PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

Application of San Diego Gas & Electric Company (U902M) to Update Rate Design to Include a Residential Untiered Time-of-Use Rate with a Fixed Charge

Application No. 21-09-001

Direct Testimony of Melissa Whited

On Behalf of Sierra Club

January 14, 2022

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I. INTRODUCTION AND QUALIFICATIONS

Q Please state your name, title, and employer.

A My name is Melissa Whited. I am a Principal Associate at Synapse Energy Economics, located at 485 Massachusetts Avenue, Suite 3, Cambridge, MA 02139.

Q Please describe Synapse Energy Economics.

A Synapse Energy Economics ("Synapse") is a research and consulting firm specializing in electricity industry regulation, planning, and analysis. Our work covers a range of issues, including economic and technical assessments of demand-side and supply-side energy resources; energy efficiency policies and programs; integrated resource planning; electricity market modeling and assessment; renewable resource technologies and policies; and climate change strategies. Synapse works for a wide range of clients, including attorneys general, offices of consumer advocates, public utility commissions, environmental advocates, the U.S. Environmental Protection Agency, U.S. Department of Energy, U.S. Department of Justice, the Federal Trade Commission, and the National Association of Regulatory Utility Commissioners. Synapse has over 30 professional staff with extensive experience in the electricity industry.

Q Please summarize your educational and professional experience.

A I have 12 years of experience in economic research and consulting. At Synapse, I have worked extensively on issues related to utility regulatory models, performance incentive mechanisms, and rate design. In 2015, I was the lead author of a report for the Western Interstate Energy Board titled "Utility Performance Incentive Mechanisms: A Handbook for Regulators," and I have presented on performance incentive mechanisms to the National Association of Regulatory Utility Commissioners, National Governor's Association Learning

Lab on New Utility Business Models, Midwest Governors' Association, and the Minnesota e21 Initiative working group.

I have sponsored testimony before the California Public Utilities Commission, the Public Utilities Commission of New Hampshire, the Newfoundland and Labrador Board of Commissioners of Public Utilities, the Georgia Public Service Commission, the Rhode Island Public Utilities Commission, the Public Service Commission of Maryland, the Massachusetts Department of Public Utilities, the Maine Public Utilities Commission, the Hawaii Public Utilities Commission, the Public Service Commission of Utah, the Public Utility Commission of Texas, the Virginia State Corporation Commission, and the Federal Energy Regulatory Commission. I hold a Master of Arts in Agricultural and Applied Economics and a Master of Science in Environment and Resources, both from the University of Wisconsin-Madison. My resume is attached as Attachment A to this testimony.

Q On whose behalf are you testifying in this case?

A I am testifying on behalf of Sierra Club.

Q Have you previously testified before the California Public Utilities Commission?

A Yes. In 2017 I submitted testimony on behalf of Natural Resources Defense Council ("NRDC"), the Greenlining Institute, Plug In America, the Coalition of California Utility Employees, Sierra Club, and the Environmental Defense Fund in A. 17-01-020, 17-01-021, and 17-01-022.

Q What is the purpose of your testimony?

A The purpose of my testimony is to explain the bill impact of San Diego Gas & Electric's ("SDG&E") proposed TOU-ELEC rate on single family customers who switch to an all-electric home. I also discuss the importance of encouraging beneficial electrification for reaching California's carbon reduction targets and provide estimates of the greenhouse gas ("GHG") reductions that can be achieved if single family customers in SDG&E's service territory electrify under the proposed TOU-ELEC rate and recommend an alternative rate design.

Q How is your testimony organized?

A First, I provide a summary of my conclusions and recommendations for the Commission. Next, I describe the model and approach used in my analysis. I then present the modeling results followed by an alternative electrification-supportive rate for SDG&E customers.

II. SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

Q Please summarize your primary conclusions and recommendations.

A My primary conclusions and recommendations are as follows:

- Rates that encourage customers to electrify their homes and vehicles will reduce carbon dioxide emissions and help the State of California meet its emissions reduction targets. A single-family customer who electrifies their home and vehicle will reduce their carbon dioxide emissions by approximately 4.2 metric tons per year, equivalent to an annual household emissions reduction of nearly 50 percent.

- Although rate schedule TOU-ELEC would likely provide bill savings to customers who electrify, its reliance on non-coincident peak demand to set the fixed charge is not cost-based and may result in perverse customer behavior. Demand charges are also difficult for customers to understand and manage. Therefore, I recommend modifying the rate to use a flat fixed charge instead of a demand-based fixed charge.

- The Company's TOU periods are outdated and do not reflect the fact that energy costs and emissions currently are lowest during the middle of the day and are projected to decline further in the future. For these reasons, I recommend that the Super Off-Peak period should be modified to include the hours of 10 am to 2 pm in order to encourage customers to adopt beneficial electrification technologies and use them during the hours with the lowest costs and emissions.

III. INTRODUCTION AND METHODOLOGY

Q Please describe SDG&E's proposed rate, TOU-ELEC.

A In compliance with D. 20-03-003, SDG&E is proposing an optional rate TOU-ELEC, which would be available for customers with qualifying electrification technologies such as electric vehicles ("EVs"), energy storage, and electric heat pump water heaters and climate control systems.[1] Relative to the default residential rate, TOU-DR-1, the proposed rate moves some costs out of the volumetric rate to a demand-based "fixed charge." The demand-based fixed charge would be set using the customer's three highest daily points of annual non-coincident demand.[2]

While the Company proposes to maintain the same TOU windows as existing TOU rates (with an On-Peak period from 4-9 pm), the proposed TOU-ELEC rate would flatten the price differential between the Off-Peak and Super-Off-Peak periods to 1.5:1 (for the commodity portion of the rate).[3] The Off-Peak Period primarily consists of morning and afternoon hours, while the Super Off-Peak Period primarily captures the overnight hours of midnight to 6 am.[4] The Company explains that the flattening of price differentials outside of the On-Peak period is intended to encourage consumption during the day when renewable energy is generally more available.[5]

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[1] Revised Direct Test. of H. Campi, at HC-2:9–HC-2:15.
[2] *Id.* at HC-6:16–HC-6:19.
[3] *Id.* at HC-7:2–HC-7:12.
[4] *Id.* at HC-7:11–HC-7:12, Table HC-1: Current Effective Standard TOU Periods.
[5] *Id.* at HC-7:4–HC-7:6.

TOU-DR-1 and SDG&E's proposed TOU-ELEC rate design are shown in the table below. TOU-ELEC has lower volumetric rates in all hours than TOU-DR-1, and TOU-ELEC has no baseline credit or minimum bill. However, TOU-ELEC introduces a new rate component, a demand-based fixed charge, which ranges from approximately $29 per month to $85 per month, depending on the customer's non-coincident demand.

Table 1. Comparison of illustrative total rates under TOU-DR-1 and TOU-ELEC [6]

		TOU-DR-1	TOU-ELEC	
Summer				
On-Peak	*$/kWh*	$0.61		$0.45
Off-Peak	*$/kWh*	$0.36		$0.22
Super Off-Peak	*$/kWh*	$0.30		$0.19
Winter				
On-Peak	*$/kWh*	$0.43		$0.30
Off-Peak	*$/kWh*	$0.42		$0.21
Super Off-Peak	*$/kWh*	$0.40		$0.18
Baseline Credit	*$/kWh*	-$0.09		
Minimum Bill	*$/day*	$0.35		
Demand-Based Fixed Charge	*$/month*	N/A	0-4 kW	$28.53
			4-8 kW	$51.28
			8-10 kW	$68.35
			>10 kW	$85.41

Q Why should the Commission consider the impact of electrification on the energy bills of residential customers in this proceeding?

A California is required by law (SB 32) to reach 40 percent reduction of economy-wide carbon dioxide emissions from 1990 levels by 2030, and Executive Order B-55-18 establishes a statewide goal "to achieve carbon neutrality as soon as possible, and no later than 2045, and achieve and maintain net negative emissions

[6] *Id.* at HC-10:1–HC-10:2.

thereafter."[7] To reach this ambitious goal, fossil fuel use will need to be reduced in all sectors of California's economy.[8]

In 2018, transportation contributed 41 percent of California's carbon dioxide emissions, while the residential sector contributed 7 percent.[9] With regard to building electrification, in a resolution adopted last year, the California Air Resources Board ("CARB") formally recognized that "100 percent electrification of natural gas appliances in California would result in significant health benefits and reduction of greenhouse gas (GHG) emissions from natural gas combustion in residential buildings."[10] The California Energy Commission ("CEC") has similarly found that "aggressive electrification," which assumes 100 percent electrification in new construction, 90 percent replacement on burnout, and 70 percent early retirement, is necessary to reduce the direct emissions from buildings in line with California's 2045 carbon neutrality goal.[11]

Designing electric rates that encourage near-term electrification of residential energy uses (including personal vehicles) is an important way to help California reduce greenhouse gas emissions and air pollution from the residential and transportation sectors.

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[7] Exec. Order No. B-55-18 (Sept. 10, 2018), https://www.library.ca.gov/wp-content/uploads/GovernmentPublications/executive-order-proclamation/39-B-55-18.pdf.

[8] *See, e.g.,* E3, Achieving Carbon Neutrality in California at 8 (Oct. 2020), https://ww2.arb.ca.gov/sites/default/files/2020-10/e3_cn_final_report_oct2020_0.pdf ("Achieving carbon neutrality by 2045 requires ambitious near-term actions around deployment of energy efficiency, transportation and building electrification, zero-carbon electricity, and reductions in non-energy, non-combustion greenhouse gas emissions.").

[9] CARB, Current California GHG Emissions Inventory Data. 2000-2018 GHG Inventory (2020 Edition). Accessed March 30, 2021. Available at: https://ww2.arb.ca.gov/ghg-inventory-data.

[10] CARB, *Resolution 20-32*, at 2 (Nov. 19, 2020), https://ww3.arb.ca.gov/board/res/2020/res20-32.pdf.

[11] CEC, *Final Commission Report: California Building Decarbonization Assessment*, at 14–15, 45–46 (Aug. 13, 2021) ("AB 3232 Report") https://www.energy.ca.gov/publications/2021/california-building-decarbonization-assessment.

Q Should the Commission consider any other factors when setting rates to encourage beneficial electrification?

A Yes. In particular, the Commission should consider whether the TOU windows in the Company's rate design proposal are reflective of marginal emissions on the system, not just marginal costs. Shifting electricity consumption away from high-emissions hours to low emissions hours is important for maximizing the benefits of electrification and helping the state meet its climate objectives.

Q How should the Commission determine whether electric rates will encourage beneficial electrification for residential customers?

A To encourage beneficial electrification among residential customers, a rate should yield lower annual energy bills relative to existing energy bills (i.e., the combined total of natural gas, gasoline, and electric costs). An analysis that compares current energy bills to projected bills after adoption of beneficial electrification technologies can provide guidance to the Commission on the anticipated impact of the proposed rate.

Bill savings are important for promoting electrification because customers must typically make substantial up-front investments in new technologies to electrify. Greater bill savings with electrification can contribute to a shorter payback period on the purchase of beneficial electrification technologies. The shorter the payback period, the greater the incentive to electrify.

Q Please describe the bill impact analysis you performed to estimate the energy bill impacts for residential customers who electrify under SDG&E's proposed rate schedule TOU-ELEC.

A I used a bill impact model developed by Synapse Energy Economics to analyze the impacts of building and vehicle electrification on existing residential single-family households in the service territory of SDG&E. For this analysis, I analyzed energy bills over the course of a year for typical single-family household customers in Climate Zones 7 (Coastal) and 10 (Inland). These regions were selected as representative climate zones for the purposes of this analysis.[12]

The bill impact model calculates the change to a customer's annual energy bills when the customer switches to a fully electrified home and vehicle, while simultaneously transitioning from their existing electric rate schedule (TOU-DR-1) and gas rate (GR-1) onto SDG&E's proposed rate schedule, TOU-ELEC.

In the model, a non-electrified customer is assumed to use a combination of natural gas (for space heating, water heating, clothes drying, and cooking); electricity (for air conditioning, lighting, and other appliances); and gasoline (for a passenger vehicle). Conversely, a fully electrified customer is assumed to use electricity for all end-uses. More specifically, the fully electrified customer is modeled with the following technologies:

- Space heating and cooling: air source heat pump ("ASHP"),
- Water heating: heat pump water heater ("HPWH"),
- Cooking stove: induction stovetop,
- Clothes drying: electric resistance clothes dryer, and
- Vehicle: a 200-mile range battery electric vehicle.

The model uses annual energy consumption values that differ by climate zone and residential building type from the *2019 Residential Appliance Saturation Study* ("RASS").[13] These values are included in the Appendix of this testimony.

For residential end-use load shapes, the model relies on the National Renewable Energy Laboratory's ("NREL") *End-Use Load Profiles for the U.S. Building Stock* for all end-uses except for space heating and water heating.[14] For space

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[12] Attach. B, SDG&E Response to Data Request Sierra Club-SDG&E-01, Q.1.
[13] DNV GL, *2019 Residential Appliance Saturation Study*, https://webtools.dnv.com/CA_RASS/.
[14] The data was accessed using the OpenEI database, last accessed January 2022. Available at: https://openei.org/doe-opendata/dataset/commercial-and-residential-hourly-load-profiles-for-all-tmy3-locations-in-the-united-states.

heating, the model uses an ASHP performance curve that relates ambient air temperature to system efficiency, which is applied to typical meteorological year data to develop annual consumption values and hourly load shapes for each climate zone.[15] For water heating, the model uses hourly load shape data specific to San Diego's climate zones developed by Ecotope and NRDC.[16] For all electrification technologies, the model uses annual average efficiency ratings for gas and electric equipment to convert RASS natural gas consumption values to electric consumption.

While adoption of beneficial electrification technologies is expected to increase electricity consumption overall, the model also assumes that the electrification process involves some envelope and air-sealing improvements that yield a 14 percent energy reduction for space heating and cooling.[17] Given California's strong building decarbonization initiatives that include both electrification and efficiency strategies, the model assumes that a customer will be able to take advantage of efficiency upgrades at the time of electrifying.[18] Furthermore, energy efficiency improvements are included in the model because of the importance of bundling efficiency programs with building electrification initiatives to achieve emissions reduction in existing buildings.[19]

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[15] Center for Energy and Environment, *Cold-Climate Air-Source Heat Pumps* (Feb. 2018), http://www.duluthenergydesign.com/Content/Documents/GeneralInfo/PresentationMaterials/2018/Day1/ccASHPs.pdf.

[16] Ecotope, Heat Pump Water Heater Electric Load Shifting: A Modeling Study (June 2018), https://efiling.energy.ca.gov/GetDocument.aspx?tn=232168&DocumentContentId=64120.

[17] EnergyStar, *Methodology for Estimated Energy Savings from Cost-Effective Air Sealing and Insulating,* Table 1: Estimated Savings from Home Sealing and Insulating, https://www.energystar.gov/campaign/seal_insulate/methodology.

[18] *See* CARB, *Building Decarbonization*, https://ww2.arb.ca.gov/our-work/programs/building-decarbonization/about.

[19] Rocky Mountain Institute, *The Economics of Electrifying Buildings*, at 53 (June 2018), https://rmi.org/wp-content/uploads/2018/06/RMI_Economics_of_Electrifying_Buildings_2018.pdf.

In sum, we estimate that a customer who adopts beneficial electrification technologies will increase their average monthly electricity use by more than 450 kWh—approximately doubling their electricity consumption.

Q Does your model account for the full cost of electrifying?

A No. Although the model analyzes total energy bills before and after adoption of beneficial electrification technologies, the model does not analyze the customer economics of the upfront cost of the electrification technologies. Therefore, it is appropriate and necessary for an electric rate to yield meaningful savings to account for the upfront installation costs (e.g., electrical panel upgrades and technology replacements before end-of-life).

Q What assumptions did you use for vehicle electrification?

A I assumed that the customer will replace a gasoline vehicle that has an efficiency of about 25.4 miles per gallon with a battery electric vehicle that has an efficiency of 3.6 miles per kilowatt-hour.[20,21] I used the California average monthly 2021 gasoline prices and assumed that gasoline prices do not vary by climate zone.[22] For charging an electric vehicle, I used monthly vehicle miles traveled ("VMT") taken from a 2016 AAA *American Driver Survey* to calculate the monthly electricity consumption required for an EV.[23] I multiplied the share of hourly electric vehicle charging from electric vehicle customers in San Diego to the monthly electricity demand to calculate the customer's approximate electric

[20] The vehicle milage assumption is taken from the U.S. EPA's 2021 Automotive Trends Report. U.S. EPA, *The 2021 EPA Automotive Trends Report*, at 5 (Nov. 2021), https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1013L1O.pdf.

[21] The battery electric vehicle conversion factor of 33.705 kilowatt-hours per gallon of gasoline equivalent is taken from the U.S. EPA's Green Vehicle Guide. U.S. EPA, *Green Vehicle Guide*, https://www3.epa.gov/otaq/gvg/learn-more-technology.htm.

[22] U.S. Energy Information Administration, *2019 Gasoline Prices in California*, https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=EMM_EPMR_PTE_SCA_DPG&f=M. I used 2019 data to exclude the impact of the COVID-19 pandemic on gasoline prices.

[23] AAA Foundation for Traffic Safety, *American Driving Survey 2015-2016*, https://aaafoundation.org/wp-content/uploads/2018/02/18-0019_AAAFTS-ADS-Research-Brief.pdf.

vehicle load in every hour of the year.[24] VMTs do not vary by climate zone, therefore electric vehicle charging costs do not vary by climate zone.

Q Does your model assess the impact of battery storage on bill impacts?

A No, the bill impact model does not incorporate the use of battery storage. However, in general, more differentiated rates (e.g., with a larger peak-to-off-peak ratio) provide a stronger incentive for adopting storage. In the case of the rates examined this analysis, adopting energy storage could provide additional bill savings, but it is unclear whether such savings would be sufficient to offset the cost of the battery storage.

Q Does your analysis include residential customers in multi-family buildings?

A No, it does not. However, multi-family customers should be given special consideration for electrification rates going forward. Customers in multi-family buildings tend to see bill increases on typical electrification rates due to their lower energy consumption. Multi-family customers use less energy on space heating and cooling because their homes tend to be smaller than single-family homes and because of the significant efficiency gained from having units above, below, or to the sides that are also heated or cooled.[25]

Because of their lower energy bills, fixed charges (which are fairly typical features of electrification rates) represent a larger fraction of the total energy bills for customers in multi-family buildings than for those in single-family homes. Therefore, care should be given to ensuring that multi-family customers are offered an electrification rate that does not increase their energy bills. My

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[24] We utilized charging data from SDG&E EV customers on rate EV-TOU. Data acquired from CPUC Docket A.17-01-020: SDG&E SB 350 Transportation Electrification Proposals, SDG&E Response to NRDC Data Request No. NRDC-SDG&E-DR-03, https://www.sdge.com/sites/default/files/NRDC_DR-03_SDGE%2520RESPONSE.zip.

[25] RASS 2009 estimates that multi-family units use about 24 percent the energy of a single-family home for climate control (space heating and cooling).

recommended modification to the Company's rate design would likely improve bill savings for customers in multifamily housing, but it may not represent the optimal rate design for these customers. For that reason, I recommend that the Company provide tools that will assist these customers in making the optimal rate choice among rate options offered by SDG&E. Per the Commission's recent decision in R.19-01-011, a baseline allowance for customers fuel-switching to heat pump technology could also be an appropriate solution for customers in multifamily buildings.[26]

Q Does the bill impact model consider GHG reductions due to electrification?

A Yes, the bill impact model also calculates carbon dioxide emissions reductions by comparing the emissions from the customer before and after they electrify their home and vehicle. Emissions from natural gas and gasoline were calculated using emissions factors from the U.S. Environmental Protection Agency,[27] and emissions from electricity consumption were calculated using historical hourly marginal emissions data for the SP15 region for 2019 from the 2021 Avoided Cost Calculator.[28]

Q How are your results presented in this testimony?

A First, I present the potential emissions reductions from electrification. I then discuss the bill impacts for SDG&E's residential customers who simultaneously transition to TOU-ELEC and adopt beneficial electrification technologies. Finally, I offer an alternative rate to TOU-ELEC that does not include a demand-

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[26] *See* D.21-11-002, *Decision on Incentive Layering, the Wildfire and Natural Disaster Resiliency Rebuild Program, Data Sharing, Rate Adjustments for Electric Heat Pump Water Heaters, and Propane Usage*, at 90–94 (Nov. 2021), https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M421/K107/421107786.PDF.

[27] U.S. EPA, *Greenhouse Gases Equivalencies Calculator - Calculations and References*, https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references.

[28] E3, 2021 Distributed Energy Resources Avoided Cost Calculator, developed under contract with the CPUC, https://willdan.app.box.com/v/2021CPUCAvoidedCosts.

based fixed charge and recommend changes to the TOU periods to better align the on-peak and off-peak hours with marginal emissions rates.

IV. EMISSIONS ANALYSIS RESULTS

Q What is the impact of vehicle and home electrification on carbon dioxide emissions?

I estimate that a single-family customer who electrifies their home and vehicle in SDG&E's service territory will avoid emitting 4.2 metric tons of carbon dioxide per year. This is equivalent to a reduction in annual household GHG emissions of nearly 50 percent. The result does not vary significantly by location.

Q How do the avoided carbon dioxide emissions vary by the electrification technology?

A Vehicle electrification yields the greatest carbon dioxide emissions reduction, accounting for about 75 percent of the total reduction. Water heating electrification (of a home that switches from a gas boiler) yields the second-highest emissions reduction, accounting for about 15 percent of the emissions reduction. Space heating electrification (of a home that switches from a gas furnace) accounts for about 6 percent of the total reduction. Space cooling with a heat pump (in lieu of an air conditioner) accounts for 3 percent of the emissions reduction.

V. BILL IMPACT ANALYSIS RESULTS FOR SDG&E CUSTOMERS IN SINGLE FAMILY HOUSES

Q What are the results of your analysis on the bill impacts of electrifying single-family customers in SDG&E's service territory?

A In SDG&E's Coastal and Inland climate zones, transitioning residential customers in single-family houses to TOU-ELEC and an all-electric home (with an electric vehicle) will decrease their annual energy bills by approximately $1,400 per year, as compared to using a combination of natural gas, electricity, and gasoline on

TOU-DR-1. These values assume 2021 gasoline prices and 2021 natural gas tariffs. Table 2 and Table 3 below show the bill impacts by end-use for customers in both climate zones.

Table 2. Bill impacts by end use for customer in Coastal climate zone (7), in $/year.

End Uses / Bill Components	Annual Operating Cost (2021$ per year)		
	Base Case (All Fuels)	Alternative Case (All Electric)	Difference
Space Heating (+ Efficiency)	$245	$177	($68)
Water Heating	$358	$229	($129)
Cooking	$37	$58	$21
Clothes Drying	$17	$59	$42
AC (+ Efficiency)	$305	$127	($178)
Vehicle	$2,122	$790	($1,332)
Other End-Uses	$1,798	$1,041	($757)
Credits (Baseline, Climate)	($465)	($69)	$396
Demand-based Fixed Charge	$0	$615	$615
Total Cost	**$4,416**	**$3,026**	**($1,390)**

Table 3. Bill impacts by end use for customer in Inland climate zone (10), in $/year.

End Uses / Bill Components	Annual Operating Cost (2021$ per year)		
	Base Case (All Fuels)	Alternative Case (All Electric)	Difference
Space Heating (+ Efficiency)	$306	$234	($72)
Water Heating	$448	$280	($168)
Cooking	$38	$58	$20
Clothes Drying	$17	$59	$42
AC (+ Efficiency)	$303	$125	($177)
Vehicle	$2,122	$790	($1,332)
Other End-Uses	$1,806	$1,036	($770)
Credits (Baseline, Climate)	($498)	($69)	$429
Demand-based Fixed Charge	$0	$615	$615
Total Cost	**$4,542**	**$3,128**	**($1,413)**

Note: Other end uses include lighting and other electric appliances, such as refrigerators, televisions, dishwashers, and computers. The energy consumption for this line item does not decrease, but the cost does due to the difference in volumetric rates.

Q How do these savings change for customers without electric vehicles?

A As shown in the tables above, nearly all of the bill savings comes from the switch to an electric vehicle. That is, of the approximately $1,400 in annual savings,

$1,332 is from switching to an EV. If the customer does not have a vehicle, the annual savings from switching to TOU-ELEC would fall to $330 in Climate Zone 7 and $354 in Climate Zone 10. These savings also include the impact of moving into a lower demand bucket for the fixed charge, as customers without an EV are expected to have lower peak demands.[29]

Q Are the savings on TOU-ELEC sensitive to changes in natural gas rates and gasoline prices?

A Yes. To illustrate the sensitivity of these results to natural gas rates and gasoline prices, I compared the savings for customers who electrify under 2021 prices to 2020 prices. Both gasoline prices and SDG&E's residential natural gas rates increased significantly from 2020 to 2021. Gasoline prices increased from an average of $3.05 in 2020 to $4.01 in 2021. SDG&E's GR-1 baseline rate increased from an average of $1.66/therm in 2020 to $1.87/therm in 2021. Of course, to some extent, changes in natural gas prices would also impact electricity rates. For the purposes of demonstrating the sensitivity to natural gas and gasoline costs alone, however, I did not model a simultaneous change in electricity prices.

The results of this sensitivity analysis (shown in Table 4 and Table 5 below) indicate that a future decline in natural gas and gasoline prices could substantially reduce the savings on SDG&E's proposed tariff. If natural gas and gasoline prices fall to 2020 levels, a customer with an EV would see their annual savings reduced to less than $900, while a customer without an EV would experience savings of less than $300.

[29] We estimate that a customer without an electric vehicle would have lower peak demands, thereby reducing their demand-based fixed charge. The savings from moving into a lower demand-based fixed charge tier total $273 per year.

Table 4. Sensitivity of Results to Changes in Natural Gas and Gasoline Prices – EV Customer

	Savings with an EV		
	2020 Prices	2021 Prices	Difference
Zone 7	$873	$1,390	$517
Zone 10	$885	$1,413	$528

Table 5. Sensitivity of Results to Changes in Natural Gas and Gasoline Prices – Non-EV Customer

	Savings Without an EV		
	2020 Prices	2021 Prices	Difference
Zone 7	$272	$330	$58
Zone 10	$284	$354	$70

Q What are the implications of your sensitivity analysis?

A I recommend that any tariff designed to promote beneficial electrification be frequently reviewed to ensure that it is providing sufficient savings to motivate customers to switch from natural gas and gasoline end-uses to electric technologies.

VI. FLAWS IN SDG&E'S RATE DESIGN PROPOSAL

Q Do you have any concerns regarding SDG&E's proposed rate design?

A Yes. I have two primary concerns with SDG&E's proposed TOU-ELEC rate design. First, SDG&E's demand-based fixed charge is essentially a non-coincident peak ("NCP") demand charge, which poorly reflects cost causation for most system costs and could lead to customers flattening their load when it is not beneficial to do so. Second, the Company's proposed TOU periods do not accurately reflect system costs or emissions, particularly during the middle of the day when solar generation is highest.

Q Please explain why an NCP demand charge sends a poor price signal to customers.

A Most demand-related distribution and transmission costs are primarily driven by the combined peak demand of many customers, for example the hundreds or thousands of customers who may be served by a single feeder or substation. It is the timing of these peaks at the substation or feeder level that drive major distribution system investments, not an individual's non-coincident peak demand.

A demand charge based on an individual customer's peak demand may be very poorly aligned with the timing of the peak demand at the substation or feeder level. Further, an NCP demand charge may even discourage a customer from increasing his or her consumption during hours in which it would be beneficial to do so. The potential for NCP demand charges to provide inefficient price signals has been recognized by the Commission, which wrote:

> Noncoincident demand charges incentivize customers to flatten their load, but given high penetration of solar resources, solar-following loads are becoming more desirable to avoid curtailing renewable resources and may be less costly to serve than customers with flat loads. Noncoincident demand charges can discourage beneficial energy use, such as electric vehicle fleet charging (overnight or during hours with high solar generation), or Reverse Demand Response to encourage customers to use renewable energy that might otherwise be curtailed due to over-generation conditions.[30]

For these reasons, it is much more reasonable to recover most distribution costs through the volumetric portion of the TOU rate.

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[30] Cal. Pub. Utils. Comm'n, D.17-08-030, at 46 (Aug. 25, 2017), https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M194/K599/194599448.PDF.

Q Would converting the NCP demand-based charge to a charge assessed only during on-peak hours resolve the issues you identified above?

A No. Although a demand charge assessed only during the on-peak period would generally provide a more accurate reflection of system costs and marginal emissions rates, I recommend avoiding demand charges for residential customers altogether, because they are difficult for customers to understand and manage.

Q Why are demand charges difficult for residential customers to understand and manage?

A Demand charges represent a much more complex rate design than residential customers and many small commercial customers are accustomed to. Surveys and focus groups have found that the concept of demand charges is not well-understood and frequently raises concerns from customers.[31] Moreover, customers are generally not aware of how much demand any one device may impose, nor are tools for monitoring and controlling household demand common. Without investing in additional monitoring technologies and apps, residential customers have little ability to monitor or adjust their demand levels. This is especially problematic when a brief overuse of appliances at the same time can have substantial bill impacts.

[31] For example, a 2016 survey found that approximately 50% of residential customers do not understand the terms "kW" and "kWh". *See* Bill LeBlanc, *Do Customers Understand Their Power Bill? Do They Care? What Utilities Need to Know* (Jan. 21, 2016), https://www.esource.com/email/ENEWS/2016/Billing. Further, focus groups in Ontario found that the concept of maximum use during peak hours "is difficult for people to understand and raised concern among a few. *See* The Gandalf Group, *Ontario Energy Board: Distribution Charge Focus Groups Final Report*, at 9 (Oct. 2013), https://www.oeb.ca/oeb/_Documents/EB-2012-0410/Appendix%20B%20-%20Gandalf%20Distribution%20Focus%20Groups.pdf. ("There is no template for measuring maximum use that people are used to in the way they understand TOU."). Customers also expressed concerns regarding fairness, specifically that "that small lapses in their conservation efforts will mean they will have to pay a high price." *Id.*

Q Is a non-coincident demand-based charge ever reasonable for residential customers?

A As noted above, I recommend avoiding demand charges for practical reasons, as well as their inability to provide an accurate price signal for most system costs. However, a small charge based on a customer's NCP demand could be justified for recovering the cost of equipment that is closest to the customer and which must be sized to meet that specific customer's NCP demand. For residential customers, it may be appropriate to recover the final line transformer costs through an NCP demand charge, but other distribution costs should be recovered through TOU rates.

Q Does SDG&E's demand-based charge recover only the costs of the final line transformer?

A No, it appears that SDG&E's NCP demand-based fixed charge is designed to recover much more than the final line transformer costs. In SDG&E's 2019 GRC Phase 2 proceeding (A.19-03-002), SDG&E estimated the residential New Customer Only (NCO) marginal distribution customer costs to be $108 per customer per year.[32] Of these costs, approximately 60% were related to the transformer, while the remainder were associated with service and meters. This implies that an NCP demand charge should collect less than $100 per year for the typical customer.[33] However, the Company's proposed TOU-ELEC rate would collect between $342 and $1,025 per year from residential customers. This appears to be much more than is justified by the transformer costs.

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[32] A.19-03-002, Revised Prepared Direct Test. of W. Saxe, Chapter 5, Attachment C (May 2019), https://www.sdge.com/sites/default/files/regulatory/A1903002%20Saxe%20Chapter%205%20 2019%20GRC%20Phase%202-Chapter%205%20DT%20%28Saxe-Distribution%20Cost%20Studies%29%205%208%20w%20ERRATA%20LOG.pdf

[33] If collecting only final line transformer costs. If collecting all new customer-related marginal costs, a demand charge should not collect more than $108 per year.

Q Please explain your concern with SDG&E's proposed TOU periods.

A The Company's proposal contains three TOU pricing periods: On-Peak, Off-Peak, and Super Off-Peak. The low prices in the Super Off-Peak period will encourage customers who electrify to shift their electricity usage to these hours, to the extent possible. However, SDG&E's TOU periods are based on stale data regarding system costs and emissions, and therefore fail to provide the most efficient price signals to customers.

Q Why do you claim that the Company's TOU periods are based on stale data?

A The Company is not proposing to modify its standard TOU periods, which were adopted five years ago in 2017, largely based on data from 2010 through 2015.[34] These TOU periods classify the weekday overnight hours of midnight to 6 AM as Super Off-Peak. In addition, the hours of 10 AM to 2 PM in March and April are classified as Super Off-Peak.

Although the TOU periods adopted in 2017 may have been a reasonable reflection of system costs for the 2010-2015 period, they should be revisited in light of changing system conditions. In particular, the overnight hours are no longer the hours in which system energy costs or emissions tend to be lowest—those hours now occur during the middle of the day. Thus, the TOU periods should be modified to reflect this fact.

Q What evidence do you have that marginal emissions are lowest during the middle of the day?

A I analyzed hourly carbon dioxide marginal emissions rates (in tonnes per MWh) from the 2021 Avoided Cost Calculator for SP15 (which includes SDG&E's territory) for the years 2019 and 2025.[35] These data indicate that weekday

[34] Revised Direct Test. of Hannah Campi, at HC-7:8–HC-7:12, referencing decision D.17-08-030 in A.15-04-012.

[35] E3, 2021 Distributed Energy Resources Avoided Cost Calculator, developed under contract with the CPUC, https://willdan.app.box.com/v/2021CPUCAvoidedCosts

emissions tend to be lowest from approximately 9 am to 2 pm, not only during the spring season of March and April, but also during virtually every other month of the year. However, SDG&E's existing TOU periods classify the midday period as "Off-Peak" rather than "Super Off-Peak" in all months other than March and April.

The figures below show the average hourly emissions by month for 2019 and 2025, with the TOU periods (winter and summer months, as well as super off-peak, off-peak, and peak periods) indicated by cell borders and at the bottom of the table. As shown in the Figure 2, by 2025, marginal emissions fall to nearly zero during the middle of the day for much of the year. Although marginal emissions are relatively low during the overnight hours, they are clearly lowest during the daytime when the sun is shining.

Figure 1. Average Hourly Marginal Emissions Rates (Tonnes/MWh) for 2019 (Weekdays)

	Hour Ending																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Jan	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.5
Feb	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.3	0.4	0.5	0.5	0.5	0.4	0.4	0.4	0.3
Mar	0.3	0.2	0.2	0.3	0.4	0.4	0.4	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.5	0.6	0.6	0.5	0.4	0.3	0.3
Apr	0.4	0.3	0.3	0.4	0.5	0.6	0.5	0.4	0.3	0.2	0.2	0.2	0.1	0.2	0.2	0.2	0.4	0.6	0.6	0.7	0.6	0.5	0.5	0.4
May	0.3	0.3	0.3	0.3	0.5	0.5	0.4	0.3	0.2	0.2	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.5	0.6	0.7	0.6	0.5	0.4	0.3
Jun	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.5	0.6	0.6	0.7	0.6	0.5	0.4	0.4
Jul	0.4	0.3	0.3	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.5	0.5	0.6	0.6	0.6	0.6	0.5	0.4	0.4
Aug	0.4	0.4	0.4	0.4	0.4	0.5	0.4	0.3	0.3	0.3	0.4	0.4	0.5	0.5	0.5	0.6	0.6	0.6	0.7	0.7	0.6	0.5	0.5	0.4
Sep	0.4	0.4	0.4	0.4	0.5	0.6	0.5	0.4	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.5	0.6	0.7	0.7	0.6	0.6	0.5	0.5	0.4
Oct	0.4	0.4	0.4	0.4	0.5	0.6	0.5	0.4	0.4	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.6	0.7	0.7	0.6	0.6	0.5	0.5	0.5
Nov	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.5	0.4	0.4	0.3	0.3	0.3	0.4	0.4	0.6	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.5
Dec	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.5	0.4	0.4	0.4	0.3	0.4	0.4	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.5
Avg	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.5	0.6	0.6	0.6	0.6	0.5	0.4	0.4
	Super Off-Peak						Off-Peak										On-Peak					Off-Peak		

Source: Synapse analysis based on emissions data in the 2021 Avoided Cost Calculator. Note: Super Off-Peak period defined as 9 pm to 6 am, as well as 10 am – 2 pm in March and April.

Figure 2. Average Hourly Marginal Emissions Rates (Tonnes/MWh) for 2025 (Weekdays)

	Hour Ending																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Jan	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.2	0.2	0.2	0.3	0.2	0.2	0.3	0.4	0.7	0.7	0.7	0.7	0.6	0.4	0.3
Feb	0.3	0.3	0.2	0.2	0.3	0.3	0.4	0.4	0.2	0.1	0.1	0.2	0.2	0.1	0.2	0.1	0.3	0.6	0.7	0.6	0.7	0.6	0.4	0.3
Mar	0.2	0.3	0.2	0.2	0.2	0.3	0.4	0.2	0.2	0.1	0.0	0.1	0.0	0.0	0.2	0.1	0.3	0.6	0.8	0.8	0.7	0.6	0.3	0.3
Apr	0.2	0.1	0.1	0.2	0.2	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.7	0.9	0.8	0.4	0.1	0.2
May	0.1	0.2	0.2	0.1	0.2	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.4	0.6	0.7	0.8	0.5	0.2	0.0
Jun	0.1	0.2	0.1	0.2	0.1	0.2	0.2	0.1	0.1	0.0	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.7	0.9	0.8	0.6	0.4	0.2
Jul	0.0	0.1	0.2	0.1	0.3	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.4	0.5	0.8	1.0	1.0	0.7	0.2	0.0
Aug	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.4	0.4	0.6	1.0	0.9	0.6	0.4	0.3	0.3
Sep	0.3	0.3	0.3	0.3	0.3	0.4	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.4	0.6	1.1	0.8	0.5	0.5	0.4	0.3
Oct	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.3	0.2	0.2	0.1	0.1	0.1	0.2	0.2	0.3	0.6	0.8	0.7	0.6	0.6	0.4	0.5	0.3
Nov	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.2	0.6	0.7	0.6	0.7	0.7	0.5	0.3	0.4
Dec	0.4	0.3	0.3	0.3	0.3	0.4	0.4	0.5	0.4	0.3	0.3	0.2	0.2	0.2	0.4	0.4	0.8	0.6	0.5	0.6	0.6	0.5	0.4	0.4
Avg	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.4	0.6	0.7	0.8	0.7	0.5	0.3	0.3
	Super Off-Peak						Off-Peak										On-Peak					Off-Peak		

Source: Synapse analysis based on emissions data in the 2021 Avoided Cost Calculator

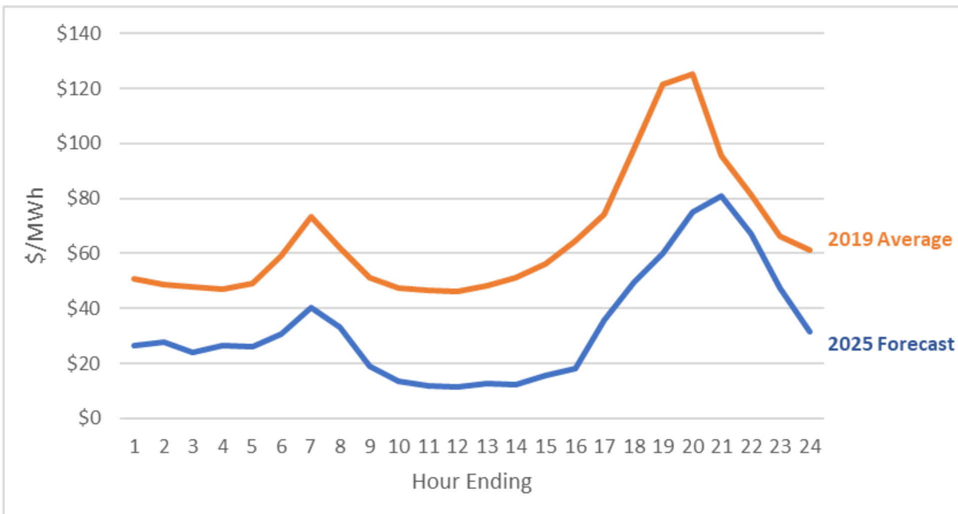
Q What does your analysis of marginal emissions rates imply regarding TOU periods?

A The analysis above suggests that it would be appropriate to include more hours in the Super Off-Peak period, particularly during the middle of the day. However, it is also important to consider marginal energy costs when developing TOU periods.

Q Did you analyze marginal energy costs?

A Yes. I analyzed day-ahead clearing prices for the SDG&E default load aggregation point (DLAP) for 2021, obtained from CAISO,[36] as well as energy price forecasts for 2025 in the 2021 Avoided Cost Calculator.[37] Both of these sources indicate that the midday period generally has prices that are as low as, or lower than, the overnight hours, particularly between the hours of 10 am and 2 pm. This analysis is shown in the figure below.

Figure 3. Average hourly energy prices for SDG&E



Source: CAISO 2019 LMP data for SDG&E DLAP; 2025 forecast in 2021 Avoided Cost Calculator.

In conclusion, the hours of 10 am to 2 pm increasingly have the lowest emissions and marginal energy costs, and therefore should be classified as Super Off-Peak.

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[36] California ISO Open Access Same-time Information System (OASIS), Locational Marginal Prices, http://oasis.caiso.com/mrioasis/logon.do.

[37] E3, 2021 Distributed Energy Resources Avoided Cost Calculator, developed under contract with the CPUC, https://willdan.app.box.com/v/2021CPUCAvoidedCosts.

VII. RECOMMENDED ALTERNATIVE RATE DESIGN

Q Based on your analysis, do you recommend modifying SDG&E's proposed electrification rate?

A Yes. I have two recommended modifications to SDG&E's proposed electrification rate. First, I recommend that the NCP demand-based charge be replaced by a flat fixed charge. Second, I recommend that the TOU periods be modified to include the middle of the day from 10 am to 2 pm.

Q Please explain your recommendation regarding the fixed charge.

A Instead of a fixed charge based on a customer's NCP demand, I recommend that SDG&E implement a flat fixed charge that recovers only customer-related costs. If the Company finds that customers on this rate impose greater customer-related costs (such as the need to upgrade the final line transformer to meet increased NCP demand), the Company could propose to implement an "excess demand" charge. This charge could be triggered if a customer's monthly peak demand exceeds some threshold, e.g., 12 kW. Setting an excess demand charge at 12 kW would allow a customer to charge their EV using a Level 2 charger (at approximately 7 kW), as well as several standard household appliances, but would encourage customers to stagger EV charging using Level 2 chargers.[38] However, such a charge should only be implemented if the Company demonstrates that the charge would likely avoid costly distribution system upgrades due to high individual peak demands, and with adequate customer outreach and education.[39]

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[38] Level 2 charging is generally in the range of 6.2 – 7.6 kW. *See* Chargepoint, *Level Up Your EV Charging Knowledge*, (Mar. 2017), https://www.chargepoint.com/blog/level-your-ev-charging-knowledge/.

[39] For example, if such a charge were implemented, the Company should clearly communicate to customers what end-uses would likely trigger the charge (e.g., charging two EVs simultaneously on Level 2 chargers.)

Q What fixed charge do you recommend?

A I recommend a fixed charge of approximately $20 per month. Based on the billing determinants contained in the Company's workpapers, this would increase the energy charges in each period by approximately 3.7 cents per kilowatt-hour, as shown in the table below.

Table 6. Comparison of SDG&E's proposed rate design to a $20 fixed charge alternative

		SDG&E Proposal	Alternative: Flat Fixed Charge
Basic Service Fee	$/Month		$ 20.00
0-4 kW	$/Month	$ 28.53	
4-8 kW	$/Month	$ 51.28	
8-10 kW	$/Month	$ 68.35	
>10 kW	$/Month	$ 85.41	
Energy Charges:			
Summer Energy:			
On-Peak	$/kWh	0.45211	0.48868
Off-Peak	$/kWh	0.22010	0.25667
Super Off-Peak	$/kWh	0.18959	0.22616
Winter Energy:			
On-Peak	$/kWh	0.29970	0.33627
Off-Peak	$/kWh	0.21180	0.24837
Super Off-Peak	$/kWh	0.18406	0.22063

Q How would this modified rate design impact customer savings?

A We estimate that a customer who electrifies would see slightly greater savings under this modified rate design than under the Company's proposal, with or without an electric vehicle. As noted previously, our model assumes a customer's electricity usage is in the range of 850 - 900 kWh/month after electrifying, which is approximately double the typical SDG&E residential customer's monthly usage. For customers with substantially higher usage, the Company's proposal may provide greater savings, assuming that the customer actively manages their demand to avoid the proposed high NCP demand-based fixed charges.

Q Would implementing a flat fixed charge negatively impact customers in multifamily buildings?

A My recommended fixed charge of $20 per month is lower than the lowest tier of SDG&E's proposed demand-based fixed charge. Thus, customers with lower usage (such as those without an EV or who live in multifamily housing) would benefit more from my proposed rate design than from the Company's proposal. However, my proposed rate design may still not be the optimal rate design for these customers. For this reason, I recommend that the Company provide web-based tools to help customers analyze their usage and determine which of the tariffs offered by SDG&E would be optimal for them after adopting beneficial electrification technologies.

Q Please elaborate on your recommendation regarding the TOU periods.

A Based on my analysis of marginal energy costs and emissions rates above, it is clear that both energy costs and marginal emissions during the middle of the day are now as low, or lower, than during the overnight hours. Further, marginal emissions and energy costs are projected to decline even further in the future, as illustrated by the forecast data for 2025.

It is important to send customers efficient price signals, particularly when they are considering investments in beneficial electrification technologies. Including the midday hours, particularly the hours of 10 am to 2 pm, in the Super Off-Peak period for all months, not just March and April, is likely to further encourage customers to invest in electric appliances that can be used during these hours by making such investments more affordable. In addition, it will encourage customers to shift load to the midday hours when low-cost renewable energy is abundant, thereby lowering emissions and using the system more efficiently.

Q Does this conclude your testimony?

A Yes, it does.

VIII. APPENDIX

Q Please provide the end-use load consumption values used in your analysis, including all sources.

A The table below provides end-use consumption values. All values are derived from 2019 RASS Study, described in this testimony above.

End-Use	Units	Annual Consumption	
		Coastal	Inland
Air Conditioning	kWh	422	422
Space Heating	MMBtu	13.8	14
Water Heating	MMBtu	20	20
Clothes Drying	MMBtu	1	1
Cooking	MMBtu	2	2
Lighting	kWh	722	722
Other Appliances	kWh	1,981	1,981
Electric Vehicle	kWh	3,771	3,771

Docket No: A.21-09-001

Sierra Club

Direct Testimony of Melissa Whited

Attachment A

Qualifications of Melissa Whited

Melissa Whited, Principal Associate

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PROFESSIONAL EXPERIENCE

Synapse Energy Economics, Cambridge MA. *Principal Associate,* 2017 – present*, Senior Associate,* 2015 – 2017*, Associate*, 2012 – 2015

Consult and provide analysis of rate design proposals, alternative regulation, and other topics including distributed energy resources and electric vehicles. Develop expert witness testimony in public utility commission proceedings. Author reports on topics at the intersection of utility regulation, customer protection, and environmental impacts.

University of Wisconsin - Madison, Department of Agricultural and Applied Economics, Madison, WI. *Teaching Assistant – Environmental Economics*, 2011 – 2012

Developed teaching materials and led discussions on cost-benefit analysis, carbon taxes and cap-and-trade programs, management of renewable and non-renewable resources, and other topics.

Public Service Commission of Wisconsin, Water Division, Madison, WI. *Program and Policy Analyst - Intern*, Summer 2009

Researched water conservation programs nationwide to develop a proposal for Wisconsin's state conservation program. Developed spreadsheet model to calculate avoided costs of water conservation in terms of energy savings and avoided emissions.

Synapse Energy Economics, Cambridge, MA. *Communications Manager*, 2005 – 2008

Developed technical proposals for state and federal agencies, environmental and public interest groups, and businesses. Edited reports on energy efficiency, integrated resource planning, greenhouse gas regulations, renewable resources, and other topics.

EDUCATION

University of Wisconsin, Madison, WI
Master of Arts in Agricultural and Applied Economics, 2012
Certificate in Energy Analysis and Policy
National Science Foundation Fellow

University of Wisconsin, Madison, WI
Master of Science in Environment and Resources, 2010
Certificate in Humans and the Global Environment
Nelson Distinguished Fellowship

Southwestern University, Georgetown, TX
Bachelor of Arts in International Studies, *Magna cum laude,* 2003.

ADDITIONAL SKILLS

- Econometric Modeling – Linear and nonlinear modeling including time-series, panel data, logit, probit, and discrete choice regression analysis
- Nonmarket Valuation Methods for Environmental Goods – Hedonic valuation, travel cost method, and contingent valuation
- Cost-Benefit Analysis
- Input-Output Modeling for Regional Economic Analysis

FELLOWSHIPS AND AWARDS

- Winner, M. Jarvin Emerson Student Paper Competition, Journal of Regional Analysis and Policy, 2010
- Fellowship, National Science Foundation Integrative Graduate Education and Research Traineeship (IGERT), University of Wisconsin – Madison, 2009
- Nelson Distinguished Fellowship, University of Wisconsin – Madison, 2008

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National Energy Screening Project. 2020. *National Standard Practice Manual for Benefit-Cost Analysis of Distributed Energy Resources*. E4TheFuture, Synapse Energy Economics, Energy Futures Group, ICF, Pace Energy and Climate Center, Schiller Consulting, Smart Electric Power Alliance.

Whited, M., J. Frost, B. Havumaki. 2020. *Best Practices for Commercial and Industrial EV Rates*. A guide prepared by Synapse Energy Economics for Natural Resources Defense Council.

Knight, P., E. Camp, D. Bhandari, J. Hall, M. Whited, B. Havumaki, A. Allison, N. Peluso, T. Woolf. 2019. *Making Electric Vehicles Work for Utility Customers: A Policy Handbook for Consumer Advocates.* Synapse Energy Economics for the Energy Foundation.

White, D., K. Takahashi, M. Whited, S. Kwok, D. Bhandari. 2019. *Memphis and Tennessee Valley Authority: Risk Analysis of Future TVA Rates for Memphis.* Synapse Energy Economics for Friends of the Earth.

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Nova Scotia Utility and Review Board (Matter No. M09777): Direct testimony of Melissa Whited regarding Nova Scotia Power Inc.'s proposed time-varying pricing tariff application. On behalf of Counsel to the Nova Scotia Utility and Review Board. February 24, 2021.

Georgia Public Service Commission (Docket No. 42516): Direct testimony of Melissa Whited and Ben Havumaki regarding Georgia Power's proposal to increase the customer charge for residential customers. On behalf of the Sierra Club. October 17, 2019.

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New York Public Service Commission (Case 17-E-0238): Direct and rebuttal testimony of Tim Woolf and Melissa Whited regarding Earnings Adjustment Mechanisms proposed by National Grid. On behalf of Advanced Energy Economy Institute. August 25 and September 15, 2017.

Utah Public Service Commission (Docket No. 14-035-114): Direct testimony of Melissa Whited regarding Pacificorp's proposed rates for customers with distributed generation. On behalf of Utah Clean Energy. June 8, 2017.

Texas Public Utilities Commission (SOAH Docket No. 473-17-1764, PUC Docket No. 46449): Cross-rebuttal testimony evaluating Southwestern Electric Power Company's proposed revisions to its

Distributed Renewable Generation tariff. On behalf of Sierra Club and Dr. Lawrence Brough. May 19, 2017.

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Public Utilities Commission of Hawaii (Docket No. 2015-0170): Direct testimony regarding Hawaiian Electric Light Company's proposed performance incentive mechanisms. On behalf of the Division of Consumer Advocacy. April 28, 2017.

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Wisconsin Public Service Commission (Docket No. 05-UR-107): Direct and surrebuttal testimony of Rick Hornby regarding Wisconsin Electric Power Company rate case. On behalf of The Alliance for Solar Choice. August 28, 2014 and September 22, 2014.

Maine Public Utilities Commission (Docket No. 2013-00519): Direct testimony of Richard Hornby and Martin R. Cohen on GridSolar's smart grid coordinator petition. On behalf of the Maine Office of the Public Advocate. August 28, 2014.

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Resume updated November 2021

Docket No: A.21-09-001

Sierra Club

Direct Testimony of Melissa Whited

Attachment B

SDG&E's Response to
Data Request Sierra Club-SDG&E-01

SIERRA CLUB DATA REQUEST – SDG&E RESPONSE
Data Request #01
SDG&E RESIDENTIAL UNTIERED ELECTRIFICATION RATE - A.21-09-001
DATE RECEIVED: October 25, 2021
DATE RESPONDED: November 8, 2021

General Objections:

SDG&E objects to the definitions and instructions included in this data request on the grounds that they are overbroad, unduly burdensome, and seek information that is irrelevant to the subject matter involved in the pending proceeding and/or not reasonably calculated to lead to the discovery of admissible evidence, and therefore, beyond the requirements of CPUC Rule of Practice and Procedure 10.1. SDG&E also notes that special interrogatory instructions of this nature are expressly prohibited by California Code of Civil Procedure Section 2030.060(d).

1. Please indicate which climate zone in SDG&E's service territory is considered "representative" of the service territory. To the extent that SDG&E considers all climate zones in its service territory "representative," please indicate the two climate zones serving the most residential customers.

SDG&E Response:

SDG&E does consider all 4 of its climate zones representative, as they represent areas within SDG&E's service territory which have different weather patterns and thus customers who consume energy differently. SDG&E's Coastal and Inland climate zones serve the most residential customers.

2. Please provide 2020 hourly load profiles for residential customers in the climate zone or zones determined in Question 1. Please provide these profiles separately for single-family and multi-family customers.

SDG&E Response:

Please see the attached file titled "Sierra Club DR01 Q2_A2109001.xlsx"

Per email communications with Sierra Club on November 3rd and 4th, SDG&E is providing 2019 load profiles, as these were previously existing and are what SDG&E utilized in this application. These load profiles are differentiated by climate zone (Inland or Coastal), CARE status (CARE or non-CARE), fuel type (all electric or dual fuel), existence of Electric Vehicle, and customer size (small or large). Small customers are defined here as those with below average peak demand. Large customers are defined as above average peak demand. SDG&E does not specifically create single family or multi-family load profiles.

3. Please provide total annual energy consumption (both electricity and gas) for a typical residential customer in the climate zone or zones determined in Question 1. Please provide these values separately for single-family and multi-family customers.

SDG&E Response:

SDG&E is defining a "typical residential customer" as a non-CARE customer on SDG&E's default electric rate schedule (Schedule TOU-DR1), with gas service. Total annual energy consumption was calculated as the average annual consumption. Average annual consumption was calculated as the sum of the monthly average consumptions. Meters with fewer than 26 days of billing data were excluded from monthly average calculations.

Please note that SDG&E does not definitively differentiate between single family and multi-family residences. SDG&E utilizes apartment/unit numbers as a proxy for a multi-family designation. All accounts represented in the below table as "single family" have an address that does not include an apartment or unit number. All accounts represented in the below table as "multi-family" have an address that does include an apartment or unit number.

Climate Zone	Dwelling Type	Year	Average Net kWh	Average Therms
Coastal	Single family	2020	5,442	320
Inland	Single family	2020	6,350	317

Climate Zone	Dwelling Type	Year	Average Net kWh	Average Therms
Coastal	Multi-family	2020	3,271	266
Inland	Multi-family	2020	4,236	341

4. Please provide the total number of single-family customers in the climate zone or zones determined in Question 1.

SDG&E Response:

The counts below are as of the March 2021 billing period. Please note that SDG&E is not able to definitively differentiate between single family and multi family residences. SDG&E utilizes apartment/unit numbers as a proxy for a multi family designation. All accounts represented in the below table as "single family" have an address that does not include an apartment or unit number.

Dwelling Type	Climate Zone	# of Accounts
Single family	Coastal	361,868
Single family	Inland	261,306

5. Please provide the total number of multi-family customers in the climate zone or zones determined in Question 1.

SDG&E Response:

The counts below are as of the March 2021 billing period. Please note that SDG&E does not definitively differentiate between single family and multi family residences. SDG&E utilizes apartment/unit numbers as a proxy for a multi family designation. All accounts represented in the below table as "multi-family" have an address that does include an apartment or unit number.

Dwelling Type	Climate Zone	# of Accounts
Multi-family	Coastal	191,232
Multi-family	Inland	85,734

6. Please provide hourly marginal emissions rates from the electric grid relevant for the climate zone or zones determined in Question 1.

SDG&E Response:
SDG&E objects to the request to the extent that it would impose an undue burden on SDG&E by requiring it to perform studies, analyses or calculations or to create documents that do not currently exist.

SDG&E does not calculate hourly marginal emissions rates specific to its service territory or specific climate zones. Therefore, SDG&E is directing Sierra Club to the Integrated Resource Planning (IRP) Proceeding's public Clean System Power (CSP) calculator data. The CSP contains SDG&E's bundled load forecast for 2020 as well as hourly emissions values and hourly load. These will allow Sierra Club to calculate hourly emissions intensity values that can be used as a proxy for the actual hourly emissions rates resulting from electricity generation to meet SDG&E's bundled customer's demand.

SDGE IRP:
https://www.sdge.com/rates-and-regulations/proceedings/2020-individual-integrated-resource-plan

CSP file:
https://www.sdge.com/sites/default/files/regulatory/sdge_csp_38mmt_preferred_conforming_na_v1%20%28Attachment%20C%29.xlsx