PREPARED TESTIMONY OF
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ADDRESSING SOUTHERN CALIFORNIA EDISON’S CHARGE READY 2
ELECTRIC VEHICLE INFRASTRUCTURE PROPOSAL

Submitted on Behalf of

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I. INTRODUCTION AND OVERVIEW OF TURN’S PRIMARY RECOMMENDATIONS

Pursuant to the October 29, 2018, “Scoping Memo and Ruling of the Assigned Commissioner” and ALJ Goldberg’s November 2, 2018 “Email Ruling Granting Joint Motion for Extension of Time on Testimony Deadlines,” TURN respectfully submits this testimony addressing Southern California Edison’s (SCE’s) Charge Ready 2 electric vehicle (EV) infrastructure proposal. SCE proposes to deploy 48,000 ports in its territory, composed primarily of a make-ready program for workplace, public, and multi-unit dwelling (MuD) sites (32,000 ports) and a new construction rebate program for MuDs (16,000 ports). The direct costs of the program are about $760 million, a total revenue requirement of $1.8 billion.

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1 TURN uses the term “EV” in this testimony to generally describe any type of electric vehicle that can run on electric grid-generated electricity (e.g., both plug-in hybrids and pure battery electrics). Where necessary, we do distinguish between battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs).

2 Nominal dollars. TURN-08, question 2, attachment 1.
Please note SCE’s marketing, education, and outreach proposal, comprising around $50 million of SCE’s request, is addressed separately in the testimony of TURN Witness Alexander.

TURN is an unequivocal supporter of transportation electrification (TE), as this holds promise to decrease electric rates, integrate renewables, lower system costs, and provide for cleaner air and other environmental benefits, if intelligent policies are adopted to enable this future. However, one must be careful to distinguish between the benefits of TE and claimed benefits of SCE’s proposal. In many instances, the two are entirely unrelated.

To this end, TURN’s analysis demonstrates that SCE’s proposal is more focused on ratepayer spending than ratepayer benefits. For example, the utility proposes no meaningful performance accountability requirements, excessive infrastructure deployment, a lack of coordination with state agency and other third-party deployment, and unnecessarily high unit

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According to the Proposed Decision of ALJ Goldberg in A.14-10-014, issued November 13, 2018, $22 million in approved “bridge funding” for the Charge Ready pilot should be deducted from the approved budget for the Charge Ready 2 program. This has not been included here or in TURN’s budget estimate. Cost summarized from Data Request TURN-01, question 3, “Charge Ready Master Workpaper.”
costs and corresponding capital spending which will burden ratepayers for decades to come.

SCE’s proposal does not reflect a reasonable attempt to maximize ratepayer benefits and minimize costs using data from the Charge Ready pilot.

TURN proposes significant modification to SCE’s proposal with this goal in mind. TURN’s proposal accounts for and incorporates the use of critical data provided in the Charge Ready pilot to develop a program that is in the ratepayer interest and more likely to help achieve state goals at a lower cost and with greater accountability for SCE to achieve results. TURN provides the following recommendations, with supporting analysis and discussion in the ensuing sections:

**Program Size, Budget, Structure, and Ratemaking:**

- Based on TURN’s analysis of infrastructure need and a more reasonable set of assumptions to determine unit costs, SCE’s ratepayers should provide funding for 29,000 ports at MuDs, workplaces, and public locations at a cost of approximately $245 million from 2020-2023;\(^4\)

- 40% of the proposed make-ready program infrastructure, measured by number of ports, must be deployed at MuDs.\(^5\) This equates to at least 5,000 ports under TURN’s infrastructure assumptions. Ratepayer funds to accomplish this goal should generally not be allocated to other segments, though TURN’s budget allows for some flexibility.

- At least 15% of make-ready charging station ports should be deployed at MuDs in DACs (disadvantaged communities).\(^6\) This requirement ensures at least some of the financial benefits of EVs will accrue to residents in DACs.

- All customer-side infrastructure costs (behind the meter) should be expensed, not capitalized. Customer-side infrastructure and labor is not a traditional utility activity yet these costs comprise a high portion of SCE’s infrastructure costs (around 75%). Capitalizing these costs is burdensome to ratepayers and does not provide any benefit to site hosts, EV drivers, or ratepayers.

- Workplace and public sites should not receive a rebate for the charging station itself and should contribute at least 10% of customer-side infrastructure costs (the remainder of which would be expensed by the utility). Leveraging funds from site hosts is an important means of decreasing costs to ratepayers and reducing significant equity issues.

\(^4\) This does not include funding for Marketing Education and Outreach (ME&O) activities which are addressed in Witness Alexander’s Testimony.

\(^5\) The make-ready program does not include the new construction rebate to be deployed at MuDs.

\(^6\) TURN’s budget assumes around 12,600 make-ready ports, so this equates to about 1,900 ports.
Performance accountability measures (PAMs):

- Based on pilot data (Section VI), SCE’s workplace and public infrastructure should achieve at least 7% utilization on a per port basis.\(^7\) If a site does not achieve this minimum utilization within 3 years of installation, all of the sites’ costs should be flagged for reasonableness review in the ensuing GRC and a minimum one-time shareholder contribution should be assessed to directly offset ratepayer expenditures of the Charge Ready 2 program.\(^8\)

- SCE should track and report site utilization on an annual basis and report this in its GRC. If a site shows near-zero or zero utilization\(^9\) for a period of a year or more, any costs associated with the site should be removed from rate base. This protects ratepayers from the risk of long-term stranded costs and does not allow shareholder returns or cost recovery for sites that provide absolutely no financial or environmental benefit to ratepayers.

Cost Recovery and Reasonableness Review:

- Costs should be recovered on an equal cents per kWh basis among customer classes, e.g. based on each class’ share of system sales.
- The program should have two one-way balancing accounts, one for the new construction rebate program and one for the make-ready program (MuDs and workplaces).
- The reasonableness review should include an evaluation of compliance with program requirements.

Utility Ownership, Load Management, and Fast Charging:

- SCE should be permitted to own charging stations at MUDs in DACs, up to 2,500 ports. Maintenance costs should also be paid for by ratepayers for utility-side and customer-side infrastructure for these sites. No other utility ownership of charging stations should be permitted to avoid unnecessary costs and anti-competitive impacts.
- Workplace and public sites should be required to participate in a demand response (DR) program to help ensure load-shifting benefits of EV charging during the day, including increased charging during low-cost hours.
- SCE should be ordered to implement submetering to charge tenants at MuD sites directly on an EV TOU rate. This ensures price signals are passed on to drivers.
- No ratepayer funds should be allotted for direct current fast charging (DCFC) as this level of charging is unnecessary for long dwell-time locations and imposes unnecessary

\(^7\) As measured by the number of kWh dispensed for EV charging divided by the maximum possible kWh on an annual basis. See Section VI.
\(^8\) TURN leaves to the Commission’s discretion what the one-time penalty should be, but believes it should be significant enough to incent high utilization from workplace and public sites, in addition to the threat of reasonableness review of costs.
\(^9\) Charge Ready pilot data showed that some sites have auxiliary load that records some usage but it is too low to be associated with EV charging. Data Request TURN-02, question 1b.
cost and risk to ratepayers. Site hosts may choose to install DCFCs if they pay for all incremental costs related to DCFCs.

This testimony proceeds as follows. First, TURN provides background regarding “anchor bias” based on our experience with utility transportation electrification proposals and other types of applications, and discusses and quantifies purported “downward pressure on rates” in SCE’s territory due to EV adoption. Next, TURN analyzes SCE’s Charge Ready 2 proposal, including request for infrastructure, budget, ratemaking, load management, and cost assumptions. TURN then provides a summary of its primary recommendations for Charge Ready 2 in Section V.

Beginning in Section VI TURN provides analysis and insight regarding SCE’s Charge Ready pilot. The reader may wish to first read the pilot analysis sections, as these help to inform TURN’s recommendations for Charge Ready 2.

II. PARTIES AND THE COMMISSION SHOULD GUARD AGAINST ANCHOR BIAS BY VETTING ALL ASSUMPTIONS OF SCE’S PROPOSAL

It is important to recognize that SCE’s proposal is a starting point that must be rigorously vetted. The Commission must determine what a reasonable light-duty charging program for SCE’s service territory should consist of and should evaluate parties’ recommendations based on their merit, not in terms of their comparison to the size and scope of SCE’s proposal. Namely, TURN urges the Commission, as well as parties, not to “anchor” to the utility’s proposal. Anchor bias, a term which comes out of behavioral economics, is defined as a bias “towards the initial value,” and is a demonstrated flaw of human psychology that manifests in various settings. As described by Tversky and Kahanman:

In many situations, people make estimates by starting from an initial value that is adjusted to yield the final answer. The initial value, or starting point, may be suggested by the formulation of the problem, or it may be the result of a partial computation. In either case, adjustments are typically insufficient. That is, different starting points yield different estimates, which are biased toward the initial values. We call this phenomenon anchoring.10

As one expert notes, the way to avoid this bias is to “verify facts you’re given.”\(^{11}\) TURN urges the Commission and parties to do just that, as well as understand that facts not given to support the proposal may be equally important – for example, SCE provides little to no guidance on the level of EV adoption that the program will cause, how benefits of the program relate to program costs, or how sites will be targeted to provide the most benefits.

### III. THE COST OF SCE’S CHARGE READY 2 PROPOSAL WILL DIMINISH “DOWNWARD PRESSURE” ON RATES FROM ELECTRIC VEHICLE ADOPTION

SCE states that transportation electrification “creates downward pressure on rates...by increasing overall system load, the fixed costs of the system will be spread over more kilowatt hours.”\(^{12}\) As further detailed by E3, a consultancy, “If the utility incurs less cost to serve PEV charging load than the revenue it collects via PEV drivers’ electric bills, then ratepayers as a whole benefit.”\(^{13}\) This is one of the primary financial benefits of EV adoption that can be conferred to all ratepayers. However, downward pressure on rates will only occur if smart, thoughtful policy from the Commission and state ensures all customers benefit from greater EV adoption. The fact is that to-date, the vast majority of EV subsidies have almost exclusively benefited wealthy consumers and businesses, paid for, in part, by low and middle-income consumers.

Despite the fact that SCE proposes $1.8 billion in ratepayer spending on EV infrastructure, it has not conducted a cost-effectiveness analysis for its proposal, which could inform the “downward pressure” on rates statements made by the utility. In order to provide illustrative figures on whether downward pressure on rates could be achieved with SCE’s infrastructure program, TURN calculated the net revenue from all EV adoption during 2019-2023 in SCE’s territory, assuming SCE’s share of the governor’s statewide goal of 1.5 million EVs is met in 2025. The 1.5 million by 2025 forecast was selected for this analysis because it is


\[\text{\textsuperscript{12} Prepared Testimony in Support of Southern California Edison Company’s Application for Approval of its Charge Ready 2 Infrastructure and Market Education Program, June 26, 2018 (“SCE-1”), p. 22, lines 5-12.}\]

\[\text{\textsuperscript{13} Energy+Environmental Economics (E3), Cost-benefit Analysis of Plug-in Electric Vehicle Adoption in the AEP Ohio Service Territory (“E3 Study”), p. 4.}\]
widely cited and is a clear metric of success used by the state, but obviously higher or lower sales would affect the results.

TURN’s illustration of potential downward pressure on rates was accomplished by calculating the present value of the average cost to serve EV load\textsuperscript{14} compared with revenue from the load (utility bills),\textsuperscript{15} for the full ten years of each vehicle’s lifetime. The difference between the revenue and cost is the “net revenue” of EV adoption from 2019-2023 in SCE’s territory assuming state goals. This is then compared to the present value of SCE’s instant proposal in the following figures.

\textsuperscript{14} This is estimated using the avoided cost calculator (ACC) and primarily off-peak charging, see Technical Appendix to this testimony for further detail.

\textsuperscript{15} This is estimated assuming primarily off-peak charging and a mix of residential TOU rates, commercial rates, and EV-specific rates. See Technical Appendix for further detail.
TURN does not have sufficient data to accurately estimate how to apportion the net revenue that can be attributed to Charge Ready 2, e.g. the incremental EV adoption pursuant to SCE’s

\[ \text{NPV Revenue} \rightarrow \text{NPV Cost to Serve Load} \rightarrow \text{NPV Net Revenue} \]

\[ \text{NPV Net Revenue} \rightarrow \text{NPV of SCE Proposal} \]

\[ \$679,000,000 \]

\[ \$301,000,000 \]

\[ \$378,000,000 \]

\[ \$378,000,000 \]

\[ \$823,000,000 \]

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16 Figures rounded. See Technical Appendix for the assumptions driving this calculation. TURN’s amended testimony provides the present value of SCE’s total revenue requirement to address concerns raised by SCE in rebuttal. This is calculated from TURN-08, question 2, attachment 1, and assumes the utility cost of capital (7.61%) for the discount rate.
program, which would provide a better understanding of program cost-effectiveness. It is striking, however, that assuming the ambitious state goals are met, the net revenue from all vehicles adopted in SCE’s territory from 2019-2023, including all revenue from vehicles’ 10-year lifetime, is not close to mitigating the cost of SCE’s proposal.

A full analysis of “downward pressure” on rates from EVs could properly include all increases to revenue requirement requested by SCE in coming years, compared with incremental revenue from EV adoption. Sensitivities regarding assumptions, including EV adoption forecasts, could also be examined. However, particularly when considering that increased costs for wildfire remediation and prevention,17 100% clean energy goals,18 and other activities have yet to be incorporated into consumer electric bills, relief from high rates and bills looks unlikely for California consumers, and will only be exacerbated if proposals like the instant one are not significantly modified to be in the ratepayer interest.

IV. TURN’S ANALYSIS OF SCE’S CHARGE READY 2 APPLICATION

SCE requests $760 million for its Charge Ready 2 program, a revenue requirement of $1.8 billion.19 SCE’s proposal consists of 32,000 “make-ready” sites, up to 4,230 of which would incorporate utility-owned charging stations at MuD and government locations, and 16,000 “new construction rebate” ports at MuD locations. SCE determined the number of make-ready workplace and public ports (around 20,000) using attach rates from the National Renewable Energy Laboratory (NREL) with some modifications, and attributing a percentage of residential MuD “need” to its program (around 12,000) ports. SCE assumes that it owns and subsidizes all utility-side and customer-side infrastructure and provides a flat $2,000 rebate for charging stations at make-ready sites. TURN finds numerous flaws in SCE’s analysis and overall request for funds to build infrastructure, summarized here and discussed further below:

17 For instance, SCE recently proposed an additional $580 million outside of its GRC for activities related to wildfire remediation and prevention. A18-09-002.
18 Recently passed SB 100 sets a goal of 100% clean electricity by 2045.
19 Nominal dollars. TURN-08, question 2, attachment 1.
Regarding SCE’s infrastructure “need” calculation:

- SCE utilizes an unreasonable forecast for the number of EVs expected to be adopted, which increases the number of charging ports “needed” through 2023 (the last year of the proposed program) in its territory;
- SCE does not sufficiently account for public and private development of charging stations in its territory;
- The vast majority of the calculated infrastructure requirement is for plug-in hybrid electric vehicles (PHEVs), which in reality may not plug in or park exactly where SCE builds infrastructure.

Regarding the proposed budget and costs:

- SCE’s budget emphasizes low-port, high-cost sites;
- SCE’s proposal does not leverage sufficient (or hardly any) funds from site hosts;
- SCE emphasizes capital costs over alternative program designs and ratemaking treatment that could decrease costs and simplify the program structure;

Regarding performance accountability measures (PAMs):

- SCE proposes no meaningful performance accountability measures.

Regarding cost recovery, reasonableness review, and balancing accounts:

- SCE proposes no means to distinguish between what will be spent on the various programs (e.g. new construction rebate, make-ready program, etc.) or location type - workplaces, public locations, and MuDs. Thus, under SCE’s proposal, funds approved by the Commission for MuDs or rebate programs may be spent on workplaces, public sites, or other unrelated activities to what the funds are authorized for;
- SCE proposes limited reasonableness review, whereby even if funds were not managed prudently there may be no penalty;
- SCE proposes to collect costs through distribution rates rather than on an equal cents per kWh basis among classes which would provide more equitable cost allocation.

Regarding utility ownership of charging stations and fast chargers:

- Fast charging is not needed, and there is no clear benefit to ratepayers, from installing DCFCs in long-dwell locations like workplaces.
- SCE proposes to own charging stations at government locations, though these sites were a large recipient of program funds in the pilot and do not require additional ratepayer subsidy to participate in the program. This treatment raises anti-competitive concerns and burdens ratepayers with unnecessary costs.

Regarding Load Management:

- SCE requires minimal load management provisions that are unlikely to properly incent EV charging that results in system benefits.
TURN also addresses additional aspects of SCE’s proposal in the sections below and makes recommendations to remedy the flaws listed above and provide for a program that is in the ratepayer interest.

A. SCE’s Charging Infrastructure “Need” Estimate

To estimate the number of L2 workplace and public chargers needed in SCE’s territory by 2023, SCE “uses the results of [an] NREL analysis and scale[s] to the total forecasted population of EVs in SCE territory.”20 Specifically, the NREL study develops attach rates (number of chargers needed per electric vehicle) based on an optimization tool called “EVI-Pro” (Electric Vehicle Infrastructure Projection Tool).

Consumer demand for non-residential L2 and DCFC is estimated using EVI-Pro. NREL developed EVI-Pro in partnership with the California Energy Commission to estimate regional requirements for charging infrastructure that supports consumer adoption of light-duty PEVs. EVI-Pro uses real-world travel data to simulate spatially and temporally resolved demand for PEV charging at homes, workplaces, and public destinations. Its fundamental assumption is that consumers prefer charging scenarios that enable them to complete all their existing travel with maximum eVMT and minimum operating cost.21

Thus, the primary objective of the tool is to maximize all electric vehicle miles traveled (eVMT) – “The EVI-Pro model used in this analysis assumes charging infrastructure must be sufficient to enable any consumer to maximize eVMT in any PEV.”22 The attach rates developed by NREL, assuming 82% residential charging rather than 88% assumed by NREL’s “central scenario,” are then applied to SCE’s forecast of electric vehicles to determine the number of workplace/public charging ports needed to fully maximize eVMT in 2019 and 2023. The two years’ results are then subtracted to determine the number of chargers to be targeted (SCE refers to these as “incremental” ports).23 This methodology results in a total of 19,703 workplace/public ports, depicted in Figure 2. The model contains numerous inputs and assumptions regarding charging behavior and electric vehicle mix (e.g. including range and type of EV) that determine this result, some of which are discussed further below.

20 SCE-1, p. 35, lines 9-10.
22 NREL Study, p. 20.
23 Data Request TURN-01, question 12, attachment “SCE TE Infrastructure.”
In contrast to the workplace and public charging calculation, which is based upon vehicle range, travel patterns, and the goal of fully maximizing eVMT, SCE’s calculation of the number of MuD chargers required stems from first assuming that 83% of EVs\textsuperscript{24} will have access to residential charging, and of this residential charging penetration, 18% should be located at MuDs (the remainder at single unit dwellings).\textsuperscript{25} SCE targets the incremental need between 2019-2023 based on this approach, and then apportions a further 17% to its program based on “the proportion of [SCE territory] MUD sites with more than 20 parking spaces.”\textsuperscript{26} Even assuming the inflated EV forecast by SCE (discussed below) this level of penetration (around 12,000 ports at MuDs) is not necessary to support actual EV adoption through 2025 or even 2030 given the number of single unit dwellings (often referred to as single family homes) in SCE’s territory – around 3.4 million.\textsuperscript{27} Therefore, emphasis on MuD infrastructure deployment is a policy choice, not a derivative of SCE’s modelling exercise. Nevertheless, TURN believes significant, if not primary, emphasis on MuDs is appropriate for SCE’s Charge Ready 2 program for numerous reasons discussed in Section V.B. below.

\textsuperscript{24} SCE-1, Appendix C, p. C-2.  
\textsuperscript{25} Data Request TURN-01, question 12, attachment “SCE TE Infrastructure.”  
\textsuperscript{26} SCE-1, Appendix D, p. D-1.  
\textsuperscript{27} Data Request TURN-01, question 9, attachment “housing units.”
Lastly, it should be noted that despite the preceding analysis which prescribes granular port counts by customer segment, SCE has not proposed any specific goals, targets, or budgets related to its estimates:

Even though SCE’s analysis derives specific port numbers for each customer segment, the results are not intended to set segment-specific goals for the program.28

Combined with a lack of any meaningful performance accountability measures, SCE’s proposal is thus for market demand to determine how ratepayer funds should be spent with little to no accountability for whether the program efficient uses ratepayer funds or targets the sites that have the greatest environmental benefit; to the contrary, ratepayer funds should be carefully targeted to maximize benefits and minimize costs of utility infrastructure.

1. SCE’s Infrastructure Estimate is Uncertain

There are many elements of NREL’s and SCE’s modelling efforts that reflect high uncertainty, as is typical for a nascent market like EVs. NREL depicts these uncertainties, and illustrates sensitivities in the Figure below. Note that the “plug count” and “PEV count” shown is not relevant to SCE’s territory.29

28 SCE-1, p. D-1.
29 The study aims to address how much charging infrastructure “is needed in the United States to support both plug-in hybrid electric vehicles (PHEVs) and battery electric vehicles (BEVs).” NREL Study, p. v.
NREL states “Perhaps surprisingly, the national PEV total is not the most sensitive input parameter in this analysis; PEV electric range, commitment to maximizing PHEV [plug-in hybrid] eVMT, and percent of charging taking place at home have the largest effects." Data to-date show that most charging occurs at the residence and that increasingly higher range vehicles are desired by consumers. Both of these trends tend to decrease the number of non-residential chargers required to support EVs. TURN urges the Commission to adopt EV programs that are necessary to promote EV adoption, not to simply fund infrastructure that may be severely underutilized and ultimately unnecessary to reach state goals.

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30 NREL Study, p. viii.
31 Ibid.
2. Most of the Infrastructure Proposed by SCE is Not Needed to Alleviate “Range Anxiety”

SCE states “Charge Ready 2 will reduce barriers to EV adoption through deployment of EV charging infrastructure, increasing the availability of charging stations to reduce range anxiety.”\(^\text{33}\) Interestingly, one of the articles cited by SCE regarding range anxiety is entitled “Range Anxiety is Scaring People Away From Electric Cars, but the Fear May be Overblown.” The article discusses a study that demonstrates “87 percent of vehicles on the road could be replaced by a low cost electric vehicle available today, even if there’s no possibility to recharge during the day,”\(^\text{34}\) Further, SCE’s rationale that infrastructure should be built due to range anxiety is belied by the utility’s own infrastructure modeling results, which show that a large majority of the infrastructure needed is actually for PHEVs, which do not face “range anxiety” issues – these vehicles can drive on gasoline if battery capacity runs out.

Figure 4. Charge Ready 2: Percentage of Infrastructure Required by Vehicle Type\(^\text{35}\)

The goal of maximizing eVMT is perfectly laudable, but must be balanced with both cost and practical concerns. PHEVs, particularly fairly high-range PHEVs like the Chevy Volt which are

\(^\text{33}\) SCE-1, p. 19, lines 11-12.
\(^\text{35}\) Data Request TURN-01, question 12, attachment “SCE TE Infrastructure.”
favored by consumers, can achieve a very high percentage of miles on electricity with access to residential charging. Driving on gasoline in these vehicles also tends to be more efficient than conventional vehicles, resulting in emissions benefits.

Further, there is no guarantee a PHEV will plug in when given the opportunity just to finish a trip on electricity – off-peak residential electricity prices will likely be cheaper than many public stations, and since the charge is not needed, the driver may wish to get on their way using a potentially small amount of gasoline. And lastly but significantly, the modeling efforts derive a numerical estimate of the theoretical number of ports required to maximize eVMT, but there is no guarantee, and it is extremely unlikely, that each station will be perfectly located such that every PHEV in the real-world has a charging opportunity every time it is parked somewhere in SCE’s territory.

The sensitivity of “PHEV Support,” or the percentage of PHEVs that are supported to maximize eVMT in SCE’s territory from 2019 to 2023 is shown in the Figure below.

**Figure 5. PHEV Support Sensitivity Analysis**
SCE Public/Work Charging Ports, 2019-2023

While TURN’s recommendation for a more sensible charging port calculation (Section A(4)). does not adjust the number of charging stations to be deployed by SCE to reflect these concerns, it is important for the Commission to recognize that much of the workplace and public charging station “need” calculated by SCE is not intended to alleviate range anxiety and may be largely

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36 Data Request TURN-01, question 12, attachment “SCE TE Infrastructure.”
unnecessary for EV adoption. Further, the future mix and preference of EVs drivers will
determine what is needed to maximize eVMT. For example, a shift towards battery electric
vehicles (BEVs) for most travel would result in less non-residential infrastructure required
according to this modeling, as would a lesser degree of “PHEV support” from a planning
standpoint. The Commission would be well within reason to further adjust TURN’s estimate of
workplace/public need downwards to reflect a lower degree than 100% of “PHEV Support.”

3. SCE’s Infrastructure Calculation Contains Two Primary Flaws

As discussed above, there are numerous assumptions that drive SCE’s forecast of needed
infrastructure, not all of which are covered in this testimony. TURN focusses on two major
assumptions in SCE’s infrastructure model that are flawed and provide an unsubstantiated and
unnecessary upward bias to the utility’s calculated infrastructure need.

a) SCE’s electric vehicle forecast is not reasonable.

TURN is optimistic about the future of EV adoption and fully recognizes the emissions
benefits of these vehicles. This does not mean utility sales forecasts that are more optimistic than
state goals or current sales trajectories should be simply adopted. SCE proposes no consequence
if its EV adoption forecasts are not realized, thus placing all risk on ratepayers with no downside
to the utility. One way of correcting for this bias is to penalize SCE, for example with
shareholder contributions to infrastructure costs that reduce ratepayer burden, for each vehicle
that does not materialize according to the utility’s forecast. This would incentivize SCE to
develop reasonable forecasts; however, TURN does not propose this treatment here. But building
infrastructure for EVs that don’t materialize results in unnecessary costs and burden on
ratepayers, as well as under-utilized infrastructure. Again, under SCE’s proposal this risk falls
entirely on ratepayers with no “skin in the game” from the utility.

SCE uses a statewide forecast that is significantly above both the governor’s goal in
Executive Order B-48-18, as well as the California Energy Commission (CEC) forecasts.
SCE apportions statewide figures to its service territory by assuming 38% of the vehicles reside in its territory. This is likely also excessive—EV sales data indicate around 32% of EVs are located in SCE’s territory. CEC figures from 2016 sales put the proportion even lower, around 25% of statewide sales occurred in SCE’s territory during this year. In combination, SCE’s territory-specific forecast, which is a primary driver of the calculation of infrastructure need, is considerably higher than even the CEC’s “high” forecast. The Figure below illustrates SCE’s forecast compared with the CEC forecasts for 2023, the last year of SCE’s proposed program.

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37 Figures rounded. State goal from Executive Order B-48-18. CEC low, mid, and high from TURN-04, question 5, attachment “Revised PEV Forecast,” slide 5. Demand Analysis Working Group (DAWG) meeting slides November 2017. 2025 forecasts estimated from the figure.

38 Data Request TURN-04, questions 3 and 4, attachment EV sales (California and SCE territory). This percentage represents an aggregation of all years’ sales. EV rebate statistics to-date generally confirm this as 30.5% of rebates though November 19, 2018 were in SCE’s territory. Data from Center for Sustainable Energy (CSE), California Air Resources Board Clean Vehicle Rebate Project, [https://cleanvehicleredbate.org/eng/rebate-statistics](https://cleanvehicleredbate.org/eng/rebate-statistics).

39 Data Request TURN-05, question 5, attachment “Revised PEV Forecast,” slide 10.
TURN’s recommendation for the purposes of SCE’s infrastructure calculation is 590,000 EVs for SCE’s territory by 2023, which is aligned with CEC’s 2018 “mid” forecast.\(^{40}\) This implies statewide adoption of around 1.8 million EVs in 2023,\(^{41}\) whereby the state goal is exceeded at least two years ahead of time. This is a realistic forecast for infrastructure planning purposes.

b) SCE’s infrastructure estimate does not adequately account for non-utility public and private development of non-residential charging stations.

As stated above, SCE’s infrastructure calculation would provide for ratepayer funding of all incremental public/workplace ports in its territory from 2019-2023. The utility does not adequately incorporate the fact that there is ongoing public and private development of charging

\(^{40}\) TURN adopts the latest revision of the CEC forecast (2018) to incorporate an expectation of increased sales from the CEC. To TURN’s knowledge this forecast was not available at the time testimony was served but it is important to base policy decisions on the best available data. TURN became aware of this forecast from SCE’s rebuttal testimony (footnote 27, page 10). CEC, 2018 IEPR Update Light Duty PEV Forecast, DAWG Meeting 11/14/18, slide 15.

\(^{41}\) Assuming 32% of EV sales are in SCE’s territory. See above.
stations in its territory that will occur regardless of utility involvement; through the beginning of October, 2018, at least 5,800 charging ports have been deployed in the territory with little to no ratepayer funds.\textsuperscript{42} The California Energy Commission, Volkswagen, and private entities (such as workplaces) will also deploy charging stations in the utility territory, regardless of whether SCE provides subsidies through Charge Ready 2.\textsuperscript{2} TURN corrects for this by subtracting expected infrastructure development in SCE’s territory from 2019-2023 from the total number of ports “needed” in the territory by the end of this time period. The details of this calculation are discussed in the ensuing section.

4. TURN’s Recommended Number of Workplace and Public Charging Stations Based on SCE’s Infrastructure Model

Based on the preceding discussion, TURN makes two primary adjustments to SCE’s charging station infrastructure forecast. First, TURN adjusts the forecasted number of EVs expected in SCE’s territory by 2023. Second, TURN estimates the number of public/workplace charging stations that are expected to be deployed in SCE’s territory from 2019-2023. This expected number of ports is then subtracted from the gross number of ports “needed” by 2023 to derive a more realistic public/workplace charging port gap for SCE’s program to address.

First, based on a reasonable but still aggressive forecast of total EV sales, TURN adopts the CEC “mid” forecast of 590,000 EVs in SCE’s territory by 2023, the equivalent of about 1.8 million EVs statewide.\textsuperscript{43} The forecast is ambitious, in that it means the state would more than achieve the 2025 goal two years early.

\textsuperscript{42} Data Request TURN-04, question 1b. SCE uses the public database from DOE to estimate infrastructure in its territory, which likely underestimates the total number of ports in its territory.

\textsuperscript{43} SCE’s territory currently has around 32\% of statewide sales. Data Request TURN-04, questions 3 and 4, attachment EV sales (California and SCE territory). This percentage represents an aggregation of all years’ sales.
Adopting SCE’s assumptions regarding attach rates but adjusting the number of EVs, as well as including an assumption of 100% “PHEV Support,” this results in 25,399 public/workplace ports “needed” in 2023. TURN then reduces this by the total number of non-residential charging ports expected to be developed in SCE’s territory through 2023, seen here in Table 2.

### Table 2. Public/Workplace Charging Station Need Calculation

<table>
<thead>
<tr>
<th>SCE Charge Ready 2 (Ports)</th>
<th>25,399</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cumulative Ports “Needed” 2023</td>
<td>25,399</td>
</tr>
<tr>
<td>Less:</td>
<td></td>
</tr>
<tr>
<td>Existing SCE 2019 Workplace/Public Ports</td>
<td>6,000</td>
</tr>
<tr>
<td>CEC Deployment</td>
<td>12,032</td>
</tr>
</tbody>
</table>

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44 Attach rates and other assumptions used to calculate the gross number of “needed” ports from Data Request TURN-01, question 12, attachment “SCE TE Infrastructure.”
TURN’s recommendation provides funding for 7,000 ports to be conservative. Below is an explanation of how TURN estimated expected deployment of the charging station ports shown above.

**TURN Assumptions for Non-Utility Investments in EV Charging Infrastructure**

- **Existing SCE workplace and public charging stations:** Through October 4, 2018, there were about 5,800 public and workplace ports in SCE’s territory. This estimate was derived from the public Department of Energy (DOE) alternative fuels database which SCE apportioned to its territory. The estimate in TURN’s calculation is conservative because it assumes essentially no port growth between now and end of year 2019 (SCE assumes infrastructure spending starting in 2020, and the DOE database likely underestimates the number of ports in SCE’s territory because only publicly noticed or known ports are recorded in the database.

- **CEC deployment:** According to the CEC’s planning goal, which the agency used the EVI Pro tool to develop, the entire workplace and public port need in SCE’s territory could be met through CEC deployment. This makes sense because it is the same modeling that SCE used to develop its charging port estimate. However, TURN recognizes that CEC deployment will be subject to available funds, which may not always reach the levels hoped for by the agency, as well as time to scale up of the program across the state. TURN incorporates these facts by basing assumed annual funding on what was approved for the current fiscal year for EV charging infrastructure, $94 million (annually). Further, based on historical deployment and EV sales proportions in SCE’s territory to-date, TURN assumes that 40% of these funds go to workplace and

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45 Data Request TURN-04, question 1b.
46 SCE-1, p. 12.
47 NREL, CEC, [https://maps.urel.gov/cec/?aL=0&bL=cdark&cE=0&dR=0&mC=36.87962060502676%2C116.34521484375001&zL=6](https://maps.urel.gov/cec/?aL=0&bL=cdark&cE=0&dR=0&mC=36.87962060502676%2C116.34521484375001&zL=6). The maps are at a county level so TURN summed workplace and public level 2 stations for the counties in SCE’s territory and then apportioned these results by the number of SCE’s number of residential customers relative to these counties’ populations (68%), which equates to around 33,000 ports. TURN’s calculation assumes around just a third of this goal will be accomplished.
public charging station deployment, 32% of which will be allocated to SCE’s territory.\(^{48}\)

Lastly, TURN assumes a per port cost of $4,000 based on current CEC rebate amounts,\(^{49}\) and four years of deployment, to account for the fact that the program will be ramping up over the next year.\(^{30}\) All of TURN’s assumptions are reasonable if not overly-conservative. CEC-driven deployment could very likely be much greater than TURN’s estimate, reducing the need for ratepayer funding even further.

- **Volkswagen deployment:** Volkswagen will invest $800 million in California related to Zero Emission Vehicles (ZEVs), pursuant to a settlement with the Environmental Protection Agency. CARB estimates between 117 and 183 charging stations will be deployed per cycle,\(^{31}\) TURN assumes the midpoint of these estimates (150 stations). CARB also estimates 90% of this investment will go towards public and workplace charging infrastructure.\(^{32}\) TURN’s estimate assumes 1.5 ports per station (an even mix of dual and single port stations) and apportions 32% of the three-cycle investment to SCE’s territory based on SCE’s proportion of EV sales to-date.

- **Private deployment:** Some workplaces and public sites will be willing and able to deploy infrastructure without the use of state or ratepayer funds, and this should be integrated into the program’s assumptions. While SCE did not investigate the extent to which this has occurred,\(^{33}\) TURN’s estimate above assumes just 1% of the charging port need developed from 2019-2023 is privately developed.

TURN’s approach results in a more reasonable estimate of charging ports that should be supported by SCE with regard to the workplace and public charging segment. TURN also proposes significant funding and deployment for the MuD segment, discussed in Section V.


\(^{49}\) CalEVIP program - [https://calevip.org/find-project](https://calevip.org/find-project). This offers $4,000 per port for single port station or $7,000 for a dual port station (equivalent to $3,500 per port). TURN utilizes the higher estimate for purposes of this calculation, which is conservative from a ratepayer perspective.

\(^{30}\) SCE’s program is proposed to run from 2019-2023, but TURN assumes the CEC is still ramping up statewide over 2019, so we utilize a 4-year assumption rather than 5.


\(^{33}\) TURN’s discovery asking for the total number of stations in SCE’s territory were responded with use of the DOE public database rather than any internal estimates (Data Request TURN-01, question 16).
B. SCE’s Proposed Costs and Ratemaking Treatment

SCE has unfortunately foregone the opportunity to use pilot data to make its program more cost-effective. Instead, SCE requests a budget that could deploy charging ports at virtually any cost, with budgeting assumptions that emphasize the most expensive sites. This is due to the following three primary flaws in the proposal.

1) Rather than propose a reasonable mix of sites to capture economies of scale through deployment at larger sites, SCE’s budget emphasizes low-port, high-cost sites.

2) SCE’s proposal does not leverage sufficient (or hardly any) funds from site hosts – under the proposal ratepayers would pay for close or equal to 100% of the cost of installing charging stations, which is not necessary for program success given demand seen in the pilot from workplaces and public sites.\(^{54}\)

3) SCE emphasizes capital costs over alternative program designs that would decrease costs and simplify the program structure. This results in a program that would be the most costly full-scale program in the state, more than five times the cost\(^ {55}\) of the California Energy Commission’s program that is beginning to scale up statewide.

Regarding the third point, TURN provides a comparison of SCE’s costs to other state and utility programs. The cost per port shown below does not include the full revenue requirement of SCE’s infrastructure program.

\(^{54}\) This statement is not true for MuDs which clearly require greater support than other types of sites based on lack of participation in the pilot and penetration of this sector to-date.

\(^{55}\) See Figure 9. TURN’s $20,000 per port statistic does not include the full revenue requirement paid by ratepayers including profit, taxes, overhead, and other elements that increase the cost of capital infrastructure.
In addition to the fact that other state programs are significantly lower cost, they are also all administered through rebate programs, a program design that is significantly simpler than the process relied on by SCE. This is addressed further in Section V.

1. SCE’s Budget Emphasizes the Highest Cost Sites

Due to significant fixed costs of deploying charging infrastructure (seen in the pilot data in Section VI below and SCE’s cost estimates), there are economies of scale that can be leveraged from deploying infrastructure at high-port sites. The Figure below provides SCE’s estimate of per port costs by average ports per site, which illustrates these economies of scale.

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56 Charge Ready 2 costs are $645 million for charging infrastructure, O&M, and rebates over 31,791 ports (cost is rounded down in the Figure). SCE’s cost per port does not include new construction MnD rebates, marketing costs, or total revenue requirement of these costs. A more complete list of other utility incentive programs is provided in an appendix. Utility programs are for workplace/commercial sites from the respective websites (links provided in Appendix 1). For CEC costs see CalEVIP program - https://calevip.org/find-project. This offers $4,000 per port for single port station or $7,000 for a dual port station (equivalent to $3,500 per port). TURN shows the higher number in the chart for comparison.
Instead of attempting to reduce overall costs and maximize the number of charging stations deployed, SCE’s site mix estimate, which drives its budget, accomplishes precisely the opposite, by seeking to deploy a majority of sites with a very low number of ports. In fact, 37% of sites that form the basis of SCE’s infrastructure budget would have just 4-6 ports; 84% with 4-13 ports per site.

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57 Data Request TURN-01, question 3, “Charge Ready 2 Master Workpaper.”
SCE must be a responsible steward of ratepayer funds by deploying infrastructure where it is most cost-effective and provides the most benefits. There must be reasonable guard rails to protect ratepayers from unnecessary rate increases. Any workplace that comes forward for ratepayer subsidy should not simply be accepted, rather the program should target the most cost-effective sites (in addition to targeting sites that provide the greatest benefits) and utilize a program structure that minimizes costs to ratepayers. TURN therefore adjusts the per port costs.
of SCE’s program by assuming (and encouraging SCE to target) sites with a higher number of ports. Further, ratepayers should not pay exorbitant per port costs for low-port sites. In some instances, these sites may be able to install fairly low-cost infrastructure by utilizing existing service drops and panels and locating charging load near existing transformers. Rather than exclude such sites to lower overall costs, TURN believes there are greater benefits to offering sites that wish to install 5 ports or less a $16,000 per port rebate, whereby all construction and procurement of charging stations is accomplished by the site host. This is very likely a quicker and less cumbersome process that also allows low-port sites to participate in the program without the unnecessarily burdensome costs to ratepayers. If the site can utilize existing on-site infrastructure, e.g. without installing a new panel or onsite transformers and limiting trenching costs, the rebate represents a large majority of costs. Participants with higher cost sites will pay a higher percentage of site costs, which also incentivizes these site hosts to try and limit costs where possible.

These recommendations, along with leveraging greater funds from site hosts, reduce the average per port costs of SCE’s make-ready program to $10,200 per port.\textsuperscript{58}

\textsuperscript{58} Calculation does not include the low-port rebate program.
Table 3. Site Mix and Average Cost per Port

<table>
<thead>
<tr>
<th>Average port/site</th>
<th>$/port (1)</th>
<th>TURN Assumed Site Mix (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>$16,000</td>
<td>20%</td>
</tr>
<tr>
<td>10</td>
<td>$14,916</td>
<td>30%</td>
</tr>
<tr>
<td>17</td>
<td>$9,431</td>
<td>30%</td>
</tr>
<tr>
<td>24</td>
<td>$7,943</td>
<td>10%</td>
</tr>
<tr>
<td>34</td>
<td>$6,997</td>
<td>10%</td>
</tr>
</tbody>
</table>

Subtotal Weighted Average $/Port (Make-ready) (2) $10,998

$/Port Reduction Due to 10% Customer-side Contribution (3) -$770

Total (Make-Ready) $10,228

(1) SCE estimate from TURN-01, question 3, attachment "Charge Ready 2 Master Workpaper," with exception of low-port sites which TURN recommends should participate in a $16,000 per port rebate program.

(2) This is the weighted average cost per port for sites with greater than 5 ports assuming TURN’s site mix.

(3) Assumes customer-side infrastructure comprises 70% of costs on average, consistent with pilot data and SCE cost estimates. Results in a 7% (70% * 10%) reduction due to customer contribution. This is used for budgeting purposes, actual customer-side infrastructure contributions will vary based on site-specific costs. See the next section on leveraging more funds from site hosts.

(4) Based on Charge Ready site mix pilot data, including a higher percentage of low-port sites (4-6 ports) than experienced in the pilot to account for TURN’s rebate program, and reasonable site mix assumptions to encourage SCE to target more cost-effective sites.

TURN’s assumed site mix results in a weighted average of just under 15 ports per site compared with 10 for SCE’s proposal. A significant difference between the two proposals is less of an emphasis on very low-port sites – while SCE assumes 84% of sites install between 4 and 13 ports, TURN assumes 50%. The second biggest difference is the rebate program for low-port sites to ensure cost containment for the most expensive types of sites. Combined with the low-port rebate program ($16,000 per port), no rebate for the charging station itself for higher port

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59 An assumption of 14.8 ports per site and 7,000 ports results in around 473 sites.
sites, as well as a 10% site host contribution towards customer-side infrastructure costs for workplace/public sites (discussed in the next section), TURN significantly reduces per port costs for make-ready infrastructure at workplace/public locations.

2. SCE Should Leverage Greater Funds from Site Hosts, Particularly for the Workplace and Public Segments

SCE’s make-ready program for 32,000 ports in the utility’s territory would provide 100% ratepayer subsidies for both utility-side and customer-side infrastructure, and a $2,000 per port rebate for L1 and L2 stations.60 This differs from the pilot approach which offered different rebate amounts depending on location and segment.61 SCE’s proposal for a $2,000 per port rebate, in addition to customer-side infrastructure costs, does not leverage sufficient funds from site hosts and is an unnecessarily high subsidy amount, particularly for workplace and public locations, to incent participation. Pilot data shows that the vast majority of sites, 73%, paid $2,000 or less per port62 for the charging stations themselves,63 meaning a rebate of $2,000 represents a nearly 100% subsidy for these customers. All make-ready infrastructure costs would also be 100% subsidized under SCE’s proposal. Including all fees related to the charging stations such as installation, data plans, freight, and taxes, customers paid an average of $3,300 per port for the charging station.64 This means SCE’s proposal is for customers to receive, on average, a 92% ratepayer subsidy of charging station installation and infrastructure costs.65

Demand from the workplace and public sectors in SCE’s pilot was robust, with some site hosts paying higher charging station costs due to preferences and selection of vendor packages. There is thus no reasonable basis for a 92% ratepayer subsidy for these sectors. There is also an

60 SCE-1, p. 48, line 8. Ratepayer-subsidized fast charging stations are not appropriate for long-dwell locations so we do not specifically address the proposed rebate amount.
62 Data from Data Request TURN-07 question 1 attachments in A.14-10-014, response on 5/17/18, Data on 55 sites representing 844 ports.
63 Cost of the charging station only.
64 Data from Data Request) TURN-07 question 1 attachments in A.14-10-014, response on 5/17/18, Data on 55 sites representing 844 ports.
65 On average, 81% of charging station installation costs were for utility-side and customer-side infrastructure. 19% of costs are for the charging stations themselves. A $2,000 rebate represents around 60% of total costs related to the charging station ($2,000 / $3,300); since 19% of costs are for the charging stations, this equates to a 92% total ratepayer subsidy (81% + (60%*19%)) = 92%.
equity element to leveraging greater funds from workplace and public locations; several of the pilot sites were multi-billion dollar corporations, charging station subsidies for which were paid for, in part, by low and middle-income residential customers who likely receive no direct benefit from the subsidy. Leveraging sufficient funds from these sites thus allows each ratepayer dollar to go further and is also a more fair and equitable program structure.

TURN recommends, for public and workplace sites, that customers pay for all charging station costs (no rebates) as well as 10% of customer-side costs. Again, this allows each ratepayer dollar to go further and partially addresses the significant equity issues inherent in the program. Further, ensuring customers pay a portion of customer-side costs aligns customer and ratepayer interest—namely, customers will have a financial incentive to reduce these costs as much as possible,\(^{66}\) whereas under SCE’s proposal, the customer has no financial incentive to reduce these costs.

TURN’s recommendation results in a ratepayer subsidy of 74% of total charging station installation and purchase costs,\(^{67}\) compared with around 92% for SCE— in many cases, the subsidy may be higher depending on the charging stations selected and other factors.\(^{68}\) Coupled with TURN’s adjustments to SCE’s site mix, this results in ratepayer costs of around $10,000 per port for workplace and public sites (Table 3), which would still provide some of the most lucrative subsidies in the state.

### 3. Capitalizing Customer-Side Infrastructure Costs Is Unnecessarily Burdensome to Ratepayers

SCE proposes to continue the same program structure as the pilot, which would capitalize all utility-side and customer-side infrastructure costs. TURN does not oppose this treatment of utility-side costs – these are traditional utility costs that are appropriately supported by ratepayers. Customer-side costs, traditionally, are the domain and responsibility of just that, the customer. SCE’s proposal to capitalize all of these costs is not only significantly more costly than other ratemaking treatments, it is also entirely unnecessary to the goals of the program —

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\(^{66}\) As mentioned above, sites may be able to utilize existing on-site infrastructure and locate charging load near power sources to limit trenching in order to reduce costs.

\(^{67}\) Assumes pilot data regarding percentage of costs. TURN’s proposal supports all utility-side infrastructure (13% of total costs), 90% of customer-side costs (68% of total costs) and no charging station and fees (19% of total costs, paid for by the site host).

\(^{68}\) For example, if customer-side infrastructure costs are lower as a percentage of total costs, the total ratepayer subsidy percentage will be higher.
customer-side ("behind the meter") infrastructure work is contracted to outside vendors and, if
subsidized by ratepayers, does not need to be owned by the utility to accomplish program goals.
While TURN recommends the majority of these costs continue to be subsidized by ratepayers,
they do not need to be part of the utility’s ratebase, which has the effect of adding unnecessary
costs to ratepayer bills. Further, due to long depreciation lives of greater than 40 years,69 the
proposition poses significant risk to ratepayers due to stranded costs, technological changes, and
site-specific risks.

Given that customer-side infrastructure costs represent a significant majority, 75%, of
infrastructure costs under SCE’s Charge Ready 2 assumptions,70 this issue warrants due
consideration by the Commission as to the appropriate ratemaking treatment of these assets.
Ratepayers can subsidize these costs, where necessary, without the utility capitalizing and adding
the costs to ratebase. Capitalizing costs is more burdensome to ratepayers than expense, yet the
ratemaking treatment of the costs does not affect the level of subsidy experienced by a
participating customer. This issue is therefore unrelated to the Commission’s deliberation
regarding the level of subsidy required by site hosts but rather the additional burden the
Commission wishes to place on ratepayers to pay for the program. The Figure below illustrates
the effect of capitalizing versus expensing SCE’s proposed customer-side infrastructure costs of
about $395 million.

69 Data Request TURN-01, question 2, attachment “useful life.”
70 $395 million of the $526 million of “make-ready” costs are for customer-side infrastructure. Data
Request TURN-01, question 3, “Charge Ready 2 Master Workpaper.”
There are other ratemaking treatments at the Commission’s disposal which could alleviate some of the burden of SCE’s EV infrastructure program – TURN lists two of the most relevant options below.

- Expense the costs.
- Expense the costs and amortize them over a ten-year period, which is a common assumption for the expected life of the charging stations deployed.\(^\text{72}\)

If amortizing costs over a longer period the Commission could award SCE the short-term commercial paper interest rate as a rate of return on the expense amount to compensate for debt financing costs.\(^\text{73}\) This is significantly less than SCE’s current weighted average cost of capital, 7.6%. However, TURN’s recommendation is to simply expense customer-side costs as they are incurred.

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\(^{71}\) Data Request TURN-05, question 2, attachment “CRP II Model Assumptions.”. SCE states that “The customer-side infrastructure costs of $395 million (constant 2018$) indicated on TURN-SCE-05.Q2 is escalated to nominal $; the nominal amounts for capital and O&M are $441 million and $437 million, respectively.”

\(^{72}\) SCE also uses this assumption (10 year asset life) for its utility-owned stations. Data Request TURN-01, question 3, “Charge Ready 2 Master Workpaper,” tab “Ownership details.”

\(^{73}\) Short-term interest rates are generally around 3%, but may depend on company-specific borrowing rates. OECD Data for United States, [https://data.oecd.org/interest/short-term-interest-rates-forecast.htm#indicator-chart](https://data.oecd.org/interest/short-term-interest-rates-forecast.htm#indicator-chart).
V. TURN'S PRIMARY RECOMMENDATIONS FOR CHARGE READY 2

A. Discussion and Recommendations for SCE Proposals Regarding the New
   Construction Rebate, Utility Ownership, Fast charging, and Load Management

1. TURN Supports SCE’s New Construction Rebate but Adjusts the Cost to Reflect Pilot Data

SCE proposes to “[o]ffer an incentive to MUD sites that exceed mandatory CALGreen
and local jurisdiction building code by installing EV charging stations. The rebate is designed to
cover the incremental cost to move a site from “EV capable” to full installation of EV charging
stations.”74 Essentially, “EV capable” ensures a MuD developer installs the make-ready portion
of EV charging stations, and SCE proposes to fill the gap in installation costs with an up to
$4,000 per port rebate for the charging station and remaining installation costs.75 SCE proposes
to apply the rebate for 4,000 ports per year, a total of 16,000 ports and $64 million of the total
budget.76 Though $64 million is added to the utility’s request, it could technically be spent on
any part of the program since SCE has not proposed a separate one-way balancing account or
similar treatment for these funds.

TURN supports the intent and structure of the new construction rebate. However, the
proposed rebate amount is likely excessive, and it is unclear to TURN how many sites will
participate in the program as it was not tested in the pilot. Additionally, pilot data shows that
most sites installed, purchased, and paid fees for charging stations for around $3,300 per port.77
A more reasonable budget estimate would therefore be $3,500 per port, though rebates could still
be administered for higher amounts if necessary, subject to a cap on total spending.78 Relatedly, a
separate one-way balancing account should be established for new construction rebates to ensure
the allocated funds are spent on this activity. TURN therefore supports a budget item for the full
16,000 ports requested by SCE subject to a separate one-way balancing account to track and cap
these costs.

74 SCE-1, p. 32, lines 1-5.
75 SCE-1, p. 56.
76 Data Request TURN-01, question 3, “Charge Ready 2 Master Workpaper.”
77 Data Request TURN-07 question 1, A.14-10-014, attachments in response on 5/17/18.
78 A reasonable per port cap for each site would also be prudent to ensure allocated ratepayer dollars can incentivize the maximum number of sites.
2. Utility Ownership of Charging Stations is Only Appropriate for MuDs in DACs, Coupled with a Minimum and Maximum Deployment Requirement

SCE proposes to “offer a turnkey option where, in addition to the make-ready, SCE will own and operate charging stations deployed in MUDs and at governmental locations. Participation would be capped at an estimated 4,230 charge ports.”\textsuperscript{79} SCE reasons that “MUDs proved to be a difficult market segment to enroll in the Phase I Pilot,” and “governmental locations required a long lead-time for charging station procurement.”\textsuperscript{80}

TURN agrees that there was very little uptake in the MuD segment during SCE’s pilot. It is plausible that utility ownership, which involves 100% ratepayer subsidy of charging station costs and procurement by the utility, may increase uptake in this critical sector. Additionally, anti-competitive concerns for the MuD segment are not as severe as public and workplace because there is very little competition today in this market. This will likely change as EV adoption increases.

Nevertheless, the Commission must balance utility ownership with anti-competitive concerns and the extra cost to ratepayers inherent with adoption of this model. Therefore, TURN supports utility ownership of charging stations for MuDs in DACs, up to 50% of the total MuD requirement (2,500 ports). TURN also supports a 100% subsidy of customer-side make-ready infrastructure be paid for by ratepayers for these sites - SCE should expense, not capitalize, these costs as discussed above. This incentive also encourages SCE to market its programs to MuDs in DACs, investment that is most likely to lead to EV adoption.\textsuperscript{81}

SCE’s proposal to own charging stations at government locations, on the other hand, lacks merit and justification. SCE states that “customers at governmental locations experienced delays in submitting required procurement documents due to their internal review processes.”\textsuperscript{82}

SCE claims this can be solved by allowing the utility to procure and own the stations. This

\textsuperscript{79} SCE-1, p. 31, lines 19-23.
\textsuperscript{80} SCE-1, p. 51, lines 5-8.
\textsuperscript{81} Through 2015 just 9% of California EV drivers live in an apartment. CVRP Survey, p. 46, question 34, \url{https://cleanvehiclerebate.org/sites/default/files/attachments/CVRPConsumerSurvey2013-15Reference.pdf}. As stated by the Department of Energy, “because residential charging is convenient and inexpensive, most plug-in electric vehicle (also known as electric cars or EVs) drivers do more than 80% of their charging at home.” DOE, \url{https://www.energy.gov/eere/electricvehicles/charging-home}.
\textsuperscript{82} SCE-1, p. 15.
“solution” ignores the fact that government locations were one of the largest participant groups in the Charge Ready pilot, comprising 38% of the first 69 sites that participated in the program.\textsuperscript{83} It is not worth the increased cost and anti-competitive impacts of utility ownership to simply decrease charging station procurement time on behalf of the site host – SCE may improve its processes to help decrease this time,\textsuperscript{84} but should not own and operate the charging stations for governmental entities, which are likely to continue as a primary recipient of ratepayer funds for charging infrastructure. SCE’s proposal to own charging stations at government sites is unnecessarily burdensome and anti-competitive, and should be rejected.

3. Fast Charging is Inappropriate for Long-Dwell Locations

SCE proposes to “offer participating customers the option to install a limited number of DCFC stations, which is more economical than separately deploying DCFC stations at a later date.”\textsuperscript{85} SCE’s budget accommodates 205 DCFC ports at 170 sites.\textsuperscript{86} DCFC rebates are budgeted to cost $5.6 million, and additional infrastructure costs of $7.7 million are incorporated into the budget,\textsuperscript{87} for a total of around $13.2 million pursuant to this proposal.

SCE’s main contention for offering a DCFC option appears to be that it is more economic to install DCFC when also installing multiple L2 chargers at a site because the additional make-ready infrastructure and labor is minimized when already installing L2 charging. However, there are insufficient ratepayer benefits to outweight the additional costs of deploying DCFC infrastructure. First, DCFC technology poses greater risk of stranded assets because there are multiple charging standards on the market and power levels will increase to match consumer preferences. Second, the primary intention of deploying charging infrastructure at workplaces and fleets is that these are “long-dwell” locations, where drivers are parked for multiple hours. As SCE described in its original Charge Ready testimony for its pilot program, long-dwell

\textsuperscript{83} Data Request TURN-07 question 1, A.14-10-014, attachments in response on 5/17/18. This percentage was determined by counting finished sites names with the word “city” or “county” in the name. TURN received pilot data in May of 2018. The sites represented 1,042 ports, or about 98% of pilot sites through Q2 2018 (SCE states in its Petition for Modification on page 9 it would deploy 1,066 ports by Q2 2018).

\textsuperscript{84} For example, SCE discusses process improvements regarding easements to shorten delay in signing these agreements. Pilot Report, pp. 28-29.

\textsuperscript{85} SCE-1, p. 34, lines 5-7.

\textsuperscript{86} SCE-1, p. 34, line 12.

\textsuperscript{87} Data Request TURN-01, question 3, “Charge Ready Master Workpaper.”
locations should offer opportunities for flexible load. “EV charging at long-dwell locations is uniquely flexible load that can address existing grid challenges by avoiding charging on peak.”

DCFC likely results in higher power charging sessions and may provide significantly less opportunity to shift load. While there certainly may be workplaces interested in offering fast charging to employees, there is no clear ratepayer benefit. Therefore, TURN supports DCFC inclusion only if all incremental costs, including for the make-ready and charging station itself, are paid for by the site host, not ratepayers.

4. **SCE’s Load Management Proposal is Insufficient**

The primary load management SCE proposes for its sites is through Time of Use (TOU) price signals, which the utility claims could “improve integration of renewable generation.” Simply applying TOU signals to sites, which commercial buildings are signed up for regardless of SCE’s program, is insufficient. Particularly for workplace sites, charging does not necessarily occur during high solar hours even if it is “off-peak” during the day. This was experienced in the pilot where most of the utilization at workplaces occurred in the early morning, peaking at 9am, as opposed to closer to noon when large amounts of electricity produced from solar energy would be expected on the grid.

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89 SCE-1, p. 22, line 14.
In order to help align site load with ratepayer benefits, all sites should be required to participate in a demand response (DR) program – sites will then have an economic incentive to bid in to the CAISO market when prices are low and/or negative, which could reduce some curtailment and also allows the vehicles to charge with a relatively clean mix of electricity. This requirement may therefore align with both the financial and environmental interest of ratepayers.

For MuD sites, where charging is expected to occur later in the day, it is beneficial for ratepayers and the environment to move charging away from the evening peak. Here, TOU rates could play a significant role in inducing behavior shifts because on-peak price signals from 4-9pm can incent drivers to schedule charging overnight, as has been consistently seen for customers at single family homes on EV rates.\(^91\) Therefore, the Commission should ensure price signals are passed through to drivers by ordering Edison to utilize submetering capabilities of EV charging stations to bill participating EV drivers on TOU rates at MuDs.\(^92\) SCE should work with charging station vendors to enable this capability.

\(^{90}\) Pilot Report, p. 47.
\(^{91}\) Load Research Report Compliance Filing of San Diego Gas & Electric and other IOU’s, December 2017, p 36.
\(^{92}\) SDG&E would enable this capability for its residential charging program, if approved. AL 3236-E.
B. TURN Recommendations for Budget and Site Requirements

Regarding workplace and public sites TURN’s analysis in Section IV demonstrates that SCE’s proposal for public and workplace charging ports utilizes an unrealistic EV sales forecasts and does not adequately account for non-ratepayer funded charging station deployment over the course of the program. TURN also demonstrates that SCE’s program emphasizes the highest cost sites resulting in an unnecessarily high budget. We thus recommend for the utility to deploy 7,000 ports at workplace/public sites at a lower per port cost than assumed by SCE, including a low-port rebate program.

The other location type SCE’s program is intended to focus on are multi-unit dwellings (MuDs). TURN believes that MuDs should comprise a significant portion of the utility program to drive EV adoption. This population is significantly under-represented in the EV market – through 2015 just 9% of California’s EV drivers live in an apartment.\textsuperscript{93} Deployment of charging infrastructure at MuDs is likely to lead to EV adoption, given the importance, convenience and affordability of residential charging for EV drivers.\textsuperscript{94} Since the primary benefit to ratepayers of utility EV infrastructure programs is incremental EV adoption \textit{due to the program}, MuDs should be a major focus for the utility. Further, because this is a less competitive and more difficult market to penetrate, it is appropriate for incumbent utilities to focus greater attention on this market. TURN’s proposed program, shown below, supports utility ownership of charging stations for MuDs in DACs, and provides for a $2,000 rebate for charging stations and 100% make-ready subsidy for the remaining MuD installations, the same level of subsidy as SCE’s proposal though targeting half of the demand as SCE. The budget also supports the utility’s full request for new construction “EV Capable” MuDs, with an adjusted rebate amount (subject to a one-way balancing account).

\begin{itemize}
\item \textsuperscript{93} CVRP Survey, p. 46, question 34, \url{https://cleanvehiclerebate.org/sites/default/files/attachments/CVRPConsumerSurvey2013-15Reference.pdf}.
\item \textsuperscript{94} As stated by the Department of Energy, “because residential charging is convenient and inexpensive, most plug-in electric vehicle (also known as electric cars or EVs) drivers do more than 80% of their charging at home.” DOE, \url{https://www.energy.gov/eere/electricvehicles/charging-home}.
\end{itemize}
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(1) See Section A(4). The low-port rebate program represents the number of ports expected assuming the site mix in Table 3, the remainder is assumed for the make-ready program. No site should receive more than the cost of installation.

(2) TURN assumes around half of the MuD ports as SCE's proposal, as demand for this segment needs to be proven but should increase from pilot results due to higher incentive levels offered and greater EV adoption in coming years. Assumes 2,500 ports are MuDs in DACs and require a higher per port incentive ($17,800 per port), the remainder a $2,000 rebate and make-ready work, equal to SCE's calculation ($16,527 per port). Does not include contingency as this is not needed given a higher level of cost certainty.

(3) Supports full SCE request at a slightly lower assumed rebate amount.

(4) Labor and non-labor costs are around 3.4% of total capital costs, TURN assumes this percentage of total costs. TURN-01, question 3, attachment "Charge Ready 2 Master Workpaper".

(5) This is a rough estimate. TURN expects maintenance costs for utility-owned charging stations (including make-ready for these sites) and utility-side costs. Since O&M is 4% of SCE's infrastructure and utility-owned charging station budget, TURN estimated the costs for utility-owned charging stations and make-ready ($41 million) and utility-side costs (25% of the make-ready budget or $33 million) and took 4% of this, equal to around $3 million.

TURN’s estimated maintenance costs do not include workplace/public customer-side make-ready installations. The Commission could, if it wished, still order the utility to expense customer-side infrastructure costs and assign ongoing maintenance costs to ratepayers.
Nevertheless, these costs are relatively small, and are the appropriate responsibility of the site host, not ratepayers.

In addition to setting a reasonable overall budget cap, it is imperative that SCE not simply be given a lump sum of money to be spent for whatever sites apply. Along with performance accountability metrics (PAMs) and separate one-way balancing accounts for the make-ready program and new construction rebates (discussed below), the Commission should adopt the following program requirements:

- 40% of the proposed make-ready program infrastructure, measured by number of ports, must be deployed at MuDs.\(^96\) This equates to around 5,000 ports under TURN’s infrastructure assumptions; thus at least $86 million of TURN’s budget should be reserved for MuD deployment and may not be spent on workplace or public infrastructure.\(^97\) This requirement still provides a good deal of flexibility, e.g. some of TURN’s recommended MuD budget may actually be used to deploy charging infrastructure at workplaces,\(^98\) but serves to focus the program and incent cost discipline.

- In addition to the overall MuD requirement, at least 15% of all make-ready charging station ports should be deployed at MuDs in DACs. While SCE proposes a relatively low overall DAC requirement (30%), it is wealthy businesses and/or commuters who are most likely to receive the benefits of these subsidies if the charging stations are deployed at workplaces and public sites, not the actual residents of DACs. On the other hand, deployment at MuDs in DACs allows for DAC residents to receive direct benefits of ratepayer subsidy, and low-income customers can particularly benefit from EV fuel cost savings if able to afford an EV. Since TURN recommends SCE’s ratepayers also pay for maintenance costs (over 10 years) for customer-side charging station infrastructure for MuDs in DACs, this removes any financial disincentive for these sites to participate.

- No ratepayer funds should be allotted for direct current fast charging (DCFC) as this level of charging is unnecessary for long dwell-time locations and imposes unnecessary cost and risk to ratepayers. Site hosts may choose to install DCFCs if they pay for all incremental costs related to DCFCs.

These requirements provide for greater deployment in MuDs and ratepayer protections to ensure that most of the funds allocated to this end are not repurposed for unnecessary ratepayer expense.

\(^95\) A recent Proposed Decision issued in A.14-10-014 on November 13, 2018 would reduce this budget by $22 million, which is not incorporated here.

\(^96\) The make-ready program does not include the new construction rebate to be deployed at MuDs.

\(^97\) TURN assumes average per port costs of around $17,000. See Table 4.

\(^98\) TURN’s make-ready budget is for $169 million – if only $86 million is spent on MuDs, this leaves $84 million for workplace/public make-ready infrastructure if there is not sufficient interest from MuDs which could deploy a total of 8,200 workplace/public ports using TURN’s unit cost assumptions.
C. Recommendations for Performance Accountability Measures

SB 350 requires utility EV charging infrastructure programs to include performance accountability measures (PAMs).\(^9^9\) Despite a much more robust data set from the Charge Ready pilot than was previously available, SCE’s proposal offers no PAM to adequately align program success with ratepayer spending. The risk of program success is placed entirely on ratepayers with rewards flowing automatically to SCE’s shareholders, regardless of how sites or the EV market performs. To better align ratepayer spending with program success, TURN proposes two primary performance accountability measures:

1) Based on pilot data shown in Section VI below, SCE’s workplace and public infrastructure should achieve at least 7% utilization on a per port basis, as measured by the number of kWh dispensed for EV charging divided by the maximum possible on an annual basis. This equates to around 27 EV miles dispensed per day on a per port basis using TURN’s methodology. This target is achievable and ensures relatively highly utilized infrastructure. If a site does not achieve this minimum utilization within 3 years after installation, all of the sites’ costs should be flagged for reasonableness review in the ensuing GRC and a minimum one-time shareholder contribution should be assessed to directly offset ratepayer expenditures of Charge Ready 2. TURN leaves to the Commission’s discretion what the one-time penalty should be, but believes it should be significant enough to incent high utilization from workplace and public sites, in addition to the threat of reasonableness review of costs.

2) SCE should track site utilization on an annual basis in its GRC. If a site shows near-zero or zero utilization\(^10^0\) for a period of a year or more, any costs associated with the site should be removed from rate base. This guards ratepayers from the risk of long-term stranded costs and does not allow shareholder returns or cost recovery for sites that provide absolutely no financial or environmental benefit to ratepayers.

With regard to the latter, SCE anticipates that some sites may be unutilized, but does not propose they be removed from ratebase. SCE states,

To the extent that certain charging sites are no longer used after the program period, capital recovery for the investment will continue under normal group depreciation procedures. SCE’s assets are depreciated using broad group procedure. Generally, a broad group is defined by FERC plant account, with some exceptions. Assets within a broad group are expected to retire before and after the average service life, and by convention, are fully depreciated when retired.\(^10^1\)

\(^{99}\) P.U. Code Section 740.12(b)
\(^{100}\) Charge Ready pilot data showed that some sites have auxiliary load that records some usage which is not associated with EV charging.
\(^{101}\) SCE-1, p. 98, Footnote 190.
Uncertainties regarding the EV market and charging station utilization should not be placed on ratepayers for decades to come – full cost recovery, including shareholder return, should only occur for the utility if assets are actually used and useful. If EV infrastructure is unutilized, they do not meet this standard, nor do they provide any benefits to ratepayers. These considerations also support TURN’s recommendation that customer-side infrastructure be expensed to limit ratepayer risk, though utility-side infrastructure built to support the program may also become stranded.

D. Recommendations for Cost Recovery and Reasonableness Review

SCE proposes that costs incurred by the program will be recorded in a one-way balancing sub-account and then transferred on an annual basis, including interest expense, to the Base Revenue Requirement Balancing Account (BRRBA) at the end of each year. SCE limits review of these expenditures to, essentially, whether they are recorded correctly and below the cost cap:

[...]

SCE also proposes these costs be submitted and reviewed in the ERRA proceeding103 until they are presented in a General Rate Case in 2024 or 2028,104 and that they be collected in distribution rates.105 SCE would file an Advice Letter (AL) each year that would update prior year expenditure and include in rates a forecast of expected expenditures.106

TURN recommends several modifications to these proposals to improve cost recovery and avoid unneeded burden on residential ratepayers. First, costs should not be recovered through distribution rates but rather on an equal cents per kWh basis among customer classes, e.g based on each class’s share of system sales. This cost recovery treatment is appropriate because TE programs are intended to benefit all ratepayers and, therefore, all ratepayers should pay

102 SCE-1, p. 88, lines 9-12.
103 SCE-1, p. 88, line 16.
104 SCE-1, p. 96, lines 4-6.
105 SCE-1, p. 96, line 4.
106 SCE-1, p. 96, lines 11-12.
equally for TE program costs. Further, using the equal cents per kWh allocation method for TE programs is consistent with other utility programs that are intended to generate broad societal benefits (e.g., Electric Program Investment Charge (“EPIC”), the California Alternative Rates for Energy (“CARE”) program, the Community Solar Green Tariff program, etc.). Like these programs, TE programs aim to provide broad societal benefits in the form of air pollution and greenhouse gas (“GHG”) emission reductions. Second, reasonableness review should include whether the program requirements have been met, as discussed in the PAM and budget sections above. Third, the program should have two separate one-way balancing accounts: one for the new construction rebate program and one for the make-ready program (MuDs, workplaces, and public locations). This ensures the funds for these programs are distinct and used for their intended purpose.

E. Data Collection

SCE proposes to continue to provide annual reports to the Commission regarding a range of fairly broad categories. TURN recommends, at a minimum, the same data collection requirements be adopted for Charge Ready 2 as the pilot. The Commission’s Decision (D.18-05-040) regarding data collection for the MD-HD sector may also be a useful starting point for various categories of data collection.

In addition, TURN recommends the Commission contract with a neutral third-party to collect data on incremental EV adoption due to SCE’s program. A neutral third-party is important as SCE may have an incentive to inflate these numbers. This data collection could occur in the following manner:

- Surveys at workplaces and MuDs should identify how many employees/tenants adopt EVs after charging stations are installed;

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107 A.14-04-012, Joint Motion to Adopt Revenue Allocation Settlement Agreement (Nov. 4, 2016). Table 5 allocation factors for EPIC are the same as those for SGIP. At the time the settlement was proposed, SGIP was “allocated according to total sales.”
108 D.18-06-027 (funding the program first through the GHG allowance revenues and then through the PPP). A pending Proposed Decision Correcting and Clarifying Decision 18-06-027 (issued 9/7/18) does not impact cost allocation for this program.
109 See, e.g., D.18-05-040, Findings of Fact 1, 53, 54, 55 and Conclusions of Law 1, 37.
110 SCE-1, p. 46.
• Surveys should ask employees and MuD residents whether the charging station installation influenced their decision to buy an EV;
• EV adoption should be tracked at the service territory level and perhaps at a more granular level to serve as an upper bound of EV adoption due to the program.
SCE should continue to track data regarding load management, including site performance in demand response activities and charging patterns.

VI. ANALYSIS OF CHARGE READY PILOT RESULTS

The Charge Ready pilot was successful in illuminating key unknown aspects of utility EV infrastructure programs, including demand for the program from various types of site hosts, utilization of charging stations, and costs. Though unfortunately critical data gaps still exist, several have been at least partially filled, and data from the pilot should be utilized to the greatest extent possible to inform the Charge Ready 2 program.

A. Benefits of the Charge Ready Pilot

The primary ratepayer and broader societal benefits of utility light-duty infrastructure programs, both financial and environmental, are achieved through incremental EV adoption and increased electric vehicle miles traveled (eVMT) – for example, an EV which is able to drive further with electricity due to the installed charging stations. Other benefits of the program are conferred directly to the site host via the substantial ratepayer subsidy to install EV charging stations – site hosts may gain revenue from electricity sales, a green image, perks for employees, and other benefits. While broader societal benefits of the pilot were limited or not quantified, benefits conferred to participating workplaces, governments, and other entities who received ratepayer subsidy during the pilot were substantial.

1. It Cannot be Assumed that the Pilot Incentivized any Meaningful EV Adoption

Regarding incremental EV adoption due to the pilot, SCE provides an anecdote to indicate that one site may have had incremental vehicle adoption due to the infrastructure

112 This refers to EV adoption above what would have occurred in the absence of the program – e.g. due to the utility infrastructure.
installation; nevertheless, the utility provides no empirical evidence, nor was sufficient analysis accomplished, to determine how many EVs were adopted due to the pilot.\textsuperscript{113}

2. Purported GHG Reduction Benefits of the Pilot were Extremely Expensive

SCE claims that, through January 2018, 214 Metric Tons of carbon dioxide equivalent (CO\textsubscript{2}e) was reduced due to the pilot infrastructure.\textsuperscript{114} The utility calculated this by comparing the GHG content of the electricity used to charge the vehicles with the GHG content of gasoline. This methodology assumes that all kilowatt hours (kWhs) of electricity used to charge were incremental (e.g. would not have been achieved without the charging stations). This is likely not accurate – a long-range BEV (battery electric vehicle) may simply substitute workplace charging for residential charging,\textsuperscript{113} or a PHEV may have sufficient range to complete roundtrip travel without a charge, depending on range and commuting/travel distance. Therefore, it is not true, as assumed by SCE, that all utilization of SCE’s infrastructure result in emissions benefits comparable to gasoline.

Nevertheless, if we take SCE’s claim at face value, emissions benefits to date have cost over $93,000 per Metric Ton.\textsuperscript{116} Continuing to take SCE’s numbers at face value, even if one assumes that the deployed infrastructure reduces emissions by 50 MT’s per month (the maximum seen in the pilot)\textsuperscript{117} every month for the next 10 years, ratepayers will spend $3,300 per MT of abated CO\textsubscript{2}e,\textsuperscript{118} compared with an IRP price of less than $20 through 2023, which represents the “marginal cost of GHG abatement associated with the 42 MMT [GHG] Scenario for the years 2018 to 2026.”\textsuperscript{119} This is the maximum price utilities are expected to pay in a given year to reduce GHG emissions based on initial modeling results in this proceeding. Other

\textsuperscript{113} SCE claims on page 23 of the Pilot Report that one customer stated “several employees…started driving an EV that weren’t doing so before the charging stations were installed.” This is anecdotal and not an analysis of the overall pilot results.
\textsuperscript{114} Pilot Report, p. 51.
\textsuperscript{115} For example, an EV driver with a 40 mile commute and 200 mile range BEV, if fully charged from her home, has sufficient range to complete the travel round-trip without a charge. The driver may nevertheless charge at the workplace, which under SCE’s methodology results in “incremental” vehicle miles.
\textsuperscript{116} $20$ million / $215$ MT = $93,053$. This does not include the total revenue requirement of SCE’s program (e.g. profit, taxes, loaders, etc.).
\textsuperscript{117} Pilot Data, p. 53.
\textsuperscript{118} $20$ million / $(50*12*10)$ = $3,333$.
\textsuperscript{119} D.18-02-018, Attachment A, p. 4.
resources, like large-scale solar or wind, could have been procured much more cost-effectively to reduce GHGs than what was accomplished due to EV infrastructure.

It should also be noted that SCE’s pilot was relatively short duration (despite taking longer than expected) so benefits may be difficult to measure over this period. Further, there is a possibility that incremental EV adoption will result from the program (and/or a future iteration) which would significantly increase the program’s benefits.

The facts cited above should be utilized to guide the parameters of Charge Ready 2. Namely, the Commission must significantly modify SCE’s proposal such that the utility will be incented to deploy infrastructure as cost-effectively as possible where it will provide the greatest benefit. TURN provides clear recommendations for how this can be accomplished, including by capturing economies of scale of high-port sites, leveraging greater funds from site hosts, and ensuring relatively high levels of utilization (a proxy for eVMT and incremental EV adoption) for each site that receives ratepayer subsidy. These recommendations are discussed in Section V.

B. Demand for the Program

Demand for Charge Ready was robust, particularly for workplaces and public installations.

Due to significant interest in the program, SCE stopped accepting new applications seven months after launch. 334 customers had submitted applications to have 2,043 EV charging stations installed on their property when SCE stopped accepting new applications.¹²⁰

Further, disadvantaged community (DAC) installations comprised around 50% of the ports deployed through the program, and there were more workplace ports deployed in DACs than in Non-DACS.

¹²⁰ Pilot Report, p. 62.
The biggest gap in deployment seen in the pilot is for multi-unit dwellings (MuDs). Just 12 ports were deployed through July 2018, and the primary reason cited by MuDs for non-participation is that installation of charging stations are a “low priority.” Without access to residential charging, it is unlikely MuD residents will increase participation in the EV market.

C. Utilization Data from the Charge Ready Pilot Demonstrate Opportunities to Maximize Benefits of Charging Infrastructure

One of the most important areas of data to come from the pilot is the degree to which ratepayer-funded charging stations were utilized. The data summarized by SCE in the pilot report, which primarily examines average kWh per port by month, is only helpful at a superficial level but leaves fundamental questions unanswered. For example, is the utilization experienced relatively good or bad? What is the distribution among sites? What is the maximum number of kWh’s that could have been dispensed over the period? How many electric miles do these kWh’s

121 Pilot Report, p. 76.
122 Pilot Report, p. 61.
123 As stated above, MuD residents are a minor participant in the EV market. Through 2015 just 9% of California’s EV drivers live in an apartment. CVRP Survey, p. 46, question 34, https://cleanvicularbate.org/sites/default/files/attachments/CVRPConsumerSurvey2013-15Reference.pdf. This is due to the fact that “residential charging is convenient and inexpensive, most plug-in electric vehicle (also known as electric cars or EVs) drivers do more than 80% of their charging at home.” DOE, https://www.energy.gov/eere/electricvehicles/charging-home.
represents? And significantly, how can the Commission use this data to optimize Charge Ready 2?

TURN thus examines the utilization statistics for all available data from the time a site is installed through August 2018. TURN measures utilization in two ways – 1) as a percentage of the maximum number of kilowatt hours per port that could have been dispensed over the period the chargers are installed\(^{124}\) and 2) the approximate number of electric miles dispensed per port per day.\(^{125}\) These statistics are shown for all site types by site and then discussed further below.

**Figure 15. SCE Pilot Charging Station Utilization – Workplace**

Percentage of Max kWh per Port

![Utilization Chart](image-url)

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\(^{124}\) Calculated from data provided in Data Request TURN-02, question 1, attachment “Pilot Monthly Average Usage.” TURN assumes an even mix of 3.3kW and 6.6kW Level 2 charging (4.95kW) despite the fact that the chargers are rated for over 8 kW. Though this is not the only way to calculate a “maximum” kWh per port, it is a reasonable assumption that puts all stations on a level playing field. Each bar of the x-axis represents a different site while the y-axis is the calculated utilization percentage (kWh dispensed / maximum kWh possible for the period the station was installed give above assumption and 24 hours per day).

\(^{125}\) Calculated from data provided in Data Request TURN-02, question 1, attachment “Pilot Monthly Average Usage.” Calculated assuming .3 kWh per mile using the following formula – Total kWh / .3 / Days / Ports = EV miles per day per port.
Figure 16. SCE Pilot Charging Station EV Miles per Port per Day – Workplace

Figure 17. SCE Pilot Charging Station Utilization – Fleet
Percentage of Max kWh per Port
The utilization data provides several valuable insights. First, there is significant variability in the level of utilization on a per site basis, with some sites performing relatively well, and some performing poorly, with little to no utilization. Second, the Commission now has sufficient data to understand what a well-performing site looks like and to target Charge Ready 2 to this type of site. Using this data, TURN therefore recommends the Commission hold SCE accountable for a minimum utilization of 7% on a per port basis for workplace/public stations, which corresponds to around 27 EV miles per port per day. TURN does not recommend a minimum utilization threshold for MuDs given the lack of data provided in the pilot of this site type. However, this should not prevent the Commission from imposing such a requirement for other utilities or in future SCE applications.
D. Costs and Ratepayer Funding of the Charge Ready Pilot

In addition to utilization, the other key learning from the pilot is the cost of deploying charging infrastructure. Due to the pilot, there is much more certainty around these costs. First, there are significant economies of scale when deploying charging station infrastructure – sites that deploy more ports cost much less on a per port basis than smaller sites.

Figure 23. Costs of Charge Ready Pilot ($/Port)$^{126}$

$^{126}$ Data just for completed site costs at time of data request – 55 sites and 844 ports. Data Request TURN-07 question 1, A.14-10-014, 5/17/18.
The average cost per site was around $230,000, with a range of costs from $100,000 to just over $1 million for a single site.

Figure 25. Cost Per Site by Number of Ports

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127 Ibid.
128 Ibid.
The majority of these costs were for customer-side infrastructure – on average, these costs represented almost 70% of total infrastructure and charging station costs, including costs paid for by the customer.

Figure 26. Average Percentage of Site Costs by Category

Under the pilot terms, which provided ratepayer-funded infrastructure and varying levels of charging station rebates for sites, ratepayers funded the vast majority, and at times close to 100%, of total costs for charging station installation and fees. Ratepayers funded between 70%-99.8% of the total costs; on average the ratepayer subsidy was about 90% of total costs, including the charging station and any fees paid by the customer to the charging station vendor.

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129 Ibid.
Figure 27. Ratepayer Subsidy
Percentage of Total Costs\textsuperscript{130}

\begin{figure}
\centering
\includegraphics[width=\textwidth]{ratepayer_subsidy.png}
\end{figure}

E. Infrastructure Deployed During the Charge Ready Pilot

Based on data for 74 sites and over 1,000 ports, SCE deployed an average of 15 ports per site, and sites with greater than 10 ports constituted 72% of the ports deployed in the pilot.

\textsuperscript{130} Ibid. Each bar corresponds to a specific site. Only completed sites at time of data request.
Table 6. Charge Ready Pilot Ports Per Site\textsuperscript{131}

<table>
<thead>
<tr>
<th>Ports per Site</th>
<th>Sites</th>
<th>Number of Ports</th>
<th>Ports %</th>
<th>Site %</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-5</td>
<td>7</td>
<td>35</td>
<td>3%</td>
<td>9%</td>
</tr>
<tr>
<td>5-10</td>
<td>34</td>
<td>275</td>
<td>25%</td>
<td>46%</td>
</tr>
<tr>
<td>10-20</td>
<td>20</td>
<td>305</td>
<td>27%</td>
<td>27%</td>
</tr>
<tr>
<td>20-30</td>
<td>6</td>
<td>140</td>
<td>13%</td>
<td>8%</td>
</tr>
<tr>
<td>&gt;30</td>
<td>7</td>
<td>361</td>
<td>32%</td>
<td>9%</td>
</tr>
<tr>
<td>Total</td>
<td>74</td>
<td>1,116</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Average Ports per Site | 15

F. Summary and Implications of Pilot Learnings for Charge Ready 2

The pilot data presented above represents some of the first insights using real data in California regarding costs, utilization, and benefits of charging station infrastructure. First, GHG benefits from increasing eVMT, even if they occurred under SCE’s flawed assumptions, could have been achieved much more cost-effectively through procurement of other clean resources. Further, there is still a significant data gap regarding the amount of incremental EV adoption that occurs due to EV infrastructure programs. Second, there are significant economies of scale when deploying charging infrastructure, and a majority of costs, around 70%, are related to customerside infrastructure. Third, there are significant disparities in utilization of ratepayer-funded infrastructure, with several poorly performing sites and some higher performers.

Taken together, pilot data should help inform the Commission how to institute a second phase of Charge Ready 2 to capture economies of scale, minimize costs, and maximize benefits of ratepayer-funded infrastructure. While SCE’s proposal does not attempt to accomplish this,

\textsuperscript{131} TURN-07, question 1, A.14-10-014, 5/17/18. Data for both completed and sites still in progress at the time of the DR response.
TURN’s recommendations regarding leveraging greater funds from site hosts, capturing economies of scale, ensuring funds are spent on their intended purpose, and performance accountability measures, including minimum utilization requirements for workplace and public charging stations, represent reasonable measures to improve upon the pilot structure.
TECHNICAL APPENDIX. “DOWNWARD PRESSURE” ON RATES
ANALYSIS

As described by E3, a consultancy, “if the utility incurs less cost to serve PEV charging load than the revenue it collects via PEV drivers’ electric bills, then ratepayers as a whole benefit.” This is referred to here as “downward pressure on rates,” and the difference between revenues and costs as “net revenue.” There are three primary inputs regarding calculation of net revenue — the cost to serve EV load, the revenue from EV load, and the assumed EV forecast. Other assumptions also play an important role in the calculation, including the efficiency of the battery (kWh/mile), miles driven per year, discount rate, vehicle lifetime, vehicle mix (PHEV vs. EV), and electric vehicle miles traveled (eVMT) for PHEVs and EVs respectively. TURN utilizes reasonable, and often conservative, assumptions, but continuing data collection and research should be used to update models such as these with real-world driving and charging patterns. These assumptions are detailed in the ensuing paragraphs.

Regarding the cost to serve EV load, effectively this is the marginal cost of serving EV load. TURN utilized the latest version of the Commission’s avoided cost calculator (ACC) to calculate this cost, which provides, essentially, a price forecast by climate zone for each utility. TURN downloaded the 24 hour levelized prices over 15 years forecast by the calculator for each SCE climate zone. TURN adjusted the hourly prices by subtracting out the “GHG adder” from the total price in each hour because this is not a financial cost incurred by ratepayers (the calculator separately forecasts cap and trade prices which are included). Prices for CZ 6 are shown by hour in the following Figure.

132 E3, p. 4.
133 The avoided cost calculator can be downloaded from the CPUC’s website here - http://www.cpuc.ca.gov/General.aspx?id=5267.
TURN then calculated a weighted average cost for each climate zone by assuming 82% residential charging overnight (SCE’s assumption for residential charging in its infrastructure model), 70% of which is assumed to be off-peak (peak is defined as 4-9pm). The remaining charging (18%) occurs during the day. Thus, TURN assumes 88% of EV load is charged off-peak, or outside of the period of 4-9pm. Based on these assumptions TURN assigned a weight to each hour of the day in each climate zone (CZ), multiplied this weight by the total price (marginal cost) in each hour, and then summed the total to determine a weighted average price in each CZ. TURN then calculated the average cost across climate zones.

134 TURN makes the hypothesis that many customers when defaulted onto TOU rates will shift most EV load off-peak, but this is only a hypothesis and real-world data must be collected to understand how EV customers charge when defaulted onto a TOU rate versus current research which shows most EVs charge off-peak when opting in to a TOU rate.
Appendix Table 1. Average Price to Serve EV Load

<table>
<thead>
<tr>
<th>CZ</th>
<th>Weighted Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>$72.76</td>
</tr>
<tr>
<td>8</td>
<td>$74.48</td>
</tr>
<tr>
<td>9</td>
<td>$74.81</td>
</tr>
<tr>
<td>10</td>
<td>$74.21</td>
</tr>
<tr>
<td>13</td>
<td>$81.11</td>
</tr>
<tr>
<td>14</td>
<td>$75.98</td>
</tr>
<tr>
<td>15</td>
<td>$78.12</td>
</tr>
<tr>
<td>16</td>
<td>$82.80</td>
</tr>
</tbody>
</table>

This assumes that each CZ has the same amount of EV load, which could be improved upon with EV sales data by CZ to weight each CZ appropriately. The average cost shown here is applied in the model for each kWh of EV load.

The other side of the coin, revenue, assumed the same charging patterns as described for cost, and a mix of rates SCE’s customers will charge on – SCE’s proposed default TOU rate (4-9pm),\textsuperscript{135} SCE’s EV rate, and SCE’s commercial EV rate (TOU-EV-8). Based on the most recent load research report around 16% of EV drivers are on the EV rate – TURN assumes around 25% of EV drivers adopt SCE’s EV rate after 2019, under the hypothesis that defaulting customers to TOU will encourage more drivers to adopt the rate. Therefore, 75% of drivers are assumed to charge on SCE’s residential default TOU rate (as proposed in its application by the utility). The remaining charging (18%) occurs on SCE’s commercial rate, TOU-EV-8, during the day. This mix of charging results in the following weighted average revenue for EV load.

\textsuperscript{135} A.17-12-012.
## Appendix Table 2. Average Revenue from EV Load

<table>
<thead>
<tr>
<th></th>
<th>Res TOU</th>
<th>62%</th>
<th>128.58</th>
<th>Res EV</th>
<th>21%</th>
<th>32.14</th>
<th>Commercial</th>
<th>18%</th>
<th>12.70</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Retail Rate Revenue ($/MWh)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Other assumptions are detailed in the Table below.

## Appendix Table 3. Modeling Assumptions

<table>
<thead>
<tr>
<th>Modeling Assumptions</th>
<th>Source:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Battery kWh Per Mile</td>
<td>0.32</td>
</tr>
<tr>
<td></td>
<td><a href="https://www.afdc.energy.gov/vehicles/electric_emissions_sources.html">https://www.afdc.energy.gov/vehicles/electric_emissions_sources.html</a></td>
</tr>
<tr>
<td>Average Revenue (c/kWh)</td>
<td>0.173</td>
</tr>
<tr>
<td></td>
<td><a href="https://www.afdc.energy.gov/vehicles/electric_emissions_sources.html">Weighted average of SCE default TOU, EV, and commercial rates</a></td>
</tr>
<tr>
<td>Average Cost (c/kWh)</td>
<td>0.077</td>
</tr>
<tr>
<td></td>
<td>[Weighted average of avoided cost calculator prices, see &quot;Prices by CZ&quot;]</td>
</tr>
<tr>
<td>Statewide EV Adoption by 2025</td>
<td>1,500,000</td>
</tr>
<tr>
<td>Miles/vehicle/person</td>
<td>11,100</td>
</tr>
<tr>
<td></td>
<td>State Goal / Executive Order</td>
</tr>
<tr>
<td>Discount rate</td>
<td>7.61%</td>
</tr>
<tr>
<td></td>
<td>[Unily WACC (SCE Testimony, p. 99)]</td>
</tr>
<tr>
<td>Vehicle Life (Years)</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>[National sales to date show an approximately 50/50 split and SCE uses this assumption in its infrastructure model]</td>
</tr>
<tr>
<td>PHEV %</td>
<td>50%</td>
</tr>
<tr>
<td></td>
<td><a href="https://dawg.energy.ca.gov/sites/default/files/meetings/6_PLEV%20Forecast%20DAWG%202011-08%20V2_0.pdf">CEC DAWG Study.</a></td>
</tr>
<tr>
<td>EV%</td>
<td>50%</td>
</tr>
<tr>
<td></td>
<td><a href="https://www.afdc.energy.gov/vehicles/electric_emissions_sources.html">65%</a></td>
</tr>
<tr>
<td>EVMT % with PHEV</td>
<td></td>
</tr>
<tr>
<td></td>
<td><a href="https://www.afdc.energy.gov/vehicles/electric_emissions_sources.html">TURN assumes higher than indicated values for 2019-2023. The DOE assumes 55% -</a></td>
</tr>
<tr>
<td>EVMT % with BEV</td>
<td>90%</td>
</tr>
<tr>
<td></td>
<td><a href="https://www.afdc.energy.gov/vehicles/electric_emissions_sources.html">UC Davis, Advanced Plug-in Electric Vehicle Travel and Charging Behavior Interim Report, January 2017. Real values could be considerably lower. However, eVMT increases as range increases. TURN assumes longer-range BEVs/PHEVs will dominate the EV market from 2019-2023, and that substitution to ICE vehicles will decrease from today.</a></td>
</tr>
</tbody>
</table>
Finally, the EV sales forecasts assume linear adoption from 2018 to meet SCE’s portion of the 1.5 million EV goal by 2025, 480,000 vehicles in SCE’s territory. This means 236,319 vehicles are adopted between 2019 and 2023, over 47,000 per year. It is the net revenue of these vehicles and their pursuant load (kWh) that form the basis of TURN’s net revenue calculation.

Appendix Figure 2. Estimated Net Revenue of Vehicles in SCE’s Territory 2019-2023

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136 SCE’s territory has around 32% of EV sales in the state.
### APPENDIX 1. STATE AND MUNICIPAL WORKPLACE/PUBLIC CHARGING STATION INCENTIVES

<table>
<thead>
<tr>
<th>Utility Name</th>
<th>State</th>
<th>Incentive Amount per Port/Station</th>
<th>Unit type</th>
<th>Maximum Rebate</th>
<th>Notes</th>
<th>Website Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salt River Project</td>
<td>AZ</td>
<td>$500</td>
<td>L2</td>
<td>$6,000</td>
<td></td>
<td>SRP Workplace Rebate</td>
</tr>
<tr>
<td>Glendale Water and Power</td>
<td>CA</td>
<td>Not specified</td>
<td>L2</td>
<td>$2,000</td>
<td></td>
<td>Glendale Water &amp; Power EV Rebate</td>
</tr>
<tr>
<td>Alameda Municipal Power</td>
<td>CA</td>
<td>$3,000</td>
<td>L2</td>
<td>Not Specified</td>
<td>Offering rebates up to $3,000 but not specified he maximum rebate per applicant. Dual-port CS eligible for single rebate. (Chargers must be wall/pedestal-mounted and installed by licensed contractor)</td>
<td>AMP EV Rebate</td>
</tr>
<tr>
<td>Rancho Cucamonga Municipal Utility</td>
<td>CA</td>
<td>$4,000</td>
<td>L2</td>
<td>$24,000</td>
<td>Offers up to $4,000 per charging station (must be 1:5 ratio for Charge Station to available parking spaces). SCE Customers do not qualify for rebate. Chargers need dedicated RCMU revenue-grade</td>
<td>Rancho Cucamonga EVSE Rebate</td>
</tr>
<tr>
<td>Utility Name</td>
<td>State</td>
<td>Rebate Amount</td>
<td>Level</td>
<td>Offered Amount</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>--------------------------------------------------</td>
<td>-------</td>
<td>---------------</td>
<td>-------</td>
<td>----------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Sacramento Municipal Utility District (SMUD)</td>
<td>CA</td>
<td>$1,500</td>
<td>L2</td>
<td>$30,000</td>
<td>Offering $120,000 per DC fast charger project, which is limited to 6 projects per year.</td>
<td></td>
</tr>
<tr>
<td>Redding Electric Utility (REU)</td>
<td>CA</td>
<td>$3,000</td>
<td>L2 or greater</td>
<td>$30,000</td>
<td>Offers $3,000 account credit for each charge station</td>
<td></td>
</tr>
<tr>
<td>City of Palo Alto Utilities (CPAU)</td>
<td>CA</td>
<td>$5,000</td>
<td>L2 or greater</td>
<td>$30,000</td>
<td>Schools &amp; non-profits earn $5,000 in rebates per EV Charger while multifamily properties receive $3,000 per Charger</td>
<td></td>
</tr>
<tr>
<td>Pasadena Water &amp; Power</td>
<td>CA</td>
<td>$6,000</td>
<td>L2 or greater</td>
<td>$50,000</td>
<td>$6,000 is a double incentive provided that are available during all business hours, any DCFC has at least 2 charging ports, serve 80% DAC ($1,500 rebate up to $15,000 for non-network charging stations)</td>
<td></td>
</tr>
<tr>
<td>Program Name</td>
<td>State</td>
<td>Minimum Rebate</td>
<td>Port Type</td>
<td>Maximum Rebate</td>
<td>Rebate Details</td>
<td></td>
</tr>
<tr>
<td>--------------------------------------------------</td>
<td>-------</td>
<td>----------------</td>
<td>-----------</td>
<td>----------------</td>
<td>--------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Los Angeles Department of Water &amp; Power (LADWP)</td>
<td>CA</td>
<td>$5,000</td>
<td>L2</td>
<td>$200,000</td>
<td>Additional $750 added per additional port on a charger. Maximum of 40 chargers per site (ports not specified)</td>
<td></td>
</tr>
<tr>
<td>Fresno County Incentive Project</td>
<td>CA</td>
<td>$4,000, $7,000</td>
<td>L2, L2 (dual-port)</td>
<td>$1,000,000</td>
<td>Applicants can receive a maximum of $1M in rebates over the lifetime of FCIP</td>
<td></td>
</tr>
<tr>
<td>PSEG Long Island</td>
<td>NY</td>
<td>80% or $4,000</td>
<td>L2</td>
<td>$4,000</td>
<td>Eligible for the lesser of $4,000 or 80% of invoice for up to 10 charging stations.</td>
<td></td>
</tr>
<tr>
<td>Austin Energy</td>
<td>TX</td>
<td>50% or $4,000</td>
<td>L1/L2/DCFC</td>
<td>$4,000</td>
<td>Offers the lesser of 50% or $4,000 to install L2 and/or L1 Outlets. Offers up to $10,000 per DCFC Charge Station</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX 2. ERIC BORDEN STATEMENT OF QUALIFICATIONS

I have been an Energy Policy Analyst with The Utility Reform Network (TURN) since the beginning of 2015. I have testified before the California Public Utilities Commission on behalf of TURN on multiple occasions on matters including general rate cases, electric vehicle charging infrastructure, rate design, and other areas. Prior to my position at TURN, I consulted for major utilities, an inter-governmental energy agency, and an energy services company. I have conducted research and published reports on energy sector topics including battery storage and the German energy transition.