Application: _____

Exhibit No.: SDGE-_____

Witness: Tony Rafati_____

PREPARED DIRECT TESTIMONY OF

TONY RAFATI

ON BEHALF OF SAN DIEGO GAS & ELECTRIC COMPANY

CHAPTER 5

BEFORE THE PUBLIC UTILITIES COMMISSION

OF THE STATE OF CALIFORNIA

JULY 30, 2018

TABLE OF CONTENTS

PREPARED DIRECT TESTIMONY OF

TONY RAFATI

CHAPTER 5

I. INTRODUCTION

This chapter summarizes net emission reduction estimates for San Diego Gas & Electric Company's ("SDG&E") proposed Assembly Bill ("AB") 1082[1] ("School Pilot") and AB 1083[2] ("Parks Pilot") Electric Vehicle ("EV") Charging Infrastructure Pilots (collectively, "Pilots"). The emission reduction estimates focus on greenhouse gas ("GHG") reductions.[3] This chapter also describes the methodology used to estimate the Pilots' related emission reductions.

SDG&E's Pilots are intended to provide EV charging infrastructure for approximately 30 school locations, 12 state parks and beaches, and 10 city and county parks. The Program design is described in detail in the prepared direct testimony of Randy Schimka (Chapter 1).

My testimony supports the January 24, 2018 Assigned Commissioner's Ruling ("ACR") guidance to utilities to, among other things, explain the expected GHG and air quality benefits of the Pilots in relation to its other transportation electrification activities and investments.[4] Reductions of GHG and air quality benefits are beneficial to public health and are policy

---

1 California Legislative Information, *Assembly Bill No. 1082* (October 10, 2017), *see* https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180AB1082.

2 California Legislative Information, *Assembly Bill No. 1083* (October 10, 2017), *see* https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180AB1083.

3 GHG examples include carbon dioxide ("CO_2"), methane, and nitrous oxide. Criteria Pollutant are not included in this testimony because they do not represent a large portion of light duty gasoline powered vehicle emissions. Criteria Pollutant examples include nitrogen dioxide and particulate matter.

4 January 24, 2018, Assigned Commissioner's Ruling Providing Guidance to Utilities Electing to Submit Applications Pursuant to Assembly Bills 1082 and 1083, in Rulemaking ("R.") 13-11-007 at 5.

objectives of Senate Bill ("SB") 350 transportation electrification programs.[5] All ratepayers benefit from GHG and Criteria Pollutant emission reductions. Reduced emissions "reduce[] harm to climate, health and the economy.[6]

GHG and air quality benefits of the programs are incremental to other transportation electrification activities and investments sponsored by SDG&E.

II. SUMMARY OF NET EMISSION REDUCTIONS FOR PILOTS

The Light Duty ("LD") EVs utilizing the Pilots' charging infrastructure are intended to displace vehicles burning fossil fuels. Displacing fossil-fueled vehicles with EVs results in reductions in hydrocarbon-related emissions, such as GHGs and Criteria Pollutants. However, EV charging results in electricity generation related emissions.[7] But overall, net emissions are reduced by displacing vehicles burning fossil fuels. Net emission reductions reported in my testimony are calculated by subtracting EV charging related emissions from displaced fossil fuel emissions.

Those reductions are calculated on a Well-to-Wheels ("WtW") basis, consistent with methodologies used by the California Air Resources Board ("CARB") Low Carbon Fuel Standard, 2016 Mobile Source Strategy, and Vision planning model.[8] Well-to-Wheels analysis

---

[5] September 14, 2016, Assigned Commissioner's Ruling Regarding the Filing of the Transportation Electrification Applications Pursuant to Senate Bill 350 at 5-6, in R.13-11-007; *see also* California Public Utilities Code ("P.U.C.") §740.12(a)(1).

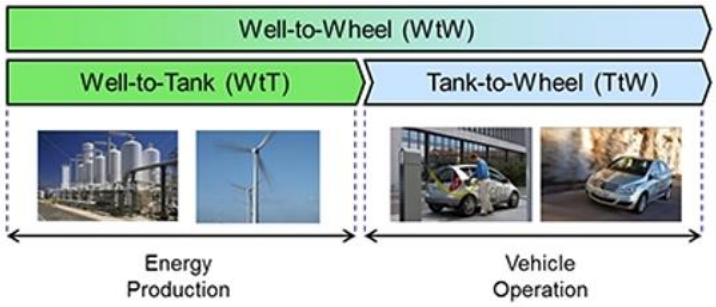
[6] America Lung Association in California, *Clean Air Future: Health and Climate Benefits of Zero Emission Vehicles* (2016), p. 9. Downloaded 7/24/2018: http://www.lung.org/local-content/california/documents/2016zeroemissions.pdf.

[7] Electricity-related emissions are generally lower than fossil fuel-related emissions for comparable vehicle operations (*e.g.*, emissions per vehicle mile traveled or per hour of operation).

[8] Well-to-wheel emissions analysis considers the energy or emissions intensity of all stages of fuel production and final use of a fuel in a vehicle (*i.e.*, the production, transport, and consumption of fuels in a vehicle). *See* CARB, *Mobile Source Strategy* (May 2016) at 38, *available at* https://www.arb.ca.gov/planning/sip/2016sip/2016mobsrc.pdf.

scope is illustrated in Figure 5-1 below. The analysis includes both Tank-to-Wheels ("TtW") emissions, resulting from vehicle operations, as well as upstream Well-to-Tank ("WtT") emissions resulting from energy production processes, which includes fuel production, transportation, refining, and delivery to the vehicle.

Figure 5-1[9]



For the purposes of this chapter, LD vehicles include the Emission Factors Model ("EMFAC") 2014 designated Light Duty Automobiles/Passenger Cars ("LDA") category of vehicles with a Gross Vehicle Weight Rating ("GVWR")[10] of less than 6,000 pounds ("lbs").[11]

Net emission reduction estimates for the Pilots are presented for both first-year and vehicle lifetime. Tables 5-1 and 5-2 below present the emission reductions estimates for each vehicle group. It includes the number of vehicles in each group, as well as the assumed displaced fossil fuel type used to estimate net emission reductions.

---

[9] California Air Resources Board, *Vision 2.1 Scenario Modeling System, Limited Scope Release* (February 2017) at 24, *available at* https://www.arb.ca.gov/planning/vision/docs/vision2.1_model_documentation_20170202.pdf.

[10] GVWR means the value specified by the manufacturer as the loaded weight of a single vehicle.

[11] California Environmental Protection Agency, *EMFAC 2014 User's Guide* (Updated December 30, 2014) at 71-72, *available at* https://www.arb.ca.gov/msei/emfac2014_users_guide.pdf.

Table 5-1 presents the first-year emission reductions estimates for the Pilots, totaling 1,283 Metric Tons ("MT") of Carbon Dioxide equivalent ("CO2e"), 0.6 MT Nitrox Oxides ("NOx"), and 0.04 MT of Particulate Matter up to 2.5 microns ("PM2.5").

Table 5-1

Net Emission Reduction Estimates					
First Year Impacts					
Pilot	eVMT fueled (000)	Displaced Fuel	Annual Net Emission Reductions		
			CO2e (MT)	NOx (MT)	PM2.5 (MT)
School Pilot	1,820	Gasoline	554	0.3	0.02
Parks Pilot (State)	1,238	Gasoline	377	0.2	0.01
Parks Pilot (City/County)	2,397	Gasoline	353	0.2	0.01
Total	5,454	--	1,283	0.6	0.04

eVMT = electric Vehicle Miles Traveled

Table 5-2 below presents the lifetime emission reduction estimates for the Pilots, totaling 13,587 Metric Tons ("MT") of Carbon Dioxide equivalent ("CO2e"), 6.5 MT Nitrox Oxides ("NOx"), and 0.43 MT of Particulate Matter up to 2.5 microns ("PM2.5").

Table 5-2

Net Emission Reduction Estimates					
Lifetime Impacts					
Pilot	eVMT fueled (000)	Displaced Fuel	Lifetime Net Emission Reductions		
			CO2e (MT)	NOx (MT)	PM2.5 (MT)
School Pilot	21,835	Gasoline	5,864	2.8	0.19
Parks Pilot (State)	14,856	Gasoline	3,990	1.9	0.13
Parks Pilot (City/County)	28,762	Gasoline	3,734	1.8	0.12
Total	65,453	--	13,587	6.5	0.43

eVMT = electric Vehicle Miles Traveled

III. METHODOLOGY FOR CHARGER UTILIZATION

This section describes the methodology used to estimate the Pilot's Chargers' utilization. Utilization is defined as the electric Vehicle Miles Traveled ("eVMT") enabled by the Pilot's Chargers.

Annual utilization in miles that is enabled by the Pilot's Chargers is used to calculate emission reductions – since a mile traveled using electric fuel is assumed to avoid a mile traveled using petroleum fuel. Daily eVMT was estimated based on the Portland General Electric ("PGE") Transportation Electrification Plan.[12] The PGE plan includes assumptions for both Direct Current Fast Charger ("DCFC") and Level 2 (Charger) ("L2") stations regarding the number of charges per station, and average electricity used per charge. These PGE assumptions are used to estimate daily utilization in eVMT per charger for DCFC (172.6 miles per day) and L2 (28.3 miles per day). Combining VMT with estimated miles per Gallon Gasoline Equivalent ("GGE"), described in the following section, results in total GGE usage for electricity and petroleum fuels.

IV. METHODOLOGY FOR NET EMISSION REDUCTIONS

This section describes the methodology used to estimate the GHG and Criteria Pollutant emission reductions summarized above. The methodology utilizes publicly available data from CARB and Argonne National Lab ("ANL"). In general, LDA vehicle estimates use CARB's data for TtW emission estimates, and ANL's data for WtT emission estimates.

---

[12] Portland General Electric, Transportation Electrification Plan (March 2017), *available at* https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0ahUKEwiZ38CRjO3aAhVX9GMKHe78CgoQFggqMAA&url=https%3A%2F%2Fwww.portlandgeneral.com%2F-%2Fmedia%2Fpublic%2Fresidential%2Felectric-vehicles-charging-stations%2Fdocuments%2Fpge-ev-plan.pdf%3Fla%3Den&usg=AOvVaw0-lLgGrFPhcG1n5KSbe0JX

The CARB Vision modules provide TtW emission estimates for the LDA vehicles considered for the Pilots.[13] The data used for LDAs are from the 2016 Vision 2.1 Passenger Vehicle Module. The Vision Modules include vehicle model years from 1961 through 2051. But vehicles with model years earlier than 2019 were filtered out – since few LDA EVs are included in earlier model years – and since it is assumed that EV purchases would likely displace a similar model year fossil fuel vehicle.

Data from the Vision Modules were consolidated and summary data were created by vehicle groups and fuel types. Summary data includes Vehicle Miles Traveled ("VMT") per vehicle, miles per GGE, and operating days per year. Summary data also includes TtW emissions per GGE. The summary data is used to estimate first-year and lifetime GGE consumption and TtW emissions per GGE for each vehicle and fuel type.

The ANL Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation Model ("GREET") is used to provide WtT emission estimates for each fuel type. GREET fuel types considered are electricity and reformulated gasoline.[14] GREET WtT emission estimates were normalized to pounds per GGE, and are combined with Vision TtW summary data to obtain total Well-to-Wheels emissions per GGE.

CARB Vision data was also used to estimate average vehicle lives. Average vehicle life is estimated to be twelve years for this analysis. This estimate is based on the 50 percent

---

[13] More information on CARB's Vision Modules are *available at* https://www.arb.ca.gov/planning/vision/downloads.htm#2016vision21lr.

[14] SDG&E's 2016 power mix was modeled in the ANL GREET model using 43% eligible renewables, 42% natural gas, and 15% unspecified sources modeled as natural gas. *See* San Diego Gas & Electric Company, *2016 Power Content Label*, *available at* http://www.energy.ca.gov/pcl/labels/2016_labels/San_Diego_Gas_and_Electric.pdf.

population survival period derived from Vision population data for model year vehicles 2019 through 2030.

Per GGE emissions are multiplied by eVMT for each program to obtain the total emission reduction estimates. The net emission estimates in Tables 5-1 and 5-2 are calculated by subtracting WtW emissions for electric fueled vehicles from WtW emissions for the displaced gasoline fueled vehicles, resulting in first year and lifetime net emissions reductions.

V. CONCLUSION

SDG&E's proposed Pilots provides GHG emission reductions and air quality improvements for all SDG&E ratepayers.

This concludes my prepared direct testimony.

VI. STATEMENT OF QUALIFICATIONS

My name is Tony Rafati. My business address is 8306 Century Park Court, San Diego, California, 92123. I am employed by SDG&E as Policy Manager in the Clean Transportation team. I have been employed at SDG&E since 2010 and have held positions of increasing responsibility in the Energy Efficiency and Demand Response programs.

I graduated from San Diego State University in San Diego, California, earning a Bachelor of Science degree in Electrical Engineering. I received a Master's of Business Administration degree with an emphasis in Finance from the University of San Diego. I hold a Juris Doctor degree from Thomas Jefferson School of Law and I am a licensed attorney in the state of California.

I have not previously testified before the California Public Utilities Commission.