BEFORE THE PUBLIC UTILITIES COMMISSION OF THE

STATE OF CALIFORNIA

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JOINT IOU ASSESSMENT REPORT FOR PEV NOTIFICATION

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Pursuant to *Decision 11-07-029 Phase 2 Decision Establishing Policies to Overcome Barriers to Electric Vehicle Deployment and Complying with Public Utilities Code Section 740.2*, issued July 25, 2011, Southern California Edison Company (U 338-E) submits, on behalf of itself, Pacific Gas and Electric Company (U 39-M), and San Diego Gas & Electric Company (U 902-M) (the Utilities), this Joint IOU Assessment Report for PEV Notification (Notification Report), attached hereto as Attachment A.

The Utilities requested an extension of time to file this Notification Report until December 23, 2011, which was granted by the letter from Executive Director Paul Clanon, dated November 28, 2011.

Respectfully submitted,

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December 23, 2011

ATTACHMENT A

JOINT IOU ASSESSMENT REPORT FOR PEV NOTIFICATION

Joint-IOU Assessment Report For PEV Notification

R.09-08-009 (AFV OIR) Ordered in D.11-07-029

12/23/2011

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EXECUTIVE SUMMARY

This report, prepared by Pacific Gas and Electric Company ("PG&E"), Southern California Edison ("SCE"), and San Diego Gas and Electric Company ("SDG&E"), collectively the investor-owned utilities ("IOUs"), in compliance with Ordering Paragraph 1 of California Public Utilities Commission Decision No. 11-07-029, sets forth the joint preliminary assessment of notification options to track the location and re-location of plug-in hybrid and electric vehicle charging on the electric grid, the merits of each option, the projected costs of these options, and implementation scenarios.

The IOUs have been developing notification solutions to anticipate and mitigate the potential impact of plug-in electric vehicles ("PEVs") charging on their distribution systems. Notification refers to a data sharing process whereby a source (third parties, customers) provides information to identify new PEV charging locations. The IOUs use notification data to conduct long-term grid planning, neighborhood infrastructure assessment (and related upgrades, as needed), and to educate customers about PEV rates and the benefits of off-peak charging.

Assessment Requirements

To effectively accomplish these activities, the IOUs need notification data and the related notification processes to meet certain requirements:

1. **Exhaustiveness:** Notification data should cover as many charging locations as possible to ensure distribution system stability.
2. **Granularity:** Notification data should include street address level information and charging rate to conduct all necessary infrastructure assessments on impacted distribution equipment (the IOUs expect impacts from charging PEVs mainly on neighborhood distribution infrastructure).

3. **Timeliness:** Notification data and processes should allow time for the IOUs to conduct infrastructure assessments and execute necessary upgrades as soon as possible.
4. **Scalability:** Notification processes and systems should be scalable to PEV market growth.
5. **Costs**: Notification processes and systems should carry the least internal and external costs.

Preferred Options

The IOUs have determined that no single notification source currently available or under consideration meets all of the necessary requirements.

Today, the IOUs are sourcing data primarily from in-market PEV manufacturers ("OEMs") for those customers who have consented to have their data shared with the utility. To supplement data obtained from OEMs, IOUs also obtain copies of electrical permits from local governments and direct notification from customers, although neither source provides exhaustive data. These multiple sources collectively meet most of the IOUs' current notification needs and constitute the IOUs' preferred solution as long as it sufficiently meets the requirements described above.

However, the IOUs anticipate several changes in the marketplace that will likely require accessing different notification data sources. For instance, as the market for used PEV develops, the IOUs will not be able to identify the relocation of these vehicles through OEMs.

As a result, the IOUs are conducting assessments to access registration data from the Department of Motor Vehicles ("DMV"), as recently authorized by law, and to evaluate scanning capabilities to detect significant changes in customer electricity usage.

Going forward, the following combination of sources would constitute the IOUs' preferred options. Based on the IOUs' initial analysis, and providing that these findings are confirmed by future research, the IOUs anticipate that they could eventually source PEV notification data primarily from the DMV and supplement the data through a combination of secondary sources, including OEMs, local government, customers, and possibly load scanning capabilities.

The following report provides a detailed analysis of the IOUs' current and future notification efforts, together with a high-level roadmap that shows the IOUs' potential implementation plan for these preferred notification options. This report is also based on interviews and collaboration with industry stakeholders, but represents only the assessment of the IOUs. The IOUs also provided regular updates to Energy Division Staff of the California Public Utilities Commission.

ACKNOWLEDGEMENT

The concept of PEV notification was initially met with a degree of skepticism. Legitimate concerns about privacy, confidentiality, and commercial practices were viewed as major roadblocks to implementing any type of robust PEV notification. But as IOUs asserted and demonstrated their commitment to facilitating the launch of the new vehicles by ensuring grid stability, reliability, and safety, key PEV stakeholders supported the IOUs' notification efforts. The IOUs wish to acknowledge the contributions of the many industry and policy leaders participating in these efforts.

INTRODUCTION

For more than a century, the fueling experience for transportation revolved around fossil fuels and its supply chain from production to pump. The adoption of Plug-in Electric Vehicles ("PEVs")[1], however, alters this picture. Where automobile drivers would visit gas stations to fill their tanks, the new PEVs will draw, store, and use electricity from the grid. This is a profound shift, with numerous consequences for consumers, utilities, and broader society. In anticipation of the near-term adoption of PEVs, California utilities are developing and implementing plans for managing the changes electrified transportation will bring, addressing both the needs of their customers and the requirements of grid infrastructure. Central to these efforts is information, specifically the knowledge of when, where, and how much PEV charging will occur.

PEV notification refers to the PEV data sharing process where a source (such as PEV customers or other third parties) provides information to identify new PEV charging locations to electric utilities for the purpose of ensuring grid stability, reliability, and safety.

Notification data will usually include customer data which the IOUs must treat as confidential pursuant to state and federal statutes.

In turn, the utility will use the PEV notification data to conduct grid assessments and execute any necessary upgrades, develop long-term distribution system work planning, and engage with customers concerning charging options, including the utility rate offerings and programs which promote optimal grid operating conditions, namely off-peak charging.

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[1] PEVs include both plug-in hybrid electric vehicles ("PHEVs") and battery electric vehicles ("BEVs").

As part of its Final Decision[2] in Phase 2 of the Alternative Fueled Vehicle Order Instituting Rulemaking ("AFV OIR", R.09-08-009), the California Public Utilities Commission ("CPUC") ordered Pacific Gas and Electric Company ("PG&E"), San Diego Gas & Electric Company ("SDG&E"), and Southern California Edison Company ("SCE") to collaborate with stakeholders to prepare an assessment report about notification. This report is the result of the foregoing order.

To inform their analyses, the three California investor-owned utilities (collectively the IOUs) have jointly conducted extensive interviews with industry stakeholders, including representatives from OEMs, charging equipment installation service providers, and out-of-state utilities[3]. These interviews covered existing business practices and future plans of key PEV players that will influence how the market evolves in the coming years.

The report also illustrates how the IOUs have been collaborating on notification as part of their PEV readiness plans for the past two years, developing and implementing notification strategies, many of which are featured in the report. This collaboration continues today and will extend beyond this report as more notification work progresses.

This report will first focus on background information and frames the overall set of issues and requirements. The report will then discuss the current and anticipated future environments for the IOUs' notification efforts, and identify requirements and constraints to evaluate data sources and notification related-processes. Based on the foregoing, the report will describe how the IOUs evaluate current notification solutions and other potential options. Finally, the report will articulate the IOUs' preferred potential notification options going forward and provide a high-level execution roadmap.

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[2] See Phase 2 decision establishing policies to overcome barriers to electric vehicle deployment and complying with Public Utilities Code Section 740.2, issued 7/25/2011 (D.11-07-029)

[3] See appendix for organizations interviewed for this report.

SECTION 1: THE NEED FOR NOTIFICATION

BACKGROUND

In the coming years, utilities, regulators, and other market observers are expecting increasing adoption of PEVs. The first mass-produced PEVs arrived at showrooms at the end of 2010, while a number of additional vehicles on multiple platforms across almost all of the major auto manufacturers (original equipment manufacturers or "OEMs") are due to launch within a few years. These vehicles are expected to range from two seat roadsters to 4-door sedans and sport utility vehicles.

These automakers are encouraged by a variety of larger factors. First, improvements in battery technologies, AC electronics and on-vehicle chargers, and the development of plug-in hybrid electric vehicle drive-trains are among the critical technology milestones of PEV innovation and market development. These advancements have improved vehicle range, reduced vehicle component costs and introduced greater flexibility to customer charging options, all of which have made PEVs more attractive to potential buyers. Second, regulatory policies and consumer attitudes about issues such as climate change and energy security are influencing public demand for alternative fueled vehicles. If concerns about environmental degradation or the United States' dependence on foreign oil do not motivate consumers, the volatile and overall high prices of gasoline also introduce further financial incentives to switch to cheaper fuels such as electricity. Taken all together, technological, policy, environmental, and financial drivers are pushing toward a future with increasing numbers of plug-in electric vehicles.

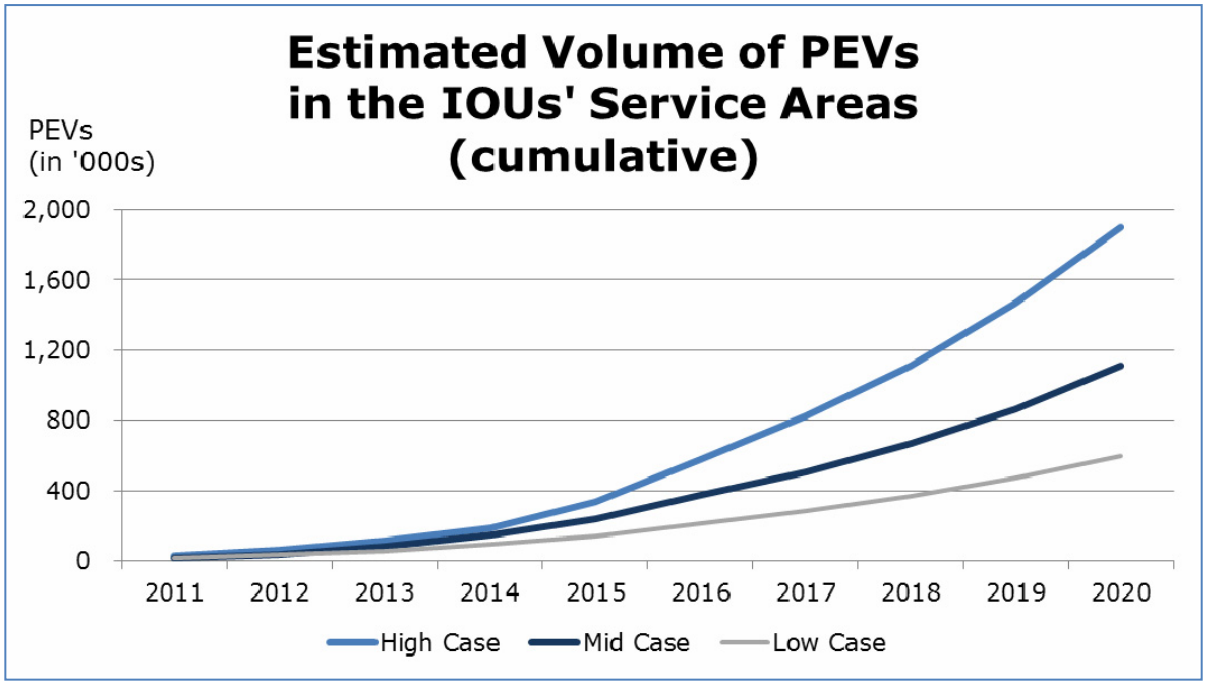

FIGURE 1 - PEV FORECASTS[4]

Although forecasts vary on the adoption and penetration of PEVs, it is widely anticipated that California residents will be significant adopters of the new plug-in technology. The strength of the hybrid-electric vehicle market in California, combined with the active involvement of multiple stakeholders (utilities, government, etc.), explains why our state has been selected by major OEMs to serve as the initial PEV launch market, along with a handful of other states[5].

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[4] These forecasts were created by aggregating SDG&E's and SCE's PEV sales forecasts, as described in their respective General Rate Case testimony, together with PG&E's current internal forecasts.

[5] The service areas of PG&E, SDG&E, and SCE are among the initial market launch areas for the first PEV models to be introduced by General Motors, Nissan, Mitsubishi, Ford, CODA, BMW, and Toyota.

POTENTIAL PEV CHARGING IMPACTS ON THE GRID

While PEV charging will add new load to the system, most of the impacts at a system level are estimated to be minor, even over a ten-year time period. For instance, IOUs estimate that in 2020, the additional charging from electric vehicles (both PEVs and PHEVs) will account for up to 3% of total electricity delivered. This small percentage share is not anticipated to translate into large infrastructure needs either in the transmission network or the generation resource portfolio, especially if a majority of customers charge during off peak hours.

While system-wide energy and generation constraints are less worrying, the more localized distribution grid infrastructure can be significantly impacted by new PEV charging loads.

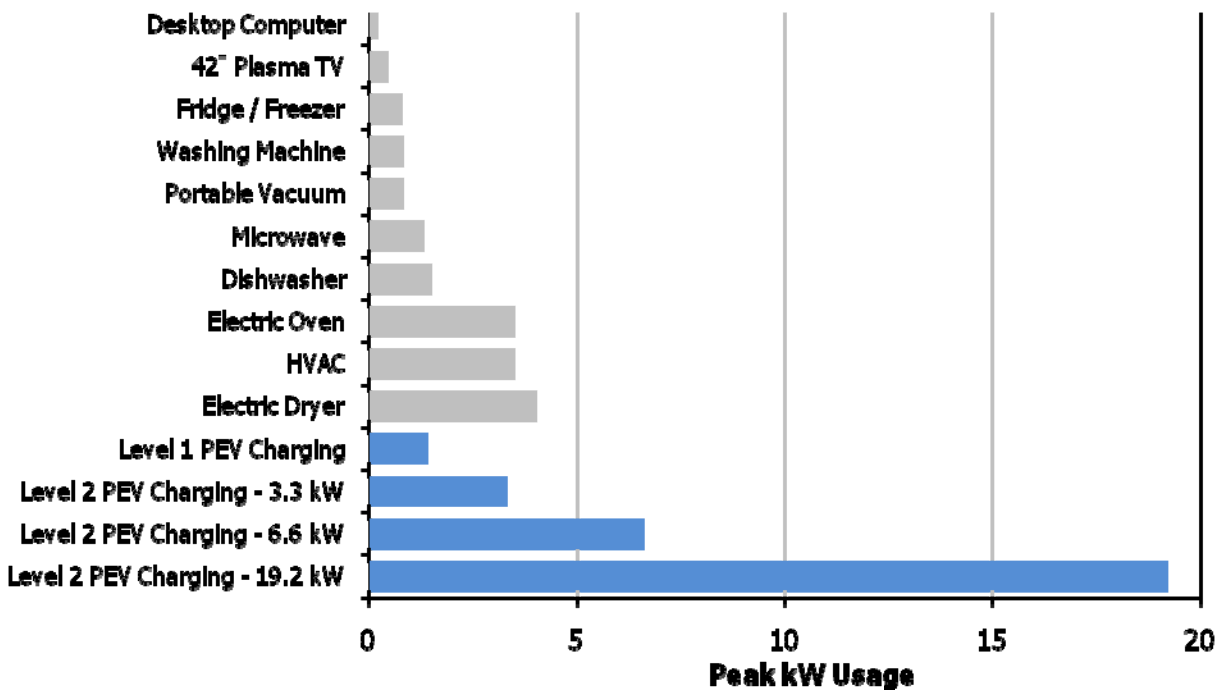

FIGURE 2 - TYPICAL LOADS FOR HOUSEHOLD APPLIANCES

As depicted in Figure 2, PEV charging may introduce significant loading compared with typical household appliances. In fact, the highest level charging may easily double or triple a household's prior peak load. These high levels of charging may, in turn, impact distribution

infrastructure if not sized to handle the new requirements. Figure 3 shows some of the infrastructure most prone to potential overloading.

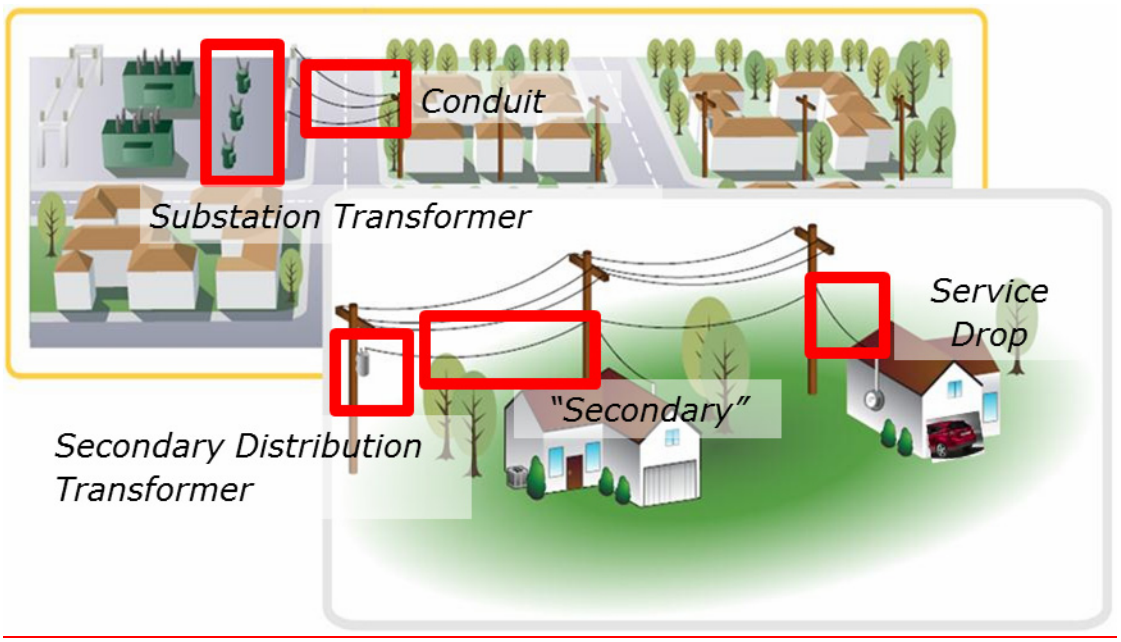

FIGURE 3 - DISTRIBUTION GRID

Service Drop	Connects a customer to the grid at a certain ampacity as determined by the size of the wire. In some cases, these may also be underground.
Secondary	Conductor or cabling "below" the secondary distribution transformer which connects multiple service drops.
Secondary distribution transformer	Converts system voltage (from 4 to 32 kV depending on the circuit) to secondary 220-240 V for residential connections, or higher for other customers (e.g., 277/480 V for some commercial/ industrial customers). These may be mounted pole-top, on a concrete pad, or in an underground vault.
Conductor	The electrical wire which transmits current. In some cases, these may be underground.
Substation transformer	Transformer which steps-down transmission or sub-transmission level voltage to serve distribution primary circuits.

FIGURE 4 - DISTRIBUTION COMPONENT DESCRIPTION

Residential vs. Commercial and Industrial Customers

Notification primarily concerns residential customers for two reasons.

First, electrical infrastructure that could be considered relatively more vulnerable to unplanned and sudden loadings tends to be in residential neighborhoods, where infrastructure is sized for smaller overall loads and thus can be more vulnerable to large PEV-related increases. Very small commercial and/or industrial customers who appear from an infrastructure perspective as residential load or are located in a highly residential area (e.g., a home converted to a day-care) may indeed have similar vulnerability issues as residential customers. Commercial and industrial ("C&I") customers tend to have higher capacity infrastructure where vehicle charging is less of a concern.

Secondly, many C&I customers have a more direct relationship with their utility, communicating on a regular basis with their utility, usually via dedicated representatives, and many participate in other utility programs. C&I customers tend to engage with their utility early planning and executing changes to their electric infrastructure.

As a result, notification in this report will refer to residential customers unless otherwise noted.

PEV Infrastructure Responsibility

In California, there is a division of responsibility between the utility and individual customers when it comes to upgrading/installing infrastructure to support new PEV load. Figure 5 below illustrates this breakdown[6]:

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[6]The rules for "service extensions" and "line extensions" are available on the IOU websites (see rules 15 and 16 for SCE , as an example)

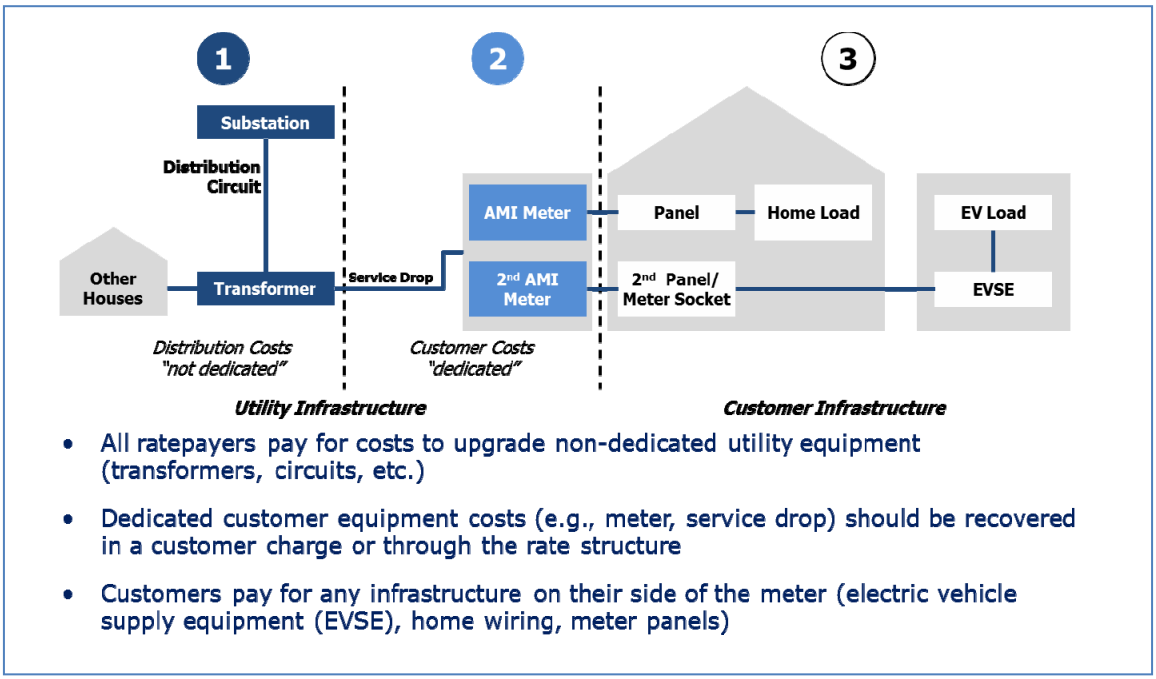

FIGURE 5 - WHO CURRENTLY PAYS FOR PEV INFRASTRUCTURE?

As shown in Figure 5, the utility is responsible for infrastructure on the grid side of the customer meter, with individual property owners bearing the full costs for devoted grid assets as well.

Residential PEV Load is Different

New PEV charging appears similar to any other new load. Indeed, outside of some of the higher level chargers (6.6 kW and above), a vehicle's charging consumes electricity just like any addition of air conditioner, spa, or home renovation would. The IOUs have over 100 years of experience integrating and accommodating these types of new loads into the distribution system. But PEV load has unique characteristics which require a different approach.

Possibility of higher charge rate: As discussed earlier, PEVs have the potential to charge at a capacity which far exceeds typical household appliances. Some of the PEVs coming to market in 2012 will be capable of 6.6 kW (and higher) charging levels. The standard for AC Level 2 charging per the Society of Automotive Engineers ("SAE International") can go as high as 19.2 kW (80As, 240V).

Varying charging start times: Many current appliances have relatively predictable operating parameters. Utilities can very accurately forecast, for example, when and how much air conditioning load will hit the grid by tracking weather patterns. Similarly, lighting load around year-end holidays occurs at dusk and lasts until about 11:00 PM. As such, most load comes and goes on predictable patterns or is correlated with key known variables like temperature. PEVs, however, are different. In scenarios of equal pricing across the day, when an end user decides to charge is driven by his or her preferences, needs, and scheduling. For example, a traditional 9-to-5 worker may get home at 6:00 PM and begin charging, whereas his or her stay-at-home spouse may have sporadic, throughout the day charging. The availability of public and workplace charging may change that pattern and introduce more peak period charging.

A Case Study: Adoption of Air Conditioning Vs. Expected PEVs

The consumer adoption of air conditioning (AC) from the 1950s to 1980s is often compared to the potential ramp of PEV purchases. There are both similarities and differences which instruct how much we might learn from this example in our current context.

As for similarities, in both cases a high consumption electricity device was and is expected to be adopted by consumers gradually, with some regions experiencing faster penetrations than others.

Unlike PEVs, however, AC load correlates with temperature, which by definition created new system peaks on summer afternoons. This resulted in a decades-long fundamental change in grid planning and operations, from generation to the customer meter, to meet summer conditions which could not be avoided.

PEVs, however, do not have to use electricity at any prescribed time (as long as they are charged for customer use), and as such the load impacts can theoretically be managed with thoughtful policy, technology and user education.

The impacts of PEV charging, therefore, will depend more on managing customer behavior for overall system benefit than accommodating a new inelastic load. A key aspect of enabling this flexibility will be PEV load notification.

PEVs offer new challenges for planners trying to predict, when, where, and how much new charging is likely to occur. While the grid planning requirements of PEV charging are the same as any other new load, in practice these vehicles introduce uncertainties which utilities have not traditionally faced in the past, even in examples of other high-consumption device adoptions. Hence, the utilities' need for identifying new PEV charging locations and the load associated with them through notification programs.

GRID READINESS AND LOAD MANAGEMENT

IOUs have implemented processes to support grid stability and promote long-term load management in connection with PEVs. Identifying existing and future charging locations helps maintain grid stability by informing long-term grid improvement planning and forecast. It also ensures that immediate upgrade needs of the neighborhood infrastructure are met. Finally, IOUs conduct significant efforts to educate their PEV customers about the availability and benefits of PEV rates and off-peak charging.

As PEV adoption increases, IOUs will be challenged to scale their current processes. As such, identifying AC Level 2 charging will be critical to prioritize IOUs' service planning and construction resources.

SERVICE PLANNING PROCESS

As part of their PEV readiness processes, the IOUs conduct on-site assessments by service planners[7] for each new PEV charging location[8] identified through direct notification by customers[9] or through third parties[10]. Service planners will contact the account holder and

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[7] SCE has implemented a detailed service planning program with as many as two service planners specifically trained for PEVs in each of the utility's 35 districts.

[8]PG&E conducts on-site service planning assessments for each identified EV owner.

[9] SDG&E conducts on-site assessments whenever residential customers request a new separate PEV meter. The IOU also conducts assessments when a customer has requested a whole-house EV rate and has applied for an AC Level 2 EVSE within SDG&E service territory. Starting in 2012, SDG&E will perform this review for all EV-TOU applicants regardless of Level 2 installation indication. This is in anticipation of possible upgrades at these locations to 3.3 kW or 6.6 kW in the future.

[10] As part of its on-going rate study, SDG&E contacts each of the ECOtality qualified customers directly to review the opportunity to

schedule an on-site visit. The visit includes a visual inspection to verify the size the transformers, number of connections to the transformer serving the premises, the number of spans for the secondaries, and the size of the service drop. The service planner activities also include calculating the impact of the anticipated household load on flicker and voltage drop.

In addition to on-site assessments, both SDG&E and PG&E are plotting AC Level 2 charging locations via Geographic Information Systems ("GIS") mapping to the corresponding assets (transformers). This effort identifies PEV adoption rates in different regions across SDG&E's and PG&E's respective service territory; it evaluates the opportunity to identify clustering in neighborhoods and proactively invest in grid upgrades at these locations.

Load Management

IOUs conduct extensive education and outreach efforts to inform PEV customers about the availability and benefits of PEV rates. In particular, PG&E sends a welcome letter to PEV customers encouraging them to visit the website, understand their rate options using the online rate calculator and sign up for one the PEV rate schedules. SDG&E actively contacts its EV Project customers (LEAF and Volt only at present) to participate in its on-going rate study. All PEV customers are encouraged to enroll in plug-in vehicle time-of-use rates (whole house or sub meter) and invited to have a rate analysis prepared. For its part, SCE is developing a program to consistently engage all customers identified through third party notification about PEV rates (planned for launch in early 2012). In the future, this conduit may also serve to inform PEV customers about specific load management programs.

While PEV rates remain the main tool for IOUs to promote off-peak charging, general education of PEV customers on charging off-peak will play an important part in shaping behaviors. As customers understand

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participate in the rate study, and qualify for a free second meter installation together with one of three randomly assigned rates.

that environmental benefits and lower system costs associated with PEVs are enhanced when charging off-peak, they may be more likely to adopt an environmentally friendly charging behavior.

SECTION 2 – APPROACH TO EVALUATING NOTIFICATION OPTIONS

As the IOUs are facing a rapidly changing PEV environment, they have developed a framework to evaluate existing and potential notification options.

Current and Future Environments for Notification

The PEV market significantly influences the notification data available to IOUs; understanding the current and future environments in which notification programs may operate is critical to informing the present feasibility assessment.

Current State Overview

Two OEMs (GM and Nissan) have been sharing the bulk of the new PEV market[11]. At present, most PEVs available for sale in California are built-to-order and require 6 to 16 weeks for delivery. While customers wait for their vehicle, they can make all necessary arrangements for their garage to become plug-in ready, especially if they want to install a charging station.

On average, the installation process, including any necessary panel upgrade or panel addition, can range from 2 to 4 weeks for the customer to complete. The build-to-order model presently provides lead time for IOUs to assess and upgrade, as needed, the neighborhood infrastructure to serve the new PEV load.

To facilitate the installation of charging equipment (electric vehicle supply equipment or "EVSE"), OEMs have entered into arrangements with large organizations of installation service providers and developed a standardized process. A customer who orders a PEV, either online or in-person at a dealership, will have the opportunity to hire the

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[11] Tesla with its Roadster and Ford with its Transit Connect EV (primarily a fleet vehicle) are also in market.

affiliated service provider to install an AC Level 2 charging station (240 V). In 2010 and for the most part of 2011, AC Level 2 charging equipment was not readily available at retail outlets. According to OEMs, the vast majority of charging stations were sold and installed by the OEMs' affiliated installation vendors.

As a result, IOUs may rely on a small group of potential notification sources, namely the OEMs (in-market or about to launch) and their affiliated service providers.

Two important changes are occurring in the marketplace as 2011 draws to a close. GM is quickly moving to an off-the-lot sales model and expects to discontinue its build-to-order model for the Volt in early 2012. Meanwhile, major retailers such as Lowes, Home Depot and Amazon, have started selling PEV charging equipment online and at some retail stores in what constitutes a harbinger of the anticipated commoditization of the EVSE market.

It should be noted that AC Level 2 charging (240 V) available for GM and Nissan PEVs has been so far limited to 3.3 kW which is roughly equivalent to an average residential HVAC unit. Tesla currently sells a 19.2 kW capable charger for the Roadster which may amount to 6 times the demand of an average California household. To date, however, Tesla vehicles and 19.2 kW chargers are seldom found in average households[12].

Finally, several government (state or federal) incentives are currently available to customers interested in AC Level 2 charging; additional help may also be available in certain areas. For instance, SDG&E customers who participate in the EV Project will receive a free EVSE. These incentives currently contribute to driving adoption of AC Level 2 charging and may offset potentially high installation costs.

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[12] IOUs have not reported any noticeable grid impact with this high level of charging.

	Affiliated Vendor (EVSE installation)	Max. Charge Rate (kW)
In-market		
Chevrolet Volt	SPX	3.3
Nissan LEAF	AV aerovironment	3.3/6.6 for 2013 model
Tesla Roadster	None	19.2
Launching late 2011 and 2012		
Mitsubishi "i" by MiEV	BEST BUY	3.3
BMW Active E (1-Series)	AV aerovironment	6.6
Ford Focus EV	BEST BUY	6.6
Toyota PHEV Prius	LEVITON	3.3
Fisker Karma	evconnect	3.3
CODA	TBD	6.6

Figure 6 - CURRENT AND NEAR-TERM PEV MODELS

Future State Overview

As the PEV market matures and PEVs eventually sell more like any other light-duty vehicles, the IOUs have identified four likely changes to the PEV market that will influence notification solutions: 1) PEVs will be sold off the lot, 2) EVSEs will become commoditized, 3) PEV sales and EVSE installation data sources will become more fragmented, and 4) OEMs will promote higher charge rates.

1. **PEVs will be sold off the lot**: Buying or leasing a PEV will no longer require prior reservation. In launching their new PEVs, early market OEMs have been greatly involved in the sales process via web based reservations/ordering, much more than for a conventional internal combustion engine vehicle. As dealers increase their inventory of PEVs, they will have greater

control over the sales process and the current reservation model will likely disappear. As a result, the sales cycle may not allow sufficient time for IOUs to conduct any of the grid readiness and load management activities described above prior to customers buying or leasing their new PEV, unless customers take steps to prepare their homes early.

2. **EVSE will become commoditized**: As public funding or utility-funded programs to install EVSE expire[13], EVSE manufacturers will develop additional retail distribution channels. In the future, buying and installing an EVSE may not be much different from buying and installing a water heater. This will likely mean that the market share of affiliated installation service providers will decrease from current levels as more PEV adopters use independent electricians.

3. **PEV sales and EVSE installation data will become more fragmented**: IOUs will likely face a PEV market that will include a much larger number of OEMs with franchise and independent dealers[14] selling new and used PEV sales, and both affiliated service providers and independent electricians installing EVSEs for residential customers, all of which could potentially provide notification data to IOUs.

4. **OEMs will promote higher charge rates:** Some major OEMs have already announced new vehicles for 2012 (2012 Ford Focus EV, 2012 BMW ActiveE, 2012 Coda Sedan, and 2013 Nissan Leaf model) with a 6.6 kW on-board charger. This trend is expected to continue with 6.6 kW becoming the de facto standard for AC

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[13] Adoption of AC Level 2 charging may decline as a result and more customers may choose to charge at AC Level 1.

[14] Franchise dealers are dealerships selling new vehicles from the OEMs with which they are affiliated (they may also sell used vehicles from various OEMs). Independent dealers sell used vehicles only, from any OEMs.

Level 2 charging. The level of adoption and clustering of higher charging levels will likely test the robustness of the grid.

The future state described above is a likely scenario developed through interviews conducted with several external subject matter experts. Market drivers will eventually shape the actual environment for notification. In the meantime, the foregoing scenario can help IOUs develop future notification plans.

Notification Requirements

IOUs have defined certain requirements to evaluate notification data and related processes applicable to both current and future environments discussed earlier.

Data Requirements

Notification data should meet the following requirements to fully satisfy the IOUs' needs:

Exhaustiveness: For utilities to ensure grid stability, reliability, and safety, they will need data as exhaustive as possible. The potential demand exerted on a transformer cannot be estimated properly if the utility is not aware of the upcoming PEV load. In those areas where transformer loading is nearing failure, the incremental load from charging a PEV may have an impact on service reliability. When considering sources of notification data, utilities need to ensure that they are able to identify as many residential charging locations as possible, including those used by new PEVs, second-hand PEVs, or resulting from a change of address.

Granularity: Data must have the right level of detail to meet notification goals. Knowing a charging location's ZIP code or city block will help with long-term capital planning, but does not provide utility personnel with the information they need to conduct local service planning assessments and execute upgrades where necessary. ZIP code-wide areas or whole city blocks are likely to be served by more than one transformer while some grid components (e.g., service drop) may only be identified with the street-level address. Ideally, data would also include charging levels of each location in order to properly evaluate their respective demand, and the impact on circuits. While

the IOUs understand that these requirements may raise privacy and confidentiality concerns, they are unequivocally committed to protecting the privacy and confidentiality of customer data in compliance with applicable laws and regulatory requirements, and have implemented processes and systems accordingly.

Timeliness: The timing of receiving notification data is important primarily for service planning assessment. It is preferable to know about charging *before* it actually occurs in order to ensure that there will be no potential issues. Although it is rare, there are indeed incidences where just plugging in a vehicle may cause distribution issues, especially for service drops and secondaries, that will not only affect the PEV customer's service, but may also impact other utility customers connected to the same distribution transformer. Distribution infrastructure problems are primarily caused by coincident peak loading. As infrastructure is built to peak standards, planners are almost exclusively concerned with incremental coincident peak loading, or new PEV charging load occurring at the same time as the circuit peaks for other reasons (e.g., AC on a hot day or holiday lights). For these issues, "after-the-fact" data is acceptable as long as it can be accessed in a timely manner when needed.

Process Requirements

When evaluating notification processes, IOUs will also take into consideration the following requirements.

Scalability: To collect and manage notification data, the IOUs have implemented a number of processes which may include some manual and automated activities. In a nascent PEV market, with a few hundred new vehicles sold each month, manual steps associated with each such vehicle may not be an immediate concern. However, in a more mature market with several thousand new vehicles entering each IOU's service territory each month, manual processes will likely become resource-intensive unless automated. Scalability issues may impact the notification source as much as the IOU. A notification source that provides data to IOUs through mostly manual processes may not continue unless its processes become automated. Likewise, the IOUs may not be able to use data that requires extensive manual processes. Of particular importance, data acquired from third parties

usually needs some level of "scrubbing" before being input in the receiving parties' systems. The cleansing may involve tasks that are manual in nature (e.g., fixing keystroke errors) or can be automated (e.g., adding an additional suffix or prefix to a data sequence, identifying redundant data, etc.).

Costs: Notification data may have both external and internal costs. IOUs may have to actually pay a source to obtain data. In this case, the cost is a processing cost to create notification data reports (in-scope third parties do not actually sell notification data to IOUs). Separately, IOUs have to consider their internal costs when sourcing and managing notification data. These costs may include the resources necessary to secure notification commitments from third parties or the analysts needed to cleanse the data received. These costs may also include systems, interfaces and databases implemented and maintained for notification purposes. When evaluating notification sources that may provide similar results, the IOUs will obviously prefer those sources that carry lower internal and external costs.

These requirements form the framework used by the IOUs to assess current and future notification solutions.

Notification Value

Notification data informs service planning assessments and improve grid reliability and safety, two of the highest priorities for utilities. Even a 99.99% non-incident rate is unacceptable if that .01% instance of an outage or a safety incident involving PEV charging were identifiable and preventable.

Notification data also helps avoid costs associated with replacing infrastructure on an emergency basis. Unplanned infrastructure repairs or replacements occur outside of the typical and most efficient supply-chain and labor scheduling processes. For example, the cost of a typical transformer replacement can double if performed on an emergency basis due to both higher labor costs (including overtime) as well as the additional work that very often is necessary when repairing a failure rather performing planned maintenance.

Now that the definition, context, goals and requirements surrounding notification are explained, the next section will explore current notification solutions that IOUs have implemented.

Section 3 – Current Notification Solutions

As IOUs defined their requirements for effectively identifying new PEV charging locations, they initially focused their efforts on two PEV notification sources: the OEMs which were about to launch new PEV models and the PEV customers. In addition, local city and county governments held useful construction permit data, but this source raised several potential concerns that required further evaluation.

The current notification solutions meet most of the IOUs' needs in the early PEV market, but do not seem sustainable in the long term. Additional solutions will likely be required as the market develops.

Notification from OEM/Affiliated Installation Vendors

IOUs are working closely with OEMs to obtain notification data while protecting customer privacy.

Existing OEM Notification Programs

As IOUs realized that a number of PEV customers would not notify them directly, IOUs engaged with OEMs about helping identify new PEV charging locations. While OEMs initially objected because of privacy considerations, they also understood that the IOUs were not trying to recruit new customers or to sell new products and services. Rather, the IOUs wanted to ensure a positive customer experience for PEV customers and avoid voltage drops, power outages, or even potential damage to customers' properties. Any such incident could not only affect the individual PEV customer, but his or her neighborhood as well[15].

Leading OEMs agreed to participate in a notification program after securing customer consents as part of the online reservation process,

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[15] Based on SCE and SDG&E's assessment, a transformer may serve an average of 10 households in their respective service territory.

either through their own website or through their affiliated EVSE installation service providers. For customers who opt in to the notification process, these OEMs will share the street-level address of the customer charging location and the estimated delivery of the PEV with IOUs. These PEV adopters are already customers of the utility.

GM and then Nissan were the first two major OEMs to launch their new PEV models in California. To date, both have been sharing notification data with the IOUs and other utilities across the United States.

GM's regional manager for California prepares and communicates notification data to IOUs on a biweekly basis. Only those customers who hire SPX, GM's affiliated vendor, to conduct a home assessment or to install an AC Level 2 charging station are included in notification reports.

Nissan uses a different process and shares data through a third-party analytics firm, Oceanus. All LEAF customers, unless they have opted out, are included in notification data reported to IOUs on a quarterly basis. IOUs also have the option to obtain more frequent and granular reports at their cost.

As of writing this report Tesla, the other PEV OEM currently in-market, has not agreed to provide notification data to the IOUs.

OEM Notification Assessment

IOUs generally agree that the notification data currently provided by OEMs have met most requirements, with certain limitations:

Exhaustiveness: Through OEM notification, IOUs are able to identify the residential charging location of about 80% of the new PEVs sold in their service territory. The balance of unidentified charging locations results from customers opting out of the notification process or choosing not to hire the OEM's affiliated installation vendor.

Granularity: OEMs are currently sharing notification data at the street address level (as opposed to ZIP or ZIP+4). However, not all IOUs are receiving the same level of information. IOUs may have to pay for supplemental reports featuring more granular data (e.g., PEV delivery date to customer).

Timeliness: The frequency of OEM reports varies according to OEMs and IOUs. The reporting period has not been standardized and some IOUs may obtain biweekly or monthly reports while others receive quarterly reports.

While the costs of obtaining notification data from OEMs have generally been low, some of the existing processes appear to raise scalability concerns.

Scalability: OEMs may rely on internal manual processes to prepare notification reports provided to utilities. As PEV adoption increases, the reporting process, if not automated, may require additional resources for both OEMs and IOUs to manage[16].

Costs: As noted above, certain notification data reports from OEMs may be available for a fee, but all participating OEMs currently provide notification data for free to the IOUs. Internal IOU costs are limited, mostly related to initial data cleansing for input into the systems that support PEV readiness efforts (e.g., customer relationship management). These costs could increase as PEV sales increase.

Long-term Viability of Sourcing Notification from OEMs

OEMs currently providing notification data are not committing to current arrangements beyond 2012. OEMs provide notification data on a voluntary basis; they are dedicating resources to preparing the data and bearing the associated costs. Also, some of the manual processes implemented by OEMs to provide notification data may not scale with increased adoption unless automated.

IOUs have also approached OEMs launching new PEV models in the coming months. As of writing this report, Ford, BMW, and Mitsubishi have agreed to provide notification data. However, IOUs have not secured notification commitments from other major OEMs launching new PEV models in 2012, primarily because of cost issues related to the data transfer to the utilities. While most OEMs and their affiliated

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[16] Manual processing for data-heavy activities tend to be intrinsically error-prone, and ultimately, more costly on a per-unit basis.

installation vendor seem willing to provide the data and have implemented a process to capture customer consent, some are asking IOUs to bear all notification-related costs. On-going discussions were not conclusive as of writing this report.

OEMs that maintain a reservation process (with built-to-order PEVs) will continue to constitute the best potential notification source for new vehicle sales, providing lead time for IOUs to conduct service planning assessments and execute potential upgrades. For these OEMs, IOUs should consider ways to secure notification commitment over a period of multiple years. In particular, IOU discussions with OEMs indicate that BEVs will likely continue to sell under this process for the foreseeable future while PHEVs will probably move to an off-the-lot sale model, which may alter the current notification system. As BEVs are likely to have a greater impact on the grid than PHEVs, identifying the charging location of the former in time will be critical to maintaining grid stability.

However, in the longer term, as the reservation process disappears, OEMs will no longer have the ability to capture customer consent for notification. Consent would have to be obtained through dealers or affiliated installation service providers. All OEMs interviewed for this report have indicated clear preference for obtaining consent through their installation service providers[17].

In light of the foregoing, notification data from OEMs will likely face a number of limitations in the mid to long term:

Exhaustiveness: Notification data provided by OEMs will likely become less exhaustive as the PEV market becomes more mature.

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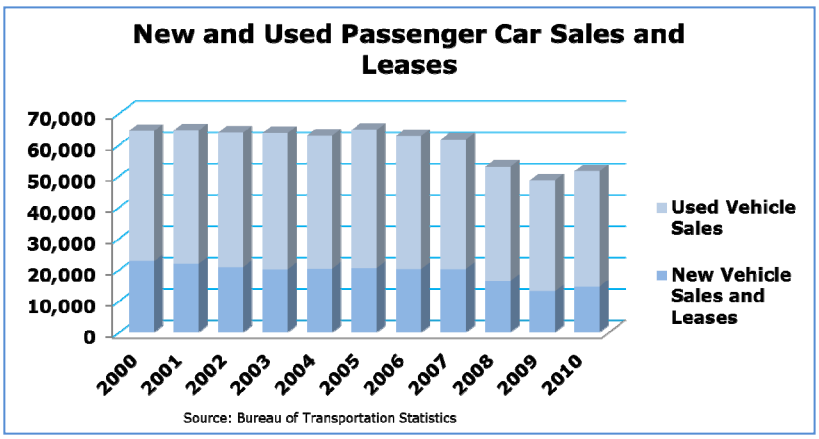
[17] Consent is usually obtained as part of the online scheduling process offered by EVSE installation service providers affiliated with OEMs. Notification language for GM, Ford, and BMW all reside on the installation partner's website. Toyota intends to approach it this way as well.

Change of address: OEMs cannot provide new addresses of PEV customers to IOUs. As a result, the new charging location of a previously identified PEV customer who moves in or within an IOU's service territory may not be captured by current notification processes.

Second-hand market: OEMs cannot share second-hand PEV sales with the IOUs. As shown on Figure 8, OEM franchise dealers are responsible for about one third of used-car sales. The IOUs will need to identify charging location for used PEVs as well as new



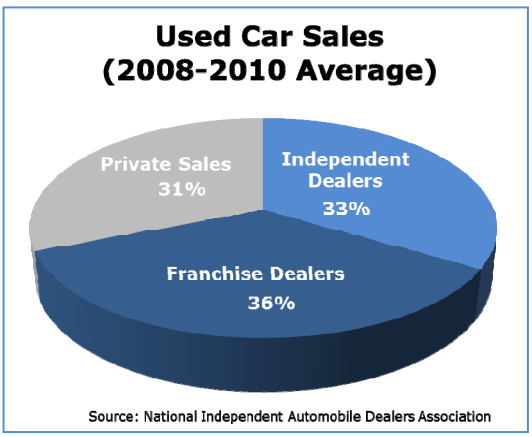


Figure 7 - Used car data

Affiliated Installation Service Providers: Installation service providers affiliated with OEMs may see their market share decline with the commoditization of the EVSE and the anticipated rise of independent electricians. As a result, OEMs sharing notification data collected through their affiliated service provider may eventually provide a smaller coverage of the new PEV market.

Timeliness: OEMs moving from an advanced reservation sales model to an off-the-lot sales model may only be able to provide after-the-fact notification data to IOUs unless installation vendors participate in the notification process.

IOUs have a strong interest in continuing to source notification data from OEMs as long as:

- PEV sales involve mostly new vehicles, or
- PEVs are sold on a reservation/build-to-order model, or
- EVSE installation occurs mostly through OEM affiliated service providers

For OEMs, notification will continue to provide the same benefits, namely a more stable grid infrastructure for their vehicles, especially when higher capacity chargers (6.6 kW and above) are installed by customers in 2012 and beyond.

Potential New Process for OEMs and Affiliated Vendors ("Clearinghouse")

As part of the initial strategy development for third party notification, the IOUs and the other members of the California Electric Transportation Coalition ("CalETC") developed a clearinghouse model to establish a long-term scalable and standardized solution to third party notification. Under this model, a clearinghouse would collect data from various notification sources[18]. It would also manage privacy issues, cleanse notification data, and eventually parse it and distribute it to participating utilities. The clearinghouse model would also improve standardization of the notification process by implementing a single model for all data sources and participating utilities. However, at this time, further research and analysis is necessary to properly assess the viability of a clearinghouse option.

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[18] The IOUs initially anticipated that the clearinghouse could have potentially sourced notification data from OEMs, the DMV, and local government. As discussed later in this document, IOUs now anticipate that the DMV will provide registration data directly to each IOU for their respective service area. Separately, counties and cities representatives have indicated that they prefer to work directly with the IOUs rather than with a third party data management organization. As the IOUs are not planning to pursue other third party notification sources at this point, the clearinghouse model, if implemented, will focus primarily on data from OEMs.

The organizational approach to a clearinghouse would likely involved two structures. A governing body would define governance and ensure compliance for the participating data sources and utilities. It would collect funds and run RFPs to hire a data management firm. The firm would actually execute the data functionalities of the clearinghouse (data collection, cleansing, aggregation, and parsing/reporting).

Since the foregoing clearinghouse model was initially conceived, it appears that the clearinghouse model would help primarily with notification data from OEMs as other sources provide data directly to the IOUs without the need for an intermediary entity[19]. At this point, it appears that a clearinghouse model could constitute an opportunity to implement a stable and scalable notification process as long as OEMs and their affiliated vendors are in a position to provide data useful to IOUs, as discussed above. The IOUs will also need to verify that a clearinghouse model can supply notification on a timely and cost-effective basis.

In essence, the new structure would help shift the notification costs from OEMs to those participating utilities. This would require two cumulative conditions:

(1) OEMs would have to agree to provide notification data to the clearinghouse over several years, and
(2) The IOUs and several other utilities would have to agree to participate and share these costs over a similar period of time (to keep each participant's prorated share low).

As this arrangement would source notification data from OEMs only, implementation could be handled at the state or federal level, depending on the level of participation of out-of-state utilities. IOUs are planning to initiate discussions with OEMs, either through direct discussions or under the umbrella of an industry group such as CalETC or the Electric Drive Transportation Association ("EDTA") in 2012.

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[19] A data management firm may also help with cleansing data received from the DMV (see supra)

While all OEMs interviewed for this report have noted that California IOUs and largest municipalities tend to be more proactive in their notification efforts than the rest of the country, out-of-state utilities interviewed directly by IOUs have provided a more subtle picture. Outside of California, many utilities have not seen a large volume of PEVs, yet. The rest of the country tends to have a more extreme climate than California with hot summers and cold winters. The grid is viewed as robust enough to provide power for electric furnaces/heaters and air conditioning, and could serve load for most charging situations at AC Level 1 or AC Level 2 at 3.3 kW.

These out-of-state utilities may not currently share some of the IOUs' immediate concerns, but things are expected to change when more PEVs get clustered and when 6.6 kW or higher chargers become more common. These out-of-state utilities have expressed interest in exploring options to source notification data from OEMs in order to maintain the current notification process beyond 2012.

Notification from Customers

As part of their education and outreach efforts, IOUs are targeting customers who have adopted or will adopt PEV technology.

Education and Outreach Efforts

Communicating to customers about the role of the utility when installing and using PEV charging equipment is one of the key PEV readiness activities conducted by the IOUs. The goals driving these education programs are also aligned with notification efforts. The IOUs want to maintain grid stability by assessing and upgrading, where needed, local distribution systems to mitigate the impact of PEV charging. The IOUs also want to ensure that PEV adopters are aware of the availability of PEV rates and of the benefits associated with charging off-peak. Ultimately, these efforts will contribute to improve the experience of PEV customers.

To achieve these goals, the IOUs are conducting education and outreach efforts targeted toward their residential customers, leveraging digital channels with sections of their website dedicated to PEV readiness.

Customers are invited to contact the utility and evaluate, through a rate analysis conducted by the utility, whether switching to a PEV rate will lower their electricity bill. After customers receive their rate analysis, they will have to contact the utility to confirm their rate selection. The IOU may then schedule a service planning visit as the rate selection may have implications on the customer's electric infrastructure, including panel upgrade or panel addition, which the service planner may need to review with the customer's electrician. At this point in the process, the IOU has detailed knowledge of the PEV customer needs and service planners can ensure that the upstream infrastructure is sized appropriately.

The IOUs have mainly used two approaches to recommending that PEV customers contact them. The IOUs have typically focused their messaging on providing plug-in readiness information or on potential savings associated with PEV rates. In all cases, the call to action is for customers to contact the utility about their new PEV.

The IOUs are closely collaborating with industry stakeholders to support their notification outreach efforts to potential and existing PEV customers. IOUs participate in national education outreach efforts such as Department of Energy's Clean Cities program and the Electric Drive Transportation Association's, GoElectricDrive.com. Each of the utilities also supports the State of California's PEV Collaborative which is developing a statewide common PEV message. IOUs participate in ride and drive events organized by OEMs and exhibit at trade shows (e.g., auto shows, home improvement shows, Earth Day events, county fairs, etc.).

In addition, IOUs are working with local government. Many city websites link to the utility's PEV readiness website and PEV readiness brochures are available at the city hall or the permitting office. Some IOUs are also conducting training and developing awareness programs for electricians through trade organizations or through installation service providers affiliated with a particular OEM.

Finally, IOUs are reaching out to franchise dealers in their service territories to familiarize them with the role of the utility. Dealers will be able to focus on selling PEVs and avoid complex installation discussions as long as they make sure that customers engage with

their utility. The key call to action IOUs are asking stakeholders is to remind PEV customers to contact their utility as soon as possible about their new vehicle. IOUs have created joint brochures distributed to dealerships in their respective service territories. Some, such as SCE, are also participating in OEM-led training to educate sales staff and have created a micro website dedicated to dealers. SDG&E also makes simple graphic plug-in vehicle time-of-use rate collateral available at their regional dealerships that carry PEVs so that it can be distributed to any customer visiting these sites that express an interest in PEVs. This involves a site visit and meeting with dealership sales staff for each regional dealership in SDG&E's service territory.

Customer Notification Data Assessment

Unfortunately, voluntary notification data from customers only partially meets the IOUs' needs:

Exhaustiveness: On average, IOUs estimate that about half of all PEV customers contact their utility. Various education and outreach efforts under way may help improve the situation, but the IOUs do not anticipate that all PEV customers will ever notify their utility about their new PEV.

Granularity: The data provided by customers include street-level address and charging level. However, the IOUs may not always have the ability to verify the data provided by the customer; customers initially charging at AC Level 1 on a PEV rate are unlikely to contact the utility again if they chose to later install an AC Level 2 EVSE.

Timeliness: Current research suggests that PEV customers, who engage with their utility, will usually do so prior to delivery of their PEVs.

Despite education and outreach efforts, IOUs observe that a significant number of PEV customers will not contact their utility. Several reasons may explain the situation:

- Customers may not be aware of the availability and benefits of PEV rates and the role of the utility in installing and using charging equipment[20].
- Customers may be reluctant to speak with the utility's call center. IOUs do not currently offer a fully automated platform to request a rate analysis and select a different rate (all IOUs are planning to eventually offer the ability to conduct the entire process through electronic communications).
- Customers may incorrectly expect that the utility will contact them because they agreed to opt in to a notification program, have responded to a PEV-related survey on the utility's website or have used online rate assistant.
- Customers have little to no incentive to contact the utility if they prefer to remain on a standard rate. IOUs are testing tools to facilitate customer notification when no rate change is involved.
- Customers are already saving a significant amount of expense switching from gasoline to electric "fuel" and may not be motivated to seek additional marginal savings through lower utility rates.

Processes relating to sourcing notification data directly from customers mostly meet the IOUs' requirements:

Scalability: Current customer processes include a number of manual steps, as discussed above, but will eventually be automated as PEV adoption ramps up.

Costs: The IOUs do not allocate any costs to their customer notification efforts because these activities have benefits beyond notifications. As ordered by the CPUC in the AFV OIR, IOUs engage in education and outreach to inform consumers about their options for

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[20] Primary research conducted by SCE suggests that many potential PEV adopters are not aware of the need to charge PEVs primarily at home and believe they may rely on public infrastructure for most of their charging needs.

metering arrangements, rates, demand response programs, charging equipment, installation, safety, reliability, and off-peak charging, among other things. In addition, these efforts are part of the normal course of ensuring overall customer satisfaction.

As a result, IOUs need to access additional notification data sources to identify more PEV charging locations.

Notification from Local Government

Current notification initiatives with local government show some potential benefits, but these will unlikely constitute the cure-all solution to IOUs' notification needs.

Existing Local Government Notification Programs

To supplement notification data received from customers and OEMs (and eventually capture charging locations for used PEVs and PEV customers with new addresses), some utilities have turned their attention to another potential source: the cities and counties issuing electrical permits in connection with the installation of PEV charging equipment (permits are public records).

Local governments have traditionally shared copies of inspection reports related to electrical upgrades with their respective utility[21]. Indeed, upgrading an electrical panel or adding a new circuit may constitute early signs that the demand of a particular household may increase. In turn, utilities need to ensure that the upstream infrastructure is appropriately sized to deliver the load[22].

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[21] SDG&E is currently receiving inspection clearances on EVSE installations from AHJs ("Authorities Having Jurisdiction" aka city inspectors) in many communities, and adding that information to its notification listings (these include whole house installs that do not involve a utility service order for a second meter placement).

[22] California Public Utilities Code §451 requires utilities to maintain appropriate equipment and facilities necessary to promote the safety and convenience of the public.

Unfortunately, local governments have not implemented standardized permitting processes unique to EVSE installation. City permitting and inspection processes follow standard electrical permitting similar to any other electrical installations (e.g., kitchen upgrades or spa installations). Depending upon the installation requirements (e.g., breaker upgrade versus full panel upgrade), some cities may not require a specific permit for installing EVSEs.

SDG&E receives permitting information from several local governments within its service territory. PG&E is discussing opportunities to engage with the City of Berkeley to receive EVSE permit information. For its part, SCE is currently piloting a program with a large county and three other cities in its service territory where significant volumes of PEVs are anticipated. Under the current program, the county and cities will email SCE any new EVSE-related electrical permits. The data is then evaluated against the utility's database. If SCE does not have prior knowledge of a particular charging location (as a result of a customer or OEM notification), the IOU will initiate a service planning assessment.

Local Government Notification Assessment

Notification data from local government may meet some of the IOUs' requirements:

Exhaustiveness: SCE and SDG&E both receive some level of permit notification from their service territory. Within SCE's pilot program, about 30% of all EVSE permits received by SCE to date have helped identify charging locations previously unknown to SCE (residential customers who did not contact SCE directly, opted out of the notification process, or acquired a PEV from a party which does not provide notification data to SCE). Unlike notification data from OEMs, local government permits may help identify changes of address; they are also agnostic to new/used PEVs since they only govern the EVSE installation. Additional data is required however, to further evaluate the ratio of charging locations identified through OEMs or direct customer contacts that are actually covered by an EVSE permit, but SCE has only received a small volume of EVSE-related permits to date.

Detailed: EVSE permit information received by both SCE and SDG&E contains street-level address, but only covers AC Level 2 charging by

definition (as AC Level 1 charging will usually not require any sort of installation permit unless a new dedicated charging circuit is installed). As a result, notification data from local governments will typically not allow the utility to engage with AC Level 1 customers about PEV rates and off-peak charging.

Timeliness: Local governments currently working with IOUs are usually providing a copy of new electrical permits within seven days following issuance. Also, customers will request permits at the time of installation of an EVSE, prior to the city inspection. This may give the utility greater lead time than other sources of notification data.

Notification processes to collect notification data from local governments face scalability issues which may impact costs in the longer term.

Scalability: Large scale notification programs with local government would require further automation of many of the steps involved. Because of current budget restrictions, local governments are not in a financial position to automate permitting systems. This makes the current efforts unlikely to scale as PEV adoption increases. Also, the lack of a standardized approach to permitting for EVSE installation may limit the IOUs' ability to source the data effectively from local governments. Finally, engaging with local government is resource-intensive and the IOUs are unlikely to approach every single local government in their service areas.

Costs: IOUs currently incur limited internal costs in connection with the current securing and cleansing notification data from local government. However, expanding current efforts to secure notification data from all cities and counties in the IOUs' respective service areas would be a costly proposition requiring a large team of analysts to prepare the data and manually input the information into the IOUs' relevant systems.

IOUs are considering focusing on a short list of key cities (where large clusters of PEVs are expected) to source permit notification data. The data will be used to complement other notification sources (OEMs, customer, etc.) which appear to provide a greater volume of data, and

to help prioritize service planning assessments by focusing on AC Level 2 charging locations.

Some of the shortfalls identified with the current notification solutions will likely continue as PEV adoption increases. As a result, IOUs will need to find new solutions to source exhaustive, detailed and timely notification data beyond the current early market phase.

Section 4 – Potential Notification Options

IOUs have assessed several options that may solve some of the issues identified with current notification solutions. While some of these potential solutions appear encouraging, further assessment will be needed to determine the actual viability of these sources. The IOUs may find, after further investigation, that one or more of these potential options fail to meet IOU needs. As the market develops, needs evolve, and further information is uncovered, the IOUs' preferred notification options may need to be adjusted accordingly.

The DMV

In preparing for the future state of the PEV market, IOUs are developing plans to potentially access DMV data, provided that on-going evaluation efforts are conclusive.

Background

On September 26, 2011, Governor Brown signed into law SB 859 authored by Senator Alex Padilla and sponsored by CalETC, a trade group formed by the IOUs, Los Angeles Department of Water and Power, and Sacramento Municipal Utility District. The law expressly authorizes California utilities to obtain PEV registration data from the DMV. The law also imposes restrictions on how to use DMV data to protect privacy.

The IOUs understand that utilities will be able to use DMV data only to identify new charging locations, conduct service planning assessments and make the necessary grid upgrades. Under the law, utilities will not promote PEV rates, off-peak charging or other load management programs specifically to those customers identified through the DMV. Also, within 15 days of receiving the data, the utility must disclose to the registered vehicle owner that it has accessed the registration data.

The IOUs have been investigating available options to obtain and use DMV data. IOUs have met with DMV representatives to initiate the data collection process. Based on an early assessment, the IOUs have confirmed the following facts:

1. The DMV has an established process to share data; a number of parties are already authorized and regularly access registration data; the process will not be unique to the IOUs. The DMV has standardized applications and dedicated staff to process third party data requests. Each IOU will have to file a "commercial requester account application", pay the $250 initial fee, and provide the statutory $50,000 surety bond.
2. The IOUs will need to submit data requests that will include their business requirements for a query to be developed by the DMV. The DMV will use the query to produce reports for each IOU's service territory. The DMV has indicated that setting up systems and creating a work request for notification may take up to 6 months to produce the initial report.
3. The DMV may generate reports on a weekly basis (or longer frequencies) at each IOU's request (each IOU will pay the DMV directly for its respective report). IOUs may also elect to obtain reports whenever new registrations or address changes occur ("event-based" reporting)[23].
4. The data obtained from the DMV will be limited to the vehicle registration. It will not include any information relating to the charging level selected by the registrant.

DMV Notification Assessment

At this point, the IOUs do not have an urgent need for accessing DMV data as the PEV market is still nascent and the used-PEV market is essentially non-existent. IOUs anticipate the following benefits and limitations which they will validate using actual data reports from the DMV. Based on the IOUs' initial assessment, notification data reported

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[23] Reports that include all current registrations at a certain point in time ("snapshot" reporting) may carry a significantly higher cost than event-based reports.

by the DMV may fully meet the need for exhaustiveness while partially satisfying their need for data granularity and timeliness.

Exhaustiveness: The IOUs anticipate that notification data from the DMV will include almost all PHEVs and BEVs registered in the respective IOUs' service territory, regardless of the charging level chosen by the PEV customer. As such, IOUs expect that the DMV may become a key notification source to identify residential charging locations for new PEVs, used PEVs, and changes of address. The IOUs do anticipate that some of the data may not be readily usable. For instance, some PEV owners may use an address (e.g., P.O. box, workplace, student vehicles registered at parents address) that differs from their actual charging location[24].

Granularity: The IOUs anticipate notification data from the DMV to provide street-level address for each registered PEV. As stated above, while DMV data will include all levels of charging, it will not actually identify such levels since that information is not gathered by the DMV.

Timeliness: Starting July 1, 2012, under AB 1215, all California dealers will be required to use electronic registration for all vehicles sold or leased in the State. This new requirement is anticipated to significantly reduce the cycle time to update the DMV records[25]. The information will be entered directly into the DMV registration systems by dealers without the need for any intermediate/manual steps by DMV personnel, the timing of which will impact the cycle time (especially if dealers wait and

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[24] When providing the statutory disclosure required by SB 859 to PEV customers, IOUs may recommend contacting the utility if the customer's charging location is different from the registered location.

[25] Transfer fees are due within 10 days of the sale. Penalties are assessed if payment is not received by the DMV within 30 days of the transaction.

input data in batches)[26]. Additional notification lag time following registration of a vehicle sold by a dealer may depend on the frequency of the reports issued by the DMV. Private party sales ("casual sales") account for about 30% of the used car market[27]. For these sales, registration of a car still requires paper applications and forms, and a visit to the local DMV branch, which may have a longer notification lag time than dealer sales. Finally, as discussed earlier, data from the DMV only includes transactions where the customer has taken delivery of the vehicle. DMV data will only show PEVs that have been delivered to customers; the actual DMV registration may occur before or after installation of an AC Level 2 charger which may or may not leave time for IOUs to conduct service planning assessments and execute grid upgrades where needed.

In 2012, the IOUs plan to continue assessing DMV data by applying for actual registration reports. This will help clarify the following questions relating to the scalability and costs of notification processes relating to DMV data:

1. **Scalability:** Until the IOUs have an opportunity to review an actual report from the DMV for their respective service area, the level of effort for scrubbing the data cannot be clearly identified. Each IOU will have to make that evaluation based on their own systems as cleansing needs may vary among IOUs. Once that internal evaluation is conducted, IOUs will share their observations and assess whether the cleansing effort may be conducted by a third party data management firm in an effort to streamline the process and produce economies of scales for the IOUs to share.

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[26] The initial test reports should help identify the average cycle time from the day an EV is sold, registered with the DMV, and actually reported to IOUs in the DMV report.

[27] See supra.

2. **Costs:** The cost for the DMV to develop the query to report unique PEV registrations is unconfirmed at this time and will be provided by the DMV based on applications from IOUs. Also, as the price of each report is based on the number of records, the first report will show the actual cost of DMV data and help project future costs based upon the actual number of registered PEVs. IOUs anticipate paying $0.10 per reported registration, as indicated by DMV representatives. Other costs could include obtaining new VINs, additional changes to the query, and potential processing charges for low volumes.

IOUs do not anticipate that notification data from the DMV will meet all of their needs, but no single notification source meets all three requirements. As the PEV market matures the DMV may likely become a key data notification source. Other secondary sources may complement primary data sources and bridge some of the anticipated data gaps identified above.

Load Research/Scanning: Notification from the Smart Grid

As IOUs complete deployment of Advanced Metering Infrastructure (AMI) meters, new data related to individual load profiles may provide a way to detect PEV charging locations.

Potential Solution

All IOUs have been deploying AMI meters as directed by the CPUC and will all be collecting usage data in one hour increments[28]. The load profile of a customer who starts charging a PEV, especially at 3.3 kW or higher will change significantly and may be detectable by the appropriate algorithm. It should be noted that IOUs are considering such a solution, but have not committed to any implementation, as the relevant due diligence is still on-going to assess the accuracy and reliability of such a solution.

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[28] SDG&E has completed AMI meter hardware deployment and will gradually phase in AMI functionality going forward. SCE will complete deployment by 2013. PG&E will complete deployment by 2012.

This solution would require developing an algorithm to sift through some or all residential accounts and identify load changes above a certain threshold made of prior usage data for the same account. Initially, IOUs will not have access to historic data and would not be able to make adjustments to account for seasonality. However, since most PEVs have a distinct charging signature, IOUs may be able to identify not only the load change, but whether the change was actually caused by a PEV or not. In turn, IOUs would be able to conduct a service planning assessment and potentially contact the customer about PEV rates and off-peak charging.

The main complexity is likely to center on the frequency at which load scanning reports are produced. To minimize impact on their data storage facilities, IOUs may also have to decide if the algorithm will scan the entire population of residential accounts or a smaller subset (e.g., those accounts in weaker parts of the grid).

Finally, a load scanning solution may raise privacy concerns and projects will have to be reviewed for compliance with the IOUs' respective policies. It should be noted that under each of the IOUs' tariffs[29], customers are required to give prior notice to the utility before any material change to their load. A load scanning solution could provide support to the rule and help locate circuits needing reinforcement.

Load Research Notification Assessment

If IOUs implement load research capabilities, they may garner a number of benefits. But these capabilities may not solve all of IOUs' notification needs.

Exhaustiveness: IOUs anticipate that notification data from load scanning may detect significant load changes at the residential level. At this point however, it is unclear whether the detected profiles would include AC Level 1 charging, especially for customers with a short commute. This would mean that load

[29] See Rule 3c.

scanning may detect PEV charging that poses a risk to the grid, but may not help IOUs identify all charging locations (which may direct some of their outreach efforts).

Granularity: Load scanning would allow IOUs to identify charging locations at the street-level address and potentially show charging levels (at least AC Level 2). It may include more than just PEV charging locations and may cast a wider net than the PEV customer population. This will not affect the need for service planning assessments ("load is load"), but may not allow targeting precisely PEV customers, only.

Timeliness: By definition, load research will only capture PEV charging after the first occurrence. This after-the-fact detection will be subject to the reporting frequency chosen by each IOU. Subject to further feasibility assessment and testing, load scanning may have potential to consistently provide somewhat early notification data in a short time frame, especially after PEV sales will have moved to an off-the-lot model.

A load scanning solution will require additional research before scalability and costs can be fully assessed.

Scalability: While load research capabilities would be automated in nature, reporting may require additional human analysis. Further feasibility work will need to validate the actual "detectability" of the PEV load and the reliability of the scanning algorithm.

Costs: IOUs have not completed cost studies at this point. Each IOU will likely need a specific solution that fits their respective back office environment, including their data storage solution. As a result, the cost of implementing load scanning capabilities may vary significantly among IOUs, especially if computer processing capabilities cannot accommodate such an option and require important upgrades

Both DMV and load scanning data have potential to meet key notification needs, but more research (to be continued in 2012) is needed to validate IOUs' current assumptions.

Other Data Notification Options: Financial Incentives

IOUs have also considered offering financial incentives to potential notification sources, but high cost and unclear returns do not support further considerations, at least not until more attractive options have been fully explored. As with any types of incentives, participation may vary and these programs are unlikely to satisfy the exhaustiveness criteria. In addition, existing PEV rates may already be considered as a form of adoption incentive[30]. Finally, IOUs would likely need to commit significant resources to inform, manage, and promote these programs.

Financial Incentives for Customers

To motivate PEV customers who do not notify their utility directly, IOUs could potentially offer financial incentives linked to PEV adoption or installation of an AC Level 2 charger.

Under this scenario, the financial incentive provided by the IOUs would have to compete for visibility with the significant tax incentives already offered by the state government and the federal government. Financial incentives on PEV notification would not guarantee that customers would actually charge off-peak unless the incentives are tied to signing up for an EV rate.

Based on PEV sales forecasts developed by the IOUs, a financial incentive program benefitting PEV customers would likely carry the largest cost of any other notification options. The IOUs have decided not to pursue such a program at this point.

Financial Incentives for Dealers

IOUs have also considered providing financial incentives to dealers for sharing notification data with IOUs. Under this option, dealers would have to obtain customer consent to share customer data with the utility. Dealers could constitute an attractive option because they will

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[30] More than 90% of both SCE and SDG&E customers who request a PEV rate analysis select a PEV time-of-use rate instead of their current rate.

handle most PEV sales (at least until the used PEV market takes off). An incentive may encourage them to provide timely notification to the utility (a rebate could be subject to sales being reported within a very short period of time). Later, it would also give IOUs access to independent dealers for used car sales. However, dealers would not be able to provide information on charging levels. As a result, dealers would likely provide data that's less exhaustive than the DMV, with similar granularity and timeliness, but at a much higher cost. Also, the large sales staff (with high turnover) at the numerous dealerships in each service territory will likely make it difficult to source notification data consistently and reliably. It should also be noted that dealer-sourced notification did not receive any OEM support based on interviews conducted for this report. For these reasons, IOUs have decided not to pursue such a program until IOUs have researched further sourcing data from the DMV.

Financial Incentives for Electricians

IOUs have also considered paying a referral fee to electricians. In this case, electricians would have to obtain customer consent to release their information with the utility. This incentive may mostly include level 2 charging, but could also include those customers who rightfully chose to have their home infrastructure inspected by a licensed electrician prior to charging their EV for the first time (for any level of charging). Under this scenario, the incentives would encourage using the services of licensed electricians, without promoting a charging level over another. It would also allow bringing in the notification scope those electricians who do not work with an installation service provider affiliated with an OEM.

While electricians could provide timely data, the IOUs have concluded that offering financial incentives to electricians would likely carry a high cost without ensuring exhaustive notification data compared to other potential notification options.

Future Plans for Notification

Preferred Options

When evaluating notification options available to them, IOUs are considering several requirements. As discussed throughout this

document, the notification data should ideally meet the IOUs' needs for exhaustiveness, granularity, and timeliness. In addition, the IOUs will give preference to those notification processes that will be scalable as PEV adoption increases and carry lower costs than other options.

IOUs are planning to continue their evaluation beyond this report to confirm initial findings and investigate new options that may present themselves. While IOUs expect to validate these initial findings, it should be noted that continuing evaluation might evolve into a different outcome than this report currently contemplates.

Since no single notification data source will fully meet IOUs' needs, a combination of sources is warranted to achieve the IOUs objectives of: 1) maintaining grid stability, and 2) educating PEV customers about the benefits of PEV rates and off-peak charging.

As the PEV market evolves, a viable option today may no longer work in the mid to long term. The market will require flexibility going forward. So far, the IOUs have been primarily relying on sourcing notification data from OEMs. However, with sales shifting from a reservation model to an off-the-lot model and a used PEV market eventually developing, OEMs are unlikely to meet all IOUs notification going forward.

As the PEV market transition to the anticipated future state described under Section 2 of this report, IOUs will continue their on-going research to evaluate sourcing data from the DMV and develop load scanning capabilities

No one can guarantee that the market will mature exactly as currently anticipated. These are likely scenarios confirmed through primary research with industry stakeholders.

To select notification options, IOUs will consider *primary* sources–sources that will provide the bulk of notification data–and *secondary* sources–sources that will supplement primary sources, but would not be otherwise considered sufficient to meet the IOUs' notification data needs.

In light of the foregoing, IOUs have identified the following as their preferred options.

Near to mid-term: The IOUs will continue to source their data primarily from OEMs. As part of their on-going discussions, the IOUs will continue to engage with OEMs and other utilities, both in- and out-of-state, in an effort to secure notification commitments over multiple years. They will also source additional notification data from some of the local governments in their respective service territories and from their customers on a voluntary basis, while further evaluating implementing a process to source data from the DMV.

Longer term: The IOUs anticipate receiving the majority of their notification data from the DMV (provided that forthcoming research validates the IOUs' expectation). Secondary sources may also include OEMs, local government, customers, and load research/scanning (provided that feasibility and cost studies are conclusive).

High-level Roadmap

Based on the IOUs preferred options, IOUs anticipate executing the following high-level roadmap to guide their on-going notification efforts. The following activities may be conducted jointly or separately, with a level of effort that may vary based on the specifics of each IOU and their respective service territory. In addition, these activities may change based on new findings from ongoing research or actual market conditions such as the pace of PEV sales and adoption of higher-level charging technologies.

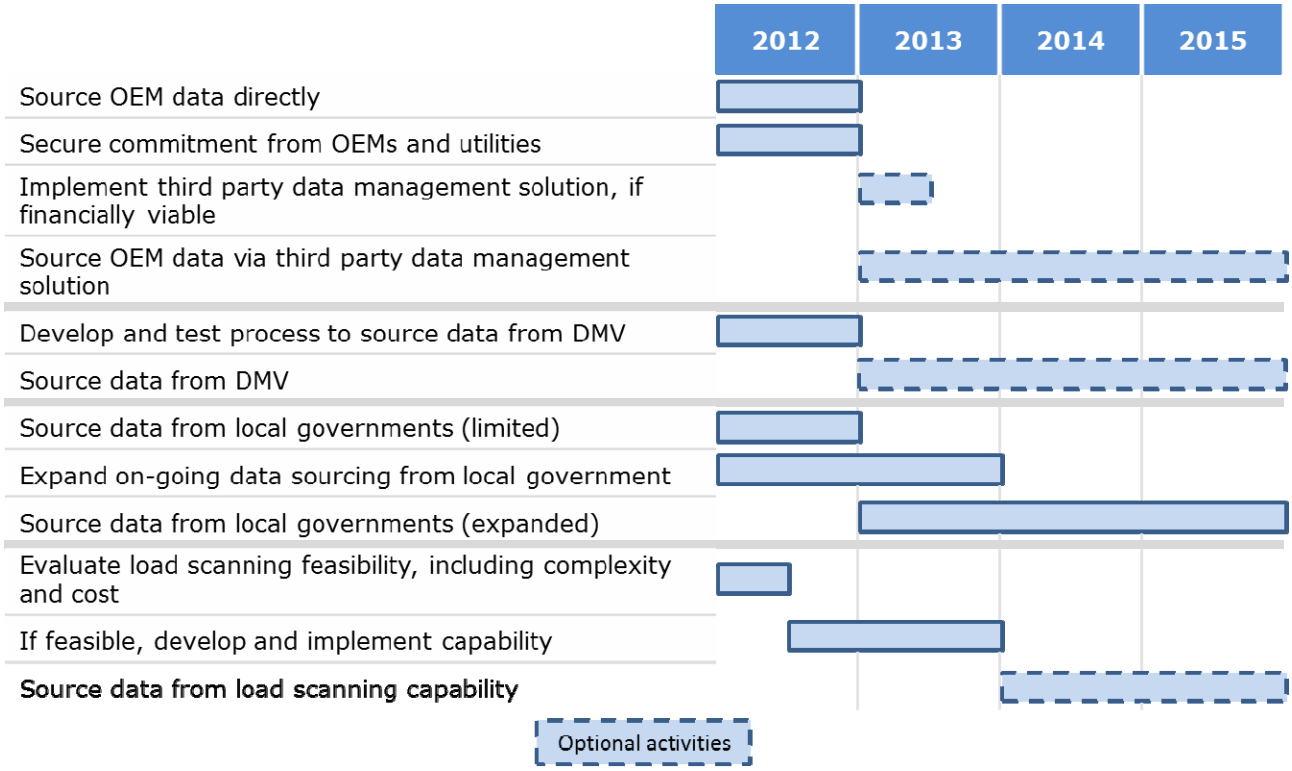

Figure 8 - NOTIFICATION TIMELINE

Definitions and Glossary

AB	Assembly Bill
AC	Air Conditioning
AMI	Advanced Meter Infrastructure
BEV	Battery Electric Vehicle (e.g., Nissan LEAF)
C&I customers	Commercial and Industrial customers
CalETC	California Electric Transportation Coalition. Trade group representing PG&E, SCE, SDG&E, LA DWP, and SMUD (General Motors, Nissan, and BMW are associated members)
CPUC	California Public Utilities Commission
DMV	California Department of Motor Vehicles
EDTA	Electric Drive Transportation Association, national trade group representing vehicle and equipment manufacturers, energy companies, technology developers, and end users
EV	Electric Vehicle
EVSE	Electric Vehicle Supply Equipment, also known as charging equipment, charger or charge station
GIS	Geographic Information System
HEV	Hybrid Electric Vehicle (e.g., Toyota Prius)
HVAC	Heating Ventilation Air Conditioning
IOU	Investor-Owned Utility
kVA	Kilovolt-Amps
KW	Kilowatt
Level 1 charging	120V up to 16 amps
Level 2 charging	240V up to 80 amps. Includes residential levels of 3.3, 6.6, and 19.2kW
OEM	Original Equipment Manufacturer (i.e., automobile manufacturer)
PEV	Plug-in Electric Vehicle
PG&E	Pacific Gas and Electric Company
PHEV	Plug-in Hybrid Electric Vehicle (e.g., Chevy Volt)
SB	Senate Bill
SCE	Southern California Edison
SDG&E	San Diego Gas and Electric Company

V	Volts

Organizations Interviewed for this Report

OEMs: BMW, Ford, GM, Mitsubishi, Nissan

Utilities: DTE Energy, Duke Energy, Northeast Utilities, Puget Sound Energy

Others: Best Buy, Oceanus, JATO, California DMV