Application No: 17-01-020, et al.

Exhibit No.: _____

Witnesses: M. Baumhefner____

M. Whited_____

C. King_____

OPENING TESTIMONY OF MAX BAUMHEFNER, MELISSA WHITED, AND CHRIS KING, SPONSORED BY THE NATURAL RESOURCES DEFENSE COUNCIL, THE GREENLINING INSTITUTE, PLUG IN AMERICA, THE COALITION OF CALIFORNIA UTILITY EMPLOYEES, SIERRA CLUB, ENVIRONMENTAL DEFENSE FUND, THE ALLIANCE OF AUTOMOBILE MANUFACTURERS, GREENLOTS, SIEMENS, AND EMOTORWERKS ON RESIDENTIAL CHARGING INFRASTRUCTURE AND RATES

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I. INTRODUCTION AND SUMMARY OF RECOMMENDED MODIFICATIONS

In accordance with the April 13, 2017 "Scoping Memo and Ruling of Assigned Commissioner and Administrative Law Judges," (Scoping Memo) the Natural Resources Defense Council (NRDC), the Coalition of California Utility Employees (CUE), Plug In America, The Greenlining Institute, Sierra Club, Environmental Defense Fund, the Alliance of Automobile Manufacturers, Greenlots, eMeter, a Siemens Business (Siemens), and Electric Motor Werks, Inc. (eMotorWerks) submit the testimony of Max Baumhefner (NRDC), Melissa Whited (Synapse Energy Economics), and Chris King (Siemens) on residential charging infrastructure and rates. With the modifications recommended below, San Diego Gas & Electric's (SDG&E) Residential Charging Program and associated rates would meet the relevant statutory and regulatory criteria and should be approved.

A. With the Following Modifications, SDG&E's Residential Charging Program and Associated Rates Should be Approved

1. SDG&E Should Offer Customers Rate Options and Suggest Optimal Rate Choices

Because EVs are relatively unique in their capability to respond to dynamic price signals, customers should have the choice between a whole-home Grid Integrated Rate (GIR), a whole-home time-of-use (TOU) rate, an EV-only GIR, and an EV-only TOU rate. While we support dynamic rates for loads that can be "set-and-forgot," offering more rate options will accommodate customers and load that lack the capacity to independently respond to dynamic price signals and ensure program participation is not hindered. During the customer intake process, SDG&E should conduct customer-specific bill analysis to suggest the optimal rate option under the customer's current consumption patterns and expected EV charging load, and ways the customer could save money if he or she switched to a new rate.[1] For each rate option, this analysis should include determining the cost to charge a EV (of average efficiency) both on a cost per kW-hr and on a cost per gallon of gas equivalent compared to a similar-sized gasoline vehicle.

While the Alliance of Automobile Manufacturers would prefer a simpler customer

[1] See, for example, Arizona Public Service's "Shift, Stagger, and Save" website: https://www.aps.com/en/residential/savemoneyandenergy/shiftstaggersave/Pages/home.aspx?src=shiftstaggersave

experience and overall program structure, the joint parties are in agreement that providing choices and simple information to facilitate decision-making will improve this program.

2. SDG&E's Whole-Home GIR Should be Modified to be Consistent with Public Utilities Code § 740.12

To provide customers who charge in a manner consistent with grid conditions the opportunity to realize fuel cost savings, as required by Public Utilities Code § 740.12, the "Grid Integrated Charge" (i.e., demand charge) component of SDG&E's proposed whole-home GIR should be revised as follows:

- The ratchet feature of the demand charge should be removed to avoid unduly punishing customers for a single charge outside of super-off-peak hours and to ensure customers retain an incentive to avoid charging outside of super-off-peak hours in subsequent months
- To avoid significant bill-impacts associated with arbitrary thresholds, any demand charge should be implemented as a continuous function ($/kW) and not in "bins"
- To better align with cost-causation and the requirements of Public Utilities Code §740.12, the magnitude any non-coincident demand charge should be significantly reduced, and a greater proportion of demand-related costs should be recovered through coincident demand charges or time-varying energy rates (such as the dynamic adders)

Further details and analysis relevant to these recommendations are included in the testimony of Melissa Whited in Section IV.

3. Customers Should be Given the Choice Between Utility and Customer Ownership of the Electric Vehicle Supply Equipment (EVSE)

Consistent with the Commission's policy of testing different models at this early stage in the electrification of the transportation sector, SDG&E should modify its program to allow residential customers the choice between utility ownership of the EVSE and customer ownership of the EVSE. As stated in the response of the Alliance of Automobile Manufacturers, the Coalition of California Utility Employees, Environmental Defense Fund, General Motors, Honda Motor Company, The Greenlining Institute, NRDC, Plug-in America, and the Sierra Club to a motion filed in 2015 to impose a single model for utility programs aimed at workplace and multi-unit dwellings: "It is far too early to mandate a single approach across all three service

territories…Competing models should be evaluated openly to evaluate how to best accelerate the EV market to meet California's air quality and climate goals and to deliver benefits for all utility customers."[2] Although at this time Greenlots, Siemens, and CUE prefer full utility ownership, the joint parties are in agreement that allowing customers the choice of EVSE ownership models would provide an opportunity to help put to the test the arguments made by those advocating for and against utility ownership—especially in a residential context, and allow customers to provide the Commission with real world data to shape its policies.

4. SDG&E Should Only Qualify Networked EVSE Capable of Responding to Dynamic Price Signals, Unless EVs are Commercially Available that Can Respond to Dynamic Price Signals

To ensure customers who choose to take service on a dynamic rate can respond to hourly price signals, to obviate the need for separate utility-metering to facilitate rate choice, to support the "Vehicle Grid Integration Roadmap" of the Commission, California Energy Commission, and California Independent System Operator, and to enable utilization of EVs as a grid resource as California's electricity supply and demand evolves, SDG&E should only qualify networked EVSE capable of responding to dynamic price signals and recording interval data consumption. If administratively feasible, SDG&E could waive this requirement for participating customers whose EVs are independently capable of responding to dynamic hourly price signals.

5. Rather than Providing EVSE to Customers at No Cost, SDG&E Should Require Customers to Pay for Costs in Excess of an Allowance

SDG&E should provide customers an allowance of $500 toward the cost of EVSE, and should provide customers who qualify for CARE and FERA or who are low- and moderate-income participants in a light-duty EV equity program implemented pursuant to the Charge Ahead California Initiative (SB 1275, De León), and customers located in Disadvantaged Communities (defined on a service territory basis), an allowance of $600 toward the cost of EVSE. Customers should bear any costs in excess of those allowances.

6. SDG&E Should Ensure Both Utility-Owned and Customer-Owned EVSE Are Warrantied for Equal Periods

To ensure customers are not unduly deterred from choosing to own EVSE and to lower

[2] *Response of Public Interest, Automaker, and Labor Groups to Motions to Consolidate Proceedings*, A. 14-04-014 and R. 13-11-007, April 27, 2015.

overall maintenance costs, SDG&E should ensure that customers who choose to own EVSE have warranties of similar duration and coverage as customers who choose to have the utility own the EVSE.

7. Customers Should Bear Installation Costs in Excess of Specified Caps

Customers should bear the installation costs (both materials and labor) in excess of $1,425 per household. CARE and FERA customers, and customers located in Disadvantaged Communities (defined on a service territory basis) should bear installation costs in excess of $1,500 per household. Up to 10 percent of customers located in Disadvantaged Communities (defined on a statewide basis) should be eligible for an additional $2,500 toward the cost of panel upgrades when required to install EVSE. Absent such a provision, customers living in older buildings in Disadvantaged Communities with older service panels may not be able to participate in the program, making it less likely SDG&E will meet the deployment goal we recommend below.

8. SDG&E Should Deploy at Least 25 Percent of EVSE in Disadvantaged Communities (Defined on a Service Territory Basis)

SDG&E should deploy at least 25 percent of EVSE in Disadvantaged Communities defined as the census tracts in SDG&E's service territory in the top-quartile as scored using the latest version of CalEnviroScreen. SDG&E should track and report on progress toward this goal.

9. SDG&E Should Prioritize Deployment of EVSE in Disadvantaged Communities Where Complementary Statewide Programs Exist

SDG&E should prioritize deployment in Disadvantaged Communities defined as census tracts in the top-quartile as scored using the latest version of CalEnviroScreen on a statewide basis. Consistent with the Commission's directive for utility programs to seek to leverage non-utility customer sources of funding, this will ensure alignment with statewide programs implemented pursuant to the Charge Ahead California Initiative (SB 1275, De León). Accordingly, SDG&E should conduct customer education and outreach that specifically targets those communities and that accounts for barriers to adoption that may be specific to those communities and should partner with the organizations that implement light-duty EV equity programs pursuant to the Charge Ahead California Initiative in SDG&E's service territory. Likewise, SDG&E should track and report on EVSE deployment in Disadvantaged Communities

as defined on a statewide basis.

10. SDG&E Should Support Supplier Diversity

SDG&E should ensure solicitations and contracts under its Residential EV Program contain a Diverse Business Enterprise (DBE) subcontracting plan, which requires the bidder/contractor to list its expected annual DBE spend with respect to the program and list any subcontractors it plans to use to achieve its DBE goal. Bidders should be requested to provide proposals in support of SDG&E's goal of meeting or exceeding an overall DBE spend of 43 percent.[3] Moreover, contractors should report back to SDG&E on a periodic basis deemed reasonable to ensure relevant DBEs are actual beneficiaries of contracts and solicitations under this program. SDG&E, likewise, should report this information in its periodic updates

It is worth noting that this modification largely borrows from the settlement agreement approved by the Commission and entered into by a broad set of parties in A.14-10-014:

> *Solicitations and contracts will contain a DBE subcontracting plan, which requires the bidder/contractor to list its expected annual DBE spend with respect to the Charge Ready Pilot and list any subcontractors it plans to use to achieve its DBE goal. Bidders will be requested to provide proposals in support of SCE's goal of achieving at least 40% diverse spend.*

Similar language was also adopted by the Commission in A.14-04-014:

> *The VGI Program will be included within SDG&E's company-wide Diversified Business Enterprise ("DBE") goal of 40%. The RFP and contract will contain a DBE subcontracting plan, which requires the bidder/contractor to list its expected annual DBE spend and list any subcontractors it plans to use to achieve its DBE goal. Bidders will be requested to provide proposals in support of SDG&E's 40% goal.*

11. SDG&E Should Further Workforce Equity and Inclusion

SDG&E should ensure that solicitations and contracts under its Residential EV Program require contractors to use their best efforts to reflect the diverse communities SDG&E serves. Contracts and solicitations should require bidders/contractors to demonstrate, *where applicable*:

[3] Beavers, D., Chen, S., *2016 Supplier Diversity Report Card: California's Public Utilities*, The Greenlining Institute, September 2016. Note: The 43 percent goal is intended to align with SDG&E's 2015 DBE spend of 42.74 percent.

- Hiring of low-income workers and other individuals with barriers to employment (through targeted or local hiring policies, or others);
- Diverse workforce demographics;
- Partnerships with skills development programs (or its own training programs) targeted at low-income workers and people with barriers to employment, such as job training and pre-apprenticeship programs; especially those that provide support services to participants (e.g. child care, transportation assistance, financial stability, etc.); and/or
- Paying of prevailing wages; providing benefits for hires, partners, and dependents (medical and dental coverage, paid vacation and sick leave, retirement savings, transportation reimbursement, childcare assistance, paid training opportunities); predictable scheduling; and opportunities for advancement for entry-level workers.

SDG&E should use this information in scoring contracts and solicitations. A contractor that demonstrates these attributes should receive additional points.

Similar provisions were included in the Charge Smart and Save settlement proposed in A.15-02-009:

> *All Smart Charge and Save contractors shall use their best efforts to reflect the communities PG&E serves in their hiring practices, including utilizing best practices to ensure maximum outreach and opportunities to disadvantaged communities to increase the pool of eligible candidates for employment for EV projects, including considering first-source hiring for projects in Disadvantaged Communities. The Program Advisory Council will also monitor and provide recommendations to contractors or subcontractors associated with the increase of hiring from Disadvantaged Communities, including best practices for hiring in Disadvantaged Communities.*

12. SDG&E Should Report on Relevant Program Metrics for Five Years After the Completion of Construction

SDG&E proposes to enroll customers over five years, and to share reports detailing program metrics with the Commission and stakeholders. SDG&E should clarify that the reporting requirements would remain in place for five years after the customer enrollment period is complete. Absent such an extension of the reporting period, the Commission and stakeholders will have no sustained visibility as to the performance of much of the infrastructure installed toward the end of the five-year construction period. Given the time required to build momentum

within such a large program, installations that occur toward the end of that five-year period could account for a very significant portion of total installations. Of course, some metrics (e.g. installation costs) will no longer be relevant after construction, but others (e.g. charging load profiles and station utilization) will be of continued value. Such information could also be needed to comply with Public Utilities Code § 740.12(c) (emphasis added):

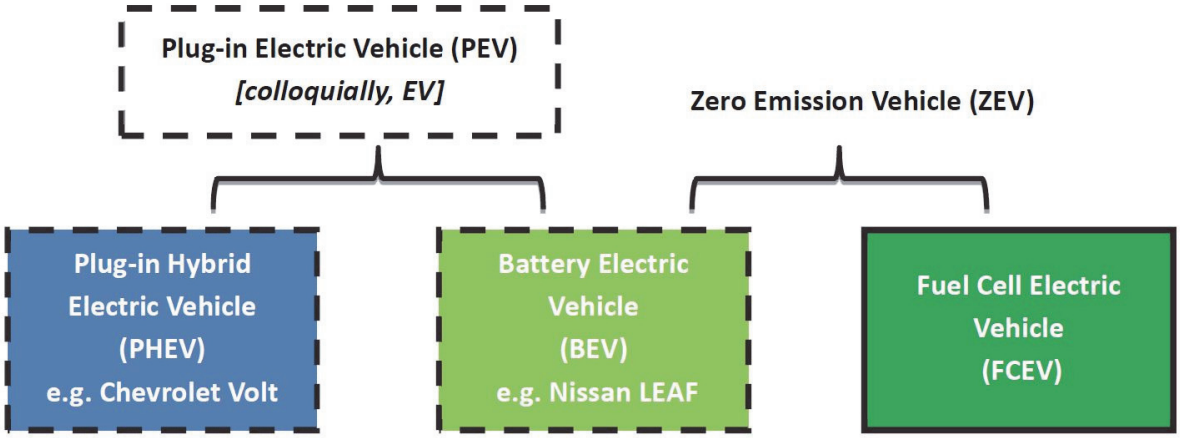
> *The commission shall review data concerning current and future electric transportation adoption and charging infrastructure utilization prior to authorizing an electrical corporation to collect new program costs related to transportation electrification in customer rates. If market barriers unrelated to the investment made by an electric corporation prevent electric transportation from adequately utilizing available charging infrastructure, the commission shall not permit additional investments in transportation electrification without a reasonable showing that the investments would not result in long-term stranded costs recoverable from ratepayers.*

To satisfy the first sentence of this sub-section, "data concerning…charging infrastructure utilization" should be available for the charging infrastructure made possible by the SDG&E program, including infrastructure installed toward the end of the construction period. The Commission should note that the second sentence of this sub-section does not apply unless "market barriers unrelated to the investment made by an electric corporation prevent electric transportation from adequately utilizing available charging infrastructure," but charging infrastructure utilization data would be needed to determine if that clause triggering an additional "reasonable showing" by utilities for future proposals is satisfied.

II. VEHICLE TECHNOLOGY AND TERMINOLOGY

Regrettably, the transportation policy space rivals the traditional utility policy world in its use of acronyms. Figure 1 harmonizes the categories of vehicle technology described in sources used in this testimony.

Figure 1: Vehicle Types



The utility proposals made pursuant to Public Utilities Code § 740.12 appropriately focus on plug-in electric vehicles (PEVs), commonly referred to as "electric vehicles" or "EVs," which can be charged with electricity from the electric grid. This includes both Battery Electric Vehicles (BEVs) that rely entirely upon electricity and Plug-in Hybrid Electric Vehicles (PHEVs) that rely upon electricity for daily driving needs, but use gasoline for longer trips. While PHEVs can be driven primarily on electricity, they are not referred to as Zero Emission Vehicles (ZEVs) because they have tailpipe emissions when operating on gasoline.

III. THE IMPORTANCE OF A TURN-KEY SOLUTION TO ADRESS THE CRITICAL RESIDENTIAL SEGMENT – WITNESS MAX BAUMHEFNER, NRDC

Please note that the testimony I provided on August 1, 2017, which focused on the relevant transportation electrification policy and statutory framework, the imperative to achieve widespread transportation electrification, and the potential for such to benefit all utility customers, is relevant to all three utility applications consolidated in this proceeding. For the sake of saving paper, I do not replicate that testimony in this document, but focus on considerations specific to SDG&E's Residential Charging Program. However, it should be clear my previous testimony is applicable to SDG&E's application, especially given passenger vehicles are the single largest source of greenhouse gas (GHG) emissions in California (alone accounting for more tonnes of GHGs annually than either the electric power sector or the industrial sector) and because overnight residential charging represents the single greatest

opportunity to increase the utilization of the electric grid to the benefit of all utility customers.[4] Likewise, the testimony provided by Joel Espino of The Greenlining Institute in the August 1, 2017 document is especially relevant to SDG&E's Residential Charging Program.

A. Accelerating Widespread Transportation Electrification Requires Addressing the Residential Segment

In her remarks at the workshop held on February 8, 2017, Commissioner Peterman rightly noted that, while results from previously authorized light-duty EV pilots should be used to inform future deployments in the workplace and larger multi-family context, we cannot afford to wait for those results before taking any further action to address the light-duty segment if we are to meet the goals specified in Public Utilities Code § 740.12. Simply put, you cannot "reduce emissions of greenhouse gases to 40 percent below 1990 levels by 2030 and to 80 percent below 1990 levels by 2050," as specified in § 740.12 without accelerating the adoption of light-duty EVs, and consumers will be unlikely to purchase plug-in vehicles if they cannot plug-in at home. Commissioner Peterman likewise noted that utility proposals should not be confined to demonstrably "failed markets" or demonstrably "underserved markets," but, in line with the directive in SB 350 (De León, 2015), should also look to "accelerate" the market where it is already occurring, e.g. the single-family and small multi-family segment. Restricting residential utility programs to the type of larger multi-family dwellings targeted by the previously authorized pilots would also undermine efforts to serve the considerable population in Disadvantaged Communities that lives in smaller multi-family and single-family units.

Unfortunately, only SDG&E has proposed a significant program to address the single-family and small multi-family segment. A gap could emerge in those critical segments in PG&E and SCE territory. Second generation vehicles, like the Chevrolet Bolt EV and the Tesla Model 3, promise to unlock pent-up consumer demand for longer-range vehicles and help realize the goals for a mainstream EV market established by the Charge Ahead California Initiative, but, to realize that promise, access to "Level 2" (240 volt) charging will be increasingly important at home. Drivers of shorter range first-generation BEVs or shorter range PHEVs can sometimes get by with "Level 1" (120 volt) charging, but they will be challenged to take advantage of longer-range vehicles without access to faster charging. Using GM's estimate of four miles per hour of

[4] Oak Ridge National Laboratory, *Transportation Energy Databook*, Edition 35, Table 1.16.

charging on Level 1, it would take nearly 60 hours to recharge a fully depleted Bolt EV.[5] The automaker is recommending Level 2 charging.[6]

Increasing the use of Level 2 EVSE in the residential segment will also be increasingly important to meet the directives of contained in SB 350 related to the integration of variable renewable resources and load management. Public Utilities Code § 740.12(a)(1)(G) specifies:

> *Deploying electric vehicles should assist in grid management, integrating generation from eligible renewable energy resources, and reducing fuel costs for vehicle drivers who charge in a manner consistent with electrical grid conditions.*[7]

SB 350 also established the relevant statutory standard of review for utility investments to accelerate widespread transportation electrification, specifying that it is in the interest of ratepayers for such investments to provide "improved use of the electric system or improved integration of renewable energy generation."[8] The flexibility provided by Level 2 charging will be increasingly important to meet those directives; daily driving needs can generally be met with Level 1 charging overnight, but the time required to do so provides little ability to modulate or shift charging to match grid conditions. However, the costs associated with purchasing and installing Level 2 equipment needed to fit charging within "off-peak" and "super-off-peak" windows can be prohibitive. In sum, would-be EV drivers are faced with a dilemma as to whether to incur the up-front expense to buy and install equipment needed to match EV charging to grid conditions and to provide the fuel cost savings that numerous surveys reveal are the most important motivator of EV purchase decisions.[9]

With the modifications recommended in Section I, SDG&E's program will address the significant up-front costs (both financial and behavioral) associated with purchasing and

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[5] https://www.chevyevlife.com/bolt-ev-charging-guide/#basic
[6] *Ibid.*
[7] Public Utilities Code § 740.12(a)(1)(G).
[8] Public Utilities Code § 740.8.
[9] Center for Sustainable Energy, *California Plug-in Electric Vehicle Owner Survey Dashboard*; Steele, David E., J.D. Power and Associates, "Predicting Progress: What We Are Learning About Why People Buy and Do Not Buy EVs," Electric Drive Transportation Association 2013 Annual Meeting, Washington, D.C., June 11, 2013; Maritz Research, "Consumers' Thoughts, Attitudes, and Potential Acceptance of Electric Vehicles," National Research Council meeting, Washington, D.C., August 13, 2013.

installing residential charging, and will also lower operational costs by encouraging charging during off-peak and super-off-peak periods when the grid is underutilized. This should accelerate widespread transportation electrification. The charging stations installed in this program will also allow drivers to take full advantage of the longer ranges of second generation EVs, displacing more petroleum, improving air quality, and reducing emissions of GHGs.

Safely installing charging stations in single-family homes and small multi-unit dwellings should address a significant cost barrier inhibiting the EV market and adoption of TOU rates that encourage charging when the grid is underutilized and are often necessary to deliver the fuel cost savings that motivate EV purchase decisions. Currently, 62 percent of SDG&E's EV customers are not taking service on TOU rates designed for EVs that encourage charging during times when the grid is underutilized.[10] The EV drivers who remain on default tiered residential rates have no incentive to avoid charging during hours when the grid is strained, and, because EV load will generally push them into the upper tiers, are not generally realizing the fuel cost savings that will be critical to achieve a mass market for EVs. SDG&E's program, with the modifications recommended in Section I, would ensure all participating customers have the opportunity to realize fuel cost savings if they charge in a manner consistent with grid conditions.

B. Residential Customers Need a Turn-Key Solution

My wife and I recently installed a Level 2 EVSE at our home to charge a used Nissan LEAF we purchased a few months prior, and were I not an environmental advocate focused on transportation electrification, we may not have completed the process. After researching and procuring EVSE independently, I identified a local electrician who had very good reviews on Yelp. After speaking with him on the phone, I sent him the marked-up image below so he would know what type of equipment his crew would need and to inform the estimate.

[10] Based on SCE's estimates included in the *5th Joint IOU Electric Vehicle Load Research Report*, December, 2016.

Figure 2: Max's EVSE Install Location

On the day of the install, I attempted to work from home, which was challenging with no electricity and no internet as a result. The installation should have been straightforward, given we have a new electrical panel that is located next to our driveway, and the 240V outlet could be installed within a few feet of the panel itself. Unfortunately, the crew installed conduit, wiring, and an outlet only certified for indoor use. A second crew returned the next day to uninstall everything and install conduit, wiring and an outlet certified for outdoor use. This required shutting off the electricity once again for most of the day, resulting in a second day of attempting to work without internet. The final bill exceeded the amount I was quoted originally. I complained, but was only given a minor cost reduction, and a promise for a discount on any future electrical work should I choose to hire the same company again (an unlikely event). In sum, if I did not have a professional obligation to drive an EV as a NRDC attorney and advocate, I may not have completed the process and would certainly have welcomed a turn-key solution

provided by my local utility. SDG&E's program, even as modified as recommended in Section I, should avoid those headaches mainstream consumers would likely find intolerable, and should accelerate widespread EV adoption by providing a turn-key solution for single-family homes and small multi-unit dwellings.

In 2015, the Commission denied a motion to impose the make-ready model upon all three utility light-duty EV pilots for reasons paralleling those stated in the response of the Alliance of Automobile Manufacturers, the Coalition of California Utility Employees, Environmental Defense Fund, General Motors, Honda Motor Company, The Greenlining Institute, NRDC, Plug-in America, and the Sierra Club to the motion: "It is far too early to mandate a single approach across all three service territories…Competing models should be evaluated openly to evaluate how to best accelerate the EV market to meet California's air quality and climate goals and to deliver benefits for all utility customers."[11] Early data from the implementation of the utility light-duty EV pilots suggests the Commission was wise to reject the call to test only a single model in 2015. There is reason to believe the make-ready model may not provide the turn-key solution needed to address barriers in certain market segments. Consider that multi-unit dwellings only account for five percent of site-hosts in Southern California Edison's (SCE) "Charge Ready" pilot, despite SCE's increased outreach to potential site-hosts in that segment.[12] In contrast, about a 30 percent of SDG&E's likely site-hosts in the "Power Your Drive" pilot, which includes utility ownership of EVSE, are multi-unit dwellings, suggesting that landlords would prefer for the utility to own and maintain the charging equipment and do not want to have to procure their own charging stations.[13]

Given professional building managers and owners of *large* multi-unit dwellings appear to require a turn-key solution, we can expect that success in addressing smaller multi-unit dwellings

[11] *See Joint Party Motion to Amend the Scope of the Rulemaking* ("Joint Motion") submitted by Marin Clean Energy ("MCE") and signed by California Energy Storage Alliance, Center for Sustainable Energy, Clean Coalition, Green Power Institute, Joint Minority Parties, Shell Energy North America (US), L.P.; The Utility Reform Network; and Utility Consumers' Action Network, April 13, 2015; *The Office of Ratepayer Advocates' Motion to Consolidate Proceedings and Implement its Alternative Proposal for Deployment of Investor owned Utility Electric Vehicle Infrastructure Pilots,* April 13, 2015; .*Response of Public Interest, Automaker, and Labor Groups to Motions to Consolidate Proceedings*, A. 14-04-014 and R. 13-11-007, April 27, 2015.

[12] SCE presentation, *Charge Ready Advisory Board*, May 19, 2017, p. 7.

[13] SDG&E presentation, *Power Your Drive Program Advisory Council Meeting*, March 14, 2017.

and single-family homes will require a seamless experience. While the modifications suggested in Section I would provide customers the option to own EVSE, as customers do in the make-ready Charge Ready pilot, SDG&E's program would still provide customers a turn-key solution, avoiding the hand-offs and multiple, sequential actions required in the Charge Ready pilot. SCE reports a majority of participants in that pilot fail to meet the 30-day deadline to independently procure EVSE, which is required before SCE will begin construction or issue rebates for EVSE. Customers report difficulties in finding charging station models that are close to the base cost rebates, changes in decision makers, a need to reevaluate program requirements, delays in the procurement process, and changes in vendor quotes after a customer signs the program agreement as reasons prompting requests for extensions beyond the 30-day deadline.[14] These complications would be avoided in the SDG&E program, even with the modifications recommended in Section I. Once a customer chooses his or her preferred EVSE, ownership, and rate option, the EVSE would be installed and activated safely in single step by SDG&E-dispatched electricians trained using the "Electric Vehicle Infrastructure Training Program," (electricians who cannot be readily identified by searching through Yelp reviews).

Rebate-only programs are also unlikely to provide the turn-key solution needed to accelerate widespread transportation electrification as required by SB 350. Los Angeles Water and Power has offered a rebate for residential customers to install EVSE since 2011; only 500-600 customers per year participate in the program. In 2011, the Indiana Utility Regulatory Commission approved a EV pilot program for the Northern Indiana Public Service Company that provides rebates of up to $1,650 for home charging stations for 250 customers and an electricity rider which modified the applicable residential tariff to allow for free charging overnight. In 2014, less than 250 rebates had been issued, and the utility filed to extend the pilot to 2017.[15] To meet the goals and requirements of Public Utilities Code § 740.12, transformative programs are needed. Likewise, regardless of program design, robust market education and outreach efforts will be required to ensure widespread customer participation needed to accelerate widespread transportation electrification.

[14] SCE Charge Ready Program Advisory Board Meeting, May 19, 2017.
[15] *Verified Direct Testimony of Cynthia C. Jackson*, Petitioner's Exhibit No. 1, Cause No. 44828, Northern Indiana Public Service Company, August 5, 2016.

IV. SDG&E'S GRID INTEGRATED RATE - WITNESS MELISSA WHITED, SYNAPSE ENERGY ECONOMICS

A. Overview of SDG&E's Proposed Residential Grid-Integrated Rate

SDG&E's proposed Residential GIR would apply to participants in its Residential Charging Program, and would be optionally made available to all customers.[16] The residential GIR would go well beyond the simple time-of-use (TOU) rates currently offered to residential EV customers, and instead would introduce a demand charge, hourly dynamic pricing, and circuit and system peak price adders. The GIR would consist of the following components:[17]

- Grid Integration Charge (GIC): a demand charge with a ratchet, ranging from $29 per month to $94 per month. The GIC would be based on a residential customer's annual maximum hour of demand outside of the super-off peak period.[18] The GIC is designed to recover all customer-related costs and 80 percent of distribution demand-related costs, while the remaining 20 percent would be collected through the dynamic adder for the top 200 circuit hours.
- Hourly Base Rate
  - Super Off-Peak: $0.07 + CAISO Day-Ahead Hourly Price
  - Other Times: $0.14 + CAISO Day-Ahead Hourly Price
- Dynamic Adders
  - System Top 150 Hours = $0.69
  - Circuit Top 200 Hours = $0.19

B. Concerns with SDG&E's Residential GIR

While SDG&E's proposed GIR is innovative, it represents a highly complex rate that is wholly unfamiliar to residential customers and could result in customers experiencing much higher bills, or simply declining to switch from their standard residential rate to an EV rate. Such an outcome would decrease the likelihood that customers will charge their vehicles in a manner that is beneficial to the grid, and could ultimately hinder widespread transportation electrification

[16] SDG&E, A.17-01-020, CF-25.
[17] Rates are rounded to the nearest cent. SDG&E, A.17-01-020, CF-26.
[18] The super off-peak period is defined as midnight to 6 a.m. on weekdays and midnight to 2 p.m. on weekends and holidays. (SDG&E, A.17-01-020, CF-20).

in the residential sector. Specific concerns with SDG&E's residential GIR are discussed below.

1. SDG&E's proposed GIR is Highly Complex

SDG&E's proposed GIR would represent a significant departure from current rates for residential customers. Not only would the rate have an hourly dynamic energy rate and peak adders, but it would also include a demand charge. Demand charges are conceptually new for most residential customers, and surveys have found that the concept of demand charges are not well-understood and frequently raise concerns from customers.[19] The Commission recently declined to implement demand charges for residential net metering customers, noting that "demand charges can be complex and hard for residential customers to understand."[20]

Where residential demand charges have been implemented, enrollment tends to be very low, indicating low levels of customer acceptance. Of the 24 other examples of demand charges that have been applied to residential customers in the United States on an opt-in basis, most have enrollment below 1 percent,[21] despite existing for multiple years and customer marketing efforts.[22]

Because demand charges are new and unfamiliar to residential customers, it is unlikely that SDG&E's GIR will be widely embraced by customers. If offered as the only rate to customers wishing to enroll in SDG&E's residential charging program, the GIR could have the

[19] Recent surveys indicate that approximately 50 percent of residential customers do not understand the terms "kW" and "kWh". *See:* LeBlanc, Bill. "Do Customers Understand Their Power Bill? Do They Care? What Utilities Need to Know." Blog summary of E Source Survey. January 21, 2016. *https://www.esource.com/email/ENEWS/2016/Billing*

Further, focus groups in Ontario found that the concept of maximum use during peak hours "is difficult for people to understand and raised concern among a few. There is no template for measuring maximum use that people are used to in the way they understand TOU." Customers also expressed concerns regarding fairness, specifically that "that small lapses in their conservation efforts will mean they will have to pay a high price". *See:* Gandalf Group, Ontario Energy Board Distribution Charge Focus Groups Final Report, October 9, 2013("Gandalf Report"), available at : http://www.ontarioenergyboard.ca/oeb/_Documents/EB-2012-0410/Appendix percent20B percent20-percent20Gandalf percent20Distribution percent20Focus percent20Groups.pdf at p. 9.

[20] California Public Utilities Commission, Decision 16-01-044, Decision Adopting Successor to Net Energy Metering Tariff, Rulemaking 14-07-002, January 28, 2016, p. 75.

[21] Rocky Mountain Institute, *A Review of Alternative Rate Designs*, May 2016 ("RMI Review"), at p. 72.

[22] For example, Alabama Power Co. has enrollment levels far below 1 percent, despite marketing efforts and having had the program in place for more than four years.

perverse effect of discouraging customers from enrolling in the program.

2. The Step Function Design of the GIC Would Result in Inequitable Bill Impacts for Customers Who Briefly Exceed Specified Thresholds

As designed, the GIC does not increase in a smooth, continuous fashion. Instead, the GIC segments customers into bins based on maximum annual demand, which results in a step change in the GIC as customers cross thresholds between bins. Because of this, similar customers will experience large differences in their bills, depending upon whether their annual peak usage falls just above or below a bin boundary.

Maximum kW Demand	GIC ($/Mo)	Annual GIC	Annual Bill Change from Moving to Larger Bin
0 - 3	$29	$354	
3 - 6	$48	$577	$223
6 - 9	$67	$799	$223
9 +	$94	$1,133	$334

For example, a customer who, for one hour, reaches a maximum demand of 6.1 kW would pay $223 more annually than a customer with a demand of 5.9 kW. Such dramatic differences in bills between two otherwise similar customers raises serious concerns regarding equity and fairness.

3. SDG&E's Residential Charging Program Would Likely Lead to High GICs

Under SDG&E's proposed GIR, a customer's bill would be largely dependent upon their maximum annual demand.[23] Because SDG&E's proposed residential charging program would cover the cost of a Level 2 EVSE, (with a demand of up to 7 kW by itself), it virtually ensures that customers in the program would fall into the second-highest bin (with a monthly GIC of $67), since it is reasonable to expect that customers will occasionally charge outside of the super off-peak period. Moreover, having set a peak demand of 7 kW, a customer would not be able to

[23] When fully implemented, on average, more than 70 percent of the customer's annual electricity bill for their EV charging would be recovered through the GIC (based on an analysis of a sample of 30 current EV-TOU customers' load profiles provided in response to NRDC DR03 - Q1.

reduce their demand for at least 11 subsequent months, as discussed in the following section.

4. The Demand Ratchet Would Result in a Single Hour of Peak Demand Setting a High Fixed Charge for at Least a Year

The proposed Grid Integration Charge is designed as a demand ratchet, where a customer's maximum annual peak demand during any single hour would determine the monthly GIC that the customer will pay for at least the following 11 months.

Demand ratchets are problematic for several reasons. First, under a demand ratchet, the GIC would essentially operate as a fixed charge, as a customer must maintain a lower demand level for a full year before the customer would experience a lower demand charge. Once established, the GIC would offer little incentive for customers to reduce demand below their annual peak, even if it would be beneficial to the system to do so, since savings from reducing demand below the customer's peak would not be realized for up to 11 months.

In other words, a ratchet would both significantly delay bill savings and make it extremely difficult for a customer to actually achieve bill savings, since a single charge could undo 11 months of a customer's efforts to reduce demand. As such, customers may very well choose to ignore the GIC's intended price signal to charge only during super off-peak periods.

Second, demand ratchets also excessively penalize customers who experience brief equipment failures. Under such a scenario, a customer could face an entire year of high demand charges due to a brief spike in demand, despite the fact that a single customer's temporary demand spike would likely have little impact on the distribution system.

Third, for customers with a solar PV system, the whole-house demand ratchet may reduce incentives for customers to install storage technologies. Ratchets penalize customers whose demand varies substantially from month-to-month. Customers with solar PV and storage may be especially penalized, as they are likely to have low demands during the summer months, but higher demands during the winter months. This is due to the solar PV being used to reduce demand during daylight hours, and the storage system being able to charge during the day and reduce demand during the other hours. By basing a demand charge on a customer's maximum annual demand rather than monthly demand, a demand ratchet would charge a customer with solar and storage technology based on their winter demand, and would not recognize that the

customer has low demands during the summer when the system tends to be most stressed. In this way, the GIC is likely to reduce customer investments in storage and reduce the use of existing storage systems.

5. The GIC Overly Emphasizes Customer Non-Coincident Demand

SDG&E's proposed GIR seeks to recover 80 percent of demand-related costs through the GIC. However, the GIC is based on customer individual non-coincident demand outside of super off-peak hours, regardless of whether that demand occurs during hours in which the system is stressed. This is largely inconsistent with the manner in which costs are incurred on the system, particularly for residential customers who share the vast majority of distribution system equipment.

Distribution system capacity upgrades are primarily driven by the local peak demand of each circuit and substation, and may include transformer additions, reconductoring circuits to larger wires, adding additional circuits, or even adding new substations.[24] In docket A.15-04-012, SDG&E stated that it designs its distribution facilities "to meet the peak demand for that portion of the distribution system which serves customers located in the specific area."[25] The average SDG&E circuit serves well over 1,000 customers and has a peak demand of more than 5 MW.[26] It is the combined demands of these customers that drive circuit peaks and substation peaks, rather than individual customers' non-coincident peak demands during other hours.

In order to provide a price signal that reduces stress during circuit peak hours, rates should encourage customers to shift their demand away from local peak hours. SDG&E's residential circuits currently tend to peak during summer afternoons and evenings. Based on data for circuits primarily serving residential customers for 2014 through 2016, approximately 85 percent of the top ten hours occurred from hour 13 to hour 22. The timing of these top 10 hours is shown in the heat map below.[27]

[24] For example, an analysis by Southern California Edison identifies 60 percent of its demand-related costs as driven by peak loads, rather than non-coincident demand. SCE transportation electrification testimony, Appendix E, page E-29

[25] Prepared Direct Testimony of John Baranowski in Support of Second Amended Application, February 9, 2016, pages JB-1 – JB-2.

[26] Analysis of data provided in response to NRDC-01-04 and NRDC-02-02.

[27] *Id.*

Figure 3: Heat Map of Frequency of Top 10 Hours for Each Circuit (2014-2016)

	Month											
Hour	1	2	3	4	5	6	7	8	9	10	11	12
1	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	1	-	-	-	-
8	-	-	-	-	-	-	1	1	-	-	-	-
9	1	1	2	1	-	2	3	4	3	-	-	4
10	1	1	1	2	1	4	9	16	17	-	1	2
11	-	-	-	1	1	13	26	31	48	1	3	-
12	-	-	1	1	2	37	45	65	80	-	1	-
13	-	-	-	1	2	62	135	128	134	2	3	-
14	-	-	-	1	1	91	254	209	187	2	3	-
15	-	-	-	-	1	100	325	248	188	-	2	2
16	-	-	-	1	1	112	351	297	196	-	2	-
17	-	-	-	1	-	110	345	335	242	1	3	2
18	12	1	-	-	-	85	257	234	266	1	7	41
19	62	9	1	1	-	18	109	85	384	-	8	99
20	37	7	1	-	-	11	100	132	266	-	1	70
21	7	2	-	-	-	3	41	31	101	-	2	32
22	3	1	-	-	-	-	2	1	8	-	2	2
23	-	-	-	-	-	-	-	-	-	-	2	-
24	-	-	-	-	-	-	-	-	-	-	-	-

Note: Limited to circuits with 50 percent or more residential customers.

As proposed, the GIC largely fails to take into account the timing of a customer's demand and its coincidence with circuit peaks (other than exempting demand during the hours of midnight to 6 am). Since the demand ratchet is based on a customer's maximum demand on any day of the year during almost any hour, the GIC provides little incentive for customers to reduce demand when it matters most—during summer afternoon/evening hours. Because of this, the GIC provides a less efficient price signal relative to a rate that concentrates the price signal during local peak hours (such as SDG&E's proposed adder for the top 200 circuit hours, or a time-of-use rate).

C. To Comply with Public Utilities Code § 740.12, the Commission Should Revise SDG&E's Proposed Residential Rate

To address the issues described above, we recommend the following modifications to SDG&E's proposed Residential GIR:

1. SDG&E Should Offer Customers Rate Options and Suggest Optimal Rate Choices

Because SDG&E's proposed GIR is a complex rate that is unfamiliar to most residential customers, without modifications to prevent undue bill impacts, it could dissuade customers from enrolling in SDG&E's residential program. To mitigate this complexity, residential customers should be able to choose between multiple rates to ensure that they can enroll in a rate that best matches their ability to understand and respond to the price signals. Customers should have the choice between a whole-home Grid Integrated Rate (GIR), a whole-home time-of-use (TOU) rate, an EV-only GIR, and an EV-only TOU rate. Further, during the customer intake process, SDG&E should conduct customer-specific bill analysis to suggest the optimal rate option under the customer's current consumption patterns, and ways the customer could save money if he or she switched to a new rate and modified his or her consumption patterns.[28]

2. The GIC Should be a Continuous Function based on Monthly Demand

The current use of demand bins for determining a customer's GIC would result in a customer's annual electricity bill increasing by several hundred dollars when a customer crosses a bin threshold. To avoid significant bill-impacts associated with arbitrary thresholds, any demand charge should be implemented as a continuous function ($/kW) and not in "bins."

3. The Ratchet Feature Should be Eliminated

The demand ratchet would effectively operate as a fixed charge and would be highly punitive for customers who experience a rare demand spike. Instead of basing the GIC on the customers' single highest hour of demand during a 12-month period, any demand charge should be reset monthly.[29] This will help customers experience more immediate impacts from reductions in their demand, providing a much more effective price signal. In addition, the financial consequences of a single demand spike will be less extreme, thereby reducing the risk that customers will experience rate shock.

[28] See, for example, Arizona Public Service's "Shift, Stagger, and Save" website: https://www.aps.com/en/residential/savemoneyandenergy/shiftstaggersave/Pages/home.aspx?src=shiftstaggersave

[29] A demand ratchet allows the demand charge to be increased due to higher demand in a month, but does not allow the demand charge to decrease due to lower demand in a subsequent month. In other words, there is a ratcheting effect that locks in higher charges for 12 months.

4. The Magnitude of the GIC Should be Reduced

SDG&E's proposed GIC would recover 80 percent of demand-related costs through a non-coincident demand charge. However, most distribution system equipment serves many customers, and is designed to meet the combined peak demand of those customers, rather than being driven by any one customer's non-coincident peak demand.[30] To better align with cost-causation and the requirements of Public Utilities Code § 740.12, the magnitude of the demand charge that is based on non-coincident peak demand should be significantly reduced.

5. A Larger Proportion of Demand-Related Costs Should be Recovered during Peak Hours

To better reflect the inherent time-related nature of distribution peak demands and to provide customers a more actionable incentive to reduce demand when it matters most, a larger proportion of costs should be recovered during peak hours. As discussed above, recent data show that residential distribution circuit peaks currently tend to occur during summer afternoon and evening hours. This implies that the GIC should either be restricted to a smaller number of hours, or be set higher during summer peak hours than during the rest of the year (e.g., $6/kW during summer peak hours, but $2/kW the rest of the year). Alternatively, the GIC should be set very low (e.g., $2/kW), and more demand-related costs should be recovered through time-varying energy rates (such as the proposed peak adders).

V. EV CHARGING COMPANY SUPPORT FOR SDG&E'S PROGRAM AND RECOMMENDED MODIFICTIONS - WITNESS CHRIS KING, SIEMENS

A. Introduction

Siemens offers testimony in this proceeding in support of California's transportation electrification (TE) goals and in support of SDG&E's proposal to provide residential electric vehicle supply equipment (EVSE). Siemens was the world's first large industrial corporation to commit to zero net carbon emissions by 2030. Siemens's position is that TE is essential for decarbonizing the economy and achieving California's GHG targets.

Our testimony focuses on residential charging, where 80 percent to 90 percent of EV

[30] *See, for example:* Jim Lazar, "Use Great Caution in Design of Residential Demand Charges," *Natural Gas & Electricity*, February 2016, available at https://www.raponline.org/document/download/id/7844, p. 19: "NCP [Non-Coincident Peak] demand is not relevant to any system design or investment criteria above the final line transformer, and only there if the transformer serves just a single customer."

charging occurs[31] and where we believe 80 percent of EV owners will want to have Level II chargers.[32] Our testimony recommends the following:

- The most important strategy for achieving California's TE goals is to minimize for consumers and businesses the costs of owning and operating electric vehicles.
- A key path for maximizing the benefits and minimizing the costs of TE is to leverage the full assets and capabilities of electric utilities.
- SDG&E should be permitted to own residential Level II EVSEs.
- SDG&E's proposed Grid Integrated Rate should be adopted with the modifications recommended by Melissa Whited in Section IV, and consumers should be able to select each tariff option as either whole home or EV-only, as recommended in Section I.
- The Commission should allow use of metering capability within EVSEs for use in billing of EV-only rates.
- SDG&E should require that all EVSEs include both metering capability and networking (communications) and use open standards.

B. Siemens offers a wide range of TE products and services and strongly supports California's GHG reduction targets.

Siemens is a global powerhouse in technology, infrastructure, and services, offering a wide variety of technology solutions to a broad spectrum of customers. Relevant to TE, our technologies include:

- hardware and software for charging light, medium, and heavy duty vehicles;
- software and services, including smart phone apps, for managing charging and engaging electric vehicle and electricity customers;
- make-ready equipment ranging from transformers to service drops;
- utility software to plan, operate, and manage the grid, including integrating EV charging into system operations;

[31] - Bloomberg New Energy Finance (BNEF), "Long-Term Outlook for EV Adoption," Webinar, August 2, 2017.
[32] - Our 80 percent estimate is based on our experience in selling EVSEs directly to residential consumers, our participation in various residential charging programs, and our research.

- software to run transmission grids and wholesale electricity markets;
- battery storage and microgrid systems for DC fast charging installations; and
- building management and operations software that can integrate EV charging operations.

We operate in over 180 countries and spend over $5 billion annually on research and development, including substantial amounts on TE-specific technologies.

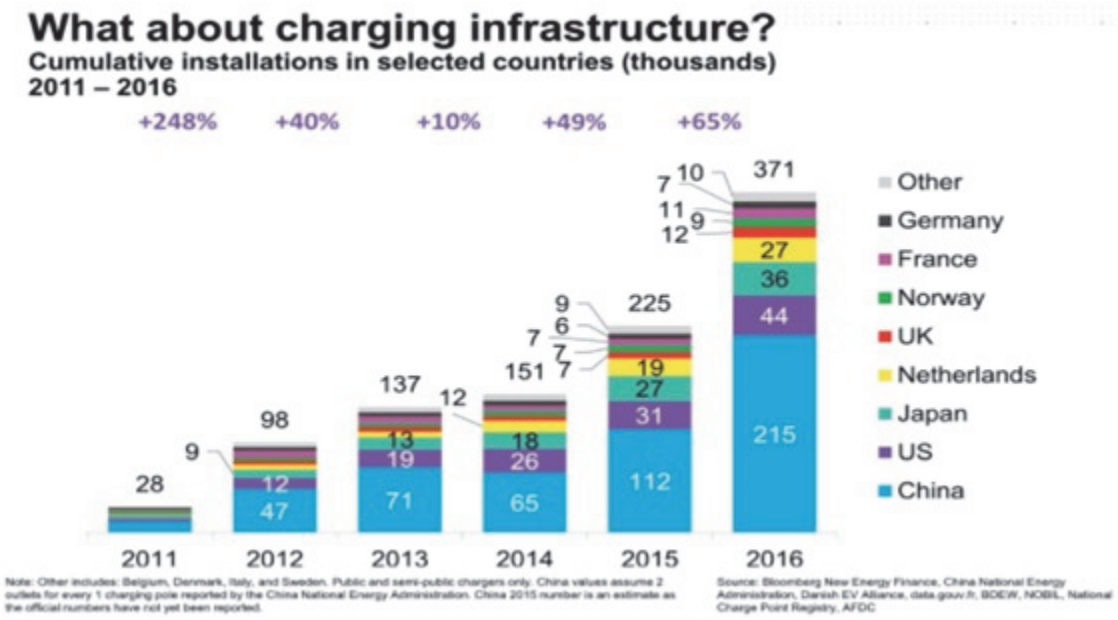
Our customers span a wide range of participants in the TE ecosystem. We sell to utilities, federal and state governments, cities, site owners (both residential and commercial, including for workplace charging), transit authorities, non-utility charging network providers, and others.

C. There needs to be a sense of urgency to achieve California's TE and GHG targets.

While California and the U.S. are leaders in EV adoption, the state and country lag in charging infrastructure deployment as illustrated in Figure 4. In addition, the consumer experience in terms of ease and cost of implementation of EVSEs (in addition to other factors such as model availability) must be dramatically improved, and rapidly – because the annual EV share of vehicles sold in California must grow by an incredible 422 percent to meet the state's 2020 one million EVs target.[33] The Air Resources Board's 2030 target requires even more aggressive growth. According to GreenTech Media, "Electric Vehicles may never reach their full potential without a clear focus on infrastructure."[34] SDG&E's proposal would dramatically improve the consumer experience regarding home charging and is in direct support of meeting California's targets.

[33] - From a market share of 2.7 percent in 2017 to 14.1 percent in 2020.
[34] - GTM, May 9, 2017.

Figure 4: Cumulative Charging Infrastructure by Country



D. The most important strategy for achieving California's TE goals is to minimize for consumers and businesses the costs of owning and operating EVs.

There are several barriers to EV adoption, but the most important barrier is the total cost of ownership – the purchase price and the cost of operation. A comprehensive study of fiscal incentives recently found that, "larger market penetration can only be achieved if EVs become price competitive [with internal combustion engine vehicles]."[35] By adopting proposals such as SDG&E's residential EVSE program (including its rate and grid integration elements with the modifications recommended in Section I), the Commission has the ability to reduce the cost of operation and maintenance and, therefore, drive cost attractiveness.

E. A key path for maximizing the benefits and minimizing the costs of TE is to leverage the full assets and capabilities of electric utilities.

As the legislature recognized in SB 350, electric utilities are uniquely positioned to help drive EV adoption and help achieve California's ambitious TE goals. We agree with the Commission's adopted policies in D.14-12-079 that electric utility participation in the market should not be anti-competitive.

[35] - Petra Levay et al., "The effect of fiscal incentives on market penetration of electric vehicles: A pairwise comparison of total cost of ownership," Energy Journal, June 2017.

In considering the TE applications in this proceeding and to maximize the state's chances of achieving its TE goals, the Commission's first goal – in the context of D.14-12-079 – should be to determine how best to leverage utility assets and capabilities to maximize benefits and minimize costs of TE. Those assets and capabilities have different relevancy in different EV charging contexts, such as home, workplace, public, fleets, and so on. Here we focus on home charging, the subject of SDG&E's proposal.

1. California needs to fully leverage utility assets and capabilities to maximize the benefits associated with EV ownership and operation to animate the market.

EVs offer the obvious benefit to their owners (or operators) of providing transportation and to society of reducing GHG and other air pollution. However, EVs also offer important benefits (or can impose additional costs) to the electricity grid, wholesale electricity markets, and integration of both centralized and distributed renewable generation. For the grid, EVs can provide peaking capacity and, thus, act as a non-wires alternative to traditional grid reinforcement when there is a need for additional capacity. For wholesale markets, EVs can provide peaking capacity and ancillary services such as imbalance energy. For renewable generation, EVs can reduce curtailments by using wind and solar energy at times of abundance (overgeneration). We refer to these as the full value stack of EV benefits.

These benefits are widely recognized, but there is less discussion of how to capture the benefits. Capturing the full value stack requires:

- an end-to-end integrated system approach that is only possible via the active involvement and participation by the utility;
- seamless, low-cost, reliable, and efficient integration of EV charging data and operations with utility planning, operational, business, and customer systems; and
- a robust connection with the CAISO operational and market systems.

Utility planners can minimize their grid investment requirements if they know where and when EV charging loads are occurring and how those loads will grow over time. Utility operators can maintain reliability by having the same information in near real time, as well as the ability to either control such charging or accurately predict how EV owners (or their third-party service providers) will control such charging in response to price signals. Utility customer engagement and charging management software can send price or control signals to smart phones and directly to EVSEs (or

third party service providers), as well as allow consumers to program their charging preferences. Utility meter data management systems can use the data from chargers to disaggregate consumption – at the interval level – of EVSEs from the whole house to enable application of separate tariffs to the home and the EV. Utility billing systems can use this disaggregated data to calculate bills for EV-only tariffs, incentive payments for demand reductions during peak times, and other financial incentives adopted by the Commission. Utility rate designers can use the data to develop rates that enable EV owners to minimize the cost of charging by taking advantage of low-cost wholesale rates, especially during times of abundant wind and solar power. And because these rates can be EV-only by disaggregating the whole house data, customers can keep their preferred rate for their other-than-EV consumption. Utility demand response program operators can use the EV data to bid peak demand reductions and ancillary services into the CAISO market. The examples cited above are not exhaustive.

2. California needs to fully leverage utility assets and capabilities to minimize the costs associated with EV ownership and operation to animate the market.

Utilities also have important assets and capabilities to reduce the total cost of ownership (TCO) – buying, owning and operating EVs. Of course, capturing the full benefits as described above directly reduces operating costs by minimizing electricity costs, including costs that might otherwise be required to reinforce the grid. Utilities can greatly reduce costs in three key areas: asset ownership and maintenance, EVSEs, and the consumer experience. They can have the greatest ability to reduce these costs when they own EVSEs. Again, our context is residential home charging, though many of these concepts apply more broadly.

A core competency and central business model element for utilities has always been asset ownership and maintenance. They specialize, in part, in the distribution grid, which consists of very large numbers (millions) of widely dispersed devices that must operate safely and reliably with low maintenance costs for periods of decades. EVSEs are exactly this type of asset and, in fact, have many features in common with smart meters (data recording, communications, electronics in harsh environments, etc.). Utilities have the necessary expertise, business processes, and software for deploying, managing, and maintaining these assets. Utilities can achieve scale economies in borrowing, maintenance personnel and systems, customer base, and other areas to that minimize EVSE deployment, ownership, and maintenance costs. Utilities have access to low cost capital. They have the ability to depreciate the assets over long periods of time, because they

have long-standing franchises and investors whose expectations are consistent with lengthy depreciation periods. Utilities have the ability to redeploy assets such as EVSEs, if needed, to other customers, because they have very large, diverse, and lasting customer bases. So if a utility installs an EVSE for a consumer who then moves out of state or sells their EV, the utility can more easily take the EVSE and install it elsewhere – keeping the ratepayer-funded asset used and useful. (Alternatively, the utility could be part of a policy of having a Level II charger installed at every residential premise over a long period of time as is planned in the European Union.[36]) On the maintenance side, utilities have existing field personnel and mobile workforce management systems to provide reliable and efficient services across a widely dispersed service territory. These maintenance capabilities not only reduce costs but also ensure that consumers relying on their EVSE for charging will have rapid and high quality response to a service need – an essential element of California policymakers providing consumers with the comfort they need to fully rely on an EV as their sole transportation source.

Utilities can play a major role in reducing EVSE costs as well. One way is by procuring larger quantities of EVSEs. Quantity discounts enabled by large scale utility purchases reduced smart meter costs by two thirds virtually immediately.[37] Today's EVSE purchases are in the quantities of up to hundreds; SDG&E's proposal would increase that level to potentially tens of thousands. Another way is through standardizing functionality. We expect EVSEs to continue to have diverse features, so customers should have the ability to choose from a range of utility-qualified products as proposed by SDG&E. However, just as all home networks run on WiFi, all EVSEs should have common communications capabilities (probably WiFi with cellular as an option). In addition, all EVSEs should have the metering capability of recording consumption in intervals of one hour or less and sufficiently accurate to allow billing of EV-only tariffs. These standard features allow for interoperability – a key requirement for cost reduction – and reduced risk of obsolescence. Our goal here is not to specify all the standards but instead to make the point that such standards are essential to both short- and long-term cost reductions.

Utilities can also play a major role in minimizing consumer experience costs, a major

[36] - Yale Environment 360, "European Union Could Require New Homes to Have Electric Car Chargers," October 11, 2016. Available at http://e360.yale.edu/digest/european_union_require_new_homes_electric_car_charging_stations

[37] - Personal experience in three decades of experience with advanced and smart meters.

barrier to EV adoption.[38] For example, utilities can play a key role in substantially reducing concerns and uncertainties for consumers when buying an EV. There are many questions in which the utility is not involved that relate to a specific vehicle's features and performance, but the utility can assist by being the trusted energy adviser regarding the home EVSE. Where the utility manages the solution, as proposed by SDG&E, the consumer can rely on the utility's experience, expertise, longevity, service delivery capability, service reliability, and other strengths in providing and maintaining the EVSE. The consumer can rely on the utility's objectivity in qualifying EVSEs, estimating EV charging costs, helping manage EV charging hours for time-varying rates, and so on. The consumer's goals relative to EVSEs are simplicity, reliability, safety, and efficiency (low cost), goals that are well served by the utility being the asset owner and maintainer (in SDG&E's proposal, the consumer can choose an alternate maintainer, which is a good option to make available as well). Where the utility provides the home EVSE solution, as proposed by SDG&E, there is a benefit for the sale of EVs as well. The National Research Council found that car salesmen have little expertise and even less desire to discuss EVSE requirements with EV buyers.[39] This is a critical step in the buying process – which needs to be managed effectively to close the sale. The answer to the EVSE question, "Call your local utility, and they will take care of it," is a compelling one for both consumers and car dealers, overcoming a major barrier to EV adoption.[40]

F. SDG&E should be permitted to own residential Level II EVSEs

Siemens supports the utility ownership option for the reasons given above, because the proposal is consistent with CPUC policy and SB 350, and because it is an essential step in the necessary market animation for California to achieve its TE goals.

[38] - "Finding: Most potential PEV customers have little knowledge of PEVs and almost no experience with them. Lack of familiarity with the vehicles and their operation and maintenance creates a substantial barrier to widespread PEV deployment." in "Overcoming Barriers to Electric-Vehicle Deployment," National Research Council, 2013.

[39] - O*p. cit.,* National Research Council, 2013

[40] - "The main barriers to the widespread adoption of residential charging of PEVs appear to be the cost and the effort of installing the wiring and charging apparatus." in *op. cit.,* National Research Council, 2013.

G. SDG&E's proposed Grid Integrated Rate should be adopted with the modifications recommended by Melissa Whited in Section IV, and consumers should be able to select each tariff option as either whole home or EV-only, as recommended in Section I.

Siemens supports SDG&E's goals of encouraging charging at the lowest-cost times, allowing EV owners to reduce their TCO, a key factor in promoting EV adoption, and supports the modifications recommended by Melissa Whited in Section IV that would ensure EV drivers who charge in a manner that supports the grid have the opportunity to realize operating cost savings. EVs or chargers can generally be programmed to charge at only certain times or even in response to broadcasted price signals, so aligning charging with low-cost periods can be done easily and conveniently by EV owners. Another principle with which we agree is including an option in which tariffs are separately metered for the EV, as recommended in Section I. Siemens has managed or participated in the management of time-varying rate (TVR) programs for residential consumers in different states and countries, including California. We have found strong customer interest in TVR but also that many customers have concerns about TVR. Such customers would happily sign up for TVR, often including hourly pricing, for their EV, but may be reluctant to do so for their whole premises. Separately-metered tariffs allow the Commission to approve tariffs for EVs that best align with the Commission's goals.

In sum, Siemens endorses the modifications to SDG&E's proposed GIR recommended by Melissa Whited in Section IV to allow consumers who charge in a manner consistent with grid conditions the opportunity to realize fuel cost savings and the recommendations included in Section I that would allow customers to choose between whole-home and EV-only rates.

H. The Commission should allow use of metering capability within EVSEs for use in billing of EV-only rates.

We recommend that the meter in the EVSE be accepted as approved for use in measuring EV-charging consumption and for calculating bills for a tariff applied only to the EV. This approach is typically less than one-tenth the cost of installing a separate meter, including the necessary wiring, conduit, meter box, and meter. Of course, such a meter would have to meet accuracy requirements established by SDG&E.

I. SDG&E should require that all EVSEs include both metering capability and networking (communications) and use open standards.

Siemens recommends that all EVSEs have metering capability. This will maintain future flexibility for consumers and reduce the risk of EVSE obsolescence, an important consideration for an electronic device that may well be used for 10 years or more. Other reasons to require this functionality are because many EVSEs already have metering capability and because the data associated with charging has many benefits beyond simply calculating the bill. These benefits are described in Section V(E).

Likewise, as recommended in Section I, to ensure customers who choose to take service on a dynamic rate can respond to hourly price signals, SDG&E should only qualify networked EVSE capable of responding to dynamic price signals. Specifically, EVSEs should have open standards-based communications capability to receive and send data. As with the metering capability, the reasons are to maximize the ability of EVSEs to capture the full benefits available, to retain future flexibility for consumers, and to reduce the risk of EVSE obsolescence. Data to be sent to EVSEs includes price signals, control signals, programming parameters (when to charge, etc.), and updates to EVSE firmware. Data to be received from EVSEs includes interval consumption, state of charge of the EV, and alerts. A minimum data set should be specified so that a robust range of functionality is available. However, the required data set should be as small as possible so as to prevent unnecessary costs. In addition, EVSE providers should not be restricted from adding any additional optional data to differentiate or add value to their equipment. Similar concepts have been used in the specification of smart meters. In addition to standardized data sets, the communications networks should be standardized to minimize cost. WiFi is used in all home computer networks and, thus, a good option for EVSEs. WiFi in EVSEs would allow for connection to home networks and, via the home router, to the Internet and back to the utility and/or third party service provider. Cellular is a good option where WiFi is not available or for other reasons, but is far more costly and should be an add-on option.

VI. CONCLUSION

With the modifications recommended above, SDG&E's Residential Charging Program and associated rates would meet the relevant statutory and regulatory criteria and should be approved.

Dated: August 7, 2017

Respectfully,

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Attachment A: Statement of Qualifications for Max Baumhefner

Max Baumhefner is an attorney and expert in clean vehicles and fuels, within the *Energy and Transportation Program* of the Natural Resources Defense Council (NRDC) based in San Francisco. Since joining NRDC in 2010, his focus has been on policies to accelerate the electrification of the transportation sector and to ensure the efficient integration of electric vehicles into our nation's utility system. Mr. Baumhefner has testified and presented on energy issues before the California State Legislature, the California Energy Commission, the California Public Utilities Commission, and the California Air Resources Board. He holds a bachelor's degree from Pomona College and a Juris Doctor from Boalt Hall at the University of California, Berkeley.

Attachment B: Statement of Qualifications for Melissa Whited

Melissa Whited is a Principal Associate at Synapse Energy Economics, where she has worked extensively on issues related to utility regulatory models, rate design, and policies to address distributed energy resources (DER). In the rate design arena, Ms. Whited's work focuses on the development of rate designs that effectively balance the fundamental principles of revenue sufficiency, fair apportionment of costs, and efficiency of use. She has authored numerous reports and testimony regarding the impacts of fixed charges and demand charges on low-income customers, customers with distributed generation, and the ability of states to achieve their energy policy goals. Ms. Whited has testified on rate design matters before the Massachusetts Department of Public Utilities, the Texas Public Service Commission, and the Public Service Commission of Utah. In addition, she has filed testimony on performance-based regulation and market power before the Hawaii Public Utilities Commission and the Federal Energy Regulatory Commission, respectively. Ms. Whited holds a Master of Arts in Agricultural and Applied Economics and a Master of Science in Environment and Resources, both from the University of Wisconsin-Madison.

Attachment C: Statement of Qualifications for Chris King

My name is Chris King. I am employed by Siemens as the Chief Policy Officer of the Digital Grid business unit. My business address is 4000 E. Third Ave., Foster City, CA 94404. My current responsibilities include leading global policy and strategy initiatives on behalf of Siemens for electric utility digitalization and automation, especially related to distributed energy resources, and including transportation electrification. I have been employed in the electricity industry for over three decades at Pacific Gas & Electric Company, three Silicon Valley start-up companies in the advanced metering and software space, and, for the past five years, Siemens. I have extensive experience in rate design, energy efficiency, demand response, advanced metering, consumer engagement, and retail competition. I have testified on these matters before the California Public Utilities Commission, the California Legislature, the Energy and Commerce Committee of the U.S. House of Representatives, and other state regulatory commissions and legislatures. I hold Bachelor and Master of Science degrees in Biological Sciences from Stanford University, a Master of Science, Management from the Stanford Graduate School of Business, and a J.D. from Concord Law School. I have been awarded three smart meter and smart grid patents.