Application No. A.14-04-014
Exhibit No.: SDG&E-12
Witness: JC Martin

Application of SAN DIEGO GAS & ELECTRIC COMPANY (U902E) for Approval of its Electric Vehicle-Grid Integration Pilot Program.	Application No. 14-04-014 (Filed April 11, 2014)
And Related Matter.	Rulemaking 13-11-007

PREPARED REBUTTAL TESTIMONY OF
JC MARTIN
CHAPTER 5
ON BEHALF OF SAN DIEGO GAS & ELECTRIC COMPANY

**BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA**

APRIL 13, 2015

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PREPARED REBUTTAL TESTIMONY OF

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CHAPTER 5

I. OVERVIEW AND PURPOSE

The purpose of my rebuttal testimony is to respond to the direct testimony submitted by intervening parties in the Application ("A") 14-04-014, *Electric Vehicle-Grid Integration Pilot Program* ("VGI program") on San Diego Gas & Electric Company's ("SDG&E") proposal in this proceeding. I have previously submitted testimony in this proceeding supporting the April 2014 application and the January 2015 supplemental testimony. Specifically in this rebuttal testimony, I will respond to the issues raised by the following parties ("Parties") regarding SDG&E's proposal:

- Office of Ratepayer Advocates ("ORA"):
- The Utility Reform Network ("TURN")
- Utility Consumers' Action Network ("UCAN")
- ChargePoint
- Environmental Defense Fund ("EDF")
- Green Power Institute ("GPI")

II. ALL RATEPAYERS SHOULD BENEFIT FROM THE VGI PROGRAM

My direct testimony presented a cost effectiveness model in line with the Commission's VGI White Paper issued November 22, 2013. It introduced a methodology for the Commission's consideration to use in evaluating various VGI solutions, such as those proposed in SDG&E's VGI pilot. The methodology relies on an analytical model developed at my direction by Energy and Environmental Economics ("E3"), a consulting firm that has conducted economic assessments to support the Commission's policy development in the area of distributed energy resources. The methodology and model described in my testimony thus builds upon standard cost effectiveness tests familiar to the Commission. Note that while my testimony offers illustrative model results, the model is not intended to be predictive:

> Cost-effectiveness methodology is used to model EV charging in SDG&E's service territory under two sets of hypothesized assumptions, including assumptions on SDG&E's VGI Pilot Program. Results are used to infer market level insights into the cost and benefits of deploying EV charging at workplace and multi-unit dwelling (MuD) locations. The model output is illustrative only and is not intended to be predictive. However, results may provide policy makers with insights about various VGI solutions in the SDG&E EV charging market. [1]

Notwithstanding its use of hypothetical assumptions, the modeling is especially informative with respect to scenario comparisons. The modeling using the hypothesized assumptions indicates that an EV market with the VGI program should provide superior ratepayer benefits compared to a similar program where the drivers pay a Flat Fee charging price.[2] Electric supply costs are reduced by $3,000 per VGI charger when EV drivers charge their cars under the VGI rate, compared to Flat Fee charging price. To summarize, the methodology models future EV charging in SDG&E's service territory under two EV Market scenarios. The two EV Market Scenarios are: the **SDG&E VGI Rate Scenario** and a **Non-utility Flat Fee Scenario**. These market scenarios include similar EV charging deployments at MuD and workplace charging locations, but with two key differences: 1) Who owns the deployed charging technology (SDG&E or a Non-utility entity) and; 2) What price

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[1] SDG&E (Martin) JCM-2:10-14. Testimony served in this proceeding will be cited to as follows: Party nickname (witness surname) page(s):lines(s). Examples: TURN (Jones) 6:18-7:5; ORA (Aliaga-Caro) 2-5:11-16. SDG&E's rounds of testimony will be cited as "SDG&E" [for the direct case served April 11, 2014 and as revised June 3, 2014 (Cynthia Fang) and July 29, 2014 (J.C. Martin)], "SDG&E Supp." [supplemental served January 14, 2015], otherwise using the forgoing form. Please note that SDG&E witness James P. Avery subsequently adopted the testimony of Lee Krevat submitted with the original application. SDG&E Supp. (Avery) ST-4:16-ST-5:2.

[2] The "Flat Fee" charging price, as defined in my direct testimony, is intended as a generalized price for non-utility EV charging for purposes of modeling assumptions. *See,* SDG&E (Martin) JCM-12:18 – JCM-13:4.

EV driver pays at the charging technology (VGI Rate or Flat Fee).[3] The scenarios model all current and future EV charging in the SDG&E service territory through 2028.

Results from these scenarios are used to infer market level costs and benefits. The two scenarios are compared to isolate relative benefits of the SDG&E VGI Rate scenario, compared to a Non-utility Flat Fee scenario. The results from my April 11, 2014 Direct Testimony (Chapter 6) are presented using standard Cost-Benefit test methodologies familiar to the Commission. Each cost test answers a key policy question relating to the EV market development. The table below describes the key questions answered by the Cost-Benefit tests. The cost tests are: Ratepayer Impact Measure ("RIM"), Participant Cost Test ("PCT"), Total Resource Cost ("TRC"), and Societal Cost Test ("SCT").

Cost-Benefit Tests - Key Questions Answered		
Cost Test	**Acronym**	**Key Question Answered**
Ratepayer Impact Measure	RIM	Will utility rates increase?
Participant Cost Test	PCT	Will the participants benefit over the measure life?
Total Resource Cost	TRC	Will the total costs of energy in the utility service territory decrease?
Societal Cost Test	SCT	Is the utility, state, or nation better off as a whole?

I address certain parties' testimony relating to SDG&E's cost-benefit methodology and results. Such testimony includes: proposals for alternative rates to be considered in the SDG&E VGI pilot or modifications to SDG&E's proposed VGI rate; concerns about the costs and benefits accruing to ratepayers; and cost test applicability, methodology, and assumptions used by SDG&E. Parties' testimony also addresses issues regarding: The size of the program; suggestions for phasing

[3] SDG&E (Martin) JCM-5:9 – JCM-6:2.

the program; and suggestions to focus the program on either workplace or MuD locations. My rebuttal testimony addresses these suggestions and concerns.

A. Electric Supply Costs Should Be Lower For The VGI Program Compared to a Non-Utility Flat Fee Scenario.

Several parties suggest alternative designs to the VGI rate proposed by SDG&E. Unfortunately none include estimates of ratepayer benefits for their suggestions or a quantification of their suggested reductions in electric supply costs. Electric supply costs include energy, losses, ancillary services, generation capacity, T&D capacity and renewable portfolio standards costs.

The modeling described in my direct testimony suggests that EV Drivers paying the VGI rate at VGI facilities save electric supply costs of $16.8 Million Net Present Value ("NPV") compared to the Non-utility Flat Fee scenario.[4] This translates to an electric supply cost savings of over $3,000 NPV per each of the 5,500 VGI chargers. This ratepayer benefit increases to $3,500 and $3,600 NPV per VGI charger in the sensitivities requested by UCAN discussed in section II.C below.[5]

1. EDF confirms that EV contributions to peak require managed charging

EDF acknowledges that "[i]n the absence of managed charging, the contribution to peak demand that EVs could have can be quite significant".[6] Over 100 MWs of Projected Statewide EV Peak Demand by 2020 is projected by the CEC in its 2013 mid scenario, as presented in EDF's testimony and reproduced below.[7]

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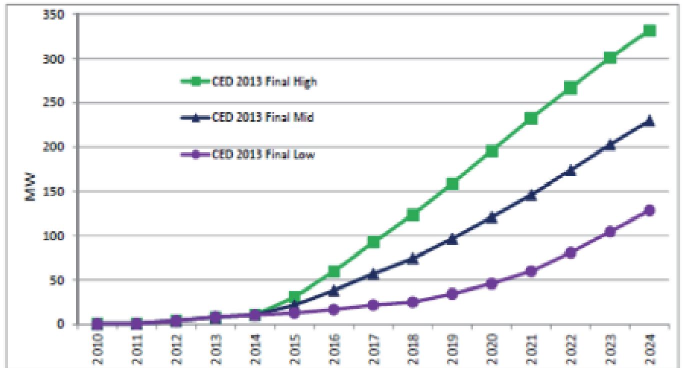
[4] SDG&E (Martin) JCM-34, Table 6-14.

[5] UCAN (Croyle) 40 (Electric Supply Costs in Question 24a and Question 24b).

[6] EDF (Fine) 24:3-4.

[7] *Id.*, p. 25:8-12.

Projected Statewide EV Peak Demand[43]



Source: California Energy Commission, Demand Analysis Office, 2013

EDF concludes that "[l]ess conservative recharging assumptions could also result in higher projected peak demand levels due to EV charging needs, creating a need for new peak resources, which could have significant financial and environmental impacts. Such a scenario is very likely to arise in the absence of effective, well-designed incentives for EV charging at off-peak hours."[8] This EDF testimony illustrates the importance of managed charging to mitigate EV charging peak demand and related generation capacity (*i.e.*, peak resources). Minimizing peak demand and generation capacity impacts of EV charging is a focus of SDG&E's proposed VGI Pilot Rate.[9]

2. TURN's pricing proposals are unsupported and impractical

TURN speculates that "[a] potentially more significant benefit could be achieved by smart charging that responds to system contingencies or real-time price spikes, as opposed to only day-ahead forecast prices. Certain dispatchable demand response can provide resource adequacy value and/or may be counted to reduce long-term peak demand forecasts so as potentially to avoid the construction of new fossil generation."[10]

TURN's testimony fails to quantify the "potentially more significant benefit" of its proposed rate design; TURN also fails to factor in the added cost and complexity of its real-time proposal, or

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[8] *Id*., p. 4-8.

[9] SDG&E (Fang) CF-5:3-4.

[10] TURN (Hawiger) 7:3-8.

the negative impacts on EV drivers of its recommended interruptible curtailments, "up to 80 hours per year."[11]

SDG&E acknowledges that CAISO prices are different between the day-ahead and hourly market, which is why the VGI rate contains a downward day-of CAISO price adjustment for Surplus Energy. This day-of price adjustment helps to avoid over supply situations (and related generation curtailment costs) when renewable resources are abundant relative to demand. However, SDG&E is concerned that exposing EV driver customers to real-time price spikes (as compared to the day-ahead VGI rate) could create customer resistance and confusion which would be counter-productive at this early stage of the customer experience. The VGI rate in conjunction with the mobile phone application and web site are designed to appeal to EV drivers customers and remove risks associated with negative events happening in real-time, such as price penalties or supply curtailments.

TURN recommends that "SDG&E provide the site owner…an option for service billed at either: 1) the VGI rate as proposed by SDG&E, or 2) an otherwise applicable volumetric TOU and CPP tariff."[12] TURN acknowledges the limitation of its proposal in that "…this strategy does not guarantee that the time-variant price signal will be passed through to the EV owner...,"[13] unlike the SDG&E VGI program. TURN's states its, "…proposal tests how rate design can impact EV charging under conditions that more realistically approximate the future EV market."[14] However, TURN provides no evidence that their speculated future EV market conditions might result in dynamic prices to the EV driver that encourage charging behavior which minimizes electric supply

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[11] *Id.*, p. 10:6.

[12] *Id.*, p. 8:22-26.

[13] *Id.*, p. 9:13-14.

[14] *Id.*, p. 4:11-13.

costs. In contrast, EV pilot research conducted for SDG&E by Nexant, Inc. ("Nexant")[15] clearly shows that EV drivers respond to price signals in combination with enabling technology.[16] This research, involving 430 Nissan LEAF drivers over two years, clearly shows that EV drivers exposed to time-of-use (TOU) pricing conduced 78% to 85% of their charged in the super off-peak period, facilitated by timer technology.[17] Without the price signals EV drivers have no incentive to delay EV charging to the super off-peak period and would start charging when they arrive home during the Peak period (noon to 8 pm).

SDG&E's VGI pilot program is a natural progression from this prior TOU pilot designed to avoid system peaks, to a dynamic pricing pilot designed to avoid both system and distribution peaks and designed to encourage charging when renewables are plentiful relative to demand. Future EV charging markets that do not send dynamic pricing signals to EV drivers are more likely to cause increased electric supply costs.

3. UCAN's comparison test is not useful

UCAN states "[t]o test the VGI Pilot rate, SDG&E should be comparing the results of customers on the VGI Pilot rate to a control group of customers on the currently available EV TOU and EV TOU2 rates for residential customers."[18] Unfortunately UCAN does not understand that the proposed VGI pilot program charger installations are targeted to MuD and workplace settings where typically the otherwise applicable rate is a commercial rate. These settings are not considered

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[15] Report, "Final Evaluation of San Diego Gas & Electric's Plug-in Electric Vehicle TOU Pricing and Technology Study," prepared by Nexant, dated February 20, 2014 ("Nexant Report"). Available at http://www.sdge.com/sites/default/files/documents/1681437983/SDGE%20EV%20%20Pricing%20%26%20Tech%20Study.pdf?nid=10666. SDG&E's supplemental testimony discussed this report at Appendix A, pp. A-1, 2.

[16] Nexant Report, p. 4.

[17] Nexant Report, p. 2.

[18] UCAN (Croyle) 41.

residential from a rate perspective (in the case of MuDs although the residents are "residential" the VGI facility would be on a separate service installed in locations typically considered commercial – such as a common parking area). UCAN's proposal to use residential rates as a comparison group to the VGI rate is not feasible in the commercial setting of VGI installations. UCAN also provides no evidence that EV-TOU energy supply benefits and ratepayer benefits might be higher than the VGI rate.

4. ChargePoint mischaracterizes the VGI customer experience

ChargePoint's criticisms of the VGI program include statements like SDG&E is "mandating participating in the VGI Rate Plan."[19] However, ChargePoint mischaracterizes participation in the VGI rate. SDG&E will not mandate participation in the VGI rate any more than ChargePoint or their site-hosts mandate participation in their charging services. Interested EV drivers may charge at VGI facilities under a Commission- approved VGI rate. The VGI Pilot rate is just like any other optional rate for SDG&E customers. The EV driver customer voluntarily signs up for the rate, just like ChargePoint customers sign-up for a ChargePoint Card.[20]

ChargePoint states it would support a SDG&E program with several general parameters including suggested changes to the VGI rate including: "Separate from the infrastructure…Not mandatory…Available to other SDG&E customers … incentives to encourage participation."[21] ChargePoint appears to misunderstand the intent of the VGI pilot. The VGI rate is intended to provide ratepayer benefits and reduce electric supply costs, which can be achieved when drivers receive the VGI price signal. ChargePoint provides no evidence as to how their "general parameters" would or could be implemented, and how their suggested changes are beneficial to rate

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[19] ChargePoint (Quinn) 13:21 – 14:1.

[20] For example *see* [http://www.chargepoint.com/activate.](http://www.chargepoint.com/activate)

[21] ChargePoint (Quinn) 24:13-21.

payers or provide electric supply benefits greater than the VGI rate. SDG&E does not intend to "mandate" the VGI rate to customers, but considers the VGI rate a reasonable means to assure ratepayers that their investment in EV charging provides quantifiable ratepayer and electric supply benefits.

ChargePoint's general parameter of making the VGI rate available, "… to other SDG&E customers (not just pilot participants), including existing EV users"[22] may have merit in the long run. But this suggestion is best assessed after SDG&E has gained experience with the VGI rate in the VGI program because the VGI rate was designed with the assumption that the EV chargers provide automated technology to help customers manage the dynamic nature of the VGI price.

B. Turn is Wrong - All Ratepayers Should Benefit from a Robust EV Market and the VGI Pilot Program

A robust EV market as envisioned by Governor Brown's Executive Order B-16-2012 and as modeled by SDG&E, suggests benefits to all ratepayer by providing an estimated $127.7 Million NPV downward pressure on rates (RIM test)[23] and by providing Societal Benefits valued at $387.3 Million NPV (SCT test).[24] As my direct testimony concerning the illustrative modeling shows, the SDG&E VGI rate scenario provides superior net benefits to ratepayers compared to a non-utility flat fee scenario that includes ratepayers subsidizing third party provided EV chargers and administration costs.[25]

EDF agrees that a robust EV market provides ratepayer benefits. According to EDF, "If California meets its goal of putting 1.5 million ZEVs on the road by 2025, this means an annual

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[22] *Id.*, p. 24:19-20.

[23] SDG&E (Martin) JCM-33, Table 6-12.

[24] *Id*. *See* Table 6-12 for societal benefits such as avoided gasoline CO2, LCFS benefits, and criteria pollutant benefits).

[25] *Id.*, p. JCM-32:1-6.

emissions savings of between 4.4 million and 5.5 million tons of CO2e – equivalent to the annual emissions from 1 million traditional vehicles."[26] These air quality benefits accrue to society as a whole.

EDF reinforces the fact that EV drivers respond to demand response and critical peak pricing to help reduce GHG pollution. "In the Pecan Street study, emissions from car charging were reduced by an average of 1.2 % by household participation in residential DR or CPP.[27] EDF states "the Pecan Street results show that car owners can and will respond to price signaling in ways that enables grid planners to avoid GHG pollution, extract more value from renewable energy, and reduce peak demand."[28]

SDG&E agrees with EDF that a robust EV market provides ratepayers and society with reduced GHG pollution, and that dynamic rates like the VGI Pilot Rate, can extract more value from renewable energy, while reducing peak demand.

TURN claims "cost effectiveness calculations show benefits of SDG&E's program accrue to EV owners, not ratepayers."[29] As evidence, TURN cites an SDG&E's data request response which TURN claims "… demonstrates that the majority of program benefits accrue to EV owners in the form of gasoline savings if large-scale market growth in the SDG&E territory is not achieved."[30]

TURN's claim is not true for the VGI program as proposed by SDG&E. The TURN data request is based on unrealistic market assumptions; including an SDG&E EV market of only 5,500

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[26] EDF (Fine) 13:6-8.

[27] *Id.*, p. 10:7-8.

[28] *Id.*, p. 11:1-4.

[29] TURN (Borden) 22:1-2.

[30] TURN (Borden) 23:11-12.

EVs[31] and ignores the interaction of EV charging at non-VGI locations. TURN's conclusions also overlook results supporting SDG&E VGI rate scenario. In the response to TURN's data request, "[t]he SDG&E VGI rate scenario has superior cost test results than the Non-utility Flat Fee scenario, if the non-utility entity's charger infrastructure and administrative costs, estimated at $72 Million NPV, were funded by ratepayers."[32]

C. Robust Benefits are Demonstrated by Sensitivity Analysis of the VGI Program

UCAN states that, SDG&E's VGI pilot proposal is deficient or lacking in several respects including, "limited sensitivity analysis was provided to test the validity of the illustrative results."[33] UCAN also states, "The illustrative CE results, particularly the RIM test, were highly dependent on utility revenues by EV owners that use the utility-owned EV charging stations which exceed charger station equipment and program costs. This is a weakness of using the RIM test to test load building scenarios since revenues are much more uncertain."[34] Recall that the RIM test is the Ratepayer Impact test and is designed to answer the question of whether utility rates will increase due to a particular utility program.[35]

SDG&E's sensitivity analysis in my direct testimony[36] and provided in data request responses to ORA TURN and UCAN,[37] point to the fact that the SDG&E's VGI Pilot Proposal provide robust benefits (RIM test) for SDG&E ratepayers.

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[31] SDG&E's current estimate of EVs in the service territory is over 14,700.

[32] TURN (Borden) Attachment 3,SDG&E response to TURN data request 05, Q.9a.

[33] UCAN (Croyle) 8, item 13.

[34] *Id*., item 12.

[35] SDG&E (Martin) JCM-30, Table 6-10.

[36] *Id*., p. JCM-32 (Table 6-11), JCM-34 (Table 6-13) and JCM-35 (Table 6-15).

[37] *See* Appendix A, "Summary of Cost Effectiveness Sensitivity Analysis Provided By SDG&E," attached hereto.

SDG&E's provided cost effectiveness sensitivity analysis points to the fact that RIM test net benefits remain positive even with an increase in costs and decrease in benefits of 15%. A UCAN data request responses[38] can be used to estimate a RIM test break-even point, which occurs when costs arbitrarily increase and benefits arbitrarily decrease by15% (15% Sensitivity). *See* the grand total RIM benefits of $0.5 Million NPV for the SDG&E VGI rate scenario in the following table:

Cost Effectiveness Sensitivity - Illustrative Detailed Results
(Costs Reduced and Benefits Increased by 15%)
(NPV $ Millions)

		SDG&E VGI Rate Scenario				Non-utility Flat Fee Scenario				VGI Net Benefits			
Test Component		RIM	PCT	TRC	SCT	RIM	PCT	TRC	SCT	RIM	PCT	TRC	SCT
EV Customer Costs & Benefits	Incremental Vehicle Cost		($619.6)	($619.6)	($619.6)		($619.6)	($619.6)	($619.6)	$0.0	$0.0	$0.0	$0.0
	Utility Bills	$421.0	($553.8)			$422.3	($543.6)			($1.2)	($10.1)	$0.0	$0.0
	Commercial Charging Fees		($41.2)				($72.3)			$0.0	$31.1	$0.0	$0.0
	Gasoline Savings		$817.1	$817.1	$817.1		$817.1	$817.1	$817.1	$0.0	$0.0	$0.0	$0.0
	Federal Tax Credits		$255.1	$255.1	$255.1		$255.1	$255.1	$255.1	$0.0	$0.0	$0.0	$0.0
	State Tax Credits		$77.4				$77.4			$0.0	$0.0	$0.0	$0.0
EV Charger & Admin Costs	Utility Charger and Admin Costs	($91.0)		($91.0)	($91.0)					($91.0)	$0.0	($91.0)	($91.0)
	Third Party Charger and Admin Costs			($43.3)	($43.3)	($82.8)		($126.1)	($126.1)	$82.8	$0.0	$82.8	$82.8
	Customer Charger Costs		($144.8)	($144.8)	($144.8)		($144.8)	($144.8)	($144.8)	$0.0	$0.0	$0.0	$0.0
Electric Supply Costs		($329.6)		($329.6)	($329.6)	($348.9)		($348.9)	($348.9)	$19.3	$0.0	$19.3	$19.3
Societal Benefits	Avoided Gasoline CO2				$42.7				$42.7	$0.0	$0.0	$0.0	$0.0
	LCFS Benefit				$85.1				$85.1	$0.0	$0.0	$0.0	$0.0
	Criteria Pollutant Benefit				$37.0				$37.0	$0.0	$0.0	$0.0	$0.0
Grand Total		$0.5	($209.6)	($156.0)	$8.8	($9.4)	($230.6)	($167.1)	($2.3)	$9.8	$21.0	$11.1	$11.1
Total Costs		$420.6	$1,359.3	$1,228.2	$1,228.2	$348.9	$1,380.3	$1,239.3	$1,239.3				
Total Benefits		$421.0	$1,149.7	$1,072.2	$1,237.0	$422.3	$1,149.7	$1,072.2	$1,237.0				
C/B Ratio		1.0	0.8	0.9	1.0	1.2	0.8	0.9	1.0				

In the 15% Sensitivity above the SDG&E VGI Rate Scenario provides greater benefits compared to a Non-utility Flat Fee scenario when the non-utility entity's charger infrastructure and administrative costs are funded by ratepayers. The relative benefit of the SDG&E VGI Rate Scenario is superior by $9.8 Million NPV in the RIM test, superior by $21.0 Million NPV for the PCT test, and superior by $11.1 Million NPV for the TRC and SCT tests.[39] These results show that ratepayers, EV drivers, California and society as a whole are better off when SDG&E provides VGI charges and drivers pay the VGI rate, than if ratepayers subsidized a third party to install similar chargers and the EV drivers pay a flat fee.

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[38] UCAN (Croyle) 40 (Electric Supply Costs in Question 24a and Question 24b).

[39] These tests (RIM, PCT, TRC & SCT) answer four key policy questions, the tests and questions are described in SDG&E (Martin) JCM-30, Table 6-10.

UCAN states, "The sensitivity results requested by UCAN, ORA and TURN suggest that more sensitivity analysis was required to determine whether the illustrative results were meaningful and sufficient to make a decision on a $103 million pilot program."[40] Appendix A lists SDG&E's sensitivity analysis and demonstrates that the EV market and the VGI pilot program can provide benefits to all SDG&E ratepayers even with diverging assumptions requested by these parties.

Note that the Commission does not require a positive RIM test for Energy Efficiency ("EE"), Demand Response ("DR") or Distributed Generation ("DG"). In fact the RIM test is less than 1.0 for many EE, DR and DG programs. These programs are nevertheless encouraged by the Commission because they promote policy goals, provide environmental and societal benefits, reduce energy procurement costs and reduce customer bills. Passing the RIM test is not a requirement for EE, DR or DG programs, nor should it be an absolute requirement for the VGI program. SDG&E uses the RIM test to show that, unlike other programs, the SDG&E VGI program can potentially be implemented without upward pressure on rates for non-participating customers. Under most scenarios studied, rates can actually be reduced.

D. The CPUC Standard Practice Manual Tests are Appropriately Applied to the VGI Program

UCAN uses erroneous reasoning to claim that the VGI program does not pass the Standard Practice Tests. UCAN states that:

In the evaluation of demand-side management programs, a program must pass both the PAC and TRC tests. The EV VGI pilot program would not pass the 'dual test' because the PAC test fails. Furthermore, since the PCT includes gasoline savings, it is inappropriate for use in this load building scenario. This makes the TRC invalid as well. EV VGI clearly fails the dual test.[41] UCAN understands the Program Administrator Cost ("PAC") test is inappropriate for an evaluation of the

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[40] UCAN (Croyle) 41.

[41] UCAN (Croyle) 34.

VGI program but erroneously uses it anyway.[42] UCAN's testimony states that "[s]ince the VGI pilot is tantamount to load building albeit off peak, the Standard Practices Manual (SPM) indicates that only the Rate Impact Measure (RIM) may be an appropriate test for assessing utility-owned EVSE."[43] The SPM also states that "[f]or load building programs, only the RIM tests are expected to be applied." The SPM clarifies that for load building programs, "[t]he Total Resource Cost and Program Administrator Cost tests are intended to identify cost-effectiveness relative other resource options."[44] The Commission should note that relative to a Non-utility Flat Fee Scenario, the VGI Rate Scenario is superior by $9.7 million NPV as measured by the PAC test[45] and superior by $9.6 million NPV as measured by the TRC test.[46]

UCAN's reasoning is erroneous because an evaluation of DR programs, (such as UCAN provided in testimony), should consider not only the CA Standard Practice Manual (SPM), but also the 2010 Demand Response Cost Effectiveness Protocols (Protocols)[47] and recent Commission decisions on demand response programs.

UCAN erroneously claims that in an evaluation of demand-side management programs, a program must pass both the PAC and TRC tests. Evaluation of demand-side management programs does not necessarily require a program passing both the PAC and TRC tests. As the *Decision*

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[42] All load building programs will fail the PAC test since electric supply costs rise as load builds. SDG&E's VGI program is designed to minimize the electric supply cost increases.

[43] UCAN (Croyle) 7, item 11.

[44] California Standard Practice Manual – Economic Analysis of Demand-Side Programs and Projects dated October 2001 at p.6. Available at http://www.cpuc.ca.gov/nr/rdonlyres/004abf9d-027c-4be1-9ae1-ce56adf8dadc/0/cpuc_standard_practice_manual.pdf.

[45] UCAN (Croyle) 34, The PAC Test table shows $365.7 Million costs for the VGI Scenario and $375.4 Million for the Non-utility Flat Fee scenario, indicating the VGI scenario has $9.7 Million lower PAC costs than the Flat-Fee scenario.

[46] SDG&E (Martin) JCM-32, Table 6-11.

[47] 2010 Demand Response Cost Effectiveness Protocols. *See*: http://www.cpuc.ca.gov/NR/rdonlyres/7D2FEDB9-4FD6-4CCB-B88F-DC190DFE9AFA/0/Protocolsfinal.DOC.

Adopting Demand Response Activities and Budgets for 2012 through 2014 (D.12-04-045) acknowledges, "The Protocols state that 'flexibility in the application of these protocols may be necessary to fully reflect the attributes of some DR programs."[48] D.12-04-045 also adopted cost-effectiveness criteria that do not require a program pass both the PAC and TRC Test.[49]

UCAN is incorrect when it claims, "…the PCT is calculated by including gasoline savings. According to the SPM, this is inappropriate. If the PCT cannot be applied because of the gasoline savings, the TRC is also inappropriate as is the SCT."[50] The gasoline savings in the Participant Cost Test are private monetizable cost savings accruing to participants. Clearly in the context of the EV market and VGI pilot, EV driver participants receive the benefit of avoiding gasoline purchases. These private monetized cost savings carry over to the wider context of the TRC and SCT tests as well.

SDG&E agrees with UCAN that "[t]heoretically, the CE tests could be expanded to include the impacts on the transportation sector (conventional vehicle and gasoline) and redefined as fuel substitution."[51]

E. Reasonable Assumptions are Used for the VGI Pilot Program Cost-Effectiveness Analysis

GPI questions assumptions used to calculate the illustrative cost-effectiveness results. SDG&E provides the following rationale and clarifications for assumption reasonableness.

GPI states:

> SDG&E does not list a source or any rationale for the 'cost premium' figures in Table 6-6 and we urge them to do so. It is also not clear that a cost premium for EVs should be included considering that consumers are receiving many features not present in an

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[48] 2010 Demand Response Cost Effectiveness Protocols, p. 6 and D. 12-04-045, p. 43.

[49] D.12-04-045, p. 44.

[50] UCAN (Croyle) 26.

[51] *Id*., p. 26.

> ICE. (Vol. 6 Revised Testimony, JCM-18). Intangible benefits such as reduced sound, improved driving quality and better safety are difficult to quantify but the GPI urges SDG&E to propose some manner in which these benefits may also be included in the cost-effectiveness analysis."[52]

SDG&E sourced the cost premium for EVs from the forthcoming (at the time) California Transportation Electrification Assessment (CalTEA) – Final Draft Phase 1 Report. The same cost premiums as presented in Table 53: PEV Passenger Car Annualized Cost Analysis, in the CalTEA–Phase 1: Final Report, page 85.[53] Intangible benefits of EVs are difficult to quantify and should include intangible costs, such as range anxiety.[54] If GPI is correct that intangible benefits are higher than intangible costs then PCT results would be higher.

GPI states "SDG&E cites a 2009 CEC report for the 2014 price of gasoline ... SDG&E should, instead incorporate actual gasoline prices in the SDG&E service territory for the first year of their cost-effectiveness analysis."[55] SDG&E intends to use the most current Transportation Fuel Price and Demand Forecast available from the CEC in future VGI program data analysis.

GPI states figures for electrical losses should be presented.[56] SDG&E testimony states, losses are calculated from the E3 DER avoided cost model using SDG&E's time of use-specific transmission and distribution loss factors.[57] The E3 DER loss factors are presented below and are consistent with the losses cited by GPI.[58]

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[52] GPI (Morris) 10:20-24.

[53] *See*: http://www.caletc.com/wp-content/uploads/2014/09/CalETC_TEA_Phase_1-FINAL_Updated_092014.pdf.

[54] For instance *see*: http://www.valuewalk.com/2015/04/tesla-range-anxiety-not-solved-gm/.

[55] GPI (Morris) 11:3-5.

[56] *Id.*, 12.

[57] SDG&E (Martin) JCM-23:4-6.

[58] Wong, L., "A Review of Transmission Losses in Planning Studies." California Energy Commission, 2011." CEC-200-2011-009, Table 12 Demand Response Avoided Cost Loss Factors, p. 29.

Electricity System Losses Factors (Secondary Voltage)		
TOU	Description	SDG&E
1	Summer Peak	1.081
2	Summer Shoulder	1.077
3	Summer Off-Peak	1.068
4	Winter Peak	1.083
5	Winter Shoulder	1.076
6	Winter Off-Peak	1.068
	Generation Peak	1.081
	Transmission Peak	1.071
	Distribution Peak	1.043

GPI states:

> EV L2 charger units are assumed to cost $1,500 (*Id.*, JCM-27). This seems high, even for commercial-grade chargers, given the many lower cost options for home-based L2 chargers available today, with prices all but certain to go down substantially further in the future as these technologies grow to scale. Additionally, when buying chargers at scale, as SDG&E plans to, significant discounts should be available over the single unit price.[59]

GPI misunderstands the context of the L2 charger equipment costs cited in my Revised Direct Testimony (Chapter 6) at JCM-17. These charger equipment costs represent preexisting L2 workplace charging equipment and L2 single family residence charges for BEVs and PHEV-40 EVs. The charging equipment costs include installation costs and do not represent the costs of the VGI pilot program infrastructures charger costs.[60] In the context of the VGI cost effectiveness model the L2 charger equipment costs at JCM-17 are reasonable.

GPI states, "It is not clear from SDG&E's testimony whether state taxes are deducted from the calculated federal taxes, which is permitted by federal tax law. SDG&E should clarify this issue. (*Id.*, JCM-30)."[61] SDG&E uses the state and federal taxes at JCM-30 within the context of the

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[59] GPI (Morris) 11:17-21.

[60] *See* SDG&E (Schimka), Chapter 2, Section V for VGI Pilot Program Cost Components, included EVSE and installation.

[61] GPI (Morris) 11:22 – 12: 2.

paragraph discussing the Net Present Value (NPV) discount rate. The tax rates are assumptions used to calculate SDG&E's after tax Weighted Average Cost of Capital (WACC), which is the discount rate used to calculate NPV results. The tax rates used are 35% federal and 8.84% State, with a combined tax rate of 40.75%.

II. THE SIZE IS APPRORIATE AND TIMELY FOR THE VGI PILOT PROGRAM TO MEET CALIFORNIA OBJECTIVES AND INFORM COMMISSION POLICY.

Several parties express reservations about the size of the VGI program, generally as being too large for a pilot designed to collect EV market data, test cost effectiveness, or conduct a VGI rate experiment. On the contrary, the VGI program was sized and developed to support multiple objectives. The VGI pilot program objectives include:

- Demonstrates net benefits to all ratepayers,
- Protects EV drivers and all ratepayers (ensure assets continue to be used and useful),
- Provides equitable deployment of assets and services,
- Provides customer choice to EV drivers through pricing,
- Supports Governor's 2020 grid-integrated infrastructure and 2025 vehicle deployment goals, and State's clean air and climate change objectives, and
- Collects data and findings to help inform CPUC policy.[62]

ORA states "The size of SDG&E's VGI Pilot Program can be greatly reduced while testing whether an increase in charging stations will increase PEV adoption rates."[63] This statement might be true if SDG&E's sole purpose for the VGI pilot program is to answer the chicken-or-egg questions (*i.e.*, do EVs spawn EVSEs or due EVSEs spawn EVs). Unfortunately, ORA does not consider the multiple objectives supported by the VGI program.

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[62] SDG&E (Avery) JPA-3:14 – JPA-4:3.

[63] ORA (Aliaga-Caro) 2-15:17-19.

UCAN and TURN seem to believe that SDG&E intends to locate VGI installations on a majority of SDG&E's distribution circuits. UCAN states that, "To test the EV VGI rate and the cost effectiveness of the SDG&E EV VGI pilot it should not require 5,500 charging station units; nor should testing grid integration require installing the EVSE on 1,100 circuits."[64] TURN states "SDG&E argues that this large 'pilot; is needed in order 'to achieve robust results' and 'ensure a reasonably strong statistical representation of SDG&E circuits in the pilot.' While TURN appreciates SDG&E's desire to achieve robust results, a pilot program need not test a majority of the circuits in its service territory. Indeed, circuits with representative load shapes could more easily be chosen for testing."

Consistent with TURN's suggestion, the VGI program sample frame uses circuits with representative load shapes; and contrary to UCAN's claim, SDG&E does not intend to install EVSE on each distribution circuit. SDG&E's Illustrative Sample Frame and Error Calculations[65] indicate significant statistical validity can be achieved, using 550 VGI systems (5,500 charging stations) deployed within a 30 cell (distribution circuit) sample frame,[66] This quantity of VGI Systems and VGI Chargers is necessary to ensure that the pilot results will have sufficient statistical validity, to show "whether hourly-variant pricing influences changing decisions, with the aid of enabling technology."[67]

ChargePoint states that "We take no position on whether and how the number and diversity of participating locations and drivers will affect the ability to achieve 'robust results' from SDG&E's rate pilot. But we strongly disagree with SDG&E's inference that it needs to *procure and deploy*

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[64] UCAN (Croyle) 17.

[65] SDG&E Supp. (Schimka and Martin), Chapter 3, Appendix A-3 Figure A-1 and A-5 Table A-1.

[66] SDG&E Supp. (Schimka and Martin), Chapter 3, Appendix A-4.

[67] SDG&E Supp. (Schimka and Martin), Chapter 3, Appendix A-1; SDG&E (Krevat) LK-11:18-19.

5,500...charging stations in order to conduct the proposed experimental VGI rate pilot ....”[68] ChargePoint fails to understand that 5,500 VGI chargers are necessary to support California’s multiple objectives and to provide VGI rate statistical validity.

III. PROGRAM PHASING IS UNNECESSARY BECAUSE OF EXISTING COMMISSION AUTHORITY AND SDG&E’S DATA COLLECTION PLAN

Several Parties recommend various ideas for VGI program phasing or off-ramps, and additional data collection. However, existing Commission authority and SDG&E’s data collection plan makes program phasing unnecessary. Additional data collection can be accommodated by SDG&E, if and only if, sufficient additional O&M budget is authorized for additional program evaluation work.

TURN recommends, “A phasing approach for the program…”[69] TURN, suggests that, “SDG&E’s proposal does not provide sufficient time for the utility to learn from its initial experiences or to adjust the VGI pilot program in response to lessons learned or innovations in technology. It also does not provide an opportunity for the Commission to mandate changes to the program in the event that promised program benefits do not manifest or that the assumptions underlying the program are incorrect.”[70] ChargePoint proposes phasing which “will allow review and program adjustment.”[71] UCAN states SDG&E offered no early exit strategy i.e., no off ramps, during the installation phase in case the preliminary CE results revealed the program should be terminated, expanded or redesigned.”[72]

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[68] ChargePoint (Quinn) 17:12-16 (emphasis in original).

[69] TURN (Borden) 6:22-24.

[70] *Id.*, 23:25-24:4.

[71] ChargePoint (Quinn) 18: 9-10.

[72] UCAN (Croyle) 7, item 7.

These concerns are unfounded, with an implicit assumption that SDG&E will blindly build VGI sites regardless of demand. SDG&E will utilize the proposed two-way balancing account[73] to slow-down or halt VGI installations should a major reduction in work be required. Moreover, these assertions ignore a fundamental premise of SDG&E's pilot – that the limited rollout requested is a maximum – the quantity and rate of installation for VGI facilities require customer site host interest and driver demand for charging at those sites.[74] If the demand is lower than expected, the installation will be concomitantly lower. As discussed above, the concerns TURN, UCAN and ChargePoint raised can be addressed with existing Commission authority and procedures, but their concerns should not be addressed by built-in implementation delays and inefficiencies guaranteed by phasing.

The Commission has authority to review, suspend or terminate authorized Investor-owned utility programs at any time; therefore, suggestions for phasing are unnecessary. Annual load impact reports and periodic cost-effectiveness analysis proposed in SDG&E's Research Plan[75] will provide progress reports suitable for periodic progress reviews. SDG&E should have the flexibility to learn as it recruits site hosts, installs VGI installations and provides VGI rate service to EV driver customers. If SDG&E believes a significant change to the VGI program or VGI rate is warranted, an Advice Letter or new Application would provide the same assurances as phasing, without the built-in delays guaranteed by phasing, and without the built-in disruption and inefficiencies for customer recruitment guaranteed by phasing. Furthermore, phasing creates the risk that insufficient time is spent generating meaningful results.

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[73] *See* Prepared Rebuttal Testimony of Norma Jasso (Chapter 5), p. NGJ-1:9-10.

[74] SDG&E (Schimka) RS-3:1-7, RS-7:5-7.

[75] SDG&E (Martin) JCM-35 – JCM-37.

ORA recommends "alternative methods to obtain data for cost effectiveness-related analyses must be considered,"[76] and suggests tracking "…customer engagement in the VGI Pilot Program."[77] Also:

> ORA recommends that the Commission direct the utilities to participate in a coalition in which PEV market stakeholders (i.e. relevant government agencies (CPUC, CEC, CARB), electric vehicle service providers (EVSPs), the CAISO, commercial property management associations and automobile manufacturers) are invited to develop a process to measure how EVSE-related market barriers affected customer interest in SDG&E's VGI Pilot Program and their ensuing charging behavior….[78]

SDG&E is open to and supportive of additional data collection and analyses that can help ensure the success of the VGI program and help inform public policy, if and only if, sufficient additional O&M budget is authorized for this additional program work.

IV. WORKPLACE AND MUD LOCATIONS ARE IDEAL FOR SDG&E'S VGI PILOT PROGRAM.

Parties have countervailing opinions regarding priority locations for the VGI program, recommending as preferred markets, either workplace setting or MuD setting. Given these offsetting opinions (as well as for the reasons offered in SDG&E's direct and supplemental testimony), SDG&E suggests maintaining its proposed "blend of workplace and MuD host sites."[79]

UCAN states, "the more attractive segment for testing, and the segment that is most responsible for the illustrative cost effectiveness results, is the workplace segment."[80] TURN recommends enhancing the effectiveness of utility expenditures by limiting eligible sites to MuDs

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[76] ORA (Mutialu) 4-5:18-19.

[77] *Id*., 4-6; 5-6.

[78] *Id*., 4-7:19-24.

[79] SDG&E (Schimka) RS-3:2-3.

[80] UCAN (Croyle) 27.

only.[81] ORA states, "increasing the availability of workplace charging may not be the most effective way to increase PEV adoption..." [82]

SDG&E's intention is to site VGI installations at long EV dwell time locations other than single family residences. These long dwell time locations include both MuD and workplace sites and can provide information to test Parties' assertions whether the workplace or MuD is a better target market.

V. CONCLUSION

Cost effectiveness results suggest that all ratepayers benefit from SDG&E's VGI program by providing downward pressure on rates. The energy supply costs of the VGI program and VGI rate are lower than a similar scenario where the EV driver customer pays for EV charging with a flat fee. These cost-benefit results are robust across many sensitivity analyses provided by SDG&E and prepared for Parties. SDG&E appropriately applied Standard Practice Manual tests to the VGI pilot program using reasonable assumptions

The size of the VGI pilot program is appropriate to meet California objectives and to inform Commission policy. Existing Commission authority and SDG&E's data collection plan make program phasing unnecessary. Long EV dwell time locations are ideal for SDG&E's VGI pilot program, which includes a blend of workplace and MuD locations.

This concludes my prepared rebuttal testimony.

[81] TURN (Borden) 3:29-30.

[82] ORA (Aliaga-Caro) 2-4:7-8.

APPENDIX A - SUMMARY OF COST EFFECTIVENESS SENSITIVITY ANALYSIS PROVIDED BY SDG&E

SDG&E VGI Pilot Program
List of Cos- Effectiveness Sensitify Analysis Provided by SDG&E

		SDG&E VGI Rate scenario				Non-Utility Flat Fee scenario (w/o ratepayer funding of 3rd party Charger and Admin. costs)				VGI Scenario Benefit (w/o ratepayer funding of 3rd party Charger and Admin. costs)				VGI Scenario Benefit (with ratepayer funding of 3rd party Charger and Admin. costs)			
Source	Summary of Sensitivity Analysis	RIM	PCT	TRC	SCT	RIM	PCT	TRC	SCT	RIM	PCT	TRC	SCT	RIM	PCT	TRC	SCT
Revised Testimony	40% RPS; 1.0 Charger Utilization Multiplier	$127.7	$172.3	$193.4	$387.3	$191.4	$154.1	$183.8	$377.7	($63.7)	$18.2	$9.6	$9.6	$8.3	$18.2	$81.6	$81.6
Revised Testimony	33% RPS; 1.0 Charger Utilization Multiplier	$199.0	$171.6	$264.0	$457.9	$271.2	$154.1	$263.6	$457.5	($72.2)	$17.5	$0.4	$0.4	($0.2)	$17.5	$72.4	$72.4
Revised Testimony	40% RPS; Charger Utilization Multiplier = 1.5	$133.6	$181.9	$207.1	$405.0	$194.3	$155.1	$195.2	$393.1	($60.7)	$26.8	$11.9	$11.9	$11.3	$26.8	$83.9	$83.9
Revised Testimony	Sensitivity: 40% RPS; Charger Utilization Multiplier = 2.0	$138.8	$191.3	$219.9	$421.8	$197.5	$156.0	$206.9	$408.8	($58.7)	$35.3	$13.0	$13.0	$13.3	$35.3	$85.0	$85.0
Revised Testimony	Sensitivity: 33% RPS; Charger Utilization Multiplier = 1.5	$203.1	$180.9	$275.7	$473.6	$274.0	$155.0	$274.9	$472.8	($70.9)	$25.9	$0.8	$0.8	$1.1	$25.9	$72.8	$72.8
Revised Testimony	Sensitivity: 33% RPS; Charger Utilization Multiplier = 2.0	$207.6	$190.0	$287.5	$489.4	$277.1	$155.9	$286.4	$488.3	($69.5)	$34.1	$1.1	$1.1	$2.5	$34.1	$73.1	$73.1
ORA DR-06 Q1a & TURN DR-03 Q1a	Assume no tax credit starting in 2016	$127.7	($104.9)	($83.8)	$110.1	$191.4	($123.1)	($93.4)	$100.5	($63.7)	$18.2	$9.6	$9.6	$8.3	$18.2	$81.6	$81.6
ORA DR-06 Q1b & TURN DR-03 Q1b	75% TOU (non-tiered) rates and 25% tiered rates	$140.6	$233.3	$267.4	$461.2	$204.7	$216.3	$259.3	$453.2	($64.1)	$17.0	$8.1	$8.0	$7.9	$17.0	$80.1	$80.0
ORA DR-06 Q1b & TURN DR-03 Q1a	25% TOU (non-tiered) rates and 75%% tiered rates	$114.8	$111.3	$119.5	$313.4	$178.1	$91.9	$108.3	$302.2	($63.3)	$19.4	$11.2	$11.2	$8.7	$19.4	$83.2	$83.2
ORA DR-06 Q1c &TURN DR-03 Q1c	Charger utilization rate of 0.5 per day	$121.1	$162.7	$178.9	$368.8	$189.1	$153.4	$173.7	$363.5	($68.0)	$9.3	$5.2	$5.3	$4.0	$9.3	$77.2	$77.3
ORA DR-06 Q1d & TURN DR-03 Q1d	EVSE costs 25% higher than base case.	$123.0	$172.3	$188.7	$382.6	$191.4	$154.1	$179.2	$373.1	($68.4)	$18.2	$9.5	$9.5	$3.6	$18.2	$81.5	$81.5
ORA DR-06 Q1d & TURN DR-03 Q1d	EVSE costs 25% lower than base case.	$132.4	$172.3	$198.2	$392.1	$191.4	$154.1	$188.4	$382.3	($59.0)	$18.2	$9.8	$9.8	$13.0	$18.2	$81.8	$81.8
ORA DR-06 Q1g & TURN DR-03 Q1g	The Resource Balance Year is 2022 rather than 2014	$186.2	$114.2	$196.4	$390.2	$250.7	$93.9	$187.2	$381.0	($64.5)	$20.3	$9.2	$9.2	$7.5	$20.3	$81.2	$81.2
TURN DR-05 Q9a	just for the proposed pilot program (i.e., not at the market level). varying "pilot charger utilization" = 1.00	($64.5)	$19.6	($49.6)	($41.6)	($1.9)	$1.3	($59.2)	($51.2)	($62.6)	$18.3	$9.6	$9.6	$9.4	$18.3	$81.6	$81.6
TURN DR-05 Q9a	just for the proposed pilot program (i.e., not at the market level). varying "pilot charger utilization" = 0.66	($70.2)	$12.9	($59.6)	($54.3)	($1.3)	$0.9	($63.6)	($58.3)	($68.9)	$12.0	$4.0	$4.0	$3.1	$12.0	$76.0	$76.0
TURN DR-05 Q9a	just for the proposed pilot program (i.e., not at the market level). varying "pilot charger utilization" = 0.33	($74.6)	$6.5	($69.4)	($66.7)	($0.6)	$0.4	($67.8)	($65.1)	($74.0)	$6.1	($1.6)	($1.6)	($2.0)	$6.1	$70.4	$70.4
TURN DR-05 Q10a	80% of EV Population Forecast used in Scenarios	$86.3	$137.8	$138.9	$294.0	$153.1	$123.3	$132.6	$287.7	($66.8)	$14.5	$6.3	$6.3	$5.2	$14.5	$78.3	$78.3
TURN DR-05 Q10a	60% of EV Population Forecast used in Scenarios	$45.0	$103.4	$84.4	$200.7	$114.8	$92.5	$81.5	$197.8	($69.8)	$10.9	$2.9	$2.9	$2.2	$10.9	$74.9	$74.9
TURN DR-05 Q10a	40% of EV Population Forecast used in Scenarios	$3.6	$68.9	$29.9	$107.5	$76.6	$61.6	$30.3	$107.9	($73.0)	$7.3	($0.4)	($0.4)	($1.0)	$7.3	$71.6	$71.6
TURN DR-05 Q10a	20% of EV Population Forecast used in Scenarios	($37.7)	$34.5	($24.6)	$14.2	$38.3	$30.8	($20.8)	$17.9	($76.0)	$3.7	($3.8)	($3.7)	($4.0)	$3.7	$68.2	$68.3
TURN DR-05 Q16	Pilot Charger Utilization = 0	$114.2	$152.7	$163.9	$349.8	$193.3	$152.7	$171.0	$356.9	($79.1)	$0.0	($7.1)	($7.1)	($7.1)	$0.0	$64.9	$64.9
UCAN DR-02 Q1a	Assume Reduced EV additions: 2 incremental EV per MuD and 4 per Workplace Installation	$119.9	$159.7	$174.5	$364.1	$195.3	$154.9	$176.9	$366.5	($75.4)	$4.8	($2.4)	($2.4)	($3.4)	$4.8	$69.6	$69.6
UCAN DR-02 Q2	Assume Reduced EV additions: 1 incremental EV per MuD and 2 per Workplace Installation	$117.1	$156.2	$169.2	$356.9	$194.3	$153.8	$174.0	$361.7	($77.2)	$2.4	($4.8)	($4.8)	($5.2)	$2.4	$67.2	$67.2
UCAN DR-02 Q3	Assume 1:2 ration of MUD to Workplace EV Additions w/Diminishing Quantities	$114.0	$153.0	$164.0	$350.0	$193.0	$153.0	$171.0	$357.0	($79.0)	$0.0	($7.0)	($7.0)	($7.0)	$0.0	$65.0	$65.0
UCAN DR-04 Q24	Costs Reduced and Benefits Increased by 10%	$43.5	($82.9)	($39.5)	$135.0	$113.4	($103.0)	($50.1)	$124.4	($69.9)	$20.1	$10.6	$10.6	$2.1	$20.1	$82.6	$82.6
UCAN DR-04 Q24	Costs Reduced and Benefits Increased by 20%	($42.6)	($336.4)	($272.4)	($117.3)	$33.4	($358.2)	($284.0)	($128.9)	($76.0)	$21.8	$11.6	$11.6	($4.0)	$21.8	$83.6	$83.6
UCAN DR-04 Q25	Total EV Population reduced by 25%	$76.0	$129.2	$125.3	$270.7	$143.5	$115.6	$119.8	$265.3	($67.5)	$13.6	$5.5	$5.4	$4.5	$13.6	$77.5	$77.4