Demand Response Baseline Enhancements

February 14, 2022 from 10-12PM

This web conference is recorded for stakeholder convenience, allowing those who are unable to attend to listen to the recordings after the meetings. The recordings will be publically available on the ISO web page. The recording, and any related transcriptions, should not be reprinted without the ISO's permission.

Agenda

Time	Item	Speaker
10:00 – 10:05	Welcome & Introductions	Brenda Corona
10:05 – 10:15	Background	Jill Powers
10:15 - 10:45	Review and updates to request and approval of load adjustment factors outside of min/max caps for 2022	Hewayda Ahmed
10:45 – 11:30	Update of comparison/control group methodology	Adam Scheer (Recurve)
11:30 – 11:45	Final Q&A	All

BACKGROUND

Background:

- Demand response providers (DRPs) expressed concerns that demand response performance was under-valued during 2020 high heat events

In response, CAISO proposed tariff compliant options in to address baseline contributing factors in 2021

- Track 1 – Recurve comparison methodology study
  - ✓ Produced a report studying the 2020 summer high heat events under a comparison group method for multiple demand response providers in multiple service territories
  - ✓ 11/16/2021 – stakeholder call to discuss report and request comments
  - ✓ Methodology approved for use

- Track 2 – Approved use of load adjustment factors outside of the min/max caps for summer 2021
  - ✓ 11/16/2021 – stakeholders informed that option will continue to be available for summer 2022

ISO supports three baseline types for DR supply side resource performance measurement

1. **Control Groups** – Establishes baseline of load patterns during curtailment event using non-dispatched customers with similar profiles
2. **Day Matching** – Estimates what electricity use would have been in absence of DR dispatch, using electricity use data on non-event but similar days
3. **Weather Matching** – Estimates what electricity use would have been in absence of dispatch during non-event days with most similar weather

Tariff compliant options available in 2022:

- Recurve comparison methodology under Control Group type
- Day and Weather matching baselines use of adjustment factors with outside of min/max caps

2022 REQUESTS

-REQUEST/APPROVAL TEMPLATE AND PROCESS

Request Process

- Request Form
  - *Visit www.caiso.com – Participate – Demand Response and Load – Proxy demand resource agreements information request sheets – Load Cap Adjustment Request Form*
    - *https://www.caiso.com/Documents/LoadCapAdjustmentRequestForm.docx*
  - Return completed form to PDR@caiso.com
  - ISO requires 5 Business days to approve
  - Requests received after the first of month will be approved to begin using the adjustment for the following Trade Month
  - CAISO will execute the Load Cap Adjustment Request Form through DocuSign
    - DocuSign document will be sent to Scheduling Coordinator and Demand Response provider for signature
  - NOTE: If you would like to be approved for the May Trade Month, please submit your request NO LATER THAN Monday, April 25, 2022

Request For Use Of Adjustment Factors Outside Established Min/Max Values
(Effective May– October Trade Months)

IMPORTANT: Please complete the form and send the request to PDR@caiso.com in a word document format (.docx). A PDF document will not be accepted.

Section 1: Point of Contacts

Scheduling Coordinator Representing DRP:			
Requestor Name:	Title:	Company:	
Address:	City:	State:	Zip:
Email:		Phone #:	
Demand Response Provider Representing Resources:			
Requestor Name:	Title:	Company:	
Address:	City:	State:	Address:
Email:		Phone #:	

Section 2: PDR/RDRR Resources Requesting Use

If needed, please add additional rows in table below to list all resources for which request is being made.

Resource ID	Performance Evaluation Methodology (Day Matching 5/10, 10/10, Combined or Weather Matching)	Select All Applicable Months Load Cap Adjustments will only be approved to DREM calculations starting on the first of each month.
		☐May ☐June ☐July ☐Aug ☐Sep ☐Oct
		☐May ☐June ☐July ☐Aug ☐Sep ☐Oct

California ISO | Request Form | Distribution Restriction: None
Load Cap Adjustment Request Form

Section 3: Request and Approval Status

CAISO Terms and Conditions for Request Approval
By execution of this request form, the SC and DRP agree to maintain compliance to the additional requirements established in the CAISO Demand Response Business Practice Manual, Appendix G. Failure to meet the additional requirements will result in revocation of the approved request. This request will remain in effect for the Trade Months and Resource IDs listed in Section 2 of this request form. This request form must *be approved by the CAISO prior to use in development of the resource's Demand Response Energy Measurement (DREM) submitted for market settlement.*

Scheduling Coordinators Representative Signature:	Date:
Demand Response Provider Representative Signature:	Date:

To be completed by CAISO	
Status:	Date:
CAISO Manager's Signature	Date:

CONDITIONS FOR APPROVAL

- ADDITIONAL DATA SUBMITTAL REQUIREMENTS

Additional data submittals required as condition of approval to allow ISO to evaluate adjustment factors used during May - October

Additional requirements for DR meter monitoring data submission:

For BASE measurement type:

1. Provide measurement data for 4 hours before and 4 hours after the hour for which a bid is submitted. Currently, submission is required only for the hour there is a bid.
2. Include "Percent Residential" values for the data being submitted.

For CBL measurement type:

3. Provide data for the day of the DR event in addition to the data being provided for 90 days prior.
4. Include "Percent Residential" values for the data being submitted.

Additional data submissions required for monitoring purposes

Additional hours for the BASE and CBL Measurement Types

Measurement Type	Adjusted/Unadjusted	Periods Covered
BASE	Adjusted for intervals where TEE>0; Unadjusted for all other hours	Current requirement: Calculated customer load baseline (CLB) values used to derive DREM. BASE data represents the customer load baseline used to calculate the DREM attributed to the pure load reduction only. BASE data is submitted for trade dates when the resource/registration is being actively bid into the market for the hours in which it is bid. Approved LPA data requirement: In addition to the above BASE data submittal time frames, data will be required for 4 hours preceding and 4 hours after a demand response event if they fall outside the hours in which the resource/registration is being actively bidding into the market. Data Granularity: Hourly By resource ID
CBL	N/A	Current requirement: Underlying load data used in the customer load baseline calculation 90 days of historical data prior to the day of the event is required. Approved LPA data requirement: Provide data for the day of the DR event in addition to the data being provided for 90 days prior. Data Granularity: Hourly By resource ID

Additional data submissions required

Applicable to resource IDs using the Day Matching Combined performance methodology.

- Submission of, hour by hour, the percent of BASE (unadjusted baseline) and CBL (intra-day load) that is attributed to the residential service accounts within the aggregation.

Measurement Type	% Residential	Note for both types
BASE	Data Granularity: Hourly % of Calculated customer load baseline (CLB) values used to derive DREM attributed to residential customer load baseline.	For resources using the Day Matching Combined methodology
CBL	Data Granularity: Hourly % of underlying Load (CBL) for DAY OF Event and 90 days historically serving residential customer	By resource ID

Additional Data Requirements

- Example:

Type of event	Res ID	Trade Date	Trade Hour	Measurement Type	Meas Qty (MW)	Percent Residential
BASE Scenario						
	PDR_ResA	3/1/2021	12	BASE	10	20
	PDR_ResA	3/1/2021	13	BASE	9.2	20
	PDR_ResA	3/1/2021	14	BASE	8.6	23
	PDR_ResA	3/1/2021	15	BASE	8.9	24
Market Bid	PDR_ResA	3/1/2021	16	BASE	4.2	25
Market Bid	PDR_ResA	3/1/2021	17	BASE	4	25
	PDR_ResA	3/1/2021	18	BASE	5.6	24
	PDR_ResA	3/1/2021	19	BASE	5.7	25
	PDR_ResA	3/1/2021	20	BASE	7.9	23
	PDR_ResA	3/1/2021	21	BASE	8.9	22
CBL Scenario						
	PDE_ResB	1/7/2021	All hours	CBL	7	87
	PDE_ResB	to		CBL	6.5	87
	PDE_ResB	4/7/2021	13	CBL	6.9	86
	PDE_ResB			CBL	7.8	87
	PDE_ResB			CBL	7.8	87
DR Event	PDE_ResB	4/7/2021	14	CBL	2.3	89
DR Event	PDE_ResB	4/7/2021	15	CBL	2.4	89
	PDE_ResB	4/7/2021	16 to 24	CBL	4.9	85

Next Steps

Technical Specifications and Artifacts available:

CAISO Developer > Artifacts > MRI-S > TechSpecs > MRI-S Interface Specification version 2.7:

https://developerint.oa.caiso.com/Artifacts/MRI-S/TechSpecs/MRI-S Interface Specification v2.7.pdf

- Please submit questions through our Customer Information & Dispute Inquiry (CIDI) ticket process

MID-QUESTIONS/COMMENTS

RECURVE STUDY OVERVIEW AND UPDATE

RECURVE
SHAPE THE FUTURE OF ENERGY

FLEXmeter Methods Review

Adam Scheer
Vice President of Applied Data Science
adam@recurve.com

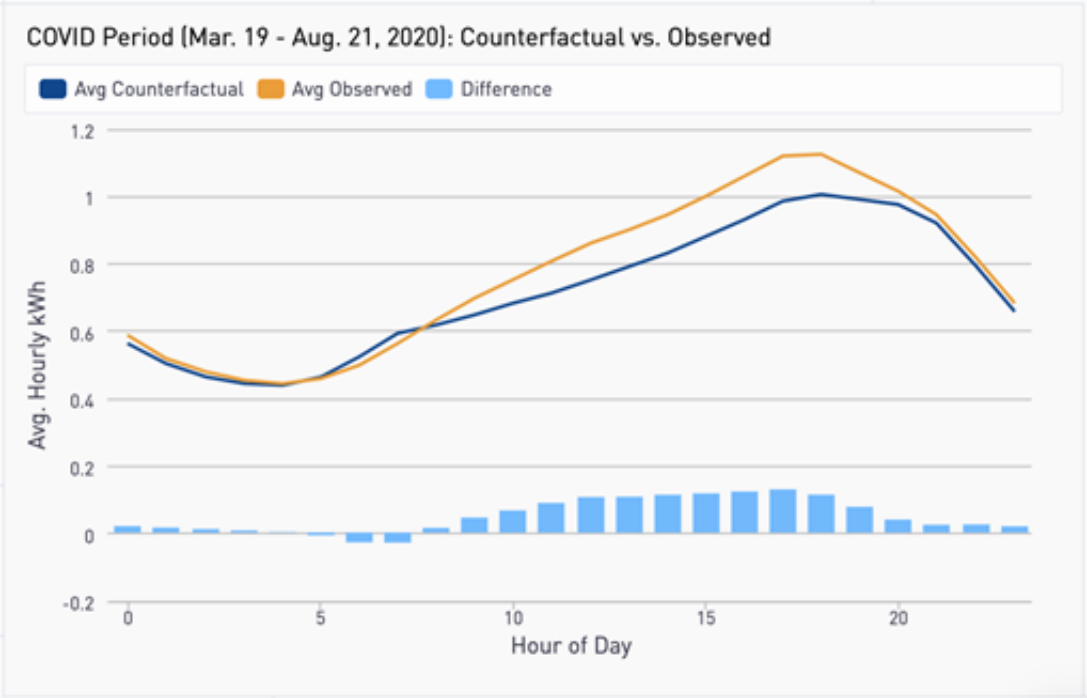
Joe Glass, Steve Suffian, Carmen Best

History

COVID-19 altered energy consumption in every area of society and the economy.

Crisis for EE program M&V

Hourly Comparison group method development was critical



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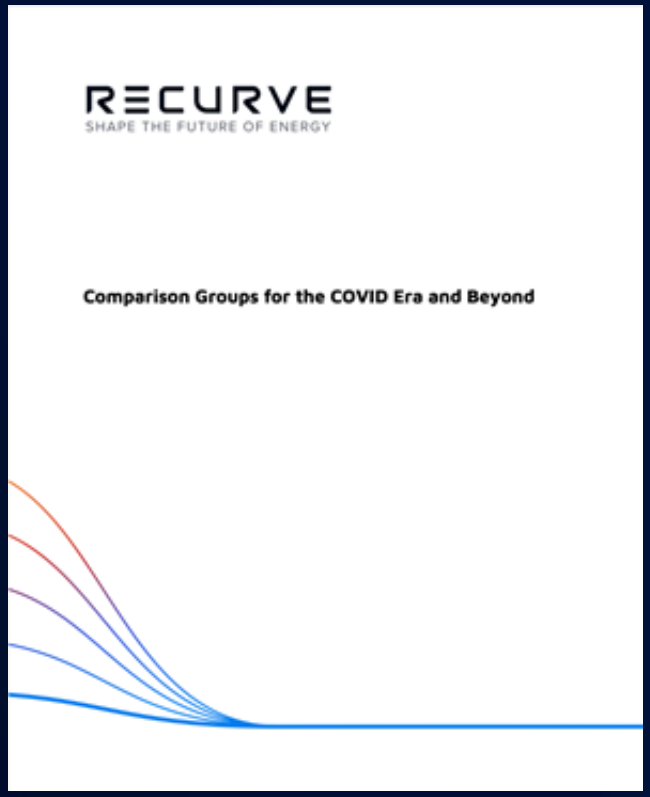
Recurve/DOE Partnership: *Comparison Groups For the COVID Era and Beyond*

Resulting Methods:

- Random Sampling
- Advanced Stratified Sampling
- Site-based matching



https://groups.recurve.com/methods.html

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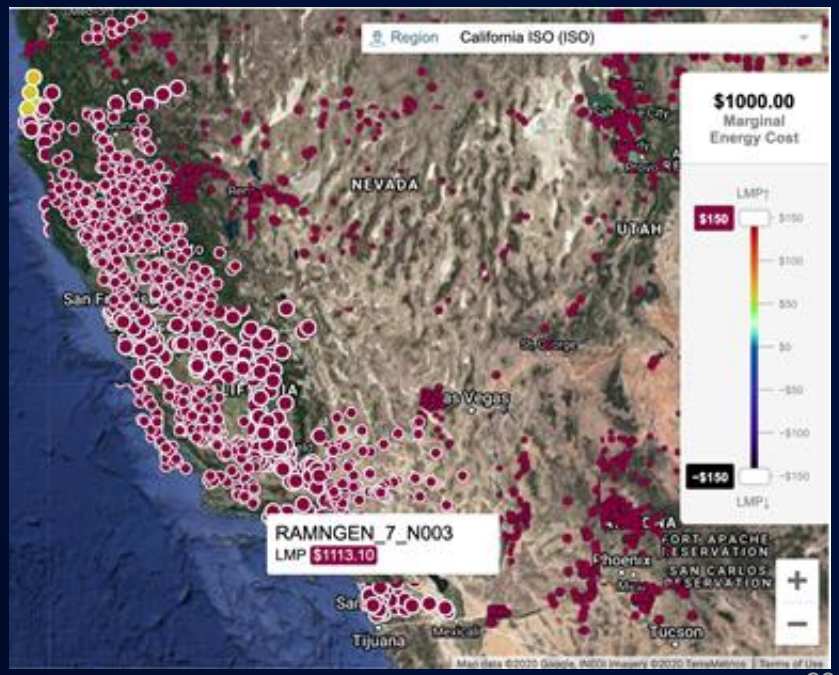
Test Case: August 14th 2020 Outage Event

- Emergency grid event
- > $1,000/MWh real time prices across the grid
- “All Hands on Deck” DR Events

Standard DR methods did not sufficiently capture event impacts

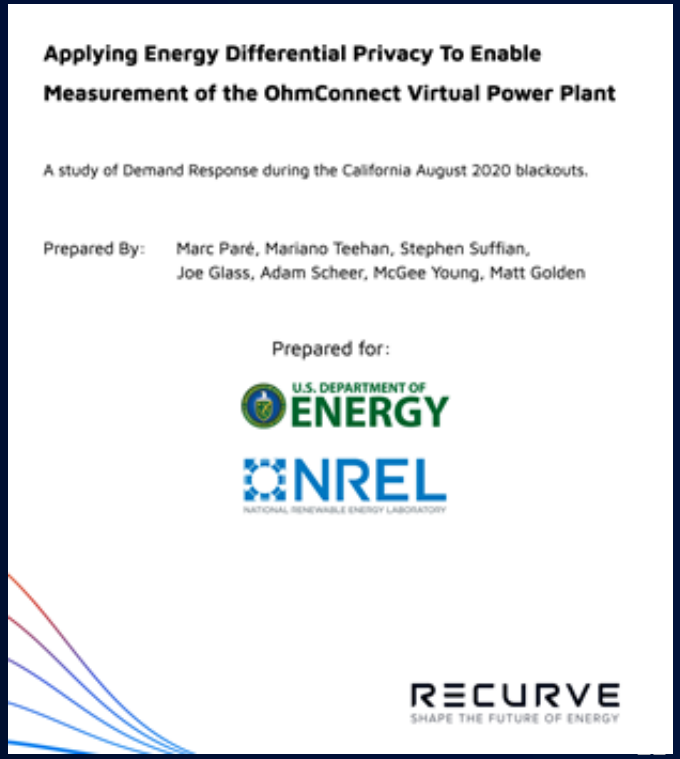
Aug 14, 7 pm: Demand Spikes, Rotating Power Outages



DR Study Origins: MCE / NREL / RECURVE Event Analysis

Pilot Deployment of Differential Privacy

- Analysis of OhmConnect's response in MCE territory
- DR Event 5 - 8 PM
- Sample of 1,150 MCE Res participants
- Non-participant Comparison group
- GRIDmeter advanced stratified sampling/CalTRACK 2.0 Hourly methods



Comparison Groups for Demand Response

- **Approved in CAISO Tariff**
- **Often considered a best practice**
- **Have only rarely been deployed**

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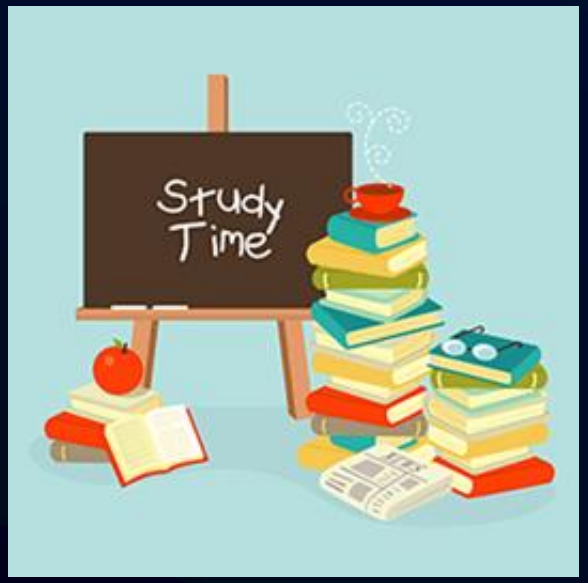
CAISO Key Objectives



1. *Understand and operationalize the baseline and comparison group methods in relation to existing guidance and practice*

1. *Identify barriers to data access and viable paths to overcome them*

1. *Better understand the 2020 heat storm events*

1. *Measure impacts of demand response events through methods operationalized at scale.*

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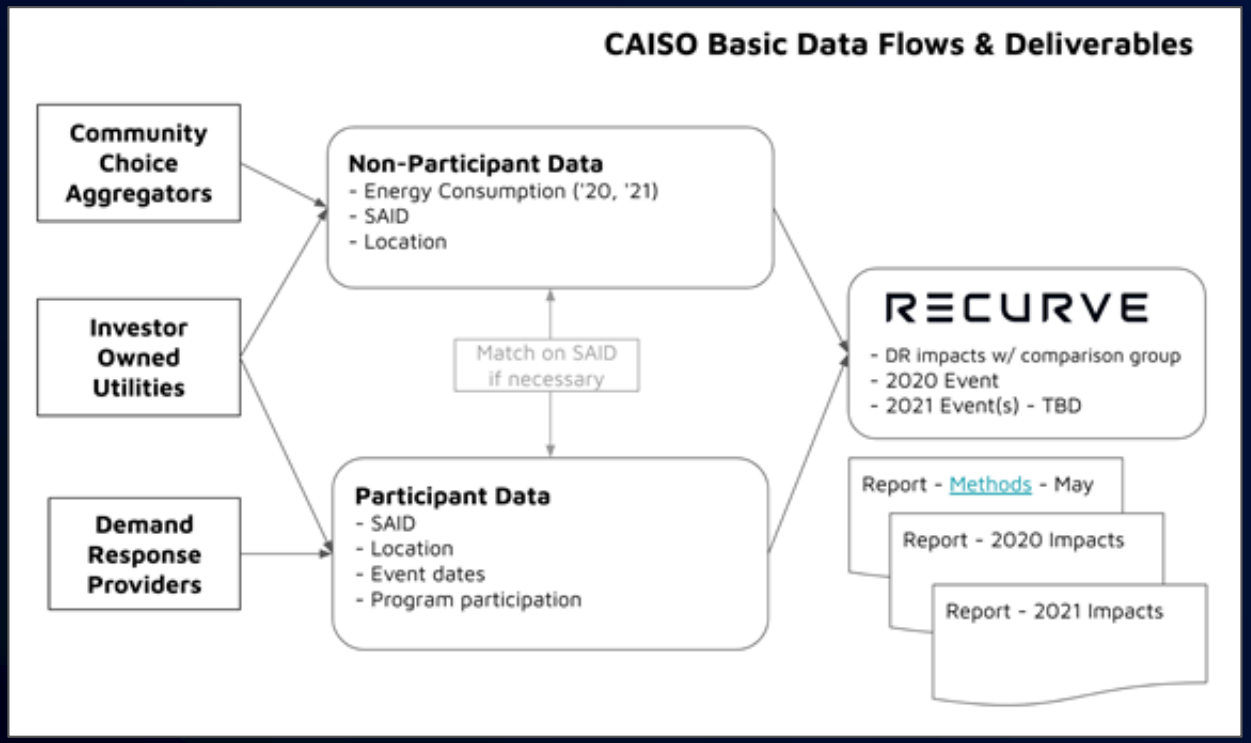
Data Makes the World Go ‘Round



Data Donors

6 DRPs

6+ LSEs

- Res and Non-Res
- 11 Distinct Climate Zones
- Solar and Non-Solar
- Variety of Programs

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FLEXmeter

Foundations

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Open-Source, Standardized Methods

Advantages of Open Source

- Full transparency
- Consistency and Verifiability
- Concrete settlement
- Leverage community of experts
- Focus on program, not M&V

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Methods Overview

FLEXmeter Load Impacts Calculation:

1. Sample matched comparison group
2. Calculate treatment and comparison group hourly load impacts
3. *% Difference of Differences* adjustments
4. Differential privacy to protect non-participant data

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How Do Comparison Groups Work Again?

The “Difference of Differences” Calculation

- **Step 1**: Measure change in consumption for program participants

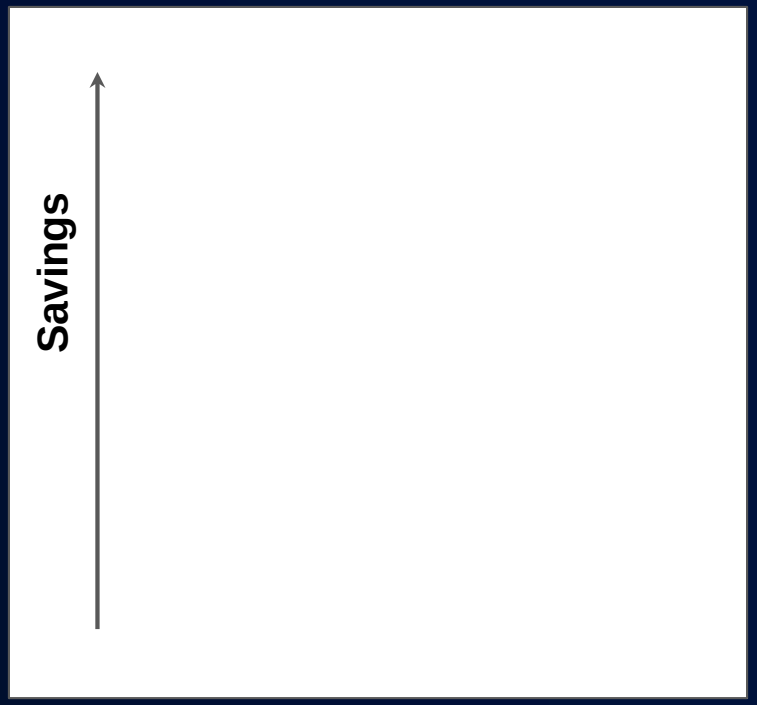
(“*Difference_Treatment*”)

- **Step 2**: Measure change in consumption for selected non-participants

(“*Difference_Comparison*”)

- **Step 3**: Calculate savings as:

Savings = Difference_Treatment - Difference_Comparison



FLEXmeter Comparison Group Selection:

Site Based Matching

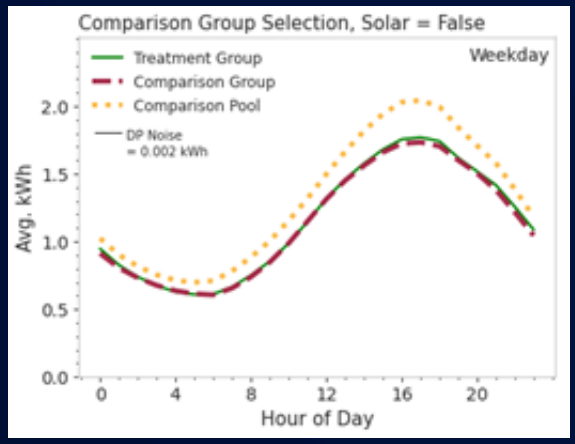
Treatment and comparison customers must share:

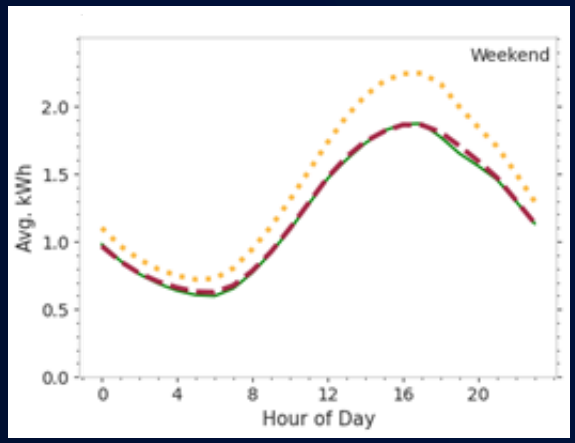
- Sector
- LSE Territory
- Climate Zone
- Solar Status

Basis for equivalence: Avg. weekly load shape

Each participant meter is matched to the most similar non-participant meters

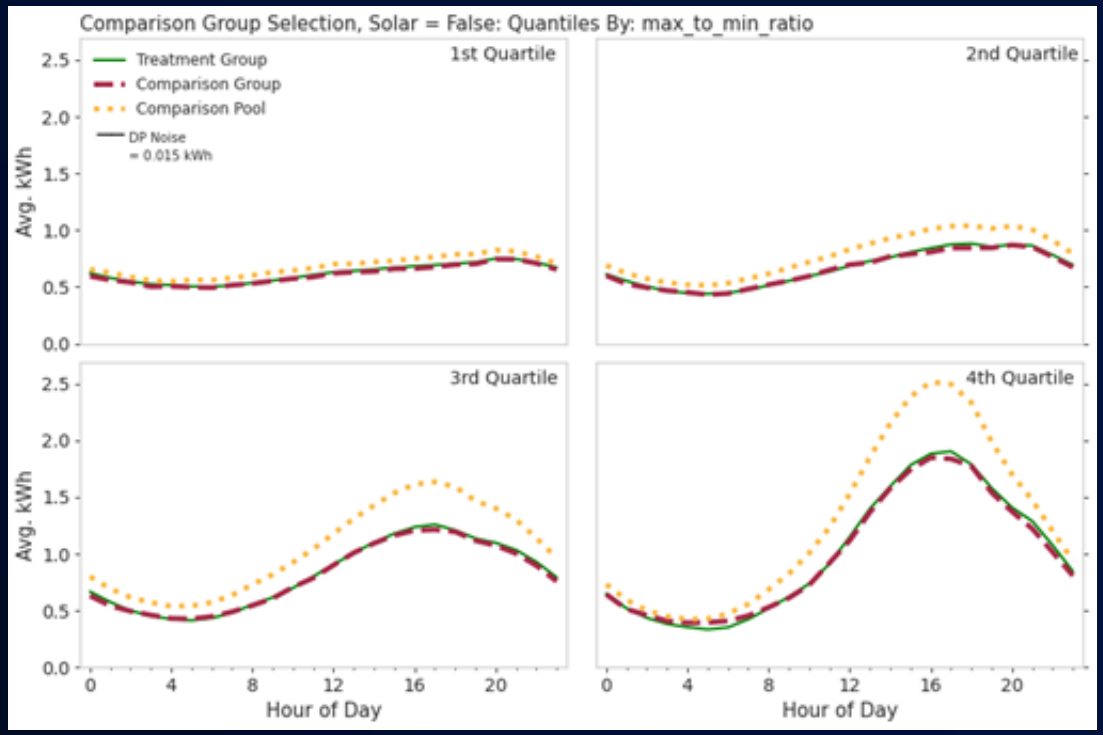
Comparison group: the collection of non-participants that are best matches to individual participants





FLEXmeter Comparison Group Selection:

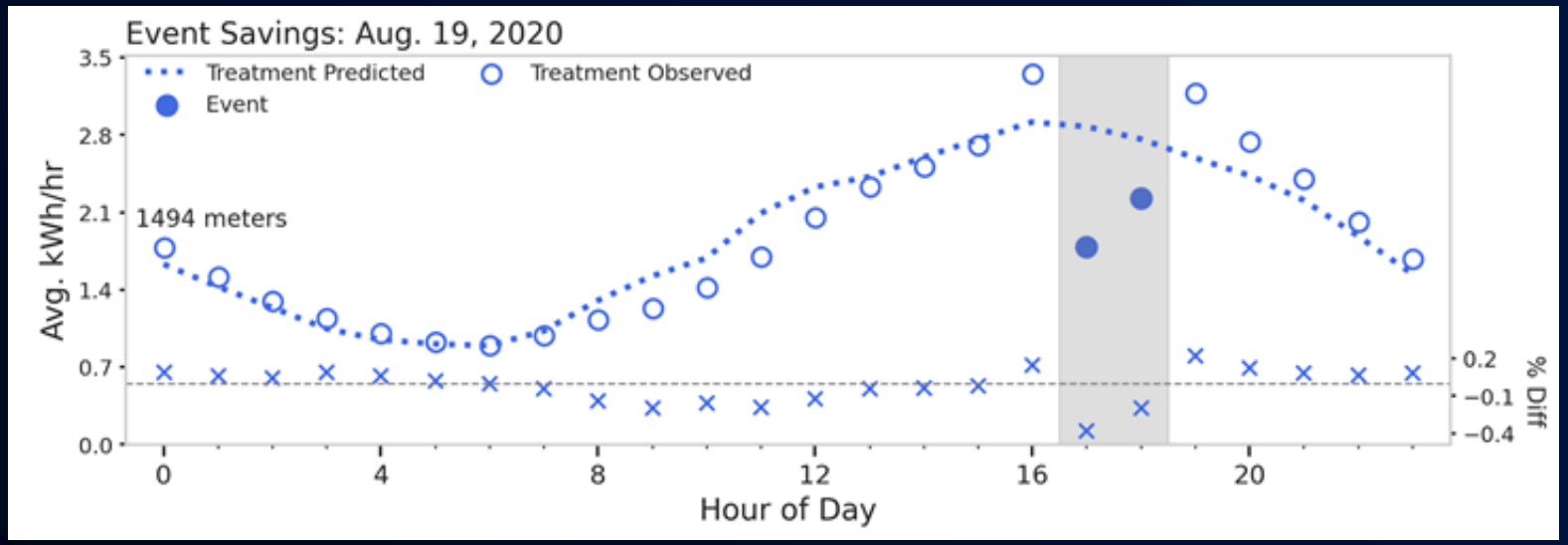
Matching load characteristics across the entire range of participating customers



% Diff of Diff Example (DRP B, LSE 2, Aug. 19, 2020)

Step 1. Treatment % Diff

Event % Diff = -28.7%



Treatment customers used 28.7% *less* than predicted during event.

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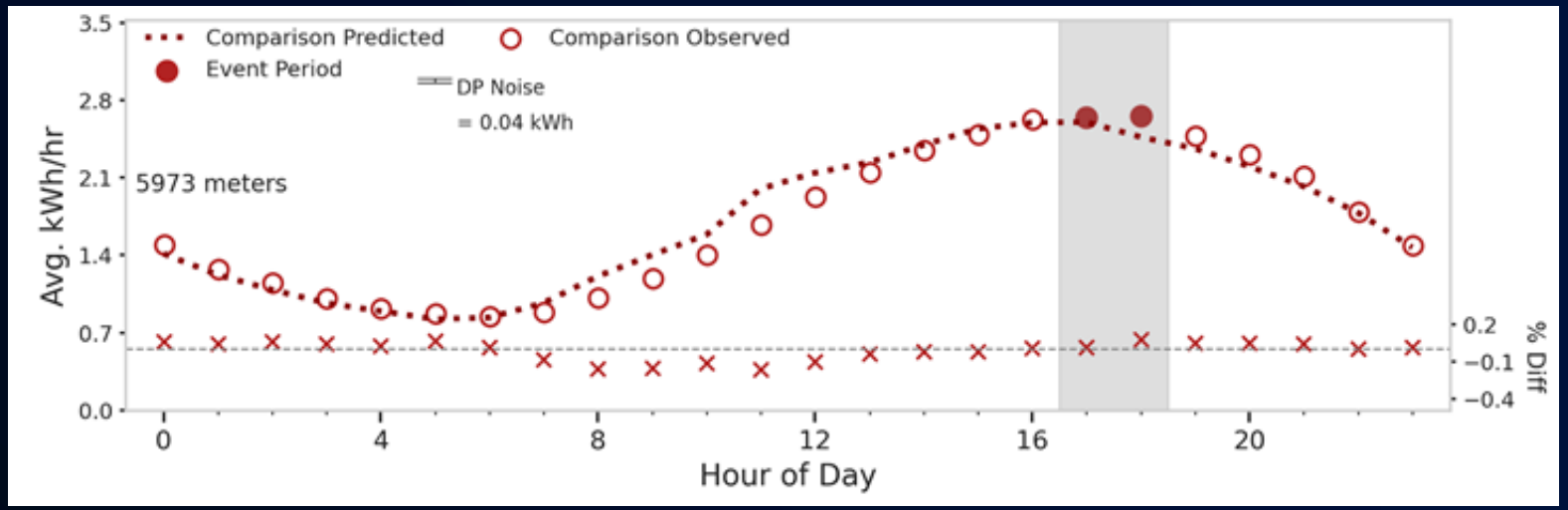
% Diff of Diff Example

Step 2. Comparison % Diff

Event % Diff = 5.1%



Comparison customers used 5.1% *more* than predicted during event.

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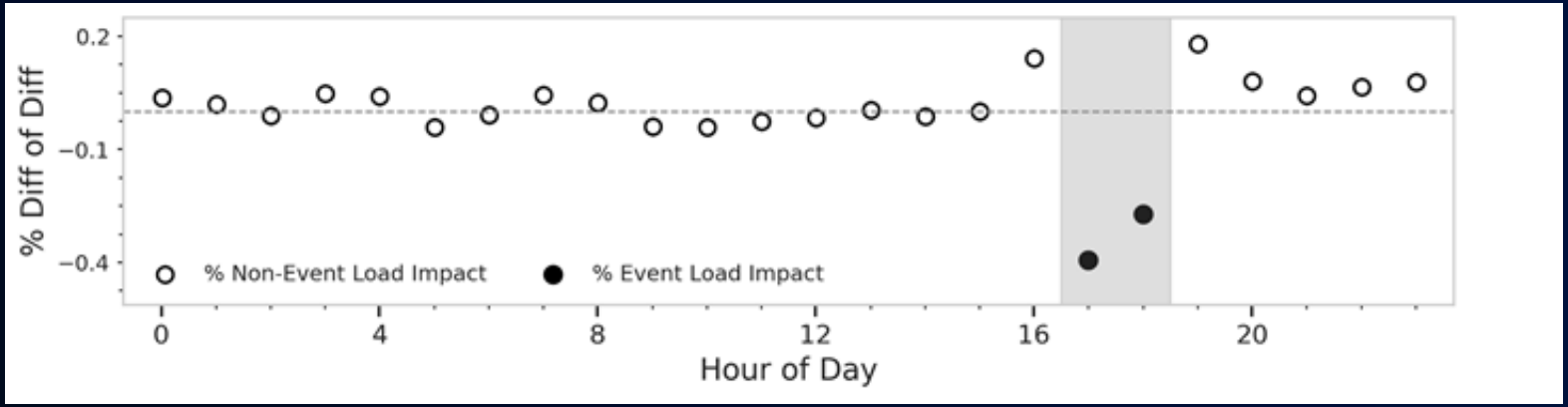
% Diff of Diff Example

Step 3. % Diff of Diff

Event % Diff of Diff = -33.8%



Taking the comparison group into account the demand response event had a -28.7% - 5.1% = -33.8% event period load impact.

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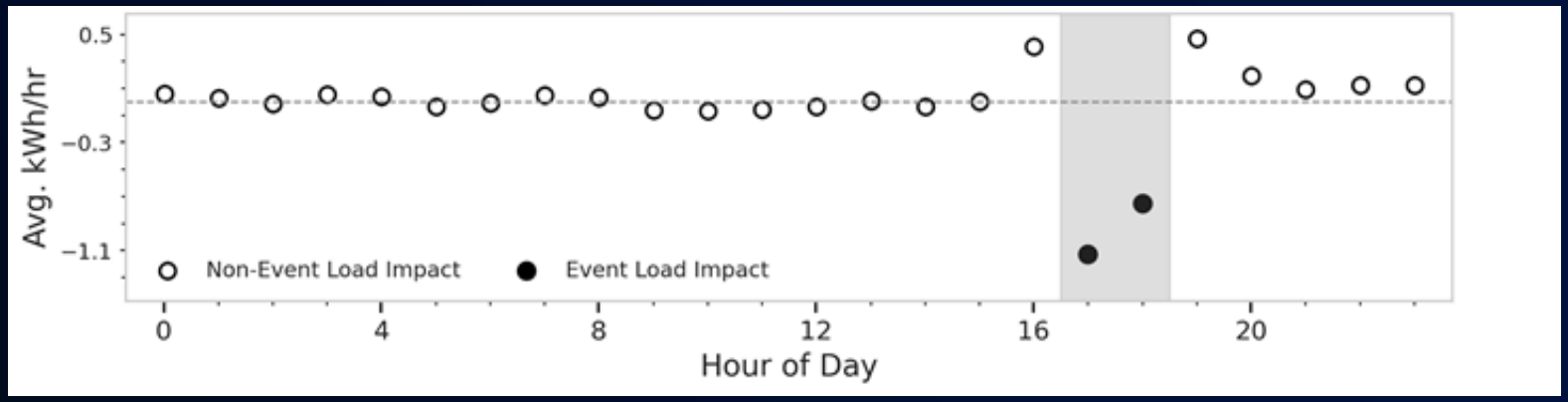
% Diff of Diff Example

Step 4. Total Savings

Avg. Event Load Impact = -0.94 kW



Scaling the % Diff of Diff to predicted participant consumption yields average customer event load impacts of -0.94 kW.

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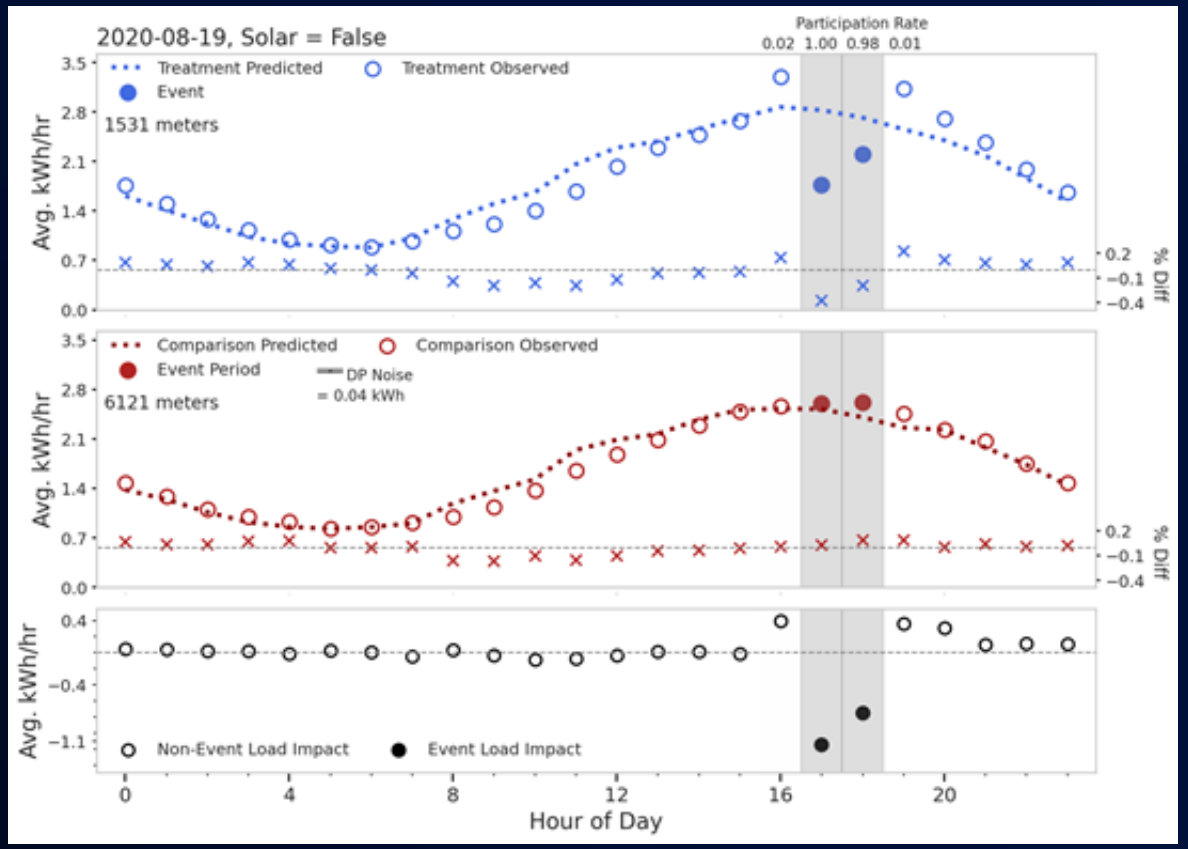
Bringing it All Together

One graph to rule the world



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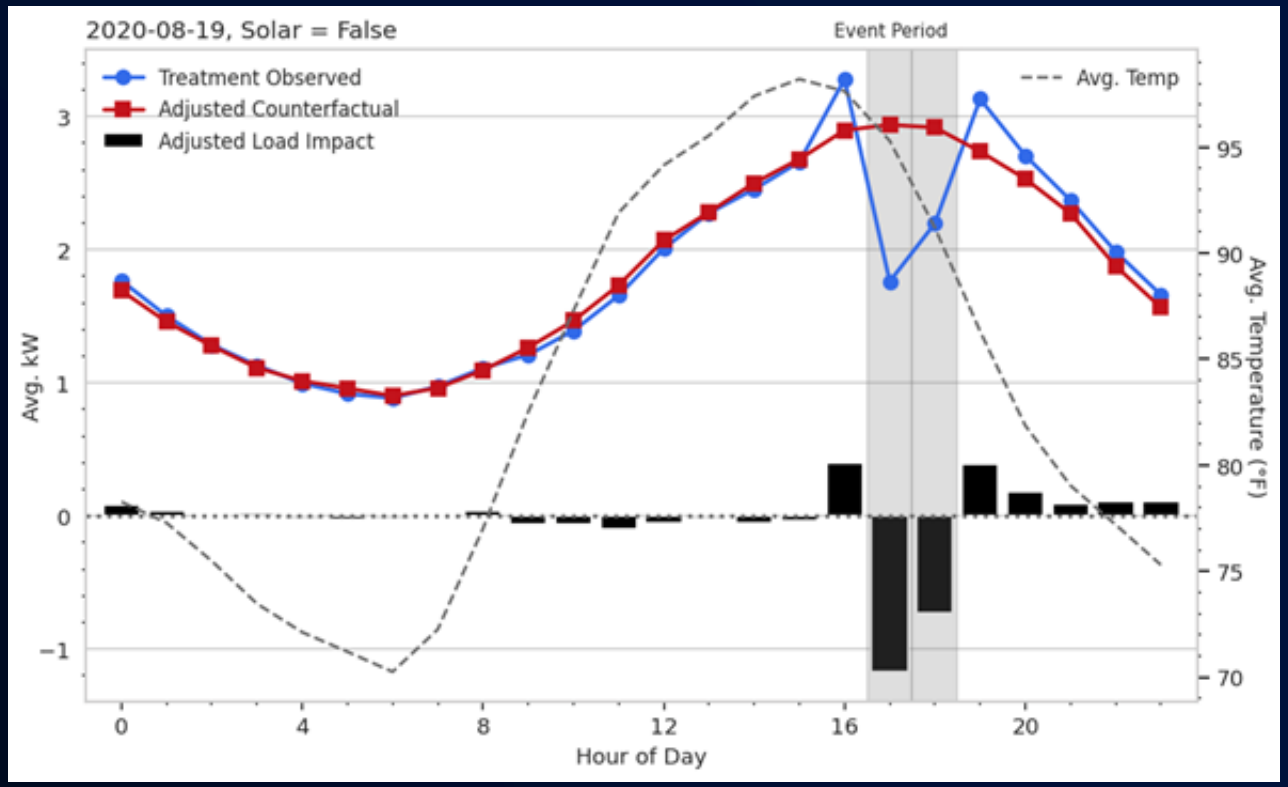
The “Adjusted Counterfactual”

Condenses % Diff of Diff components into a few steps

Adjusted Counterfactual = best prediction of usage absent the event



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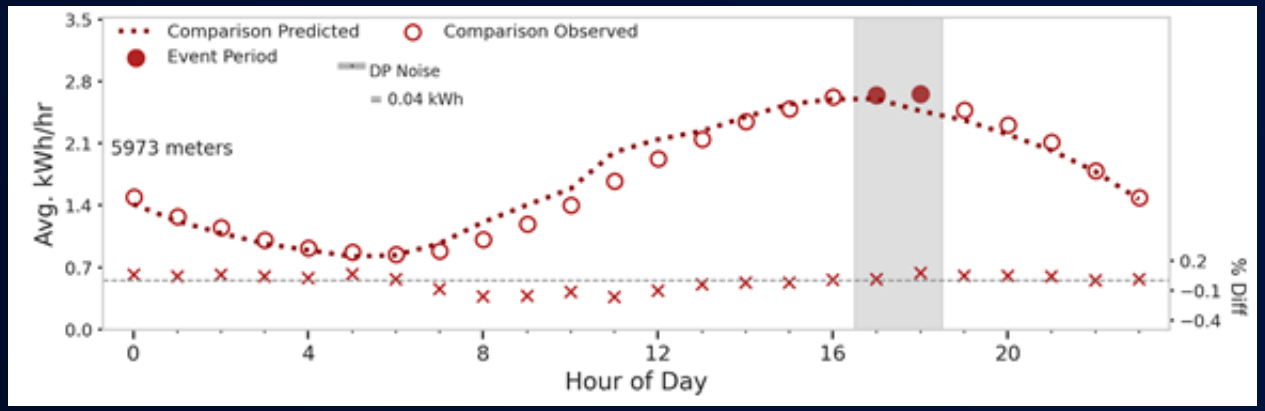
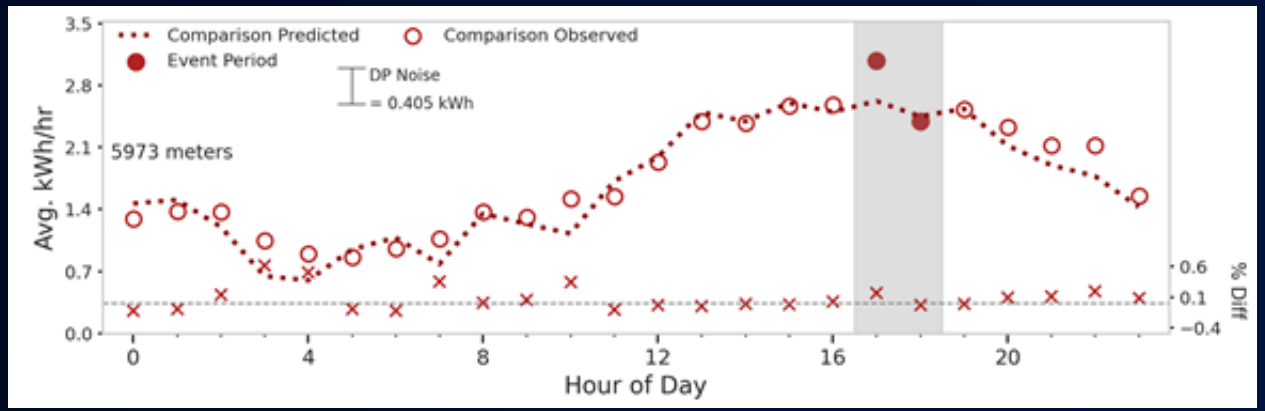
Differential Privacy

- Calibrated noise addition
- Masks the presence of individuals in datasets
- Much stronger protection than traditional aggregation methods





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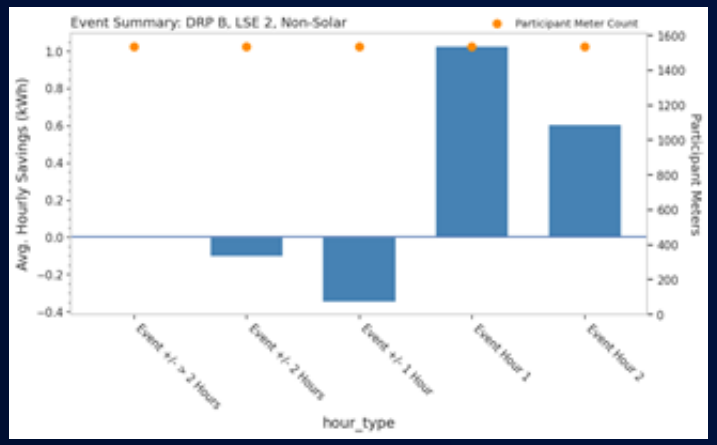
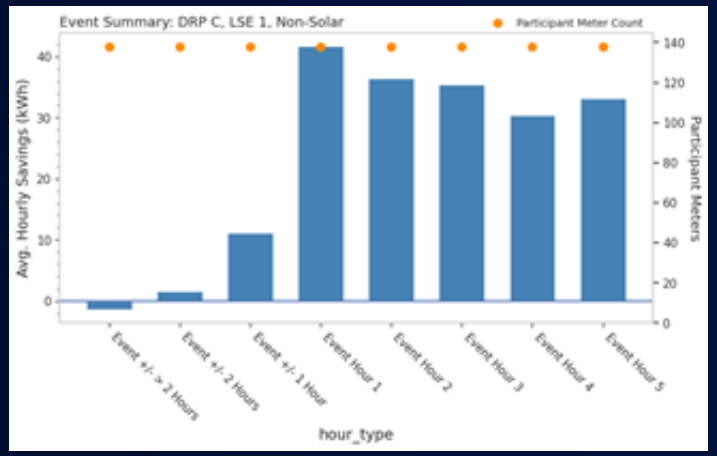
Event Day: Comprehensive Results

FLEXmeter enables measurement of load impacts <u>all hours of the day</u>.

- Total savings determined (both event and non-event)
- Can directly monitor “takeback”

DRP	Sector	Total Event Savings (MWh)	Total Non-Event Savings (MWh)	Total Savings (MWh)
A	Res	28.7	-13.1	15.6
B	Res	22.2	-7.6	14.6
D	Res	115.2	-22.6	92.6
C	Non-Res	87	17.3	104
D	Non-Res	99.9	-129.9	-30.0





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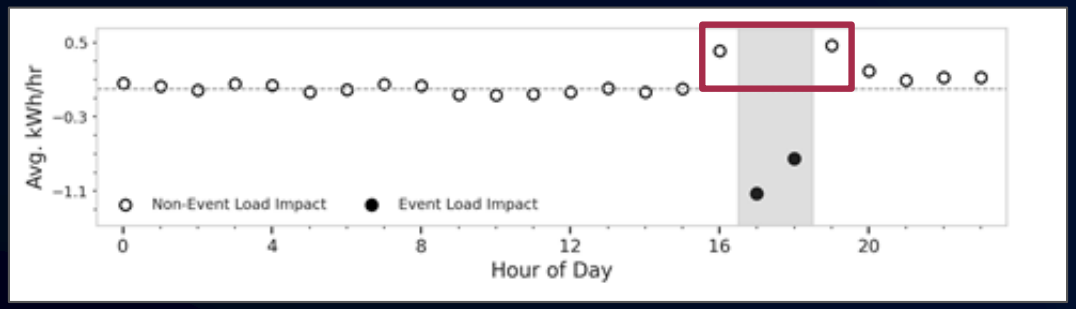
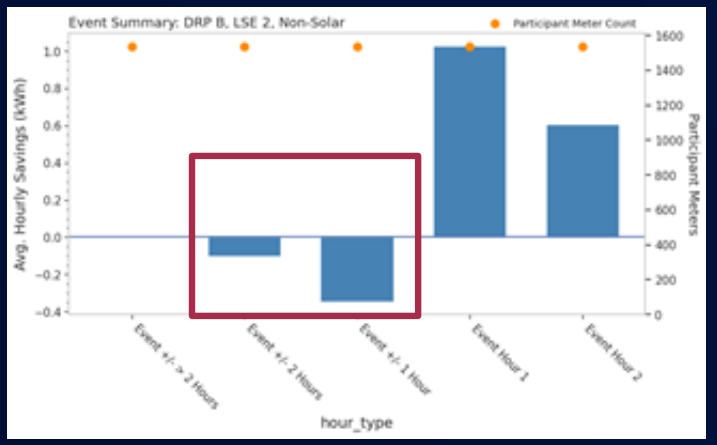
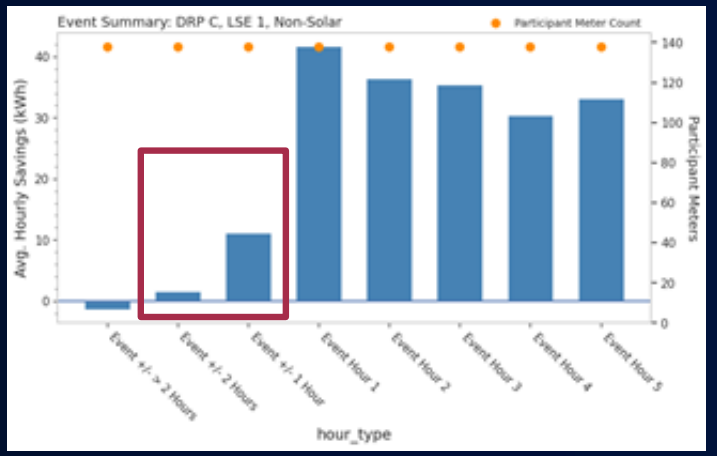
Takeback: Common but Varies By Program

For most (but not all) programs Recurve observes takeback.







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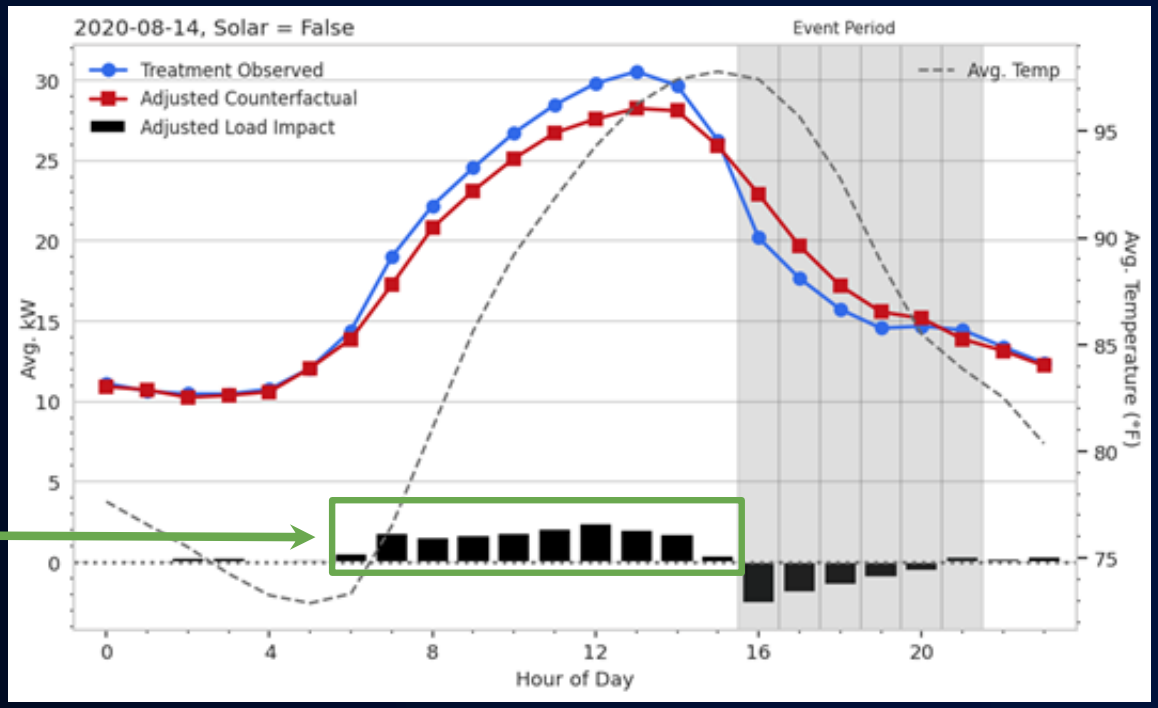
Takeback and 10 of 10 Baselines with SDA

For most (but not all) programs Recurve observes takeback.

Takeback can bias baselines with Same Day Adjustments

DRP D, LSE 1, Non-Res



Takeback during non-event hours

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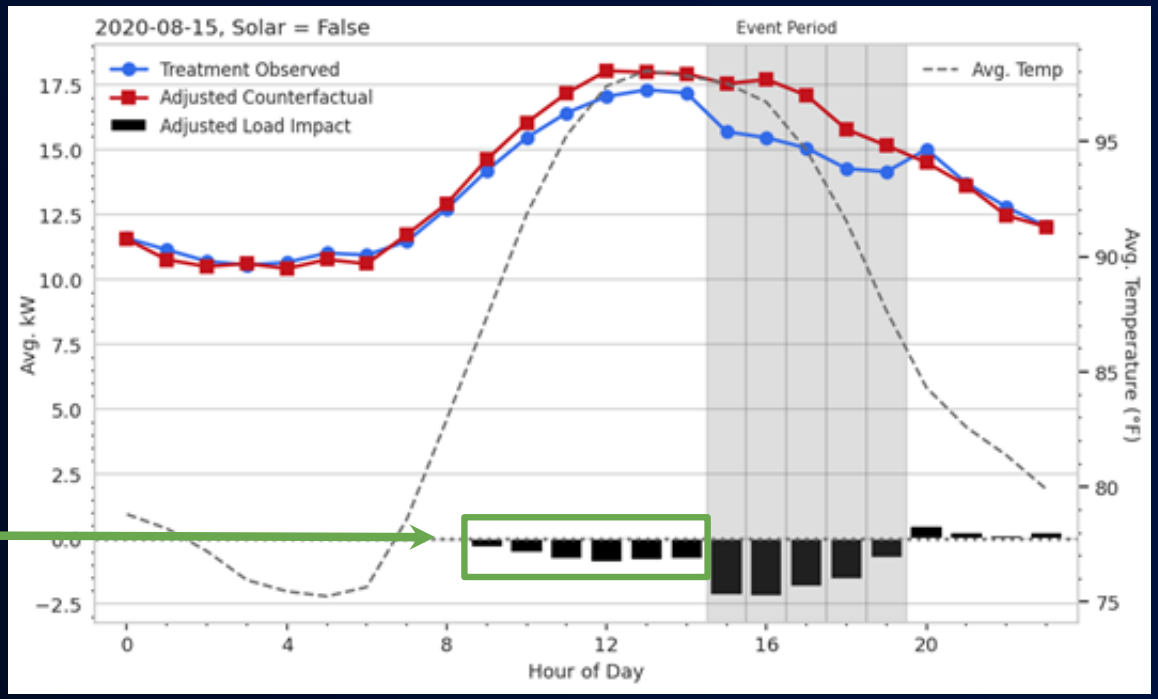
Takeback and 10 of 10 Baselines with SDA

For most (but not all) programs Recurve observes takeback.

Takeback can bias baselines with Same Day Adjustments

DRP D, LSE 1, Non-Res



Savings during non-event hours

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Summary Results

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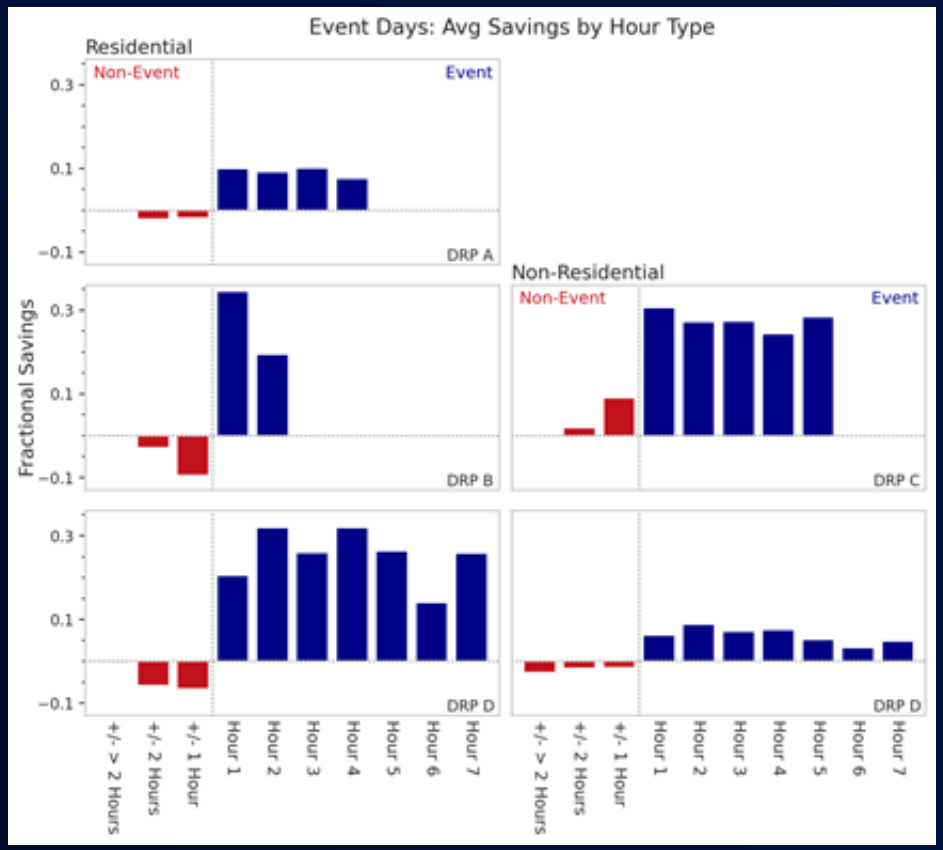
FLEXmeter Summary Results

DRP	Sector	DRP/LSE/Date Combinations	Unique Participants	Avg. Event Hours	Avg. kW Savings	% Savings
A	Res	12	13,496	3.7	0.20	9.5%
B	Res	9	2,771	2.1	0.80	26.9%
D	Res	6	5,077	7.0	0.79	26.2%
C	Non-Res	5	137	5.0	37	28%
D	Non-Res	6	2,758	7.0	1.30	6.9%

Wide variety of programs, territories and results, and...

Apples to apples comparisons across the board



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Standardization and Reliable Measurement: Data Specification

Appendix B: Recommended Standardized Data Specification

Events

An event denotes a call for demand response as measured by the program. Each event must have an EventID, a datetime (the date and time the event was called), and a duration (the length of time the event lasted). If preferred, an event start time and end time can be provided.

Field Name	Required	Type	Unit	Example
EventID	Required	UTF-8 String		Event_001
EventName (type of event)	Optional	UTF-8 String		august_blackouts
EventStart	Required	ISO 8601	datetime	2020-08-14 16:00:00
Duration	Required	ISO 8601	Timedelta (hours)	4:00
EventEnd	Optional	ISO 8601	datetime	2020-08-14 20:00:00

Meter Trace Records

A meter trace is a time series of energy consumption at the meter, typically given in raw form as automated reads with daily, hourly, or sub-hourly frequency. Each record needs a start and end datetime.

Field Name	Required	Type	Unit	Example
MeterID	Required	UTF-8 String		meter4321
Unit	Required	UTF-8 String		electric/gas
Interval	Optional	UTF-8 String		billing-monthly/daily/hourly
Start	Required	ISO 8601	datetime	2020-08-01 00:00:00
End	Required	ISO 8601	datetime	2020-08-01 01:00:00
Value	Required	Numeric	kWh/Therms	0.12

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Error and Uncertainty

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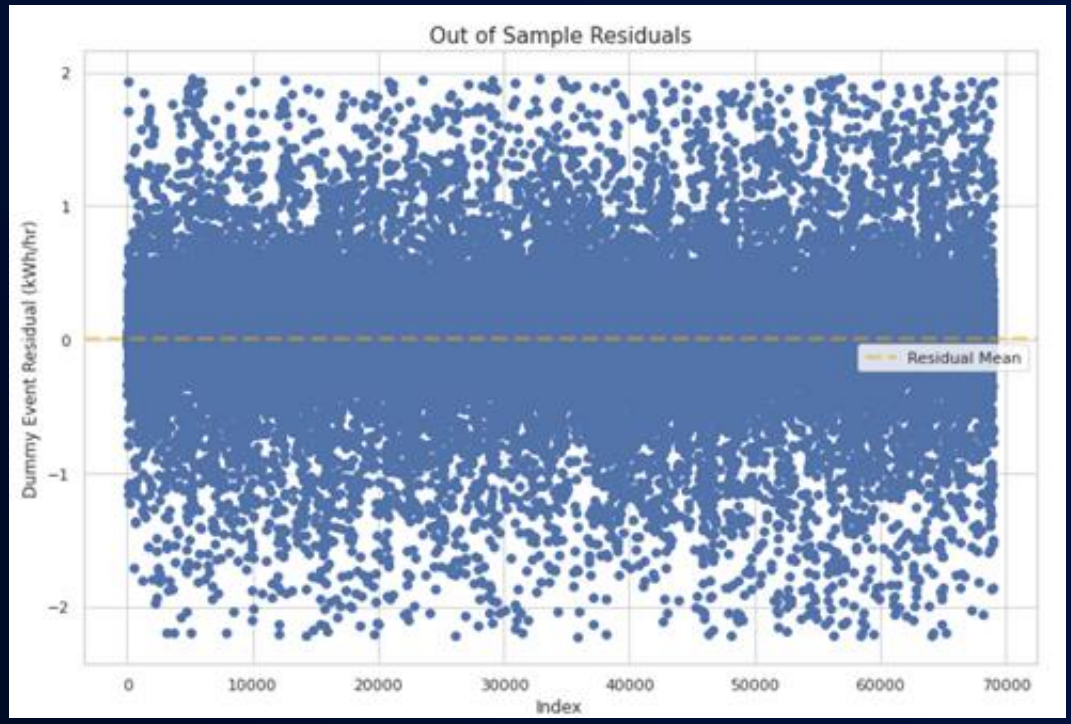
Error Analysis (DRP B, LSE 2 Dummy Events)

Model error falls within 0.008 kWh ± 0.006 kWh at the 95% confidence level.

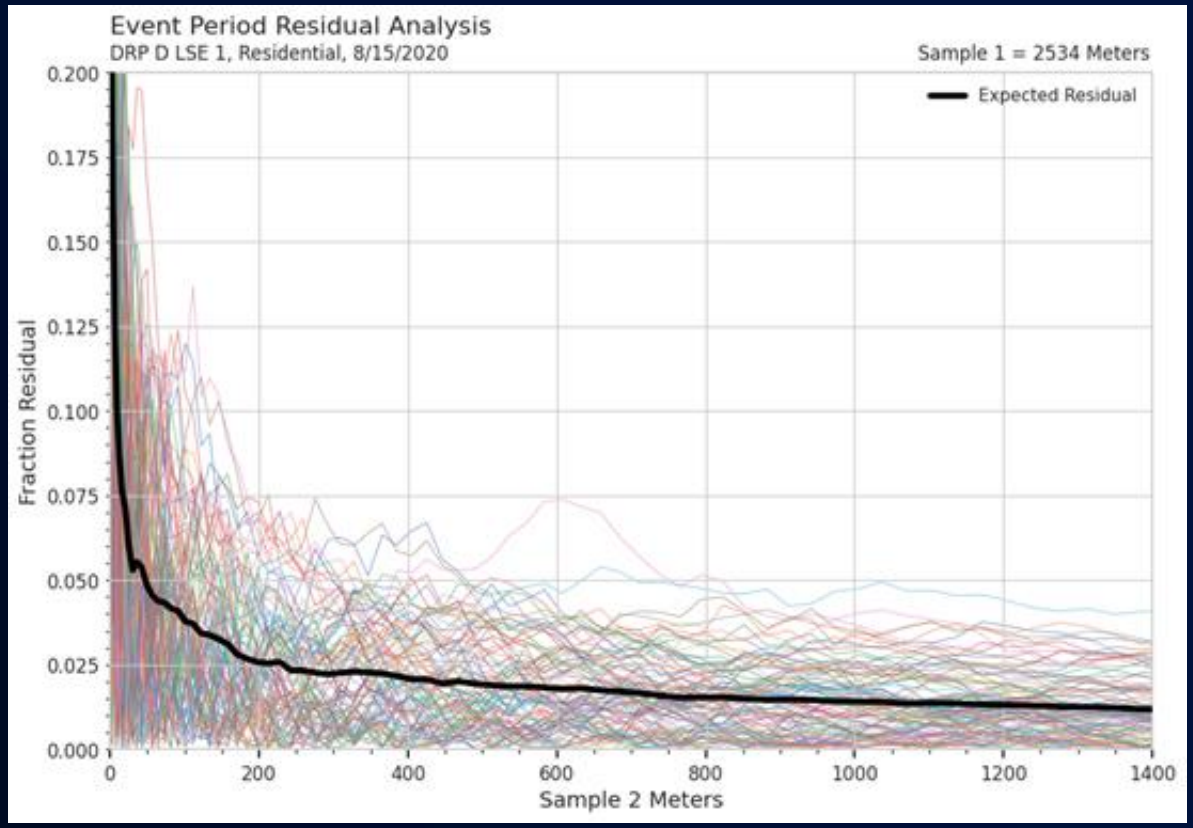


RECURVE

Monte Carlo Analysis (DRP D, LSE 1, Residential, 8/15/2020)

Experiment:

- Randomly split participants into 2 equal sized samples
- Calculate Sample 1 % Event Savings
- Calculate Sample 2 % Event Savings based on growing random samples
- Calculate difference between Sample 1 and Sample 2 % Event savings at every step
- Repeat analysis 100 times



RECURVE

Monte Carlo Analysis (DRP D, LSE 1, Residential, 8/15/2020)

Experiment:

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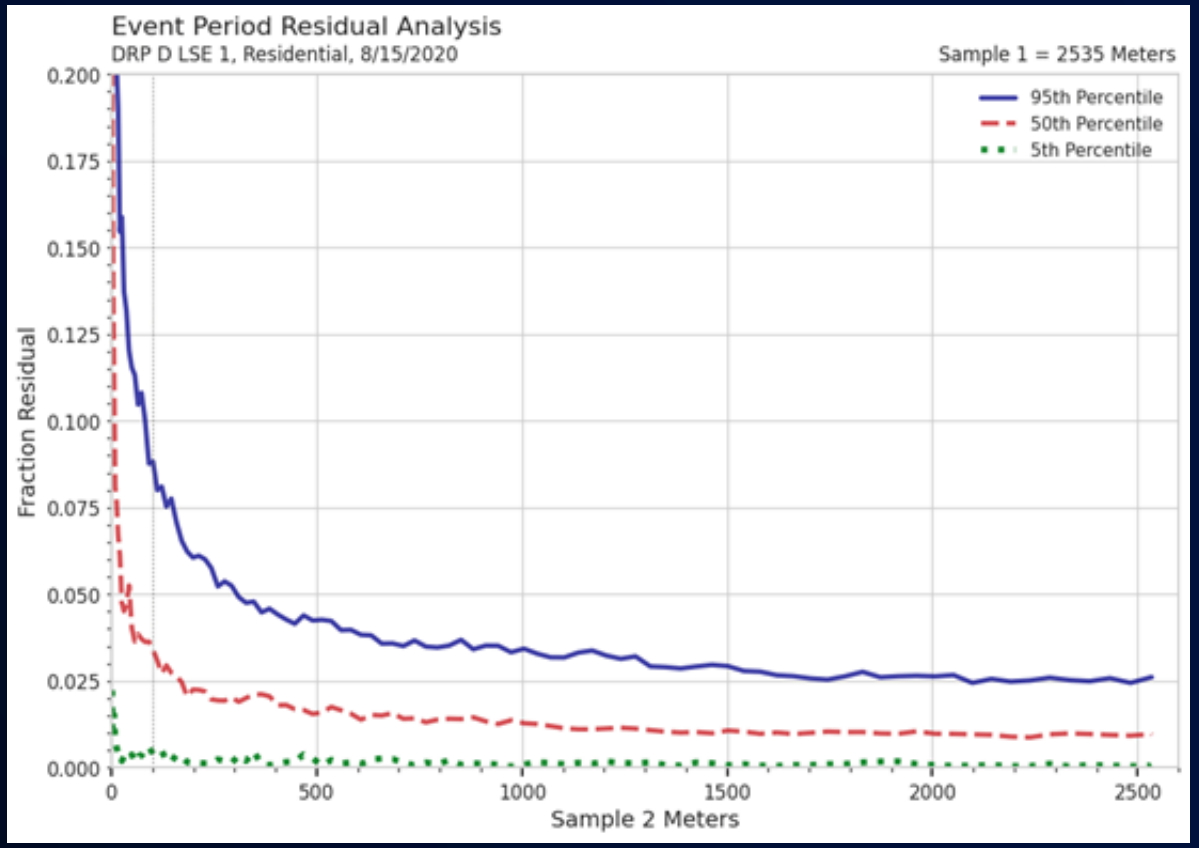

RECURVE

FINAL QUESTIONS/COMMENTS

Stakeholder written comments on today's discussion are encouraged, and may be sent to isostakeholders@caiso.com