SDG&E Residential Default TOU Pilot PY2019 Evaluation

DRMEC Workshop on the Utilities’ 2020 Annual Load Impact Protocol Reports

Prepared by:

Eric Bell

George Jiang

Aimee Savage

May 4, 2020

Agenda Topics

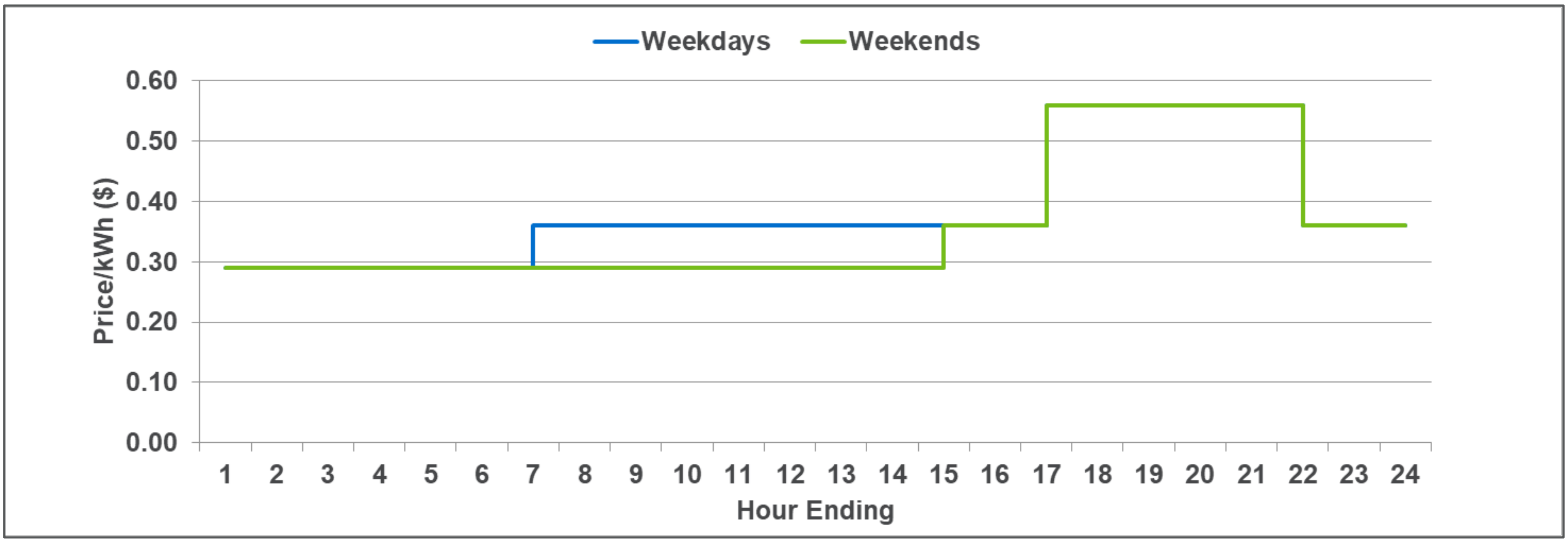
- Background
- Ex Post Methodological Overview
- Summer 2019 Ex Post Load Impacts
- Ex Ante Methodological Overview
- Per-Customer Ex Ante Load Impacts

Pilot Introduction

- San Diego Gas & Electric Company's residential default time-of-use pricing pilot launched in Spring 2018
- The pilot tested two TOU rate options
  - 113,000 customers assigned to Rate 1
  - 27,000 customers assigned to Rate 2
  - 169,000 customers retained as a control
- The impacts included in this presentation represent the pilot population during the summer of 2019 (June through October)
  - Additional customers who have been defaulted onto Rate 1 as part of the full TOU roll-out are not included here

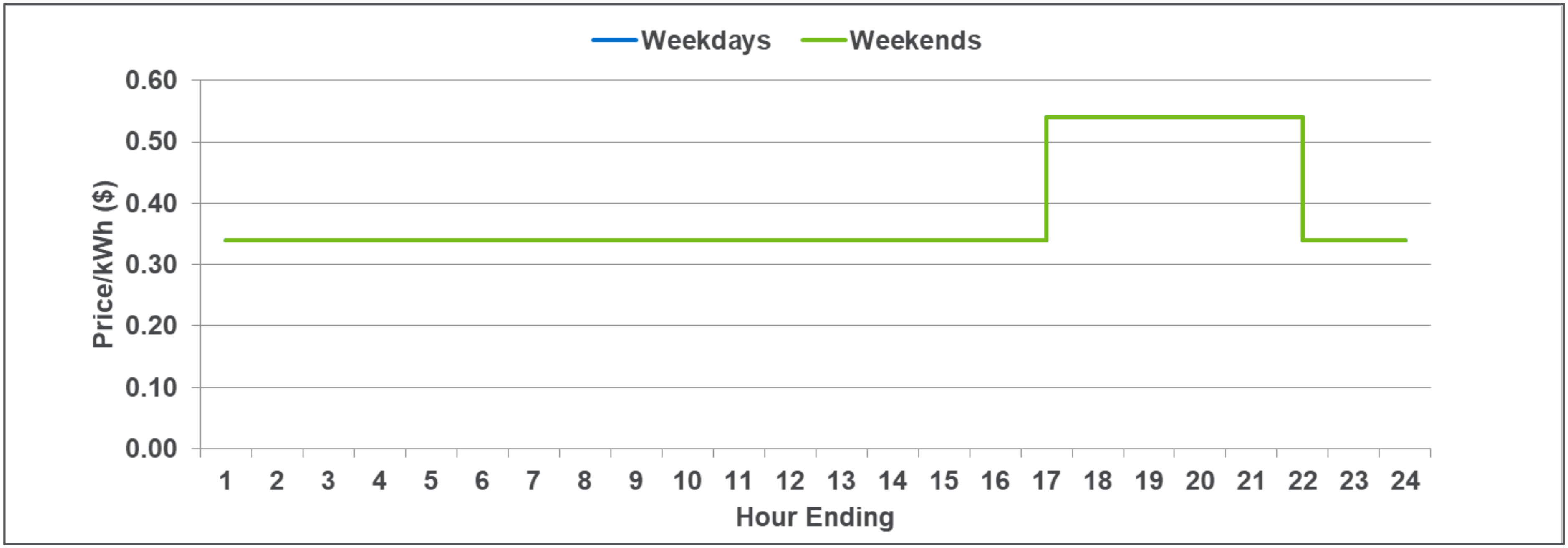
Rate 1 Description (June – October)

- Peak period is weekdays from 4-9 PM and the peak price is 56¢/kWh
- The off-peak price on summer weekdays from 6 AM - 4 PM and 9 PM – 12 AM is 35¢/kWh. All other hours are 29¢/kWh
- Customers receive a baseline credit of 10¢/kWh for usage up to 130% of baseline



Rate 2 Description (June – October)

- Peak period is the same for summer weekdays and weekends from 4-9 PM and the peak price is 53¢/kWh
- The off-peak price for summer from 9 PM – 4 PM is 34¢/kWh
- Customers receive a baseline credit of 10¢/kWh for usage up to 130% of baseline



Nexant

Ex Post Impact Methodology for Rate 1- Matched Control Group

- Both Rate 1 and Rate 2 were designed to be evaluated as a randomized encouragement design (RED)
- Initial validation tests comparing customer demographics and pre-treatment loads for treatment and control customers showed significant differences
- A matched control group was developed using propensity score matching to find customers with load shapes and other characteristics that were most similar to treatment customers
- Load impact analysis for each rate treatment was based on a fixed effects, difference-in-differences (DiD) model

Ex Post Impact Methodology for Rate 2 - RED

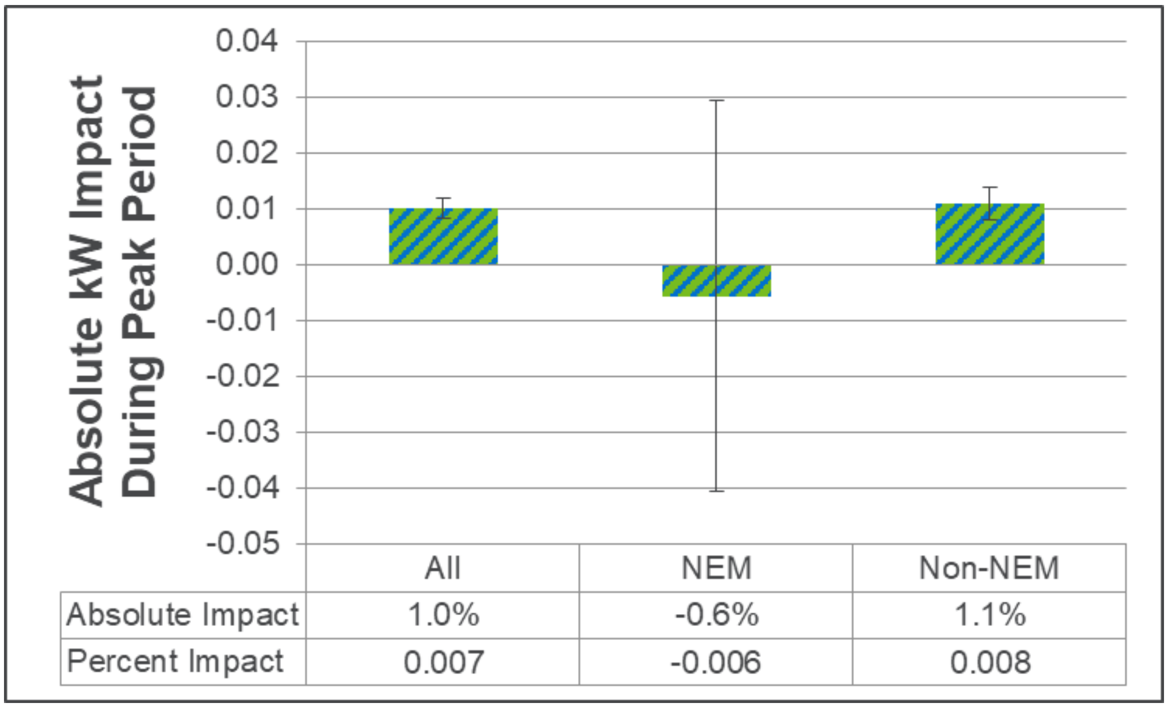
- Fixed effects, difference-in-differences (DiD) model analyzed as a randomized encouragement design (RED)
  - RED allows for differing opt-out rates in the treatment versus control group (as the control group was unaware of the pilot and could not opt out)
- Data for customers who dropped out of the pilot is maintained in the evaluation to estimate the “intention-to-treat” impact, which is then divided by 1 minus the opt-out rate (e.g., if the opt-out rate is 5%, the ITT is scaled up by dividing it by 0.95) to determine the impact for those who stay on the rate
  - Customers who dropped out due to account closures were removed from both the treatment and control groups in the month of the account closure and for all months thereafter

NEM Adjustments

- Load impacts were estimated for NEM and Non-NEM segments
  - NEM: customers who were NEM **prior to 12 months before** the transition to TOU
    - Matched while NEM in pre-treatment period
    - Only Rate 1 had NEM customers in this period
  - Non-NEM: customers who **never became NEM**
- Customers who became NEM during the pre-treatment period or during the pilot were removed from the analysis
  - There were difficulties associated with matching on rolling NEM transitions
  - This resulted in the exclusion of approximately 2,484 customers in Rate 1 and 2,269 customers in Rate 2 from the analysis

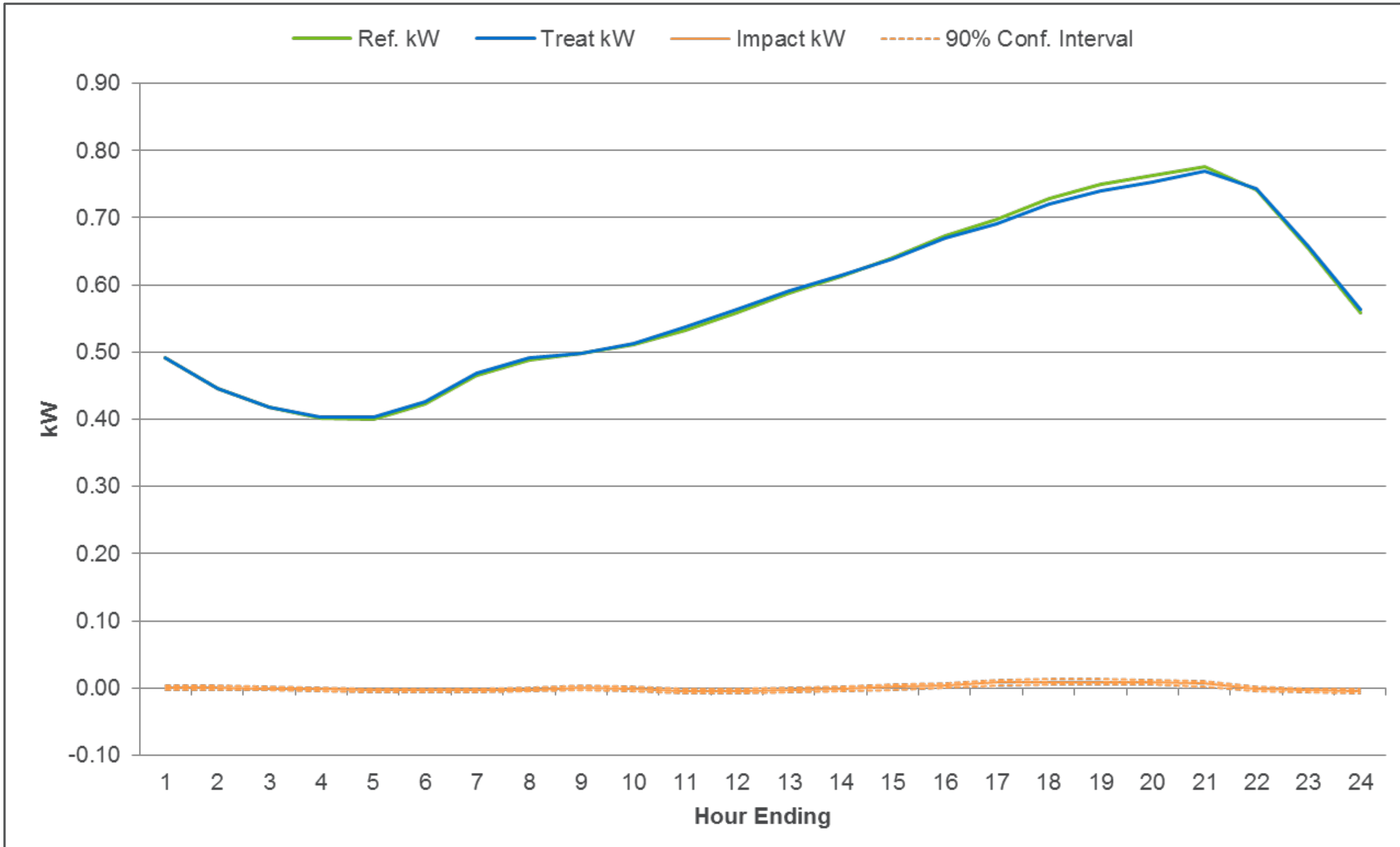
Rate 1 Summer 2019 Average Weekday

- Summer peak impacts on the average weekday for both the Rate 1 population as a whole* was 0.007 kW (1.0%); Non-NEM groups were 0.008 kW (1.1%)
- Aggregate impacts were 0.55 MW for whole population and 0.54 for non-NEM group
- Percent impacts for the NEM group (-0.6%) have very wide confidence bands due to load variation and relatively small sample size (NEM = 903, Non-NEM = 66,928)

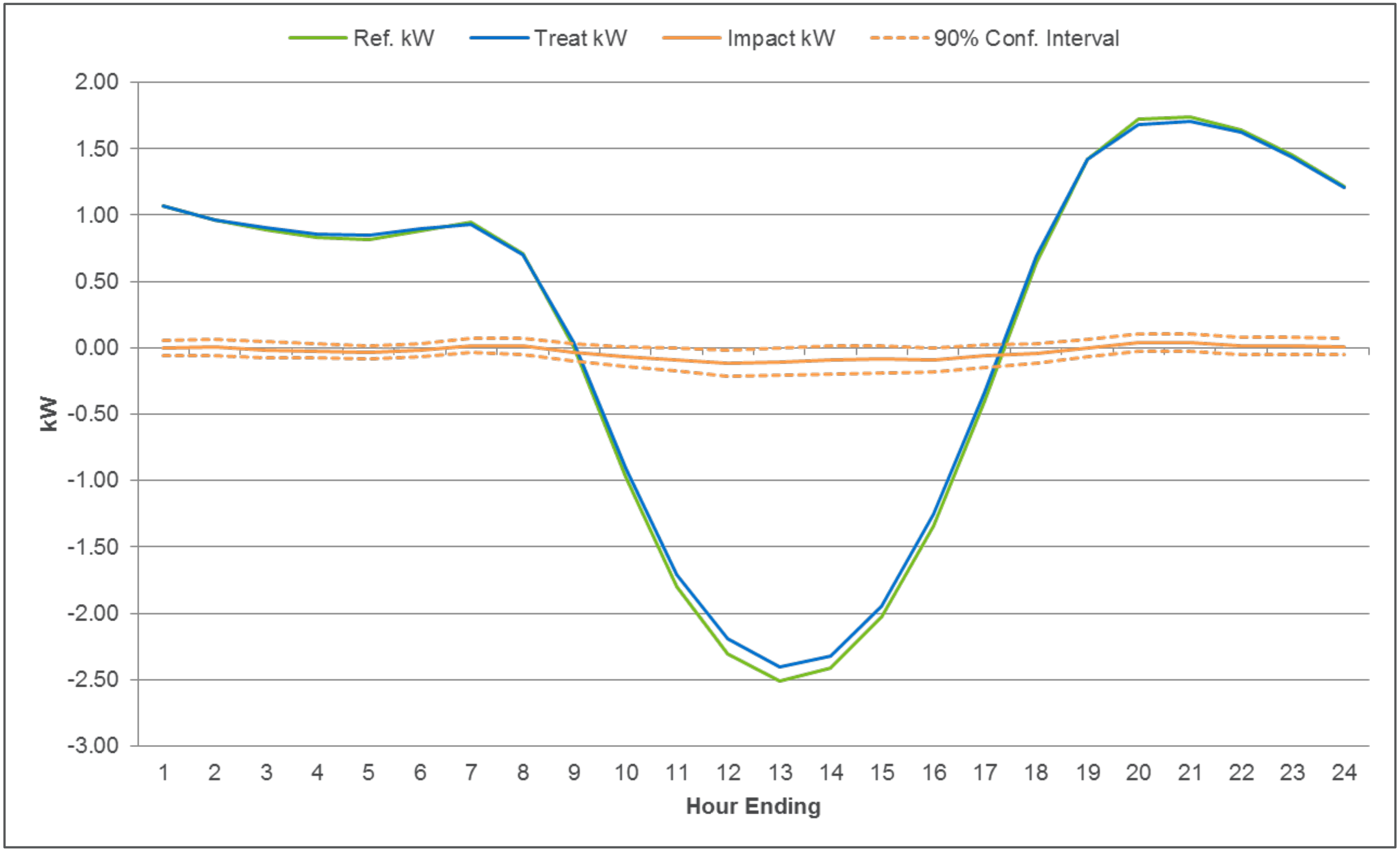


*All group reflects non-NEM customers and customers who were NEM prior to 12 months before treatment period. Customers transitioning to NEM after this period are not included in this group.

Summer 2019 – Rate 1 – Average Weekday – Non-NEM

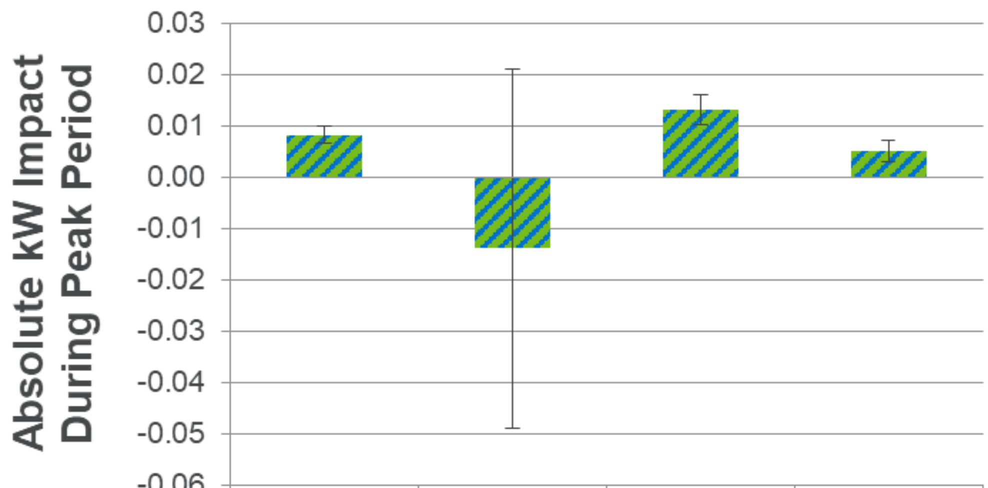


Summer 2019 – Rate 1 – Average Weekday – NEM



Rate 1 Summer 2019 Average Weekday – Climate Regions

- Summer peak impacts on the average weekday for the Moderate climate region were 0.013 kW (1.6%), higher than the Cool climate region's 0.005 kW (0.7%)
- Aggregate impacts were 0.34 MW for the Moderate climate region (26,034 customers) and 0.24 MW for the Cool climate region (40,467 customers)
- The Hot climate region showed load increases during the peak period, but they are not not statistically significant due to small sample size (376 customers)

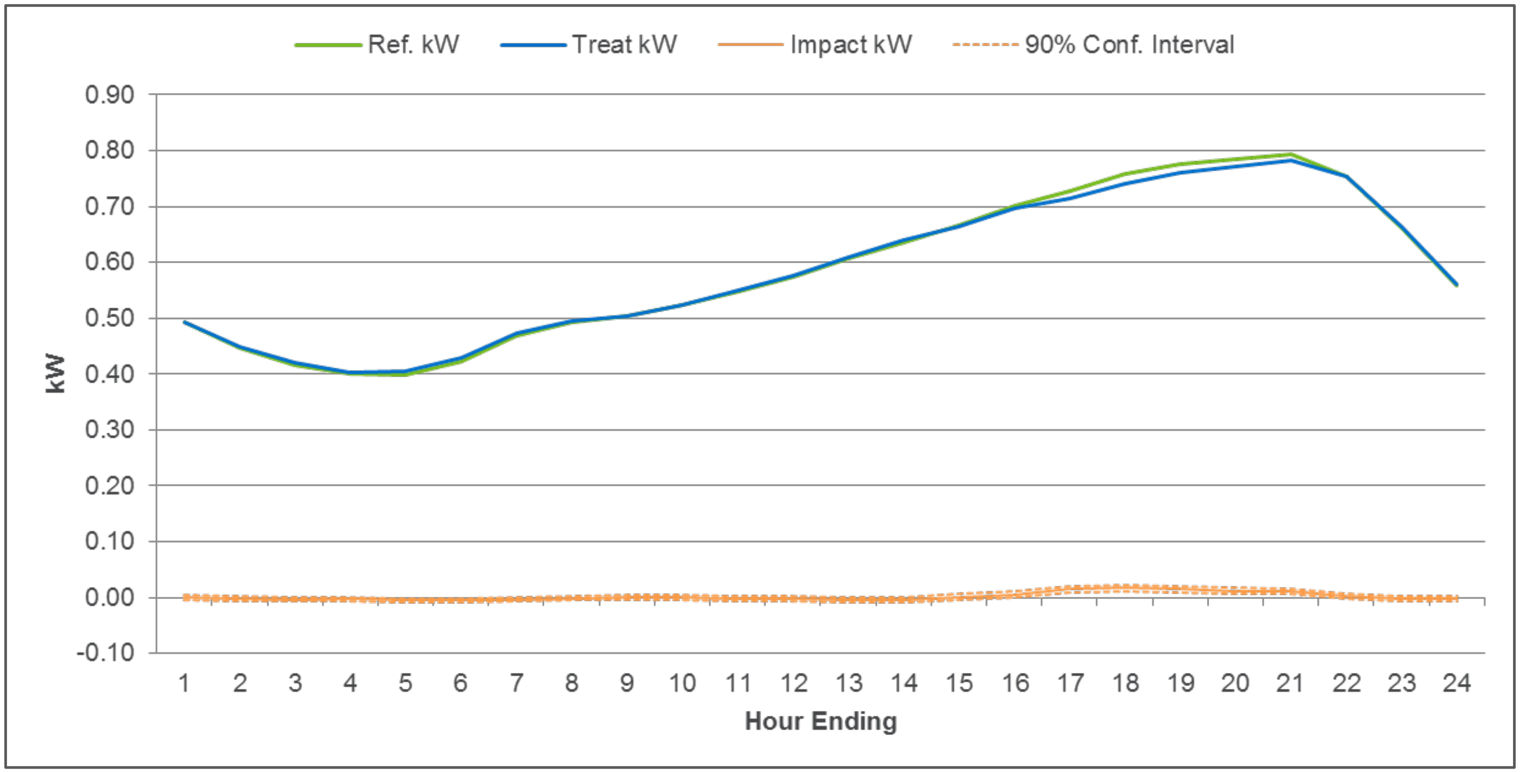


	All	Hot	Moderate	Cool
Percent Impact	1.1%	-1.4%	1.6%	0.7%
Absolute Impact	0.008	-0.014	0.013	0.005

*All group reflects non-NEM customers and customers who were NEM prior to 12 months before treatment period. Customers transitioning to NEM after this period are not included in this group.

Rate 2 Summer 2019 Average Weekday

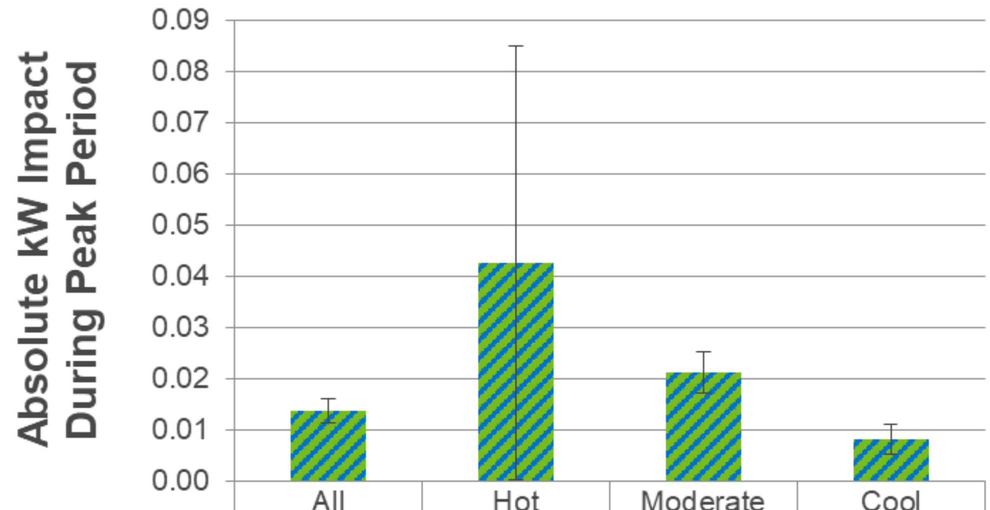
- Virtually no Rate 2 treatment customers became NEM prior to 12 months before rate transition
  - The overall group still excludes customers who became NEM after this period
- Peak impacts for the overall group are 0.014 kW (1.8%)
- Aggregate impacts were 0.23 MW for whole population (16,942 customers)



Nexant

Rate 2 Summer 2019 Average Weekday

- Summer peak impacts on the average weekday for the Moderate climate region were 0.021 kW (2.5%), higher than the Cool climate region's 0.008 kW (1.2%)
- Aggregate impacts were 0.14 MW for the Moderate climate region (6,582 customers) and 0.09 MW for the Cool climate region (10,251 customers)
- The Hot climate region showed the largest impacts of 0.04 kW (4.2%), but has a very large confidence interval due to small sample size (249 customers)



	All	Hot	Moderate	Cool
Percent Impact	1.8%	4.2%	2.5%	1.2%
Absolute Impact	0.014	0.043	0.021	0.008

*All group reflects non-NEM customers and customers who were NEM prior to 12 months before treatment period. Customers transitioning to NEM after this period are not included in this group.

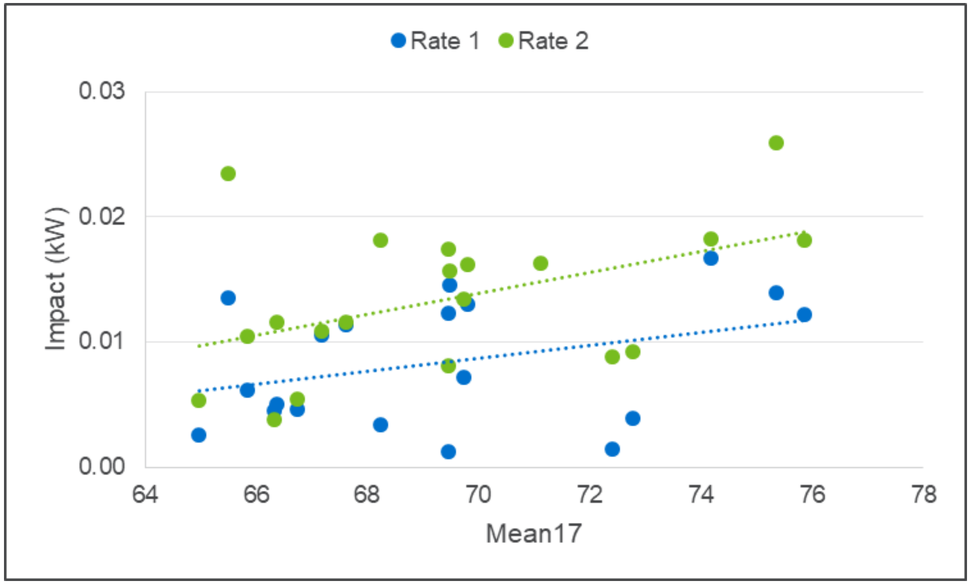
Nexant

Modeling the relationship between load impacts and weather

- Ex post load impacts from November 2018 through October 2019 were re-estimated at the weekly level
  - The ex post load impacts that will be presented in the report are estimated at the monthly and seasonal level
  - Estimating impacts at the weekly level provides more data points for estimating the ex ante load impact regression model
- Nexant tested 20 models to estimate the relationship between load impacts and weather conditions
  - Used out-of-sample testing to compare models
  - Models that predicted best across segments, rates, and calendar months were chosen
  - A similar approach was used to model reference loads (what customers would use in the absence of TOU)

Forecasting ex ante load impacts

- The ex ante model has two independent variables:
  - *mean17* and a binary indicator for each calendar month
  - *mean17* equals the average temperature from midnight to 5 PM
- Warmer temperatures are expected to lead to larger impacts
  - In the summer months, 1-in-10 weather is warmer than 1-in-2 weather
  - In some winter months, 1-in-2 weather is warmer than 1-in-10 weather

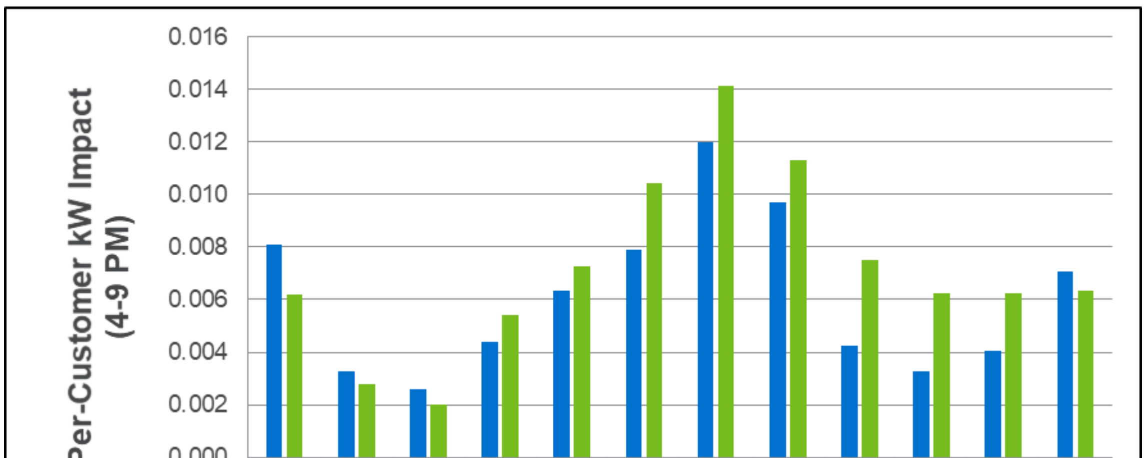


Forecasting ex ante load impacts

- Nexant ran the models separately for each hour (1-24), season (summer/winter), segment (NEM/non-NEM), and rate (Rate 1/Rate 2)
- Impacts are presented for the Resource Adequacy (RA) window, which is 4:00 to 9:00 PM
  - This is the same as the peak period for both Rate 1 and Rate 2

Per-Customer Ex Ante Load Impacts – Rate 1 – Non-NEM

- Per-customer impacts are expected to reach over 0.01 kW in June, July and August under 1-in-10 weather conditions, and in July under 1-in-2 weather conditions
- Impacts are expected to be smallest under 1-in-2 conditions in in the shoulder months of February, March, and October

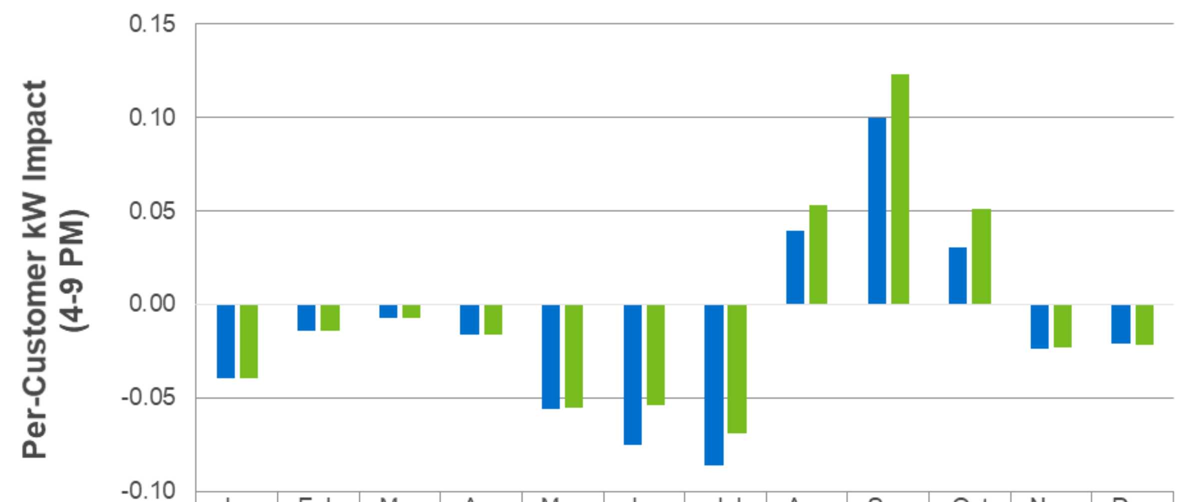


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
SDG&E 1-in-2	0.008	0.003	0.003	0.004	0.006	0.008	0.012	0.010	0.004	0.003	0.004	0.007
SDG&E 1-in-10	0.006	0.003	0.002	0.005	0.007	0.010	0.014	0.011	0.008	0.006	0.006	0.006

Nexant

Per-Customer Ex Ante Load Impacts – Rate 1 – NEM

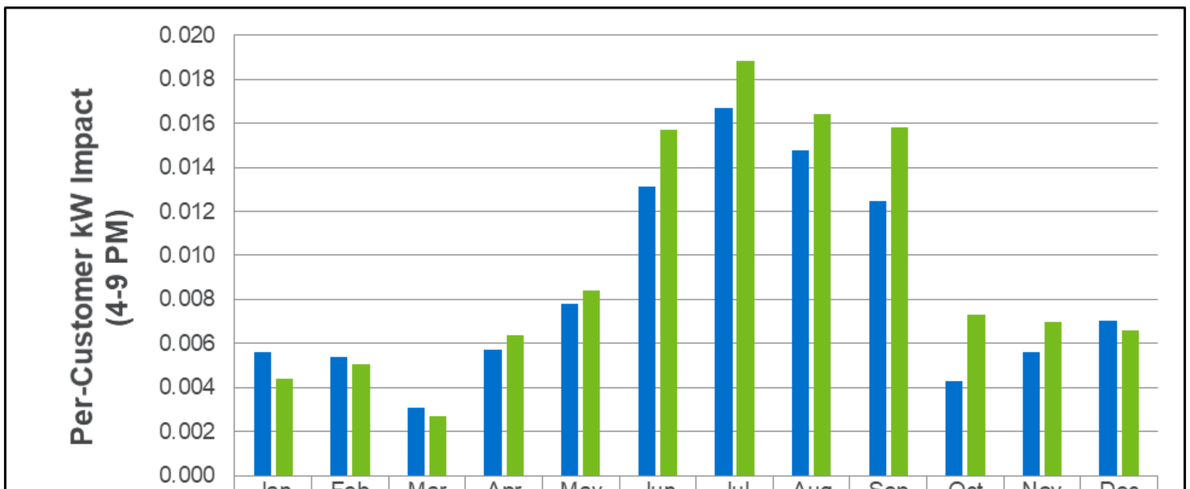
- Ex ante impacts for NEM customers are consistent with the observed ex post impacts, with negative impacts in most months except for August, September, and October
- Impacts are expected to be greatest in a 1-in-10 September



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
SDG&E 1-in-2	-0.039	-0.014	-0.007	-0.016	-0.056	-0.076	-0.086	0.039	0.100	0.030	-0.024	-0.021
SDG&E 1-in-10	-0.040	-0.014	-0.008	-0.016	-0.056	-0.054	-0.069	0.053	0.123	0.051	-0.023	-0.022

Per-Customer Ex Ante Load Impacts – Rate 2 – Non-NEM

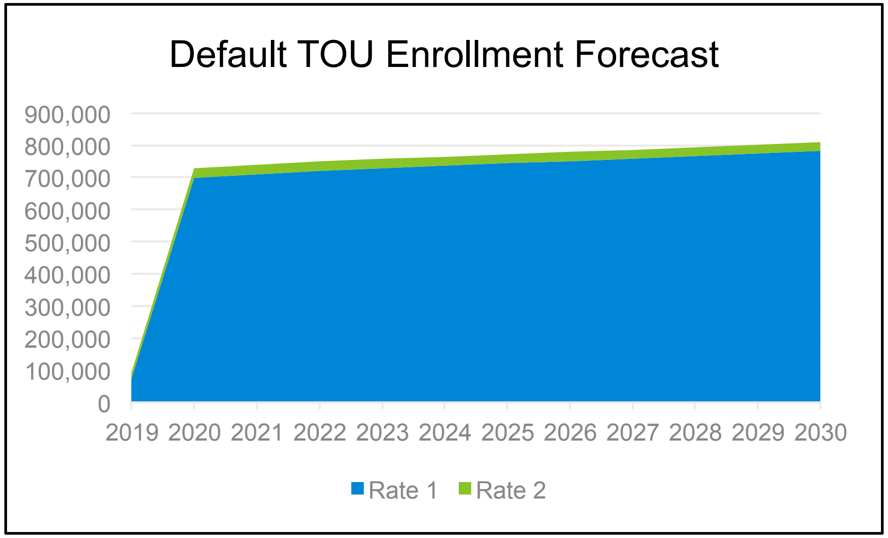
- Impacts are expected to be greatest in the summer months from June through September, and smallest in the winter and shoulder months
- Like Rate 1, impacts in a 1-in-10 summer are expected to be larger than those in a 1-in-2 summer
  - Impacts are larger when temperatures are warmer



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
SDG&E 1-in-2	0.006	0.005	0.003	0.006	0.008	0.013	0.017	0.015	0.012	0.004	0.006	0.007
SDG&E 1-in-10	0.004	0.005	0.003	0.006	0.008	0.016	0.019	0.016	0.016	0.007	0.007	0.007

Residential Default TOU Aggregate Ex Ante Impacts

- Mass rollout of TOU rate to SDG&E residential customers
- Rate 1 population is expected to slightly grow, while Rate 2 is expected to slightly decline
- Total aggregate impacts are expected to reach about 8.4 MW (1-in-2) to 10.2 MW (1-in-10) in August 2020; however there is a substantial amount of uncertainty associated with this estimate



Forecast Year	1-in-2					1-in-10				
	Jun	Jul	Aug	Sep	Oct	Jun	Jul	Aug	Sep	Oct
2020	2.7	5.1	8.4	7.2	3.5	5.2	7.2	10.2	10.4	6.4
2021	2.7	5.2	8.6	7.3	3.6	5.4	7.3	10.3	10.6	6.5
2022	2.7	5.2	8.7	7.4	3.6	5.4	7.4	10.4	10.7	6.6
2023	2.8	5.3	8.7	7.4	3.6	5.5	7.4	10.5	10.8	6.7
2024	2.8	5.3	8.8	7.5	3.7	5.4	7.5	10.6	10.8	6.7
2025	2.8	5.4	8.9	7.6	3.7	5.5	7.6	10.7	10.9	6.8
2026	2.8	5.4	9	7.5	3.7	5.5	7.7	10.8	11	6.9
2027	2.9	5.5	9.1	7.6	3.8	5.6	7.7	10.9	11.1	6.9
2028	2.9	5.5	9.2	7.7	3.8	5.6	7.8	11	11.2	7
2029	2.9	5.6	9.3	7.8	3.8	5.7	7.9	11.1	11.3	7.1
2030	2.9	5.5	9.3	7.8	3.9	5.7	8	11.2	11.4	7.1

Reimagine tomorrow.

Nexant, Inc.
49 Stevenson St., Suite 700
San Francisco, CA 94105

For comments or questions, contact:

Eric Bell, Ph.D.
Principal
EBell@nexant.com

George Jiang
Managing Consultant
GJiang@nexant.com

Aimee Savage
Consultant
ASavage@nexant.com