BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

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Order Instituting Rulemaking to consider Alternative-Fueled Vehicle Programs, Tariffs, and Policies	Rulemaking 13-11-007 (Filed November 22, 2013)

LOAD RESEARCH REPORT COMPLIANCE FILING OF SOUTHERN CALIFORNIA EDISON COMPANY (U 338-E), ON BEHALF OF ITSELF, PACIFIC GAS AND ELECTRIC COMPANY (U 39E), AND SAN DIEGO GAS AND ELECTRIC COMPANY (U 902-M), PURSUANT TO ORDERING PARAGRAPH 4 OF D.13-06-014

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Dated: **January 31, 2014**

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STATE OF CALIFORNIA

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Southern California Edison Company, on behalf of itself, Pacific Gas and Electric Company, and San Diego Gas & Electric Company, hereby files the Load Research Report, attached hereto as Appendix A, as required by Ordering Paragraph 4 of Decision (D.) 13-06-014.[1] The Load Research Report was prepared based on the load research methodology developed by the California Public Utilities Commission's Energy Division with input from stakeholders pursuant to Ordering Paragraph 3 of D.13-06-014.

[1] The deadline for this report was extended to January 31, 2014, by Executive Director Clanon, to allow the utilities sufficient time to prepare the report under the Energy Division's revised methodology. See letter from the Executive Director dated December 30, 2013.

Respectfully submitted,

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January 31, 2014

Appendix A

Joint IOU Electric Vehicle Load Research Report

2nd Report

Filed on January 31, 2014

Electric Vehicle Load Research & Cost Studies

R.09-08-009/R.13-11-007 (AFV OIR)

Ordered in D.11-07-029 and D.13-06-014

Pacific Gas and Electric Company

SOUTHERN CALIFORNIA EDISON
An EDISON INTERNATIONAL Company

SDGE
A Sempra Energy utility

Contents

Executive Summary:

On July 25, 2011, the California Public Utilities Commission (CPUC) issued D.11-07-029 (the Phase 2 Decision) in the Alternative-Fueled Vehicle Rulemaking, R.09-08-009 (AFV OIR), to evaluate policies and develop infrastructure sufficient to overcome barriers for the deployment and use of Plug-in Electric Vehicles (PEVs) in California. The Phase 2 Decision ordered California's investor owned utilities (IOUs), made up of Pacific Gas & Electric (PG&E), San Diego Gas & Electric (SDG&E), and Southern California Edison (SCE), to conduct research to examine PEV customer charging behavior, as well as track service and distribution system upgrade costs related to PEV load. The IOUs filed the first Joint IOU Electric Vehicle Load Research Report (1st Load Research Report) in December 2012. Decision 13-06-014, issued July 3, 2013 (the Extension Decision), extended the research for an additional three years[1] with reports to begin in December 2013.[2] The Extension Decision also directed the Energy Division to work with stakeholders to revise the load research methodology.[3] The deadline for the December 2013 report was extended to January 31, 2014, by CPUC Executive Director Clanon, to allow the IOUs more time to prepare the report under the revised methodology.

This report includes data through October 2013 for service line and distribution system upgrades and for the period September 2012 through August 2013 for load research data, along with the conclusions reached through analyzing this data. Data from the 1st Load Research Report is considered in drawing conclusions. It is important to note that the PEV market is still evolving. New vehicle models, vehicle battery sizes, charging levels, charging equipment, and charging services are continually entering the PEV market. PEV manufacturers and charging providers are also leaving the market. This evolution is expected to continue in the near team as the PEV market grows and matures.

As of October 31, 2013, the IOUs estimate there are over 41,100 PEVs within the three service territories. For the 41,100 vehicles currently on the road, only 69, or 0.2%, have required a service line and/or distribution system upgrade. Further, PG&E and SCE have completed more than 9,000 residential infrastructure checks related to PEVs[4] and only 58, or 0.6%, of the checks identified the need for an upgrade. In all but 10 instances, the allowance for residential service upgrades was sufficient to cover the portion of the service upgrade cost that is assigned to the utility.[5] The IOUs have evaluated the service and distribution system upgrades needed due to the addition of PEV load, and have determined that the number of upgrades and associated costs to date is immaterial. The IOUs will

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1 D.13-06-014, p 15

2 D.13-06-014, Ordering Paragraph 4

3 D.13-06-014, Ordering Paragraph 3

4 SDG&E does not separately track distribution infrastructure checks related to PEVs, the service call is tagged as PEV only if a construction project is opened to perform an upgrade.

5 For a service line upgrade, the utility is responsible for the cost of the service conductor, connecters, support poles, and metering. These costs are covered by the residential allowance and any amount in excess of the allowance (absent the CPUC's current policy for the excess to be paid by all customers for upgrades related to PEVs) is billed to the customer. The customer is responsible for any trenching, conduit, substructures, or protective structures required for the upgrade. These costs are not covered by the residential allowance, or the CPUC policy currently in place that directs costs in excess of the allowance to be paid by all customers.

continue to track and report data on service and distribution system upgrades related to PEVs through 2015, as required by the Extension Decision.

The IOUs tracked Load Research data on a monthly basis and have included 12 months of data in this report. The usage and demand of customers was tracked in each rate group. The goal of this structure was to determine how monthly usage varies, how rates impact peak demand, and how usage varies by time-of-use rate among different groups of customers.

Generally, the usage and demand levels for customers on single-metered PEV rates are higher than that of the typical residential customer. PEV customers (separately-metered and single-metered) on TOU rates take advantage of the lower off-peak costs and tend to charge their vehicles during the super off-peak period. Single-metered PEV customers tend to peak during the super off-peak period. Many of these customers use timers either equipped in the vehicle or on the charging station.

Part 1: Introduction

California is the fifteenth largest emitter of greenhouse gases in the world, representing about 2% of worldwide emissions, and California's transportation sector is the largest contributor, consisting of 38% of the State's total greenhouse gas emissions. Passenger vehicles alone are responsible for almost 30% of California's greenhouse gas emissions.[6] To address these vehicle emissions, the California Air Resources Board proposed a comprehensive three pronged strategy, which includes the following: reduce greenhouse gas emissions from vehicles, reduce the carbon content of the fuel vehicles use, and reduce the miles vehicles travel. Electrification of vehicles is a critical component of this strategy.[7]

The California Public Utilities Commission (CPUC) opened the Alternative-Fueled Vehicle Rulemaking, R.09-08-009 (AFV OIR), to consider alternative-fueled vehicle tariffs, infrastructure, and policies to support California's Greenhouse Gas Emissions Reductions Goals.

In December of 2013, Go Electric Drive on its online virtual showroom lists 16 PEVs currently for sale by dealers[8]: the Chevy Spark, Chevy Volt, Fiat 500e, Ford C-Max Energi, Ford Focus, Ford Fusion Energi, Honda Accord, Honda Fit, Mitsubishi iMiev, Nissan Leaf, Panamara S, Smart Electric, Tesla Model S, Toyota Prius, Toyota RAV 4, and Wheego Life. These vehicles have on-board chargers capable of charging at levels ranging from 3.3 kW to 19.2 kW.

The IOUs estimate more than 41,000s PEV are in their service territories as of October 31, 2013. The number of PEVs forecasted to be operating in the IOUs service territories from 2014 through 2022 are:

Year	PG&E[9]	SCE[10]	SDG&E[11]
2014	56,045	37,764	8,317
2015	79,080	63,828	21,580
2016	150,175	103,270	39,978
2017	221,270	151,796	59,828
2018	292,365	211,534	77,735
2019	371,950	278,244	99,439
2020	461,596	356,324	121,996
2021	551,797	443,456	144,384

6 *Climate Change Scoping Plan, A Framework for Change, Pursuant to AB 32, the California Global Warming Solutions Act of 2006* (herein ARB's 2008 Scoping Plan) at 11, adopted by the California Air Resources Board on December 11, 2008. The ARB 2008 Scoping Plan is available at: http://www.arb.ca.gov/cc/scopingplan/document/scopingplandocument.htm.

7 D.11.07-029, p 3-4

8 http://goelectricdrive.com/index.php/electric-cars/virtual-showroom

9 *California Energy Demand 2014-2024 Final Forecast, Volume 1, December 2013, pp. 42, Table 11*: http://www.energy.ca.gov/2013publications/CEC-200-2013-004/CEC-200-2013-004-SF-V1.pdf. PG&E extrapolated a mid-scenario from an average of the high and low case data based on the knowledge that roughly 35% of California's hybrid vehicles reside in PG&E service territory. PG&E expects that trend will also hold true for electric vehicles going forward.

10 SCE's PEV Forecast Methodology Overview presentation to CEC IEPR workshop on August 21, 2013.

11 California Energy Demand 2014-2024 Final Forecast published January 2014 by the California Energy Commission, SDG&E forecast for number of electric vehicles on the road, mid demand scenario.

Year	PG&E[9]	SCE[10]	SDG&E[11]
2022	641,999	540,308	168,395

This report includes data through October 2013 for service line and distribution system upgrades and for the period September 2012 through August 2013 for load research data along with the conclusions reached analyzing the data. Data from the 1st Load Research Report is also considered in drawing conclusions. It is important to note that the behavior of the early adopters of PEVs during this time period may not be representative of the average customer. While the data collected is illustrative of the behaviors of early adopters of PEVs, one cannot conclude that these behavior patterns will hold as PEV technology matures, charging technology and charging behaviors evolve, and PEVs achieve greater market adoption beyond the early adopter phase.

Part 2: Scope of Load Research

In the Phase 2 Decision the CPUC required the IOUs to perform load research to inform future Commission policy[12]. The CPUC determined that additional research is needed to inform policies for the next stages of PEV market development.[13] Specifically, the CPUC ordered the IOUs to:

1. Track and quantify all new load and associated upgrade costs in a manner that allows PEV load and related costs to be broken out and specifically identified. This information shall be collected and stored in an accessible format useful to the Commission.

2. Evaluate how metering arrangements and rate design impact PEV charging behavior.

3. To the extent relevant, determine whether participation in demand response programs impacts PEV charging behavior.

4. Determine how charging arrangements, including metering options and alternative rate schedules impact charging behavior at Multi Dwelling Units (MDU).

5. Evaluate whether distribution costs are increased by different charging levels, i.e., Level 1, Level 2, and quick charging, in public locations.

6. Separately track costs associated with PEV-related residential service facility upgrade costs and treated as "common facility costs" between the effective date of this decision and June 30, 2013, and propose a policy and procedural mechanism to address these residential upgrade costs going forward.[14]

In collaboration with the Energy Division and other stakeholders, the IOUs developed a load research plan to meet these specific requirements and filed the plan with the CPUC on October 1, 2012.[15] The plan identified certain areas where data is not available or sufficient to produce data or conclusions. The CPUC further ordered the IOUs to complete the load research by January 1, 2013 and file a load research report by January 1, 2013.[16] The IOUs filed the 1st Load Research Report in December 2012. The Extension Decision extended the research an additional three years[17] to begin in December 2013[18] and directed the Energy Division to work with stakeholders to revise the load research methodology.[19] The deadline for the December 2013 report was extended to January 31, 2014 by CPUC Executive Director Clanon, to allow the IOUs more time to prepare the report under the revised methodology.

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12 D.11-07-029, p. 3
13 D.11-07-029, p. 60
14 D.11-07-029, Ordering Paragraph 6
15 See Advice Letters 2403-E for SDG&E, 2786-E for SCE, and 4115-E for PG&E
16 D.11-07-029, Ordering Paragraph 7
17 D.13-06-014, p 15
18 D.13-06-014, Ordering Paragraph 4
19 D.13-06-014, Ordering Paragraph 3

Part 3: Cost Tracking Data, Findings, and Policy Recommendations

Introduction

In the Phase 2 Decision the CPUC ordered:

- Between July 25, 2011 and June 30, 2013, all residential service facility upgrade costs in excess of the residential allowance shall be treated as common facility costs rather than being paid for by the individual plug-in hybrid and electric vehicle customer.[20]
- The CPUC further ordered the IOUs to separately track costs associated with PEV-related residential service facility upgrade costs and treated as "common facility costs" and propose a policy and procedural mechanism to address these residential upgrade costs going forward. [21]
- The IOUs should evaluate whether distribution costs are increased by different charging levels, i.e., Level 1, Level 2, and quick charging, in public locations. [22]

The Extension Decision extended the "common facility treatment" for costs in excess of the allowance to June 30, 2016[23], and extended the cost tracking and research an additional three years[24] with reporting to begin in December 2013[25].

Approach

Based on notification of the location of a PEV, such as from the customer or auto OEMs, the utilities' service planning departments may conduct assessments of the customer service line and the distribution system supporting the customer service (such as the secondary line, transformer, etc.) to determine whether the new PEV load can be served by the existing infrastructure. The assessment considers factors such as voltage drop and flicker on the service and diversity of load on the distribution system. If the assessment shows that existing infrastructure can accommodate the new PEV load, no upgrade is needed and the assessment is complete. If the existing infrastructure cannot accommodate the new PEV load, then the customer service line and the distribution system supporting the customer service are evaluated to determine if one or both need to be upgraded. As part of the evaluation, the service planning departments consider if the upgrade was needed before the addition of the PEV, and the PEV simply brought attention to the need for the upgrade. If an upgrade was needed before the addition of the PEV, then the upgrade is not attributed to the PEV because the PEV did not cause the need for the upgrade.[26] Similarly, if the customer is adding a PEV plus other new load such as a room addition, air conditioner, or pool pump, and an upgrade is needed, the upgrade is not attributed to the PEV since it was not the sole source of the new load.[27] Once the evaluation is complete, a new project is

[20] D.11-07-029, Ordering Paragraph 5
[21] D.11-07-029, Ordering Paragraph 6
[22] D.11-07-029, Ordering Paragraph 6
[23] D.13-06-014, Ordering Paragraph 1
[24] D.13-06-014, p 15
[25] D.13-06-014, Ordering Paragraph 4
[26] That is, even if the customer ultimately decided not to purchase the car, the upgrade would still be completed because it was needed absent the PEV.
[27] The upgrade would be completed absent the PEV because other new load is being added.

opened for the upgrade and attributed to the PEV if it was the sole source of the new load and an upgrade was not needed before the PEV was added. The IOUs create PEV-specific work orders to capture the costs and report those costs when the upgrade work is complete. This is the most practical way for the IOUs to capture and report upgrade costs attributable solely to PEVs.

Upgrade costs related to PEVs fall into three general categories:

- equipment on the customer side of meter
- the individual customer service line, and
- the utility distribution system that serves multiple customers.

The costs for each category are treated differently.

Costs for equipment on the customer side of the meter are borne by the customer and the utility does not have information on these costs. They are not included in this report.

The table on the following page illustrates how costs for upgrades to the individual customer service line are split between the customer and the utility. The customer's assigned costs are the costs incurred in fulfilling the Applicant Responsibility of Rule 16. The utility's contribution toward the utility assigned costs is limited to the amount of the residential allowance and any costs in excess of the allowance are billed to the customer. The customer is responsible for the costs of the service line upgrade that are assigned to them. These costs are not covered by the residential allowance, or the CPUC policy currently in place that directs costs in excess of the allowance to be paid by all customers. The utility does not have information on the costs borne by the customer for the service upgrade and they are not included in this report.

Costs for upgrades to the utility distribution system, including secondary lines and transformers, are paid by the utility and recovered through distribution rates. The table that follows summarizes the types of costs in each category and the party responsible for the costs.

	Customer Assigned Costs	Allowance?	Utility Assigned Costs
Equipment on Customer Side of Meter	Customer pays all costs for charging equipment, including costs to plan, design, install, own, maintain, and operate facilities and equipment beyond the Service Delivery Point		
Service Line Upgrade	• Excavation: trenching, backfilling, and other digging as required including permit fees • Furnishing, installing, owning, and maintaining all Conduits (including pulling tape) and Substructures, furnishing riser materials • Protective Structures: Furnishing, installing, owning, and maintaining all necessary Protective Structures as specified by utility for utility's facilities	Yes, to cover work responsibility assigned to utility. Customer pays amount exceeding allowance. This is in addition to Customer assigned costs. **NOTE: CPUC policy exemption in place through June 2016 for residential upgrades when PEV load is added. Under exemption, amount exceeding allowance is not paid by customer and instead paid by utility and recovered through distribution rates.**	• Underground Service: Service conductors and connectors • Overhead Service: conductors and support poles • Metering: meters and associated utility owned metering equipment
Secondary Lines/ Transformer Upgrade (serving 2 or more Service Lines)			Utility pays all costs for upgrading and maintaining the distribution system. Recovered through distribution rates.

Summary Data

Table IOU-1 summarizes the PEV-related service line and distribution system upgrade costs for the period July 2011 through October 2013.

Table IOU-1: Summary of Service Line and Distribution System Upgrades

	PG&E	SCE	SDG&E	Total
Residential Customers				
Estimated PEV customers through October 31, 2013	20,400	16,300	4,400	41,100
Residential Upgrades				
Number of PEV-related Infrastructure Checks Completed	3,420[28]	5,600	Not[29] tracked	9,020
Number PEV-related Service Line and/or Distribution System Upgrades[30]	39	19	11	69
Total Costs Incurred by Utility for Upgrades	$419,299	$76,826	$32,041	$528,166
Range of Costs for Upgrades	$148-$46,320	$274 - $10,384	$294 - $11,604	N/A
Average Cost for Distribution System Upgrade[31]	$12,767	$6,310	$4,089	N/A
Average Cost for Service Line Upgrade	$3,864	$2,004	$939	N/A
Number of Service Line Upgrades Exceeding Residential Allowance	10	0	0	10
Current Residential Allowance	$1,918[32]	$2,859[33]	$2,841[34]	N/A
Amount of Foregone Billings to Customers for Service Line Upgrades Pursuant to "Common Facility Treatment" Policy Exemption for PEVs	$36,029	$0	$0	$36,029

PG&E Specific Details

As of October 2013, PG&E's best estimate of the number of PEVs in the PG&E service territory is 20,400. PG&E estimates the number of PEVs in its service territory utilizing an estimation method derived from national sales numbers and the Clean Vehicle Rebate Program numbers. There is a significant amount of uncertainty in this number and it is appropriately considered to be a lower bound of the number of PEVs in the territory.

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[28] See Appendix A for a correction to the number reported for the "Number of PEV-related Infrastructure Checks Completed" field in the *"Compliance Filing of Pacific Gas and Electric Company (U 39E), Southern California Edison Company (U 338E) and San Diego Gas & Electric Company (U 902M) Pursuant to Ordering Paragraph 7 of D.11-07-029"* filed on December 28, 2012.

[29] SDG&E does not separately track distribution infrastructure checks related to PEVs, the service call is tagged as PEV only if a construction project is opened to perform an upgrade.

[30] If a both a service line upgrade and distribution line upgrade was performed at the same residence, it is counted as one upgrade.

[31] For upgrades that included both a distribution system and service line upgrade PG&E and SDG&E broke them out between the distribution upgrade and service line upgrade line items. SCE reported total amount in distribution system upgrade line item.

[32] PG&E Electric Rule 15, Section C.3: http://www.pge.com/tariffs/tm2/pdf/ELEC_RULES_15.pdf

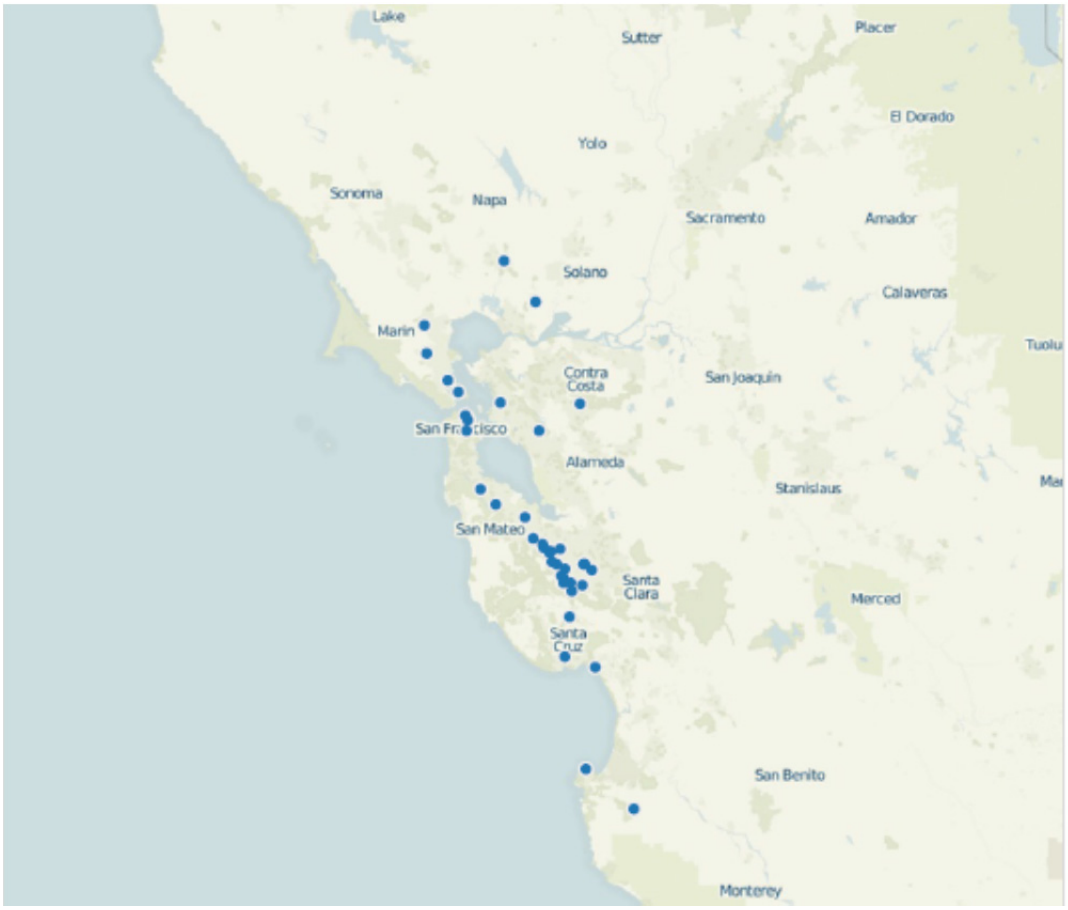
[33] SCE Electric Rule 15, Section C.3: https://www.sce.com/NR/sc3/tm2/pdf/Rule15.pdf

[34] SDG&E Electric Rule 15, Section C.3: http://regarchive.sdge.com/tm2/pdf/ELEC_ELEC-RULES_ERULE15.pdf

While PG&E's total estimate of PEVs in the service territory is 20,400, PG&E is only able to perform service assessments for those vehicles for which customer specific notification is received. As of October 31, 2013, PG&E had completed 3,420 such service assessments. Of the 3,420 service assessments completed to date, 39, or 1.1%, have required upgrades due solely to the addition of PEV load. In 10 instances the allowance was not sufficient to cover the portion of the service upgrade assigned to the utility, and the customer would have incurred additional costs had the exemption not been in place. The total cost of the excess over the allowance for all 10 customers combined was $36,029.

The map below identifies the locations of the 39 upgrades.

Figure PG&E-1: PEVs in the PG&E Service Territory Requiring a Residential Upgrade as of October 2013



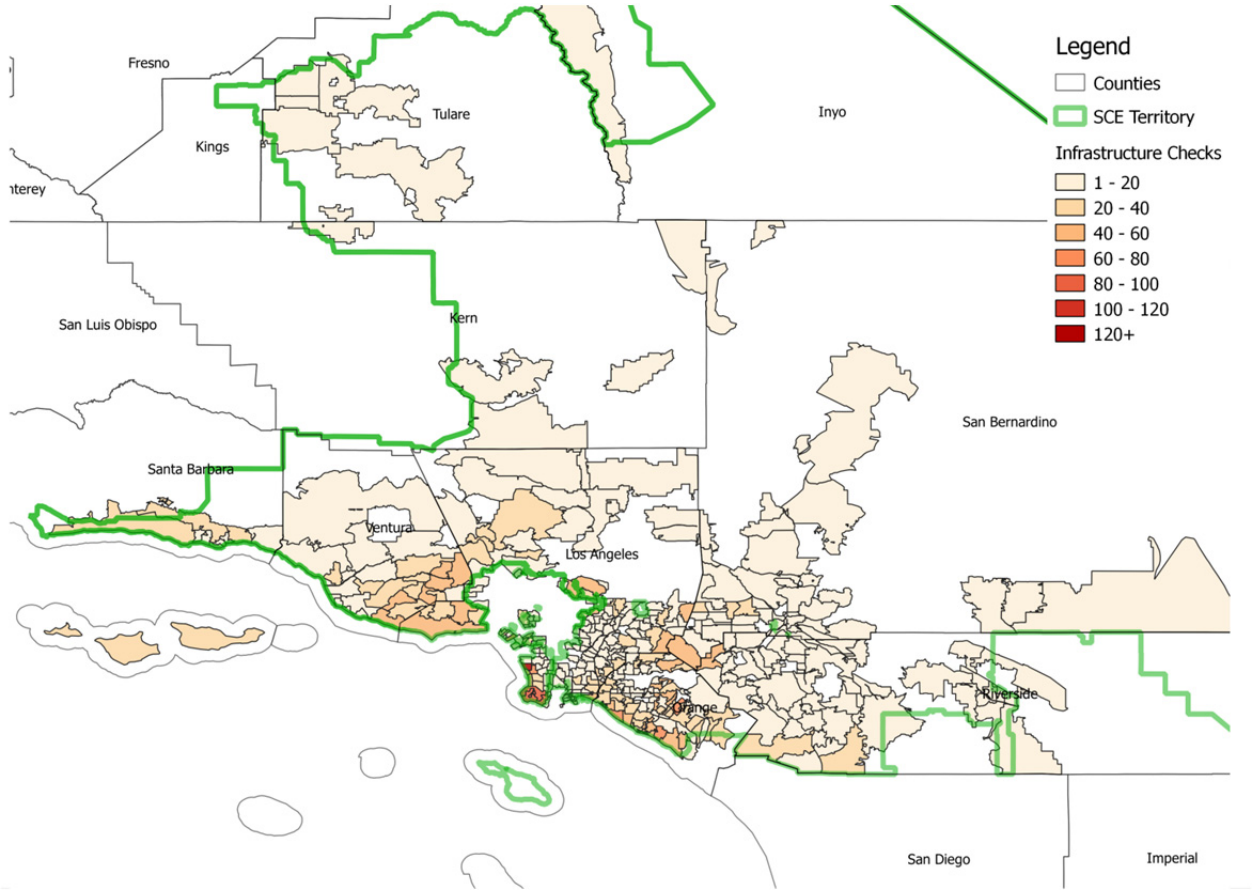
SCE Specific Details

As of October 2013, SCE's best estimate of the number of PEVs registered to residential customers in SCE's service territory is 16,300. The data sources for this estimate are: Customer self-identification, OEM-shared data (with customer consent), city/county electrical permits, estimates based on national sales, and PEV counts received through a third party DMV vendor. There is some amount of uncertainty in this number and it is appropriately considered to be a lower bound of the number of PEVs in the territory.

SCE is only able to perform a residential service assessment when it has been notified of the street address of a charging location. As a result, as of October 31, 2013, SCE had completed approximately 5,600 such residential service assessments out of the 16,300 electric vehicles estimated in its service territory.

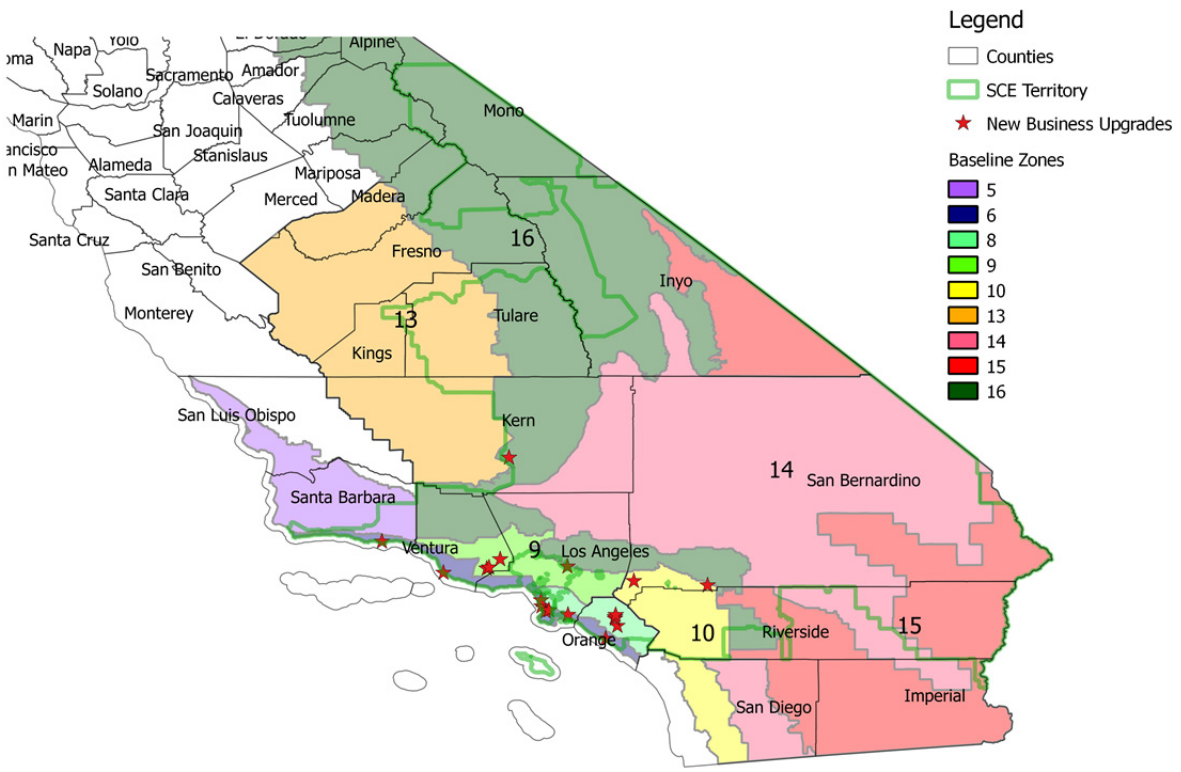
This map shows the concentration of infrastructure checks by ZIP Code.

Figure SCE-1: Infrastructure Checks Completed SCE Service Territory



Of the 5,600 residential service assessments completed to date, 19, or 0.3%, have required upgrades due solely to the addition of PEV load. The locations of the upgrades are depicted on this map.

Figure SCE-2: PEVs in the SCE Service Territory Requiring a Residential Upgrade as of October 2013



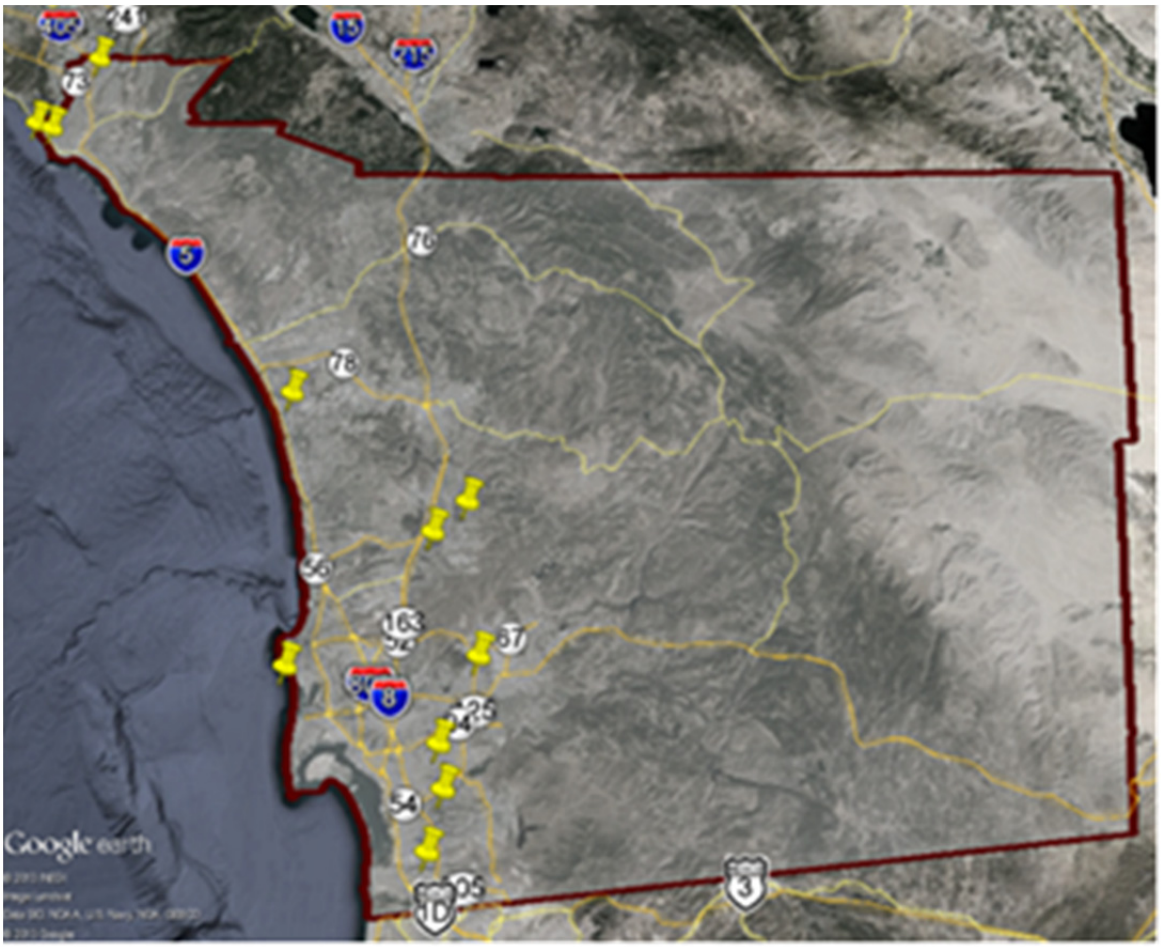
SCE also had six upgrades relating to the commercial installation of PEV charging stations totaling approximately $70,500.

SDG&E Specific Details

As of October 2013, SDG&E's best estimate of the number of PEVs registered to residential customers in the SDG&E service territory is 4,400. The data sources for this estimate are: customer self-identification, OEM opt-in notification, car dealership reporting, and PEV counts received through a third party DMV vendor. There is some uncertainty in this number and it is appropriately considered to be a lower bound of the number of PEVs in the SDG&E service territory.

Of the approximately 4,400 residential vehicles in SDG&E's service territory, 11, or 0.3%, have required upgrades where the PEV was the sole source of the new load. The locations of the upgrades are depicted on this map.

Figure SDG&E-1: PEVs in the SDG&E Service Territory Requiring a Residential Upgrade as of October 2013



SDG&E also completed 5 commercial upgrades for the installation of PEV charging, totaling approximately $27,000.

Conclusions/Recommendations

As of October 31, 2013, the IOUs estimate there is approximately 41,100 PEVs within the three service territories. For the 41,100 vehicles currently on the road, only 69, or 0.2%, have required a service line and/or distribution system upgrade. Further, PG&E and SCE have completed more than 9,020 residential infrastructure checks[35] and only 58, or 0.6%, of the checks identified the need for an upgrade. In all but 10 instances, the allowance for residential service upgrades was sufficient to cover the portion of the service upgrade cost that is assigned to the utility. The IOUs have evaluated the service and

[35] SDG&E does not separately track distribution infrastructure checks related to PEVs, the service call is tagged as PEV only if a construction project is opened to perform an upgrade.

distribution system upgrades needed due to the addition of PEV load, and have determined that the number of upgrades and associated costs to date to be immaterial. The IOUs will continue to track and report data on residential service and distribution system upgrades related to PEVs, as required by the Extension Decision.

Part 4: Load Research & Customer Behavior on Rates in Various Settings

Introduction

The Extension Decision directed the IOUs to continue its load research reporting related to PEVs for an additional three years. The Extension Decision along with the Phase 2 Decision provided direction on scope and instructed the IOUs to work with the Energy Division on revising and continuing PEV load research reporting. In the Phase 2 Decision the IOUs were ordered to:

- Evaluate how metering arrangements and rate design impact PEV charging behavior.
- To the extent relevant, determine whether participation in demand response programs impacts PEV charging behavior.
- Determine how charging arrangements, including metering options and alternative rate schedules impact charging behavior at MDU.[36]

To satisfy these requirements, metering data was collected to provide insight into residential charging behavior under:

- Whole House TOU Rates known as "single–metered"
- Electric Vehicle TOU Rates known as "separately–metered"
- Tiered Residential rates

This metering data provided the basis for analysis as to how charging behavior has been impacted by tariff rates or charging levels. Additionally, the recorded metrics allowed for the evaluation of metering scenarios on PEV charging behavior for customers in the following residential categories[37]:

- Single Family Home (SF)
- Multi Family Dwelling Unit (MDU)
- Net Energy Metering (NEM)
- Demand Response (DR)

The data for this 2nd Load Research Report covers the 12-month period of September 2012 to August 2013. Distinctions between single metering and separate metering are shown, as well as Net Energy Metering (NEM) and Demand Response (DR) program participation. The usage and demand of customers were tracked in each rate group. The goal of this structure was to determine how monthly usage varies, how rates impact peak demand and how usage varies by time-of-use rate among different groups of customers. A baseline for residential customers has been analyzed for context in the form of an average for a month during the season being examined.

[36] D.11-07-029, Ordering Paragraph 6

[37] The MDU and SF categories are mutually exclusive. However, the others categories can overlap. For example, a NEM customer that is also on DR would appear in three categories.

For this 2nd Load Research Report additional tables and charts were developed to allow for comparisons across the utilities. To the extent possible the IOUs provided similar information for easy comparisons, but there are some cases where this is simply not possible due to differences in the underlying IOU data.

Metrics with less than 15 customers are clearly noted and not reported due to confidentiality concerns described in the 15/15 Rule adopted by the Commission in Decision 97-10-031. All statistics in this report are provided as an average on a per-customer basis in each rate group and are based on interval data collected by each IOU. All time periods are reported in clock time, except for SCE's load profiles, which are reported in Pacific Standard Time. Time-of-use periods vary across the IOUs and will be explicitly defined within each separate section below.

PG&E

Single-Metered (EV-A) and Separately-Metered (EV-B) PEV Rates

As of the date of this report, PG&E has two residential PEV rates, EV-A and EV-B, as described in Schedule EV[38] for single and separately-metered PEVs respectively. The EV-A rate is designed for residential customers who have their typical load and electric vehicle charging on the same meter. The EV-B rate is designed for customers who wish to bill their vehicle charging separately and who have installed a separate meter to do so. Both rate plans use an un-tiered time-of-use (TOU) rate structure. They offer on-peak, partial peak, and off-peak energy prices according to the time periods in Table PG&E-1a.

These rates are the successors to the experimental time-of-use rates for low emission vehicle customers, E-9A and E-9B, as described in Schedule E-9[39]. Schedule E-9 was closed as of the effective date of the new Schedule EV, August 1, 2013 and will be eliminated on the later of the date of a decision in Phase 2 of PG&E's 2014 General Rate Case, or December 31, 2014. Because the lifespan of the two schedules overlap during the study period and because Schedule EV was patterned after Schedule E-9, for the purposes of this study data for EV-A and E-9A customers will be reported as "EV-A" and data for EV-B and E-9B customers will be reported as "EV-B."[40]

Regardless of season, or day of the week, both rates seek to encourage usage in off-peak hours from 11:00 p.m. to 7:00 a.m. The rates further encourage weekend usage by removing the "partial-peak" time periods on Saturdays and Sundays.

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[38] Pacific Gas and Electric Company, San Francisco, CA. Electric Schedule EV. Residential Time-of-Use Service for Plug-in Electric Vehicle Customers. Retrieved from http://www.pge.com/tariffs/tm2/pdf/ELEC_SCHEDS_EV.pdf Please note that as of the date of this report, the rates available at this link which became effective January 1, 2014 differ from those displayed in "Table PG&E-1a: Tariff Type and Rate ($/kWh)" which reflect the rates associated with Schedule EV as of October 31, 2013.

[39] Pacific Gas and Electric Company, San Francisco, CA. Electric Schedule E-9. Experimental Residential Time-of-Use Service for Low Emission Vehicle Customers. Retrieved from http://www.pge.com/tariffs/tm2/pdf/ELEC_SCHEDS_E-9.pdf.

[40] However, the analyses in Tables PG&E 6, 7 and 8 used the TOU periods from Schedule E-9 because this schedule was in-effect for the largest portion of the study period.

Table PG&E-1a: Tariff Type and Rate ($/kWh)

Rate: EV-A

Clock Hour Ending*	Winter Weekday	Winter Weekend / Holidays	Summer Weekday	Summer Weekend / Holidays
1	0.10085	0.10085	0.09841	0.09841
2	0.10085	0.10085	0.09841	0.09841
3	0.10085	0.10085	0.09841	0.09841
4	0.10085	0.10085	0.09841	0.09841
5	0.10085	0.10085	0.09841	0.09841
6	0.10085	0.10085	0.09841	0.09841
7	0.10085	0.10085	0.09841	0.09841
8	0.16667	0.10085	0.20808	0.09841
9	0.16667	0.10085	0.20808	0.09841
10	0.16667	0.10085	0.20808	0.09841
11	0.16667	0.10085	0.20808	0.09841
12	0.16667	0.10085	0.20808	0.09841
13	0.16667	0.10085	0.20808	0.09841
14	0.16667	0.10085	0.20808	0.09841
15	0.27392	0.10085	0.38119	0.09841
16	0.27392	0.27392	0.38119	0.38119
17	0.27392	0.27392	0.38119	0.38119
18	0.27392	0.27392	0.38119	0.38119
19	0.27392	0.27392	0.38119	0.38119
20	0.27392	0.10085	0.38119	0.09841
21	0.27392	0.10085	0.38119	0.09841
22	0.16667	0.10085	0.20808	0.09841
23	0.16667	0.10085	0.20808	0.09841
24	0.10085	0.10085	0.09841	0.09841

Rate: EV-B

Clock Hour Ending*	Winter Weekday	Winter Weekend / Holidays	Summer Weekday	Summer Weekend / Holidays
1	0.10044	0.10044	0.09803	0.09803
2	0.10044	0.10044	0.09803	0.09803
3	0.10044	0.10044	0.09803	0.09803
4	0.10044	0.10044	0.09803	0.09803
5	0.10044	0.10044	0.09803	0.09803
6	0.10044	0.10044	0.09803	0.09803
7	0.10044	0.10044	0.09803	0.09803
8	0.16382	0.10044	0.20543	0.09803
9	0.16382	0.10044	0.20543	0.09803
10	0.16382	0.10044	0.20543	0.09803
11	0.16382	0.10044	0.20543	0.09803
12	0.16382	0.10044	0.20543	0.09803
13	0.16382	0.10044	0.20543	0.09803
14	0.16382	0.10044	0.20543	0.09803
15	0.26823	0.10044	0.37589	0.09803
16	0.26823	0.26823	0.37589	0.37589
17	0.26823	0.26823	0.37589	0.37589
18	0.26823	0.26823	0.37589	0.37589
19	0.26823	0.26823	0.37589	0.37589
20	0.26823	0.10044	0.37589	0.09803
21	0.26823	0.10044	0.37589	0.09803
22	0.16382	0.10044	0.20543	0.09803
23	0.16382	0.10044	0.20543	0.09803
24	0.10044	0.10044	0.09803	0.09803

Legend:

	Winter	Summer
On		
Part		
Off		

* While the table depicts “clock-time”, there is a daylight saving time adjustment as described in the tariff.

These rates change seasonally, rising in summer and dropping in winter. Table PG&E-1b depicts price ratios for the TOU periods by season to illustrate this seasonal difference.

Table PG&E-1b: Price Ratios

	EV-A Tariff		EV-B Tariff	
Season	Between Off-Peak and Partial Peak	Between Off-Peak and Peak Period	Between Off-Peak and Partial Peak	Between Off-Peak and Peak-Period
Winter	0.61	0.37	0.61	0.37
Summer	0.47	0.26	0.48	0.26

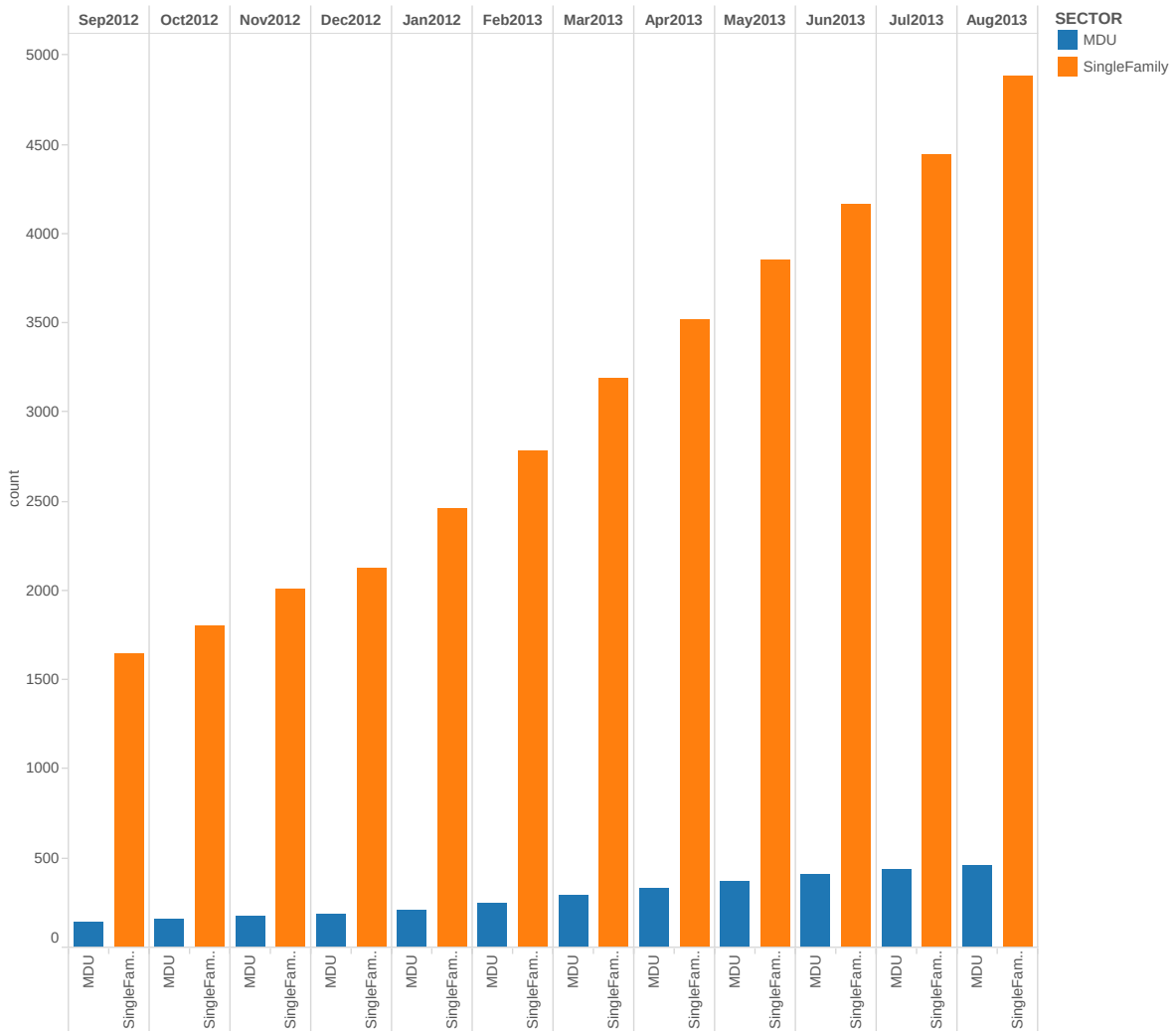
Single Metering (EV-A) Rate Growth

Participation in both EV-A and EV-B has increased several fold during the study period, although not all PEV customers have adopted PEV rates.[41] The vast majority of PEV rate participants are on the EV-A single metering rate.

Chart PG&E-1 below displays the total customers on the EV-A rate. During the study period, there was a steady increase in EV-A overall, as well as the Single Family and MDU subcategories. Between September 2012 and August 2013, the number of accounts in the EV-A group as a whole increased by 199% at the last reported month compared to the base month.

[41] Data obtained by PG&E from auto manufacturers and other sources cannot be verified by the due date of this report to produce a load analysis for Chart 9 or Tables 10, 11, or 12 from Energy Division's reporting requirements. PG&E will seek to include these data in future reports, if feasible. Therefore, the load research figures in this report only represent the number of PEV customers in PG&E service territory on PEV rates, not all PEV customers.

Chart PG&E-1: Single Metering Accounts by Customer Type



NEM (Net Energy Metering) customers on the PEV rates are an important group to consider. Of all PG&E customers who were on a PEV rate up to 18% were also on NEM at any given time during the study period. Virtually all of these dual PEV Rate/NEM customers were on the single-metered EV-A rate (see Tables PG&E-2 and PG&E-4).

The fact that NEM customers with PEVs predominately use the EV-A rate presents a load research challenge. The presence of onsite distributed generation (DG) alongside a PEV behind these customers' meters indicates that their utility energy usage data does not reflect their gross consumption. This is because the DG will have offset some portion of consumption; however, without additional metering of

the DG it is not feasible to isolate the effect PEV ownership has on usage patterns for this group using utility metering data alone. [42]

Table PG&E-1: Single Metering NEM Program Enrollment by Customer Type

Year	Month	Total Single Metering NEM (n)	NEM % of Single Metering	NEM % of SF Single Metering	NEM % of MDU Single Metering
2012	Sep	334	19%	19%	10%
2012	Oct	364	19%	19%	9%
2012	Nov	396	18%	19%	9%
2012	Dec	433	19%	20%	9%
2013	Jan	489	18%	19%	8%
2013	Feb	549	18%	19%	8%
2013	Mar	624	18%	19%	7%
2013	Apr	709	18%	19%	7%
2013	May	774	18%	19%	6%
2013	Jun	834	18%	19%	6%
2013	Jul	892	18%	20%	6%
2013	Aug	977	18%	19%	6%

Demand Response (DR) program participating customers on the PEV rates are another important group to consider. Of all PG&E customers who were on a PEV rate up to 13% were also participating in a DR program at any given time during the study period. Virtually all of these dual PEV Rate/DR customers were on the single-metered EV-A rate (see Tables PG&E-3 and PG&E-5). This dual participation is important to consider because DR customers are familiar with altering their usage patterns in response to TOU price signals. Consequently, these customers should respond to the PEV rate price signals and charge their vehicles during partial or off-peak periods.

[42] While there are numerous other demographic and behavioral attributes of this early PEV adopter group that affect usage, there was insufficient data or resources to isolate and identify their contribution to load shapes.

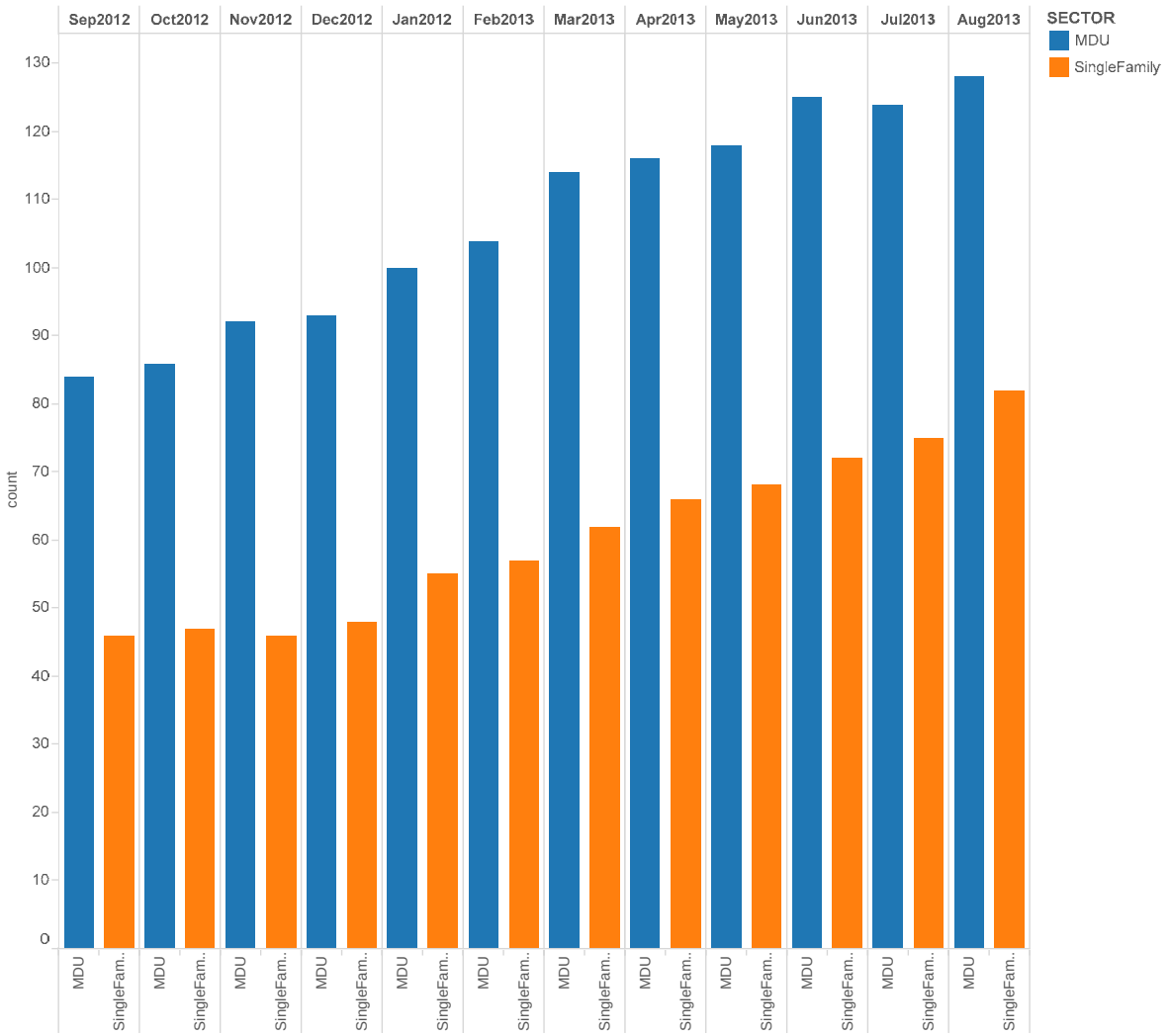
Table PG&E-3: Single Metering DR Program Enrollment by Customer Type

Year	Month	Total Single Metering DR (n)	DR % of Single Metering	DR % of SF Single Metering	DR % of MDU Single Metering
2012	Sep	190	11%	10%	13%
2012	Oct	217	11%	11%	13%
2012	Nov	258	12%	12%	14%
2012	Dec	282	12%	12%	13%
2013	Jan	339	13%	13%	14%
2013	Feb	382	13%	13%	13%
2013	Mar	446	13%	13%	14%
2013	Apr	499	13%	13%	15%
2013	May	566	13%	13%	15%
2013	Jun	624	14%	14%	15%
2013	Jul	674	14%	14%	15%
2013	Aug	729	14%	14%	15%

Separate Metering (EV-B) Rate Growth

The EV-B rate also saw steady growth over the study period from 130 customers to 210 customers. Despite this growth (see Chart PG&E – 2) separate metering remains a much less popular option for PEV rate customers than single metering.

Chart PG&E-2: Separate Metering Accounts by Customer Type



Though the number of PEV rate customers on EV-B and NEM increased during the study period, the growth was minor and inconsequential. This trend is not surprising as customers with PEVs on NEM can offset their PEV load with retail rate credits for their DG system production. PEV customers with a separate meter currently cannot offset their load on the PEV meter with DG production on a separate meter. Therefore, the EV-A rate is a more attractive option for PEV customers on NEM despite the aforementioned challenges it poses to load research.

Table PG&E-4: Separate Metering NEM Program Enrollment by Customer Type

Year	Month	Total Separate Metering NEM (n)	NEM % of Separate Metering	NEM % of SF Separate Metering	NEM % of MDU Separate Metering
2012	Sep	2	2%	2%	1%
2012	Oct	2	2%	2%	1%
2012	Nov	2	1%	2%	1%
2012	Dec	4	3%	6%	1%
2013	Jan	5	3%	7%	1%
2013	Feb	4	2%	5%	1%
2013	Mar	4	2%	5%	1%
2013	Apr	4	2%	5%	1%
2013	May	4	2%	4%	1%
2013	Jun	4	2%	4%	1%
2013	Jul	4	2%	4%	1%
2013	Aug	5	2%	5%	1%

Similar to dual participation in NEM and PEV rates, there was minimal dual participation during the study period in EV-B and a DR program.

Table PG&E-5: Separate Metering DR Program Enrollment by Customer Type

Year	Month	Total Separate Metering in DR (n)	DR % of Separate Metering	DR % of SF Separate Metering	DR % of MDU Separate Metering
2012	Sep	1	1%	0	1%
2012	Oct	1	1%	0	1%
2012	Nov	1	1%	0	1%
2012	Dec	1	1%	0	1%
2013	Jan	1	1%	0	1%
2013	Feb	1	1%	2%	0%
2013	Mar	1	1%	0	1%
2013	Apr	1	1%	0	1%
2013	May	1	1%	0	1%
2013	Jun	1	1%	0	1%
2013	Jul	2	1%	1%	1%
2013	Aug	2	1%	1%	1%

Notes of Caution Regarding Reliance upon Load Research Data

The reader should take careful note of the following issues that make the load research data ill-suited for drawing conclusions for policymaking at this time.

1. The current group of PEV owners is comprised of early adopters who are likely to be materially different than later PEV owners. These differences could include, but are not limited to, income, pre-PEV ownership usage habits, NEM penetration, altruistic tendencies and willingness to adopt usage patterns beneficial to grid stability.
2. The types of PEVs available in the market changed significantly during the study period, suggesting that the types of PEVs owned by PEV rate customers would have changed during that same time frame. New vehicles and charging requirements will likely lead to changing charging profiles in the future (i.e. differing charging demands and durations).
3. The study period was relatively short and the customer counts were fairly small in all cases. This is particularly true for EV-B data derived from PG&E's load research sample.
4. The mix of customers being evaluated changed over time due to customers joining or leaving the EV-A or EV-B.
5. While PEV charging for EV-A (single meter) may be fairly obvious if peak customer demand occurs during off-peak rate periods, the lack of on-site survey or end-use data to help disaggregate other loads from PEV charging prevents the identification of PEV charging in other periods (particularly partial-peak) where multiple significant loads are likely present.

Therefore, while the data collected are illustrative of the behaviors of early adopters of the types of vehicles that are currently available in the market, one cannot conclude that these behavior patterns will hold as PEV technology matures, as charging technology and charging behaviors evolve, and as PEVs achieve greater market adoption beyond the early adopter phase. Data that is sufficiently reliable for policymaking can only be obtained via an appropriately funded and carefully designed study that controls for the above issues.

Average Monthly Usage for PEV Rate Customers

Keeping in mind the above cautions about the data collected, Chart PG&E-3 displays the average monthly usage for each EV-A category including NEM customers, which means that the average monthly usage of these categories is net of behind the meter generation. Chart PG&E-4 displays the average monthly usage for each EV-A category but does not include NEM customers. NEM customers are not segregated in the EV-B rate class for Chart PG&E-5 due to much lower penetration.

Chart PG&E-3: Single Metering Average Monthly Usage (kWh) by Customer Type with NEM

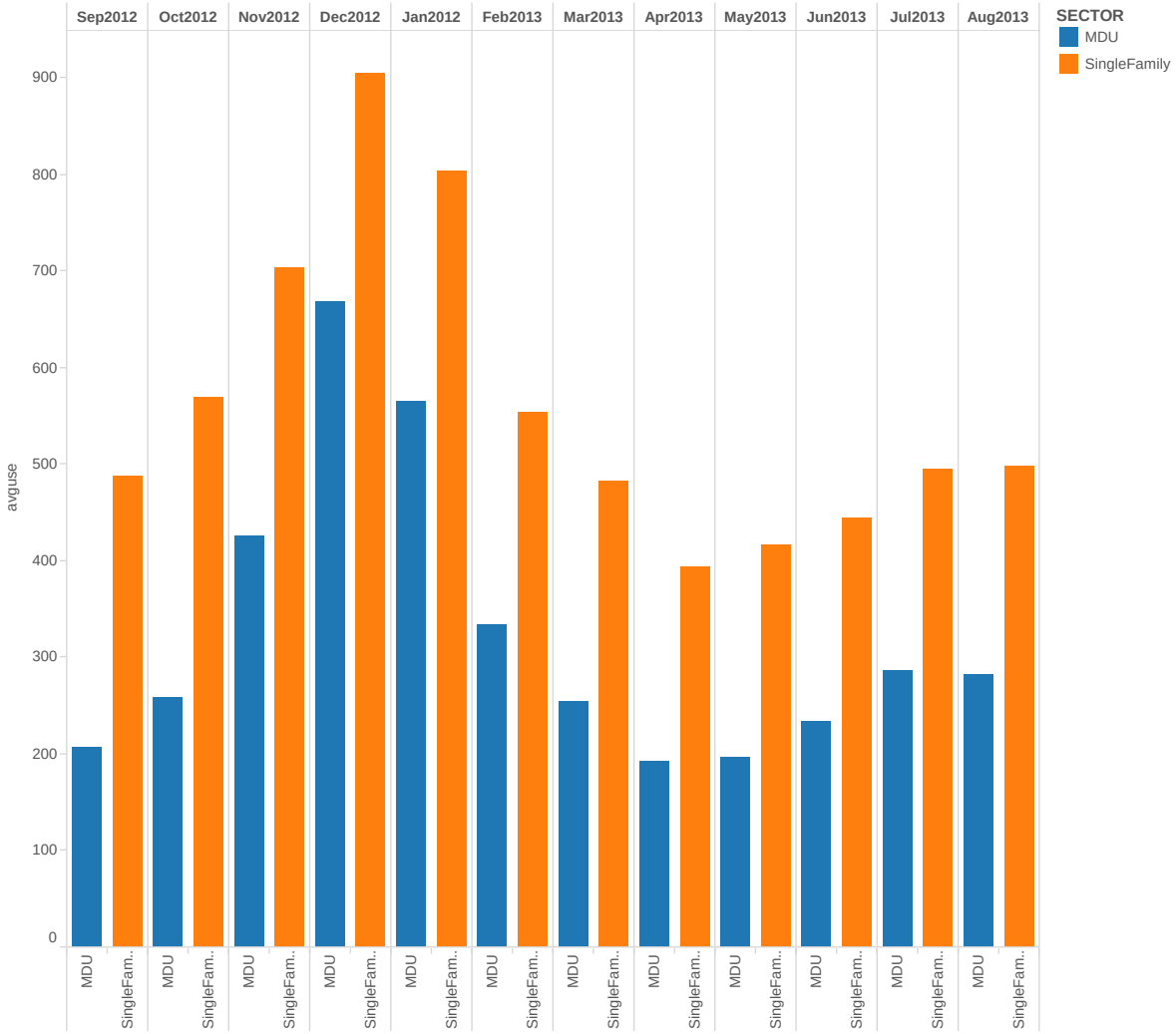
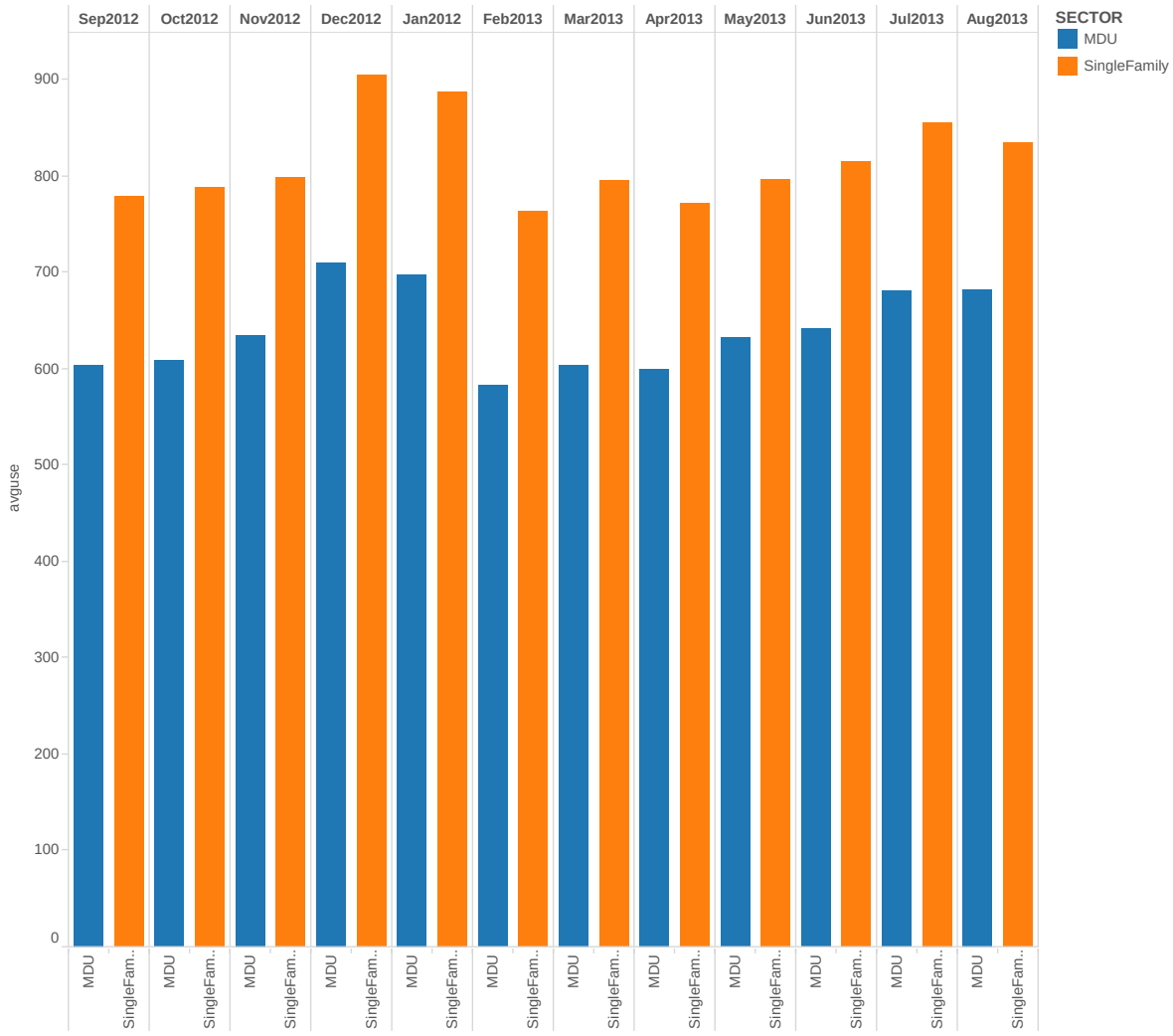
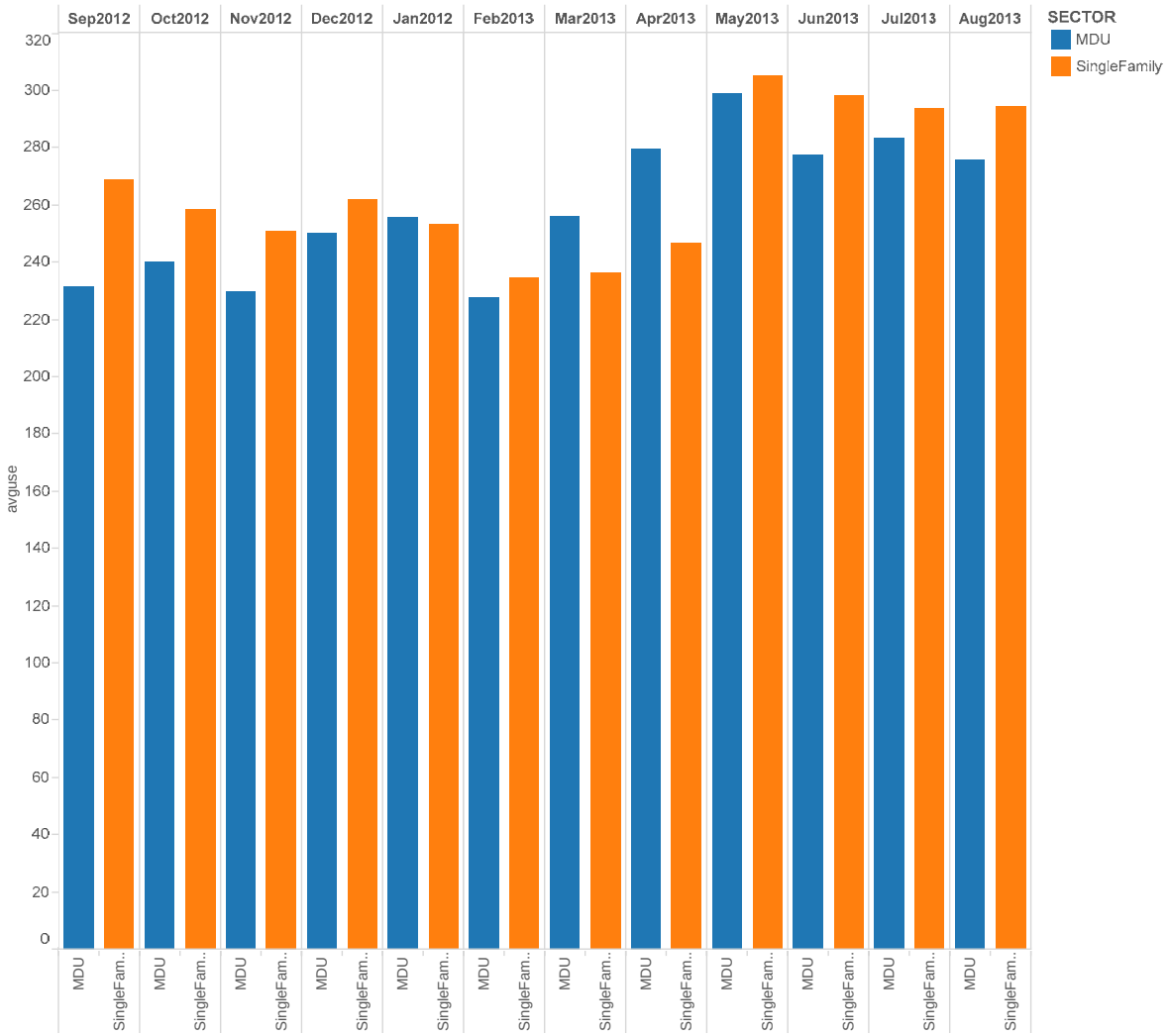


Chart PG&E-4: Single Metering Average Monthly Usage (kWh) by Customer Type without NEM



A comparison of Charts PG&E 3 and 4 reveal an unsurprising result for both sectors: absent the NEM accounts usage is flatter for both PEV rate customers throughout the study period. This result demonstrates that offsetting consumption with behind the meter generation obfuscates researchers' ability to parse PEV load from other site loads for NEM customers using their consumption data alone.

Chart PG&E-5: Separate Metering Average Monthly Usage (kWh) by Customer Type



The results depicted in Chart PG&E-5 demonstrate that absent other loads on the meter researchers can better observe PEV rate customers' charging patterns. For example, the increase in usage during spring and summer months (April to August) relative to fall and winter months (September to February) suggest increased charging in spring/summer months to support the typical increased driving and travel patterns during that period.

Average Usage during Time of Use Periods

TOU PEV rates are designed to discourage charging during on-peak hours and instead encourage charging during off-peak hours when the grid is less stressed and generation costs are lower. For both EV-A and EV-B customers, the time of use periods are defined in Table PG&E-1a. It is noteworthy that the analyses in Tables PG&E 6, 7 and 8 used the TOU periods from Schedule E-9 because this schedule was in-effect for the largest portion of the study period.

One useful way to determine whether the TOU PEV rates are achieving their goal of avoiding peak PEV charging is to measure the distribution of charging in the various time periods. Given that NEM customers have a very unique usage profile, they are segregated from all other EV-A customers groups in Tables PG&E-6, 7 and 8.

- Table PG&E-6 shows the EV-A and EV-B customers share of peak usage by sector, with and without NEM, compared to the peak usage of PG&E's entire residential population. Non-NEM customers on EV-A used an average of 4% less energy than the average PG&E residential customer and NEM customers on EV-A used 7% less energy than the residential population. Likewise non-NEM customers on EV-B used an average of 9% less energy, and NEM customers on EV-B used 1% less than the residential population. As previously noted the small customer population of NEM customers on EV-B detracts from the meaningfulness of results produced by its data. Because the goal of PEV rates is to encourage customers to charge their vehicles during off-peak hours, the fact that PEV rate customers' peak period usage is reasonably below that of non-PEV customers indicates that the rates are not having an adverse effect on PEV customers' usage. Consequently, the EV TOU rates are achieving their goal among this group of early PEV adopters by avoiding PEV charging during the peak period.
- Table PG&E-7 shows the EV-A and EV-B customers share of off-peak usage by sector, with and without NEM, compared to the off-peak usage of PG&E's entire residential population. Consistent with performance expectations for customers on EV rates, during the study period, non-NEM customers on EV-A used an average of 12% more energy than the average PG&E residential customer and NEM customers on EV-A used 30% more energy than the residential population. Likewise non-NEM customers on EV-B used an average of 38% more energy and NEM customers on EV-B used 23% more than the residential population. Consequently, all groups met the off-peak performance expectations for their EV TOU rate by consuming more energy during this period than non-PEV customers.
- Table PG&E-8 shows the EV-A and EV-B customers share of partial peak usage by sector, with and without NEM, compared to the partial peak usage of PG&E's entire residential population. Consistent with performance expectations for customers on EV rates, during the study period non-NEM customers on EV-A used an average of 8% less energy than the average PG&E residential customer, and NEM customers on EV-A used 22% less energy than the residential population. Likewise, non-NEM customers on EV-B who used an average of 28% less energy and NEM customers on EV-B used 22% less than the residential population. Again, all groups met the performance expectations for their EV TOU rate by consuming less energy during this period than non-PEV customers.

Table PG&E-6: Share of On-Peak Usage by Tariff and Customer Type

Year	Month	Total Residential Population*	All Single Metering, excluding NEM	SF Single Metering, excluding NEM	MDU Single Metering, excluding NEM	Single Metering NEM	All Separate Metering excluding NEM	SF Separate Metering, excluding NEM	MDU Separate Metering, excluding NEM	Separate Metering NEM
2012	Sep	23%	19%	19%	17%	15%	8%	8%	8%	31%
2012	Oct	26%	16%	16%	15%	14%	6%	7%	6%	20%
2012	Nov	0%	3%	3%	3%	3%	1%	1%	1%	3%
2012	Dec	0%	0%	0%	0%	0%	0%	0%	0%	0%
2013	Jan	0%	0%	0%	0%	0%	0%	0%	0%	0%
2013	Feb	0%	0%	0%	0%	0%	0%	0%	0%	0%
2013	Mar	0%	0%	0%	0%	0%	0%	0%	0%	0%
2013	Apr	0%	3%	3%	3%	2%	1%	2%	1%	4%
2013	May	24%	14%	15%	14%	5%	6%	7%	6%	19%
2013	Jun	25%	18%	19%	17%	8%	8%	8%	8%	23%
2013	Jul	25%	19%	19%	18%	10%	7%	8%	7%	24%
2013	Aug	29%	19%	19%	18%	10%	7%	7%	7%	26%
Max		**29%**	**19%**	**19%**	**18%**	**15%**	**8%**	**8%**	**8%**	**31%**
Average		**13%**	**9%**	**9%**	**9%**	**6%**	**4%**	**4%**	**4%**	**12%**

*Load data used for the analysis are from September 2012 to August 2013.

Table PG&E-7: Share of Off-Peak Usage by Tariff and Customer Type

Year	Month	Total Residential Population*	All Single Metering, excluding NEM	SF Single Metering, excluding NEM	MDU Single Metering, excluding NEM	Single Metering NEM	All Separate Metering excluding NEM	SF Separate Metering, excluding NEM	MDU Separate Metering, excluding NEM	Separate Metering NEM
2012	Sep	43%	51%	50%	53%	67%	78%	80%	76%	49%
2012	Oct	37%	51%	50%	53%	63%	78%	79%	77%	59%
2012	Nov	42%	49%	49%	51%	57%	75%	77%	74%	56%
2012	Dec	43%	48%	48%	50%	55%	76%	81%	73%	53%
2013	Jan	39%	49%	49%	51%	58%	76%	76%	76%	54%
2013	Feb	39%	50%	50%	52%	64%	75%	73%	77%	63%
2013	Mar	38%	50%	49%	52%	68%	69%	69%	69%	81%
2013	Apr	38%	52%	52%	54%	79%	74%	75%	73%	82%
2013	May	39%	54%	53%	56%	83%	78%	81%	77%	62%
2013	Jun	39%	52%	52%	55%	80%	78%	80%	78%	57%
2013	Jul	39%	51%	51%	54%	76%	81%	82%	80%	61%
2013	Aug	35%	52%	52%	55%	77%	80%	82%	79%	61%
Max		**43%**	**54%**	**53%**	**56%**	**83%**	**81%**	**82%**	**80%**	**82%**
Average		**39%**	**51%**	**50%**	**53%**	**69%**	**77%**	**78%**	**76%**	**62%**

*Load data used for the analysis are from September 2012 to August 2013.

Table PG&E-8: Share of Partial-Peak Usage by Tariff and Customer Type

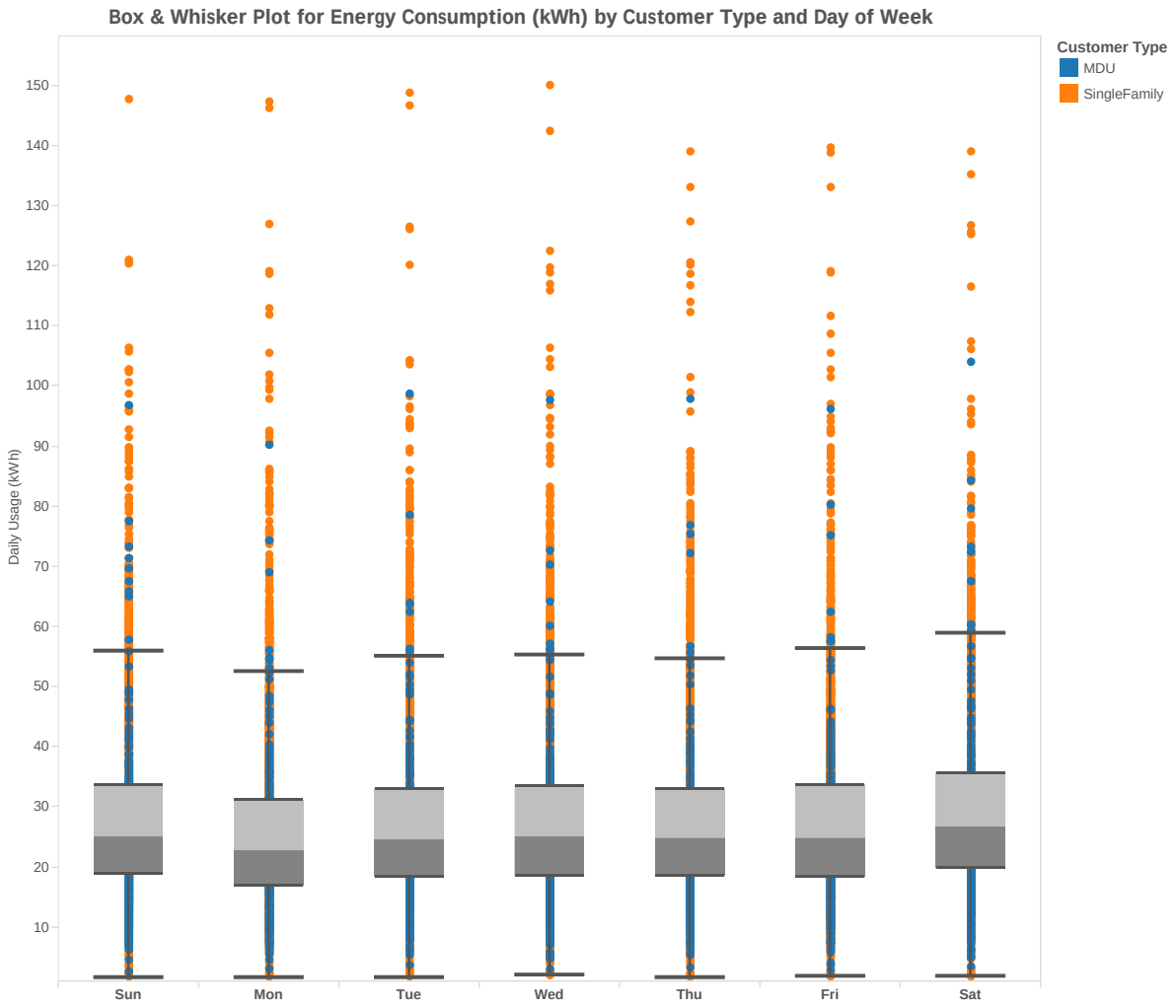
Year	Month	Total Residential Population*	All Single Metering, excluding NEM	SF Single Metering, excluding NEM	MDU Single Metering, excluding NEM	Single Metering NEM	All Separate Metering excluding NEM	SF Separate Metering, excluding NEM	MDU Separate Metering, excluding NEM	Separate Metering NEM
2012	Sep	34%	30%	30%	29%	18%	14%	11%	15%	20%
2012	Oct	37%	34%	34%	33%	23%	16%	14%	17%	21%
2012	Nov	58%	48%	48%	46%	41%	24%	22%	25%	40%
2012	Dec	57%	52%	52%	50%	45%	24%	19%	27%	47%
2013	Jan	61%	51%	51%	49%	42%	24%	24%	24%	46%
2013	Feb	61%	50%	50%	48%	36%	25%	27%	23%	37%
2013	Mar	62%	50%	51%	48%	32%	31%	31%	31%	19%
2013	Apr	62%	45%	45%	43%	19%	25%	23%	26%	14%
2013	May	37%	32%	32%	30%	12%	15%	13%	17%	19%
2013	Jun	36%	30%	30%	28%	12%	14%	12%	15%	19%
2013	Jul	36%	30%	30%	28%	14%	12%	11%	13%	16%
2013	Aug	36%	29%	29%	28%	13%	12%	10%	14%	13%
Max		**62%**	**52%**	**52%**	**50%**	**45%**	**31%**	**31%**	**31%**	**47%**
Average		**48%**	**40%**	**40%**	**38%**	**26%**	**20%**	**18%**	**20%**	**26%**

*Load data used for the analysis are from September 2012 to August 2013.

Collectively, the data show that for both EV-A and EV-B customers a smaller percentage of their usage is in on-peak and a larger percentage is in off-peak as compared to customers not on a PEV rate. Furthermore, non-NEM separately-metered EV-B customers are completing 77% of their charging in the off-peak period on average and 4% on average during the on-peak period. This suggests that customers on the PEV rates are responding to the price signal embedded in their rates and charging during the off-peak periods.

Chart PG&E-6 displays a box and whisker plot for PEV energy consumption (kWh) by customer type and data of week. The daily differentiation between consumption is minimal with the weekend (Friday to Sunday) demonstrating slightly higher usage patterns than weekdays (Monday to Thursday).

Chart PG&E-6: Box & Whisker Plot for Energy Consumption (kWh) by Customer Type and Day of Week (Sunday through Saturday)



Average Load Profiles for PEV Rates

Depicted below are the average daily load profiles for the EV-A and EV-B rate groups for each sector during the study period. The load profiles demonstrate that for all rates and sectors, high off-peak usage corresponds to the PEV rate price signals, i.e. customers are largely responding to the price signal and charging during off-peak hours (12:00am to 5:00am). This responsiveness is more clearly depicted in the data from the EV-B customers (Charts PG&E-8a and 8b) where the vast majority of the usage occurs during off-peak hours.

Chart PG&E-7a: Average Load Profile for SF Single Metering by Day of the Week

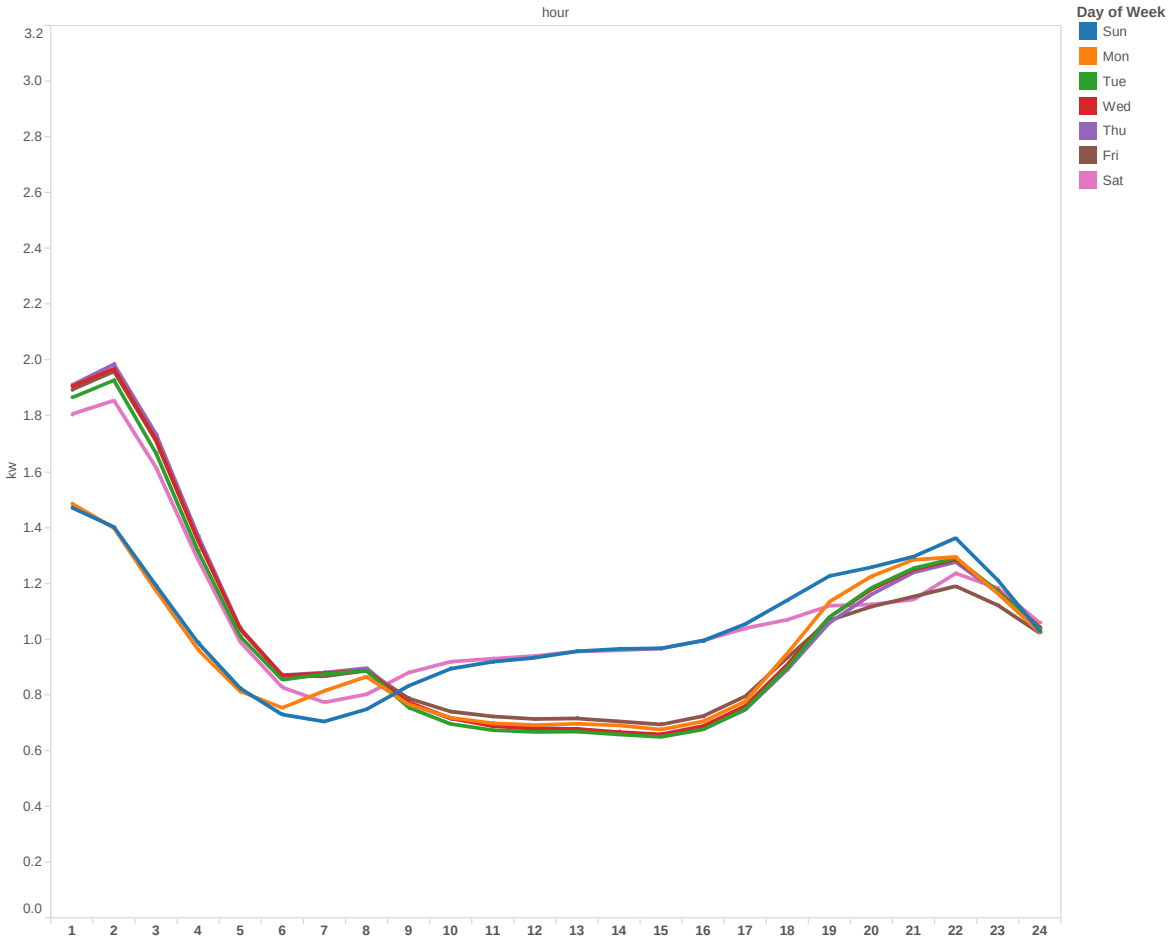


Chart PG&E-7b: Average Load Profile for MDU Single Metering by Day of the Week

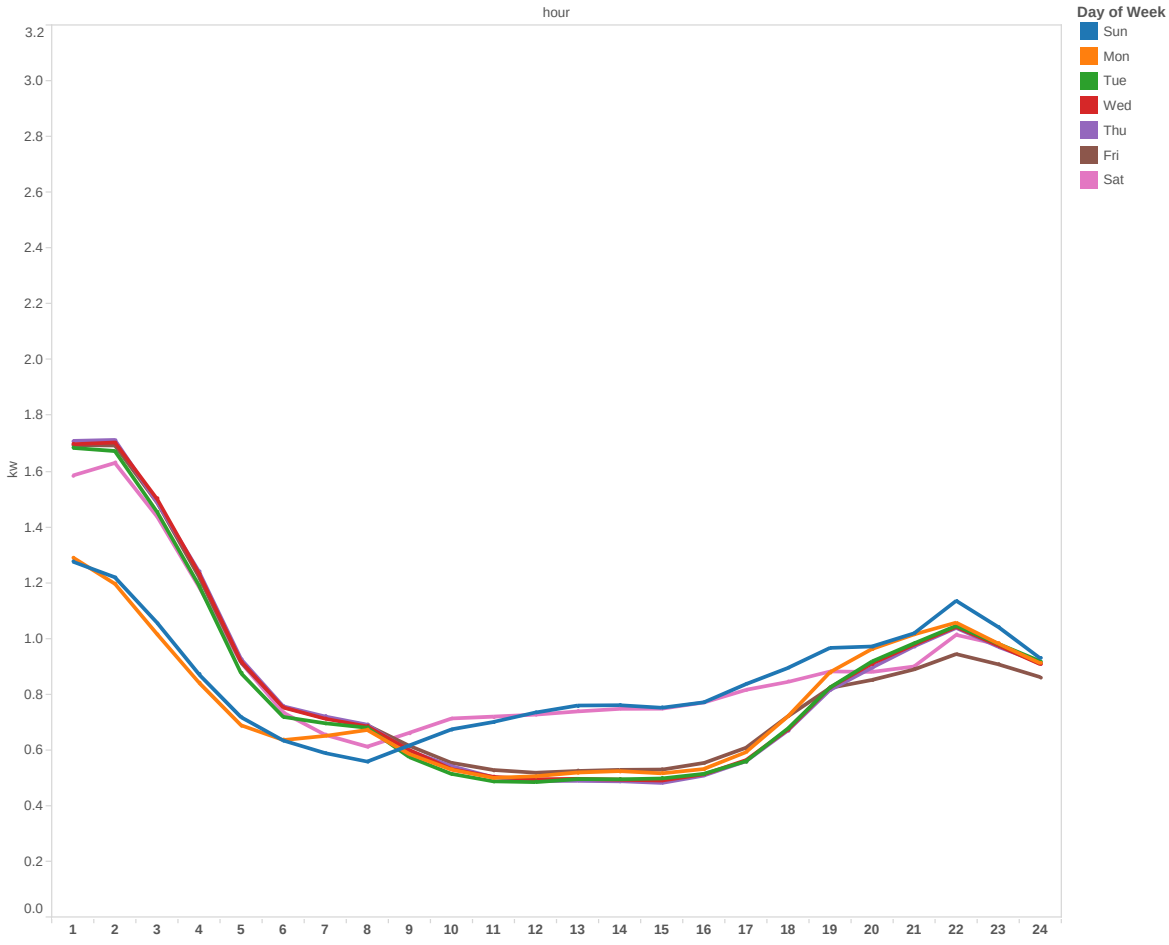


Chart PG&E-8a: Average Load Profile for SF Separate Metering by Day of the Week

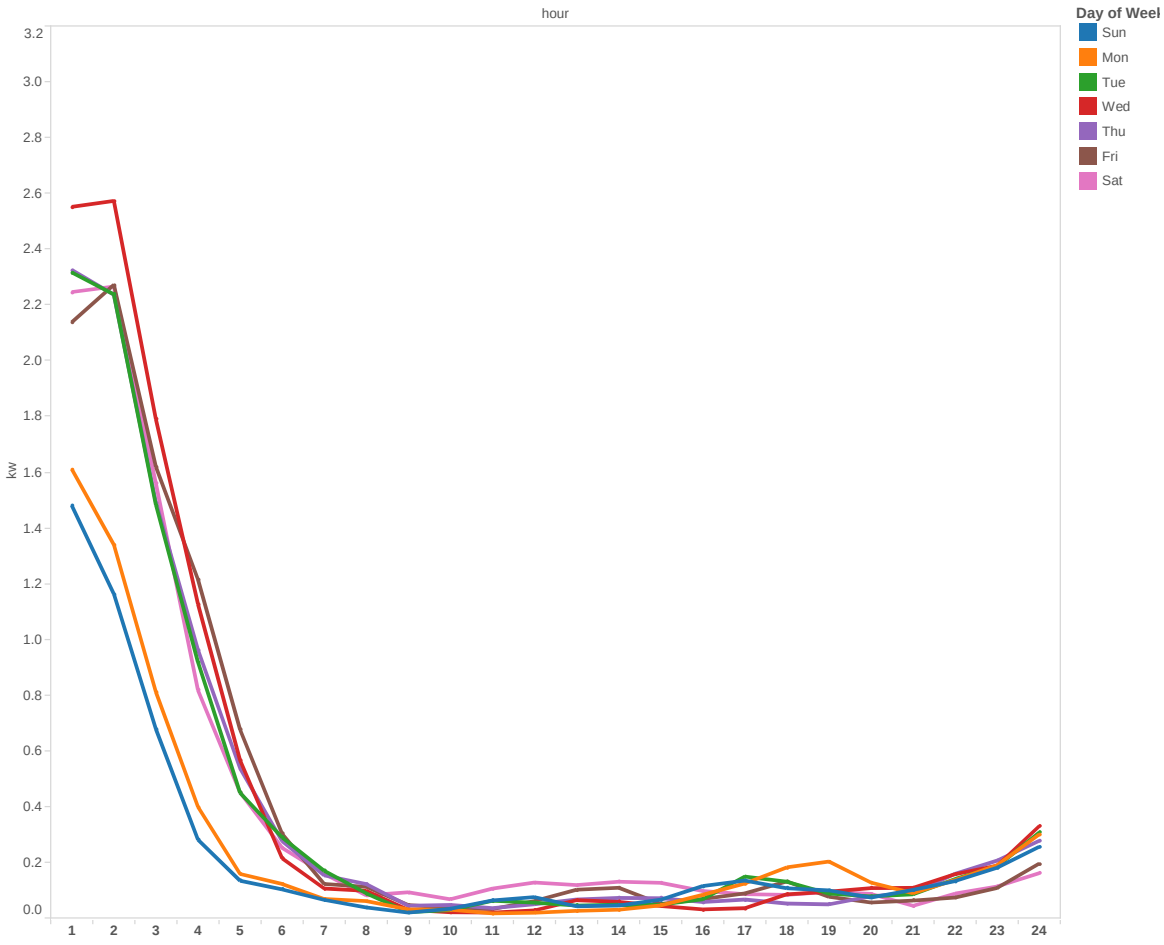


Chart PG&E-8b: Average Load Profile for MDU Separate Metering by Day of the Week

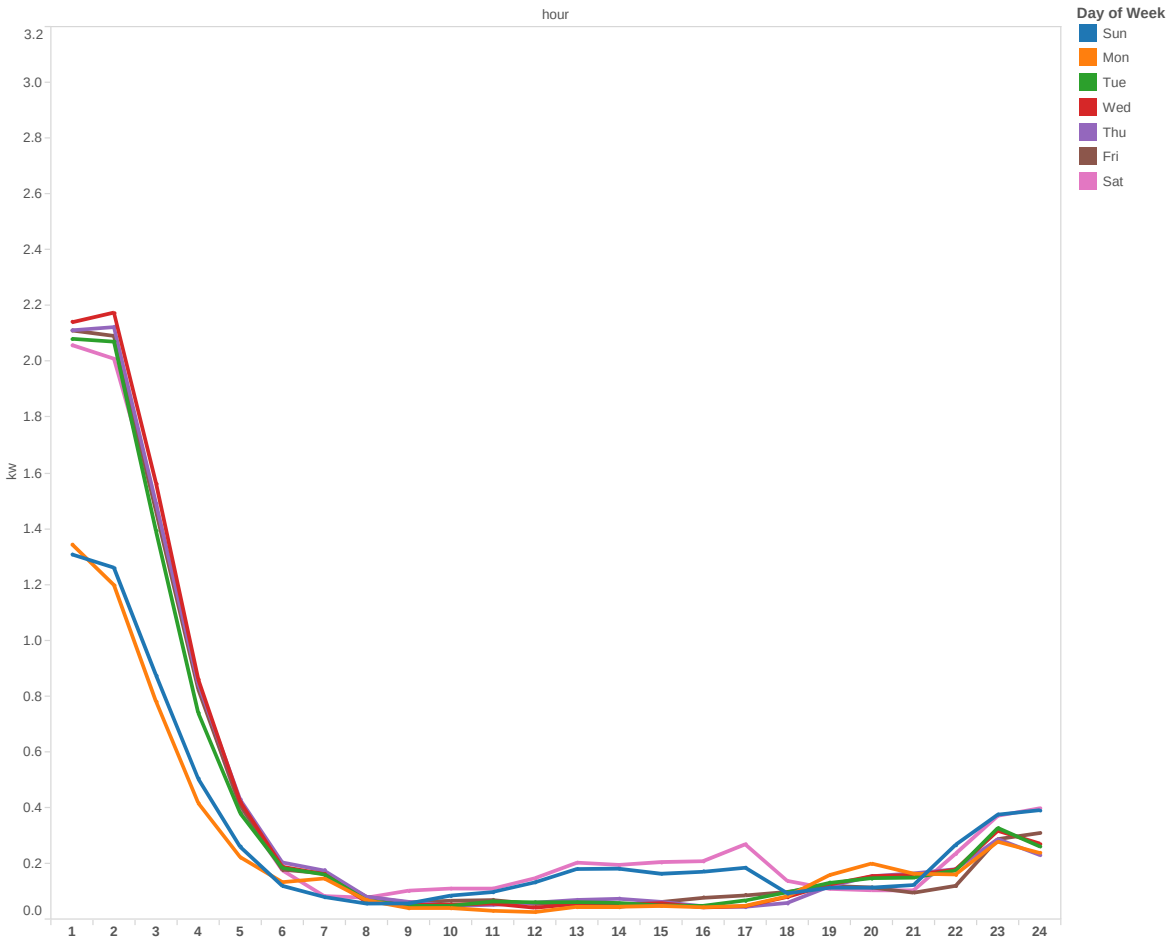


Chart PG&E-9 Average Load Profile for PEV Owners on a Non-EV Rate

Data obtained by PG&E from auto manufacturers and other sources could not be verified by the due date of this report to produce a load analysis for Chart 9 for "PEV Owners on a Non-EV Rate" from Energy Division's reporting requirements. PG&E will seek to include these data in future reports, if feasible. Consequently, the figures in this report only represent the number of PEV customers in PG&E service territory on PEV rates, not all PEV customers.

Non-Coincident Peak Load

Collectively, the data in Table PG&E-9 and Charts 10a, 10b, 11a, and 11b suggest that, despite the fact that charging is primarily occurring in the off-peak hours, the average household with a PEV will have a higher maximum demand that must be accommodated by the electric distribution system as compared to the average household without a PEV.

- Table PG&E-9 shows the monthly comparison of the average non-coincident peak for the EV-A and EV-B customer sectors and the full residential population. The average non-coincident peak was 1.68kW higher for the EV-A group category compared to the average residential peak.[43] This was 1.04kW higher for single family customers and 2.79kW higher for multi-family customers. The average non-coincident peak was 0.88kW higher for the EV-B group category compared to the average residential peak. This was 0.44kW[44] higher for single family customers only during the months of March 2013 to August 2013, and 1.85kW higher for multi-family customers throughout the study period.

- Charts PG&E-10a and 10b display the average monthly non-coincident peak loads for EV-A and EV-B customers, respectively.

- Charts PG&E-11a and 11b display the hour at which the non-coincident peak load occurred for EV-A and EV-B customers, respectively. The accompanying table provides the data points depicted in each chart.

[43] The average non-coincident peak was calculated by denoting the maximum hourly interval for each account within the month. These maximum values were then summed for each category. The average is then calculated by dividing the total by the number of customers. The average non-coincident peak is therefore an approximation of the maximum demand for customer in each stratum.

[44] This figure was calculated using only data for the SF Population and SF EV-B customers from March 2013 to August 2013 as data for the SF EV-B group were suppressed for September 2012 to February 2013 because there were less than 15 customers in the sample.

Table PG&E-9: Monthly Average Non-Coincident Peak Load (kW)

Year	Month	Residential Population*	SF Population	MDU Population	All Single Metering	SF Single Metering	MDU Single Metering	All Separate Metering	SF Separate Metering	MDU Separate Metering
2012	Sep	3.93	4.63	2.32	5.24	5.28	4.76	*4.12*	n/a**	3.46
2012	Oct	3.88	4.55	2.31	5.32	5.36	4.86	4.26	n/a	3.61
2012	Nov	3.95	4.62	2.41	5.54	5.59	4.91	*4.3*	n/a	3.53
2012	Dec	4.32	5.03	2.66	6.02	6.1	5.12	*4.21*	n/a	3.67
2013	Jan	4.16	4.81	2.65	5.81	5.88	4.98	*4.27*	n/a	3.62
2013	Feb	3.95	4.59	2.47	5.54	5.58	5.04	4.03	n/a	3.81
2013	Mar	3.97	4.61	2.47	5.63	5.68	5.14	*5.67*	*7.39*	4.74
2013	Apr	3.95	4.61	2.43	5.48	5.49	5.34	5.49	*6.35*	5
2013	May	3.85	4.52	2.29	5.52	5.53	5.4	5.38	*6.35*	4.82
2013	Jun	4.07	4.81	2.34	6.11	6.15	5.74	5.49	*6.8*	4.74
2013	Jul	4.12	4.88	2.37	6.1	6.15	5.59	6.03	*7.37*	5.22
2013	Aug	4.16	4.92	2.39	6.19	6.23	5.74	5.65	*6.46*	5.14
Average		**4.03**	**4.72**	**2.43**	**5.71**	**5.75**	**5.22**	**4.91**	**6.79**	**4.28**

* Load data used for the analysis are from September 2012 to August 2013.

** "n/a" signifies that the data were suppressed due to less than 15 customers present in the sample.

***Italicized figures signify estimates with a precision > 10%.

Chart PG&E-10a: Average Non-Coincident Peak Load (kW) for Single Metering by Customer Type by Month

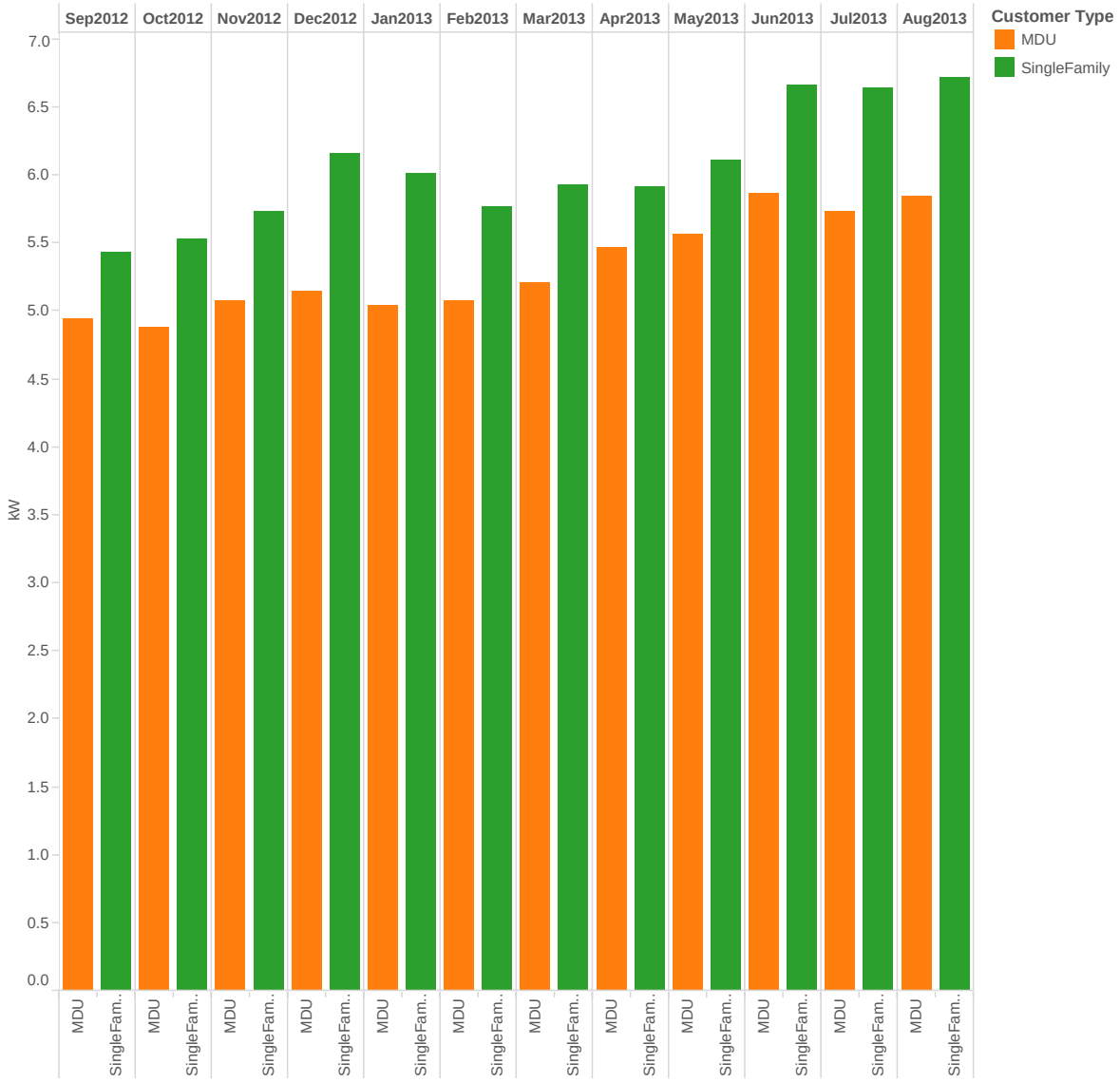


Chart PG&E-10b: Average Non-Coincident Peak Load (kW) for Separate Metering by Customer Type by Month

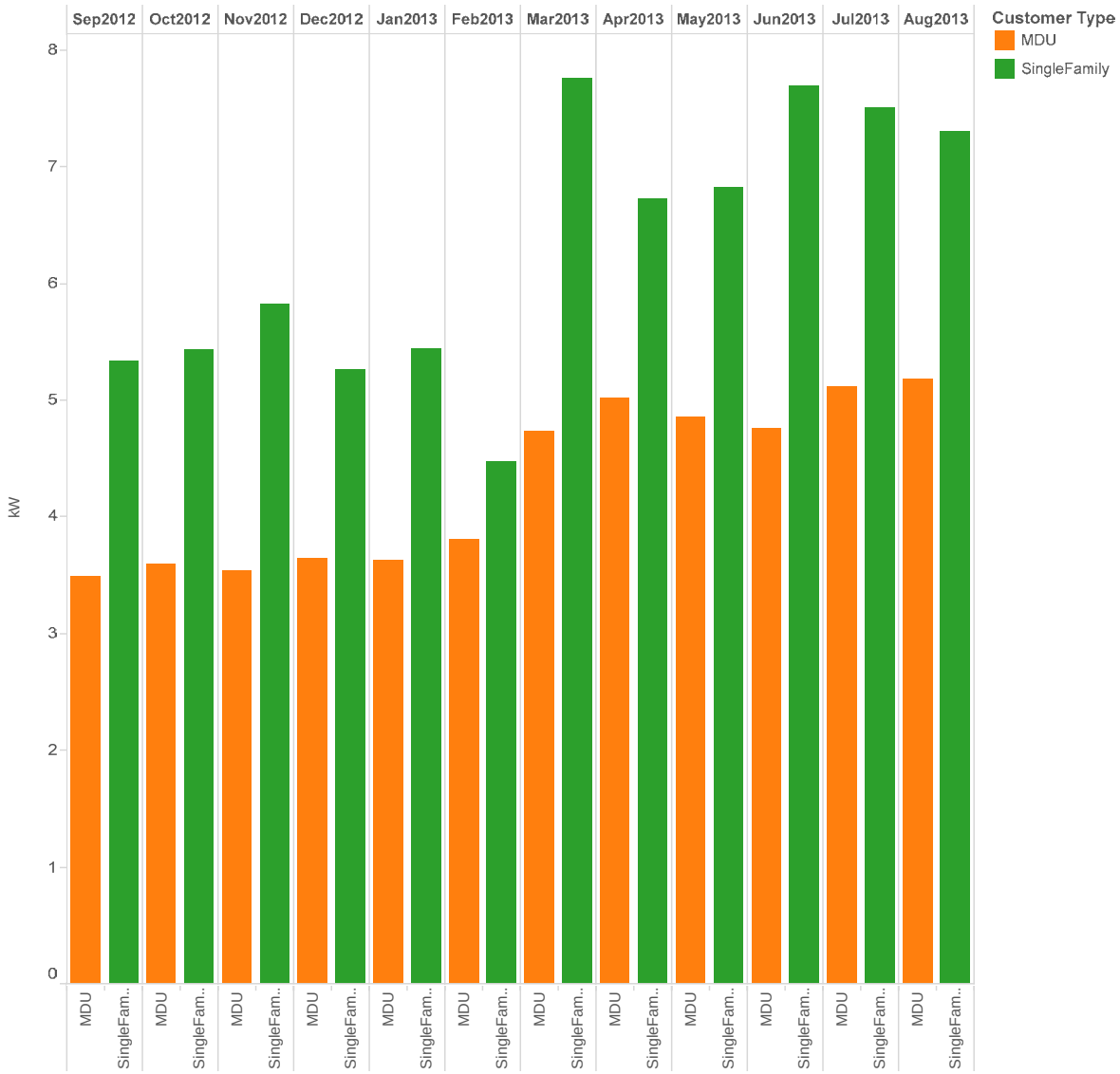


Chart PG&E-11a: Histogram of the Hour at which the Non-Coincident Peak Load Occurred for Single Metering by Customer Type

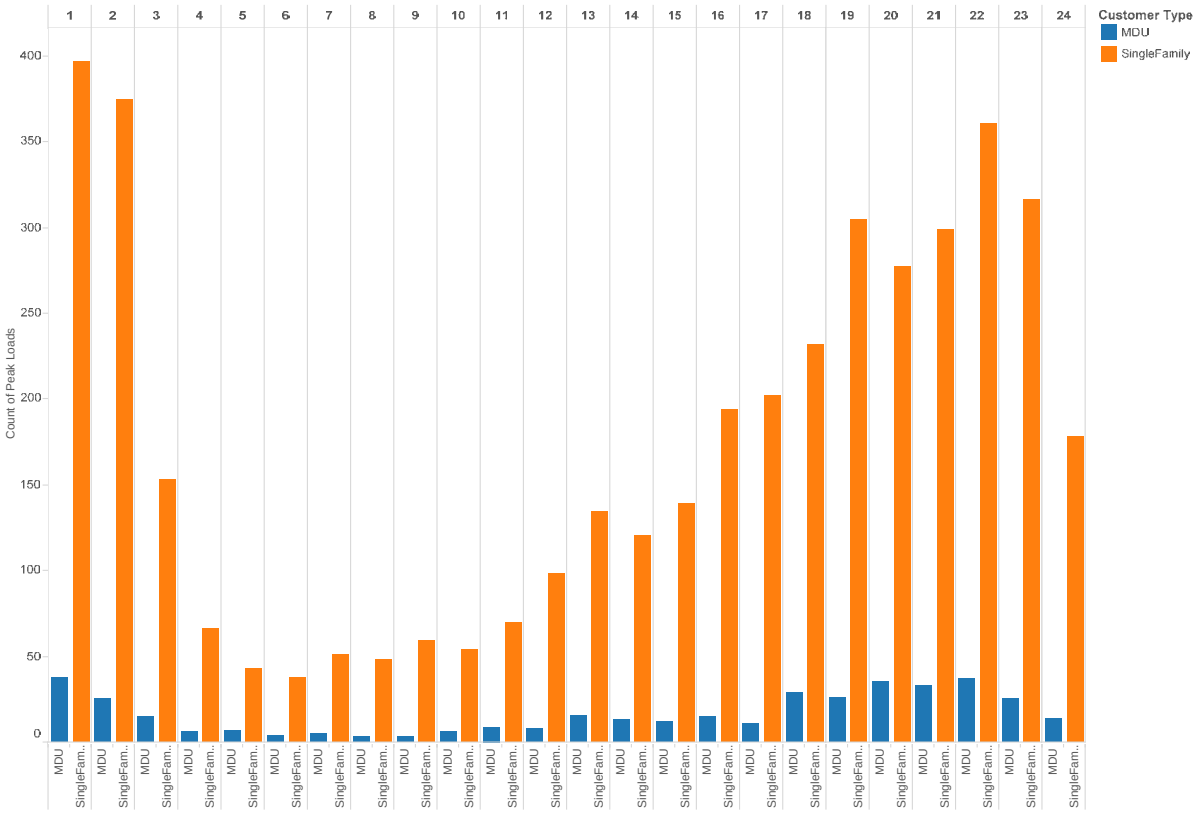
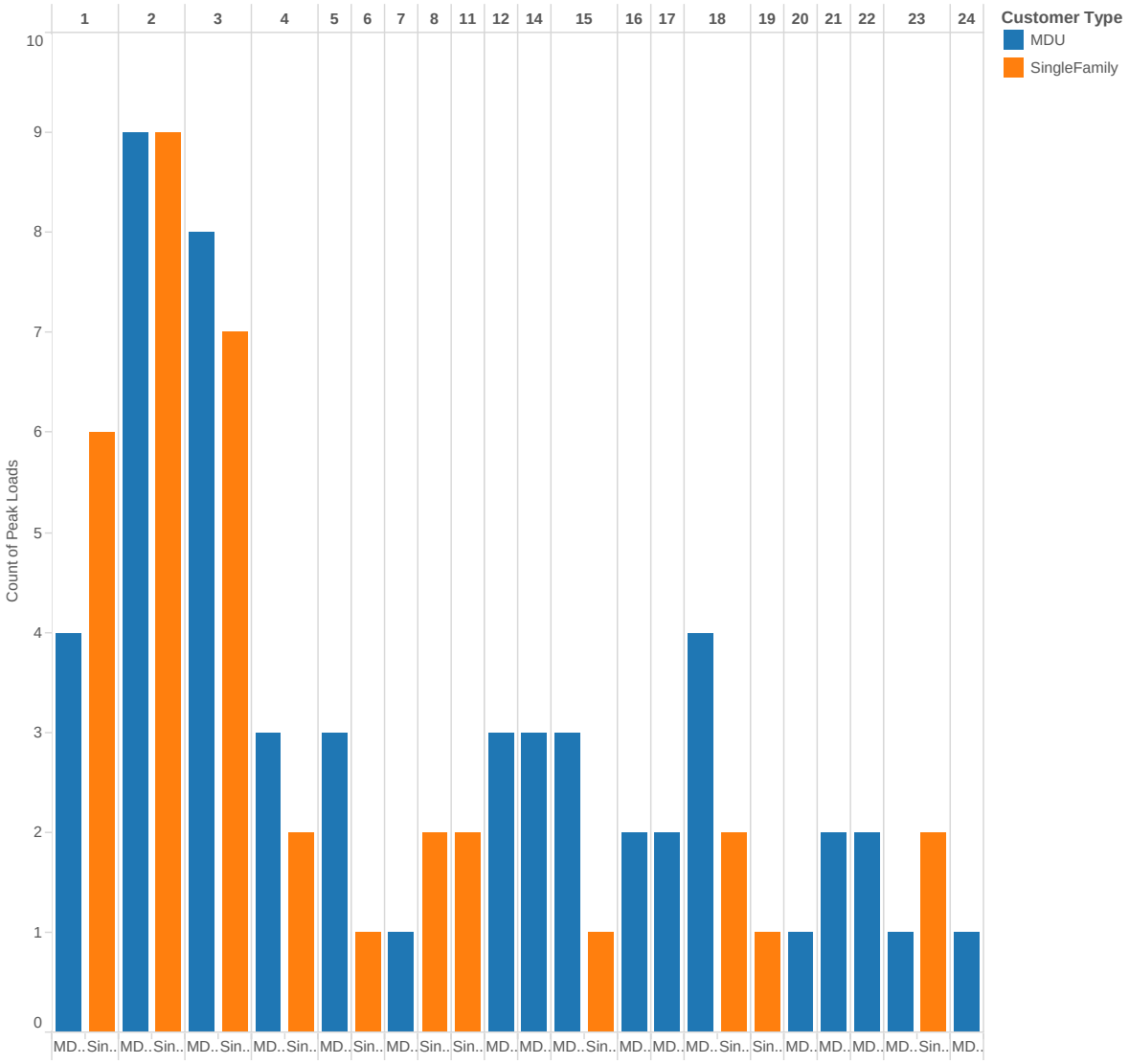


Chart PG&E-11b: Histogram of the Hour at which the Non-Coincident Peak Load Occurred for Separate Metering by Customer Type



Data Accompanying Charts PG&E 11a and 11b

Peak Hour	Residential Population	SF Pop	MDU Pop	All Single Metering	SF Single Metering	MDU Single Metering	All Separate Metering	SF Separate Metering	MDU Separate Metering
1	1%	1%	1%	9%	9%	10%	11%	17%	8%
2	1%	1%	1%	9%	9%	6%	21%	26%	17%
3	1%	0%	1%	4%	4%	4%	17%	20%	15%
4	1%	1%	1%	2%	2%	2%	6%	6%	6%
5	0%	0%	1%	1%	1%	2%	3%	0%	6%
6	1%	0%	1%	1%	1%	1%	1%	3%	0%
7	2%	2%	2%	1%	1%	1%	1%	0%	2%
8	2%	2%	3%	1%	1%	1%	2%	6%	0%
9	2%	2%	3%	1%	1%	1%	0%	0%	0%
10	4%	3%	4%	1%	1%	2%	0%	0%	0%
11	3%	4%	3%	2%	2%	2%	2%	6%	0%
12	4%	4%	4%	2%	2%	2%	3%	0%	6%
13	4%	4%	4%	3%	3%	4%	0%	0%	0%
14	4%	4%	4%	3%	3%	3%	3%	0%	6%
15	5%	5%	4%	3%	3%	3%	5%	3%	6%
16	5%	5%	6%	5%	5%	4%	2%	0%	4%
17	7%	8%	6%	5%	5%	3%	2%	0%	4%
18	10%	10%	10%	6%	6%	7%	7%	6%	8%
19	12%	12%	12%	7%	7%	7%	1%	3%	0%
20	11%	12%	10%	7%	7%	9%	1%	0%	2%
21	9%	8%	9%	7%	7%	8%	2%	0%	4%
22	6%	6%	7%	9%	9%	9%	2%	0%	4%
23	4%	4%	4%	7%	8%	6%	3%	6%	2%
24	2%	2%	2%	4%	4%	4%	1%	0%	2%

Diversified Peak Load

The time of diversified peak load gives the time that the group peaks as a whole. The time of diversified (or group) peak load is generally the same for all categories of EV-A and EV-B customers. Table PG&E-10 shows that the diversified peak load occurs between midnight and 2:00 am for all categories in all months for both rates. This suggests that this early adopter group of customers on the PEV rates are charging during the off-peak periods thereby achieving the intent of the rate designs.

Table PG&E-10: Time and Associated Demand of Diversified Peak Load – Entire Residential Population

Year	Month	Residential Population Demand*	Residential Population Hour	SF Population Demand	SF Population Hour	MDU Population Demand	MDU Population Hour
2012	Sep	1.21	21	1.43	21	0.72	20
2012	Oct	1.32	20	1.57	20	0.75	20
2012	Nov	1.1	19	1.29	19	0.68	19
2012	Dec	1.34	20	1.57	20	0.81	21
2013	Jan	1.34	20	1.55	20	0.85	20
2013	Feb	1.18	20	1.37	20	0.74	19
2013	Mar	1.18	21	1.37	21	0.75	21
2013	Apr	1.07	21	1.25	21	0.66	21
2013	May	1.12	21	1.31	21	0.67	21
2013	Jun	1.43	18	1.73	18	0.73	19
2013	Jul	1.45	20	1.76	20	0.76	22
2013	Aug	1.54	19	1.86	19	0.79	19

Table PG&E-10 (cont'd): Time and Associated Demand of Diversified Peak Load – Single Meter EV

Year	Month	Single Metering Demand	Single Metering Hour	SF Single Metering Demand	SF Single Metering Hour	MDU Single Metering Demand	MDU Single Metering Hour
2012	Sep	2.09	2	2.12	2	1.9	2
2012	Oct	2.06	2	2.09	2	1.73	2
2012	Nov	2.14	2	2.18	2	1.91	1
2012	Dec	2.23	2	2.26	2	1.97	1
2013	Jan	2.17	2	2.2	2	2	1
2013	Feb	2.08	2	2.11	2	1.78	1
2013	Mar	2.04	2	2.07	2	1.8	2
2013	Apr	2.16	2	2.17	2	2.05	2
2013	May	2.26	2	2.3	2	1.99	1
2013	Jun	2.25	2	2.29	2	2.01	2
2013	Jul	2.32	1	2.34	1	2.1	2
2013	Aug	2.26	2	2.28	2	2.09	2

Table PG&E-10 (cont'd): Time and Associated Demand of Diversified Peak Load – Separate Meter EV

Year	Month	Separate Metering Demand	Separate Metering Hour	SF Separate Metering Demand	SF Separate Metering Hour	MDU Separate Metering Demand	MDU Separate Metering Hour
2012	Sep	3.18	1	n/a**	n/a	2.88	2
2012	Oct	2.76	1	n/a	n/a	2.63	2
2012	Nov	*2.45*	*1*	n/a	n/a	*2.29*	*1*
2012	Dec	*2.89*	*1*	n/a	n/a	*2.51*	*2*
2013	Jan	*2.92*	*1*	n/a	n/a	*2.69*	*2*
2013	Feb	*2.71*	*2*	n/a	n/a	*2.96*	*2*
2013	Mar	*2.51*	*2*	*3.29*	*2*	*2.67*	*2*
2013	Apr	*3.15*	*2*	*4.05*	*2*	*2.8*	*1*
2013	May	*3.22*	*2*	*4.11*	*2*	*2.94*	*2*
2013	Jun	*3.3*	*1*	*3.87*	*2*	*3.19*	*1*
2013	Jul	*3.54*	*2*	*5.03*	*2*	*3.13*	*1*
2013	Aug	*3.33*	*2*	*4.21*	*2*	*2.78*	*1*

* Load data used for the analysis are from September 2012 to August 2013.

**"n/a" signifies that the data were suppressed due to less than 15 customers present in the sample.

*** Italicized figures are estimates with a precision > 10%.

Taken together, Table PG&E-10 and Data Accompanying Charts PG&E 11a and 11b suggest that although the early adopter PEV customers may have a higher average maximum demand, those customers on the PEV rates tend to hit their maximum demand while non-PEV customers are at their lowest usage. Thus, there is a diversity benefit created by the TOU rates. However, at the most local service assessment level perspective (i.e. a single household or set of households serviced by a single transformer), the value of this diversity is limited by the fact that the distribution system must still be prepared to accommodate PEV charging during the peak period since these customers can, and occasionally do, charge during those times.

Average Load Coincident with System Peak

The average load coincident with system peak is the average load occurring at the same time that the system peak occurs. The system peak days and times were used to extract the appropriate hourly load at the time of system peak. The average group load coincident with system peak was calculated taking the total group load and dividing by the number of customers.

The average load coincident with system peak amongst the general population is very similar to that of each EV-A category (See Table PG&E – 11). This suggests that, for this particular group of early adopters, customers on a PEV rate are not doing a substantial amount of charging during the on-peak period.

Table PG&E-11: Average Load Coincident with System Peak (kW/customer)

Year	Month	Residential Population*	SF Population	MDU Population	All Single Metering	SF Single Metering	MDU Single Metering	All Separate Metering	SF Separate Metering	MDU Separate Metering
2012	Sep	1	1.17	0.59	0.78	0.81	0.55	*0.15*	n/a**	*0.05*
2012	Oct	1.14	1.36	0.64	1.1	1.11	1	*0.1*	n/a	*0.06*
2012	Nov	0.81	0.93	0.52	0.99	1.02	0.66	*0.01*	n/a	*0.01*
2012	Dec	1.3	1.52	0.78	1.62	1.66	1.22	*0.02*	n/a	*0.03*
2013	Jan	1.06	1.22	0.7	1.54	1.57	1.21	*0.29*	n/a	*0.44*
2013	Feb	1.09	1.24	0.72	1.39	1.41	1.13	*0.13*	n/a	*0.18*
2013	Mar	0.98	1.13	0.64	1.26	1.29	0.89	*0.09*	*0.04*	*0.11*
2013	Apr	1.01	1.18	0.6	0.8	0.81	0.73	*0.09*	*0.13*	*0.06*
2013	May	0.96	1.13	0.56	0.69	0.7	0.57	*0.04*	*0.05*	*0.04*
2013	Jun	1.43	1.73	0.71	1.31	1.33	1.1	*0*	*0*	*0*
2013	Jul	1.36	1.63	0.73	1.3	1.32	0.99	*0.02*	*0*	*0.03*
2013	Aug	1.39	1.69	0.7	1.21	1.23	0.98	*0.08*	*0.01*	*0.13*

* Load data used for the analysis are from September 2012 to August 2013.

**"n/a" signifies that the data were suppressed due to less than 15 customers present in the sample.

***Italicized figures are estimates with a precision > 10%.

Geographic Concentration of PEVs

The following tables and figures illustrate the geographic concentrations of PEVs in PG&E's service territory. Tables PG&E-12a & 12b as well as Figure PG&E-2 demonstrate that PEV customers are predominantly located in the San Francisco Bay Area and Central Coast (California Energy Commission Climate Zones 3 and 4[45]). Furthermore, dual participating NEM and PEV rate customers are highly concentrated in the Bay Area per Figure PG&E-3.

Table PG&E-12a: Geographic Concentration of PEVs by Climate Zone

Climate Zone	% Single Metering	% Separate Metering	%Residential Population
Z01	0%	0%	1%
Z02	6%	5%	8%
Z03	40%	38%	31%
Z04	33%	32%	14%
Z05	1%	0%	3%
Z06	0%	0%	0%
Z09	0%	0%	0%
Z11	1%	2%	7%
Z12	15%	20%	21%
Z13	1%	2%	13%
Z16	0%	0%	1%
Total	100%	100%	100%

Table PG&E-12b: Geographic Concentration of PEVs (Top 5 Zip Codes by Rate)

Rate	Zip Code	Customers	% Total
Single Meter	94539	155	2.90%
	95014	132	2.50%
	95120	119	2.20%
	95070	114	2.10%
	94025	102	1.90%
Separate Meter	94022	9	4.30%
	94010	7	3.30%
	94024	7	3.30%
	95014	6	2.80%
	94087	5	2.40%

[45] California Energy Commission (2013). California Building Climate Zones with 2012 Zip Codes. Retrieved from: http://www.energy.ca.gov/maps/renewable/Climate_Zones_Zipcode.pdf

Figure PG&E-2: Electric Vehicles on EV Rates in the PG&E Service Territory as of August 2013 – Single (EV-A) vs. Separate (EV-B) Meter

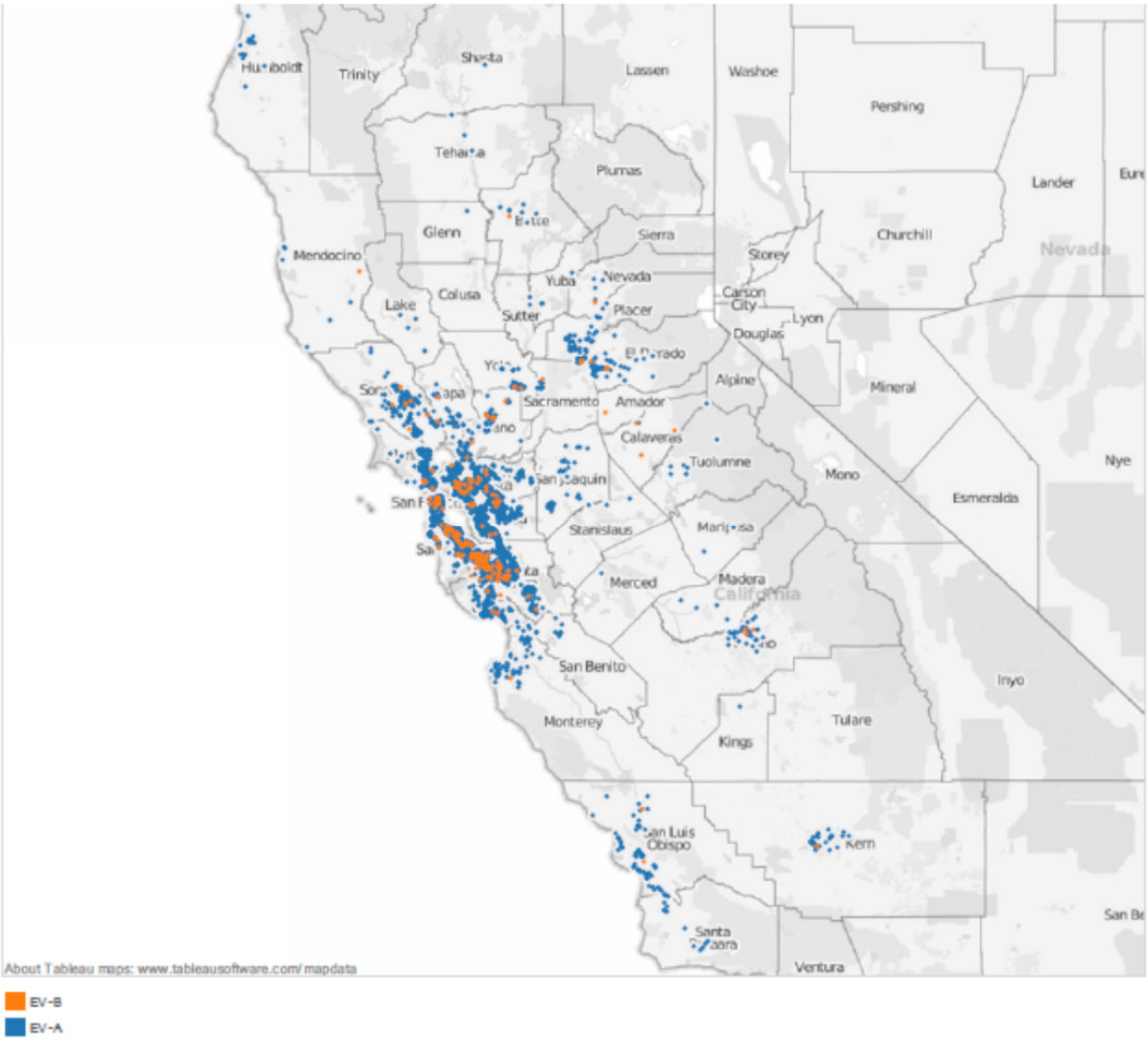
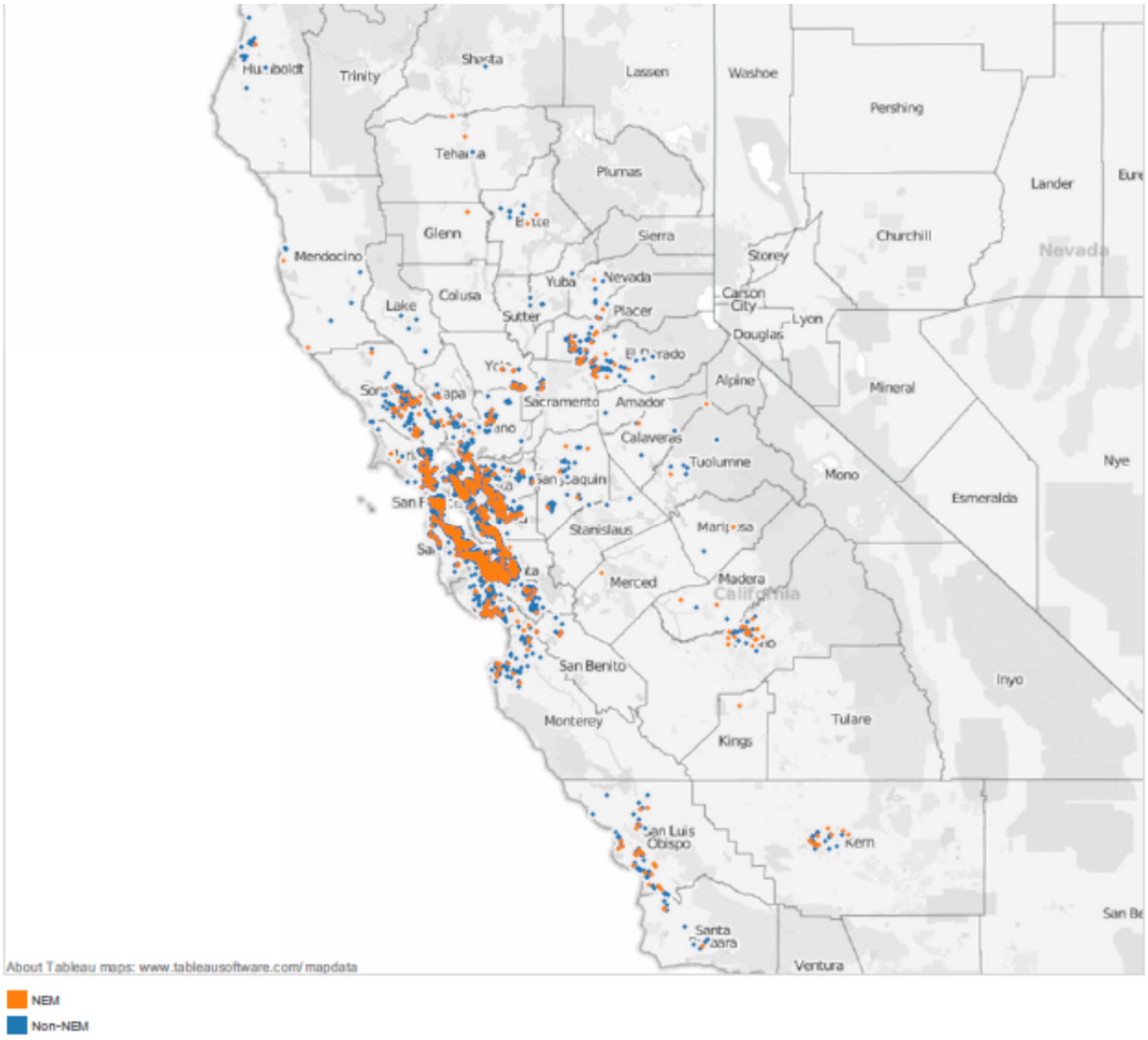


Figure PG&E-3: Electric Vehicles on EV Rates in the PG&E Service Territory as of August 2013 – NEM vs. Non-NEM



Southern California Edison

SCE currently offers residential[46] customers two rates designed with the charging of PEVs in mind. Both of these rates are time-of-use (TOU) rates which offer different pricing depending on the time of day electricity is used. One rate, TOU-D-TEV, is based on a single meter for residential customers who wish to meter both their regular household load and their PEV load with the same meter. The second rate option, TOU-EV-1, requires a separate meter to discretely measure PEV charging. Residential PEV customers also have the option of remaining on their current rate, likely the Schedule D (domestic rate plan). SCE believes the majority of the PEV owners in their service territory choose to remain on the domestic rate plan.

Single-Metered Whole House Rate

The single-metered TOU-D-TEV rate plan uses baseline allocations and a tiered structure similar to the standard residential rate. Currently, this plan has two pricing tiers whereas the standard residential rate has four tiers. As with the standard rate plan, the price per kilowatt hour (kWh) increases as pre-determined thresholds of consumption during that billing period are surpassed and the next tier is reached. With this rate plan, rates change seasonally. These prices and factors are represented in Table SCE – 1a. This rate offers energy prices for different TOU periods and includes an off-peak period where generation and distribution charges have been set near their marginal cost floor levels. The structure of the single meter TOU periods are defined as follows:[47]

On-peak	10:00 a.m. - 6:00 p.m., weekdays all year, except holidays.
Off-peak	12:00 (midnight) - 6:00 a.m., daily
Mid-peak	All other hours.

It should be noted that the TOU-D-TEV rate will potentially see significant changes in 2014 as SCE recently proposed rate revision as part of the 2013 Rate Design Window (RDW) application[48] as ordered in D.11-07-029. The implementation of these changes is pending decision by the California Public Utilities Commission. In the proposed future structure, the two tiers will be eliminated and the TOU periods would change.

Because of the current tiered structure of the single-metered PEV rate, the price during any given hour of the day will depend on the previous amount of consumption during the current billing period. The

[46] SCE also offers two PEV TOU rates for commercial customers: TOU-EV-3 and TOU-EV-4. As of the beginning of August 2013, there were 12 TOU-EV-3 accounts and 26 TOU-EV-4 accounts.

[47] The language of SCE's TOU-D-TEV tariff identifies the off-peak period as "super off-peak" and the mid-peak as "off-peak". In this report the more conventional on-, mid- and off-peak nomenclature is used.

[48] 2013 Rate Design Window application (Proceeding: A1312015) http://docs.cpuc.ca.gov/SearchRes.aspx?DocFormat=ALL&DocID=84187517

tiers of the TOU-D-TEV rate are denoted as Level I and Level II which correspond to the tiers in the regular domestic rate; Tiers 1 and 2 of the domestic rate are collapsed into Level I and Tiers 3 and 4 into Level II.

Table SCE – 1a: Single Meter (TOU-D-TEV) Tariff ($/kWh)

Clock	Winter				Summer			
Hour	Weekday		Weekend		Weekday		Weekend	
Ending	Level I	Level II	Level I	Level II	Level I	Level II	Level I	Level II
1	0.1	0.1	0.1	0.1	0.09	0.09	0.09	0.09
2	0.1	0.1	0.1	0.1	0.09	0.09	0.09	0.09
3	0.1	0.1	0.1	0.1	0.09	0.09	0.09	0.09
4	0.1	0.1	0.1	0.1	0.09	0.09	0.09	0.09
5	0.1	0.1	0.1	0.1	0.09	0.09	0.09	0.09
6	0.1	0.1	0.1	0.1	0.09	0.09	0.09	0.09
7	0.11	0.29	0.11	0.29	0.12	0.31	0.12	0.31
8	0.11	0.29	0.11	0.29	0.12	0.31	0.12	0.31
9	0.11	0.29	0.11	0.29	0.12	0.31	0.12	0.31
10	0.11	0.29	0.11	0.29	0.12	0.31	0.12	0.31
11	0.16	0.35	0.11	0.29	0.28	0.47	0.12	0.31
12	0.16	0.35	0.11	0.29	0.28	0.47	0.12	0.31
13	0.16	0.35	0.11	0.29	0.28	0.47	0.12	0.31
14	0.16	0.35	0.11	0.29	0.28	0.47	0.12	0.31
15	0.16	0.35	0.11	0.29	0.28	0.47	0.12	0.31
16	0.16	0.35	0.11	0.29	0.28	0.47	0.12	0.31
17	0.16	0.35	0.11	0.29	0.28	0.47	0.12	0.31
18	0.16	0.35	0.11	0.29	0.28	0.47	0.12	0.31
19	0.11	0.29	0.11	0.29	0.12	0.31	0.12	0.31
20	0.11	0.29	0.11	0.29	0.12	0.31	0.12	0.31
21	0.11	0.29	0.11	0.29	0.12	0.31	0.12	0.31
22	0.11	0.29	0.11	0.29	0.12	0.31	0.12	0.31
23	0.11	0.29	0.11	0.29	0.12	0.31	0.12	0.31
24	0.11	0.29	0.11	0.29	0.12	0.31	0.12	0.31

Table SCE – 2a: Single-Metered PEV Rate (TOU-D-TEV) Price Ratios

	Summer	Winter
	On-peak : Mid-peak : Off-peak	On-peak : Mid-peak : Off-peak
Level I	3.0 : 1.3 : 1.0	1.6 : 1.0 : 1.0
Level II	5.0 : 3.3 : 1.0	3.4 : 2.9 : 1.0

Separately-Metered PEV Rate

The TOU-EV-1 rate is designed for residential customers who have a separate meter exclusively for PEV charging. Therefore, the TOU-EV-1 rate only reflects the customer's charging load. The second meter is provided and installed at no additional cost, however the home's electrical infrastructure needs to be upgraded with a second panel and wiring to the charging location. Any costs related to the changes to the home's electrical infrastructure are the responsibility of the customer. For this rate plan, lower rates apply during off-peak hours of 9:00 p.m. to 12:00 noon, and rates change seasonally. For usage between noon and 9 p.m., rates are higher in summer. The following are the TOU periods for the separately-metered rate:

On-peak	12:00 noon – 9:00 p.m., daily
Off-peak	All other hours.

Table SCE – 1b: Separate Meter (TOU-EV-1) Tariff ($/kWh)

Clock Hour Ending	Winter Weekday	Winter Weekend	Summer Weekday	Summer Weekend
1	0.11	0.11	0.11	0.11
2	0.11	0.11	0.11	0.11
3	0.11	0.11	0.11	0.11
4	0.11	0.11	0.11	0.11
5	0.11	0.11	0.11	0.11
6	0.11	0.11	0.11	0.11
7	0.11	0.11	0.11	0.11
8	0.11	0.11	0.11	0.11
9	0.11	0.11	0.11	0.11
10	0.11	0.11	0.11	0.11
11	0.11	0.11	0.11	0.11
12	0.11	0.11	0.11	0.11
13	0.23	0.11	0.33	0.11
14	0.23	0.11	0.33	0.11
15	0.23	0.11	0.33	0.11
16	0.23	0.11	0.33	0.11
17	0.23	0.11	0.33	0.11
18	0.23	0.11	0.33	0.11
19	0.23	0.11	0.33	0.11
20	0.23	0.11	0.33	0.11
21	0.23	0.11	0.33	0.11
22	0.11	0.11	0.11	0.11
23	0.11	0.11	0.11	0.11
24	0.11	0.11	0.11	0.11

Table SCE – 2b: Separately-Metered PEV Rate (TOU-EV-1) Price Ratios

Summer On-peak : Off-peak	Winter On-peak : Off-peak
3.1 : 1.0	2.1 : 1.0

Per guidelines provided by Energy Division staff, this report differentiates two customer types: single family (SF) and Multiple Dwelling Units (MDU). Some load profile and demand metrics for the average residential customer are also provided to serve as a comparison to the single-metered PEV customers. This data is derived from SCE's 2012 Domestic Rate Group Load Study.

There are a relatively small number of PEV owners even though this number has been steadily increasing in size. As such, these customers are still considered early adopters and it is likely that this group shares unique characteristics distinct from the general population.

Program Enrollment

One characteristic which may impact usage patterns and load shape is the relatively high percentage of Net Energy Metering (NEM) participants among PEV owners on a TOU tariff. During the study period, NEM customers comprised between 25%-31% of the single-metered group as shown in Table SCE 3a. While the number of NEM customers has continued to grow, it has not grown as fast as the adoption of the TOU-D-TEV plan. This has resulted in a small decrease in the percentage of NEM participants on this rate.

Table SCE 3a: NEM Program Enrollment for Single Metering by Customer Type

Month	NEM Customers with Single Metering	NEM as % Single Metering	NEM as % SF Single Metering	NEM as % MDU Single Metering
Sep. 2012	254	31%	33%	18%
Oct. 2012	263	29%	32%	18%
Nov. 2012	293	29%	31%	16%
Dec. 2012	325	28%	31%	16%
Jan. 2013	353	28%	30%	16%
Feb. 2013	387	27%	30%	15%
Mar. 2013	410	27%	29%	15%
Apr. 2013	447	27%	29%	15%
May 2013	487	27%	29%	14%
Jun. 2013	532	26%	29%	14%
Jul. 2013	573	26%	28%	14%
Aug. 2013	614	25%	28%	13%

Table 4: DR Program Enrollment for Single Metering by Customer Type

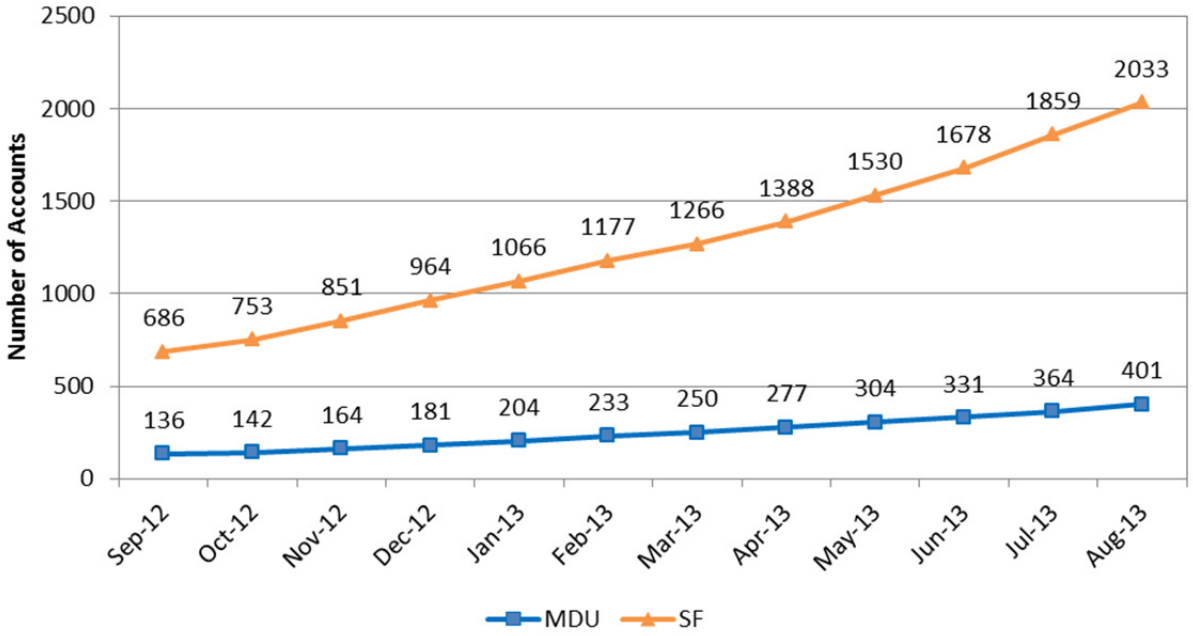
Month	DR Customers with Single Metering	DR as % Single Metering	DR as % SF Single Metering	DR as % MDU Single Metering
Sep. 2012	167	20%	22%	12%
Oct. 2012	189	21%	23%	12%
Nov. 2012	211	21%	22%	13%
Dec. 2012	243	21%	23%	14%
Jan. 2013	264	21%	22%	14%
Feb. 2013	295	21%	22%	14%
Mar. 2013	305	20%	21%	14%
Apr. 2013	328	20%	21%	13%
May 2013	347	19%	20%	12%
Jun. 2013	387	19%	21%	13%
Jul. 2013	422	19%	20%	12%
Aug. 2013	465	19%	20%	13%

NEM and Demand Response (DR) are associated with the energy use of the whole house and as such are attached to the meter recording the whole house usage, therefore there are no separately-metered (TOU-EV-1) NEM and DR customers (i.e., Table 3b: NEM Program Enrollment by Separate Metering and Table 5: DR Program Enrollment by Separate Metering are not applicable).

Number of PEV Time-of-Use Accounts

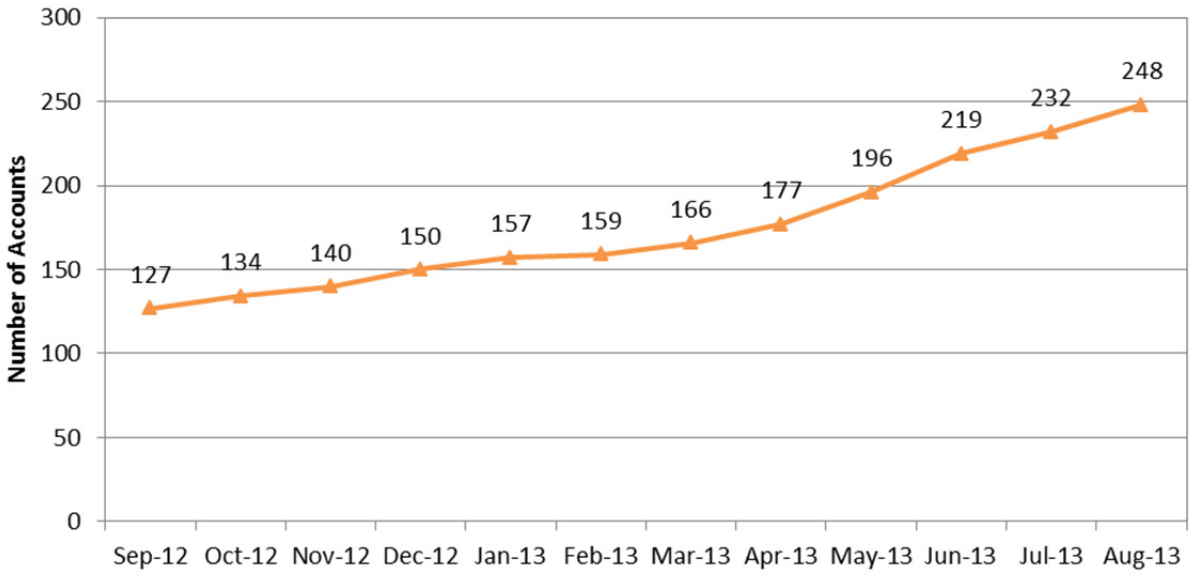
Chart SCE – 1 shows the number of accounts at the beginning of each month. There was a constant growth in the number accounts of both customer types with single-metered household load over the period studied. The number of single-metered accounts in aggregate increased about 200% from September 2012 to August 2013.

Chart SCE – 1: Single Meter (TOU-D-TEV) - Number of Accounts by Customer Type at the Beginning of Each Month



During the study period, SCE observed an increase in the number of separately-metered accounts. While single-metered accounts grew by almost 200%, the number of accounts with an additional separate meter increased nearly 100% from the first month of the study period (See Chart SCE – 2). From September 2012 to August 2013 the percent of separately-metered PEV, TOU accounts dropped from about 15% to 10% of all PEV, TOU accounts.

Chart SCE – 2: Separate Meter (TOU-EV-1) - Number of Accounts at the Beginning of Each Month



Average Monthly Usage for TOU Accounts with a PEV

For each month, the average monthly usage for both customer types with single-metered household load was computed. As expected, multi-family customers have lower average monthly usage compared to single-family units. Both customer types exhibit average usage which increases from May through the summer and begins tapering in October; the usage is roughly 30% greater in September than in April. Because it is an aggregate household load of which the majority is not the result of a PEV, this effect likely reflects seasonal demands of the household.

The average monthly usage is quite high for both the single- and multi-family customers and increases only very slightly when NEM accounts are excluded. Average monthly usage of the NEM accounts would need to significantly differ in order for those accounts to impact the general group averages.

Chart SCE – 3: Single Meter (TOU-D-TEV) – Average Monthly Usage (kWh) by Customer Type with NEM

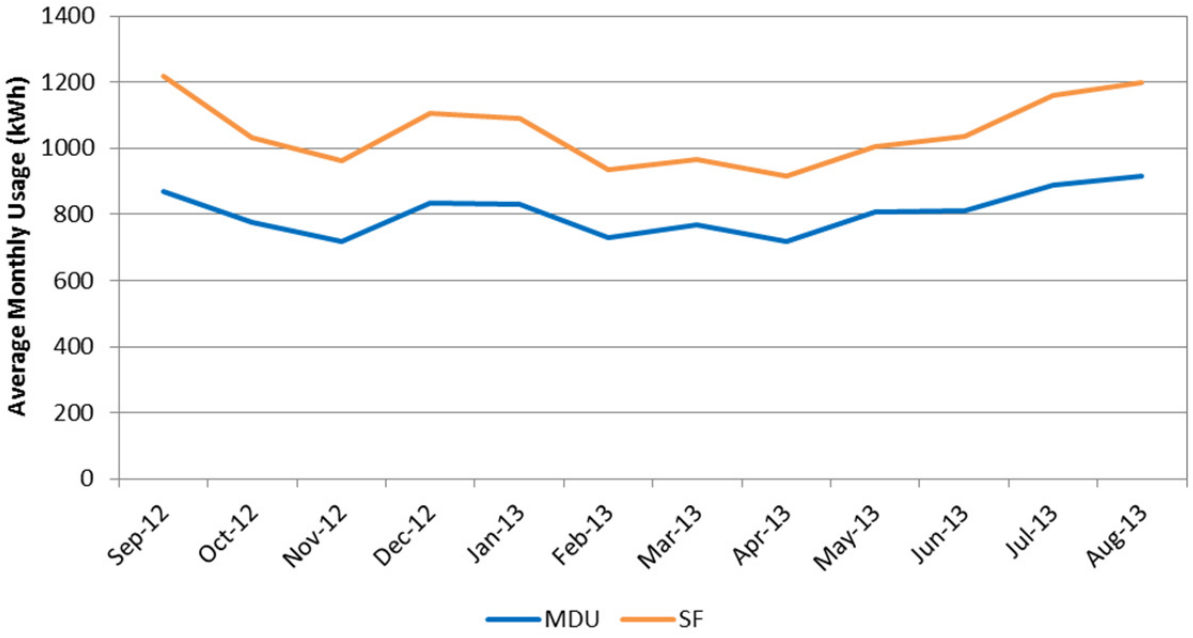


Chart SCE – 4: Single Meter (TOU-D-TEV) – Average Monthly Usage (kWh) by Customer Type without NEM

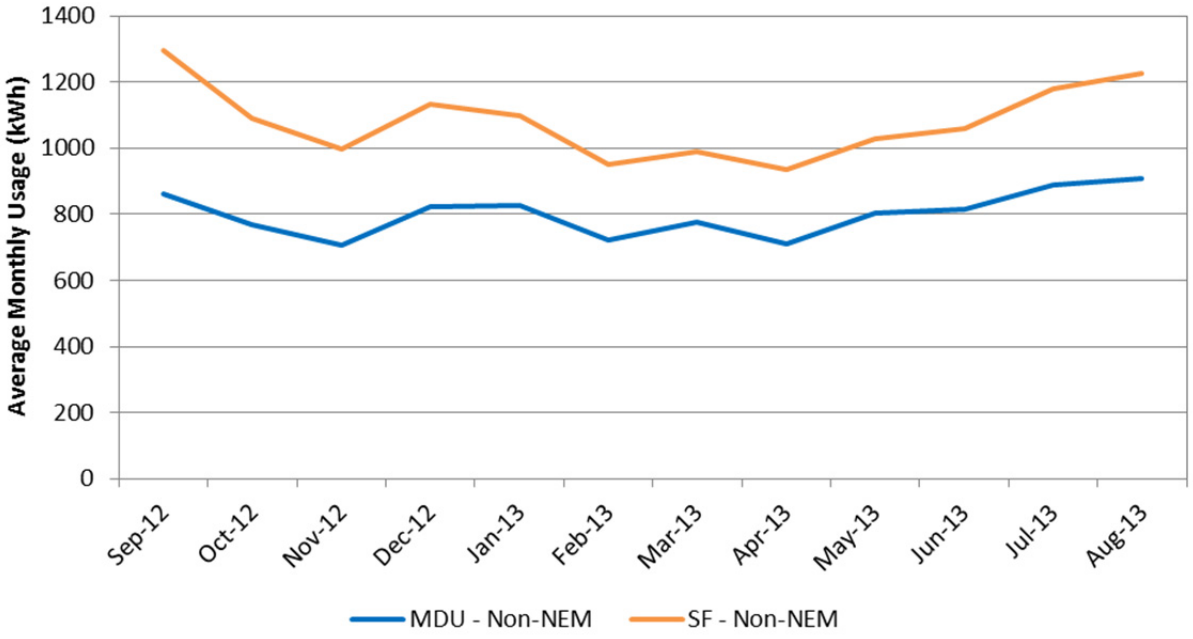
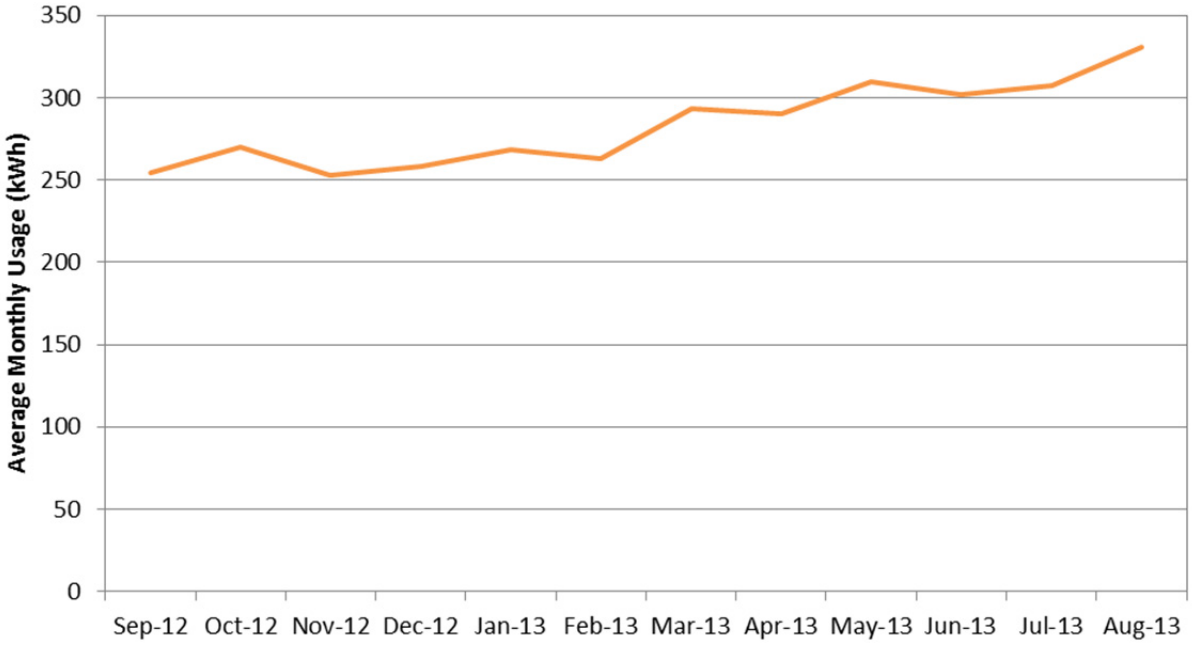


Chart SCE – 5 shows the average monthly usage for customers with separately-metered PEVs increasing over the reporting period. The number of separately-metered accounts has risen consistently over the twelve months so it could be that the influx of new accounts represents a different composition of vehicles with greater battery capacity. Alternatively, increasing average monthly usage could also result from a greater number of miles being driven by PEVs. These effects cannot be established from the available data. Similarly, it cannot be determined whether increased PEV usage is limited to separately-metered accounts.

Chart SCE – 5: Separate Meter (TOU-EV-1) - Average Monthly Usage



Average Usage during Time-of-Use Periods

When considering usage within a TOU period, it is important to remember that most residential customers are on rate plans where pricing does not vary by the time of day and therefore have no explicit TOU period. Thus, when the usage of accounts on a TOU rate is compared with the usage of the aggregate residential customer, observed discrepancies could be the result of not only the distinct consumption patterns of a self-selected group but possibly the different pricing structure encountered.

The percent of on-peak usage shows slight seasonal effects with December through March having the lowest percentage of usage on-peak. Conversely, the percentage of off-peak usage shows the opposite effect. PEV owners displayed slightly greater proportions of usage in the spring, from March to June, while the residential population as a whole had slightly higher percentage of off-peak usage during the winter months, November through March. While these trends are only slight, one might expect higher off-peak usage in winter when the hours of daylight are fewer and temperatures are cooler.

Across all groups with a PEV, slightly less electricity is used during on-peak hours as compared to the overall residential population. Also, the off-peak period household usage is roughly 10-15% more than on-peak usage. This would be expected as these accounts are all on a time-of-use rate which offers considerably cheaper energy prices during the off-peak period as compared to the on-peak period.

As shown in Table SCE – 8, the greatest proportion of residential usage occurs in the mid-peak period. This amounts to 50-60% of usage, which is not surprising given that this includes the periods 6:00 p.m. to midnight during the week and 6:00 a.m. to midnight on the weekends. These are times during the day when the most activity would be expected to occur in residential units. The whole residential population

consistently consumes about 60% of its electricity during this period, while each of the PEV groups consumes somewhat less, around 53%.

The effect of NEM can be seen because these customers have the lower on-peak usage than any non-NEM customer type. This is likely the result of their consumption of self-generated electricity during that period. This makes their super off-peak usage a greater percentage of their overall metered usage.

Table SCE – 649a: Single Meter (TOU-D-TEV) – On Peak* TOU Distribution

Month	All Residential	Single: Non-NEM	SF: Non-NEM	MDU: Non-NEM	NEM
Sep. 2012	23.2%	17.6%	17.8%	16.3%	10.5%
Oct. 2012	26.0%	19.5%	19.7%	18.2%	10.7%
Nov. 2012	21.5%	17.0%	17.2%	15.7%	11.7%
Dec. 2012	20.1%	16.4%	16.6%	15.6%	11.3%
Jan. 2013	20.9%	17.1%	17.3%	16.0%	11.4%
Feb. 2013	21.3%	15.9%	16.1%	15.0%	9.3%
Mar. 2013	21.4%	15.9%	16.0%	15.1%	7.1%
Apr. 2013	22.3%	17.1%	17.3%	16.4%	7.1%
May 2013	24.2%	17.7%	17.8%	17.2%	7.6%
Jun. 2013	25.3%	16.9%	17.0%	15.9%	7.7%
Jul. 2013	25.9%	19.8%	20.1%	18.6%	10.1%
Aug. 2013	29.9%	19.6%	19.8%	18.4%	9.5%
* On-peak period is defined as 10:00 a.m. - 6:00 p.m., weekdays all year, except holidays.					

Table SCE – 7: Single Meter (TOU-D-TEV) – Mid-peak* TOU Distribution

Month	All Residential	Single: Non-NEM	SF: Non-NEM	MDU: Non-NEM	NEM
Sep. 2012	61.2%	55.4%	55.6%	54.4%	55.1%
Oct. 2012	56.3%	50.0%	50.2%	48.9%	50.8%
Nov. 2012	60.3%	53.0%	53.2%	51.6%	51.5%
Dec. 2012	61.8%	55.4%	55.6%	54.0%	54.7%
Jan. 2013	59.8%	53.1%	53.3%	52.4%	52.6%
Feb. 2013	59.3%	53.4%	53.5%	52.8%	52.2%
Mar. 2013	59.0%	52.7%	52.8%	52.1%	51.5%
Apr. 2013	59.1%	50.3%	50.3%	50.1%	49.8%
May 2013	58.3%	50.2%	50.3%	49.7%	48.7%
Jun. 2013	57.8%	52.0%	52.2%	51.1%	50.5%
Jul. 2013	58.0%	50.1%	50.1%	49.9%	50.4%
Aug. 2013	54.3%	50.4%	50.5%	50.2%	50.6%
* Mid-peak period is defined as all other hours that are not On-peak or Off-peak.					

[49] To remain consistent with Energy Division requirement, this table is labeled as 6 even though Table SCE – 5 does not exist.

Table SCE – 8: Single Meter (TOU-D-TEV) – Off-peak* TOU Distribution

Month	All Residential	Single: Non-NEM	SF: Non-NEM	MDU: Non-NEM	NEM
Sep. 2012	12.5%	27.0%	26.7%	29.4%	34.4%
Oct. 2012	14.4%	30.5%	30.1%	32.8%	38.5%
Nov. 2012	17.9%	30.0%	29.6%	32.7%	36.8%
Dec. 2012	18.1%	28.2%	27.9%	30.4%	34.0%
Jan. 2013	19.3%	29.8%	29.4%	31.7%	36.1%
Feb. 2013	19.4%	30.7%	30.4%	32.2%	38.5%
Mar. 2013	17.2%	31.4%	31.1%	32.7%	41.4%
Apr. 2013	15.2%	32.6%	32.4%	33.5%	43.1%
May 2013	14.2%	32.1%	31.9%	33.1%	43.8%
Jun. 2013	13.6%	31.1%	30.8%	33.0%	41.7%
Jul. 2013	12.8%	30.1%	29.8%	31.5%	39.5%
Aug. 2013	12.6%	30.0%	29.7%	31.4%	39.9%
* Off-peak period is defined as 12:00 (midnight) - 6:00 a.m., daily.					

The separately-metered customers are highly responsive to the cheaper off-peak period and respond to the lower price by charging their vehicles approximately 85% of the time during the off-peak hours from 9:00 p.m. to 12:00 noon. This is not surprising because PEV load is easy to manipulate and the off-peak period occurs during hours that are convenient for charging a PEV driven during the day.

The off-peak charging percentage has been rising with the increasing number of accounts on this rate. This observed trend could be attributed to any number of factors including an increased awareness of TOU pricing, the changing attributes of customers choosing a separate meter to charge their PEV or even customers attracted to greater savings from off-peak charging as the result of increased usage. Besides customer behavior, evolving technology could also contribute to more off-peak charging. An uptake in Level 2 charging would shorten the time to charge the battery allowing it to concentrate in the off-peak window.

Table SCE – 6b: Separate Meter (TOU-EV-1) - Usage during Time-of-Use Periods

Month	On-peak	Off-peak
Sep. 2012	18.3%	81.7%
Oct. 2012	16.8%	83.2%
Nov. 2012	18.8%	81.2%
Dec. 2012	20.6%	79.4%
Jan. 2013	18.4%	81.6%
Feb. 2013	17.4%	82.6%
Mar. 2013	17.0%	83.0%
Apr. 2013	13.9%	86.1%
May 2013	12.8%	87.2%
Jun. 2013	12.4%	87.6%
Jul. 2013	12.0%	88.0%
Aug. 2013	12.2%	87.8%

Charts SCE – 6a for SF with a single meter, 6b for MDU with a single meter, and 6c for separately-metered PEVs illustrate the dispersion of individual average consumption for each day of the week. The average consumption for each account was calculated for each day of the week and then the distribution of all accounts for each day is displayed. What is most notable for both rates and both SF and MDU accounts is the prevalence of accounts with extremely high average usage. Within the single-metered group, the MDU accounts do not have any accounts that average more than 100kWh for any day of the week, whereas the SF customers have a handful of accounts with average consumption greater than 100kWh and up to about 425kWh per day.

The median average usage by individual accounts and the inter-quartile range are quite similar for each day of the week for the single-metered groups. The separately-metered PEV median usage shown in Chart SCE – 6c is lower on Saturday and Sunday. Monday appears to have individual average consumption that is somewhat lower than the other weekdays, but a bit higher than the weekend. This will be further examined in the subsequent load profiles.

Chart SCE – 6a: Single Meter (TOU-D-TEV), SF - Box-and-Whisker Plot of Individual Daily Consumption(kWh) by Day of the Week

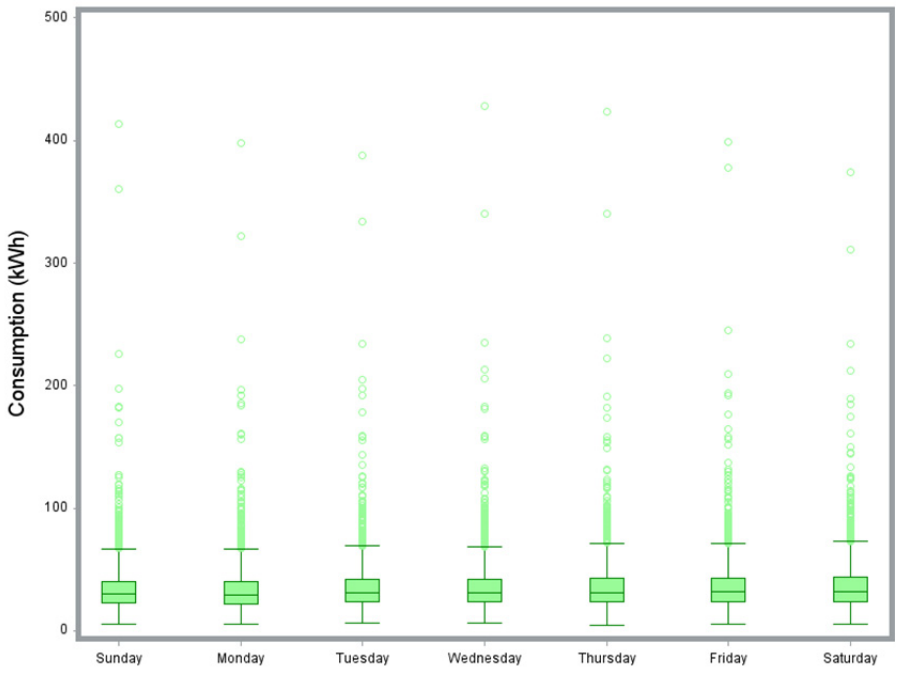


Chart SCE – 6b: Single Meter (TOU-D-TEV), MDU - Box-and-Whisker Plot of Individual Daily Consumption(kWh) by Day of the Week

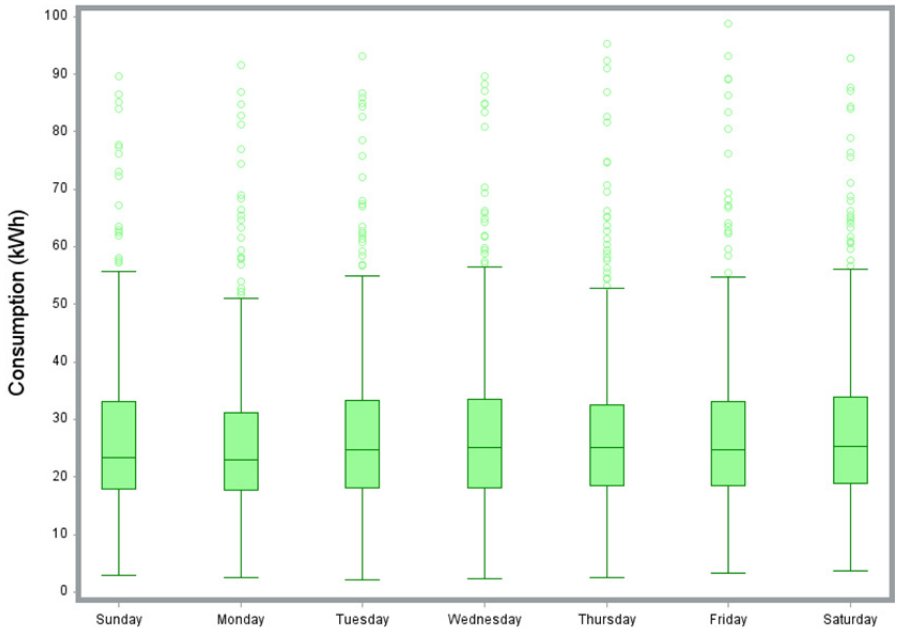
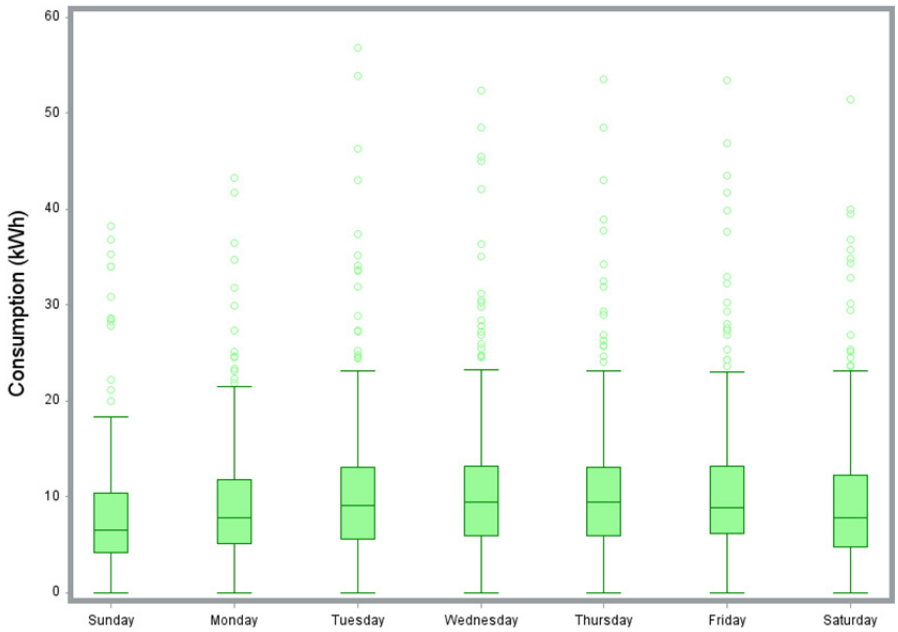


Chart SCE - 6c: Separate Meter (TOU-EV-1), SF - Box-and-Whisker Plot of Individual Daily Consumption(kWh) by Day of the Week



Average Load Profiles

The hourly load profiles allow for a more granular examination of PEV charging during time-of-use periods.

Charts SCE – 7a & b show the average load profile for both single meter customer types described previously. The increase in load occuring in the late afternoon hours is likely due to customers coming home from work, which also explains why usage during mid-peak hours is the highest. The load profiles for both the SF and MDU accounts also show abrupt increases in load around 12 a.m. This is most likely attributable to charging the PEV and accounts for the high percentage of usage occuring during the off-peak period. Furthermore, it appears that customers are starting their charging toward the end of the mid-peak period and the majority of charging occuring during the off-peak period (12 midnight – 6:00 a.m.). On average, customers seem to respond to time-of-use pricing signals. Although multi-family accounts have a similar load shape as single-family accounts, multi-family demand is lower throughout the day.

These load profile charts for single-metered TOU accounts also show Saturday and Sunday to have a muted second spike in demand at 12:00 a.m. when compared to weekdays. This would seem to suggest that PEVs during the period under review are predominantly utilized for commuting to work and on average are charged in the evening after arriving home.

Chart SCE – 7a: Single Meter (TOU-EV-1), SF - Average Hourly Load Profile for Each Day of the Week

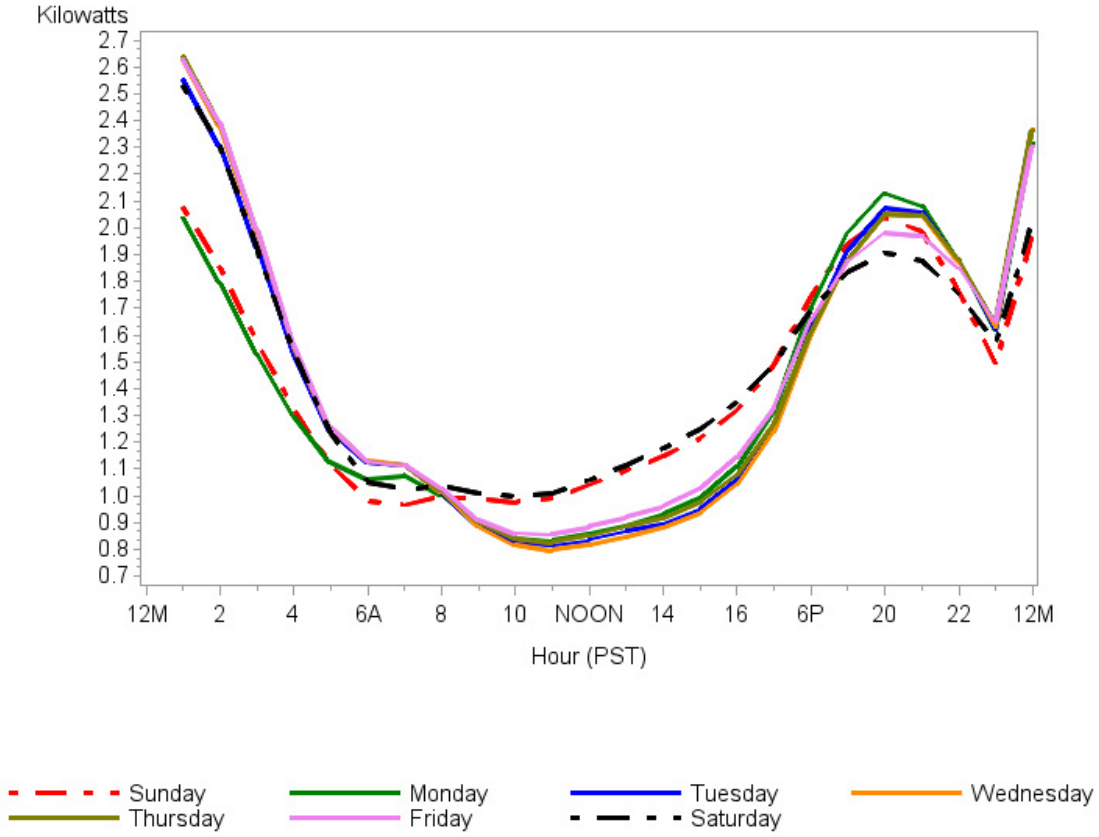
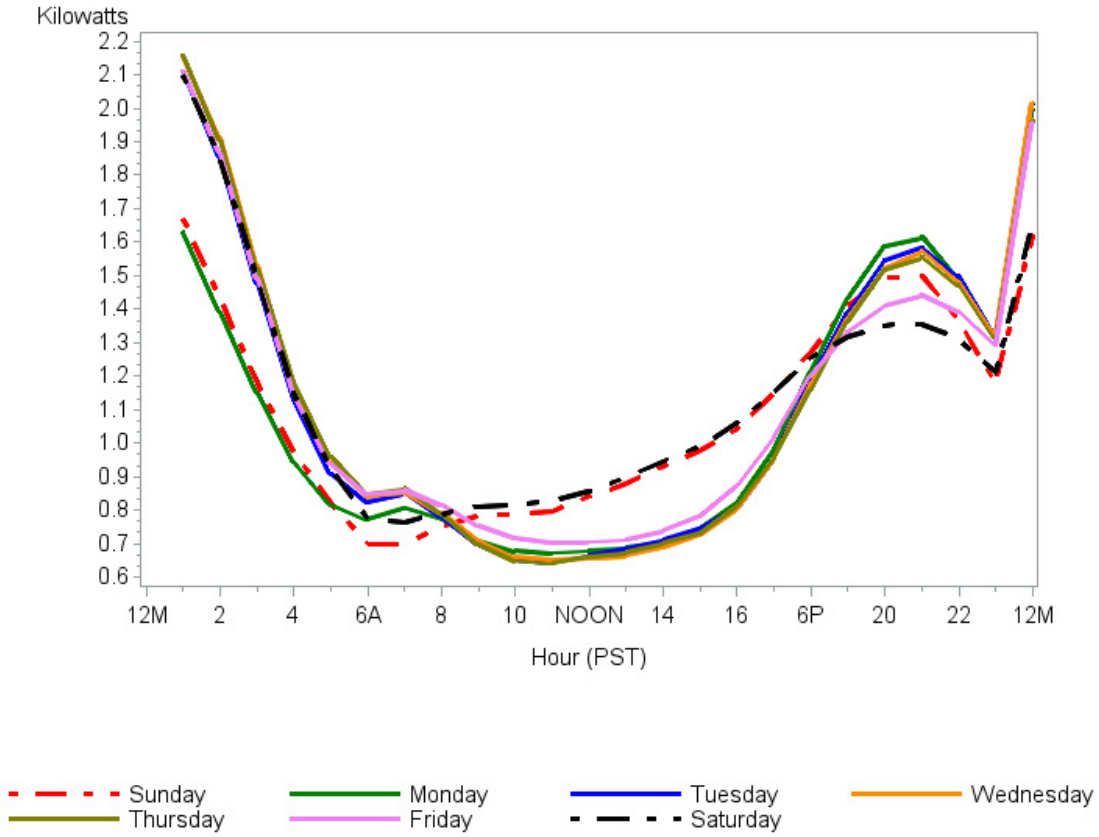


Chart SCE – 7b: Single Meter (TOU-D-TEV), MDU – Average Hourly Load Profile for Each Day of the Week



In Chart SCE – 8, separately-metered accounts have a single spike in PEV load around 10 p.m., suggesting that customers are very cogniziant that off-peak charging times begin at 9 p.m. They continue to charge during the off-peak time until they stop charging between 6:00-8:00 a.m. Again, as with the early morning peak present in the single-metered profle, the peak for separatly metered PEVs is about 0.4 kW lower on Saturday and Sunday than on weekdays. The lower peak occuring Sunday evening tapers into the early morning hours of Monday, which produces the lower usage on Mondays shown in Chart SCE – 6c.

Chart SCE – 8: Separate Meter (TOU-EV-1) - Average Hourly Load Profile for Each Day of the Week

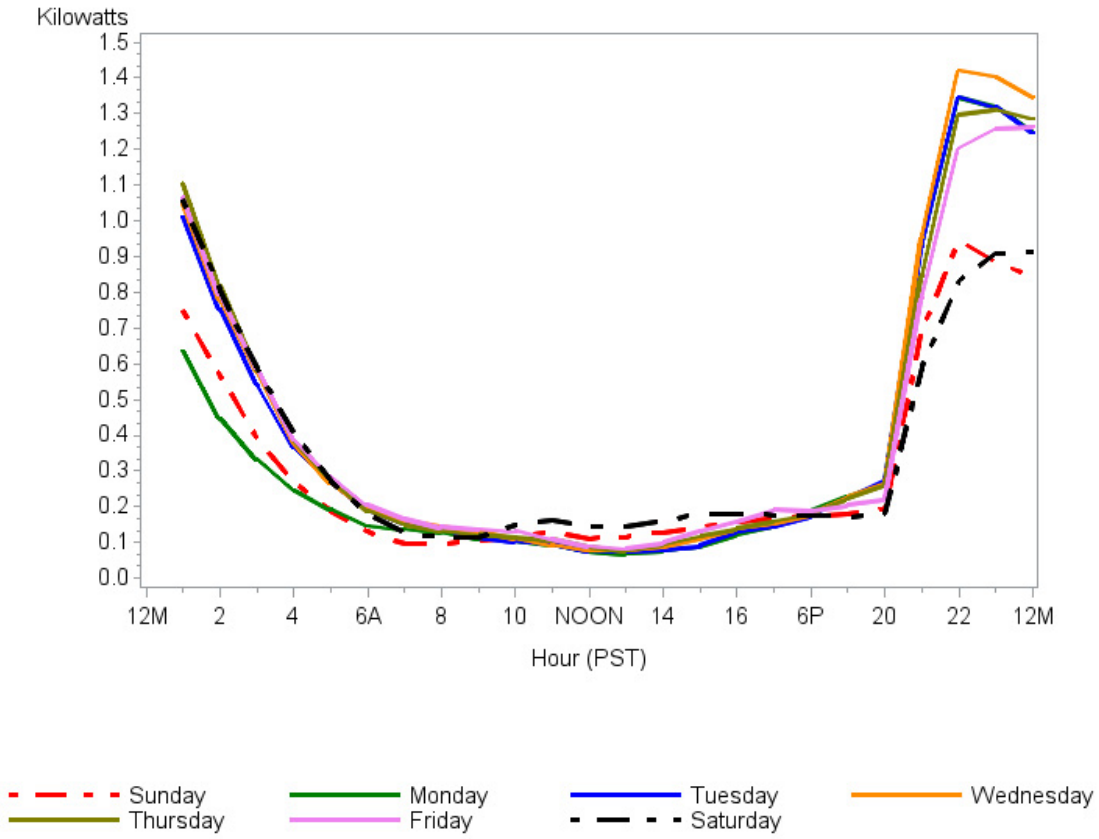
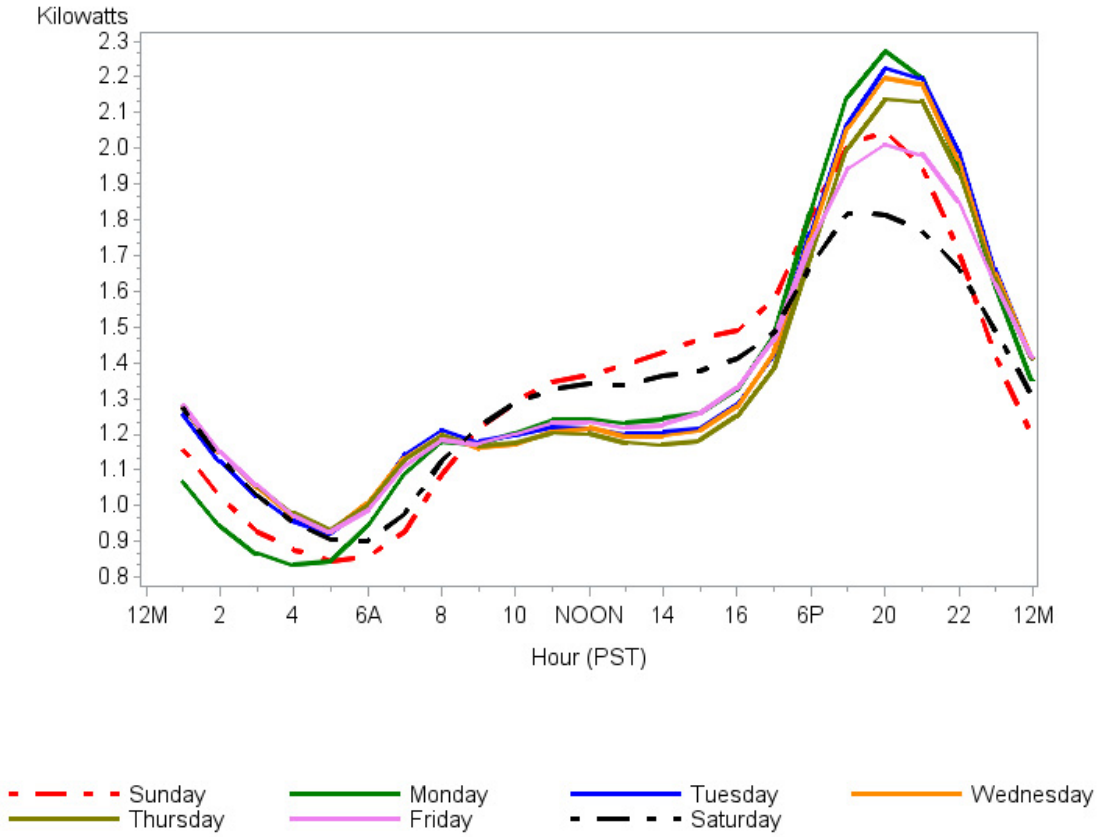


Chart SCE – 9 shows the load profile for a portion of the customers who are known to SCE to own a PEV but choose to remain on the regular tiered domestic rate. Their demand increases around 7 a.m., remains flat during the day and peaks in the evening. As compared to the single-family, whole-house TOU customers in Chart SCE – 7a they lack the second peak occurring midnight to 4 a.m. They also have slightly higher daytime levels of demand which may be a factor in their decision to remain on the regular residential rate as opposed to the TOU rate. Their evening peak, however, is very similar in magnitude to the TOU-D-TEV customers.

Chart SCE – 9[50]: Single Meter PEV Owners51 on a Non-TOU Rate – Average Hourly Load Profile for Each Day of the Week



Average Non-Coincident Peak Load

Table SCE – 9a shows the average non-coincident peak was approximately 2.5kW higher for the single-metered TOU group compared to the average residential peak.[52] Similar to the monthly average usage, average non-coincident peak usage is lower from November through April.

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[50] Identification of regular domestic accounts that belong to PEV owners relies on self-identification and therefore is subject to large selection bias. Furthermore, the duration of PEV load as a component of the metered household load cannot be determined. The reliability of this information therefore cannot be guaranteed.

[51] Non-NEM accounts on the regular Domestic rate schedule with load data between September 1, 2012, and August 31, 2013, and an identifiable delivery date of the PEV.

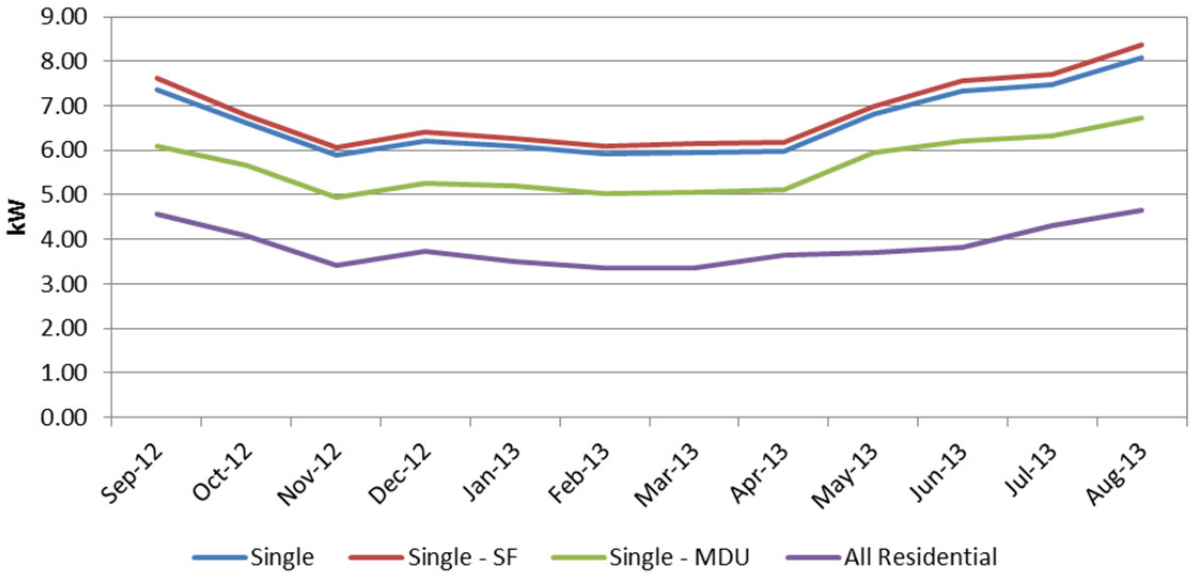
[52] The average non-coincident peak was calculated by denoting the maximum hourly interval for each account within the month. These maximum values were then summed for each category. The average is then calculated by dividing the total by the number of customers. The average non-coincident peak is therefore an approximation of the maximum demand for customer in each stratum.

These patterns are present in both single- and multiple-dwelling units and, as with the residential population at large, multiple-dwelling units have a lower non-coincident peak on average. Chart SCE – 10a plots the average non-coincident peaks for the reported time frame and it can be seen that, while the seasonal trend appears similar, the general residential population has a much lower peak load than that of single-metered accounts with PEVs.

Table SCE – 9a: Single Meter (TOU-D-TEV) - Monthly Average Non-Coincident Peak Load (kW)

Month	Residential Pop.	SF Pop.	MDU Pop.	All Single Metering	SF Single Metering	MDU Single Metering
Sep. 2012	4.56	5.03	3.25	7.37	7.62	6.09
Oct. 2012	4.09	4.47	3.04	6.60	6.78	5.66
Nov. 2012	3.41	3.59	2.89	5.90	6.08	4.95
Dec. 2012	3.73	3.93	3.16	6.22	6.40	5.25
Jan. 2013	3.49	3.68	2.95	6.08	6.25	5.20
Feb. 2013	3.35	3.51	2.89	5.93	6.10	5.04
Mar. 2013	3.36	3.51	2.92	5.96	6.14	5.06
Apr. 2013	3.63	3.86	2.96	5.99	6.17	5.11
May 2013	3.70	3.99	2.90	6.83	7.00	5.96
Jun. 2013	3.82	4.13	2.95	7.33	7.56	6.20
Jul. 2013	4.30	4.74	3.07	7.48	7.71	6.31
Aug. 2013	4.65	5.15	3.26	8.09	8.37	6.71

Chart SCE – 10a: Single Meter (TOU-D-TEV) - Monthly Average Non-Coincident Peak Load (kW)



The average non-coincident peak (or average maximum demand) was approximately 5.3 kW for separately-metered PEVs. Again, the results in Table SCE – 9b are similar to those in Chart SCE - 5. There is a consistent growth through the 2013 period of the months under review. This seems to support other indicators that there is an increased capability for vehicles to charge at Level 2 (240V).

Table SCE – 9b: Separate Meter (TOU-EV-1) - Monthly Average Non-Coincident Peak Load (kW)

Month	Separate Metering
Sep. 2012	4.63
Oct. 2012	4.63
Nov. 2012	4.73
Dec. 2012	4.82
Jan. 2013	4.92
Feb. 2013	4.86
Mar. 2013	5.15
Apr. 2013	5.45
May 2013	5.79
Jun. 2013	5.99
Jul. 2013	6.15
Aug. 2013	6.58

Chart SCE – 10b: Separate Meter (TOU-EV-1) - Monthly Average Non-Coincident Peak Load (kW)

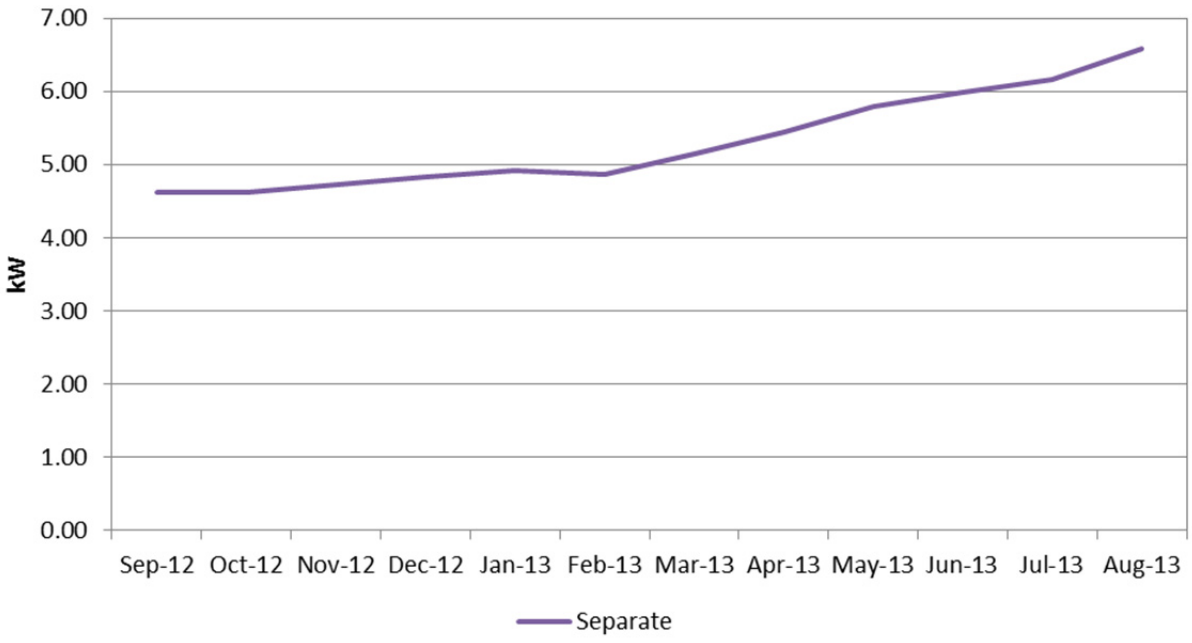


Chart SCE – 11a: Single Meter (TOU-D-TEV) - Histogram of Hour of Non-Coincident Peak Load Occurrence for Each Account by Customer Type

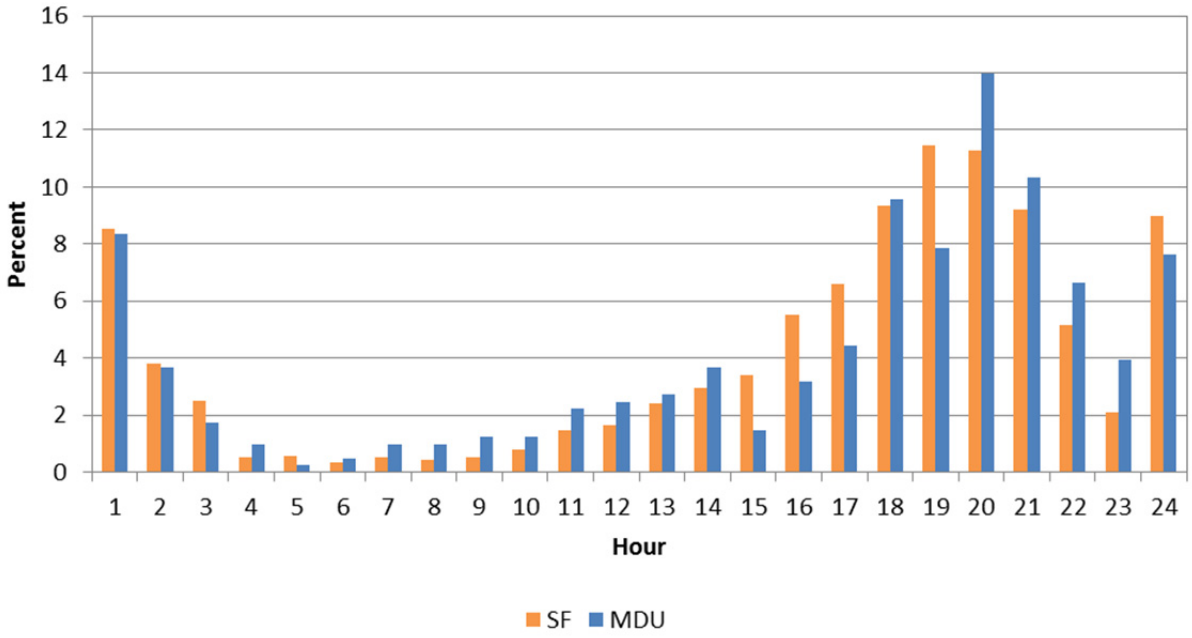
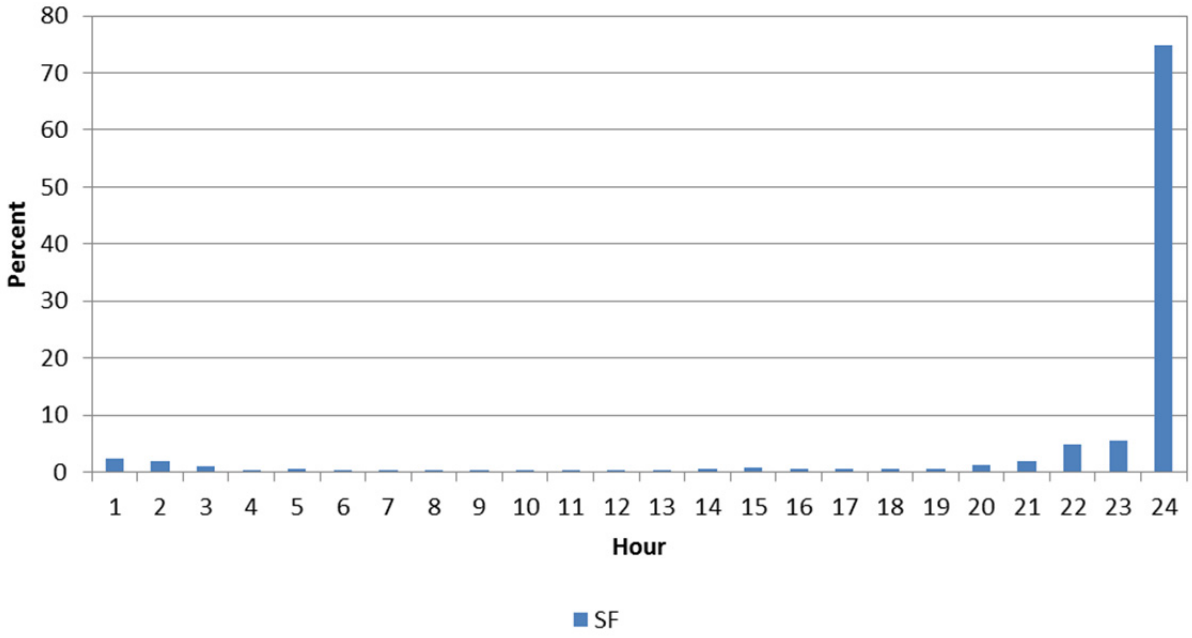


Chart SCE – 11a shows the distribution of the hour at which non-coincident peak load occurs during the year for each of the single-metered TOU accounts. This chart presents the number of accounts peaking in each hour as a percentage to allow for a better comparison between the numerically smaller MDU group and the more prevalent SF group. The general distributions for single meter accounts are quite similar; however the multi-dwelling units peak in slightly greater proportion from 8 p.m. to 11 p.m. and slightly lower proportion between 3 p.m. and 5 p.m.

For the separately-metered PEV load, the accounts nearly all peak after midnight as shown in Chart SCE – 11b.

Chart SCE – 11b: Separate Meter (TOU-EV-1) - Histogram of Hour of Non-Coincident Peak Load Occurrence for Each Account by Customer Type



Data Accompanying Chart SCE – 11a, b

Hour	Residential Pop.	SF Pop.	MDU Pop.	All Single Metering	SF Single Metering	MDU Single Metering	Separate Metering
1	1%	1%	1%	8%	9%	8%	2%
2	0%	0%	0%	4%	4%	4%	2%
3	0%	0%	0%	2%	3%	2%	1%
4	0%	0%	0%	1%	1%	1%	0%
5	1%	1%	0%	1%	1%	0%	0%
6	1%	1%	0%	0%	0%	0%	0%
7	2%	2%	3%	1%	1%	1%	0%
8	2%	2%	2%	1%	0%	1%	0%
9	3%	2%	3%	1%	1%	1%	0%
10	3%	2%	4%	1%	1%	1%	0%
11	4%	4%	4%	2%	1%	2%	0%
12	6%	5%	6%	2%	2%	2%	0%
13	6%	6%	5%	2%	2%	3%	0%
14	7%	8%	5%	3%	3%	4%	1%
15	7%	8%	5%	3%	3%	1%	1%
16	8%	8%	8%	5%	6%	3%	1%
17	10%	11%	7%	6%	7%	4%	1%
18	11%	11%	8%	9%	9%	10%	0%
19	10%	10%	11%	11%	11%	8%	1%
20	8%	7%	10%	12%	11%	14%	1%
21	6%	5%	8%	9%	9%	10%	2%
22	3%	2%	4%	5%	5%	7%	5%
23	1%	2%	4%	2%	2%	4%	6%
24	0%	1%	1%	9%	9%	8%	75%

Time and Average Diversified Peak Load

The time of diversified peak load gives the time that the group peaks as a whole. The time of diversified (or group) peak load is mostly the same for all customers in each month (See Tables SCE – 10a). The general residential populations as a whole display a greater variability from month to month and their demands are slightly lower than the TOU accounts. The diversified peak load does not significantly change across months and occurs between midnight and 2:00 am for all categories. This would indicate that on average one single-metered customer type is not more responsive than another to a time-of-use rate. It also shows that these customers are responsive to the off-peak rate which begins at 12:00 midnight. For single-metered customers, the off-peak rate provides the lowest rate for charging purposes. While PEV customers peak in the early morning hours, domestic customers typically peak in the late afternoon or early evening hours (3:00 p.m. – 8:00 p.m.). The average diversified peak load is usually only slightly higher for single-metered TOU accounts than the average domestic customer.

Table SCE – 10a: Single Meter (TOU-D-TEV) - Time and Average Diversified Peak Load

Month	Residential Demand (kW)	Hour of Residential Demand	SF Population Demand (kW)	Hour of SF Population Demand	MDU Population Demand (kW)	Hour of MDU Population Demand
Sep. 2012	1.19	16	1.34	15	0.83	16
Oct. 2012	1.20	17	1.32	17	0.85	17
Nov. 2012	1.18	19	1.30	19	0.83	19
Dec. 2012	1.14	20	1.26	20	0.75	21
Jan. 2013	1.31	20	1.45	20	0.87	20
Feb. 2013	1.47	20	1.68	20	0.88	19
Mar. 2013	1.82	20	2.08	19	1.07	20
Apr. 2013	2.30	17	2.68	17	1.26	17
May 2013	2.14	17	2.44	17	1.29	17
Jun. 2013	1.96	17	2.23	17	1.19	18
Jul. 2013	1.11	17	1.24	17	0.77	17
Aug. 2013	1.33	15	1.47	15	0.90	15

Table SCE – 10a cont'd: Single Meter (TOU-D-TEV) - Time and Average Diversified Peak Load

Month	Single Metering Demand (kW)	Hour of Single Metering Demand	SF Single Metering Demand (kW)	Hour of SF Single Metering Demand	MDU Single Metering Demand (kW)	Hour of MDU Single Metering Demand
Sep. 2012	2.51	24	2.60	1	2.10	24
Oct. 2012	2.30	1	2.38	1	2.00	24
Nov. 2012	2.15	1	2.21	1	1.82	1
Dec. 2012	2.17	1	2.23	2	1.83	1
Jan. 2013	2.22	1	2.28	1	1.91	1
Feb. 2013	2.24	2	2.30	2	1.93	1
Mar. 2013	2.20	1	2.26	1	1.87	1
Apr. 2013	2.26	24	2.32	1	1.95	24
May 2013	2.41	24	2.47	24	2.13	24
Jun. 2013	2.51	24	2.57	24	2.21	24
Jul. 2013	2.65	24	2.72	24	2.32	24
Aug. 2013	2.72	24	2.79	24	2.35	24

Separately-metered customers peak as a group between 10:00 p.m. – 11:00 p.m. (time of diversified peak load). Thus, separately-metered customers seem to respond to time-of-use periods and charge during off-peak times which begin at 9:00 p.m. Comparing these demands to the non-coincident peak demand in Table SCE-9b, one might infer that on any given night, only a subset (perhaps about one in three) customers is charging.

Table SCE – 10b: Separate Meter (TOU-EV-1) - Time and Average Diversified Peak Load

Month	Separate Metering Demand (kW)	Hour of Separate Metering Demand
Sep. 2012	1.08	23
Oct. 2012	1.10	22
Nov. 2012	1.02	23
Dec. 2012	0.97	23
Jan. 2013	1.13	23
Feb. 2013	1.22	23
Mar. 2013	1.20	22
Apr. 2013	1.33	22
May 2013	1.46	22
Jun. 2013	1.50	22
Jul. 2013	1.44	22
Aug. 2013	1.50	22

Average Load Coincident with System Peak

The average load coincident with system peak is the average load occurring at the same time that the system peak occurs. The system peak days and times were used to extract the appropriate hourly load at the time of system peak. The average group load coincident with system peak was calculated taking the total group load and dividing by the number of customers.

Table SCE – 11 shows that the average load coincident with system peak does not seem to have much seasonal fluctuation except for the NEM accounts, which appear to have a relatively lower average load coincident with system peak during the summer months compared to winter months, a result most likely due to on-site generation in the summer. At the time of system peak, monthly average demand for multiple-dwelling units is lower than for single-family units. This result is the same for residential customers regardless of PEV ownership.

Table SCE –11a: Single Meter (TOU-D TEV) - Average Load Coincident with System Peak (kW/customer)

Month	Residential Population	SF Population	MDU Population	All Single Metering	SF Single Metering	MDU Single Metering
Sep. 2012	1.91	2.17	1.13	2.32	2.45	1.68
Oct. 2012	1.86	2.12	1.09	2.01	2.13	1.36
Nov. 2012	1.06	1.17	0.72	1.60	1.71	1.00
Dec. 2012	1.30	1.45	0.87	2.11	2.21	1.55
Jan. 2013	1.12	1.25	0.73	2.09	2.19	1.60
Feb. 2013	1.19	1.30	0.85	1.90	2.00	1.39
Mar. 2013	1.01	1.13	0.66	1.71	1.78	1.39
Apr. 2013	0.90	0.98	0.60	0.81	0.83	0.70
May 2013	1.16	1.29	0.75	1.75	1.81	1.43
Jun. 2013	1.22	1.35	0.80	1.84	1.92	1.42
Jul. 2013	1.69	1.92	0.99	2.00	2.09	1.55
Aug. 2013	1.91	2.19	1.08	2.21	2.31	1.70

Table SCE –11a- cont'd: Single Meter (TOU-D TEV) - Average Load Coincident with System Peak (kW/customer)

Month	NEM	DR
Sep. 2012	1.95	2.43
Oct. 2012	1.81	2.01
Nov. 2012	1.81	1.54
Dec. 2012	2.25	2.13
Jan. 2013	2.32	2.02
Feb. 2013	2.20	1.79
Mar. 2013	1.90	1.55
Apr. 2013	0.44	0.74
May 2013	1.30	1.74
Jun. 2013	1.37	1.62
Jul. 2013	1.82	2.05
Aug. 2013	1.55	2.16

The average load coincident with system peak is very small for separately-metered customers. This result is anticipated as we have seen previously that this load is very responsive to TOU pricing and is very highly concentrated in off-peak hours due to the structure of the rate. Table SCE – 11b shows the distribution of the average load coincident with system peak which fluctuates only slightly by month.

Table SCE –11b: Separate Meter (TOU-EV-1) - Average Load Coincident with System Peak (kW/customer)

Month	Separate Metering
Sep. 2012	0.21
Oct. 2012	0.12
Nov. 2012	0.14
Dec. 2012	0.23
Jan. 2013	0.38
Feb. 2013	0.14
Mar. 2013	0.22
Apr. 2013	0.12
May 2013	0.17
Jun. 2013	0.13
Jul. 2013	0.12
Aug. 2013	0.19

Table SCE – 12 shows the geographic distribution of customers on PEV, TOU rates within the service territory. There are a large number of PEVs in Zone 6, a coastal zone running from Point Conception to San Clemente. Although only 19% of the general population resides in Zone 6, 38% of PEV TOU accounts are in Zone 6. Zones 8 and 9 have the next largest populations of PEVs. However, relative to single-metered accounts, the separately-metered accounts are located in larger proportion in Zone 9, the parts of Ventura and Los Angeles counties which border the inland side of Zone 6. Inversely, the separately-metered accounts show a relatively larger proportion in Zone 10, which is further inland. However, the proportion of both separate- and single-metered accounts in Zone 10 is relatively smaller than the general population proportion.

Table SCE –12: Percentage of PEV Customers on TOU Rates by Zone[53] as Compared to Residential Population

Zone	Residential Population*	Single Meter	Separate Meter
5	0%	0%	0%
6	19%	39%	34%
8	24%	25%	23%
9	21%	23%	33%
10	20%	10%	5%
13	4%	0%	0%
14	7%	2%	2%
15	3%	1%	2%
16	2%	1%	2%

* Percentages are based on residential customers at the end of October 2013.

This geographical distribution gives some indication of characteristics of these early adopters of PEVs:

- Their socio-demographic attributes such as income, education, and housing type correlate with those of coastal dwellers.
- Coastal dwellers have less air conditioning load, which may make them less resistant to TOU rates and their higher on-peak prices.
- Residents in the more densely populated zones such as zones 6, 8, and 9 may have shorter commutes that are within the range of PEVs, allowing easier adoption.

[53] SCE's baseline information can be found at: http://www.sce.com/NR/sc3/tm2/pdf/ce63map.pdf.

The dispersion of PEVs on a time-of-use rate in SCE's territory is illustrated on the maps in Figure SCE – 3. Tables SCE – 13a & b show zip codes ranked by frequency of electric vehiles on TOU. Most of these zip codes belong to cities which are along the coast.

Figure SCE – 3: Geographic Location PEV TOU Accounts by Tariff Type and NEM Designation

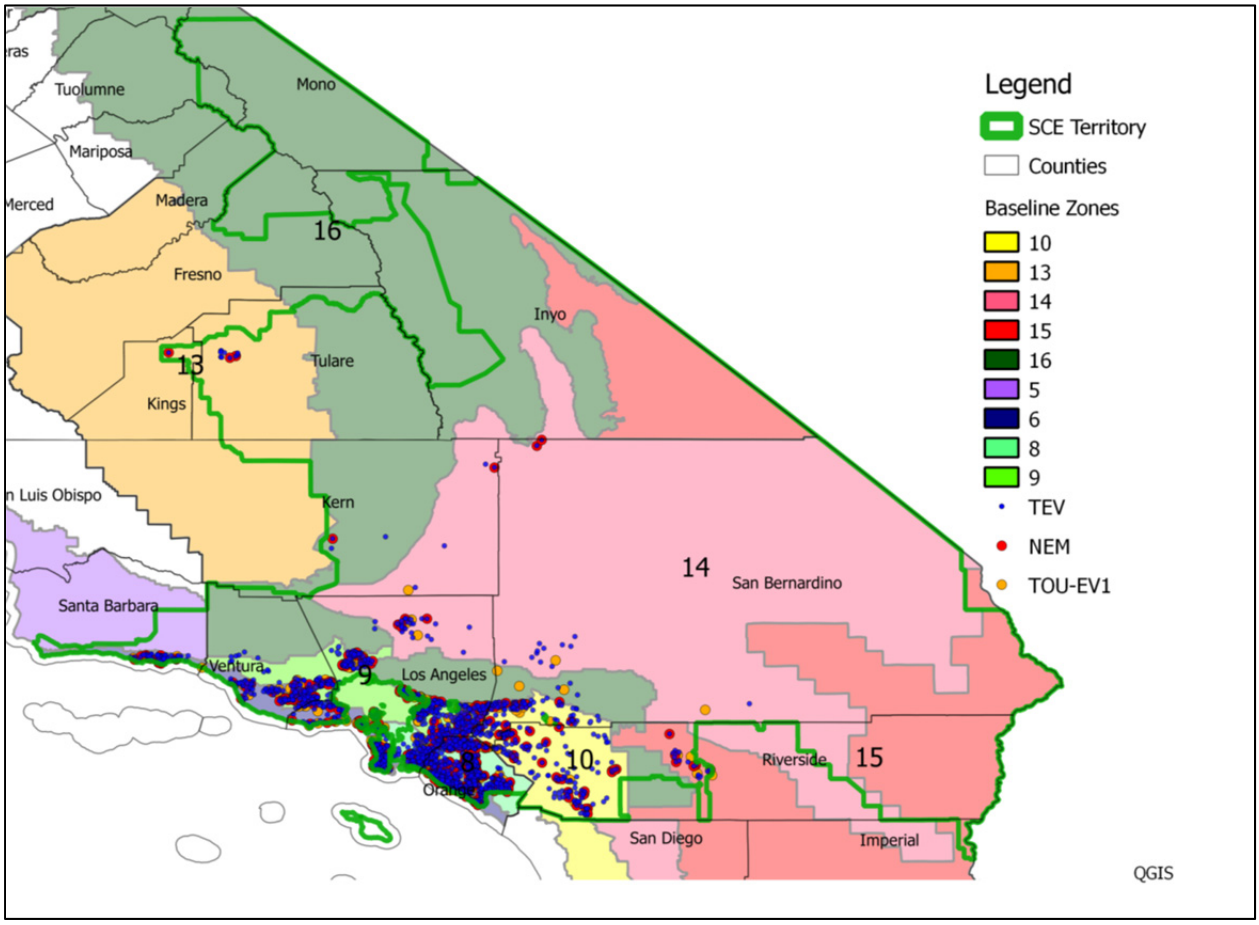


Table SCE –13a: Top Five Most Populous Zip Codes with Single-metered PEVs

Rank	Zip Code(s)	City of Zip Code	Number of Accounts with PEV
1	90266	Manhattan Beach	71
2	90274	Palos Verdes Peninsula	48
3	90275, 90278, 92657	Rancho Palos Verdes, Redondo Beach, Neport Coast	42
4	92648	Huntington Beach	40
5	92620, 92660	Irvine, Newport Beach	36

Table SCE –13b: Top Five Most Populous Zip Codes with Separate-metered PEVs

Rank	Zip Code(s)	City of Zip Code	Number of Accounts with PEV
1	90402	Santa Monica	14
2	90266	Manhattan Beach	7
3	90274, 90720, 91001, 92603	Palos Verdes Peninsula, Los Alamitos, Altadena, Irvine	6
4	90275, 90803	Rancho Palos Verdes, Long Beach	5
5	90807, 91362, 91381, 92887	Long Beach, Thousand Oaks, Stevenson Ranch, Yorba Linda	4

SDG&E

SDG&E offers residential customers two different meter configurations within five rates for PEV owners. First, a single meter rate (EV-TOU2) which captures car and house load. Second, four separately-metered rates (EV-TOU, EPEV-X, EPEV-Y, and EPEV-Z) for the PEV only. Currently, SDG&E does not have a commercial Electric Vehicle rate option. TOU rates are provided in Table 1. As of August 2012, there were only 11 customers enrolled on the EV-TOU rate, therefore no analysis of customer charging behavior was provided. In addition, there were less than 15 customers living in multi-dwelling units (MDU) in both single and separate metering rate classes and were therefore excluded from the study.

SDG&E Table 1a: Tariff (¢/kWh)

Tariff	TOU	Hour Beginning	Winter Weekday	Winter Weekend	Summer Weekday	Summer Weekend
EV-TOU	Super Off Peak	Midnight to 5am	11.5	11.5	11.4	11.4
	On Peak	Noon to 8pm	11.6	11.6	11.8	11.8
	Off Peak	All other	11.5	11.5	11.5	11.5
EV-TOU-2	Super Off Peak	Midnight to 5am	11.5	11.4	11.4	11.4
	On Peak	Noon to 8pm	11.6	11.5	11.8	11.8
	Off Peak	All other	11.5	11.5	11.5	11.5
EPEV-X	Super Off Peak	Midnight to 5am	15.9	15.8	15.1	15.1
	On Peak	Noon to 8pm	19.7	19.6	30.2	30.2
	Off Peak	All other	18.9	18.8	18.4	18.4
EPEV-Y	Super Off Peak	Midnight to 5am	9.1	9.1	8.5	8.5
	On Peak	Noon to 8pm	27.7	27.6	32.6	32.6
	Off Peak	All other	18.5	18.4	20.5	20.5
EPEV-Z	Super Off Peak	Midnight to 5am	7.8	7.8	7.4	7.4
	On Peak	Noon to 8pm	37.8	37.8	42.8	42.8
	Off Peak	All other	15.1	15.1	17.1	17.1

Table 1b provides the price ratios between the different TOU periods for each rate. The separate-metered rate EPEV-Z has the largest difference between peak and super off peak prices. The peak price per kWh for EPEV-Z was 385% and 478% greater than the off-peak price during the winter and summer respectively.

SDG&E Table 1b: Price Ratios

Tariff	Winter		Summer	
	Super Off Peak and Off Peak	Super Off Peak and Peak	Super Off Peak and Off Peak	Super Off Peak and Peak
EV-TOU	1:1	1:1	1:1	1:1
EV-TOU-2	1:1	1:1	1:1	1:1
EPEV-X	1:1	1:1	1:1	2:1
EPEV-Y	2:1	3:1	2:1	4:1
EPEV-Z	2:1	5:1	2:1	6:1

SDG&E Single Meter PEV Rate:

The EV-TOU-2 rate option is designed for residential customers that have their household load and their PEV load on the same meter. Service under this optional rate is specifically limited to residential customers who require service for charging of a currently registered Motor Vehicle which is: 1) a battery electric vehicle (BEV) or plug-in hybrid electric vehicle (PHEV) recharged via a recharging outlet a the customer's premises; or, 2) a natural gas vehicle (NGV) refueled via a home refueling appliance (HRA) at the customer's premises. The On-Peak period is noon-6pm daily. The Off-Peak period is 5am – 12 noon, and 6pm - 12 midnight daily, and the Super Off-Peak period is 12 midnight to 5am daily.

Please note that the current information drawn from those subgroups is preliminary and any judgments and/or policy decisions would be premature. Additionally, SDG&E also cautions readers from drawing any major conclusions from any of the PEV rate information that has been provided over this past year. As can be seen from the information presented in this document, the last 12 months of reporting for PEV rates in general is experiencing large growth rates and the demand and energy data may not be stable enough to draw any major conclusions.

The current preliminary research presented herein analyzes usage patterns of early adopter customers whose characteristics and consumption patterns are often markedly different from the general population. One characteristic in particular is the possession of PV systems. Currently this group is over represented in the PEV rates class. The residential population in SDG&E's service territory consists of approximately 2% NEM customers, yet NEM comprises approximately 18% of the single meter PEV rates class. SDG&E believes that these customers tend to be more affluent with higher monthly consumption and also more energy conscious with a greater awareness and desire to modify usage behaviors when possible, than the average residential customer. As EVs become more popular, it is not known what proportion of this group will also be NEM customers in the future. Table 4 has been included with Table 2 below. Currently, less than 5% of single meter customers are enrolled in demand response prorams.

SDG&E Table 2: NEM and DR Program Enrollment by Single Metering Rate

Month	Total Customers in Single Metering	Total Customers in NEM	NEM as a % of Single Metering	Total Customers in DR (n)	DR as a % of Single Metering
12-Sep	367	73	19.89%	16	4.36%
12-Oct	391	81	20.72%	18	4.60%
12-Nov	452	87	19.25%	20	4.42%
12-Dec	530	98	18.49%	26	4.91%
13-Jan	609	115	18.88%	28	4.60%
13-Feb	682	128	18.77%	31	4.55%
13-Mar	758	144	19.00%	38	5.01%
13-Apr	838	157	18.74%	41	4.89%
13-May	955	181	18.95%	44	4.61%
13-Jun	1,095	198	18.08%	52	4.75%
13-Jul	1,214	213	17.55%	57	4.70%
13-Aug	1,360	234	17.21%	63	4.63%

SDG&E Separately-Metered Electric Vehicle Rates

EV-TOU:

The EV-TOU rate option is designed for residential customers that have their PEV load on a dedicated meter. This is an optional rate to domestic service for charging of a currently registered Motor Vehicle which is one of the following: 1) a battery electric vehicle (BEV) or plug-in hybrid electric vehicle (PHEV) recharged via a recharging outlet a the customer's premises; or, 2) a natural gas vehicle (NGV) refueled via a home refueling appliance (HRA) at the customer's premises. The point of service must contain facilities to separately meter PEV or CNG charging. On-peak is noon-8pm daily.

EPEV-X, Y and Z:

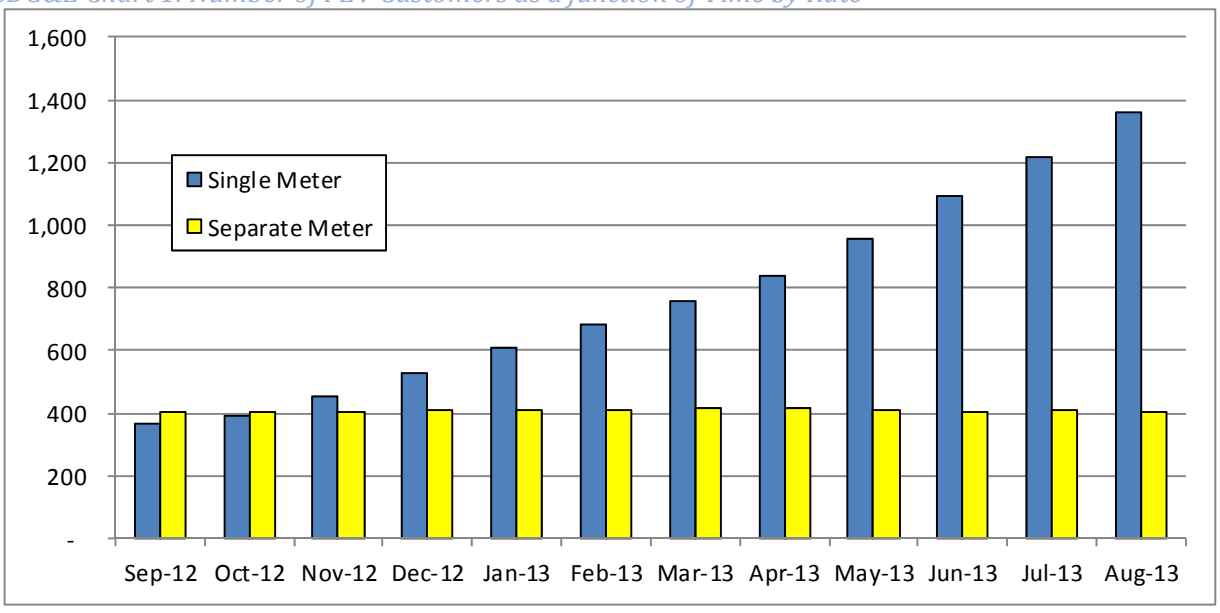
This is an experimental bundled service schedule available to selected residential customers exclusively for charging a PEV. The PEV must be a currently registered motor vehicle, as defined by the California motor vehicle code. This schedule is not available to customers with a conventional charge sustaining (battery recharged solely from the vehicle's on-board generator) hybrid electric vehicle (HEV). On-peak is noon-8pm daily. The ratio from on-peak to off-peak is 2 to 1, for EPEV-X, 4 to 1 for EPEV-Y and 6 to 1 for EPEV-Z. The off-peak time period is 5am - 12 noon, 8pm - 12 midnight daily, and the super off-peak is 12 midnight to 5am daily. These rate options with the different on peak to off-peak ratios were developed specifically for an electric vehicle pricing study. The study recruited Nissan LEAF and Chevy Volt customers and randomly assigned one of the three rate options to each customer as they joined the study. Each customer in the study received an EVSE (charger) with a timer as part of The EV Study funded by the DOE and CEC. This technology enabled customers to plug in the PEV at their convenience, yet charging would mostly occur during the super off-peak hours by utilizing the timer on the charger. Because the majority of charging was done in this manner, there was little variation in consumption patterns and charging behavior over the course of the study. Average monthly consumption was between 220 to 260 KWH and approx. 78% of consumption occurred during super off peak time period.

SDG&E Table 3: NEM and DR Program Enrollment by Separate Metering

Month	Total Number of Customer in Separate Metering	Total w/ NEM	NEM as a % of Separate Metering	Total Customers in DR	DR as a % of Separate Metering
Sep-12	405	111	27.41%	36	8.89%
Oct-12	405	114	28.15%	36	8.89%
Nov-12	407	114	28.01%	36	8.85%
Dec-12	409	115	28.12%	36	8.80%
Jan-13	409	115	28.12%	35	8.56%
Feb-13	413	114	27.60%	36	8.72%
Mar-13	415	116	27.95%	36	8.67%
Apr-13	417	120	28.78%	36	8.63%
May-13	411	120	29.20%	35	8.52%
Jun-13	402	118	29.35%	35	8.71%
Jul-13	408	121	29.66%	37	9.07%
Aug-13	402	124	30.85%	35	8.71%

Table 5 has been combined with Table 3 above. There a higher proportion of NEM and DR customers with separate metering configurations than single metering. Approximately 30% of the EPEV customers have solar generation, and about 9% are enrolled in demand response programs.

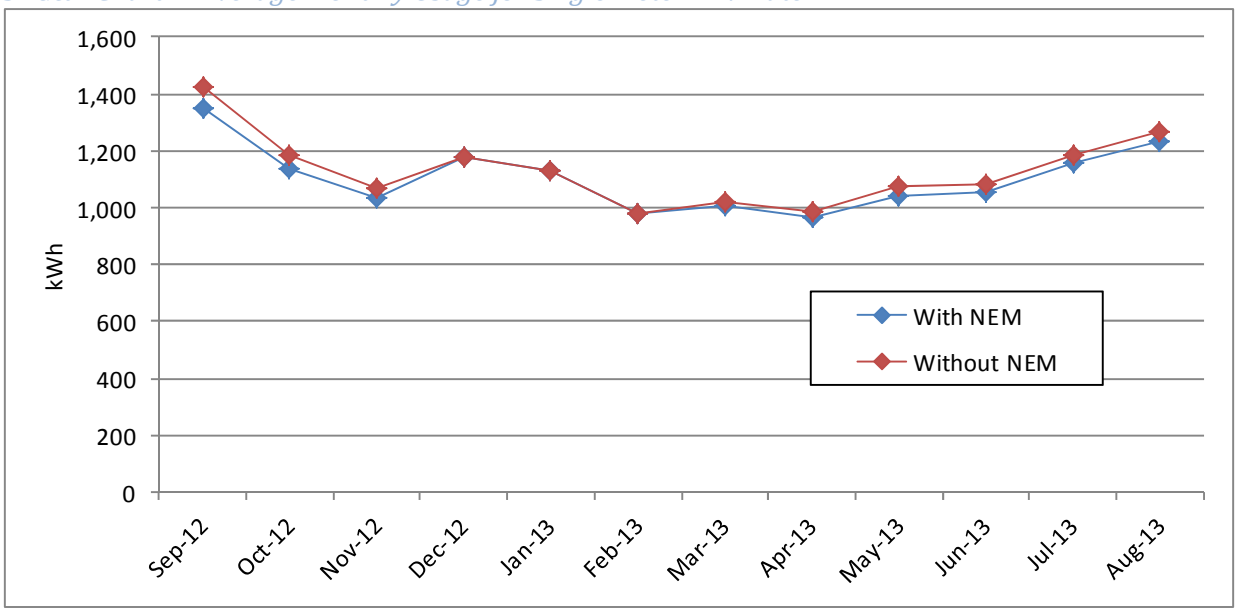
SDG&E Chart 1: Number of PEV Customers as a function of Time by Rate



From September 2012 to August 2013, enrollment in the EVTOU-2 (single metering) rate grew approximately 270% while the number of customers on the EPEV rates (separate metering) remained flat (Chart 1). This disparity in growth rates can be attributed to three factors associated with the EPEV rates: (1) only customers who purchased Nissan Leafs (and later a handful of Chevy Volt owners) were eligible for the EPEV rates, (2) the EPEV rates were originally schedule to be closed at the end of 2013,

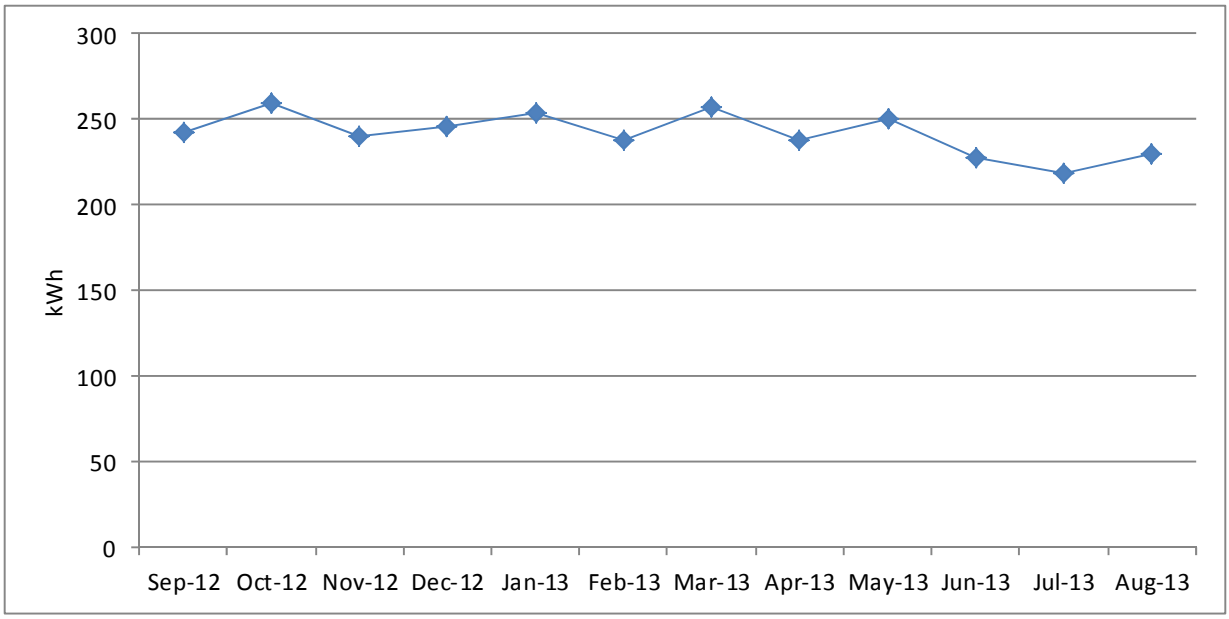
and (3) the EPEV rates were closed to new customers in the 2nd quarter of 2013. Chart 2 was omitted as the data for separate metering customers was included in Chart 1.

SDG&E Chart 3: Average Monthly Usage for Single Meter PEV Rate



The average monthly usage for Single Meter accounts follows similar seasonal patterns and magnitude when comparing NEM and non-NEM. Assuming car load is approximately 220-260 kWh, the household load for those on EV-TOU2 is roughly double the average residential customer of 485 kWh per month. For comparison purposes, Chart 4 has been included with Chart 3 above. Combined, the graphs show that there is little variation in monthly consumption patterns between NEM and non-NEM EV owners.

SDG&E Chart 5: Average Monthly Usage for Separate Meter PEV



As shown in Chart 3, the average monthly usage for Separate Meter rates is fairly consistent during the reporting period, ranging from 220-260 KWH per month.

Time of Use Analysis of Single and Separate Metering Customers

One of the questions attempted to be answered by the PEV Pricing Experiment relate to whether the EV rates act as effective deterrents to on-peak charging behavior. The load shapes provided previously would seem to indicate this is the case. In addition the following tables show that the consumption patterns across the TOU periods for EV customers remain relatively constant for the duration of the study. For separate meter customers, the high rates of super off peak charging reinforce the idea that these customers choose to do the majority of their charging by simply setting their timers to coincide with super off peak hours. NEM does not seem to make a large difference in the distribution of charging consumption patterns across TOU periods for single or separate meter customers. There is little variability in the distribution for single meter customers as well, indicating that this group takes advantage of off-peak charging for their vehicles as well. The hourly load shapes in Chart 7 support this finding.

SDG&E Table 6: Share (percentage) of Peak Usage by Tariff

Month	Single Metering excluding NEM	Single Metering with NEM	Separate Metering excluding NEM	Separate Metering with NEM
September	36.31	38.03	10.06	10.06
October	32.51	34.09	10.1	10.1
November	33.21	33.89	9.88	9.88
December	33.54	34.17	10.77	10.77
January	31.22	32.08	9.83	9.83
February	30.2	31.02	10.28	10.28
March	30.02	30.02	10.5	10.5
April	27.4	29.53	10.31	10.31
May	27.8	30.01	10.12	10.12
June	28.91	31.24	10.54	10.54
July	30.89	32.77	10.52	10.52
August	31.32	33.06	10.24	10.24

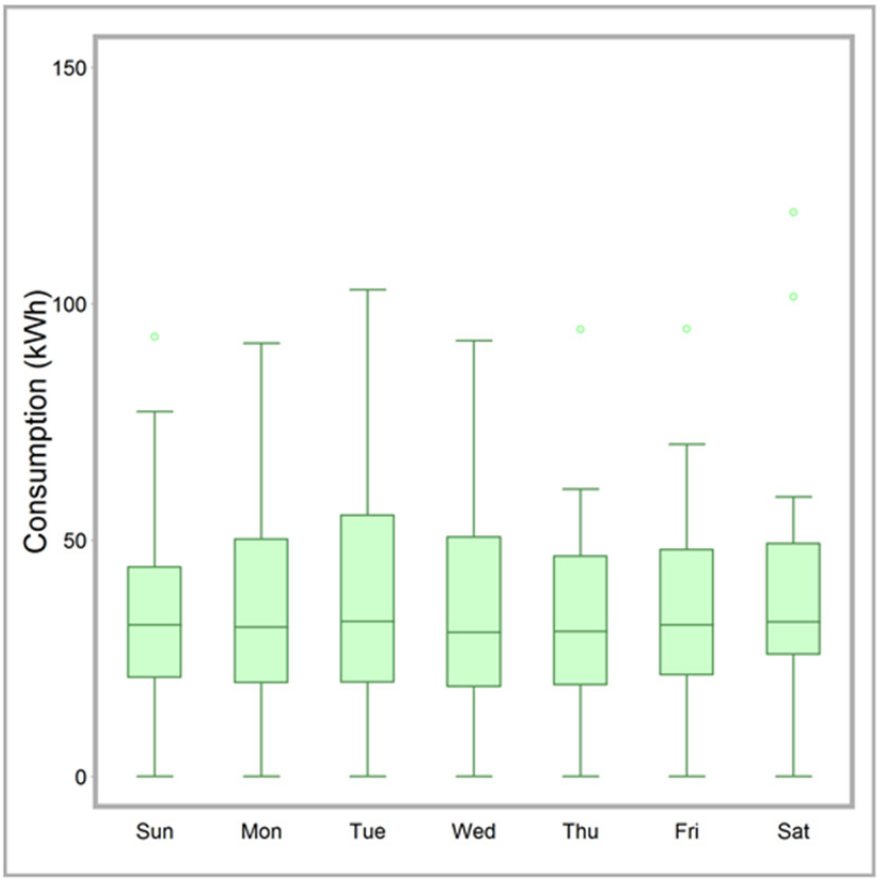
SDG&E Table 7: Share (percentage) of Off-Peak usage by Tariff

Month	Single Metering excluding NEM	Single Metering with NEM	Separate Metering excluding NEM	Separate Metering with NEM
September	40.91	41.05	11.05	11.05
October	42.09	42.5	10.24	10.24
November	41.62	42.48	11.76	11.76
December	42.64	43.34	10.87	10.87
January	43.11	43.6	11.57	11.57
February	42.99	43.49	11.14	11.14
March	44.3	44.3	10.98	10.98
April	43.44	43.65	10.73	10.73
May	42.55	42.98	11.23	11.23
June	42.32	42.66	11	11
July	41.64	41.85	10.94	10.94
August	41.47	41.64	10.57	10.57

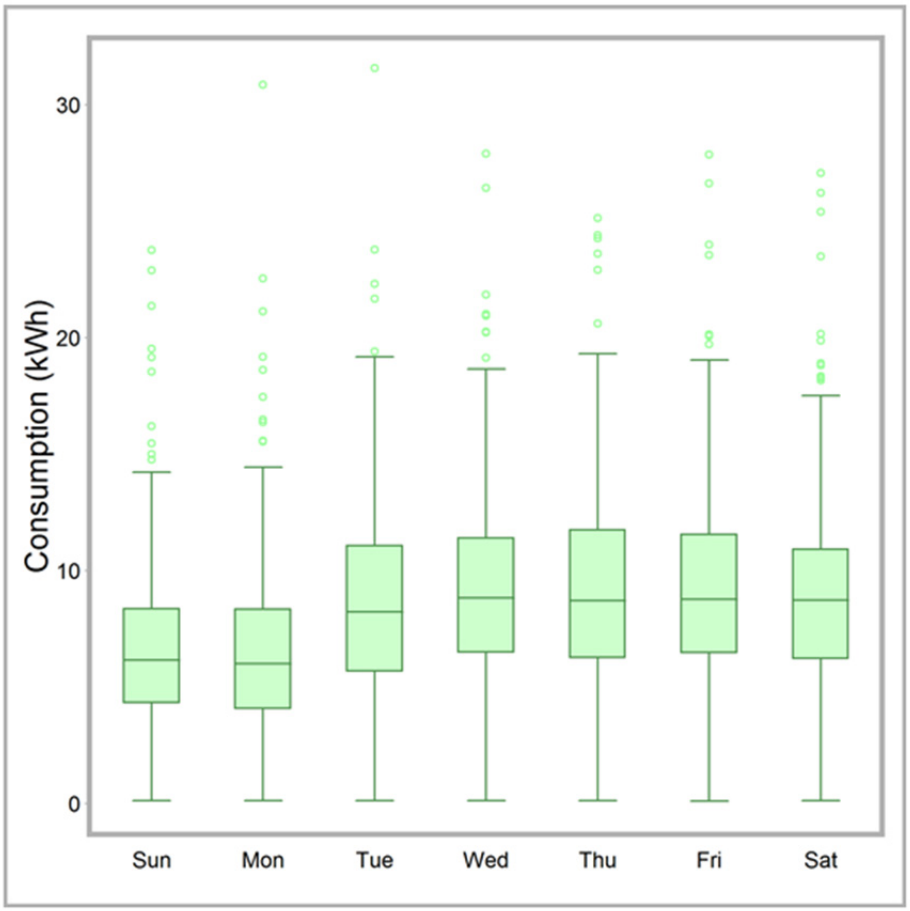
SDG&E Table 8: Share (percentage) of Super Off-Peak Usage by Tariff

Month	Single Metering excluding NEM	Single Metering with NEM	Separate Metering excluding NEM	Separate Metering with NEM
September	22.78	20.92	78.9	78.9
October	25.4	23.41	79.66	79.66
November	25.17	23.63	78.36	78.36
December	23.81	22.5	78.37	78.37
January	25.67	24.32	78.6	78.6
February	26.81	25.49	78.59	78.59
March	25.69	25.69	78.51	78.51
April	29.16	26.82	78.96	78.96
May	29.65	27.01	78.65	78.65
June	28.77	26.1	78.45	78.45
July	27.47	25.38	78.54	78.54
August	27.21	25.3	79.18	79.18

SDG&E Chart 6a: Box & Whisker Plot for Single Meter PEV Rate Energy Consumption by Day of the Week



SDG&E Chart 6b: Box & Whisker Plot for Separate Meter PEV Rate Energy Consumption by Day of the Week



The box and whisker plots above show lower overall consumption for separate meter customers on Sundays and Mondays, while consumption is highest on Tuesdays for single meter households. The hourly load profiles for each group are shown below.

SDG&E Chart 7: Average Load Profile for Single Meter PEV Rate by Day of Week

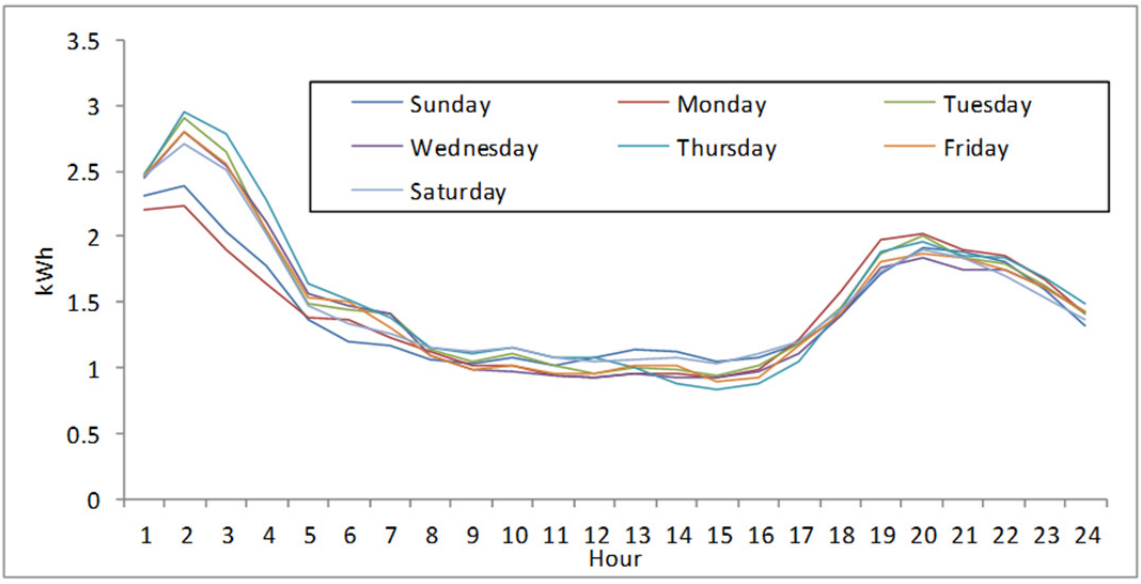


Chart 7 looks at the average load profile throughout the week for Single Meter PEV customers. The load shapes remain relatively flat during the day with an increase in evening consumption, similar to typical residential load profiles, except that there is a large spike that steadily decreases over the early morning hours as these customers take advantage of super-off peak rates to charge their vehicles.

SDG&E Chart 8: Average Load Profile for Single Meter PEV Rate by Day of Week

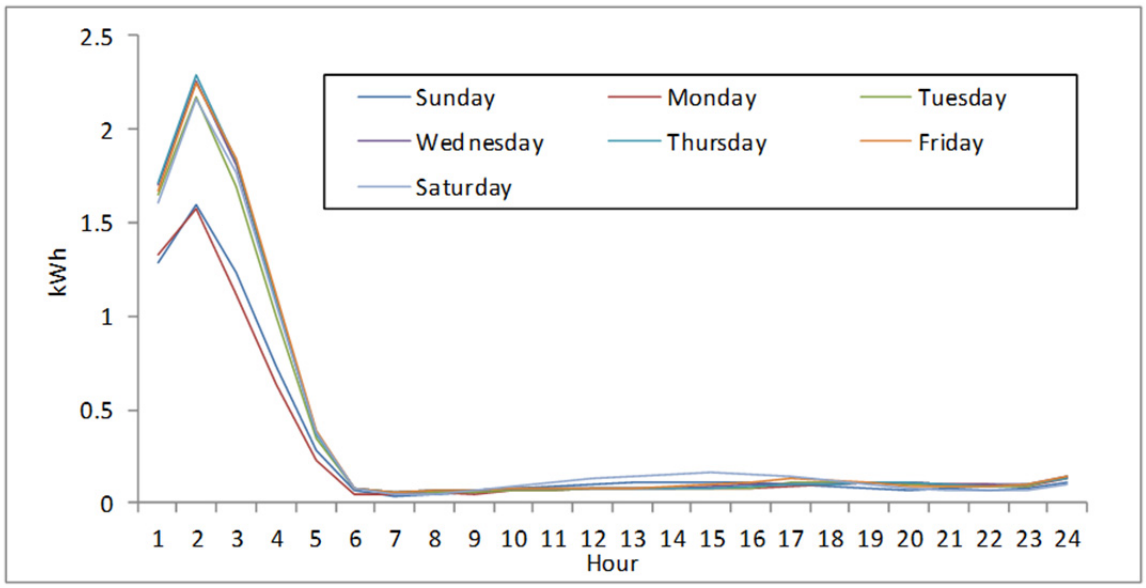


Chart 8 takes the same approach as before but for Separate Meter accounts. These accounts peak during the 12am-1am interval just like the Single Meter load shape; however, there is virtually zero consumption during the rest of the day. This would indicate that the rates are extremely successful in encouraging charging during off peak hours. In addition, the graph shows that consumption is lower for Sundays and Mondays. This is due to the fact that charging represents the need for replenishing electric consumption occurring the previous day, and vehicles tend to be driven less on Saturdays and Sundays.

SDG&E Chart 9: Average Load Profile for PEV Owners on Non-PEV Rate by Day of Week

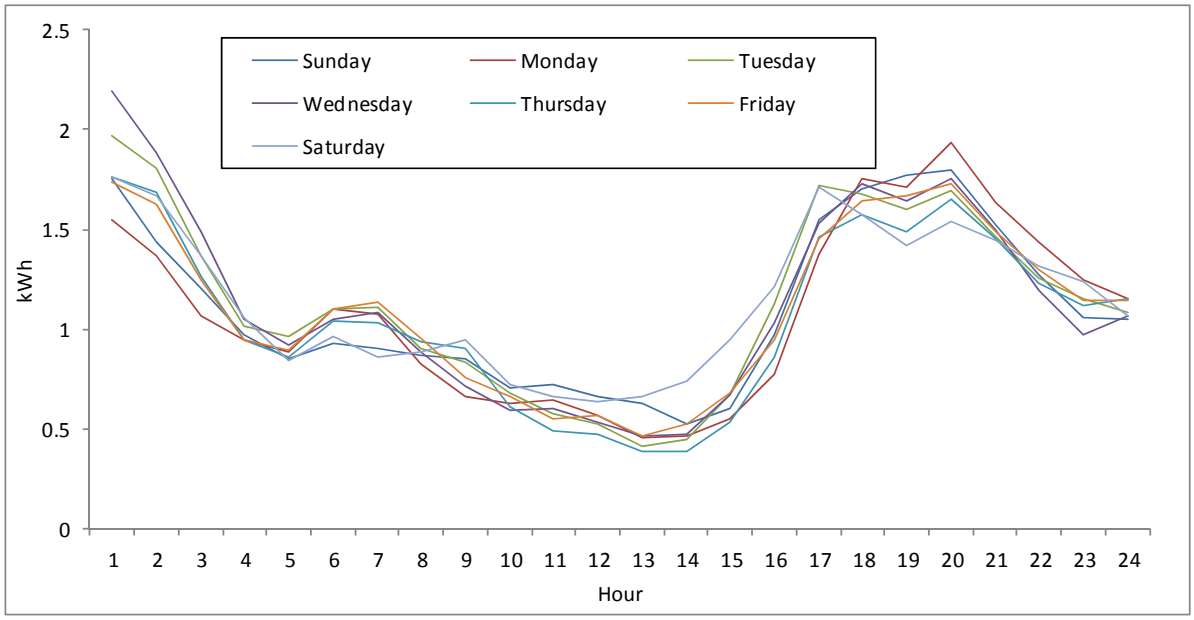
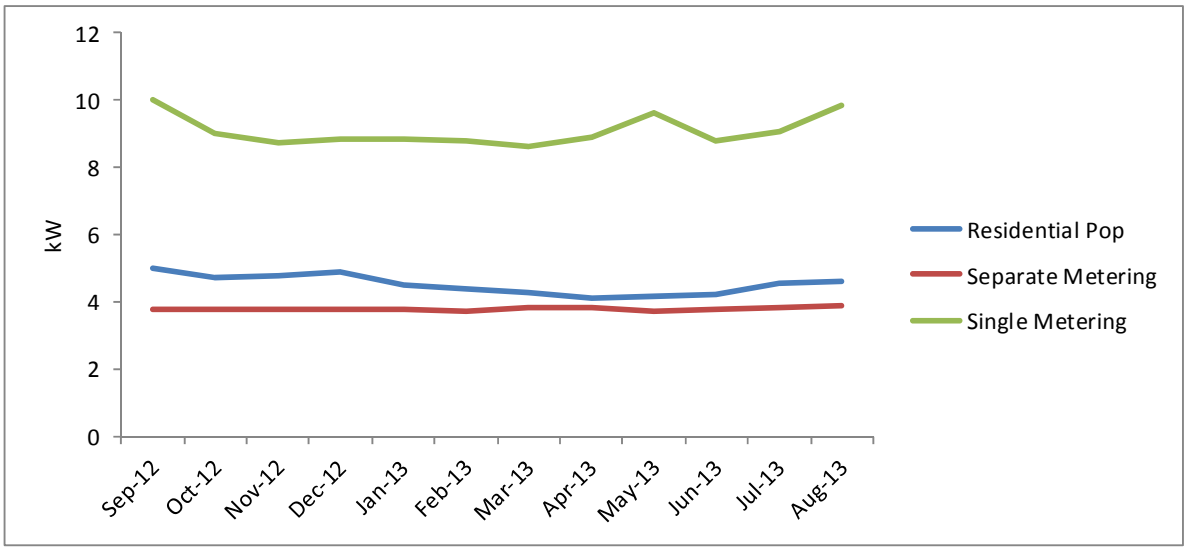


Chart 9 shows daily load shapes for customers who we believe own an EV but are not on a TOU rate. In constructing this customer list, data was provided by Ecotality, GM, Nissan and Oceanus. Customers were given the choice to opt in and allow their addresses and EV sales information to be shared with SDG&E. Most of the data provided was obtained in January 2013 and as such at this time it is not known how many of the customers still own EVs. SDG&E cautions about drawing any conclusions from the load shapes derived from these customers.

SDG&E Table 9: Monthly Average Non-Coincident Peak Load (kW)

Month	Residential Pop	Separate Metering	Single Metering
Sep-12	4.99	3.78	10.02
Oct-12	4.71	3.77	9.02
Nov-12	4.75	3.75	8.71
Dec-12	4.86	3.78	8.83
Jan-13	4.49	3.76	8.84
Feb-13	4.36	3.74	8.79
Mar-13	4.29	3.82	8.62
Apr-13	4.08	3.85	8.91
May-13	4.16	3.71	9.59
Jun-13	4.20	3.77	8.81
Jul-13	4.52	3.80	9.08
Aug-13	4.61	3.89	9.84

SDG&E Chart 10: Average Non-Coincident Peak Load (kW) by Customer Type by Month



Average non-coincident peak load for separate meter customers is nearly constant at 3.8 kW as this is roughly the max setting on the Leaf EVSEs. Single meter customers have non-coincident demands of about twice the normal residential population.

SDG&E Table 10: Time and Associated Demand of Diversified Peak Load

Month	Residential Population-Hour	Residential Population-Demand	Time	Single Metering NEM & Demand EVTOU2	Time	All Separate Metering NEM Hour & Demand EVTOU
September-12	6:45 PM	1.67	7:45PM	4.04	1:30 AM	2.45
October-12	7:30 PM	1.18	8:45PM	3.78	1:30 AM	2.62
November-12	7:45 PM	1.25	0:30AM	4.39	1:30 AM	2.53
December-12	8:15 PM	1.36	6:15PM	3.17	1:30 AM	2.48
January-13	6:45 PM	1.18	1:15AM	3.27	1:30 AM	2.53
February-13	6:45 PM	1.06	1:15AM	3.12	1:30 AM	2.54
March-13	7:15 PM	1.12	1:30AM	3.18	1:30 AM	2.60
April-13	8:30 PM	0.95	1:30AM	3.51	1:30 AM	2.41
May-13	9:00 PM	0.95	1:15AM	3.64	1:30 AM	2.57
June-13	8:15 PM	0.95	1:15AM	2.91	1:30 AM	2.39
July-13	5:30 PM	1.31	1:15AM	2.83	1:30 AM	2.26
August-13	8:00 PM	1.36	0:30AM	3.73	1:30 AM	2.30

Single meter customers vary between peaking in the evening hours, driven by house load, or early morning hours, caused by EV consumption. Chart 11 further illustrates this point by showing the highest occurrences of non-coincident peak loads in the evening and very early morning hours. The separate meter customers always peak at 1:30 AM as a class.

SDG&E Chart 11: Hourly Occurrence of Single Meter Non-Coincident Peak Load

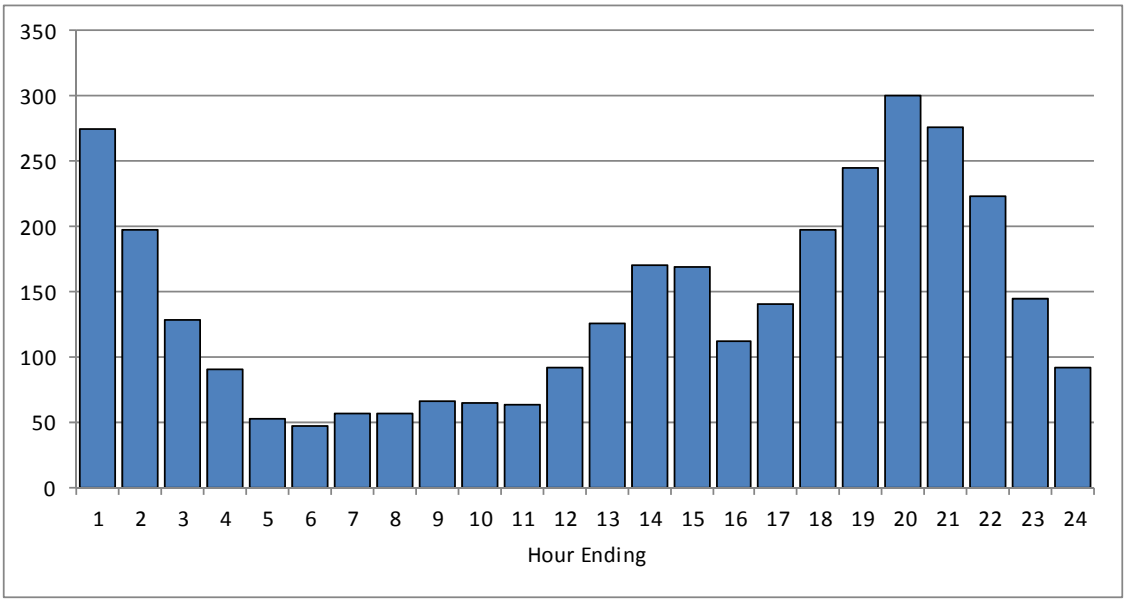


Table Accompanying Chart 11

Hour	Count	%
1	274	8%
2	197	6%
3	129	4%
4	90	3%
5	53	2%
6	47	1%
7	57	2%
8	57	2%
9	66	2%
10	65	2%
11	63	2%
12	92	3%
13	125	4%
14	170	5%
15	169	5%
16	112	3%
17	140	4%
18	197	6%
19	245	7%
20	300	9%
21	276	8%
22	223	7%
23	145	4%
24	92	3%

SDG&E Table 11: Average Load Coincident with System Peak

Month	Residential Population	Single Metering	Separate Metering
Sep-12	1.53	2.94	0.15
Oct-12	0.74	3.58	0.12
Nov-12	0.93	2.36	0.09
Dec-12	1.18	2.68	0.08
Jan-13	1.20	3.05	0.18
Feb-13	1.06	2.68	0.59
Mar-13	0.99	2.47	0.10
Apr-13	0.94	2.50	0.13
May-13	0.86	1.71	0.11
Jun-13	0.66	2.57	0.61
Jul-13	1.27	2.41	0.06
Aug-13	1.22	2.70	0.08

Separate meter customers have extremely low demands coincident with system peak because most customers are not charging their vehicles during the day. The single metering customers show higher demands than the average residential customers. It should be noted that the data provided for the residential population in Tables 10 and 11 is derived from 2010 Load Studies as more current information about this class is not currently available.

SDG&E Table 12a: Geographic Concentration of PEVs (Top 5 Zip Codes by Rate)

Rate	Zip Code	Area	Number of Customers	Percent of Total
Single Meter	92130	Carmel Valley	88	6%
	92037	La Jolla	71	5%
	92067	Rancho Santa Fe	51	4%
	92009	Carlsbad	51	4%
	92694	Ladera Ranch	48	3%
	92024	Encinitas	48	3%
Separate Meter	92130	Carmel Valley	44	10%
	92024	Encinitas	26	6%
	92129	Rancho Penasquitos	21	5%
	92037	La Jolla	18	4%
	92127	Rancho Bernardo	16	4%
	92128	Rancho Bernardo	16	4%

SDG&E Table 12b: Geographic Concentration of PEVs by Climate Zone and Rate

Climate Zone	Single Meter	Separate Meter	Total	Percent of Total
Coastal	990	266	1,256	69%
Mountain	5	1	6	0%
Desert	0	0	0	0%
Inland	386	173	559	31%

69% of PEV accounts are located in the coastal climate zone with the remaining 31% located in the Inland zone. The results are presented in Table 12b, Chart 12a, and Chart 12b. PEV ownership is heavily concentrated in the more affluent regions (La Jolla, Rancho Santa Fe, etc.) of the service territory.

Figure SDG&E-2: Geographic Concentration of PEV's by Rate

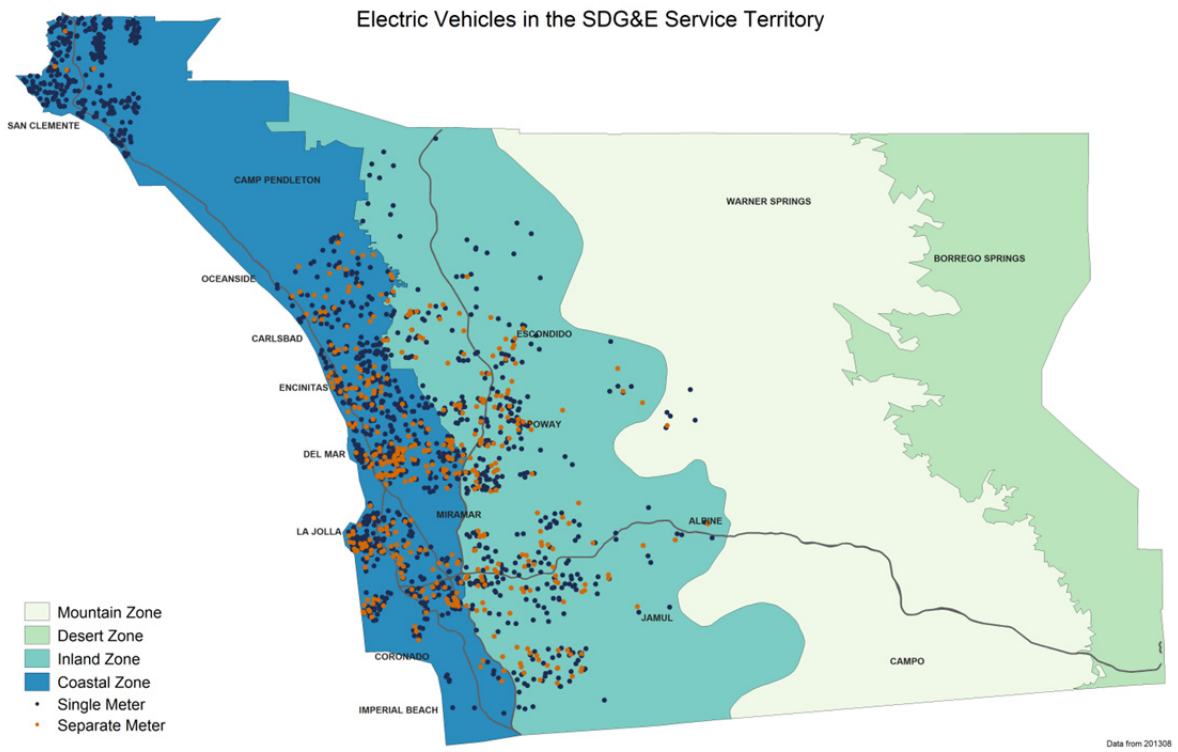
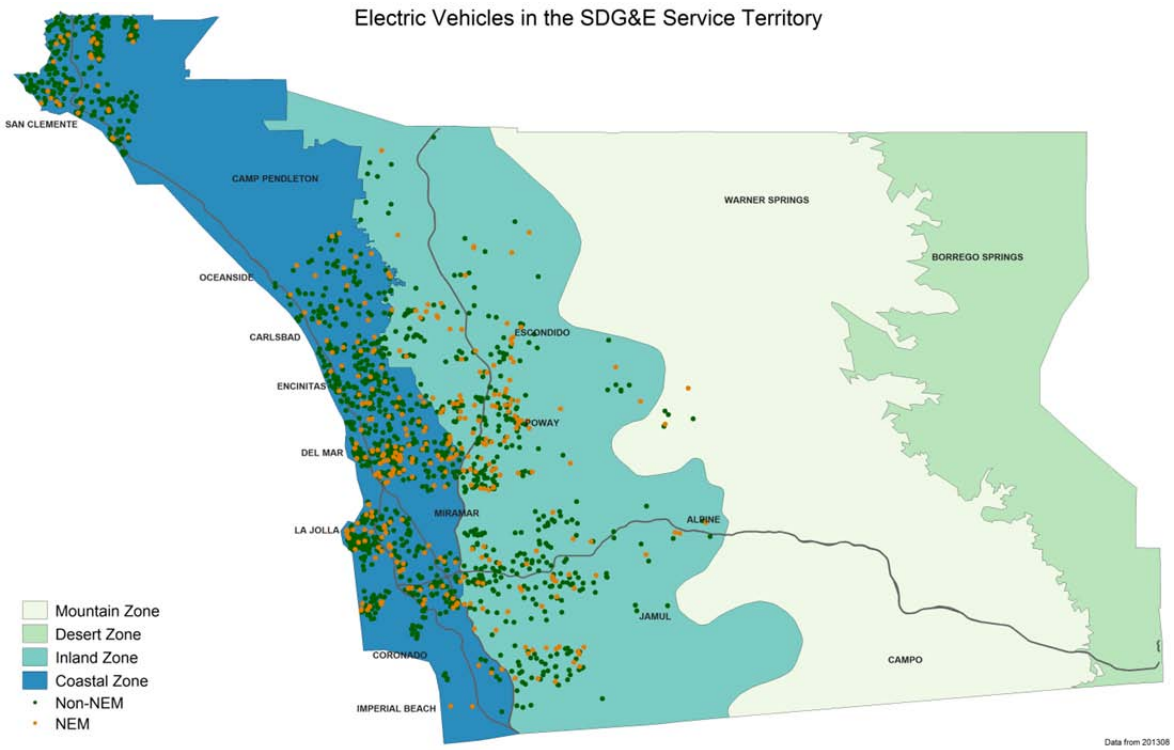


Figure SDG&E-3: Geographic Concentration of PEV's by NEM



Conclusions and Observations

PG&E

- While the data collected are illustrative of the behaviors of early PEV adopters one cannot conclude that these behavior patterns will hold as, PEV technology matures, charging technology and charging behaviors evolve, and PEVs achieve greater market adoption beyond the early adopter phase. Consequently, data that is sufficiently reliable for policymaking can only be obtained via an appropriately funded and carefully designed study that controls for the above issues.
- There is evidence that, amongst this group of early adopters and for this current composition of vehicles, customers on TOU PEV rates are charging during off-peak periods: all EV-A customers use a lower percentage of energy in the on-peak period and a higher percentage in the off-peak period as compared to the residential population; non-NEM EV-B customers do 78% of their PEV charging in the off-peak period and just 4% in the on-peak period; the diversified peak for customers on EV-A or EV-B occurs between 12am – 2am.
- On average, the PEV early adopters have a higher maximum demand that must be accommodated by the electric distribution system as compared to the average household without a PEV.
- Although the early adopter PEV customers may have a higher average maximum demand, those customers on the PEV rates tend to hit their maximum demand while non-PEV customers are at

their lowest usage. Thus, there appears to be a diversity benefit created by the TOU rates. However, from the most local service assessment level perspective (i.e. a single household or set of households serviced by a single transformer), the value of this diversity is limited by the fact that the distribution system must still be prepared to accommodate PEV charging during the peak period since these customers can, and occasionally do, charge during those times.

- All of the above conclusions are subject to change as the mix of customers and vehicles changes over time. During the study timeframe, the rapidly changing nature of PEV ownership was clearly evident in the changes that occurred in the mix of customers who own PEVs and types of PEVs available. These changes will need to be considered in ratemaking and cost allocation policymaking. Therefore, California will need to continue to be flexible and adaptable with respect to PEV policies.

SCE

- The number of time-of-use accounts has been steadily increasing from 822 in September 2012 to 2,434 in August 2013. This growth rate is comparable to that of the number of plug-in PEVs in SCE's territory which have increased from 6,338 to 14,530[54] over the same time period.
- On average, residential PEV owners who are on a TOU rate are responding to the price signals as they consistently charge more during off-peak and mid-peak hours. Furthermore, the time of peak is identical across months and across customer types.
- The group of separate-metered accounts for PEVs has grown steadily throughout this twelve month period of observation and has shown a concurrent increase in average peak demand and average usage. This may indicate a shift in the capability of the technology, the usage frequency, or the demographics of the vehicle owners.
- The statistics and metrics found in this report are based on a relatively small population of early adopters in a very dynamic environment. As fuel and materials costs fluctuate, vehicle options expand, and technology continues to adapt to customer needs, the observed behavior is expected to change. If the population of PEV owners continues to grow, the future population may have different characteristics than the current group. Therefore, it may be difficult to assess continuing longer term trends.

SDG&E

- Current Time-of-use (TOU) rates coupled with charging timers result in super off-peak PEV charging.
- Customers with PEVs that stay on SDG&E's typical residential non-TOU rate tend to show less usage during the super off peak period and increased usage during the afternoon-evening hours relative to those on PEV rates.
- Net-Energy-Metering (NEM) customers with PEVs respond to TOU rates.
- Demand and usage levels for these early PEV adopters are nearly double that of the average residential customer.

[54] Based on DMV data obtained from R.L. Polk.

- Peak times for PEV Demands are typically in the early morning hours compared to evenings for typical residential customers.
- Sundays & Mondays have the lowest daily kWh consumed, for PEV customers on TOU rates.
- EV-TOU-2 (SDG&E's whole-house TOU rate) customer growth has increased almost 300% over the past 12 months, which may cause instability in current Load Research results.

Next Steps

The IOUs will file additional load research reports, as ordered in the Extension Decision.

In its GRC Phase 2 Application filed April 18, 2013, PG&E included updates to its PEV rates. In its Rate Design Window Filing on December 24, 2013, SCE proposed new rates for its PEV customers. Both proceedings are currently underway.

In November 2013 the Commission opened a new Rulemaking (New AFV OIR), R.13-11-007, to consider Alternative-Fueled Vehicle Programs, Tariffs, and Policies. The New AFV OIR contemplates a track to address AFV rate design policy.

Appendix A

PG&E Correction To Joint IOU Electric Vehicle Load Research Final Report, Filed On December 28, 2012

Appendix A: PG&E Correction to Joint IOU Electric Vehicle Load Research Final Report, Filed on December 28, 2012

Corrections to Table IOU-1 and the following text from pp. 8-9 of the report are identified by strikethrough of the errant text and **bold** for the correct text:

Table IOU-1: Summary of Cost Tracking Data

	PG&E	SCE	SDG&E
Estimated PEV customers through October 31, 2012	6,969	7,976	2,125
Residential			
Number of Infrastructure Checks completed	~~3,066~~ **1,778**	2,600	640
PEV customers requiring service facility upgrades – Rule 15 & 16	9	8	5
Total Costs Incurred	$41,834	$28,097	$9,592
Range of Costs	$656-$8,265	$274 - $10,384	$666 - $4,007
Average Cost	$4,648	$3,512	$1,590
Number of Foregone Rule 16 Billings	5	0	0
Existing Residential Allowance	$1,918	$2,506	$2,578
Amount of Foregone Billings – Rule 16	$9,226	$0	$0
Commercial			
PEV customers requiring service facility upgrades – Rule 15 & 16	0	3	1
Total Costs Incurred	$0	$33,423	$4,007
Range of Costs	N/A	$3,506 - $15,977	N/A
Average Cost	N/A	$11,141	N/A

PG&E Specific Details

As of October 2012, PG&E's best estimate of the number of PEVs in the PG&E service territory is 6,969. The data sources for this estimate are customer self-identification, OEM opt-in notification, identification through city/county permits, and estimates based on national sales. There is a significant amount of uncertainty in this number and it is appropriately considered to be a lower bound of the number of PEVs in the territory. Since December 31, 2010, PG&E's estimate of PEVs in the service territory has grown by 6,894 vehicles.

While PG&E's total estimate of PEVs in the service territory is 6,969, PG&E is only able to perform service assessments for those vehicles for which customer specific notification is received. As of October 31, 2012, PG&E had completed ~~3,066~~ **1,778** such service assessments. Of the ~~3,066~~ **1,778** service assessments completed to date, 9, or ~~0.3%~~ **0.5%**, have required upgrades due solely to the addition of PEV load. In 5 instances the allowances were not sufficient to cover the customer portion of the upgrade and the customer would have incurred costs had the exemption not been in place. The total cost of the excess over the allowance for all 5 customers combined was $9,226.