

# Advanced Technology 2013009 - Submetering Phase 1 Pilot Final Project Report

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Developed by  
SCE Transmission & Distribution, Advanced Technology  
Organization



## Disclaimer

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## Acknowledgments

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Prepared for:

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Principle Investigators (s)

## Change Log

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Version	Date	Description of Change	Project Report No.
<b>0.01</b>	201402xx	Annotated Outline	TC/PS/FE-XX-XXX-TRXX

# Table of Contents

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1	Executive Summary .....	1
2	Project Summary .....	4
2.1	Project Objective .....	6
2.2	Problem Statement .....	6
2.3	Scope .....	7
2.4	Schedule .....	7
2.5	Milestones and Deliverables .....	8
3	Test Set-Up/Procedure <sup>1</sup> .....	9
4	Project Results .....	10
4.1	Technical Results, Findings, and Recommendations .....	10
4.2	Technical Lessons Learned .....	10
4.3	Value Proposition .....	11
4.4	Technology/Knowledge Transfer Plan .....	12
5	Metrics .....	12
5.1	Total number of SCE customer Phase 1 Pilot participants: .....	12
5.2	Number of SCE NEM customer participants: .....	13
5.3	Complete and accurate Customer Enrollment Agreements: .....	13
5.4	Submeter MDMA on-time delivery of customer submeter interval .....	14
	usage data: .....	14
	Figure 14.....	16

## List of Figures

---

- Figure 1: Residential EV Charging Example
- Figure 2: Commercial EV Charging Example
- Figure 3: Submetering Energy, Data, Bill and Payment Process
- Figure 4: Submeter Data collection and Billing Process
- Figure 5: IOU Total Cumulative CEAs Received
- Figure 6: Submetering Phase 1 Pilot Key Milestones Schedule
- Figure 7: Customer Early Opt-Outs
- Figure 8: SCE Submeters
- Figure 9: SCE NEM Submeters
- Figure 10: Submeter MDMA CEA Quality
- Figure 11: Submeter MDMA Returned CEAs
- Figure 12: Late Submeter Data Billing Cycles
- Figure 13: Subtractive Billing Process With Bad Interval
- Figure 14: Average Monthly Bad Intervals and Lost Savings

## List of Tables

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- Table 1: Submeters by IOU & Submeter MDMA

## Preface

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## 1 Executive Summary

### Summary

On 11/14/13, the California Public Utilities Commission (CPUC) voted to approve the revised Proposed Decision (PD) Modifying the Requirements for the Development of a Plug-In Electric Vehicle Submetering Protocol set forth in D.11-07-029. The investor-owned utilities (IOUs), Pacific Gas & Electric (PG&E), San Diego Gas & Electric (SDG&E) and Southern California Edison (SCE) were directed to implement a two phased pilot beginning in May 2014, with funding for both phases provided by the Electric Program Investment Charge (EPIC). In addition to helping meet regulatory requirements, this pilot supports “smart charging” components associated with the integration of electric transportation in a smart grid environment.

The Phase 1 Pilot was available to a maximum of 500 eligible PEV participating submeters within SCE’s service territory. All residential and commercial customers could participate except streetlight customers and customers taking Direct Access, Electric Service Provider, and Community Aggregation service.

Eligible customers (single customers-of-record) charged a plug-in electric vehicle which was measured by a submeter (submeter load) and was connected to the same meter that registers the customer’s primary load. The submeter load was manually subtracted from the customer’s primary meter load and billed, each month, on SCE’s applicable electric vehicle rate schedule. Eligibility conditions required that customers have an interval data recorder type meter as their primary meter. The PEV submeter was used for the sole purpose of measuring electricity used to charge the PEV. Examples of residential and commercial EV charging are shown below in Figures 1 & 2 respectively. Submeter processes are shown in Figures 3 and 4 on the next page.

**Figure 1**

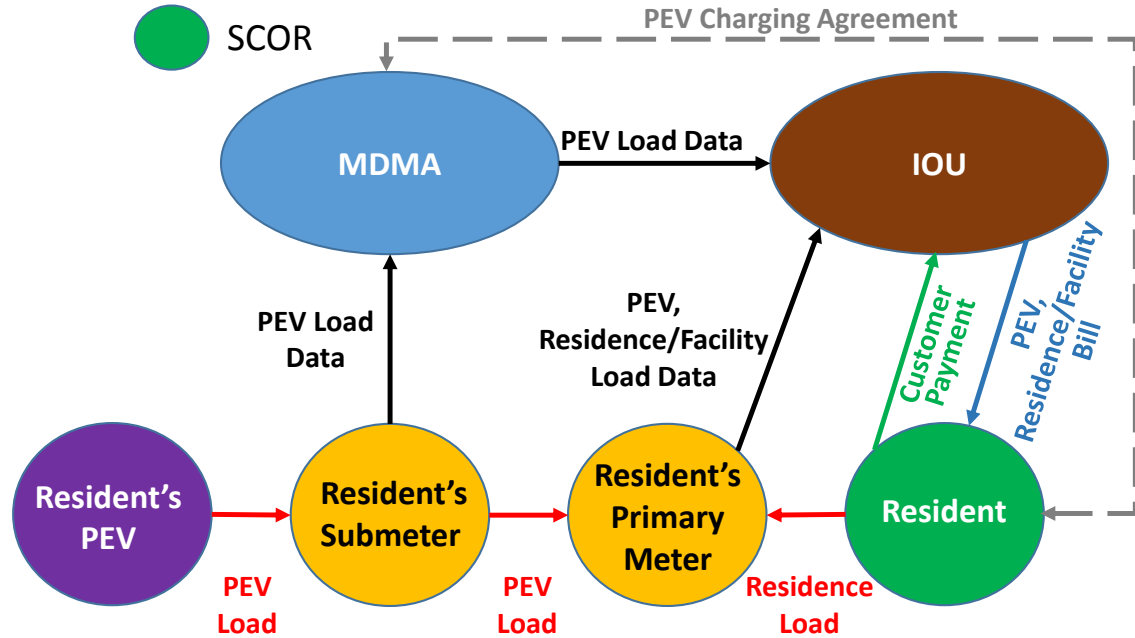


**Figure 2**



Figure 3

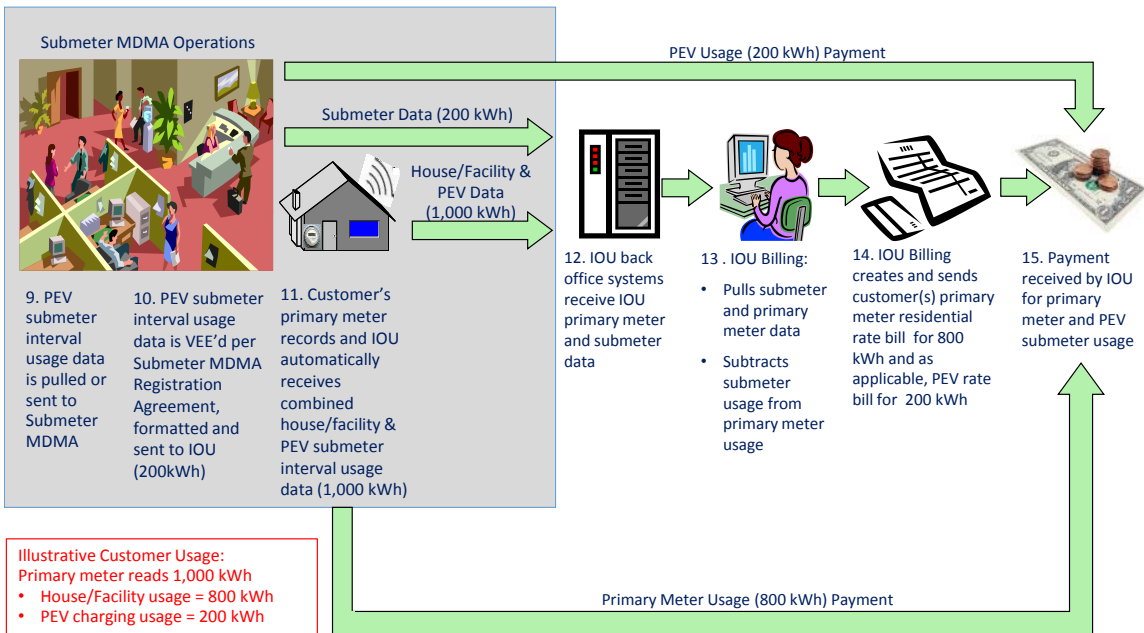
**Submeter Energy, Data, Bill and Payment Process  
Single Family Resident/Commercial Facility<sup>1</sup> Resident**



<sup>1</sup> Facility includes residents in MUD, condo complex or commercial facility

Figure 4

**Submeter Pilot Data Collection – Billing**



A Submeter Meter Data Management Agent (Submeter MDMA) was responsible for enrolling customers with PEVs into the Phase 1 Pilot program. Submeter MDMA's were selected by the Energy Division. IOUs had no role in the approval process.

The Energy Division CPUC ordered IOUs to competitively solicit and select an independent third-party Phase 1 Pilot evaluator. The IOUs selected Nexant from among three proposals.

On July 10, 2014, in compliance with Decision (D.) 13-11-002 and Resolution E-4651, the IOUs filed new tariffs to implement Phase 1 of the Pilot by establishing Schedule PEVSP, Plug-In Electric Vehicle Submetering Pilot (Phase 1), and associated customer and Submetering Meter Data Management Agent (MDMA) agreements.

Seven to ten potential submeter MDMA's participated for all or part of the development of the Phase 1 Pilot requirements from July 2011 to July 2014. Only three companies applied and all were approved to provide Submeter MDMA services during the Phase 1 Pilot. They included:

- eMotorWerks (eMW)
- NRG EVgo (NRG)
- Ohmconnect

On September 1, 2014, the six-month enrollment period began. By December 17, 2014, no Customer Enrollment Agreement (CEA) had been accepted by the IOUs. Accordingly, the IOUs and MDMA's requested and received approval for an extension of six months to comply with February 28, 2015 deadline in Resolution E-4651 for ending the Phase 1 Submetering Pilot open enrollment period.

## Results

The initial 6-month enrollment period ended on February 28, 2015 with no Customer Enrollment Agreement (CEA) accepted by SCE. Over the next six-month enrollment period ending on August 31, 2015, the Submeter MDMA's enrolled a total of 92 (18.4%) residential submeters of a maximum of 500 submeters in the Phase 1 Pilot in SCE's territory.

The period of performance for this project was 34 months which includes Pilot preparation. Total expenditures were \$1.03M (As of 10.30.16) vs. a budget of \$2.195M. *(Note: Report can be updated when December 2016 financial report is published in February 2016 with actual FINAL Pilot cost.)*

## Lessons Learned

Lessons learned that will be applied to the Submetering Phase 2 Pilot include:

1. The Submeter MDMA's were not prepared to start the Phase 1 Pilot on September 1, 2014.  
Require more stringent preliminary ED review of stakeholder's qualifications to be a Submeter MDMA including final approval by the IOUs that Submeter MDMA candidates meet all requirements stated in Advice Letter prior to the start of the Pilot.  
In addition, provide the Submetering MDMA's with more comprehensive, detailed training prior to the start of the Phase 2 Pilot to help improve their performance and level of customer satisfaction.
2. The manual customer enrollment process was challenging for our customers and the Submeter MDMA's.  
Streamline the customer enrollment process by simplifying the Customer Enrollment Agreement (CEA); replacing the Phase 1 Excel spreadsheet tracker used to record customer

status throughout the Pilot with a more robust, more flexible Access database; and provide the Submeter MDMA's more details when a CEA is returned to them for correction.

3. The term submeter 'accuracy' is equivalent to the same term used in the ANSI C-12 standard or equivalent to 'tolerance' in NIST Handbook 44 Section 3.40 T.2. Require the submeter to demonstrate meter acceptance accuracy of +/-1%, and maintain accuracy of +/- 2% during the Phase 2 Pilot. Submeter MDMA is responsible for describing how they comply with this accuracy requirement prior to pilot installation.
4. Require the submeter's time be synchronized to the Universal Time Coordinate (UTC) time standard as defined by the National Institute of Standards and Technology (NIST), and be within +/- two (2) minutes of UTC, while the EVSE is in service. Submeter MDMA is responsible for describing how they comply with this accuracy requirement prior to pilot installation.

## 2 Project Summary

On June 27, 2014, the CPUC issued Resolution E-4651, which approved SCE's request to implement a Plug-In Electric Vehicle Submetering Pilot (PEVSP) in compliance with Decision 13-11-002, in which the Commission ordered the implementation of Submetering pilots to understand the requirements of and customer experiences with non-utility plug-in electric vehicle submetering. Upon this Decision, SCE procured contract project management support (Corepoint and Choice Workforce), launched the Phase 1 Pilot announcement on SCE's plug-in electric vehicle (PEV) website, collaborated with PG&E and SDG&E on an Request for Proposal to identify a third-party evaluator, set-up internal processes and training documentation, began working with Submeter MDMA's (i.e., eMotorWerks, NRG and Ohmconnect) selected by the Energy Division (ED), received CPUC approval of the Submetering Pilot tariff, and officially started the Phase 1 Pilot on September 1, 2014.

The three Submeter MDMA's, were issued purchase orders to enable SCE to pay the MDMA's for enrolling customers and providing SCE with monthly EV submeter usage data. Nexant was selected by the three IOU's to be the third party evaluator of the Submetering Pilots. PG&E contracted Nexant on behalf of the three IOU's who will share the costs equally, 33% each, as mandated by the CPUC. SCE's Phase 1 Pilot share was \$220,000 which was payable annually through 2016 for the Phase 1 Pilot. SCE's actual Phase 1 Pilot Nexant cost was \$120,264.

Ohmconnect and eMotorWerks started the Pilot without a UL certified submeter. NRG's submeter had met UL safety requirements but NRG was still testing its internal submeter communications as the Pilot started. Consequently, SCE did not receive any Customer Enrollment Agreements from any of the MDMA's during the six-month enrollment period. The IOU's and the Commission's ED then held a series of meetings with the participating MDMA's to understand the issues that were preventing the MDMA's from enrolling any customers. The MDMA's requested an extension of the customer enrollment period to allow additional time to obtain submeter Underwriters Laboratories (UL) certification and meet all other Pilot requirements including additional time to complete CEAs, pass submeter communications testing, and establish accounts at each IOU to receive incentive payments.

In December 2014, the ED requested that the IOU's develop a draft Contingency Plan to possibly extend the Phase 1 Pilot. The Plan was submitted to Energy Division on January 20, 2015. Subsequently, the ED directed the IOU's to send the CPUC Executive Director a Phase 1 Submetering Pilot letter requesting an extension before the end of February 2015. SCE worked closely with the CPUC/ED and Submetering MDMA's to extend the Phase 1 Pilot six months to August 31, 2015, resulting in the enrollment of enroll 92 customers.



The initial 6-month enrollment period ended on February 28, 2015 with no Customer Enrollment Agreement (CEA) accepted by SCE. Over the next six month enrollment period, ending August 31, 2015 the Submeter MDMA's enrolled a total of 92 residential submeters of a maximum of 500 submeters in the Phase 1 Pilot in SCE's territory as shown in Table 1 below.

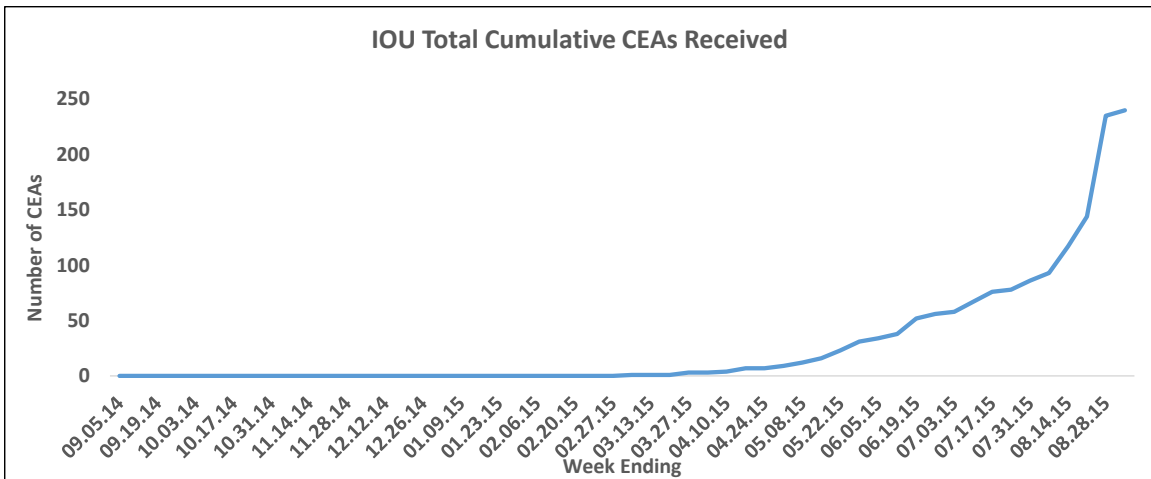
**Table 1**

**Number of Submeters by IOU & Submeter MDMA**

IOU	EMW	NRG	OMC	Total	IOU Max	Percent
PG&E	108	1	22	131	500	26%
<b>SCE</b>	<b>71</b>	<b>2</b>	<b>19</b>	<b>92</b>	<b>500</b>	<b>18%</b>
SDG&E	12	1	4	17	500	3%
<b>Total</b>	<b>191</b>	<b>4</b>	<b>45</b>	<b>240</b>	<b>1,500</b>	<b>16%</b>
<b>Percent</b>	<b>80%</b>	<b>2%</b>	<b>19%</b>	<b>100%</b>		

154 of 240 (64%) CEAs were received in last month of the 12-month enrollment period as shown in Figure 3 below overloaded IOU manual processes.

**Figure 5**



During the Pilot, SCE provided its customers with manual subtractive billing to separately bill household and EV charging on their respective rates. The three IOUs all experienced billing problems due to various accuracy and timing problems with the MDMA's submeters. Syncing the submeter to the U.S. time standard as defined by the National Institute of Standards and Technology or within three minutes of the time used by the utilities appears to be the bigger issue and the cause of most recorded submeter "Bad" intervals which occur when the submeter kWh exceeds the primary meter kWh. (See Section 4.2 Technical Lessons Learned for further details)

SCE also supported its customer's Pilot participation by answering their questions and resolving their issues. SCE provided a similar service to the three Submetering MDMA's. The Phase 1 Submetering Pilot customer participation ended on schedule and under budget.

Customer satisfaction key Learnings from Nexant's customer surveys during the Phase 1 Pilot across the three IOUs follows:

- 78% of respondents said they were extremely or somewhat satisfied with their overall submetering service
- 82% of respondents said they would recommend submetering services to a friend or colleague based on their Phase 1 Pilot experience
- 77% said they would be interested in participating in the Phase 2 pilot
- Customers participating in the Phase 1 Pilot reported charging their EV during off-peak hours 90% of the time vs 48% before the Pilot.
- Median perceived customer charging savings was \$30 per month, equivalent to 43% savings
- 30% of surveyed customers experienced a significant number of billing issues caused by inaccurate submeter data and poor customer service from their Submeter MDMA (Note: Phase 1 Pilot customers were not provided bill guarantee to ensure that they would not be financially penalized for participating in the Pilot.)

## 2.1 Project Objective

Decision 13-11-002: During Phase 1, the utilities tested the use of Single Customer of Record submetering. Single Family Homes, Apartment Units, and Commercial Facilities were allowed to use submetering under a Single Customer of Record. However, the Submeter MDMA's did not enroll any commercial customers in SCE's territory.

Primary goals of the Phase 1 Pilot were to:

- Evaluate the demand for Single COR submetering in Single Family Homes, Apartment Units, and Commercial Facilities, and customer uptake prior to making larger investments.
- Ensure a positive Customer Experience while determining customer perceptions, estimating customer costs and benefits of Single COR submetering-enabled services, and smoothly transitioning between tariffs.

## 2.2 Problem Statement

- CPUC issued an AFV OIR Phase 2 Decision mandating the California IOUs develop methods enabling third parties—current utility customers and/or providers of electric vehicle (EV) services—to submeter the EV load to reduce customer cost related to installing a dedicated meter for EV charging.
- Decision 13-11-002, dated November 14, 2013, adopted the Energy Division Staff PEV Submetering two-phase pilot project.
- Resolution E-4651, dated June 26, 2014, approved the utilities' Schedule Plug-In Electric Vehicle Submetering Pilot tariff with modifications for Phase 1.

- SCE's Tier 2 Advice Letter, ADVICE 3075-E, dated July 10, 2014, established Schedule PEVSP, Plug-In Electric Vehicle Submetering Pilot and associated forms to support the implementation of the Submetering Phase 1 Pilot.
- IOUs and MDMAs requested and received approval for an extension of six months to comply with February 28, 2015 deadline in Resolution E-4651 for ending the Phase 1 Submetering Pilot open enrollment period.

### 2.3 Scope

1. **Pilot Term:** Phase 1 duration was 18 months beginning September 1, 2014 and ending February 28, 2016. The IOUs were directed by the Energy Division to extend the Phase 1 Pilot six months to August 31, 2016 for a total of 24 months.

2. **Pilot Participation Cap:** On a first-come, first-served basis, a maximum of 500 submeters could have been enrolled in the Phase 1 Pilot. Of the 500 submeters, a limit of 100 submeters could have been related to NEM accounts.

3. **Pilot Participation Period:** Customers were allowed to participate for up to a maximum of 12 consecutive billing cycles. Customers were able to unenroll from the Pilot at any time, but could not re-enroll in Phase 1 of the Pilot unless they were relocating in one of the IOU's service territories.

### 2.4 Schedule

Shown in Figure 6 below

Figure 6

Submetering Phase 1 Pilot Key Milestones Schedule																										
Pilot Tasks	2011		2012				2013				2014				2015				2016							
	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4				
Decision I11-07-029 Issued	█																									
Submetering Roadmap Submitted		█	█																							
Submetering Strawman Submitted			█	█	█	█																				
CPUC Proposal Review and Comments Completed							█	█	█	█																
Decision 13-11-002 Issued																										
Phase 1 Tier 2 Advice Letter Submitted																										
Resolution E-4651																										
Phase 1 Tier 1 Advice Letter Submitted																										
Phase 1 Pilot Enrollment Period Starts 09.01.14																										
Phase 1 Pilot Ends 08.31.16																										
Phase 1 Third Party Evaluator Report Received																										
Phase 1 Pilot Extension Approved																										
Pilot Tasks	2011		2012				2013				2014				2015				2016							
	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4

## 2.5 Milestones and Deliverables

### Milestones:

See Section 2.4 above – Submetering Phase 1 Pilot Key Milestones Schedule above schedule

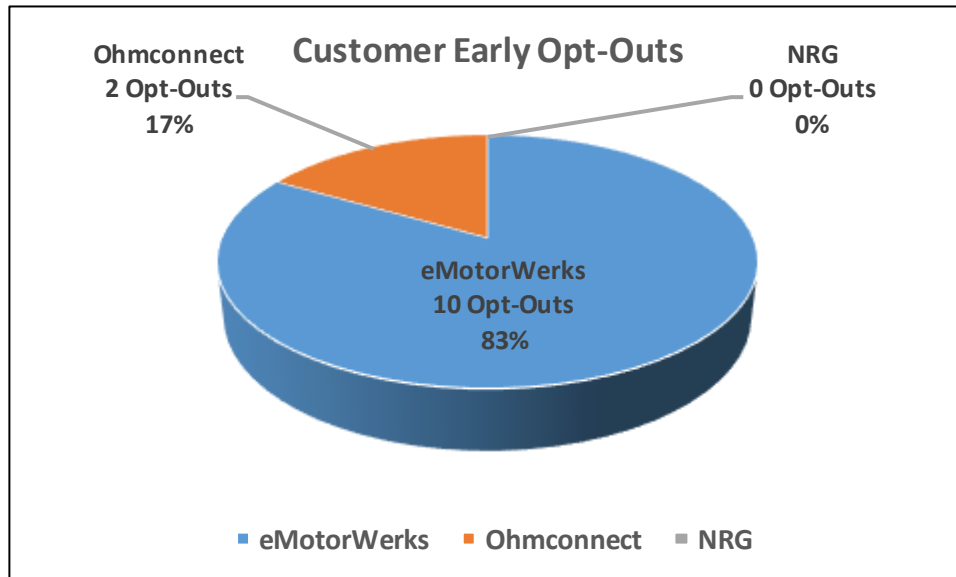
### Deliverables:

#### 1. Customer Enrollment

SCE enrolled and supported 92 residential submeter customers including 13 NEM accounts were limited to a maximum of 12 billing cycles.

- a. 78 Of the 92 enrolled customers completed their maximum of 12 billing cycles.
- b. 14 (15.2%) customers opted to terminate their participation early.
  - i. Two customers moved out of SCE’s territory.
  - ii. The remaining twelve customers left the Pilot primarily due to EV charging cost that did not meet their expectations as shown on next page in Figure 7.

**Figure 7**



#### 2. Manual Subtractive Billing Procedure

A process in which the SCE billed EV usage separately from other usage. All usage was first measured through the primary meter, while the Electric Vehicle usage was also measured by a dedicated submeter. The Electric Vehicle usage was subtracted from the usage measured by the primary meter to bill the house consumption and the Electric Vehicle consumption separately as illustrated below in Figure 8.

**Figure 8**

Time Interval	Submeter kWh	Primary Meter kWh	Net Primary Meter kWh
11:00 - 11:15	3	7	4
11:15 - 11:30	5	9	4
11:30 - 11:45	2	5	3

**3. Nexant Third Party Evaluation Phase 1 Report**

The Phase 1 Initial and Final Reports covered the customer-experience evaluation, Submeter MDMA business models, submeter accuracy and Phase 1 conclusions and recommendations. Copies of the Nexant reports are attached below..

Interim Nexant Phase Pilot 1 Pilot Report

  
 California Statewide  
 PEV Submetering Pilo

  
 PEV Submetering  
 Post-Pilot Survey Resi

**3 Test Set-Up/Procedure<sup>1</sup>**

Testing of the submeter’s accuracy was performed independently by Nexant, the third party evaluator. As part of the Phase 1 evaluation, Nexant installed data loggers for a sample of 34 submeters at participating customers’ premises for the period December 14, 2015 through February 12, 2016 to independently measure PEV charging loads. The accuracy sample included 31 eMotorWerks (eMW) submeters and three NRG submeters.

Data collected from the loggers was compared to submetering data over the same period to assess the accuracy of the submeters. During the data collection period, however, eMW experienced server-side data processing software issues that caused erroneous

December 2016 financial report will be published in February 2016 with FINAL Pilot cost. Measurements for 16 to 24% of PEV charging loads for some pilot participants. The most serious issue occurred as an unintended side effect of eMW’s server migration that took place on October 26, 2015 causing a 24 hour shift for some 15 minute data intervals. eMW was notified of the problem in December 2015 through customer complaints of overbilling<sup>1</sup> and resolved the issue on January 8 and 9 via fixes to the server. Because of this known issue and the fact that any measurement errors resulting from affected loggers would have overwhelmed the 5% accuracy

threshold, the analysis dataset was split into two periods—December 14, 2015 through January 8, 2016 and January 9 through February 12, 2016. Unless otherwise stated, the results and figures presented in this section utilize the second half of the study period when the eMW software issue was not a concern.

In addition to the server malfunction, eMW also reported two submeters in the accuracy sample that had sporadic data coverage and one that was completely offline during the study period. Due to the missing data, these submeters would not have met the 5% accuracy requirement and were dropped from the analysis. Nexant also experienced some attrition in its logger sample due to technical and fielding issues. Out of the initial sample of 34 loggers, 3 were not usable because the amps recorded by the logger could not be converted to kW, 2 stopped recording data in the middle of the study period, 2 did not pass data validation checks, and 11 were installed without properly synchronizing the logger clock with the smart meter or submeter clock. Combining the remaining 16 loggers with the eMW/NRG submeters with reliable data resulted in 14 logger-submeter pairs that were available for analysis.

Based on the results of the various equivalence tests, most submeters for which data was available meet the 5% accuracy threshold specified by Phase 1 of the pilot. However, one submeter in the sample was offline for a portion of the study period and a second incorrectly allocated some usage to the peak and partial peak periods during the simulated billing cycle. In addition, the results should be caveated by the fact that 4 out of 31 eMW submeters in the analysis sample were not included in the analysis due to data issues and half of the analysis period was affected by a software malfunction that caused data errors for some eMW customers. These measurement errors would certainly have affected customer bills and may account for some of the dissatisfaction customers expressed about billing accuracy.

<sup>1</sup> Source: Nexant, Inc. – California Statewide PEV Submetering Pilot Phase 1 Report

## 4 Project Results

### 4.1 Technical Results, Findings, and Recommendations

The Phase 1 Pilot's technical results, key findings, and recommendations are focused on the performance of the Submeter MDMA's submeters. The submeters' accuracy of  $\pm 5\%$  and related synchronization errors created unacceptable submeter data errors resulting in significant customer billing issues.

### 4.2 Technical Lessons Learned

**Issue:** Billing issues occurred during the Phase 1 Pilot due to differences in submeter and SCE meter accuracy,  $\pm 5\%$  vs.  $\pm .5\%$  respectively, and submeter synchronization errors.

The three IOUs all experienced varying accuracy problems with the MDMA's submeters. However, synching the submeter to the U.S. standard as defined by the National Institute of Standards and Technology or within three minutes of the time used by the utilities appears to be the bigger issue and the cause of most recorded submeter "Bad" intervals which occur when the submeter kWh exceeds the primary meter kWh. See Section 5.5 for discussion of bad interval impact on customers.

**Lesson Learned:** (To be applied to the Phase 2 Pilot)

1. (The term ‘accuracy’ is equivalent to the same term used in the ANSI C-12 standard or equivalent to ‘tolerance’ in NIST Handbook 44 Section 3.40 T.2.) Require the submeter to demonstrate meter acceptance accuracy of +/-1%, and maintain accuracy of +/- 2% during the Phase 2 Pilot. Submeter MDMA is responsible for describing how they comply with this accuracy requirement prior to pilot installation.
2. Require the submeter’s time be synchronized to the Universal Time Coordinate (UTC) time standard as defined by the National Institute of Standards and Technology (NIST), and be within +/- two (2) minutes of UTC, while the EVSE is in service. Submeter MDMA is responsible for describing how they comply with this accuracy requirement prior to pilot installation.

### 4.3 Value Proposition

**Primary Principles:**

- Greater reliability: Not applicable
- Lower costs:

Many Submetering Phase 1 Pilot participants enrolled to save energy cost. For example, a customer on residential rate plan Schedule D in Tier 3 pays \$.29/kWh to charge their EV. Pilot participants charging their EV during off-peak paid \$.14/kWh. The average SCE EV owner's EV charging monthly load on SCE's separate meter TOU-EV-1 rate was 345 kWh resulting in a potential savings of \$51.75/month.

- Increased safety and/or enhanced environmental sustainability:

Hybrid Plug-in Electric Vehicles and Battery Electric Vehicles enhanced environmental sustainability by reducing pollutants.

**Secondary Principles:** *[Project may promote these areas, but not required]*

- The Loading Order: Not applicable
- Low-Emission Vehicles/Transportation:

SCE developed methods enabling third parties—current SCE customers and/or providers of electric vehicle (EV) services—to submeter the EV load to reduce customer cost related to installing a dedicated meter for EV charging thereby supporting the growth of electric vehicles while enhancing environmental sustainability.

- Safe, Reliable, and Affordable Energy Services:

See Lower Cost section under Primary Principles above.

- Economic Development: Not applicable
- Efficient Use of Ratepayer Monies: Not applicable

## 4.4 Technology/Knowledge Transfer Plan

There are three possible means to transfer technology/knowledge:

1. This document, the Phase 1 Pilot Final Project Report documents technical results, finding, recommendation and lesson learned.
2. Presentation of the Phase 1 Pilot Final Project Report highlights technical results, finding, recommendation and lesson learned.
3. At the conclusion of the Phase 2 Pilot the CPUC will determine if the IOUs will be directed to develop and submit the Submeter Protocol. If required, the Protocol would incorporate a technology/knowledge transfer of results of both pilot phases to apply to future submetering applications. The Protocol would also include the cost and schedule to automate key Pilot processes such as enrollment and subtractive billing.
4. In addition, Nexant, the independent third party evaluator, has provided an Interim and Final Phase 1 Report. Nexant will also provide a final Report on both phases of the submetering Pilot at the end of Phase 2. This report will include a report on any technology/knowledge transfer of results of both pilot phases to apply to future submetering applications.

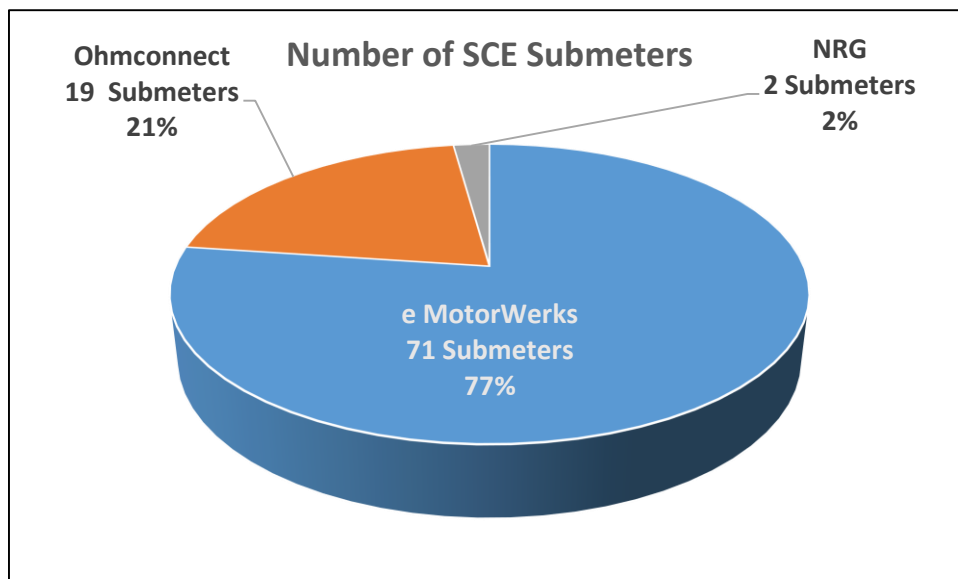
## 5 Metrics

### 5.1 Total number of SCE customer Phase 1 Pilot participants:

SCE enrolled 92 (18%) of the total 500 maximum submeters as shown in Figure 6 below:

- a. eMotorWerks enrolled 71 (77%) of total SCE participants
- b. Ohmconnect enrolled 19 (21%) of total SCE participants
- c. NRG enrolled 2 (2%) of total SCE participants

**Figure 8**



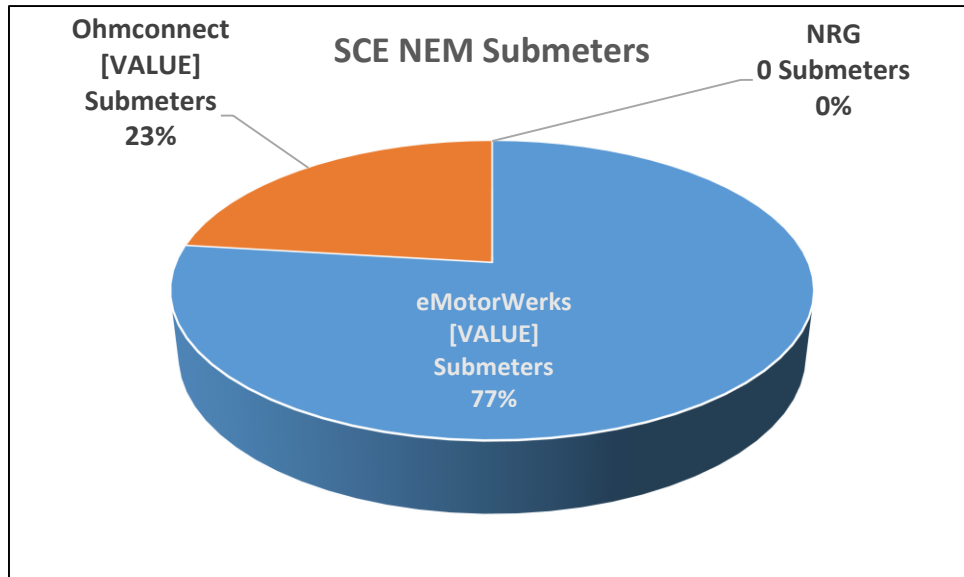


## 5.2 Number of SCE NEM customer participants:

SCE had 13 (13%) of the total 100 maximum NEM submeters of the 500 submeter limit as shown in Figure 7 below:

- eMotorWerks enrolled 10 (77%) of total SCE NEM participants
- Ohmconnect enrolled 3 (23%) of total SCE NEM participants
- NRG enrolled 0 (0%) of total SCE participants

**Figure 9**

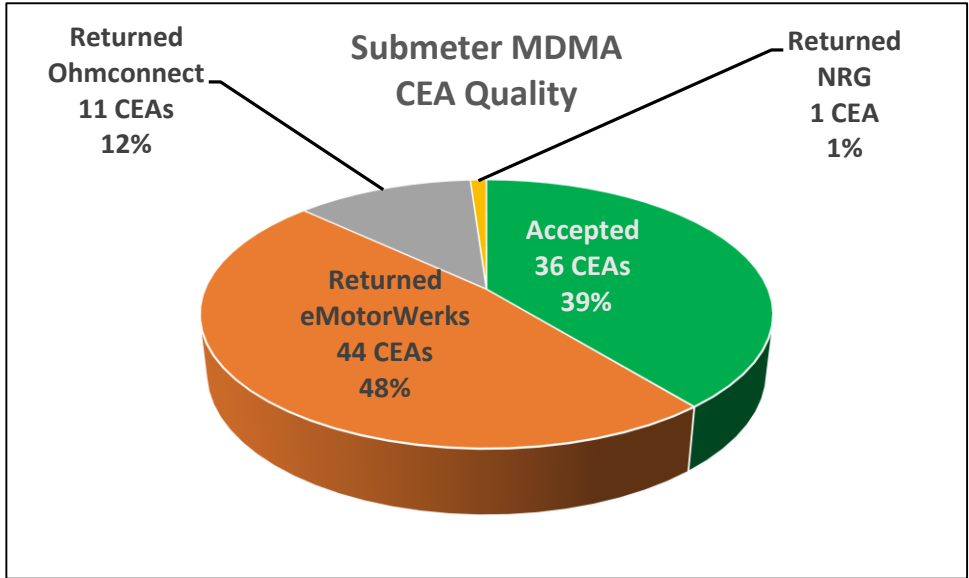


## 5.3 Complete and accurate Customer Enrollment Agreements:

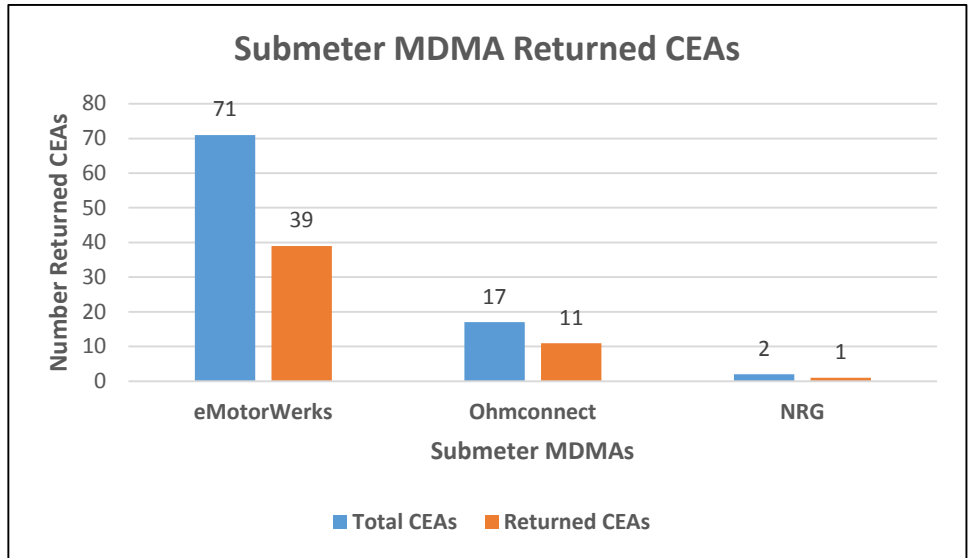
SCE returned 56 (60.9%) of the 92 Customer Enrollment Agreements received from the Submeter MDMA's due to incomplete, inaccurate or corrected information as shown in Figures 8 and 9 below:

- SCE returned 39 (55%) of 71 CEAs submitted by eMotorWerks
- SCE returned 11 (65%) of 17 CEAs submitted by Ohmconnect
- SCE returned 1 (50%) of 2 CEAs submitted by NRG

**Figure 10**



**Figure 11**

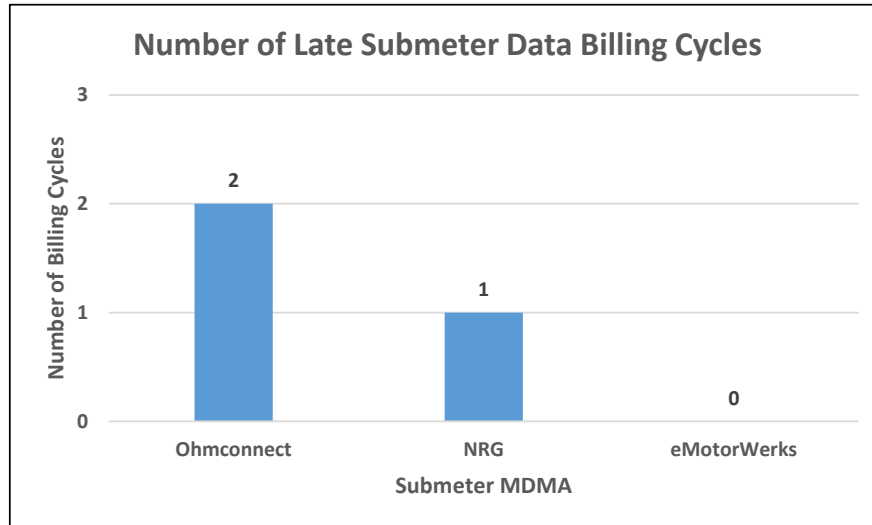


#### 5.4 Submeter MDMA on-time delivery of customer submeter interval usage data:

Two of the Submeter MDMA experienced problems delivering their submeter data to SCE on-time for the first few customers but subsequently delivered all monthly submeter data on-time as shown in Figure 10 below:

- a. The submeter data for NRG's first SCE customer, PEV000001, was late for the customer's first two billing cycles resulting in all the EV charging billed on the customers Primary meter rate.
- b. The submeter data for Ohmconnect's second SCE customer, PEV000003, was late for the customer's first billing cycle resulting in all the EV charging billed on the customers Primary meter rate.

**Figure 12**



## 5.5 Submeter MDMA accuracy of customer submeter interval usage data:

The three IOUs all experienced varying accuracy problems with the MDMA's submeters. The IOUs expected some data quality problems caused by the accuracy differences between the IOUs' SmartMeters at  $\pm 0.5\%$  vs the submeters at  $\pm 5\%$ , a ten-fold difference.

- However, synching the submeter to the U.S. standard as defined by the National Institute of Standards and Technology or within three minutes of the time used by the utilities appears to be the bigger issue and the cause of most recorded submeter "Bad" intervals which occur when the submeter kWh exceeds the primary meter kWh. Bad interval reduced customer charging savings as illustrated on next page in Figure 13 and contributed to their dissatisfaction with IOU service.

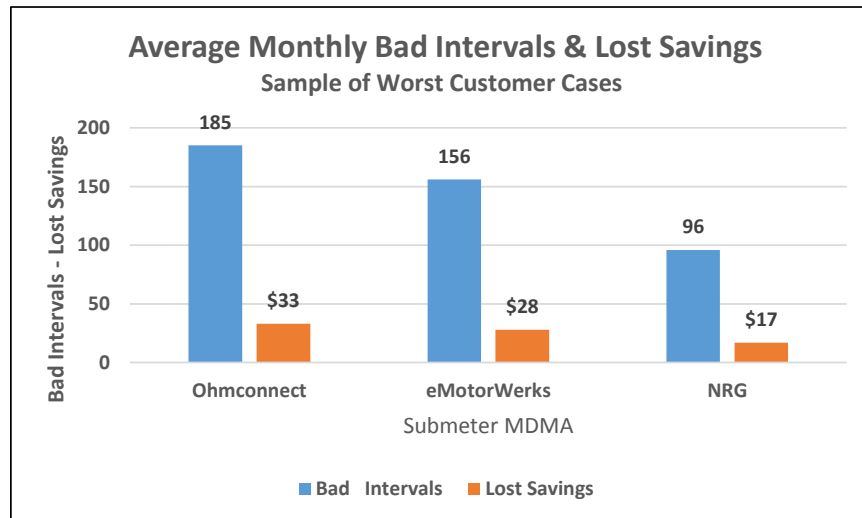
**Figure 13**

Time Interval	Submeter Reported kWh	Primary Meter kWh	Submeter Billed kWh	Net Primary Meter kWh
11:00 - 11:15	3	7	3	4
11:15 - 11:30	5	9	5	4
11:30 - 11:45	7	5	0	5

Worst case SCE examples are discussed and shown in Figure 11 below:

- a. **Ohmconnect** customer PEV000004 averaged **185 (31%) bad intervals per month** over 12 billing cycles costing the customer on average about \$33/mo. or \$400/yr. (Assumes tier 4 @ \$.30 vs. TOU-EV-1 @ \$.12 )
- b. **EMotorWerks** customer PEV000078 averaged **156 (26%) bad intervals per month** over nine billing cycles costing the customer on average about \$28/mo. or \$252/yr.
- c. **ERG** customer PEV000015 averaged **96 (16%) bad intervals per month** over 11 billing cycles costing the customer on average about \$17/mo. or \$190/yr.

**Figure 14**



## List of Acronyms

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ARRA	American Reinvestment and Recovery Act
AT	Advanced Technology (the organization)
ATP	Advanced Technology Procedure, or Authority to Proceed
BOM	Bill of Materials
CCB	Change Control Board
CMO	Compliance Management Office
COTS	Commercial Off-The-Shelf
CPUC	California Public Utilities Commission
DBE	Disadvantaged Business Enterprise
DOE	Department of Energy
eDMRM	electronic Data Management/Records Management
EPIC	Electric Program Investment Charge
FY	Fiscal Year
GRC	General Case
IAW	In Accordance With
ICC	Integrated Change Management
IO#	Internal Order Number
IP	Intellectual Property
O&M	Operations and Maintenance
PDF	Portable Document Format (Acrobat file)
PfMP	Portfolio Management Plan
PM	Project Manager
PMBOK	Project Management Body of Knowledge
PMI	Project Management Institute
PMO	Portfolio Management Office
PMP	Project Management Plan
PMR	Portfolio Management Review
PO	Purchase Order
PPM	PMO Process Matrix
PPP	PMO Procurement Plan
PRR	PMO Risk Register
PSR	Project Status Review
SCE	Southern California Edison

SME	Subject Matter Expert
TFC	Termination for Convenience
TL	Technical Lead
Ts&Cs	Terms and Conditions

# Glossary

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Term to define

Definition here

Also see glossary's available for the electric utility industry available on the internet like this one:  
[http://www.nwppa.org/advertise\\_sponsor/Facts\\_Figures\\_Glossary\\_of\\_Terms.aspx](http://www.nwppa.org/advertise_sponsor/Facts_Figures_Glossary_of_Terms.aspx)