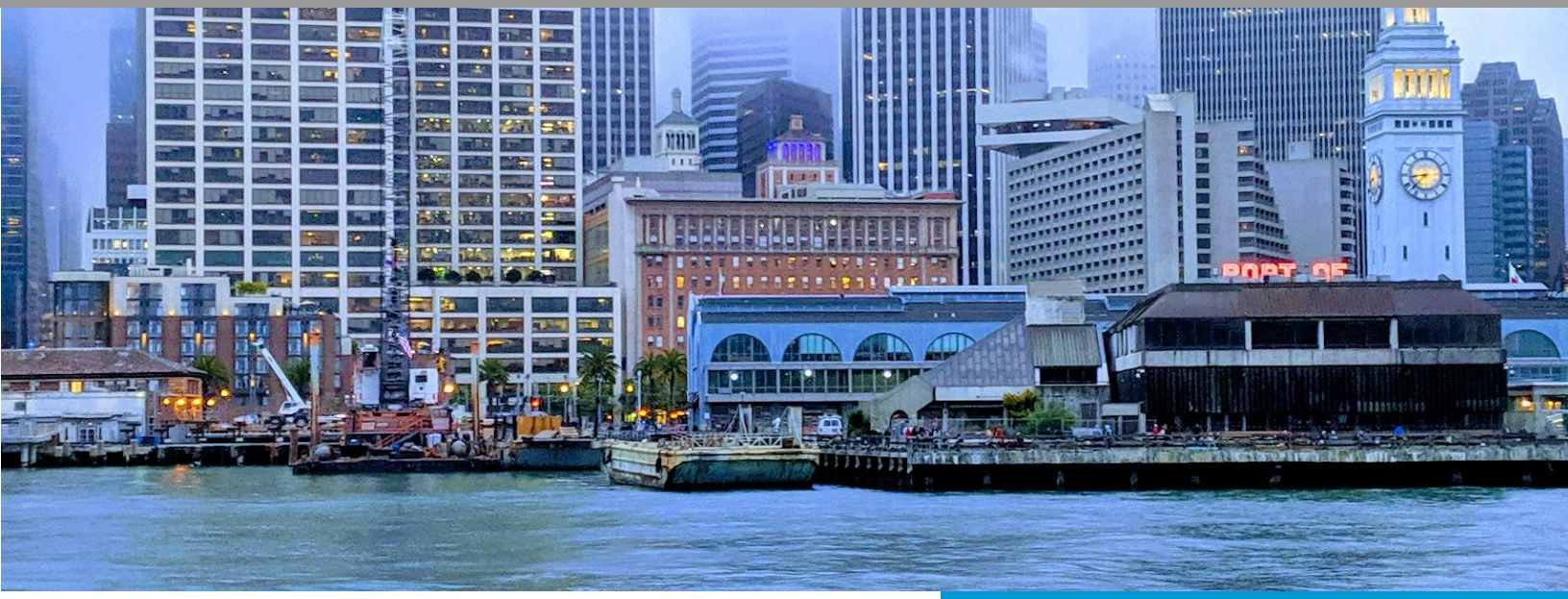
Demand Side Analytics
DATA DRIVEN RESEARCH AND INSIGHTS

FINAL REPORT

Early M&V Report for Program Year 2023
Energy Efficiency Summer Reliability Program



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By: Demand Side Analytics

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DSA Research Team

- Stephanie Bieler
- Josh Bode
- Patrik Karlovic

Pacific Gas and Electric Company Team

- Megan Geraci
- Ezana Kemmer
- Larsen Plano
- Mark Salavitch
- Brian Arthur Smith

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1 EXECUTIVE SUMMARY

Pacific Gas and Electric Company (PG&E) contracted with Sunrun to implement the Energy Efficiency Summer Reliability Program (EESRP) in 2023. Marketed to customers as the Peak Power Rewards Program, the objective of EESRP was to reduce Peak (5 p.m. to 9 p.m.) and Net Peak (7 P.M. to 9 p.m.) energy demands from August through October, seven days a week. This program involved recruiting single-family homeowners with rooftop solar and battery systems who were incentivized to allow Sunrun to manage their battery discharge efficiency, especially during Net Peak hours.

This report, an Early M&V[1] analysis commissioned by PG&E, aims to assess the accuracy of various Population-Based Normalized Metered Energy Consumption (Population NMEC) methods to estimate payable and claimable savings for battery storage within the EESRP. Additionally, it seeks to identify the most effective method for estimating future claimable savings.

An initial analysis was conducted to compare the results derived from hourly whole-building electric interval data (from PG&E) and 15-minute battery discharge data (from Sunrun). This approach was important to understand the impact of battery discharge on energy use at participating sites, especially considering how energy consumption patterns were influenced by factors beyond weather, season, and time of day. Key findings of this analysis include:

- EESRP saw engagement from 8,483 PG&E customers enrolled, which resulted in an estimated energy savings of 10,349 MWh and 10,563 MWh as measured by the battery discharge data (supplied by Sunrun) and hourly interval data (supplied by PG&E), respectively. These energy savings are the potential estimates of what claimed savings would be but were not claimed by PG&E toward its energy efficiency portfolio goals.
- The average estimated per customer peak reduction is 1.68 kW when estimated using the battery discharge data and 1.69 kW when estimated using hourly interval data.
- Customers with SolarEdge and Delta brand inverters showed markedly lower peak kW savings (0.70 kW) as compared to customers with the Tesla brand inverter (3.97 kW), when calculated using hourly meter data. This difference may be the direct result of customers with SolarEdge and Delta batteries experiencing an intervention in the pre-period, while customers with the Tesla batteries did not. This finding underscores the need to ensure that baselines are based on uniform conditions.

[1] An Early M&V evaluation commissioned by a program administrator "seeks to validate key savings assumptions and to better understand how savings are achieved for the purpose of improving programs." See Decision 10-04-029 (April 21, 2010), p. 25.

The report also explores the accuracy of estimating energy savings using "end-use" data (that is, energy consumed from the discharge of batteries captured by Sunrun meters) and "whole home" data (that is, energy as measured using PG&E's net meters) through Population NMEC methods. The accuracy assessment of the Energy Efficiency Summer Reliability Program resulted in several key findings:

1. The Time-of-Week and Temperature (TOWT) model and the Difference-in-Difference (DiD) model with controls were the most effective, both for end-use and whole-home data sources.
2. Incorporating battery end-use data significantly enhanced model accuracy and precision, surpassing results of methods that incorporated only whole-home data.
3. In the context of model evaluation for battery programs, error metrics for peak times (7-9 pm) perform better than those calculated annually (over 8760 hours). This is because annual metrics are less reliable due to their reliance on small denominators. Focusing on peak demand periods provides more accurate insight into model performance.[2]
4. The large sample size (> 5,000 customers) allowed for robust estimations, meeting FSU targets with a range of savings from 3% to 15%.
5. Savings varied across inverter brands, with Tesla batteries showing more significant savings than SolarEdge and Delta. The TOWT model, while generally effective, was insufficient in capturing battery behavior during the atypical conditions in the baseline period that resulted in this finding.
6. The individual-matched controls DiD method demonstrated effectiveness in the whole-home evaluation, despite its limitations. Although individually matched controls provide value in a pre-post analysis, they do not capture the entirety of the impact due to a subset of participants exhibiting consumption patterns not observed within any of the control group members.
7. Recommendations resulting from the analyses include:
    a. Revising baseline construction methods to consider undisturbed load patterns;
    b. Incorporating battery end-use data for more accurate baseline establishment and model evaluation, and
    c. Adding additional right-hand weather variables, such as Solar Irradiance and Cloud Cover, to bolster Population NMEC analysis models for battery programs.

[2] Many readings of battery charge/discharge throughout a year centralize around zero and so measurement of annual effects are low but traditional error metrics (e.g., Mean Percent Error) produce large measurement errors due to having denominators very close to zero even when in reality measurement error could be +/-.01 kW.