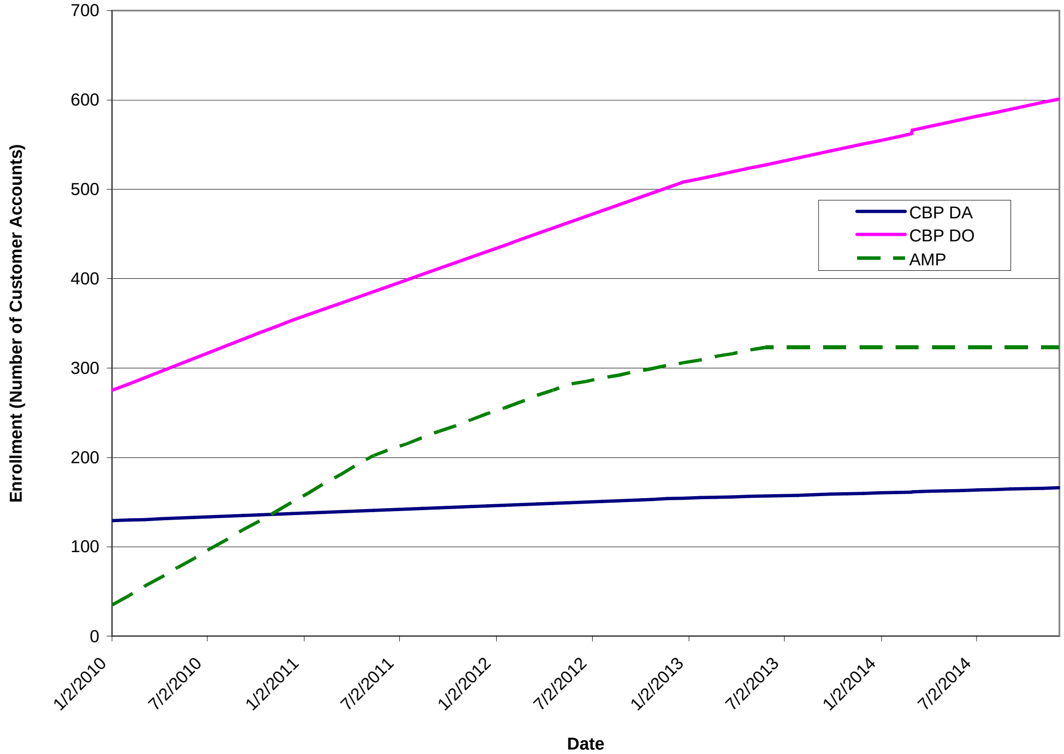



Figure 5.3 summarizes PG&E's AMP enrollment forecast. Enrollments are expected to increase over the first 18 months, reaching about 460 customer accounts for DA and 1,270 for DO and remaining constant through 2020.

**Figure 5.3: Enrollment Forecasts – PG&E AMP**

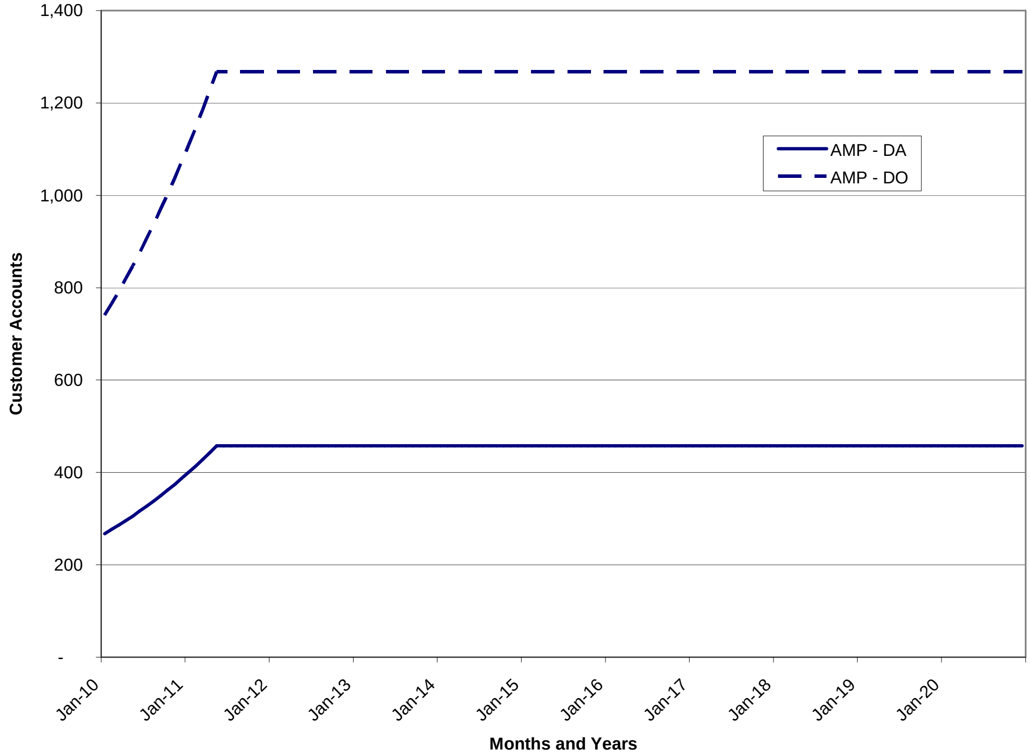



Figure 5.4 summarizes SCE's DRC contract load amounts for DA and DO program types for 2009, and the anticipated contract amounts through 2012. Figure 5.5 shows SCE's forecast of annual enrolled customer service accounts in DA and DO based on an allocation of combined enrollment to meet the forecast contract amounts.

**Figure 5.4: Expected Contract Amounts – SCE DRC**

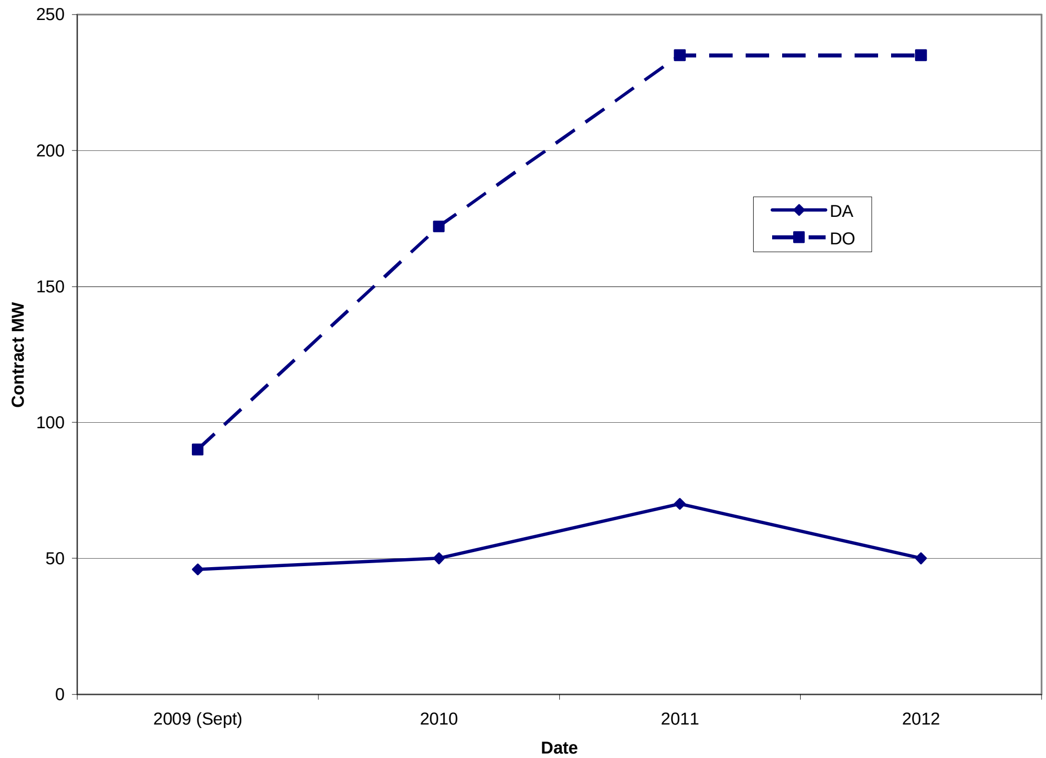
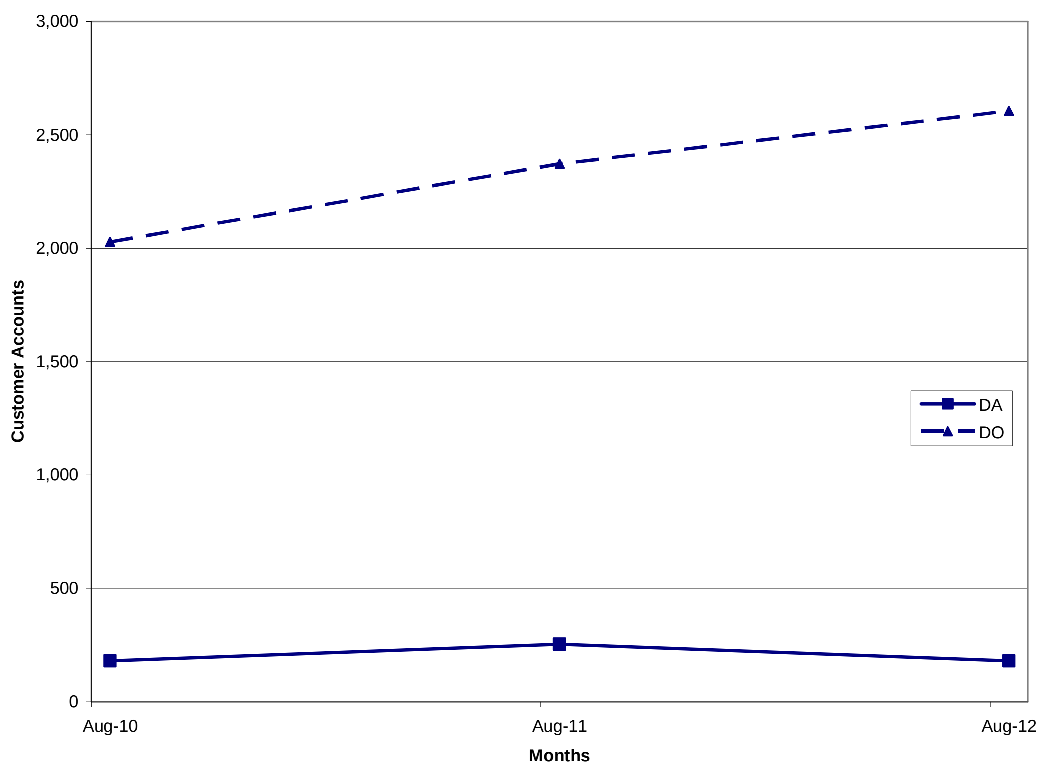



**Figure 5.5: SCE DRC Enrollment Forecast**



### *5.4 Reference Loads and Load Impacts*

For each utility and program type, we provide the following summary information about the load impact forecasts:

1. Figures showing the hourly profile of the reference load, event-day load, and load impacts for the typical event day in 2012, in a 1-in-2 weather year;
2. Average event-hour load impacts by year; and
3. The allocation of load impacts to LCA, where relevant.

Together, these figures provide a useful indication of the anticipated changes in the forecast load impacts across the various scenarios represented in the Protocol tables. All of the tables required by the Protocols are provided in a spreadsheet table generator in an Appendix.

#### 5.4.1 PG&E CBP

Figure 5.6 shows the forecast reference load, event-day load, and load impacts for a typical event day in August 2012 in a 1-in-2 weather year for CBP DA.[25] Event-hour load impacts average 13.8 MW, which represents approximately 15 percent of the enrolled reference load. Figure 5.7 shows comparable information for CBP DO. Event-hour load impacts for CBP DO average 39.7 MW, which represents approximately 27 percent of the enrolled reference load.

[25] For this program, program-level impacts and portfolio-level impacts are the same.

**Figure 5.6: Hourly Event Day Load Impacts for the Typical Event Day in a 1-in-2 Weather Year for August 2012 – *PG&E CBP - DA***

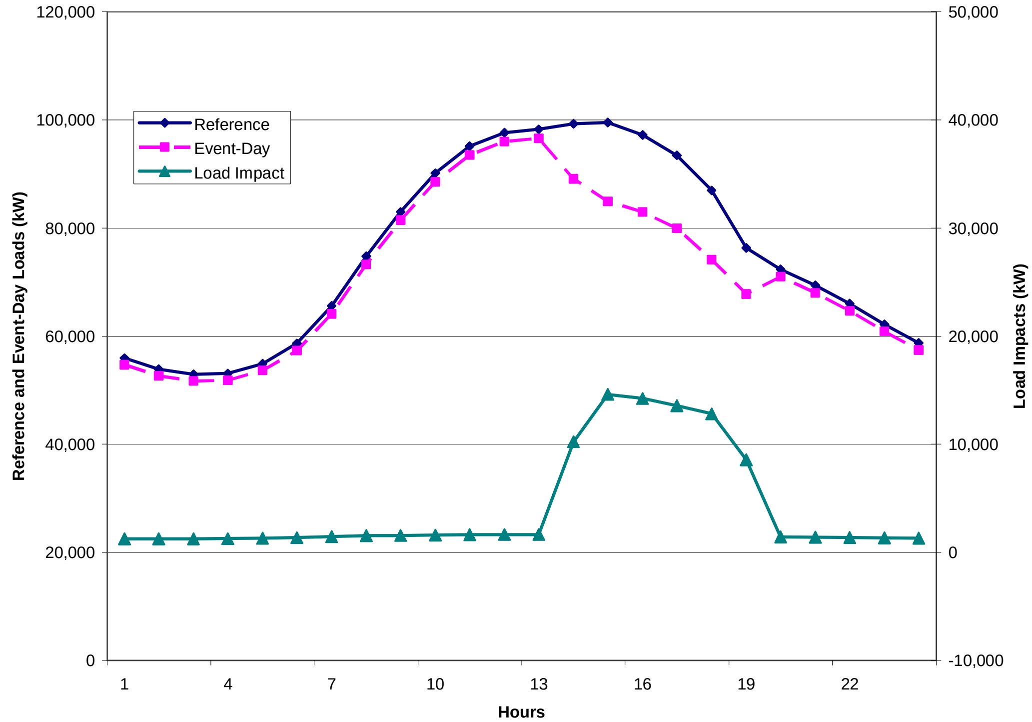



**Figure 5.7: Hourly Event Day Load Impacts for the Typical Event Day in a 1-in-2 Weather Year for August 2012 – *PG&E CBP - DO***

**Figure removed for confidentiality reasons.**

Figure 5.8 shows forecast load impacts by LCA for the DA and DO program types.

**Figure 5.8: Load Impacts by LCA for a Typical Event Day in August 2012 in a 1-in-2 Weather Year (*PG&E CBP DA and DO*)**

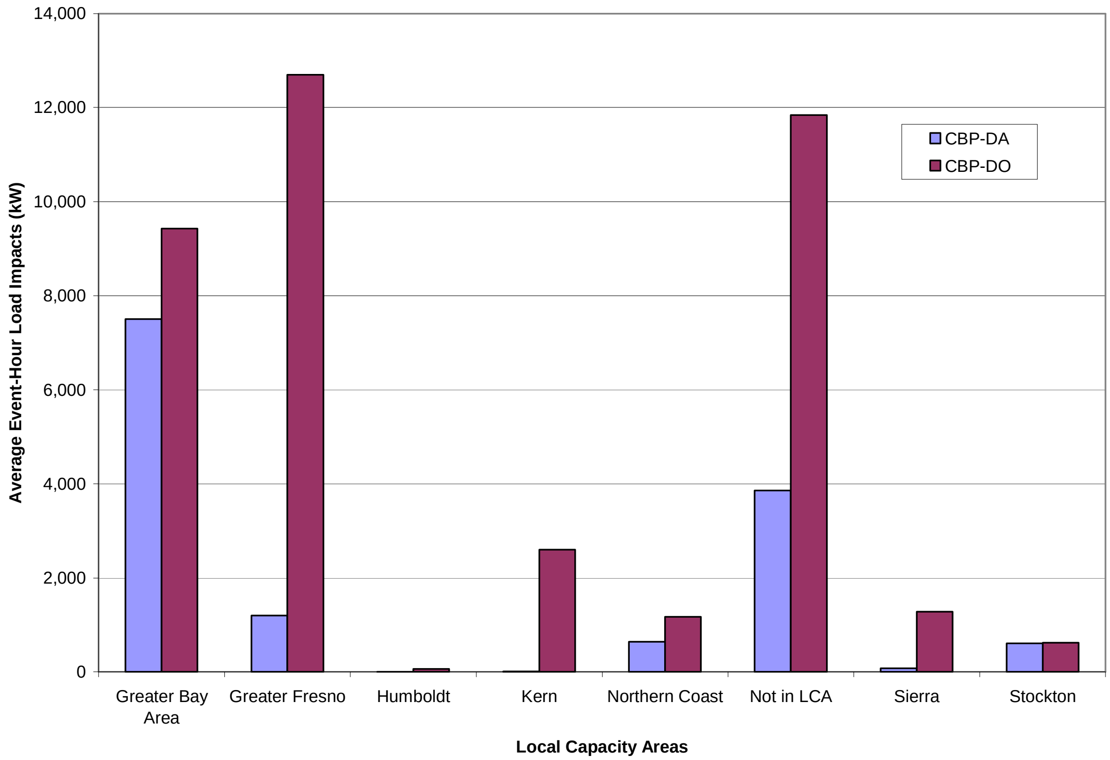
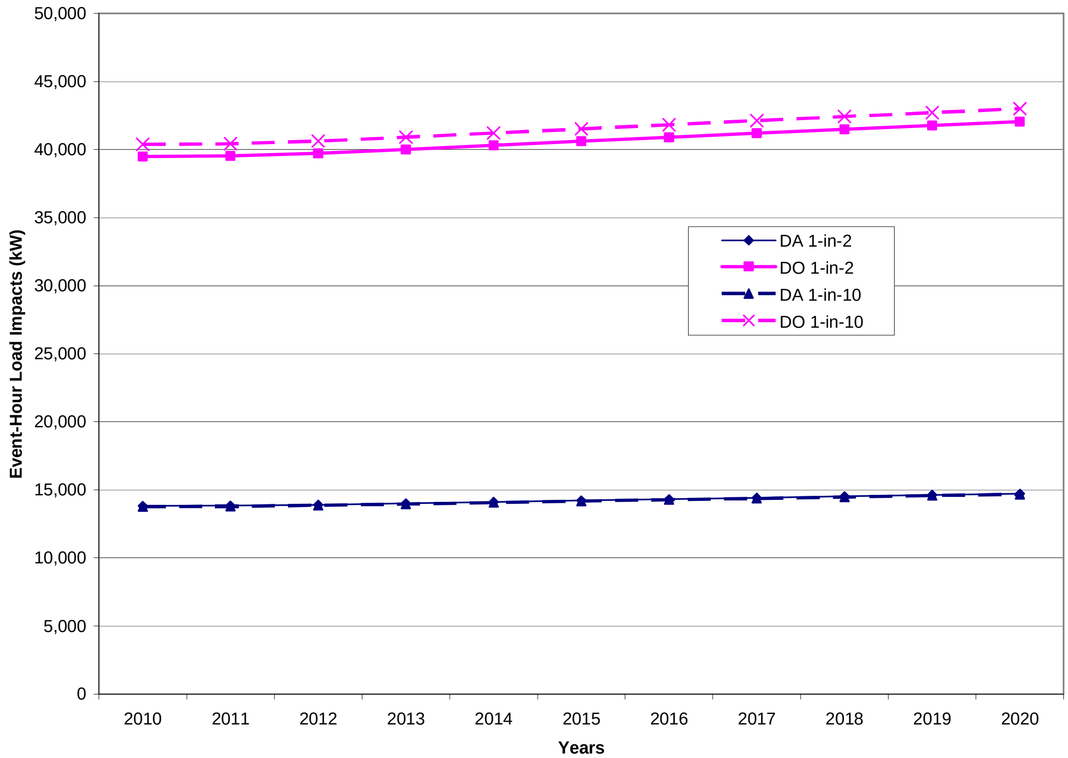



Figure 5.9 illustrates average event-hour load impacts across years for typical event days in August in 1-in-2 and 1-in-10 weather years. The load impacts in this figure mirror the enrollments shown in Figure 5.1, with impacts rising slowly over the forecast period.

**Figure 5.9: Average Hourly Load Impacts by Year on Typical August Event Day in 1-in-2 and 1-in-10 Weather Years – *PG&E CBP DA and DO***




### 5.4.2 SCE CBP

Figures 5.10 and 5.11 show the forecast reference load and load impacts for a typical event day in a 1-in-2 weather year in 2012 for the SCE CBP DA and DO program types respectively. Event-hour load impacts average about 0.7 MW for the DA program type, which is approximately 10 percent of the enrolled reference load. DO load impacts average about 13.3 MW, or 13.6 percent of the reference load.

**Figure 5.10: Hourly Event Day Load Impacts for the Typical Event Day in a 1-in-2 Weather Year for 2012 – *SCE CBP DA***

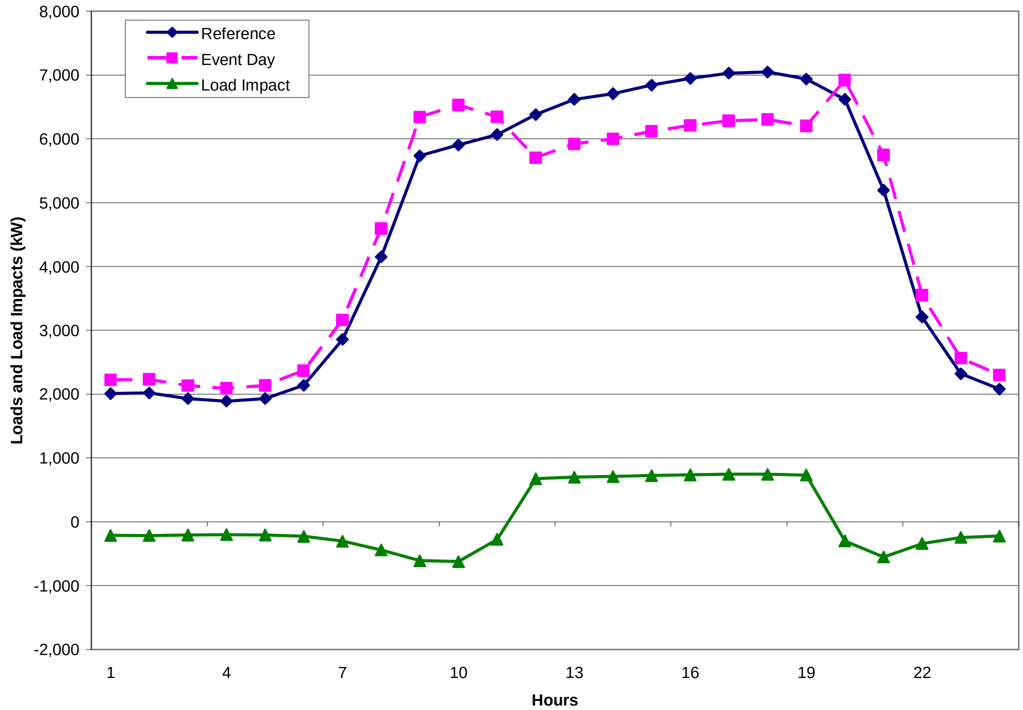



**Figure 5.11: Hourly Event Day Load Impacts for the Typical Event Day in a 1-in-2 Weather Year for 2012 – *SCE CBP DO***

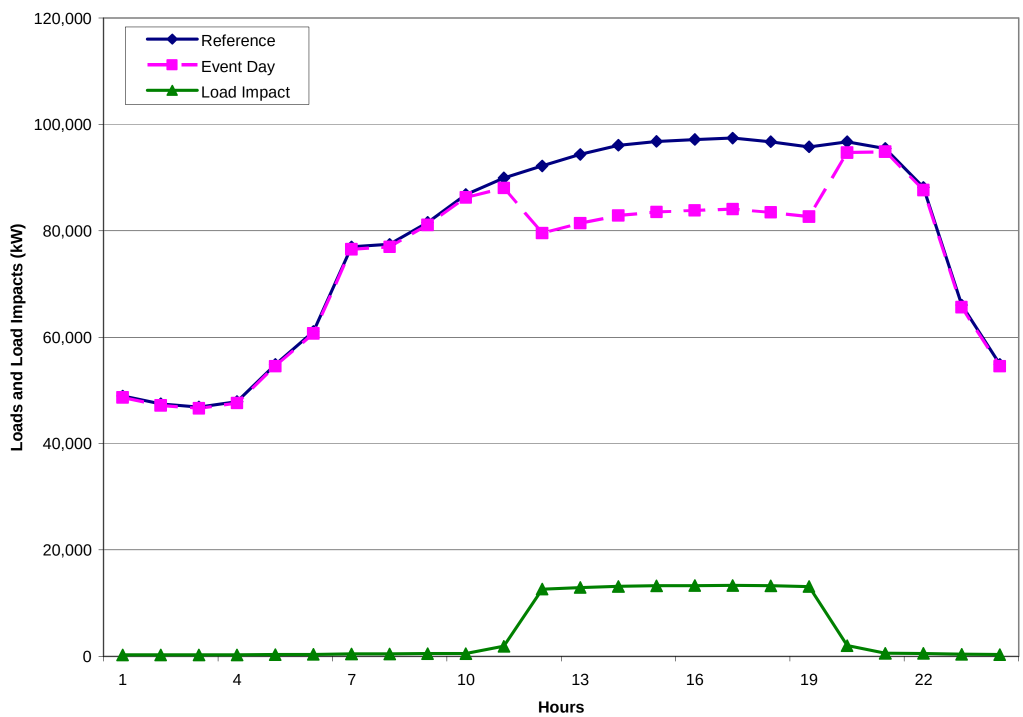


Figure 5.12 illustrates average event-hour load impacts across the first three years of the forecast, for the typical event day in a 1-in-2 weather years. Given the flat enrollment forecasts, the level of load impacts does not change through the forecast period.

**Figure 5.12: Average Event-Hour Load Impacts by Forecast Year for the Typical Event Day – *SCE CBP DA and DO***

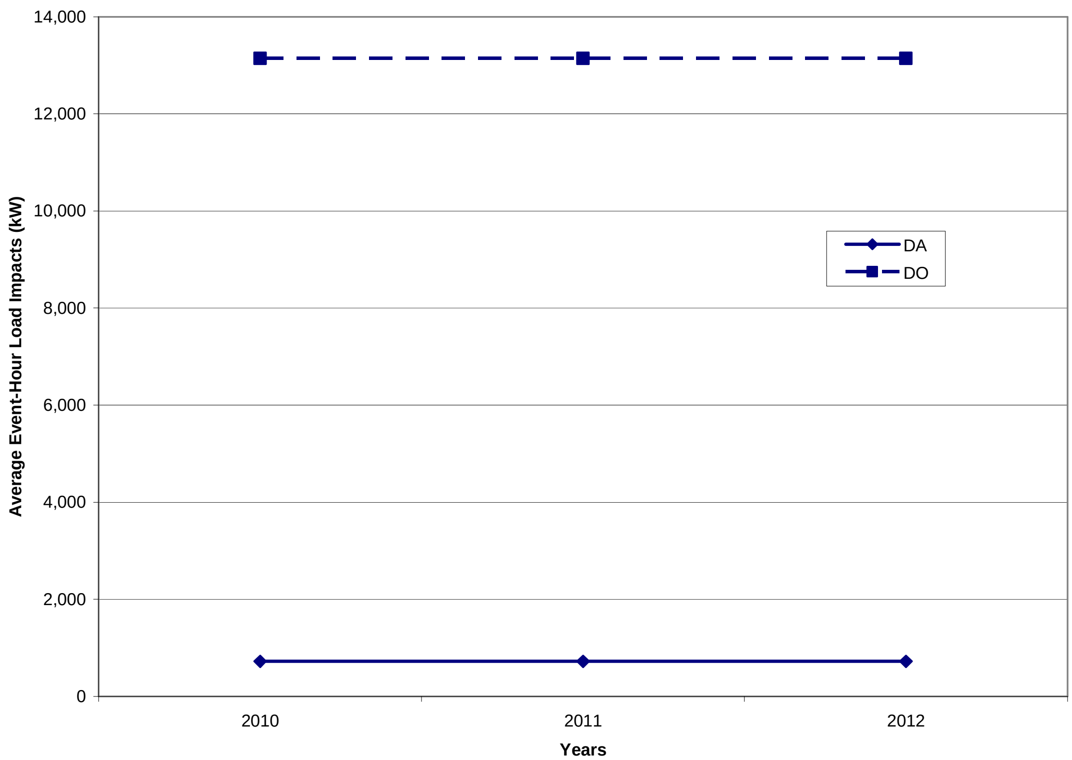
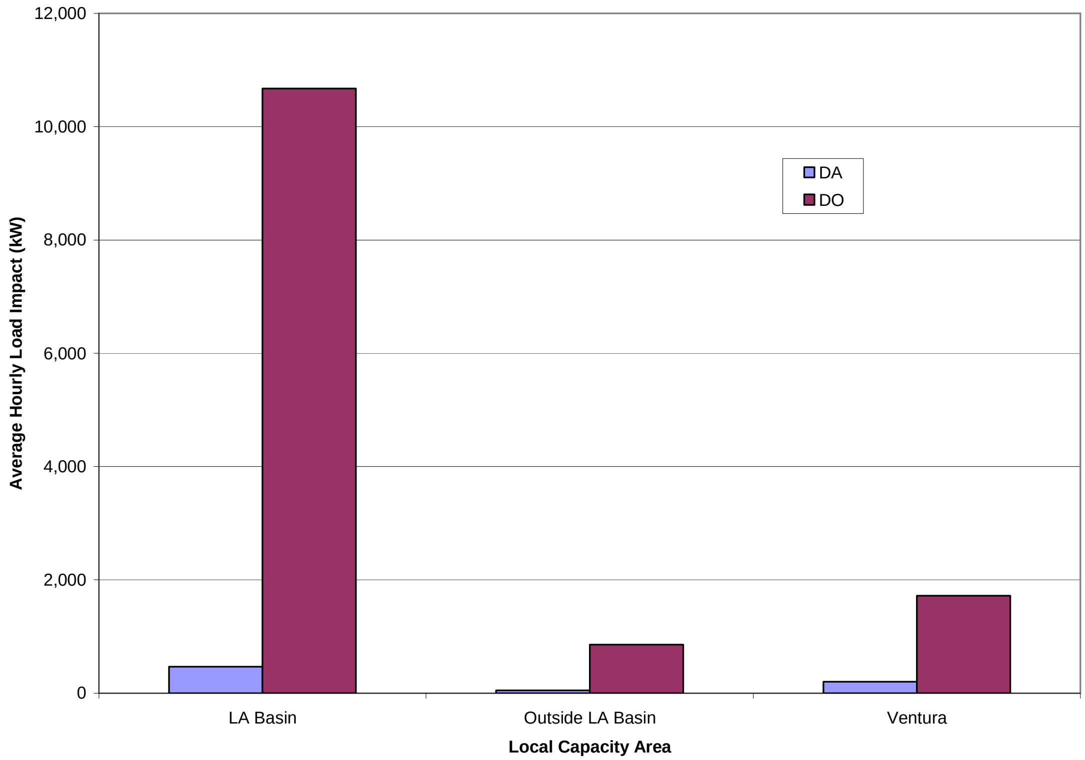



Figure 5.13 shows average event-hour load impacts by LCA for the typical event day in a 1-in-2 weather year in 2012 for the DA and DO program types.

**Figure 5.13: Average Event-Hour Load Impacts by LCA for the Typical Event Day in a 1-in-2 Weather Year in 2012 – *SCE CBP DA and DO***




### 5.4.3 SDG&E CBP

Figures 5.14 and 5.15 show the forecast loads and load impacts for a typical event day in a 1-in-2 weather year for 2012 for the SDG&E CBP DA and DO program types respectively. Event-hour load impacts for DA average about 11.6 MW, which is approximately 26 percent of the enrolled reference load.  DO load impacts average 17 MW, or 15 percent.

**Figure 5.14: Ex Ante Load Impacts for the Typical Event Day in a 1-in-2 Weather Year for 2012 – *SDG&E CBP DA***

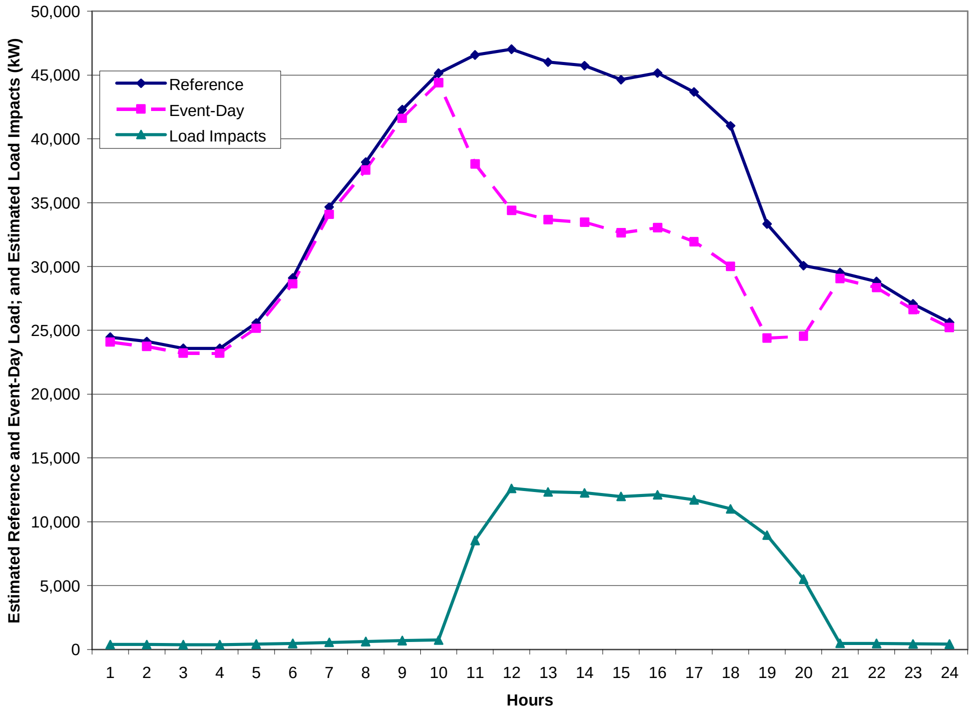



**Figure 5.15: Ex Ante Load Impacts for the Typical Event Day in a 1-in-2 Weather Year for 2012 – *SDG&E CBP DO***

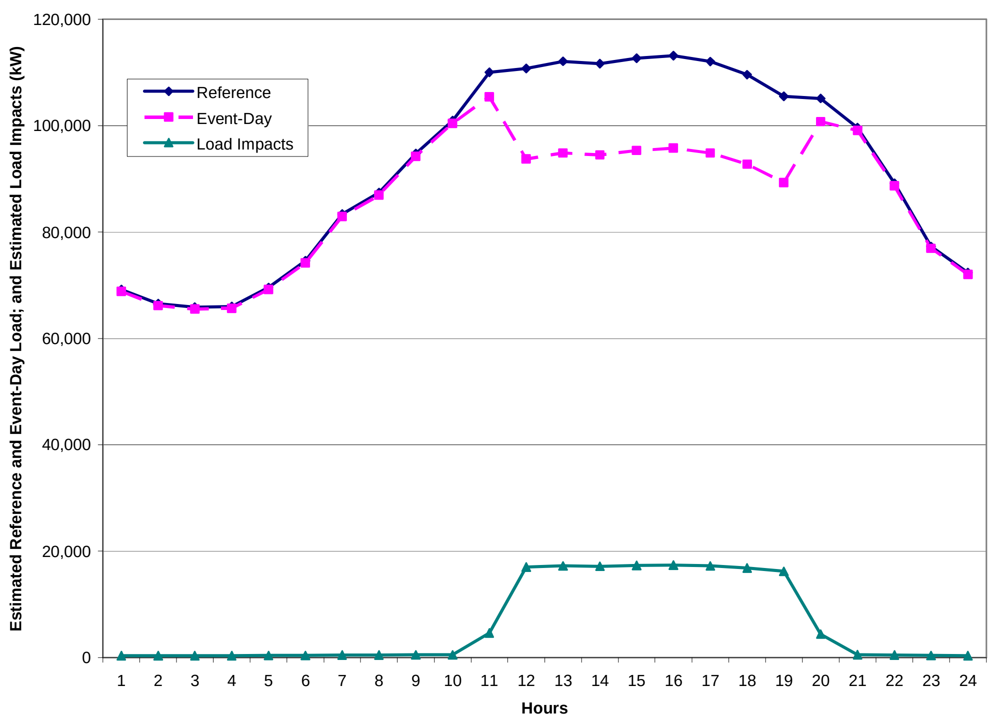
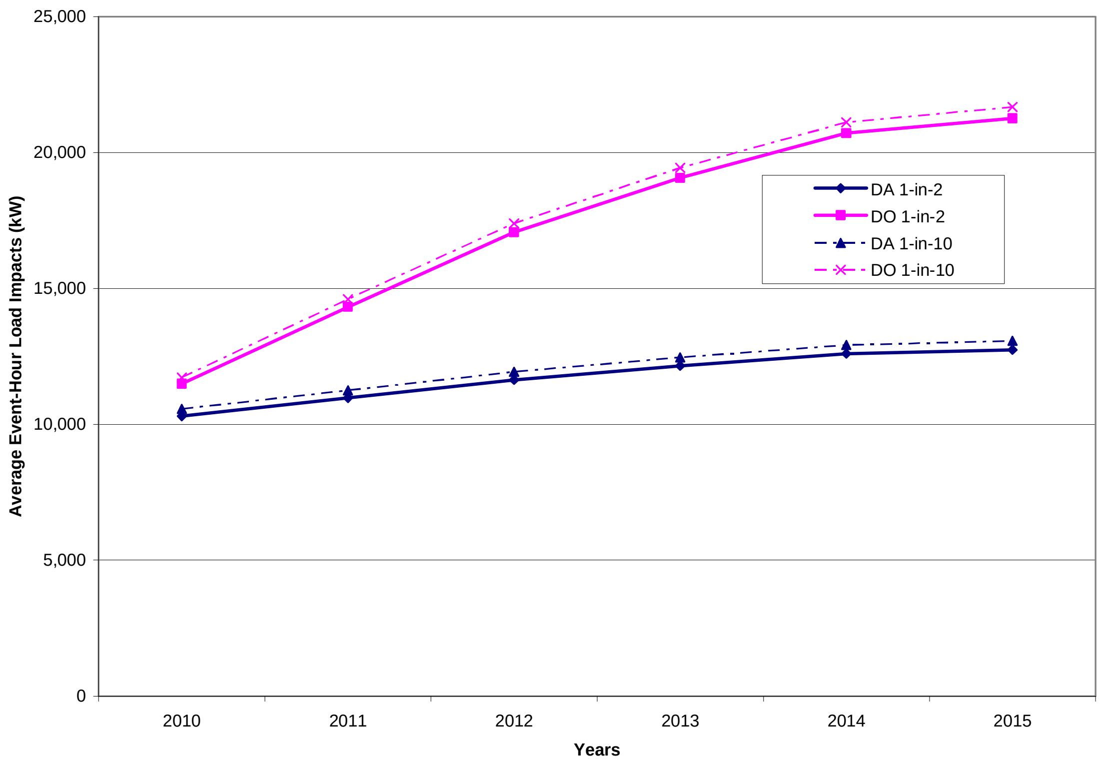


Figure 5.16 illustrates average event-hour load impacts across years for the typical event day in 1-in-2 and 1-in-10 weather years. Given the enrollment forecasts, the levels of load impacts rise until 2015, with DO rising faster than DA, and level off for the remainder of the forecast.

**Figure 5.16: Average Event-Hour Load Impacts by Forecast Year – *SDG&E CBP* (Typical Event Day)**




### 5.4.4 PG&E AMP

Figures 5.17 and 5.18 show the forecast loads and load impacts for a typical event day in August in a 1-in-2 weather year for the PG&E AMP DA and DO program types.[26] Average event-hour load impacts are 57.2 for the DA program, and 151.8 for DO, which represent 18 percent and 22 percent of the enrolled reference loads for DA and DO respectively.

[26] For this program, program-level impacts and portfolio-level impacts are the same.

**Figure 5.17: Hourly Event Day Load Impacts for the Typical Event Day in a 1-in-2 Weather Year for August 2012 – *AMP - DA***

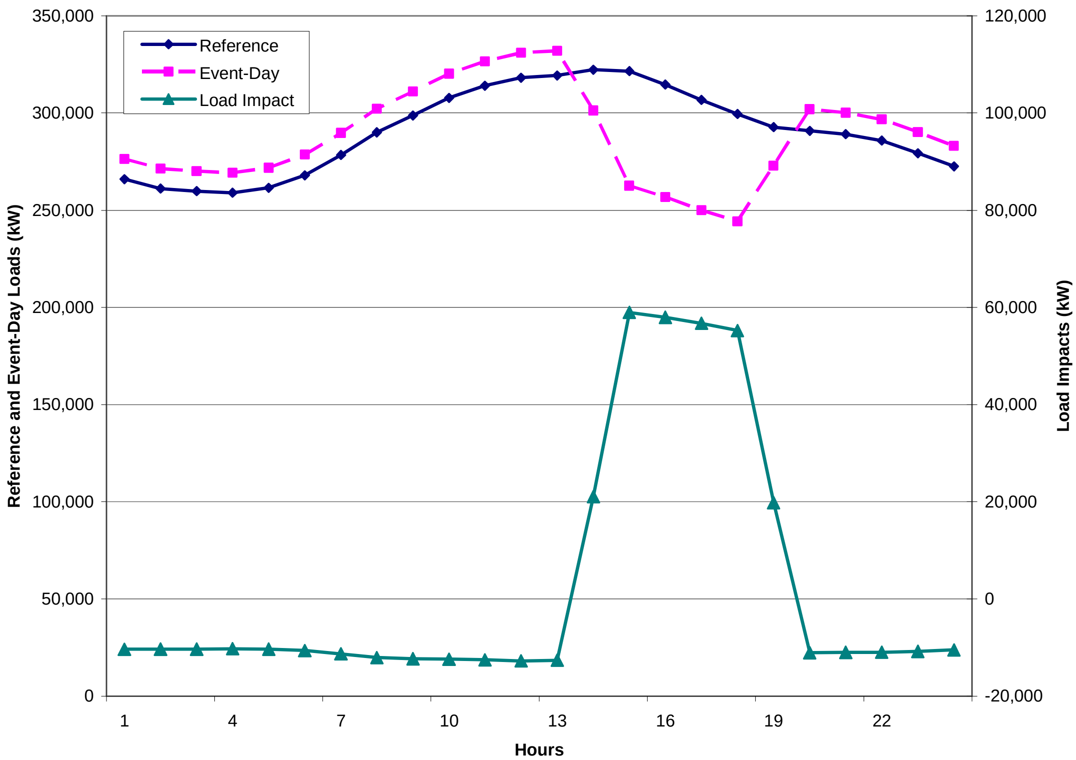


**Figure 5.18: Hourly Event Day Load Impacts for the Typical Event Day in a 1-in-2 Weather Year for August 2012 – *AMP - DO***

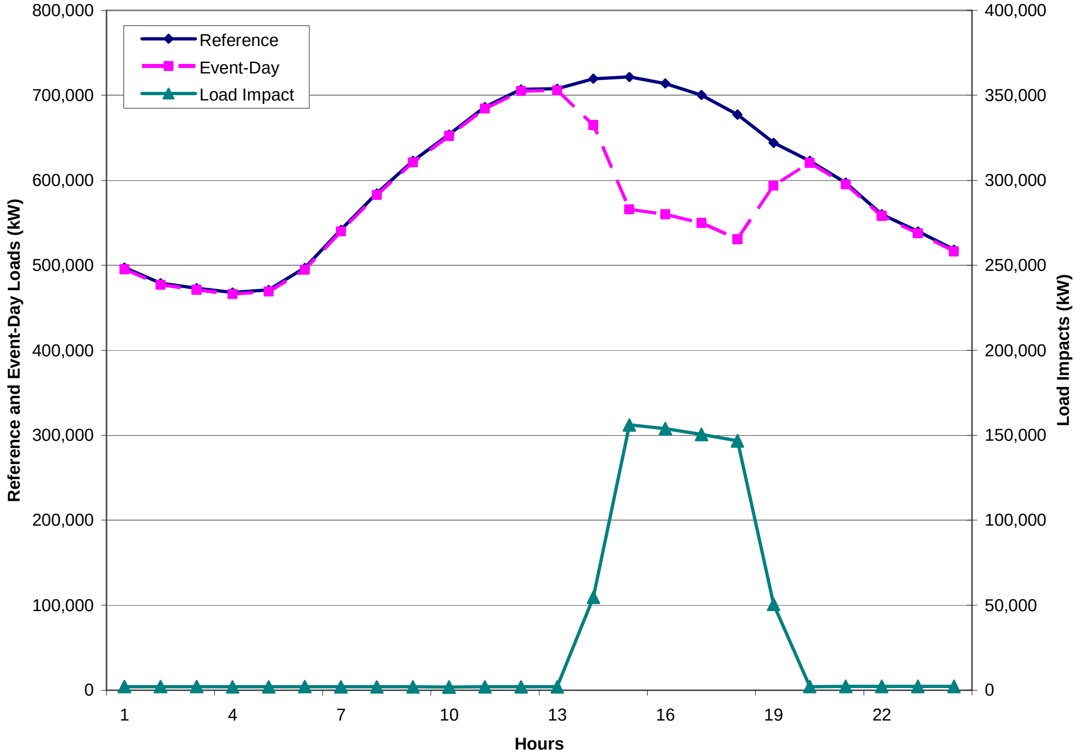



Figure 5.19 shows average event-hour load impacts by LCA for the two program types.

**Figure 5.19: Load Impacts by LCA for the August 2012 Typical Day in a 1-in-2 Weather Year – *AMP DA and DO***

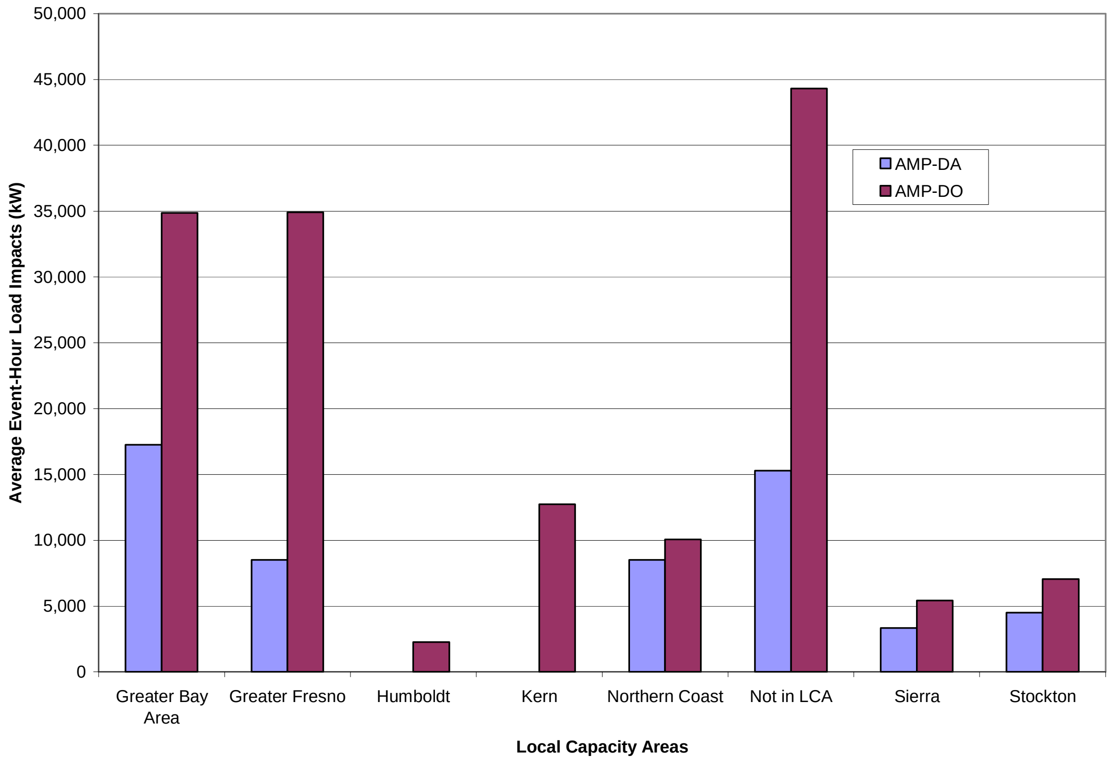
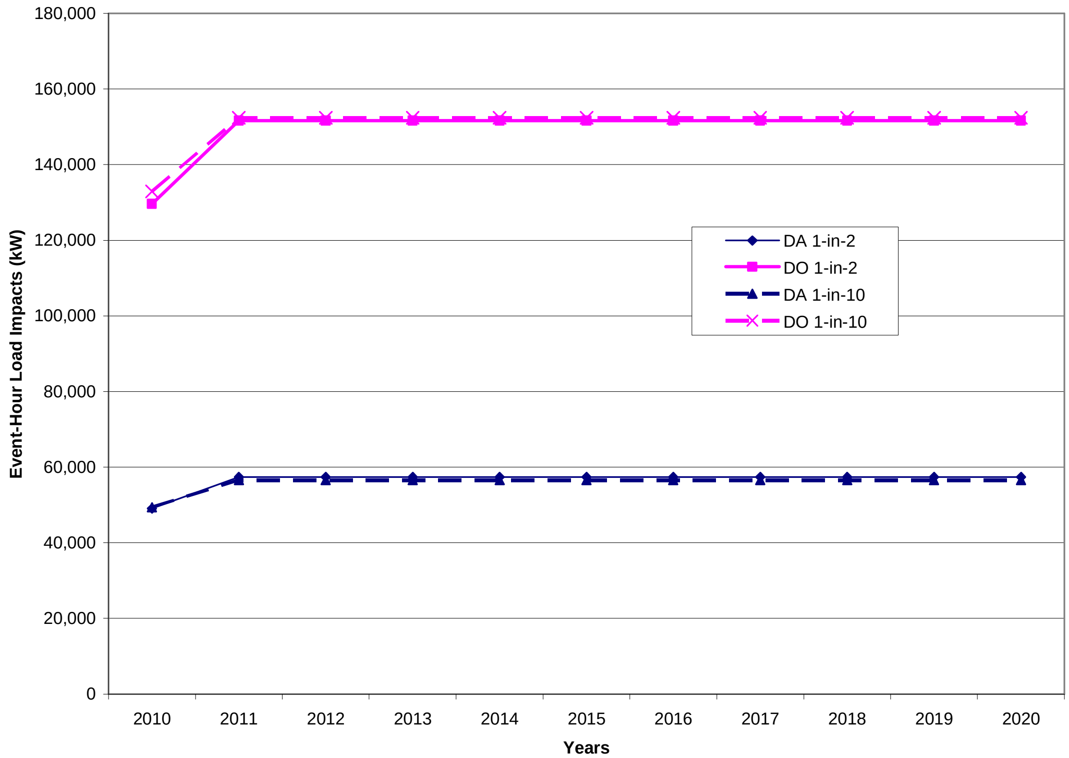



Figure 5.20 illustrates the forecast average event-hour load impact across years for the August peak day in 1-in-2 and 1-in-10 weather years. The load impacts in this figure mirror the enrollment forecast, with impacts increasing through 2011 and then remaining stable.

**Figure 5.20: Average Event-Hour Load Impacts by Year for 1-in-2 and 1-in-10 Weather Scenarios – *AMP DA and DO***




### 5.4.5 SCE DRC

Figures 5.21 and 5.22 show the hourly profiles of forecast loads and load impacts for a typical event day in a 1-in-2 weather year for 2012 for SCE's DRC DA and DO program types. Event-hour load impacts average approximately 3 MW for DA, which is about 6 percent of the enrolled reference load.[27] DO load impacts average 131 MW, which is approximately 19 percent of the enrolled reference load.

[27] This level of load impacts for the DA program type is substantially below SCE's anticipated contract level. However, it is consistent with program performance in 2009.

**Figure 5.21: Hourly Event Day Load Impacts for the Typical Event Day in a 1-in-2 Weather Year for 2012 – *SCE DRC DA***

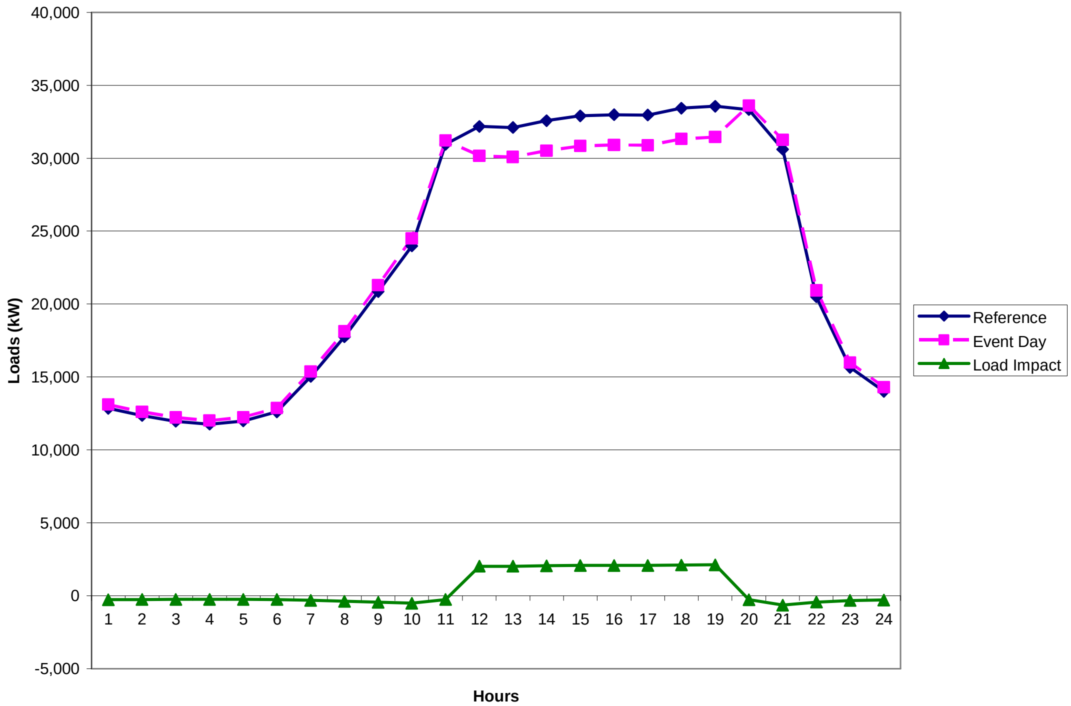



**Figure 5.22: Hourly Event Day Load Impacts for the Typical Event Day in a 1-in-2 Weather Year for 2012 – *SCE DRC DO***

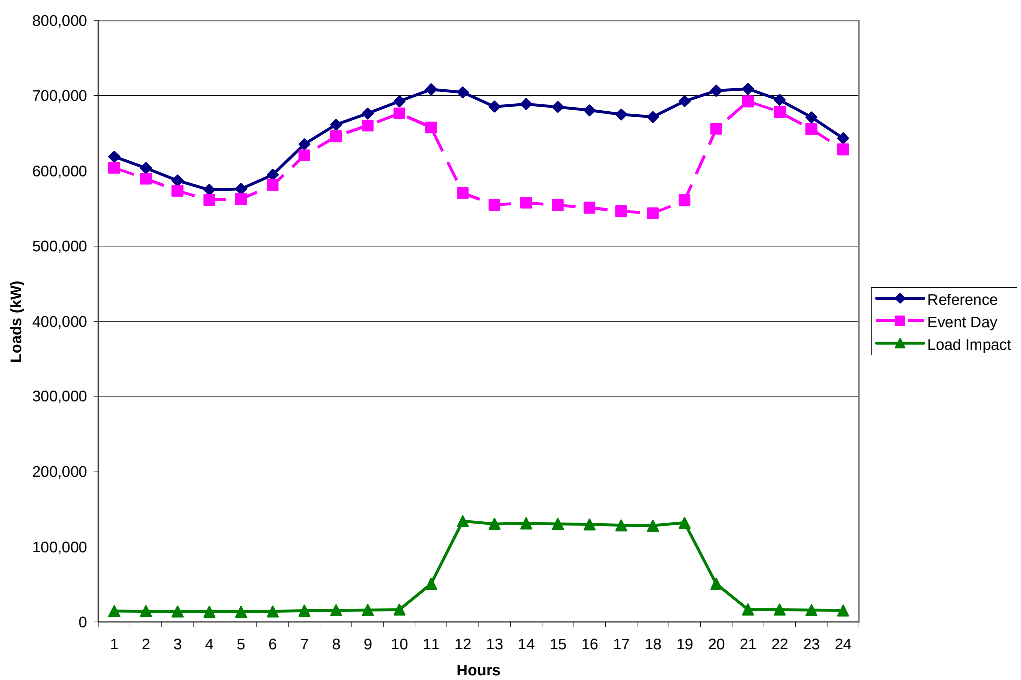


Figure 5.23 illustrates average event-hour load impacts across years for DA (right axis) and DO (left axis) program types, for the typical event day in 1-in-2 weather years. Values are shown through 2012, after which the level of load impacts does not change. Annual values reflect the forecast enrollments, rising for DA in 2011 and then falling to about 3 MW, and rising in 2011 for DO and then remaining level at 131 MW for the remainder of the forecast period.

**Figure 5.23: Average Event-Hour Load Impacts by Forecast Year for the Typical Event Day – *SCE DRC***

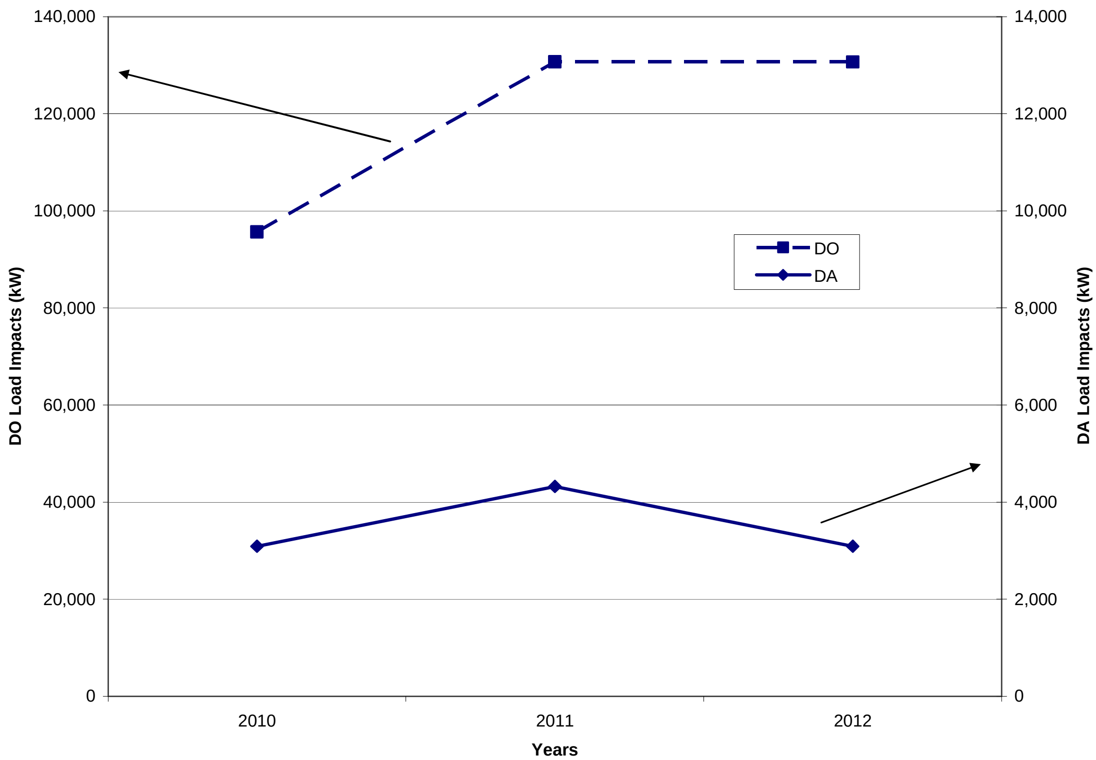
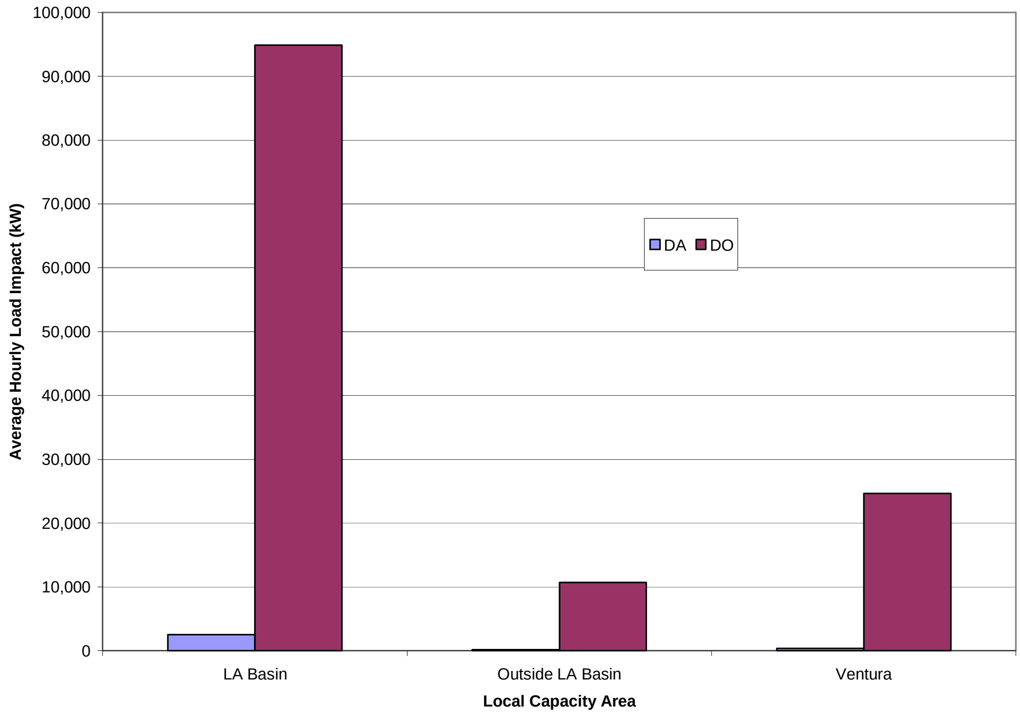



Figure 5.24 shows average event-hour load impacts for the three LCAs for DA and DO.

**Figure 5.24: Load Impacts by LCA for the August 2012 Typical Day in a 1-in-2 Weather Year – *DRC DA and DO***




### 5.4.6 SDG&E AMP

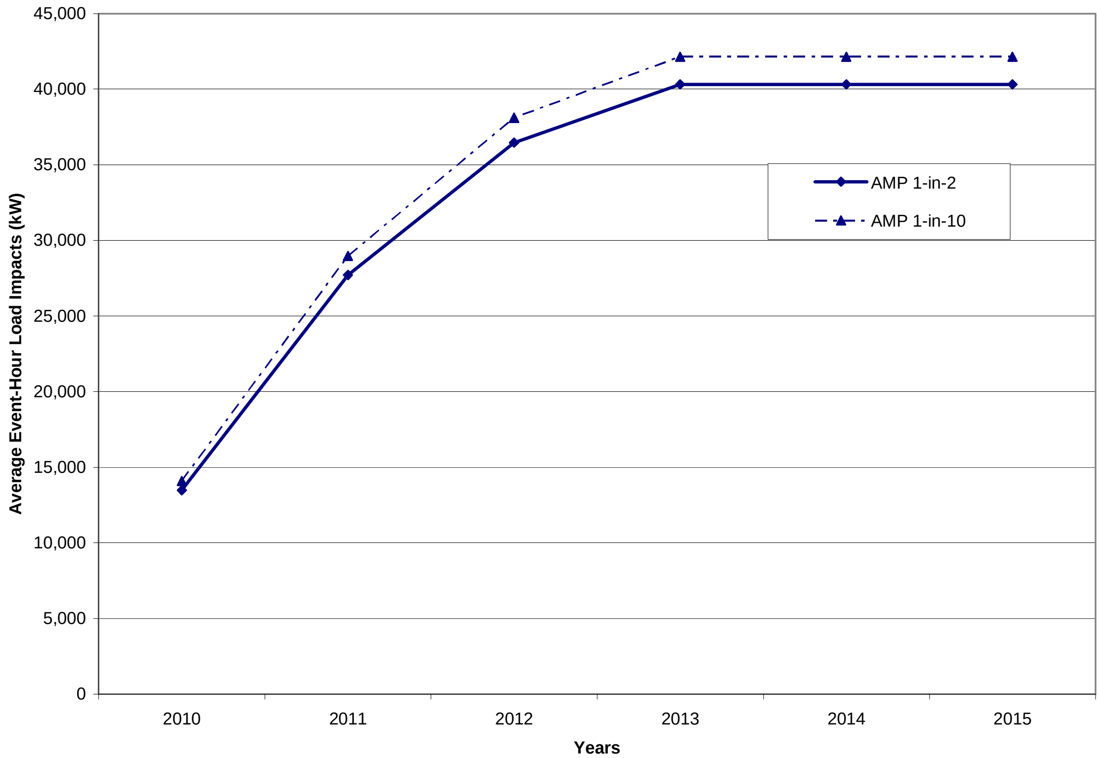
Figure 5.25 shows the hourly profiles of forecast loads and load impacts for a typical event day in a 1-in-2 weather year for 2012 for SDG&E's new AMP program, which only contains the DO program type. Reference loads and per-customer load impacts are based on the historical load data and estimated ex post load impacts for the customer accounts enrolled by one aggregator that has converted his CBP DO program type to an AMP DO contract for 2010. Estimated event-hour load impacts based on the enrollment forecast for the new contract average 36.5 MW, which is about 28 percent of the enrolled reference load.

**Figure 5.25: Ex Ante Load Impacts for the Typical Event Day in a 1-in-2 Weather Year for 2012 – *SDG&E AMP***

**Figure removed for confidentiality reasons.**

Figure 5.26 illustrates average event-hour load impacts across years for the typical event day in 1-in-2 and 1-in-10 weather years. Load impact values rise to just over 40 MW in 2013 for the 1-in-2 scenario, after which they remain constant.

**Figure 5.26: Average Event-Hour Load Impacts for Typical Event Day by Year – *SDG&E AMP***




## 6. Validity Assessment

In this study, we estimated customer-specific load-impact regression models that accounted for each customer's enrollment dates, and nomination and called status for each event. This method has several strong advantages (*e.g.*, properly accounting for bidding behavior, allowing the results to be summarized according to any observed customer characteristic without requiring the estimation of a new model, and the ability to screen customer-specific results for reasonableness). However, it does require the estimation of many models (*e.g.*, for hundreds of customers for each program). While we have largely automated the estimation process, the resulting number of equation results limits the extent to which each customer's regression equation can be subjected to detailed examination due to time and resource constraints. In addition, in order to facilitate efficient post-processing of the results, it is important to use a uniform model structure across all of the customers in a program. That said, we have screened the estimated equations, particularly looking for large outliers, and have rejected a few load impact estimates when the underlying raw data suggest spurious results. Fortunately, in the case of the aggregator programs, we found very few cases of unusual patterns of estimated load impacts which might suggest spurious results. In fact, most all of the largest estimated load impact coefficients were estimated with high degrees of precision (*e.g.*, t-statistics in excess of 2).

# 7. Recommendations

One issue that arose during the ex ante evaluation suggests a possible improvement in linkage between the ex post and ex ante efforts. The issue dealt primarily with PG&E's enrollment forecast developed by The Brattle Group. Briefly, Brattle started the enrollment forecast for PG&E CBP from enrollment data provided by PG&E. However, their calculated percentage shares by industry group differed from those that we had developed in the ex post evaluation, and on which the per-customer reference load and load impacts were based. As described above, we had to go to some effort to sort out the program data on monthly enrollments and nominations. It appears to be a duplication of effort for Brattle to have to go through the same process to determine the starting point for their enrollment forecast. We recommend that in future evaluations we work more closely at the beginning of the enrollment forecasting process to ensure comparability of results and avoid duplication. Similar feedback might be appropriate for the enrollment forecasting process for the other two utilities as well.