Application No. A.14-04-014
Exhibit No.: _____
Witnesses: James P. Avery, Barry Pulliam, Randy Schimka, J.C. Martin

Application of SAN DIEGO GAS & ELECTRIC COMPANY (U902E) for Approval of its Electric Vehicle-Grid Integration Pilot Program.	Application 14-04-014 (Filed April 11, 2014)
And Related Matter.	Rulemaking 13-11-007

PREPARED SUPPLEMENTAL TESTIMONY OF SAN DIEGO GAS & ELECTRIC COMPANY

BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

JANUARY 14, 2015

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CHAPTER 1

PREPARED DIRECT TESTIMONY OF

JAMES P. AVERY

OVERVIEW OF APPLICATION AND SUPPLEMENTAL TESTIMONY

I. INTRODUCTION – WHY SUBMIT SUPPLEMENTAL TESTIMONY?

San Diego Gas & Electric Company ("SDG&E") submits this supplemental testimony to support its application for a pilot program for utility-provided electric vehicle ("EV"), grid-integrated charging,[1] in order to address the questions raised by D.14-12-079. To summarize testimony submitted with the application in April, 2014, SDG&E has designed this proposal to provide the following benefits:

(1) Ratepayer benefits: Reduces emissions and avoids new generation and other infrastructure expenses with price signals to encourage off-peak charging by drivers:

- Day-ahead pricing and hourly rates
  - Allow drivers to get their required energy even on grid impacted days.
  - Encourage drivers to charge at times of grid surplus to efficiently integrate and manage charging loads with grid operation.
  - Factor in loading on individual distribution feeders, loading on transmission grid and impact on overall system peak, incenting the customer to charge during off peak periods and thus greatly reducing the need for costly system upgrades and new fossil generation additions.

[1] To emphasize the vehicle-grid integration ("VGI") benefits of the application, SDG&E refers to its proposed pilot program in this case as its "VGI" proposal. This usage is consistent with the VGI concept as referenced in, *e.g.*, the *California Grid Integration Roadmap* (December 27, 2013) (http://www.caiso.com/Documents/Vehicle-GridIntegrationRoadmap.pdf) and the Energy Division Staff White Paper: *Vehicle-Grid Integration: A Vision for Zero-Emission Transportation Interconnected throughout California's Electricity System* (November 14, 2013) (http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M080/K775/80775679.pdf).

- Eliminates demand charges for the site owner.
- Reduces carbon emissions.

(2) Benefits to promote EV adoption:

- Provides scalable solution that can be utility owned and responsible for installing, managing, and reliably maintaining the charging equipment.
- Offers EV customers choices for charging their vehicles via day-ahead hourly rates based on circuit and system conditions, including the efficient integration of energy from renewable energy resources.
- Allows SDG&E to install charging infrastructure at locations that offer the best opportunity for grid-integrated charging due to long parking durations: multi-family communities and places of work.
- Helps prevent the market from stalling by creating opportunities for third-party contractors to build, install, operate and maintain charging equipment to SDG&E specifications at 550 facilities (with 10 chargers each) over 5 years.
- Customer billing benefit: Allows drivers to pay SDG&E directly for their energy on their monthly bills with no additional service fees. Billing summary data will also be provided to drivers.
- Maintenance benefit: Provides funding for ongoing maintenance for the customer charging apparatus, which is not the case for the bulk of commercially-installed electric vehicle supply equipment ("EVSE")[2] in the region.

(3) Transparent data collection and cost effectiveness measurement will inform future Commission EV policy, to help achieve the objectives of D.14-12-079.

- Customer data collected on program participation will be aggregated to protect customer privacy and made available to the Commission and stakeholders.

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[2] The Commission uses this term, "EVSE", for example, in D.11-07-029, and in D.14-12-079, and it is generally understood to reference the equipment that a customer plugs into the EV. SDG&E understands the term to reference SAE J1772, the standard for electrical connectors for EVs maintained by the Society of Automotive Engineers. This standard defines a common EV conductive charging system architecture including operational requirements and the functional and dimensional requirements for the vehicle inlet and mating connector.

- Drawing on Commission experience with energy efficiency, SDG&E proposes a cost-effectiveness measurement methodology which will be populated with data generated by the proposed pilot.

This testimony supplements the testimony SDG&E submitted in April 2014.

II. THIS SUPPLEMENTAL TESTIMONY AIMS TO ADDRESS D.14-12-079

On December 18, 2014, the Commission voted out D.14-12-079 ("Decision").[3] This Decision sets aside the requirement in D.11-07-029 that the utilities demonstrate a "market failure" or "underserved market" as part of any application to own plug-in electric vehicle ("PEV")[4] charging infrastructure. This Decision now allows the Commission to consider utility requests on a case-specific basis, and it clarifies (p. 2) the elements the Commission will examine "in determining whether utility entrance into a competitive market with non-utility participants should be allowed." The Decision affirms the test applied in D.11-07-029, which would balance the benefits of utility ownership of PEV charging infrastructure against the competitive limitation that may result from that ownership. The Decision (p. 8) states the Commission's intent to:

> … take a more detailed, tailored approach to assessing any proposed utility program based upon the facts of specific requests, the likely competitive impact on the market segment targeted, and whether any anticompetitive impacts can be prevented or adequately mitigated through the exercise of existing rules or conditions.

The Decision goes on to specify certain items it will consider in applying this competitive balancing test (*id.,* p. 9). SDG&E submits this supplemental testimony to address the foregoing items in compliance with D.14-12-079. My testimony below, and that of an

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[3] *Phase 1 Decision Establishing Policy to Expand the Utilities' Role in Development of Electric Vehicle Infrastructure* (issued December 22, 2014).

[4] "Plug-in electric vehicles." This term is used to distinguish standard hybrid vehicles that do not require battery charging from an external source.

expert economist (Barry Pulliam, Chapter 2), address the competitive issues set forth in the Decision.

In addition, recall that SDG&E served prepared testimony to support its application (A.14-04-014), which was filed April 11, 2014 in this since-consolidated matter.[5] Since that time, SDG&E has responded to 17 discovery requests containing a total of 106 questions on this testimony by ORA, TURN, UCAN and Joint Minority Parties.[6] From lessons learned in responding to this discovery, it appears that there are some items that would be useful for SDG&E to include in this supplemental testimony to enhance understanding of its proposal. Those items are summarized in the next section.

Finally, witness Randy Schimka (Chapter 3) addresses concerns expressed in the Scoping Memo that SDG&E's proposal is too large and explains why it is not.[7]

III. WHAT SPECIFIC ISSUES DOES THIS SUPPLEMENTAL TESTIMONYADDRESS?

The first item of supplemental testimony is this policy and overview of the supplemental testimony (Chapter 1). My testimony includes below a response to the Decision's questions about regulations needed to protect competition. Please also note that I

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[5] On April 11, 2014, SDG&E served testimony sponsoring the following areas: Chapter 1 - Policy (Lee Krevat now adopted by James Avery), Chapter 2 - Implementation Costs and Management (Randy Schimka), Chapter 3 – Rates (Cynthia Fang), Chapter 4 – Revenue Requirement (Jonathan Atun), Chapter 5 – Cost Recovery (Norma Jasso), Chapter 6 – Cost Effectiveness (J.C. Martin). On June 3, 2014, SDG&E served revised testimony of Chapter 3 – Rates. On July 29, 2014, SDG&E served revised testimony of Chapter 6 – Cost Effectiveness.

[6] SDG&E has also held several "meet and confer" sessions with ORA, TURN and Commission Energy Division, to explain aspects of SDG&E's proposal.

[7] *Joint Assigned Commissioner and Administrative Law Judge's Scoping Memo and Consolidation Ruling* (September 29, 2014), pp. 3-4. The concern expressed was that the scope of the request "put the SDG&E Application on par with a full program business model, rather than an initial, research-oriented test project" (*id.,* p. 4).

am adopting as my testimony the prepared direct testimony of Lee Krevat,[8] Chapter 1 of SDG&E's testimony submitted in this matter in April, 2014.

Chapter 2 of this supplemental testimony is the prepared testimony of Barry Pulliam, a principal of Econ One, an economics consulting firm. Mr. Pulliam's testimony applies the Commission's competitive balancing test to the issues presented by this application.

Chapter 3 of this supplemental testimony, the prepared testimony of Randy Schimka and J.C. Martin, addresses three items. First, it shows how EVSE installation is falling short of that needed to support the State's electric transportation goals. Second, based on lessons learned from the discovery process in this proceeding, it clarifies the architecture of SDG&E's proposed vehicle-grid integration ("VGI") facility. Third, it addresses the concern expressed in the September 29, 2014 scoping memo in this matter, regarding the size of the proposal.

IV. WHAT RULES ARE NEEDED TO PROTECT COMPETITION?

D.14-12-079 states that the Commission will examine utility EV charging applications to consider (p. 9):

> 4. If the potential for the utility to unfairly compete is identified, the commission will determine if rules, conditions or regulatory protections are needed to effectively mitigate the anticompetitive impacts or unfair advantages held by the utility.

This section addresses this consideration. Specifically, in the following sections, I address (1) how, without utility participation, the current market will not meet the State's goals, (2) how Commission public utility regulation can protect the public interest from "unfair" competition if SDG&E's proposal is implemented.

[8] Since submission of the April, 2014 testimony, Mr. Krevat has moved to a position in SDG&E's information technology group.

A. Can the State's Goals be Achieved Without Substantial Utility Participation?

Recognizing that widespread consumer purchases of electric vehicles will not be achieved without convenient access to charging facilities, especially in locations where vehicles spend the majority of their time, such as at home and at work, the Governor's Executive Order (B-16-2012) also set a goal of deploying the infrastructure necessary to support up to 1 million electric vehicles by 2020.[9] The Decision implicitly recognizes that substantial utility participation is crucial to meeting this goal. Many recognize that the deployment of electric vehicle charging equipment is falling well behind the pace necessary to meet the Governor's goal. And, as Mr. Schimka's supplemental testimony (Chapter 3, section I) shows, the EVSE installation trend under a variety of assumptions will not support the goal unless something is done to change that trend.

Meeting the goals will not be determined by the installed volume alone, but also requires addressing the location of equipment installation. Two key areas need more attention and increased deployment in the SDG&E service area: multi-unit dwellings ("MuDs") and workplace locations (both of which have the longest duration of parking, and provide the most convenient opportunity for grid-integrated EV charging). SDG&E's proposal targets these key areas. In sum, SDG&E believes that substantial utility participation in providing electric charging – including integrating charging with efficient grid operation – is crucial to meeting the state's goals.

[9] Governor Brown Executive Order B-16-2012 benchmark

B. What Conditions or Regulatory Protections Are Needed To Prevent "Unfair Competition?"

If SDG&E's proposal is approved, its implementation will be subject to the entire panoply of the Commission's public utility oversight. In addition to rate case regulation and audit powers, SDG&E's proposal has the following Commission-enforced limits: (1) total size of program, (2) staged rollout, (3) transparent data collection and (4) cost-effectiveness reporting.[10]

As for any "unfair" competitive effects of the proposal, as indicated in the prepared testimony of Barry Pulliam submitted as part of this supplemental testimony (Chapter 2), the proposal has no such effects as properly measured by the effect on consumer welfare. In addition, the Commission should note that this is a pilot proposal of finite scope, to test the effect of making EV charging available at currently underserved long-duration parking locations - MuDs and workplaces - with pricing to encourage efficient integration of charging with grid operation. It is not an open-ended business venture. This fact in and of itself limits any asserted "unfairness." And, as SDG&E witness Randy Schimka testified (Chapter 2, pages R-8 to RS-9), the installation, procurement, operation and maintenance of the program's charging equipment will be competitively bid to third party providers, enabling competition in these EV-supporting market segments.

The Decision (pp. 7-8) cites the recent *Clean Energy Fuels Corp. v. CPUC* court decision,[11] where the court upheld the Commission's approval of the Southern California Gas Company's (SoCalGas) Compression Services Tariff over challenges that SoCalGas'

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[10] Elaborated upon in testimony served April 11, 2014 (Chapters 2 and 6)

[11] (2014) 2014 Cal.App.LEXIS 578.

status as a monopoly provided it an unfair competitive advantage over non-utility market participants in provision of the same services. While, as the Decision notes, that case acknowledged that Pub.Util. Code § 740.3 requires that the Commission "'ensure that the utilities do not unfairly compete with nonutility enterprises,' it does not prevent the utilities from competing at all." The enforceable limits and reporting requirements of SDG&E's proposal, coupled with the pervasive nature of Commission public utility regulation, are "the proper conditions and restrictions to address the potential anticompetitive impacts" (Decision, p. 8).

This concludes my supplemental testimony.

CHAPTER 2

PREPARED DIRECT TESTIMONY OF BARRY PULLIAM

EFFECT ON COMPETITION

SDG&E's Electric Vehicle Grid Integration Pilot Program

I. INTRODUCTION

My testimony deals with the issue of competition in the provision of electric fuel to Plug-in Electric Vehicle (PEV) drivers in the SDG&E service area through Electric Vehicle Supply Equipment (EVSE). I analyze the competitive landscape for these services and the potential for unfair competition associated with SDG&E's application in light of the balancing test articulated by the Commission in D.14-12-079, which states that "the benefits of utility ownership of PEV charging infrastructure must be balanced against the competitive limitation that may result from that ownership."[12]

I have reviewed SDG&E's application and related testimony in support of its application. In this section I provide a brief overview of SDG&E's proposal based on my review of that information.

SDG&E proposes to sell electricity to PEV drivers through a limited-scope Vehicle-Grid Integration (VGI) Pilot Program. SDG&E proposes to install a maximum of 5,500 EVSE, up to 550 VGI facilities (a potential of up to 10 EVSE per VGI facility) located at multi-unit dwellings (MuDs), workplaces and related settings which accommodate long duration parking.[13] The Pilot Program is intended to offer PEV drivers an innovative time-

[12] D. 14-12-079, p. 5.

[13] It is possible to have multiple "facilities" installed at a given location or site if there is sufficient demand.

variant rate to promote efficient grid usage with PEV charging and to boost the adoption rates of PEVs.[14]

SDG&E targets these locations because (1) they allow for charging at critical times of the day with long parking durations, which is necessary to take advantage of VGI rates that reflect times during the day when system demand and energy prices are low, and (2) to provide charging facilities where there is a low deployment of EVSE.[15]

To the greatest extent possible, SDG&E intends to contract with third parties for the installation, operation and maintenance of the EVSE.[16] PEV drivers would purchase electric fuel directly from SDG&E and would be billed monthly, in the same fashion as single family residential PEV drivers fueling through EVSE at home are today.

The VGI pricing proposal is a key aspect of the SDG&E application. The pricing plan is intended to reflect the dynamic nature of the grid's supply and demand balance for electricity and to incent PEV drivers through pricing to fuel their vehicles at system non-peaking times and when there is a surplus of capacity available on the grid and when the cost of energy is low. The technology proposed by SDG&E is designed to provide drivers with a flexible and convenient way to meet their charging needs, minimize their fuel costs, and promote efficient grid utilization. Efficient grid utilization is a key to avoiding potentially costly utility infrastructure additions as PEV usage increases.[17] Avoiding infrastructure additions helps keep rates lower for all electricity users (ratepayers).

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[14] Testimony of Lee Krevat (LK-1).

[15] Testimony of Lee Krevat (LK-13).

[16] Testimony of Randy Schimka (RS-2).

[17] Testimony of Lee Krevat (LK-2).

The rates offered to drivers would be regulated by the CPUC. SDG&E's proposal would recover VGI Pilot Program costs through rates charged to all ratepayers. SDG&E estimates that the average rate increase across all ratepayer classes would be approximately 0.25% at the end of the Pilot Program, assuming installation of the maximum number of units (5,500).[18]

II. SUMMARY OF OPINIONS

In my opinion SDG&E's proposal will not provide it with an unfair competitive advantage that is likely to limit competition in any significant way or to harm consumers in the provision of PEV fueling services in SDG&E's service territory. Further, the potential for competitive harm under SDG&E's proposal appears small relative to the potential net public benefits associated with the VGI Pilot Program. My opinions are based on the following factors.

First, PEV fueling services in the SDG&E service area have benefited from subsidies in the form of grants, rebates and tax credits.[19] The performance of the industry to date, as well as recent studies of the costs associated with providing PEV fueling infrastructure suggests that these types of subsidies will continue to be a key factor in the future if the industry is to grow in line with state-wide policy goals for the deployment of PEVs. SDG&E's proposal to spread PEV fueling infrastructure costs associated with the Pilot Program over all ratepayers is similar in function.

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[18] Testimony of Cynthia Fang (CF-19, 20).

[19] I use the term "PEV fueling services industry" here to refer to companies providing fueling services to PEV drivers.

Second, SDG&E's proposal is intended in part to increase the demand for and accelerate adoption of PEVs. This should help expand the overall market demand for PEV fueling services and provide additional opportunities for other service providers.

Third, the proposal contains features that mitigate against potential harm to competition and consumers. The Pilot Program is limited to the installation of a maximum 5,500 EVSE over time at MuDs, workplaces and related locations. Assuming PEV growth is in line with state-wide policy goals, SDG&E's presence in the market would be relatively small (and declining) in the future. In addition, SDG&E's intention to contract with third parties for the installation, maintenance and operation of the EVSE facilitates competition and its related benefits in these areas.

Fourth, SDG&E's Pilot Program is subject to the full range of CPUC regulation, which includes the requirement to price based on cost of service. This mitigates against the possibility that SDG&E might be able to raise prices above otherwise competitive levels, now or in the future.

Finally, the VGI Pilot Program as outlined in SDG&E's application has the potential to offer significant benefits. The VGI pricing is designed to facilitate the efficient integration of growing PEV electrical demand and usage with the electric grid, helping to avoid unnecessary capacity expansions and costs. In addition, consistent with state-wide policy goals, the Pilot Program should serve to accelerate PEV adoption rates, particularly among segments of the community that do not have access to single family residential charging. The net public benefit associated with the specifics of the Pilot Program as described in the testimony of Mr. J.C. Martin appears substantial. In contrast, the likelihood that the VGI Pilot Program would limit competition or harm consumers appears remote

given both the specifics of the market for PEV fueling services at this time and the specifics of the pilot program itself.

I discuss these issues in more detail in the sections below.

III. THE ANALYSIS OF POTENTIAL COMPETITIVE IMPACTS ASSOCIATED WITH SDG&E'S PROPOSAL

Decision 14-12-079 states that the Commission will examine the potential competitive impacts on the market segment targeted by SDG&E's application as part of a balancing test intended to weigh the benefits of utility ownership of PEV fueling infrastructure against the potential competitive limitation associated with that ownership.[20] The Commission states that its inquiry into potential competitive impacts of utility ownership will include examination of at least the following points:

(1) The nature of the proposed utility program and its elements; for example, whether the utility proposes to own or provide charging infrastructure, billing services, metering, or customer information and education;

(2) The degree to which the market into which the utility program would enter is competitive, and in what level of concentration;

(3) Potential unfair utility advantages, if any; and

(4) If the potential for the utility to unfairly compete is identified, the commission will determine if rules, conditions or regulatory protections are needed to effectively mitigate the anticompetitive impacts or unfair advantages held by the utility.

[20] D. 14-12-079, pp 5-8.

Item 1 is addressed in the April 11, 2014 direct testimony of Mr. Randy Schimka and summarized in Section I above. I discuss the remaining items in the balance of my testimony.

A. Determination of the Relevant Market

The first step in examining competition is to define the "relevant market(s)" for inquiry. Defining a relevant market serves to identify the product or service at issue (the product market) and the geographic area of competition (the geographic market). The relevant market is the intersection of the product and geographic markets. Once a relevant market is defined, one can determine market participants, measure market shares and concentration measures within the market.[21]

Market definition focuses on demand substitution, that is, consumers' ability and willingness to substitute one product for another in response to a price increase or a non-price change such as a reduction in product quality. Consumers are often faced with a range, or continuum of possible substitutes for a particular product or service. Accordingly, it may be appropriate to consider more than one definition of a relevant market when examining competitive issues.

With these principles in mind, it is helpful at this point to review PEV charging and how EVSE is used before attempting to define the relevant market(s) for inquiry. Charging

[21] The U.S. Department of Justice (DOJ) and the Federal Trade Commission (FTC) have issued "guidelines" for use in their review of the potential competitive impacts associated with mergers and acquisitions (Guidelines). While SDG&E's proposal is not a merger or acquisition, the Guidelines describe the general approach that economists use when examining competition within a market and potential effects on competition due to structural changes within the market, such as the entry or exit of participants. The definition of relevant markets is set forth beginning at page 7. See U.S. Department of Justice and Federal Trade Commission (19 August 2010). Horizontal Merger Guidelines. Retrieved from: http://www.justice.gov/atr/public/guidelines/hmg-2010.pdf

a PEV is analogous to fueling a conventional vehicle with gasoline, though at a slower rate. Unlike conventional vehicles though, PEVs can be fueled at private residences, workplaces or other areas where the vehicle stays parked for an extended period. Furthermore, PEVs can be fueled at different rates by using different types (or levels) of charging equipment.

Charging rates affect the length of time a vehicle has to be connected to the charger, the equipment and installation requirements, and the cost of providing EVSE at a particular location. There are currently three types of fueling options available to PEV drivers: Level 1, Level 2, and DC Fast Charging.

All PEVs come with a 120-volt charging cord that allows them to be charged at a conventional three-pronged wall outlet. This is known as Level 1 charging. Level 1 charging is the cheapest, but also the slowest way to fuel a PEV. Level 1 charging is a low cost and practical option for many PEV owners living in single family residences because their vehicles can be parked for long time periods in a location where they have their own dedicated fueling source.

Level 2 charging delivers fuel more quickly to the PEV, but requires installation of separate EVSE. Level 2 units operate on 208 - 240 volts. PEV drivers can have these units installed at their residences (if they own the residence or have permission of the owner to do so), or they can access them at non-residential locations such as businesses or publicly available locations.

The quickest way to fuel PEVs is through DC Fast Chargers (DCFC), though currently only about 40% of PEVs have the capability to use DCFC. These units operate at 480 volts and are more costly to install than Level 2 chargers. There are a small, but

growing number of DCFC deployed today. The DCFC is analogous to the conventional gasoline station in that the customer can sit and wait in the car while the car is charging.

Data from the US Department of Energy (DOE), Alternative Fuels Data Center and service providers show approximately 730 EVSE installed in SDG&E's service area at the end of 2014.[22] Of those, 514 (70%) were public Level 2 units, 140 (19%) private Level 2 units, 31 (4%) were publicly available Level 1 units and 48 (7%) were publicly available DCFC. (Appendix 2)

B. The Relevant Product Market For Inquiry

A relevant product market consists of the products and/or services which consumers regard as reasonably interchangeable for each other. In the broadest sense, the product market in question might be viewed as transportation fuel for vehicles. Gasoline, diesel fuel, natural gas and electricity are all used as transportation fuels. From the standpoint of a PEV driver, gasoline, diesel and natural gas are not particularly relevant as PEVs require electric fuel to operate. While Plug-in Hybrid Electric Vehicles (PHEV) run on both electricity and

[22] These figures do not include EVSE installed at single family residential locations. There are more than 1,000 EVSE installed at single family residences in the San Diego area. *See* Smart, John (18 November 2014). Workplace Lessons Learned through the Nation's Largest PEV Charging Projects. Idaho National Laboratory. Presented at the DOE Workplace Charging Challenge Summit. Retrieved from: http://avt.inl.gov/pdf/EVProj/WorkplaceChargingDataInsights.pdf

I reviewed the networks and included additional EVSE not incorporated in the DOE data. I added EVSE based on data from GE WattStation. NRG eVgo's website indicates more locations than are shown in the DOE database. It appears that these locations may not be fully functional at this time. *See*, https://www.gewattstation.com/connect/ and http://www.nrgevgo.com/find-a-station/

gasoline, gasoline alone is not the only product that PHEVs are intended to use, and none of the other transportation fuels provide any degree of substitution for all-electric PEVs. Accordingly, a market definition that includes non-electric fueling is too broad to allow for a meaningful analysis of competition for delivery of electric fuel to PEV drivers.

Another possibility is to define the product market as PEV fueling services generally. This definition focuses specifically on delivery of the product that PEVs require, electricity. As discussed in the section above, however, there are differences in how PEV drivers are situated and how they may view different fueling alternatives.

Convenience and access are important aspects in customer choice and demand for a given product. The difference in convenience associated with purchasing otherwise identical products impacts the degree to which consumers view the products as reasonable substitutes and the degree to which the products should be included within a same product market.

PEV drivers living in single family residences have the ability to charge their vehicles at home at CPUC-regulated rates. This is a particularly convenient method of fueling as it can be done "on demand" whenever the vehicle is at home. In addition, these drivers are able to substitute away from PEV fueling services offered elsewhere if they are less convenient and/or priced unattractively. The majority of PEV drivers residing in MuDs do not have this capability. These drivers must rely on EVSE owned and operated by other parties, located either at their place of residence, their workplace or another public

location.[23] They do not have the same kind of on-demand, rate-regulated fueling alternative at home as PEV drivers living in single family residences.[24]

Further, SDG&E's proposal is limited to the installation of EVSE and the sale of electric fuel through those units at MuDs, workplaces and related settings which accommodate long-term parking. The different fueling alternatives available to different PEV drivers and the limited scope of SDG&E's proposal argue for examination of a more limited relevant product market comprised only of non-single family residential PEV fueling services in addition to a broader definition that includes single family residential charging.

C. The Geographic Market

The geographic market is the area in which customers consider alternative supplier locations as reasonable substitutes for one another. SDG&E proposes to operate and sell fuel through EVSEs only in its current service area. The driving patterns of potential customers and the relatively limited range of PEVs suggest that an appropriate geographic market to consider in relation to SDG&E's proposal is its own service area.

D. The Relevant Market(s) For Competitive Analysis

For the reasons described in the sections above, I evaluate competition and the potential competitive impacts of SDG&E's proposal under two alternative relevant market definitions. The first and narrower definition is non-single family residential fueling services to PEV drivers in SDG&E's service territory. A second and broader definition is

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[23] MuD residents, including mobile homes represent a significant and growing share of the housing market in the SDG&E territory. *See* Testimony of Randy Schimka (RS-5).

[24] The recently passed AB2565, allows commercial and residential tenants to install an EVSE in a leased parking lot if the tenant is willing to pay for the cost of the EVSE and installation. *See* http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201320140AB2565

fueling to PEV drivers in SDG&E's service territory (i.e., including single family residential fueling). The narrower definition provides for a more stringent analysis of potential competitive impacts, particularly for the segment of drivers without access to single family residential fueling. Unless otherwise specified, when discussing the relevant market for PEV fueling services, I am referring to this narrower market definition.

IV. THE EVOLUTION OF PEV FUELING IN SDG&E'S SERVICE TERRITORY

The markets for PEVs and for PEV fueling services are highly inter-dependent. The demand for PEVs is dependent in part on the fueling capabilities offered by PEV fuel providers.[25] Likewise, the demand for PEV fueling services depends on the number of PEVs on the road. Each is necessary for the other's survival and growth. Both the PEV and PEV fueling services markets are in their early stages of development.

PEVs were first introduced in significant quantity in late 2010, with the introduction of the Nissan LEAF and the Chevrolet Volt. Prior to and since that time several companies have entered the PEV fueling services market in SDG&E's service area. External funding through government, non-profit and other sources has been a key factor in the growth in demand for PEVs to date and the deployment of PEV fueling infrastructure.

A. Market Participants

The Blink network is the largest provider of PEV fueling services in the market. Blink network began installing EVSE throughout the market in late 2010 to coincide with

[25] *See* p. 6 of SANDAG & California Center for Sustainable Energy (January 2014). San Diego Regional Plug-In Electric Vehicle (PEV) Readiness Plan, pp. 46-47. Retrieved from: https://energycenter.org/sites/default/files/docs/nav/programs/pev-planning/san-diego/San_Diego_PEV_Readiness_Planning_Guide-2013_low-resolution.pdf

the launch of Nissan's LEAF and Chevrolet's Volt.[26] Today it has approximately 450 EVSE installed at about 130 locations in SDG&E's service area. It has approximately 4,000 EVSE at about 1,600 locations throughout the U.S.[27]

Blink was at one time a subsidiary of ECOtality, the leader of The EV Project. The EV Project was a government and corporate sponsor-funded initiative to develop and study the emerging PEV fueling services industry. The EV Project provided residential participants with no-cost Level 2 chargers, plus up to $400 to cover installation.[28] The EV Project installed about 4,000 non-residential Level 2 units, including about 500 in the San Diego area; it installed 107 DCFC, 4 of which were located in the San Diego area.[29]

ECOtality filed for bankruptcy in the 3rd quarter of 2013.[30] ECOtality's charging network and the assets of The EV Project were acquired by Car Charging Group for about

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[26] ECOtality (October 2010). Long-Range EV Charging Infrastructure Plan for the Greater San Diego Area." Retrieved from: http://www.theevproject.com/downloads/documents/Long%20Range%20EV%20Charging%20Infrastructure%20Plan%20for%20the%20Greater%20San%20Diego%20Area%20Ver%204.1.pdf

[27] Berman, Brad (25 November 2014). The Ultimate Guide to Electric Car Charging Networks. Retrieved from: http://www.plugincars.com/ultimate-guide-electric-car-charging-networks-126530.html Blink network, Retrieved from: https://www.blinknetwork.com/membership.html#page=1

[28] The EV Project goal of 8,000 residential EVSE installations was reached in March 2013. *See* The EV Project Overview. Available at: http://www.theevproject.com/overview.php

[29] Workplace Lessons Learned through the Nation's Largest PEV Charging Projects. Idaho National Laboratory. Presented at the DOE Workplace Charging Challenge Summit. Retrieved from http://avt.inl.gov/pdf/EVProj/WorkplaceChargingDataInsights.pdf

[30] ECOtality (8 August 2013). Form 8-K. Retrieved from: www.sec.gov/Archives/edgar/data/1301206/000143774913010447/ecty20130812_8k.htm

$3 million.[31] This was Car Charging Group's fourth acquisition of a failing PEV fueling services network.[32]

ChargePoint is the next largest provider of PEV fueling services in the market. ChargePoint, along with Sequoia Solar, opened its first charging facilities in the San Diego area in 2009.[33] Since then, it has continued to expand its network in the market, with about 160 EVSE today. ChargePoint is also one of the world's largest PEV fueling service providers, offering over 20,000 places to charge across the country and throughout Europe.[34]

There are a number of smaller participants in the market, including Fortune 500 companies NRG (eVgo) and GE (WattStation). SemaCharge is a developer and seller of Level 2 EVSE. It has about 2,000 EVSE in the U.S. and Canada in addition to its local presence, which is largely through its relationship with Walgreens.[35] OpConnect is an Oregon based EV charging network with a few EVSE in the San Diego area through its Navy contract.

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[31] Doom, Justin (17 October 2013). Car Charging Gets $230 Million EV System From Bankrupt ECOtality. Bloomberg. Retrieved from: www.bloomberg.com/news/2013-10-17/car-charging-gets-230-million-ev-system-from-bankrupt-ecotality.html

[32] McDonald, Zach (10 October 2013). Car Charging Group Announces Acquisition of ECOtality's Blink Network. Retrieved from: http://www.plugincars.com/carcharging-group-announces-acquisition-bankrupt-ecotality-blink-network-128539.html

[33] ChargePoint. (2009). Sequoia Solar Brings Coulomb Electric Vehicle Charging Stations to San Diego [Press release]. Retrieved from: www.chargepoint.com/press-releases/2009/1106

[34] www.chargepoint.com/; www.chargepoint.nl

[35] SemaConnect (2014). SemaConnect, Inc. Launches New Look and Website [Press release]. Retrieved from: http://www.semaconnect.com/press-release/semaconnect-inc-launches-new-look-and-website/

B. Role of Subsidies in the Development of the PEV and Fueling Services Markets

The development of the PEV and fueling services market has been strongly supported by federal and state governments as well as non-profit organizations. Both federal and state governments provide support through grants for the research, development and manufacture of PEV technology. Both the federal and California governments have provided strong incentives for PEV drivers through tax credits. The federal tax credit allows up to $7,500 per PEV, depending on battery capacity.[36] The State of California, through the Center for Sustainable Energy, provides a Clean Vehicle Rebate of up to $2,500 for the purchase or lease of new PEVs.[37] California has issued over $160 million in Clean Vehicle Rebates to date.[38]

The federal government has been a significant source of financial support for PEV fueling infrastructure. It has provided numerous direct incentives for the installation of EVSE, including the Alternative Fuel Infrastructure Tax Credit which has provided a 30% federal tax credit, up to $30,000 for commercial facilities or $1,000 for individuals, to help offset the cost of installation of EVSE. The federal government has also provided incentives to specific industries to promote the adoption of PEV and EVSE technology. For example, the Airport Zero Emission Vehicle and Infrastructure Incentives Pilot Program provides

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[36] IRS. Qualified Vehicles Acquired after 12-31-2009. Retrieved from: http://www.irs.gov/Businesses/Qualified-Vehicles-Acquired-after-12-31-2009

[37] Center for Sustainable Energy. Clean Vehicle Rebate Project. Retrieved from: https://energycenter.org/clean-vehicle-rebate-project Subject to a maximum of two CVRP rebates per single entity or 20 rebates per year for rental car or car share fleets. http://energycenter.org/clean-vehicle-rebate-project/faqs/there-maximum-amount-rebates-i-can-apply-if-so-how-many

[38] Center for Sustainable Energy. Real-Time Funding Status for the Clean Vehicle Rebate Project. Retrieved from: https://energycenter.org/clean-vehicle-rebate-project/rebate-funding-status . This amount includes rebates for hydrogen fuel cell cars.

50% matching for the acquisition of PEVs and provides funding for infrastructure installation.[39]

The federal government provided substantial funding for PEV fueling infrastructure through the 2009 American Recovery and Reinvestment Act (ARRA), which awarded 48 grants worth $2.4 billion to accelerate the manufacture and deployment of next generation batteries and electric vehicles in the U.S. Four hundred million dollars ($400 million) in ARRA grants were designated for the purchase of PEVs, installation of electric charging infrastructure and public education.[40] One hundred and fifteen million dollars ($115 million) of the ARRA funding went to ECOtality to lead The EV Project. This grant was matched by ECOtality and its corporate sponsors.[41] Additional grants came from the California Energy Commission and other agencies, bringing total funding for The EV Project to about $240 million dollars.[42] The ARRA ($15 million), the CEC ($3.4 million)

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[39] Alternative Fuels Data Center. Federal Laws and Incentives for Electricity. Retrieved from: http://www.afdc.energy.gov/fuels/laws/ELEC/US

[40] The White House Office (2009). President Obama Announces $2.4 Billion in Grants to Accelerate the Manufacturing and Deployment of the Next Generation of U.S. Batteries and Electric Vehicles [Press release]. Retrieved from: http://www.whitehouse.gov/the_press_office/24-Billion-in-Grants-to-Accelerate-the-Manufacturing-and-Deployment-of-the-Next-Generation-of-US-Batteries-and-Electric-Vehicles/

[41] The EV Project. Overview. Retrieved from: http://www.theevproject.com/overview.php

[42] ECOtality (October 2010). "Long-Range EV Charging Infrastructure Plan for the Greater San Diego Area." Retrieved from: http://www.theevproject.com/downloads/documents/Long%20Range%20EV%20Charging%20Infrastructure%20Plan%20for%20the%20Greater%20San%20Diego%20Area%20Ver%204.1.pdf; ECOtality 2011 10-K, p. 11.

and other agencies and private funding also supported ChargePoint's $37 million ChargePoint America Program which provided 4,600 public and home charging stations.[43]

The California Energy Commission's Alternative and Renewable Fuel and Vehicle Technology Program (ARFVTP) awarded 80 grants worth over $135 million related to PEV and PEV fueling infrastructure from 2009 to June 2013. The ARFVT provided $27 million in grants to fund installations for over 2,400 residential EVSE, 2,313 commercial EVSE, 187 workplace EVSE, and 5 DC Fast Chargers in California through 2013. ARFVT plans for California include an additional 1,472 residential EVSE, 783 commercial EVSE, 556 workplace EVSE, and 72 DC Fast Chargers.[44] As part of this program, the CEC provided $0.5 million in funding to ChargePoint to help deploy PEV fueling infrastructure to MuDs.[45] The program provided the infrastructure while the MuDs paid for installation.

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[43] ChargePoint (2011). Coulomb Technologies Celebrates with US Department of Energy, City of LA Significant ChargePoint America Electric Vehicle Program Milestone [Press release]. Retrieved from: http://www.chargepoint.com/press-releases/2011/0513

[44] California Energy Commission (April 2014). 2014-2015 Investment Plan Update for the Alternative and Renewable Fuel and Vehicle Technology Program, p. 21. Retrieved from: http://www.energy.ca.gov/2013publications/CEC-600-2013-003/CEC-600-2013-003-CMF.pdf

[45] California Energy Commission (2013). Energy Commission Awards More Than $3.2 Million for Clean Transportation Projects [Press Release] http://www.energy.ca.gov/releases/2013_releases/2013-01-10_transportation_nr.html

Some of the public EVSE planned in the SDG&E service area are recipients of grant funding from the California Energy Commission, including the Old Town San Diego Historic Park EVSE sponsored by Adopt A Charger, a non-profit organization dedicated to accelerating the widespread adoption of PEV technology.[46]

C. The Role of PEV Manufacturers in Supporting PEV Fueling Services

PEV manufacturers have also been an important source of support for PEV fueling infrastructure. Nissan, for example, implemented its "No Charge to Charge" program in the summer of 2014. Under the program purchasers of the Nissan LEAF will receive 2 years of free charging in 10 of Nissan's largest markets, including the San Diego area. Drivers are provided with an EX-Charge card granting access to ChargePoint, Blink, AeroVironment and NRG eVgo networks. Nissan's senior vice president Fred Diaz stated that "Public charging is an important way to provide added range confidence to EV buyers and persuade more shoppers to join the more than 110,000 LEAF drivers around the world."[47]

Tesla also offers fueling incentives to its customers at no additional charge. Tesla offers free "supercharging" to Tesla Model S drivers for the life of the vehicle. Tesla is in the process of installing Supercharger stations on major highways around the world. So far, Tesla has installed over 150 stations across the U.S., covering the East and West Coasts. The stations are positioned to allow Tesla drivers to travel freely between cities on major

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[46] Kitty (August 2014). The California Energy Commission Awards $492,000 to Adopt a Charger to Install Electric Vehicle Chargers at 14 California State Parks. Retrieved from: http://adoptacharger.org/news/the-california-energy-commission-awards-492000-to-adopt-a-charger-to-install-electric-vehicle-chargers-at-14-california-state-parks.html

[47] Nissan (2014). Nissan launches programs to make LEAF charging free and "EZ" [Press release]. Retrieved from: http://nissannews.com/en-US/nissan/usa/releases/nissan-launches-programs-to-make-leaf-charging-free-and-ez?page=7&query=%22No+charge+to+Charge%22

highways. These chargers are as much as 16 times faster than most public EVSE. Supercharging is a standard feature on the larger battery Tesla and can be added to others for about $2,000. Once enabled, Tesla drivers can use Tesla charging stations at no charge for the life of the vehicle. The free charging would take about 30 minutes to provide enough energy to drive approximately 170 miles.[48]

V. CURRENT STATE OF THE PEV FUELING MARKET IN SDG&E'S SERVICE AREA

According to the DOE and service provider sources, there are currently about 240 non-single family residential locations with about 730 EVSEs in the market. This information is summarized in Appendix 2. Approximately 90% of the EVSE are Level 2 chargers. Measured by number of EVSE, Blink has about 61% of the market, followed by ChargePoint with 22%. NRG eVgo has about 5% of the market. Together these three providers account for about 88% of EVSE in the market. The smaller providers, OpConnect, SemaCharge and GE WattStation each have less than 5% of the market.

In addition to these current providers, Tesla has a SuperCharger facility in San Juan Capistrano and has announced plans for at least one more SuperCharger facility in the San Diego area.[49] Several other PEV fueling providers operate in other parts of the U.S. and may be candidates to enter the market in the future. These include AeroVironment, Greenlots, and Shorepower Connect.

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[48] Tesla. Supercharger: How it works. Retrieved from: http://www.teslamotors.com/supercharger

[49] Tesla. San Diego SuperCharger: Retrieved from: http://www.teslamotors.com/supercharger/sandiego

Market concentration can be a useful indicator of the level of competition within a market. Concentration is often measured using the Herfindahl-Hirshman Index (HHI). The HHI is calculated by summing individual sellers' market shares. In this way proportionately greater weight is given to larger market shares. The DOJ and FTC classify markets into three categories based on their HHI:

- Unconcentrated: HHI below1,500
- Moderately Concentrated: HHI between 1,500 and 2,500
- Highly Concentrated: HHI above 2,500

Economists and antitrust regulators use these categories as a guide in determining whether a change in market structure resulting from a merger or acquisition is likely to cause competitive concern. All else equal, more concentrated markets will tend to have participants with more market power and the ability to influence prices to the detriment of consumer welfare. The HHI concentration measure for the PEV fueling services market in SDG&E's service territory is about 4,200, which falls into the "Highly Concentrated" category. Appendix 2 provides market shares and HHI levels for the PEV fueling services market in SDG&E's service territory.

While the HHI measures the degree to which a market is concentrated, it does not indicate one way or the other whether a market is functioning competitively. Rather, the HHI is used as a screening tool to indicate whether the structure of the market is conducive to anticompetitive behavior. Concentrated markets, even highly concentrated markets, can

behave in a competitive manner. This is true particularly when entry into the market by other parties is relatively easy.[50]

There does not appear to be any significant barrier in place to prevent would-be providers from participating in the market. There do, however, appear to be significant barriers to expanding the market for and adoption rates of PEVs generally, which are related to the cost and access of PEV fueling services infrastructure.[51] Moreover, the lack of PEV fueling infrastructure at MuD and work place locations is commonly cited as a barrier to expanding demand for and adoption rates of PEVs.[52]

The history of the PEV fueling services industry to date indicates that providers have not been able to earn profits above competitive levels. Indeed, the experience of ECOtality and some other large providers suggests that profitability in the PEV fueling services industry to date may not be adequate to support additional investment without assistance.

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[50] *See* Merger Guidelines beginning at p. 27 for a discussion of the role of potential entry. U.S. Department of Justice and Federal Trade Commission (19 August 2010). Horizontal Merger Guidelines. Retrieved from: http://www.justice.gov/atr/public/guidelines/hmg-2010.pdf

[51] *See* pp. 40-42 of ICF International (September 2014). California Transportation Electrification Assessment, Phase 1: Final Report. Retrieved from: http://www.caletc.com/wp-content/uploads/2014/09/CalETC_TEA_Phase_1-FINAL_Updated_092014.pdf

See pp. 2-5 of National Research Council. *Overcoming Barriers to Electric-Vehicle Deployment: Interim Report*. Washington, DC: The National Academies Press, 2013.

[52] SANDAG & California Center for Sustainable Energy (January 2014). San Diego Regional Plug-In Electric Vehicle (PEV) Readiness Plan, pp. 46-47. Retrieved from: https://energycenter.org/sites/default/files/docs/nav/programs/pev-planning/san-diego/San_Diego_PEV_Readiness_Planning_Guide-2013_low-resolution.pdf

The former owner of the Blink network declared bankruptcy in 2013 despite being the beneficiary of significant public funding support.[53]

This experience is consistent with the results of recent analyses conducted by ICF International and the National Academy of Sciences. The ICF study found that the cost to provide PEV fueling services, assuming providers were required to price the fuel at a level that would cover the capital cost associated with PEV fueling infrastructure, would be marginally attractive relative to gasoline prices, and would be much higher than residential charging rates.[54] The National Academy of Sciences study notes that a major barrier to the development of PEV fueling infrastructure by private companies is the difficulty of achieving a favorable rate of return on investment from PEV fueling services.[55]

VI. HOW WOULD SDG&E'S ENTRY IMPACT MARKET CONCENTRATION?

As proposed in its 2014 application, SDG&E's entry into the market would be phased in from approximately 2015 to 2018. The program would be limited in scope, with a maximum of 500 EVSE installed in the first year of the pilot program. (50 VGI facilities x 10 EVSE per facility)

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[53] 350 Green is another recipient of public funding for EVSE infrastructure that has experienced financial problems. Siemens withdrew from the public charging market in 2013. This is another indication that returns have not been above competitive levels. *See* p. 53 of ICF International (September 2014). California Transportation Electrification Assessment, Phase 1: Final Report. Retrieved from: http://www.caletc.com/wp-content/uploads/2014/09/CalETC_TEA_Phase_1-FINAL_Updated_092014.pdf

[54] *See* pp. 50-53 of ICF International (September 2014). California Transportation Electrification Assessment, Phase 1: Final Report. Retrieved from: http://www.caletc.com/wp-content/uploads/2014/09/CalETC_TEA_Phase_1-FINAL_Updated_092014.pdf

[55] *See* p. 41 of National Research Council. *Overcoming Barriers to Electric-Vehicle Deployment: Interim Report*. Washington, DC: The National Academies Press, 2013.

Market concentration levels should fall relative to current levels, even if SDG&E were to install the maximum number of EVSE allowed, and other providers chose not to expand their operations. As shown in Appendix 3, concentration could decrease after the first year of the pilot from about 4,200 to about 3,200 in this scenario. While the market would continue to be in the "Highly Concentrated" category, it would move closer to a less concentrated structure.

Since SDG&E's proposal is limited in scope, its market share should trend lower over time as the State moves toward its PEV adoption goals. Assuming PEV market growth is in line with these goals (1.5 million vehicles in 2025), this would amount to approximately 138,000 PEVs in the market.[56] Further assuming a ratio of one non-single family residential EVSE installation for every five PEVs,[57] this in turn would require a total of approximately 28,000 EVSE. The maximum number of EVSE that SDG&E would be

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[56] Assuming 9.43% of California's PEVs are in the San Diego area. Testimony of JC Martin (JCM-16).

[57] ChargePoint recommends a 1:2 EVSE to PEV workplace ratio. This does not include MuDs or other public charging locations. *See* Associated Press (22 January 2014). Silicon Valley sees shortage of EV charge stations. San Jose Mercury News. Retrieved from: http://www.mercurynews.com/california/ci_24965603/silicon-valley-sees-shortage-ev-charge-stations

NREL considers two scenarios which would provide sufficient EVSE to meet the governor's goals. The scenarios envision ratios of roughly 1:8 or 1:5 EVSE to PEV. This does not include MuDs. See pp. of : Melaina, Marc, Michael Helwig. (National Renewable Energy Laboratory). 2014. California Statewide Plug-In Electric Vehicle Infrastructure Assessment. California Energy Commission. Publication Number: CEC-600-2014-003. Retrieved from: http://www.energy.ca.gov/2014publications/CEC-600-2014-003/CEC-600-2014-003.pdf

EPRI recommends 15 public chargers and 27 workplace chargers for every 100 cars. Or a ratio of roughly 1:3 EVSE per PEV. This does not include MuDs. See p. 1-2 of Guidelines for Infrastructure Planning: An Explanation of the EPRI Red Line/Blue Line Model. EPRI, Palo Alto, CA: 2014. 3002004096. Retrieved from: http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=000000003002004096

permitted to install under its application is 5,500, which would be approximately 20% of the market in 2025.[58] Other providers would have to account for 22,500 EVSE, an increase of more than 21,000 EVSE above the total number of EVSE deployed in the market today.

Even if SDG&E were able to garner a 20% share of the market, this does not imply that SDG&E would be able to raise prices above otherwise competitive levels (i.e., exercise market power). SDG&E would have to reduce supply to the market in order to raise prices.[59] Since 80% of the market would be serviced by other providers, it is likely that any attempt to reduce output by SDG&E would be met by other suppliers. Moreover, given SDG&E's position as a public utility offering pervasively regulated rates, it is difficult to envision a scenario in which it would be able to raise prices above competitive levels.

SDG&E's market share would be even smaller under a broader market definition that includes single family residential charging. Approximately 88% of the PEV market is currently accounted for by single family residential drivers.[60] Assuming that percentage was to fall over time, accounting for just 70% of the PEV market by 2025, would mean nearly 97,000 additional chargers in the market (138,000 x 70% = 96,600).[61] Combined with the 28,000 non-single family residential EVSE, this totals 125,000 total units. The maximum

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[58] If the deployment of PEVs grows beyond this amount SDG&E's share of the market would continue to fall as it would be capped at 5,500 EVSE.

[59] By way of comparison, Blink currently has a 60%+ market share; ChargePoint has a 20%+ share.

[60] Center for Sustainable Energy (February 2014). February 2014 Survey Report. Retrieved from: https://energycenter.org/clean-vehicle-rebate-project/vehicle-owner-survey/feb-2014-survey

[61] This figure implies that an increasing number of PEV drivers will be MuD residents. I use 70% for purposes of illustration only. My underlying conclusion would remain unchanged even if this figure were higher or lower than 70%.

5,500 EVSE included in SDG&E's Pilot Program would be less than 5% of the market in this scenario. Regardless of which definition of the market (excluding or including single family residential charging) is considered, SDG&E's potential share of that market in the long-term would be relatively small. It would be too small to significantly limit competition or harm consumers.

VII. UNFAIR COMPETITION AND CONSUMER WELFARE

Competition and consumer welfare are the focus of antitrust policy and law. As the Supreme Court articulated in a recent decision, "the point of antitrust law is to encourage competitive markets to promote consumer welfare."[62] Congress has charged the Federal Trade Commission (FTC) with enforcing antitrust policy and ensuring that anticompetitive or unfair competitive practices do not diminish competition to the detriment of consumers. FTC Commissioner Joshua Wright discussed the agency's focus on consumer welfare in recent congressional testimony, stating that "consumer welfare is the lodestar of competition policy and antitrust, and it guides decision-making at the FTC."[63]

As an economic matter, anticompetitive or unfair competitive practices are those that result in harm to the competitive process and ultimately harm consumer welfare. Harm to consumer welfare typically results from a reduction in output, price increases above competitive levels or reductions in product quality. If a business practice reduces consumer

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[62] FTC v Actavis, Inc., 133 S. Ct. 2223 (2013).

[63] Wright, Joshua D., Prepared Statement of Commissioner Joshua D. Wright, Federal Trade Commission. Before the U.S. House Subcommittee on Regulatory Reform, Commercial and Antitrust Law, Hearing on 'Net Neutrality: Is Antitrust Law More Effective Than Regulation in Protecting Consumers and Innovation?' June 20, 2014. Retrieved from: http://www.ftc.gov/public-statements/2014/06/prepared-statement-commissioner-joshua-d-wright-net-neutrality-antitrust

welfare it can be viewed as anticompetitive or "unfair." On the other hand, if a practice does not harm, or even enhances consumer welfare, it should not be viewed as anticompetitive or unfair.

The impact of the practices of one competitor on the welfare of other competitors is not the focus of competition policy. Noting this, the U.S. Supreme Court stated in 1993 that "the antitrust laws were passed for the protection of competition, not competitors."[64] It is important only to the extent it serves as a predictor of welfare impacts to consumers. Where there is reason to believe that the practices of one firm may disadvantage other competitors, antitrust regulators will examine the potential of those practices to provide pro-competitive efficiencies that benefit consumers, balancing the two to determine the likely overall impact on consumer welfare.

The Commission stated in Decision 14-12-079 that the Public Utilities Code requires it "ensure that the utilities do not unfairly compete with nonutility enterprises." It also stated that it intends to weigh (or balance) the issue of potential unfair competition against the potential public benefits expected under SDG&E's proposal.[65] As articulated by the Commission, the ultimate goal of the balancing test is consistent with a policy of maximizing public welfare. In this regard, it is similar to the focus of antitrust policy on consumer (public) welfare in dealing with questions of unfair competition.

I examine whether SDG&E's proposal may result in potentially unfair competitive advantages in the section below. In doing so, I apply the consumer welfare focus articulated

[64] Brooke Group Ltd v. Brown & Williamson Tobacco Corp., 509 U.S. 209 (1993).

[65] Decision 14-12-079, pp. 5-7.

by the Courts and antitrust officials, as well as the public welfare focus articulated in the Commission's balancing test standard.

VIII. THE POTENTIAL FOR UNFAIR COMPETITIVE ADVANTAGES AND COMPETITIVE IMPACTS UNDER SDG&E'S PROPOSAL

A. Introduction

SDG&E proposes to recover VGI Pilot Program costs through rates charged to all ratepayers, not just to PEV drivers. The Commission noted in the *Clean Energy* decision that cost recovery, in the manner contemplated in SDG&E's proposal, is a potential area of unfair competitive advantage for the utility. The Commission did not examine this issue in detail due to the specifics of the application in *Clean Energy*.[66] I examine the recovery aspect of SDG&E's proposal in the balance of this section.

In my opinion, SDG&E's proposal is not likely to result in an unfair competitive advantage that would significantly limit competition in the PEV fueling services market, or that would result in harm to consumers. In contrast, there appear to be significant public benefits that may flow from the proposed Pilot Program. These include the acceleration of PEV adoption rates in furtherance of state policy goals, particularly among non-single family residential drivers, the related environmental benefits associated with increased use of PEVs and the potential for efficient grid integration and cost avoidance through the VGI pricing aspect of the program.

I base my opinions regarding potential competitive impacts on the following factors and discuss each below.

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[66] The Commission noted a number of other issues as potential unfair advantages. I do not discuss those issues. To the extent they are present in SDG&E's proposal the Commission has already considered and implemented measures it deems appropriate. *See* Decision 12-12-037.

- SDG&E's cost recovery proposal is functionally similar to the subsidies current PEV fuel providers have enjoyed.
- The scope of SDG&E's proposal is limited.
- SDG&E's prices and business practices are regulated.
- SDG&E's proposal addresses identified barriers to expansion of PEV demand and adoption rates, helping to grow demand for other providers.
- SDG&E's proposal includes pro-competitive contracting features.

B. Cost Recovery and Subsidies

The Commission noted in *Clean Energy* that "requiring that the price covers the full cost of a service is the key to ensuring that a utility obtains no unfair advantage with a non-utility providing the same service."[67] Under the VGI Rate, PEV customers pay the full cost of the energy provided, including transmission, distribution, and other costs.[68] The cost of implementing the VGI Pilot Program, including PEV fueling infrastructure costs, would be spread across all ratepayers. This raises concerns as to whether non-PEV ratepayers may be inappropriately subsidizing PEV rates in a way that would give SDG&E an unfair competitive advantage by allowing it to charge lower prices than other providers, but ultimately harming consumers.

The prospect of lower fuel prices for PEV drivers is not something that itself is harmful to consumers. Indeed, lower prices enhance consumer welfare. The potential harm comes if SDG&E's pricing causes other providers to leave the market, resulting in a less competitive structure in the future in which SDG&E is able to raise prices, reduce services or both.

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[67] Decision 12-12-037, page 35.

[68] Testimony of Cynthia Fang (CF-2).

As I describe in Section IV above, current providers of PEV fueling services in California, and the SDG&E territory in particular have benefited from significant federal and/or state assistance that subsidizes the cost of PEV fueling infrastructure in the market. There are certainly legitimate economic and policy-related reasons for these subsidies. The rationale given for government subsidies of PEV fueling infrastructure recognizes that adoption of PEVs by the public provides benefits to society in general, not just to PEV users. These benefits include both a reduction in the dependence on gasoline and greenhouse gas causing emissions. They also recognize that rapid adoption of PEV technology by the public is dependent in large part on the cost and convenience of fueling.[69]

SDG&E's proposal to spread VGI Pilot Program costs over all ratepayers is functionally similar to using the kinds of grants or other forms of subsidies that have benefitted PEV fueling infrastructure to date in the market. In this respect, SDG&E's plan would allow it to operate in a similar manner as other providers that have benefited (and/or will continue to benefit) from EVSE subsidies, albeit under the CPUC's regulatory authority and oversight. The difference here is that SDG&E's ratepayers will bear infrastructure costs rather than taxpayers generally.

In this regard SDG&E has articulated an economically sound rationale for spreading costs across ratepayers due to the expected benefits of the Pilot Program. SDG&E estimates that all ratepayers will benefit by avoiding the cost of adding distribution, transmission

[69] ICF International (September 2014). California Transportation Electrification Assessment, Phase 1: Final Report. Retrieved from: http://www.caletc.com/wp-content/uploads/2014/09/CalETC_TEA_Phase_1-FINAL_Updated_092014.pdf

and/or generating capacity as PEV usage increases over time. In addition, all ratepayers in the market will benefit from the positive environmental aspects of increased PEV use.[70]

C. The Scope of SDG&E's Proposal Is Limited

SDG&E's proposal is limited in scope. SDG&E proposes to install a maximum of 5,500 chargers in its service area. As discussed in Section VI above, if fully subscribed this would represent approximately 20% of non-single family residential EVSE required by 2025, assuming the State is able meet its goal of 1.5 million PEVs by that time, and likely less than 5% of the market if single family residential charging is considered. The limited scope of SDG&E's proposal insures that it would not be able to significantly limit competition or cause harm to consumers, even if it enjoyed some cost advantage relative to other providers.

D. SDG&E's Prices are Subject to Regulation

SDG&E's prices for PEV fueling services under the Pilot Program are subject to pervasive regulation. This helps mitigate against the possibility that SDG&E might be able to harm consumers by raising prices above competitive levels in the future even if it were able to discourage some competitors with lower prices today.

E. SDG&E's Proposal Creates Opportunities for Other Service Providers

SDG&E's proposal is designed to stimulate demand and adoption rates for PEVs in the market. If successful, this would have the effect of helping to create additional demand for current and future service providers. As the market expands, SDG&E's competitive footprint will shrink as it is limited in scope under this application. Other service providers should be able to participate in a larger overall market.

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[70] Testimony of JC Martin (JCM-28 to 29).

Additionally, SDG&E's proposal involves contracting with third parties through a competitive request for proposal (RFP) process for the installation, maintenance and management of the EVSE involved in the Pilot Program, to the greatest extent possible. This feature provides other service providers the opportunity to participate directly in providing services to customers that contract with SDG&E. Other participating service providers would not be able to alter the pricing proposed by SDG&E, which is an important feature of the VGI Pilot, but they would be able to participate in other aspects, such as the installation and maintenance of the PEV fueling infrastructure included in the Pilot Program.

F. SDG&E's Proposal Includes Competitive Features Beneficial to Consumers

SDG&E intends to contract with third parties for the installation, maintenance and operation of EVSEs in the Pilot Program through a competitive process. This process will help insure that consumers enjoy the benefits expected in a competitive marketplace, including the benefits of competition in the design of EVSEs and applications.

IX. CONCLUSIONS

In summary, it is my opinion that SDG&E's proposal to provide electric fueling services through the VGI Pilot Program is not likely to significantly limit competition in the PEV fueling services market in the SDG&E service area or cause harm to consumers. The potential for any competitive harm appears small relative to the overall potential benefits associated with the VGI Pilot Program.

X. STATEMENT OF QUALIFICATIONS

My name is Barry Pulliam. I am an economist and Managing Director at Econ One Research, Inc., an economic consulting firm headquartered in Los Angeles, CA. I hold a Bachelors Degree and a Masters Degree in Economics. I have worked as an economist within the energy industry for more than 25 years. I have consulted with policy makers and

antitrust officials regarding competition and competitive issues in energy markets. I have served as an expert for the California Attorney General in investigations of competition within the State's petroleum industry. I have also advised the California Attorney General with respect to the potential competitive impacts involving numerous mergers and acquisitions over the past 20 years. In addition, I have served as an advisor to the Federal Trade Commission and U.S. Department of Justice regarding competition in the petroleum industry.

I have previously offered testimony as an expert economist in State and Federal Courts. I have also testified in FERC and state PUC regulatory hearings regarding tariff issues. Finally, I have offered testimony in front of legislative bodies regarding antitrust, competition, and policy matters, including public sector involvement in aspects of energy markets. A copy of my current CV, including my prior testimony and publications is included here as Appendix1.

Appendix 1

BARRY PULLIAM
Managing Director
Los Angeles, California
Tel: 213 624 9600

BARRY PULLIAM has been engaged in economic research and consulting for 25 years. A major part of his work has focused on economic issues related to the petroleum industry. He has extensive experience in the analysis of crude oil and natural gas markets, as well as markets, prices and competitive issues involving the refining, distribution and marketing of petroleum products.

Mr. Pulliam has testified as an economic expert on issues involving crude oil, refined petroleum products, natural gas and liquids, and chemicals. He has testified in State and Federal courts, in regulatory proceedings, in front of legislative bodies and in arbitration proceedings.

Mr. Pulliam has consulted with a number of government agencies. His clients have included the U.S. Department of Justice, the Federal Trade Commission, the Department of Interior, as well as the states of Alaska, California, Hawaii, Louisiana, New Mexico, Oklahoma and Texas.

Mr. Pulliam has also worked extensively with crude oil and natural gas producers, pipeline and mid-stream companies, refiners and chemical manufacturers. In addition, he has consulted with Native American groups regarding economic issues involving resource valuation and treaty rights.

EDUCATION

M.A., Economics, Claremont Graduate School, Claremont CA, 1988

B.A., Economics, California State University, Long Beach, 1986

PROFESSIONAL EXPERIENCE

Econ One Research, Inc., Los Angeles, CA

Managing Director 2009 - Present
Senior Economist 1997-2008

Micronomics, Inc. Los Angeles, CA

Senior Economist 1996-1997
Economist 1990-1995
Senior Analyst 1988-1990

AFFILIATIONS

International Association for Energy Economics

BARRY PULLIAM
Prior Testimony/Expert Reports

Econ One Research, Inc.
Los Angeles, California

	Proceeding	Docket/File/ Court/Commission/Agency	Case Caption	Deposition/ Trial/Reports	Date	On Behalf Of
1.	Petro-Hunt, L.L.C., v. The United States of America	United States Court of Federal Claims	No. 00-512L	Deposition Expert Report	October 2014 July 2014	The United States of America
2.	2014 State Assessment Review Board Hearing Regarding TAPS Valuation	Alaska State Assessment Review Board	OAH No.14-0555-TAX	Expert Report	May 2014	North Slope Borough
3.	Alaska Legislative Hearings on Severance Tax	House & Senate Resources and Finance Committees	No. SB21	Testimony	January 2013- April 2013	Alaska Legislature
4.	Petro Star Inc., v. BP Oil Supply Co., BP Production North America, Inc.	United States District Court, District of Alaska at Anchorage	No. 3:11-cv-00064 RRB	Deposition Expert Report	September 2012 July 2012	Petro Star
5.	State of Alaska v. BP Exploration (Alaska), Inc.	Superior Court for State of Alaska, Third Judicial District, Anchorage	No. 3 AN-09-06181 CI	Testimony Deposition Expert Report	May 2012 December 2011 September 2011	State of Alaska
6.	Murphy Exploration (Alaska), Inc. Appeal of Director's June 22, 2009 Decision Approving Northstar Participating Area Alternative Final Unit Tract Particpations	Department of Natural Resources, Office of the Commissioner	No. AN2009-103067	Testimony Expert Report	March 2012 February 2012	State of Alaska
7.	Conoco Phillips et al. v. Enterprise Products Partners, L.L.P. et al.	State of New Mexico, County of San Juan 11th District Court	No. CV-2010-1951-8	Testimony	December 2010	Enterprise

	Proceeding	Docket/File/ Court/Commission/Agency	Case Caption	Deposition/ Trial/Reports	Date	On Behalf Of
8.	Maverick LNG Holdings Ltd., et al. v. Merrill Lynch Commodities, Inc.	State of Texas, Harris County 129th Judicial District Court	No. 2009-1698	Expert Report	November 2009	Maverick LNG
9.	Mobil Cerro Negro, Ltd., Claimant v. Petroleos De Venezuela, S.A, PDVSA Cerro Negro S.A. Respondents	International Chamber of Commerce	No. 15416/JRF	Expert Report	February 2009	PDVSA
10.	Alaska Legislative Hearings on Gasoline Prices	Alaska House Judiciary Committee	N/A	Testimony	November 2008 October 2008	State of Alaska
11.	In the Matter of State of Oklahoma Commission v. Chevron, USA, Inc	Oklahoma State Court	N/A	Deposition Expert Report	September 2008 April 2008	State of Oklahoma
12.	Alaska Legislative Hearings on LNG	Joint House / Senate Hearings	N/A	Testimony	June 2008	Alaska Legislature
13.	Alaska Legislative Hearings on TransCanada AGIA license	Joint House / Senate Hearings	N/A	Testimony	June 2008	Alaska Legislature
14.	Marathon Oil Company v Enterprise Operating, L.P. & Shell Offshore	Arbitration	N/A	Deposition Expert Report	December 2007 December 2007	Enterprise
15.	Alaska Legislative Hearings on Severance Tax	House & Senate Finance Committees	No. SB2001	Testimony	November 2007	Alaska Legislature

	Proceeding	Docket/File/ Court/Commission/Agency	Case Caption	Deposition/ Trial/Reports	Date	On Behalf Of
16.	BASF Corporation v. Lyondell Chemical Company	Superior Court of New Jersey Morris County Law Division Civil Part	No. L-001069-05	Testimony Deposition Expert Report Expert Report Deposition Expert Report	August 2007 August 2007 June 2007 March 2007 March 2007 January 2007	Lyondell Chemical Company
17.	In the Matter of State of Alaska/ Exxon Mobil Direct Cost Re-opener	Arbitration	N/A	Expert Report Expert Report	September 2006 August 2006	State of Alaska
18.	Alaska State Legislative Hearings	House & Senate Resources & Finance Committee	No. HB 488; SB 305	Testimony Testimony	April 2006 March 2006	Alaska Legislature
19.	Dichter, et al. v. BP America Production Co. and ConocoPhillips Co.	State of New Mexico County of Santa Fe First Judicial Court	No. D-0101-CV-200001620	Testimony Deposition Expert Report Testimony Testimony Expert Report Expert Report	October 2007 April 2007 February 2007 May 2006 April 2006 March 2006 January 2006	Dichter, et al.
20.	Donna J. Lawrence, et al. v. Cimarex Energy Co.	United States District Court State of Oklahoma Caddo County	No. CJ-04-391	Testimony	January 2006	Objectors
21.	Alaska State Legislative Budget & Audit Hearings	Alaska Natural Gas Pipeline	N/A	Testimony Testimony	June 2006 August 2005	Alaska Legislature

	Proceeding	Docket/File/ Court/Commission/Agency	Case Caption	Deposition/ Trial/Reports	Date	On Behalf Of
22.	Flagler Automotive, et. al., v. Exxon Mobil Corporation Miami Division	United States District Court Southern District of Florida	No. 04-21541-CIV-Moreno	Expert Report	April 2005	Flagler, et al.
23.	In the Matter of State of Alaska/ Exxon Mobil Destination Value Re-opener	Arbitration	N/A	Testimony Expert Report Expert Report	April 2005 March 2005 February 2005	State of Alaska
24.	Forest Oil Corporation v. Cook Inlet Pipeline Company	The Regulatory Commission of Alaska	No. P-04-11	Deposition Testimony	February 2005 January 2005	Forest Oil
25.	State of Alaska v. Crowley Marine Services, Inc., et al.	Superior Court for the State of Alaska Second Judicial District at Nome	No. 2NO-04-100CIV	Testimony Expert Report	August 2005 October 2004	State of Alaska
26.	Lyondell-CITGO Refining, L.P. v. Petroleos de Venezuela, S.A. and PDVSA-Petoleo, S.A.	United States District Court Southern District of New York	No. 02CV0795	Deposition Expert Report	October 2004 September 2004	Lyondell-Citgo
27.	Dan Gill, et. al., v. Exxon Mobil Corporation	County Court At Law Number Four Neuces County, Texas	No. 03-60079-4	Deposition Expert Report	August 2004 August 2004	Gill, et al.
28.	State of Louisiana and Secretary of the Department of Revenue & Taxation v. Louisiana Land & Exploration Company	19th Judicial Court State of Louisiana Parish of East Baton Rouge	No. 423,602 "H"	Deposition Expert Report	May 2004 April 2004	State of Louisiana

Proceeding		Docket/File/ Court/Commission/Agency	Case Caption	Deposition/ Trial/Reports	Date	On Behalf Of
29.	Chevron U.S.A., Inc. v. State of Louisiana et al.	17th Judicial District Court, State of Louisiana Parish of Lafourche	No. 93,658	Testimony Deposition Expert Report Expert Report	March 2004 January 2004 January 2004 November 2003	State of Louisiana
30.	Power Generation Mexico, Inc., v. Entergy Power Development Corp., Entergy Power Netherlands Co., B.V. and DOES I through XX, inclusive	Superior Court of the State of California, In and For The City of San Francisco	No. 321031	Deposition Expert Report	September 2003 September 2003	Power Generation Mexico, Inc.
31.	State of Louisiana and Secretary of The Department of Revenue and Taxation v. Texaco Trading and Transportation Inc., et al.	19th Judicial District Court State of Louisiana Parish of East Baton Rouge	No. 423,598-D	Expert Report	November 2002	State of Louisiana
32.	Exxon Corp. USA v. Amerada Hess Pipeline Co., et al. consolidated with In Re: Formal Complaint of Exxon USA v. Amerada Hess Pipeline Co.	Federal Energy Regulatory Commission Alaska Public Utilities Commission	No. OR89-2-000 No. P-89-2	Testimony Deposition	January 2003 June 2002	State of Alaska
33.	Amerada Hess Corporation v. State of New Mexico ex rel. Department of Taxation and Revenue	First Judicial District, Santa Fe County, New Mexico	No. D-101-CV-2001-00797	Deposition Expert Report	April 2002 April 2002	State of New Mexico
34.	Linville Shockey, et al. v. Chevron USA, Inc., et al.	United States District Court of Washita County State of Oklahoma	No. CJ-2001-7	Fairness Hearing Certification Hearing Deposition	January 2005 January 2002 December 2001	Shockey, et al.

Proceeding		Docket/File/ Court/Commission/Agency	Case Caption	Deposition/ Trial/Reports	Date	On Behalf Of
35.	Larry Switzer, et al. v. Chevron USA, Inc., et al.	United States District Court for the Western District of Oklahoma	No. CIV-00-478-R	Expert Report Expert Report	March 2002 July 2001	Switzer, et al.
36.	HRN, Inc., et al. v. Shell Oil Company et al.	United States District Court of Harris County, Texas, 234th Judicial District	No. 1999-28202	Deposition Expert Report	October 2000 September 2000	HRN, Inc., et al.
37.	Arco v. Stewart & Young, Inc.	United States District Court Eastern District of California	No. CIV-S-99-2541-GEF-JFM	Expert Report	July 2000	Stewart & Young, Inc.
38.	James Mathis, et al. consolidated with Donald Richoux, et al. v. Exxon Corporation	United States District Court for the Southern District of Texas, Corpus Christi Division	No. C-99-033	Trial Deposition Expert Report	October 2000 August 2000 June 2000	Mathis, et al.
39.	Anzai v. Chevron Corporation, et al.	United States District Court for the District of Hawaii	No. 98-00792-SPK	Deposition Deposition Deposition Deposition Expert Report Expert Report	March 2001 December 2000 October 2000 August 2000 February 2001 June 2000	State of Hawaii
40.	The Protest of Exxon Corporation State of New Mexico v. Exxon, Corp.	State of New Mexico Taxation & Revenue		Expert Report	April 2000	State of New Mexico
41.	Stewart Petroleum v. Unocal	United States Bankruptcy Court for the District of Alaska	No. A96-00795-DMD	Expert Report	May 1999	Stewart Petroleum

	Proceeding	Docket/File/ Court/Commission/Agency	Case Caption	Deposition/ Trial/Reports	Date	On Behalf Of
42.	Exxon Corp. USA v. Amerada Hess Pipeline Co., et al. consolidated with In Re: Formal Complaint of Exxon USA v. Amerada Hess Pipeline Co.	Federal Energy Regulatory Commission Alaska Public Utilities Commission	No. OR96-1400 No. P-96-6	Testimony	May 1998	State of Alaska
43.	Hearing (No.94925)	Department of Revenue	No. 94925	Testimony Testimony Deposition Deposition Deposition Expert Report	April 1997 October 1996 August 1996 March 1996 February 1996 April 1996 February 1996	State of Alaska

BARRY PULLIAM
Publicly Available Reports/Presentations

Econ One Research, Inc.
Los Angeles, California

	Title	Prepared For	Publication Date
1.	Trying the Expert Case *co-presented with John McArthur and Jerald Block*	Presented at the Litigation Counsel of America 2013 Fall Conference	October 2013
2.	Alaska Production Tax Reform	Presented at the 2nd Annual K&L Gates Alaska Oil and Gas Conference	July 2013
3.	Presentation on Gasoline Prices	National Association of Attorneys General	June 2004
4.	Natural Gas and NGL Valuation Methodologies of North American Public Lands Agencies. *co-authored with Roger Ridlehoover and Jane Kidd.*	State of Alaska Department of Natural Resources	September 2003
5.	Impacts of Lifting the Ban on ANS Exports on West Coast Crude Oil Prices: A Reconsideration of the Evidence. *co-authored with Mark Dwyer, Ph.D.*	Presented at the 22nd Annual Meeting of the International Association for Energy Economics	October 2002
6.	Alaska Gas and NGL: Economic Analysis of Value and Royalty *co-authored with Roger Ridlehoover*	State of Alaska Department of Natural Resources	January 2002
7.	Presentations on California Gasoline Markets	California Assembly & Senate Hearings	April 2000
8.	Preliminary Report to the Attorney General Regarding California Gasoline Prices *co-authored with Keith Leffler, Ph.D.*	Attorney General State of California	November 1999

	Title	Prepared For	Publication Date
9.	Economic Effects of Lifting the ANS Export Ban *co-authored with Jeffrey Leitzinger, Ph.D.*	The President's Council of Economic Advisors	June 1994

Appendix 2 & 3

Appendix 2

SDG&E Service Area EVSE Fueling

Provider[2]	Locations	EVSE Type						Market Share by Unit[1]
		Level 1	Level 2 - Private	Level 2 - Public	DCFC	Not Reported	Total (2)+….+(6)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1. Blink	134		111	322	12		445	55.7%
2. ChargePoint	45	3	1	151	5		160	20.0%
3. NRG eVgo	21	7		9	22	66	104	13.0%
4. OpConnect	2	8	8				16	2.0%
5. SemaCharge	9			9			9	1.1%
6. WattStation	3			3			3	0.4%
7. Mossy Dealership	16		7	9	1		17	2.1%
8. SDG&E	1	11	5				16	2.0%
9. Tesla	1				7		7	0.9%
10. Pacific Nissan	2		1	1	1		3	0.4%
11. Scripps	2			3			3	0.4%
12. Weseloh Nissan	2		1	1			2	0.3%
13. Beacon Electric	1		2				2	0.3%
14. Frank Toyota	1	1	1				2	0.3%
15. NECA ETC	1			2			2	0.3%
16. Smart Center San Diego	1	1	1				2	0.3%
17. Old Town San Diego State Historic Park	1		1				1	0.1%
18. Crystal Cove State Park	1		1				1	0.1%
19. Honda of Escondido	1			1			1	0.1%
20. North County Ford	1			1			1	0.1%
21. Sullivan Solar Power	1			1			1	0.1%
22. Wild Animal Park	1			1			1	0.1%
Total	**248**	**31**	**140**	**514**	**48**	**66**	**799**	**100%**
							HHI	**3,688**

Sources: DOE data : http://www.afdc.energy.gov/data_download, using
GE WattStation website: https://www.gewattstation.com/connect/
NRG eVgo website: http://www.nrgevgo.com/find-a-station/
http://alternative-fuel.findthebest.com

Note: [1] HHI is the Herfindahl-Hirschman Index, a common measure of market concentration. It is calculated as the sum of the squares of the Market Shares of the market participants.
http://www.justice.gov/atr/public/guidelines/hhi.html

[2] The AFDC data did not contain network information for all locations.
We have used information from http://alternative-fuel.findthebest.com in some instances where this information was missing.
It is possible that some locations numbered 7 to 22 are associated with a network.

Appendix 3
SDG&E Service Area EVSE Fueling
Plus 1st Year Max EVSEs from Proposal

Network[2]	Locations	EVSE Units	Market Share by Unit[1] Current	Market Share by Unit[1] + Pilot
	(1)	(2)	(3)	(4)
Blink	134	445	56%	34%
ChargePoint	45	160	20%	12%
NRG eVgo	21	104	13%	8%
OpConnect	2	16	2%	1%
SemaCharge	9	9	1%	1%
WattStation	3	3	0%	0.2%
Mossy Dealership	16	17	2%	1%
SDG&E	1	16	2%	1%
Tesla	1	7	1%	1%
Pacific Nissan	2	3	0.4%	0.2%
Scripps	2	3	0.4%	0.2%
Weseloh Nissan	2	2	0.3%	0.2%
Beacon Electric	1	2	0.3%	0.2%
Frank Toyota	1	2	0.3%	0.2%
NECA ETC	1	2	0.3%	0.2%
Smart Center San Diego	1	2	0.3%	0.2%
Old Town San Diego State Historic Park	1	1	0.1%	0.1%
Crystal Cove State Park	1	1	0.1%	0.1%
Honda of Escondido	1	1	0.1%	0.1%
North County Ford	1	1	0.1%	0.1%
Sullivan Solar Power	1	1	0.1%	0.1%
Wild Animal Park	1	1	0.1%	0.1%
VGI Pilot (Maximum)	50	500	N/A	38%
Total	**298**	**1,299**	**100%**	**100%**
		HHI[3]	**3,688**	**2,972**

Sources: DOE data : http://www.afdc.energy.gov/data_download, using
GE WattStation website: https://www.gewattstation.com/connect/
NRG eVgo website: http://www.nrgevgo.com/find-a-station/
http://alternative-fuel.findthebest.com

Note: [1] HHI is the Herfindahl-Hirschman Index, a common measure of market concentration. It is calculated as the sum of the squares of the Market Shares of the market participants.
http://www.justice.gov/atr/public/guidelines/hhi.html

[2] The AFDC data did not contain network information for all locations. We have used information from http://alternative-fuel.findthebest.com in some instances where this information was missing.
It is possible that some locations numbered 7 to 22 are associated with a network.

[3] The HHI calculation combines SDG&E's current EVSE count with the EVSE count under the proposed pilot program.

CHAPTER 3

PREPARED SUPPLEMENTAL TESTIMONY

OF RANDY SCHIMKA AND J.C. MARTIN

CLARIFICATION OF SDG&E's APPLICATION

This Chapter addresses (1) an illustration of EVSE adoption trends under different scenarios, (2) certain clarification items that came to SDG&E's attention during discovery in this matter, and (3) the concern over the proposal's size as expressed in the September 29, 2014 scoping memo. Randy Schimka sponsors sections I, II & III, and J.C. Martin sponsors Appendix A.

I. CURRENT EVSE INSTALLATION TRENDS WILL FALL SHORT OF THE STATE'S GOALS

Let's examine the overall volume of EVSE with various trajectories to 2020. Figure 1 shows an estimate of publically available charging stations required in the SDG&E service territory to meet its portion of the State charging infrastructure goal by 2020.[71] Although EV drivers charge their vehicles at a variety of locations, both private and publically available, the use of commercial facilities here is intended to be a yardstick by which to measure progress toward charging infrastructure deployment goals.[72]

Figure 1
Estimate of San Diego Charging Station Installations by 2020 (current commercial EVSE 2012-2014, extrapolated to 2020)

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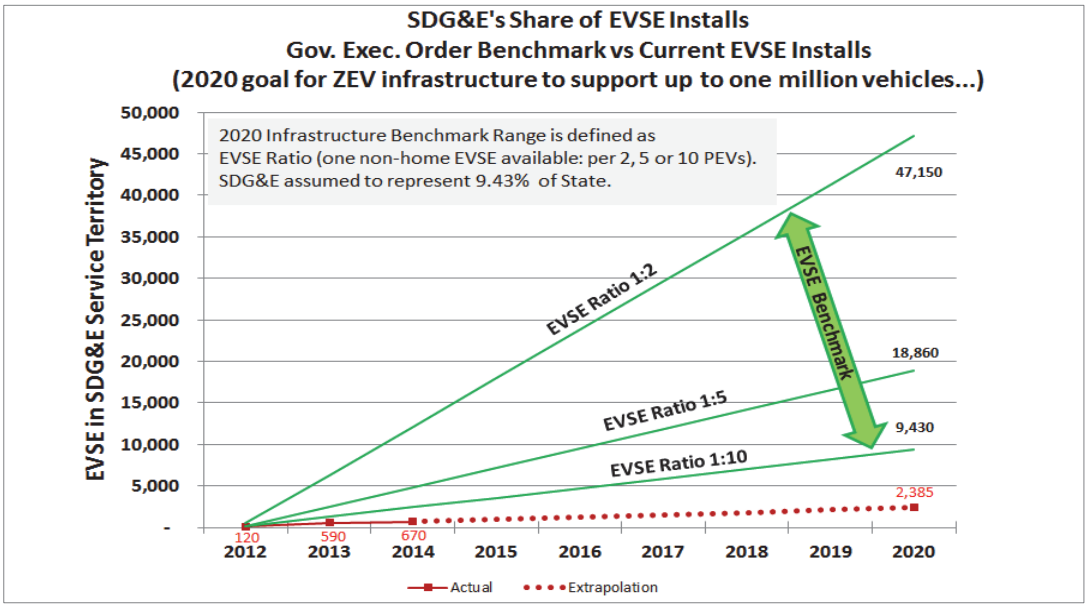
[71] SDG&E has 9.43% of California's PEVs, Source: ICF International, California Transportation Electrification Assessment – Phase 1: Final Report (2014)

[72] SDG&E references non-home commercial EVSE here, and has previously noted in Mr. Krevat's testimony that the MuD "home" segment of its customer population is still not "adequately supported" in that about 50% of its residential customers reside in MUDs.



Currently, there is one installed commercial (non-residential) charging station for every 15 vehicles in the SDG&E service territory. At the current rate of installation of commercial EVSE, the San Diego region will have just under 2,400 installed charging stations or EVSE by 2020, or approximately 25% of the amount targeted by the Governor. To meet the Governor's 2020 charging infrastructure goal, SDG&E and other industry experts believe that much more EVSE deployment is needed at both public and private sites.[73] The sheer volume of EVSE is just part of the EVSE deployment adequacy aspect of the Governor's 2020 infrastructure deployment goal. For the most effective deployment of the EVSE infrastructure, the location of such facilities is the more important consideration. This aspect

[73] See, e.g., http://www.mercurynews.com/business/ci_24947237/charge-rage-too-many-electric-cars-not-enough-workplace-chargers; Mercury News article "Charge Rage" by Dana Hull, January 19, 2014. *See also*, EPRI, Guidelines for Infrastructure Planning: An Explanation of the EPRI Red Line/Blue Line Model (product ID: 3002004096), 2014. http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=000000003002004096.

of deployment and the discussion of the locations targeted by SDG&E's Vehicle-Grid Integration VGI Pilot Program ("VGI Pilot") are described in greater detail in Section III below.

II. CLARIFICATION OF SDG&E'S PROPOSED VGI ARCHITECTURE

The proposed SDG&E VGI facility is discussed in my April testimony (Chapter 2) and described in detail in Figure 2 below. This discussion identifies the value of the separate utility service construction approach and items encompassed within cloud-based components (pictured below in Figure 2 - #11) that provide the grid-integrated managed charging and control functions necessary to implement the VGI rate, such as:

- Receive the day-ahead pricing
- Manage the charging session to the customer price and charging requirements
- Collect price and usage data
- Send these data to SDG&E to complete the billing process

Figure 2 identifies the various components of a new electric service and equipment that would be included in a typical VGI installation. The VGI Pilot proposes to contract with third party service providers to provide these "cloud" functions and other relevant functions under SDG&E's supervision, within the VGI specifications, to the greatest extent possible.

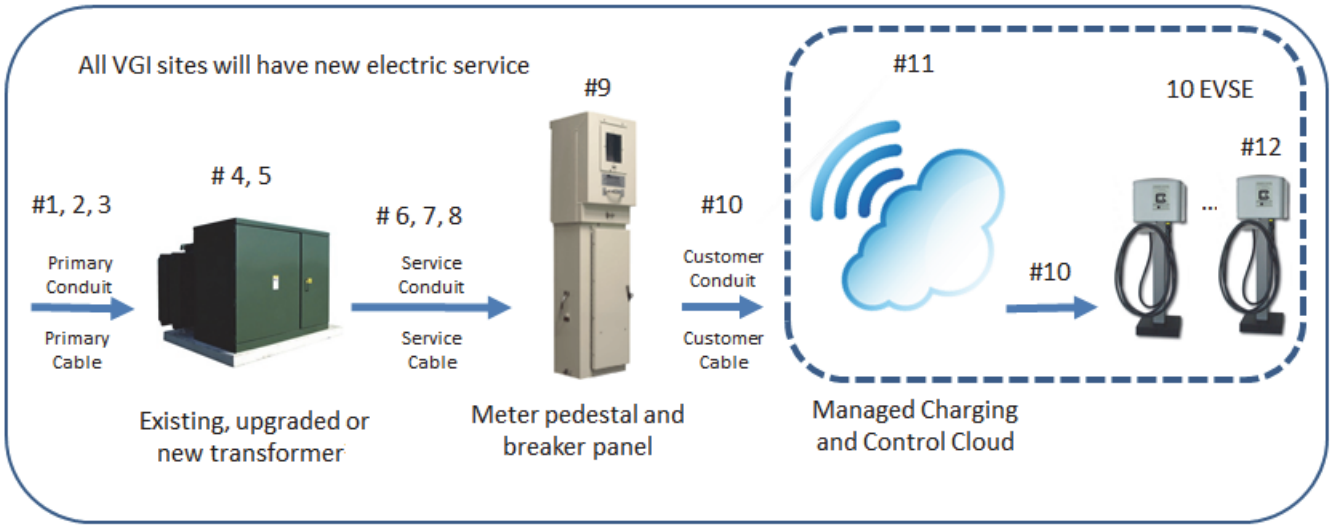


Figure 2

Components of a VGI Charging Facility Installation –Conceptual Illustration
SDG&E's VGI Pilot proposes to be responsible for building, operating and maintaining all the components of a VGI facility, leveraging the resources of third parties

1) Primary trenching/restoration
2) Primary conduit
3) Primary cable
4) Transformer [1]
5) Transformer pad
6) Service trenching/restoration
7) Service conduit
8) Service cable
9) Meter pedestal / panel
10) Customer conduit / cable from meter to EVSE
11) Managed Charging and control cloud
12) EVSE

[1] An easement would be required from property owner for placement of utility equipment.

In addition, SDG&E is proposing to fund a new electric service for each location as part of the VGI pilot. Over the past several years, based on my work and involvement with many Electric Vehicle Service Providers ("EVSPs") and installations in the SDG&E region since 2011, most of the commercial EVSE installed have been connected to their respective existing building electric panels. In fact, based on my field experience, approximately 5-10% of recent commercial EVSE installations have been connected to a new electric service (i.e., a new distribution service point at the customer premises). This is usually done for economic reasons, as it can be more expensive to install a new electric service to feed an installation of EV charging stations rather than connecting to the host site's existing power panel. Thinking longer-term, the issue with using an existing power panel to power EVSE is three-fold:

1. Existing panels are usually close to being fully subscribed; therefore many otherwise excellent locations for installing charging stations are discarded due to power not being readily available in the existing panel.

2. Even if power is available in the existing panel, in many cases only a small number of EVSE can be fed (which limits future expansion).

3. Mixing EVSE/EV energy consumption with that of the existing facility on an existing electric service limits billing rate options in the future, and also makes it difficult to reconcile EVSP billing for the site owner.

Installing a new electric service for each VGI site will provide much-needed flexibility for the installations that will remedy the issues referenced above and allow VGI facility installations to occur at more locations without the above power-related limitations.

III. IS SDG&E'S PROGRAM TOO LARGE? THE SCOPE OF SDG&E's PROPOSAL: SIZE, DURATION, FOCUS, LOCATIONS AND RATE OF INSTALLATION.

The scoping memo for SDG&E's application expressed concern about the size of SDG&E's program and its characterization as a "pilot:"[74]

> SDG&E's request for expedited treatment of its Application is predicated in large measure on the assertion that the proposed VGI program is a pilot program. However, SDG&E's Application includes at least three defining characteristics that make expedited treatment inappropriate. First, the size of the estimated cost is over $103 million, of which approximately $55 million represents a potential capital investment for which SDG&E seeks ratebase treatment…It is also on par with the size of a fully developed utility program, not an initial experimental pilot. Second, it is a utility program. Third, SDG&E's Application proposes to implement the new program over ten years and collect the costs in rates until 2037. Taken together, these factors go beyond typical pilot programs and put the SDG&E Application on par with a full program business model, rather than an initial, research-oriented test project. These factors require the Commission to allow adequate time to meaningfully assess the reasonableness of a request of this length, cost and complexity.

The Decision (D.14-12-079) has since addressed the utility ownership issue. SDG&E appreciates the opportunity provided by the Decision to show why the size of its proposal is appropriate, and why the pilot characterization is apt. In sum, in addition to its experimental nature, SDG&E considers its VGI proposal a pilot because of the limits and focus of its scope. These are as follows:

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[74] *Joint Assigned Commissioner and Administrative Law Judge's Scoping Memo and Consolidation Ruling* (September 29, 2014), pp. 3-4. SDG&E is not contending that this program's adoption turns on acceptance of the "pilot" characterization. But this testimony will use the "pilot" reference, as we believe it captures, as described herein, the limited scope and experimental nature of the proposal.

A. Size

As described in Ms. Fang's testimony,[75] the VGI rate is influenced by changes in the price of energy as well as system and circuit conditions. As such, for the pilot to achieve robust results, the number of VGI facilities considered in the VGI Pilot needs to be sufficiently large enough to ensure a reasonably strong statistical representation of SDG&E circuits in the pilot. Although no two circuits are alike, there are some relevant parameters that help to characterize the population of circuits. The relevant parameters include; type of distribution circuit (e.g., Residential, Commercial, or mixed), solar penetration on the circuit, load factor of the circuit, and peak demand hours of the circuit. These circuit characteristics are expected to impact the calculation of the VGI Rate's hourly prices (specifically the VGI D-CPP Hourly Adder), across more than 1,000 distribution circuits within SDG&E's service territory. Please see Appendix A for an illustrative distribution circuit sample frame and a discussion of associated sampling error.

B. Focus of the Pilot

As described in the testimony of Mr. Krevat and Mr. J.C. Martin,[76] the scope of the VGI Pilot is limited to focus solely on exploring the value of grid-integrated EV charging driven by customer-managed charging in response to hourly-variable electricity price signals. The VGI Pilot is not proposing to explore other commercial factors that would be associated with a larger scale program launch. Comments made during the discovery phase of this proceeding suggest that the VGI Pilot address other market needs (such as, ubiquitous

[75] Testimony of Ms. Cyndee Fang (CF-2 to CF-3)

[76] Testimony of Mr. Lee Krevat (LK-1 to LK-2) and Mr. J.C. Martin (JCM-1)

billing solutions), and in general these are well outside the parameters of a "pilot" and this pilot's focus.

C. Duration

The VGI Pilot is limited to five years of installation. Performance data can be made available during and after the installation timeline, as described in Mr. Martin's testimony (Chapter 6, pages JCM-35 to JCM-37).

D. Location (customer targets) and Installation Rate

As described in earlier testimony filed in April 2014 by Mr. Krevat and myself, customer sites and the rate of installation for VGI facilities require customer site host interest and driver demand for charging at those sites (Chapter 2, page RS-7). The customer sites targeted by SDG&E's VGI Pilot, that is, long-duration parking locations, create the best opportunity for implementing a grid-integrated charging pilot.

E. Residential Locations – Targeting Multi-Unit Dwellings

Charging locations are determined by parking duration and customer preference. Many, if not most, customers consider home charging to be ideal because it is both convenient and the place where their car is parked the longest. If residential charging is not available, workplace charging locations can serve as a reasonable alternative charging location, as is the case for most of today's residential customers living in MuDs, (e.g., apartments, townhomes, and condominiums).

Several barriers to investment in charging infrastructure at MuDs have severely hampered adoption of electric vehicles by MuD residents. Some of these barriers include complications related to the ownership of facilities (e.g. landlord/tenant), access to dedicated parking, difficulty of installation, prioritization of other facility investment needs, to

mention a few. These barriers have been documented previously, as noted in my previous testimony (Chapter 2, footnote 6, page RS-7). SDG&E's VGI Pilot proposal and solution address many of these barriers.

In 2010, approximately half of San Diego's residents lived in MuDs.[77] In discussions with industry groups,[78] SDG&E estimates that there are approximately 15,500 MuD properties in its service territory ranging from small apartment buildings to large complexes. In my work with customers and providers in the region, I am aware of approximately 14 MuD charging sites that were installed in the region at the time of SDG&E's filing. Using these estimates, EVSEs are deployed at less than 0.1% of MuD locations in the service territory. It is evident that the number of EVSEs installed at MuD locations is limited. SDG&E's VGI Pilot will help expand EVSE installations for MuD residents, expanding their adoption of EVs and the benefits and convenience of "home" charging available to residents of single family housing.

F. High Usage, Non-home Long Duration Parking Locations ("Workplaces")

After residential locations, workplaces or other similar long duration charging locations are often preferred by customers due to the convenience of EV charging while the vehicle sits all day or all night. More importantly, when residential charging at home is not available, workplaces become the primary locations for vehicle charging. The workplaces targeted for the VGI Pilot will be those with a high frequency of use during the workweek, primarily during the day. The rate of installation at such facilities will be driven by the

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[77] http://sandag.org/uploads/publicationid/publicationid_485_637.pdf

[78] CA Association of Community Managers, and the CA Apartment Association

demand from property managers or owners of these facilities, as well as the presence of EV drivers with charging needs. The proposed VGI rate applicable to workplace locations can also offer customer EV drivers the opportunity to reduce their fuel costs by taking advantage of lower-cost energy that may be available during the day, especially during times of the year when renewable resources are relatively plentiful and demands on the grid are light.

Although sites sometimes referred to as "destination locations" have similar long parking duration characteristics as workplaces, these locations have a much lower frequency of usage, and as such have a unique role in the non-home EV charging space. Examples of this type of location in the SDG&E service area include Sea World, the San Diego Zoo, Safari Park, Balboa Park and Qualcomm Stadium. These are not the primary target of SDG&E's VGI Pilot given that their low frequency of usage reduces the opportunity for grid benefits.

G. Convenience Locations (non-home, short duration parking)

Convenience locations have short duration parking for periods of less than 4 hours per visit. They include shopping centers, strip malls, big box retail stores, urban parking lots and parks. San Diego regional residents got a jump start on the deployment of convenience public charging through the Department of Energy-funded EV Project which supported the installation of over 600 charging stations at over 180 locations (including some workplaces). The greater proportion of the deployment of EVSE under the EV Project was for convenience locations with short duration parking. Growth in providing charging at these locations has slowed since the EV Project ended in 2013. EVSE is still being installed, but at a slower rate. Because the market is continuing to target these facilities and because the parking durations are short and the frequency of usage per EV customer is low, these

locations limit the benefits the VGI Pilot can provide. SDG&E has not proposed including convenience locations (non-home, short duration parking) in its VGI Pilot.

H. Trip-Continuation Locations

Given the considerably faster charging times, DC fast or quick chargers are ideal for trip-continuation locations. These typically will be those chargers placed along major highways and freeways in publically accessible locations in the region to allow customers with EVs with DC fast charging capabilities to extend the range of their EV for longer travel distances. From car counts in the San Diego region, SDG&E estimates that only about 40% of the EVs today in the region have DC fast charging capabilities. Efforts underway to install DC fast charging include those by NRG eVgo (Freedom Stations), Tesla Superchargers (exclusively for use by Tesla Model S driver), EV Oasis, BMW and Nissan. SDG&E does not propose to include trip continuation sites in the VGI Pilot due to the low frequency of usage per EV customer, limited managed charging benefits to the grid, as well as the relatively slow growth in trip-continuation charging facilities.

In sum, SDG&E's VGI Pilot is an experiment of reasonable size, given (1) its controlled rollout, (2) fully-deployed, it should constitute a relatively small share of the total commercial charging outlets in San Diego, and (3) the size is necessary to generate a robust sample to evaluate the benefits of grid-integrated charging.

This concludes my prepared supplemental testimony.

Appendix A

Portion of EVs with Access to the VGI Rate and Chargers

The portion of the EV population in SDG&E's service territory with access to the VGI Rate is presented in Table 6-4 at JCM-15 (and repeated with highlights below). At the peak of SDG&E's VGI Pilot deployment in 2018 less than 20% of the EVs in SDG&E's service territory will have access to the VGI rate and associated VGI Chargers. The portion of EVs with access to the VGI Rate and VGI Chargers grows over the five year deployment, and then diminishes after deployment completes in 2018 due to an increasing EV population forecast. By 2022, less than 10% of the EV population will have access to the VGI Rate and VGI Chargers.

Table 6-4

Allocation EV Population Forecast to EV Customer Groups																
EV Customer Groups			Portion of EV Population Forecast Applied to EV Customer Group													
Group	Residence Type	Workplace Charging Access	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
1	SF	Preexisting	46.0%	45.5%	44.3%	42.1%	40.5%	41.4%	42.3%	43.0%	43.7%	44.1%	44.5%	44.7%	44.9%	45.1%	45.2%
2	SF	Unavailable	54.0%	52.9%	50.2%	44.7%	39.6%	41.9%	44.2%	46.1%	47.9%	49.1%	50.0%	50.7%	51.2%	51.5%	51.8%
3	SF	New	0.0%	1.0%	3.2%	7.2%	10.0%	8.3%	6.8%	5.5%	4.2%	3.4%	2.8%	2.3%	2.0%	1.7%	1.5%
4	MuD	Preexisting	0.0%	0.3%	1.0%	2.8%	4.6%	3.8%	3.1%	2.5%	1.9%	1.6%	1.3%	1.1%	0.9%	0.8%	0.7%
5	MuD	Unavailable	0.0%	0.3%	1.2%	3.2%	5.4%	4.5%	3.7%	3.0%	2.3%	1.8%	1.5%	1.2%	1.1%	0.9%	0.8%
Total			100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Portion of vehicles with access to the VGI Rate (Groups 3, 4 & 5)			0.0%	1.6%	5.4%	13.2%	19.9%	16.7%	13.5%	10.9%	8.5%	6.7%	5.5%	4.6%	3.9%	3.4%	3.0%

Sample Error Calculations

SDG&E's VGI Pilot proposal includes 550 VGI Systems locations with 10 EV Chargers per system totaling 5,500 EV Chargers. This quantity of VGI Systems and VGI Chargers is necessary to ensure that the results will have sufficient statistical validity, "to see whether hourly variant pricing influences charging decisions, with the aid of enabling technology."[79]

The VGI Pilot is an informative study of customer preferences which "…builds off the results of SDG&E's current PEV Pricing and Technology Study (Study)[80], the results of which indicate that pricing and enabling technology play a strong role in influencing charging time decisions."[81]

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79 Chapter 1, page LK-11.

80 Nexant, Inc. Final Evaluation for San Diego Gas & Electric's Plug-in Electric Vehicle TOU Pricing and Technology Study. SDG&E.COM/EV. N.p., 20 Feb. 2014. Web. 01 Jan. 2015. <https://www.sdge.com/sites/default/files/documents/1681437983/SDGE%20EV%20%20Pricing%20&%20Tech%20Study.pdf?nid=10666>

81 Chapter 1, page LK-11 & LK-12.

A key finding of the Study is that, "Participant EV charging behavior responds to price signals" (Study page 4). However, "The [S*tudy's price*] elasticities are defined as applying to EV charging during the [*three*] TOU time periods. However, customer decision - making probably takes place at a more granular level of time."[82] The VGI Pilot Rate described in Chapter 2 has prices granular to each hour of the day and for each of SDG&E's more than 1,000 Distribution circuits. Therefore, a sufficiently large number of EV Chargers and charging events are required to provide sufficient statistical validity to draw inferences on how the VGI rate influences EV Charging behavior each hour and on the various types of SDG&E Distribution circuits. Low statistical validity will reduce the value of results to policy makers, market participants, interested parties and SDG&E customers.[83]

SDG&E expects to install VGI systems on distribution circuits with many different characteristics. Circuit characteristics include; the types of customers on the Distribution Circuit, Solar Penetration on the circuit, Load Factor of the circuit, and peaking hours of circuit demand. These circuit characteristics are expected to influence the calculation of the VGI Rate's hourly prices (specifically the VGI D-CPP Hourly Adder rate component), across more than 1,000 distribution circuits within SDG&E's service territory.

Placing VGI facilities on each of SDG&E's distribution circuits would be impractical and expensive. However distribution circuits with similar characteristics can be grouped into a sample frame which can help reduce the sample size required or can help increase the statistical power of a given sample size. An illustrative 48 cell sample frame utilizing the circuit characteristics described above is presented in Figure A-1. Each cell in the sample frame will need a sufficiently large sample of EV Chargers and hourly charging events to provide sufficient VGI charging behavior estimates with sufficient statistical power.

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[82] Nexant, Inc. Study page 32 (italics added for context).

[83] See the VGI Pilot Program's Research Plan described in Chapter 6 at JCM-35.

Figure A-1

VGI Pilot - Illustrative Sample Frame Frame Example: 48 Distribution Circuit Cells									
		Distribution Circuit Peaking Hours							
		Hours 22 thru 13		Hours 14 thru 15		Hours 16 thru 20		Hour 21	
Distribution Circuit Type	Solar Penetration on Circuit	High Load Factor	Low Load Factor	High Load Factor	Low Load Factor	High Load Factor	Low Load Factor	High Load Factor	Low Load Factor
Residential Dominant	High Solar Penetration								
	Low Solar Penetration								
Res. and C&I Mixed	High Solar Penetration								
	Low Solar Penetration								
Commercial & Industrial Dominant	High Solar Penetration								
	Low Solar Penetration								

Two generally accepted statistical standards for sampling are either 95% confidence levels and a 5% relative precision (95/5), or 90% confidence level and a10% relative precision (90/10).[84] The relative precision (also known as sample error) is equal to the absolute margin of error divided by the sample mean. Relative precision is calculated with the sample error formula in Figure A-2.[85]

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[84] See Load Research Manual, 2nd ed., Association of Edison Illuminating Companies, (2001) p. 4-4 "A design accuracy of +/- 10% at the 90% confidence level at the system and class peak time was specified in 1978 by PURP for all major rate classes. Although these federal standards were lifted in 1992, the PURPA specification remains somewhat of a load research standard, particularly for samples that will be used to support rate cases or other regulatory requirements."

[85] Load Research Manual, 2nd ed., Association of Edison Illuminating Companies, (2001) p. 4-15

Figure A-2

$$Relative\ precision\ of\ sample\ mean = \frac{Z_\alpha * s_x/\sqrt{n}}{\bar{X}} * 100\%$$

Where:

$Z_\alpha = Z$ *value from two tail standard normal table*
(1.96 *for* 95% *confidence level* & 1.6448 *for* 90% *confidence level*)
$s_x =$ *standard deviation of sample* x
$n =$ *sample size*
$\bar{X} =$ *mean value of sample* x

This relative precision or sample error is calculated in Table A-1 below with sample errors calculated for; two confidence levels (95% & 90%), over varying number of VGI systems, Pilot Charger Utilizations, and circuit Sample Frame Cells. In Table A-1, VGI System is the 10 charger systems described in Chapter 2. Pilot Charger Utilizations are the number of EVs utilizing a VGI charger per day on average. Sample Frame Cells are the number of unique cells with distinct treatment differences (similar to the 48 cell sample frame illustrated in Figure A-1). Systems per Cell, is the number of VGI systems within one sample frame cell, for example 550 VGI Systems evenly spread over 40 cells in a sample frame would have about 14 (550/40 = 13.75) systems in each cell of the sample frame.

The sample size used in the Table A-1 sample errors is calculated by taking the average number of VGI Systems per Cell times the number of EV Charges per VGI System (10), times the Pilot Charger Utilization (0.5, 1.0, or 2.0).

The results in the Table A-1 indicate the 95/5 standard cannot be achieved even with high (2.0) charger utilization and a low (30) cell sample frame of distribution circuits. The 90/10 standard can be achieved with a sample of 550 VGI Systems, low (0.5) charger utilization rate, and a 30 cell Sample Frame.[86]

[86] The charger utilization rate of 0.5 per day is the same 0.5 rate in ORA's data request sensitivity runs for ORA-SDG&E-DR-006, request 1.c (9/16/2014).

Table A-1

VGI Pilot Program
Illustrative Error Calculations Inputs
Estimated Population Mean and Standard Devations

SDG&E VGI Pilot
40 Circuit Cell Sample Frame
Illustrative Sample Error with 95% Confidence

VGI Systems	Systems per Cell	Pilot Charger Utilization* 0.5	1.0	2.0
550	14	13%	9%	6%
360	9	16%	11%	8%
300	8	17%	12%	9%
240	6	19%	14%	10%
180	5	22%	16%	11%
120	3	27%	19%	14%

EV Chargers per System:	10	
Cells in Sample Frame:	**40**	
Mean Usage**:	2.397	
Standard Deviation**:	1.291	
Confidence Level:	**95%**	**1.9600**

* EVs per charger per day.

** Mean and Standard Deviation from EV Pricing Pilot data (EPEV rates), 2012 Summer On-Peak hourly usage >0.4 kWh/hr.

SDG&E VGI Pilot
40 Circuit Cell Sample Frame
Illustrative Sample Error with 90% Confidence

VGI Systems	Systems per Cell	Pilot Charger Utilization* 0.5	1.0	2.0
550	14	11%	8%	5%
360	9	13%	9%	7%
300	8	14%	10%	7%
240	6	16%	11%	8%
180	5	19%	13%	9%
120	3	23%	16%	11%

EV Chargers per System:	10	
Cells in Sample Frame:	**40**	
Mean Usage**:	2.397	
Standard Deviation**:	1.291	
Confidence Level:	**90%**	**1.6448**

* EVs per charger per day.

** Mean and Standard Deviation from EV Pricing Pilot data (EPEV rates), 2012 Summer On-Peak hourly usage >0.4 kWh/hr.

SDG&E VGI Pilot
30 Circuit Cell Sample Frame
Illustrative Sample Error with 95% Confidence

VGI Systems	Systems per Cell	Pilot Charger Utilization* 0.5	1.0	2.0
550	18	11%	8%	6%
360	12	14%	10%	7%
300	10	15%	11%	7%
240	8	17%	12%	8%
180	6	19%	14%	10%
120	4	24%	17%	12%

EV Chargers per System:	10	
Cells in Sample Frame:	**30**	
Mean Usage**:	2.397	
Standard Deviation**:	1.291	
Confidence Level:	**95%**	**1.9600**

* EVs per charger per day.

** Mean and Standard Deviation from EV Pricing Pilot data (EPEV rates), 2012 Summer On-Peak hourly usage >0.4 kWh/hr.

SDG&E VGI Pilot
30 Circuit Cell Sample Frame
Illustrative Sample Error with 90% Confidence

VGI Systems	Systems per Cell	Pilot Charger Utilization* 0.5	1.0	2.0
550	18	9%	7%	5%
360	12	11%	8%	6%
300	10	13%	9%	6%
240	8	14%	10%	7%
180	6	16%	11%	8%
120	4	20%	14%	10%

EV Chargers per System:	10	
Cells in Sample Frame:	**30**	
Mean Usage**:	2.397	
Standard Deviation**:	1.291	
Confidence Level:	**90%**	**1.6448**

* EVs per charger per day.

** Mean and Standard Deviation from EV Pricing Pilot data (EPEV rates), 2012 Summer On-Peak hourly usage >0.4 kWh/hr.