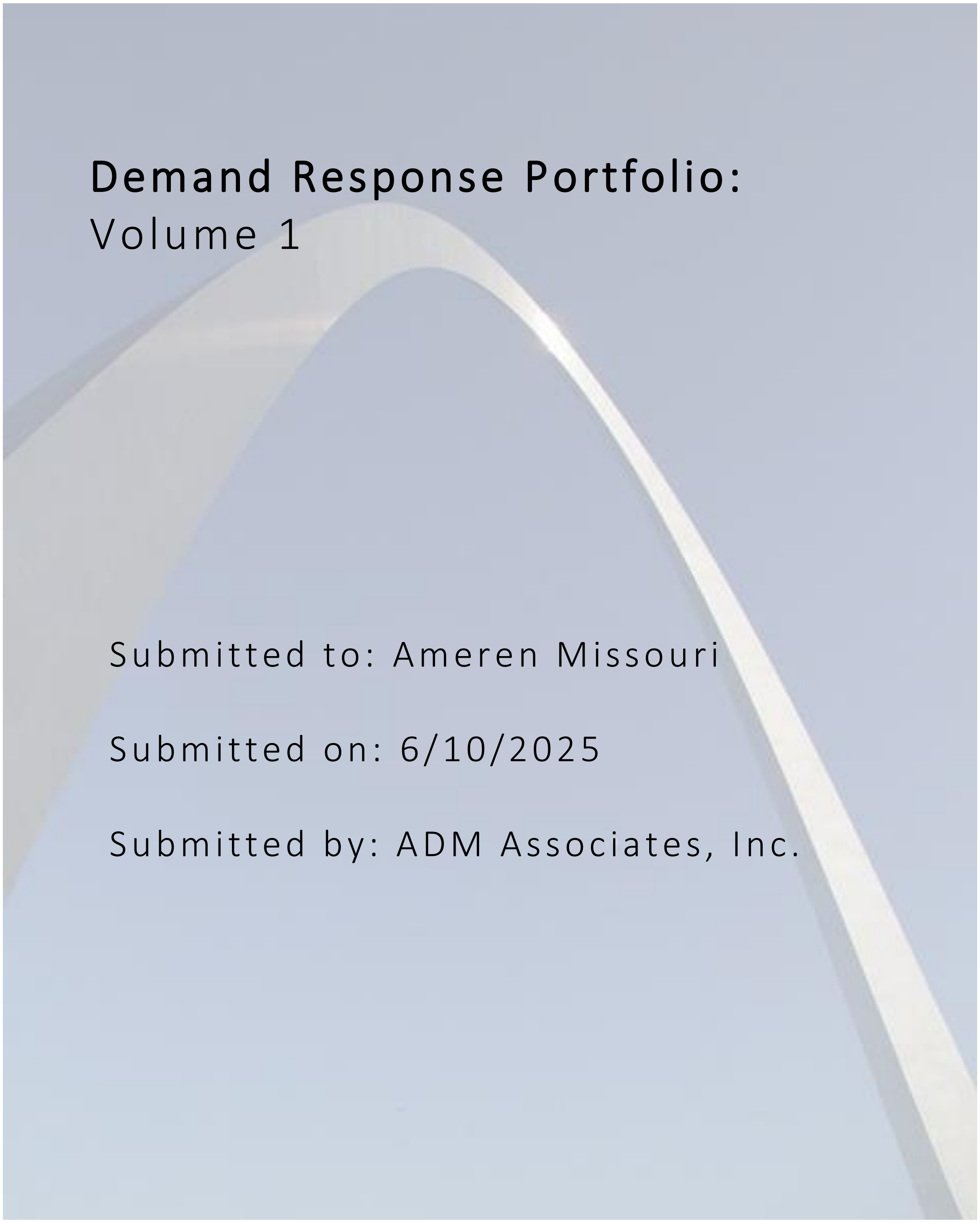

Demand Response Portfolio:
Volume 1

Submitted to: Ameren Missouri

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1 Executive Summary

Under contract with Ameren Missouri, ADM Associates, Inc., (ADM) performed evaluation, measurement, and verification (EM&V) activities to confirm the energy savings (kWh) and demand reduction (kW) realized through its energy efficiency programs.

This report is divided into two volumes providing information on the impact, process, and cost-effectiveness evaluation of the Ameren Missouri portfolio of demand response programs implemented during the 2024 program year (PY2024). Volume I presents chapters describing the evaluation and approach and the evaluation findings.

Volume I is organized as follows:

- Chapter 2: Evaluation Approach
- Chapter 3: Residential Demand Response
- Chapter 4: Business Demand Response

See report Volume II contains chapters presenting detailed information regarding evaluation methodologies, data collection instruments, and evaluation results.

Table 1-1 summarizes the demand response program and portfolio goals for the PY2019 to PY2024 periods.

Table 1-1 Summary of Demand Response Goals

Program Year	Residential DR Program		Business DR Program		DR Portfolio	
	Incremental Goal/Target	Cumulative Goal/Target	Incremental Goal/Target	Cumulative Goal/Target	Incremental Goal/Target	Cumulative Goal/Target
Demand Savings Goal (MW)						
PY2019	11.50	11.50	25.00	25.00	36.50	36.50
PY2020	13.33	24.83	25.00	50.00	38.33	74.83
PY2021	14.96	39.79	25.00	75.00	39.96	114.79
PY2022	18.62	58.41	25.00	100.00	43.62	158.41
PY2023	8.09	66.50	0.00	100.00	8.09	166.50
PY2024	1.17	67.67	37.04	137.04	38.21	204.71
Total	**67.67**	**67.67**	**137.04**	**137.04**	**204.71**	**204.71**
Energy Savings Goal (MWh)						
PY2019	1,130	1,130	500	500	1,630	1,630
PY2020	1,311	2,441	500	1,000	1,811	3,441
PY2021	1,471	3,912	500	1,500	1,971	5,412
PY2022	2,635	6,547	500	2,000	3,135	8,547
PY2023	0	6,547	0	2,000	0	8,547
PY2024	0	6,547	0	2,000	0	8,547
Total	**6,547**	**6,547**	**2,000**	**2,000**	**8,547**	**8,547**

1.1 Impact Evaluation Findings

Table 1-2 summarizes the impacts of the demand response programs.

Table 1-2 Summary of Demand Response Program Impacts

Metric	Residential DR	Business DR
Participant count	50,563	1,040
Demand Impact / Resource Capability		
Event day demand impact (MW)	31.16	143.66
Resource capability (MW)	41.96	168.23
PY2024 MEEIA III goal/target (MW)	67.67	137.04
Percent of PY2024 goal/target	62%	123%
Energy Savings		
Event season energy savings (MWh)	605.50	548.72
PY2024 MEEIA III goal/target (MWh)	6,547	2,000
Percent of PY2024 goal/target	9%	27%

1.2 Key Evaluation Findings

The **Residential Demand Response Program** included four types of events: locational, test, staggered, and winter events. Locational events, which targeted customers on specific capacity-constrained feeders, were the most frequent, occurring seven times between May and August. Test events were conducted four times, including two in December.

Two of the summer events followed a staggered structure in which four subsets of Nest devices were activated in sequence at one-hour intervals. While each group began an hour apart, all groups were deactivated at the same time, resulting in different durations of control across groups and overlapping periods of control during the event window. Staggered events are being tested in coordination with Ameren Missouri's implementer to distribute load reductions more evenly across all event hours. The goal is to increase program capability within MISO's Load Modifying Resource (LMR) registration requirements, thereby enhancing the value the program provides through MISO. This dispatch strategy is specifically designed to increase load reduction performance during the lowest-performing event hour. However, because the strategy prioritizes improving performance during the lowest-performing hour – rather than maximizing overall reductions by dispatching all devices at once – it results in lower average event performance as measured under the current and historical EM&V methodology. Consequently, both the number and frequency of staggered events affect the overall performance metrics and the program's registered resource capability.

Additionally, two test events were held in December during morning and evening hours on colder-than-average days, aligning with periods of high heating demand. The program achieved event day impacts of 31.16 MW, with a cumulative demand response capability of 41.96 MW, or 62% of the savings target. The program expanded in PY2024 with the addition of Honeywell devices, though they accounted for a small portion of enrollments. The number of enrolled accounts grew from an average of 43,340 in PY2023 to 50,563 in PY2024. However, the average number of accounts participating in an event declined from 28,985 to 18,421, likely due to the increase in locational events from three to eight and the addition of winter events.

The **Business Demand Response Program** enrolled 1,040 accounts enrolled at the end of PY2024, a slight increase from 1,025 in PY2023. During the event season, the program delivered 143.63 MW of load reduction, achieving 73% of the total nominated capacity of 197.01 MW. Event performance varied, with the highest reduction occurring on September 12, 2024, when 76% of the nominated capacity was met (147.79 MW out of 194.88 MW). Similarly, the August 20, 2024, event achieved 72% of the nominated capacity (139.16 MW out of 193.58 MW). Beyond individual events, the total PY2024 resource capability estimate reached 168.23 MW, surpassing the program goal by 23% (123% of the PY2024 target). This estimate includes reductions from customers who participated in summer events and tested reductions from new enrollees who joined after the event season but before the program year ended. These results highlight the program's ability to provide consistent and substantial load reductions.

The individual chapters present additional findings and recommendations for the programs.

1.3 Cost Effectiveness Results

The following table summarizes the cost effectiveness results of each of the programs.

Table 1-3 Cost Effectiveness Results

Program Name	TRC	UCT	RIM	PCT	SCT
Residential Demand Response Program	0.90	0.69	0.68	-	0.90
Business Demand Response Program	4.24	2.18	2.17	-	4.24

2 Evaluation Approach

This chapter presents a summary of the evaluation approach and data collection activities that the ADM Team used to evaluate the Ameren Missouri programs.

The Ex Post Savings approaches are specific to each of the two demand response programs and are presented in Section 3.3 and Section 4.3. The approaches outlined result in net savings estimates – no additional adjustments are needed to estimate the share of savings due to the program.

2.1 Process Evaluation Approach

The process evaluation focused on addressing the five process evaluation questions required by Missouri Code of State Regulations section 20 CSR 4240-22.070(8). As stated,

> *Each demand-side program and demand-side rate that is part of the utility's preferred resource plan shall be subjected to an ongoing evaluation process which addresses at least the following questions about program design.*
>
> 1. *What are the primary market imperfections that are common to the target market segment?*
> 2. *Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?*
> 3. *Does the mix of end-use measures included in the program appropriately reflect the diversity of end-use energy service needs and existing end-use technologies within the target market segment?*
> 4. *Are the communication channels and delivery mechanisms appropriate for the target market segment?*
> 5. *What can be done to more effectively overcome the identified market imperfections and to increase the rate of customer acceptance and implementation for select end-uses/measure groups included in the Program?*

In addition to addressing the five process evaluation questions, the process evaluation provides findings and recommendations, as applicable, based on the findings from the evaluation research activities.

2.2 Cost Effectiveness Analysis

ADM analyzed the final, post-implementation cost-effectiveness of each measure, program, and the overall portfolio. ADM coordinated with Ameren Missouri to obtain the economic and financial assumptions for developing the model, including discount rate, line losses, summer peak date/time, avoided electric transmission and distribution costs, and escalation rates. Additionally, program spending data costs for implementation, incentives, and administration were provided by Ameren Missouri. ADM provided measure-level data by program with model inputs for the number of units, measure life, gross energy savings, net energy savings, demand savings, end use, and incremental costs.

The ADM Team calculated cost-effectiveness using the five most widely accepted tests conducted in evaluations of energy efficiency programs across North America. These tests are summarized below:

- Utility Cost Test (UCT): Comparison of program administrator costs to resource supply costs.
- Total Resource Cost Test (TRC): Comparison of program administrator and customer costs to utility resource savings.
- Ratepayer Impact Measure Test (RIM): Impact of the program on all ratepayers, including non-participants.
- Societal Cost Test (SCT): Comparison of total societal costs to resource savings and non-monetized benefits.
- Participant Cost Test (PCT): Comparison of costs and benefits from the perspective of the customer implementing the measures.

Each test was performed in accordance with the methodologies described in the National Action Plan for Energy Efficiency (NAPEE) manual on cost-effectiveness analysis.

2.3 Summary of Data Collection

The ADM Team engaged in several forms of data collection in the process of completing the evaluation of the Ameren Missouri programs. We present a brief overview of the data collection activities here.

2.3.1 Interviews with Program Staff

The ADM Team completed interviews with program staff from Ameren Missouri and its implementation partners. The purpose of the interview was to review our understanding of the program design and operations, obtain additional information on program marketing and markets targeted, delivery approaches and strategies, as well as quality control and data management approaches. The interviews were completed in March and April of 2024.

2.3.2 Online Surveys

Online surveys were completed with program participants. The populations for these surveys were developed using data from program participation records and the database of Ameren Missouri. Table 2-1 summarizes the survey data collection.

Table 2-1 Summary of Data Collection

Program Name	Data Collection Activity	Mode	Population Targeted	Completed Surveys / Interviews	Response Rate
Residential Demand Response	Participant survey	Email	8,257	160	1.9%
Business Demand Response	Participant survey	Email	265	18	6.8%

2.3.3 Review of Program Documents

The ADM Team reviewed several types of documents to obtain information about the programs and their operations. The types of documents included:

- Program database queries and extracts.
- Application forms and participation agreements.
- Program websites.

3 Residential Demand Response

The Residential DR Program is aimed at managing cooling load through smart thermostats to attain demand and energy savings. The program is open to Ameren Missouri electric customers possessing central air conditioning systems (including heat pumps) and/or electric heating systems, who either owned or were prepared to acquire an eligible smart thermostat and enroll in the program. The eligible thermostats are:

- Google Nest
- Copeland Sensi
- Honeywell
- Ecobee

Customers who enroll receive a $50 bonus when they sign up and $25 for each subsequent year enrolled. The program initially employed a randomized control trial (RCT) approach for the first few events, withholding treatment for a subset of participants to serve as a control group. This approach was later discontinued when the evaluation methodology was revised to use a separately constructed matched comparison group of non-participants. One event included all enrolled thermostats.

Participating customers may opt-out of events by adjusting the temperature of the thermostat. Customers who opt out may be removed from the program, but program staff reported they have not removed customers from the program. Some customers chose to unenroll for various reasons.

Events were scheduled from May through December, with a maximum of 15 events in 2024. Ameren Missouri introduced winter enrollments starting April 1, 2024. Additionally, certain events might be specific to circuits and the program may implement phased events, staggering start times for different participants.

In PY2024, the program called 13 summer events during May – August and two winter events in December.

3.1 Program Activity Summary

Table 3-1 summarizes enrollment during PY2024. The difference between the average number of enrollments and the average number of participating accounts is largely due to the nature of the events. As shown in Table 3-2, locational events—called for a subset of customers on specific capacity-constrained feeders—were the most frequent event type, occurring seven times between May and August. The frequency of locational events decreased the average number of accounts participating in events. Test events were conducted four times, including two in December. Staggered events occurred twice during the summer, with control initiated in one-hour intervals across four subsets of Nest devices, all of which were deactivated at the same time. Additionally, two test events were called in December during morning and evening hours on days with below-average temperatures, aligning with conditions for high heating loads.

Table 3-1 Summary of Program Activity – Residential Demand Response

Manufacturer	Average Number of Enrolled Accounts	Average Number of Accounts Participating in Event
Nest	31,153	11,772
ecobee	11,189	3,999
Sensi	7,639	2,502
Honeywell	581	148
All	50,563	18,421

Table 3-2 Summary of Events – Residential Demand Response

Event ID	Date	Type	Start Hour	End Hour	Duration (Hours)	Temperature
1	5/21/2024	Locational	15	16	2	90
2	6/13/2024	Test	14	17	4	93
3	6/17/2024	Locational	14	15	2	93
4	6/21/2024	Staggered	14	17	4	92
5	6/25/2024	Locational	14	15	2	101
6	7/15/2024	Locational	14	15	2	95
7*	7/16/2024	Test	13	16	4	74
8	7/30/2024	Staggered	14	17	4	91
9	7/31/2024	Locational	16	17	2	92
10	8/5/2024	Locational	16	17	2	96
11	8/6/2024	Locational	14	15	2	93
12	8/16/2024	Test	14	17	4	90
13	8/29/2024	Locational	14	15	2	96
14	12/3/2024	Test	7	8	2	21
15	12/5/2024	Test	17	20	4	20

* The actual temperature on July 16, 2024, was lower than the forecasted temperature.

3.2 Data Collection Activities

The ADM Team administered the survey to a census of unique contacts with contact information available at the time the surveys were fielded.

Table 3-3 Summary of Data Collection – Residential Demand Response

Data Collection Activity	Mode	Time Frame	Population Targeted	Completed Surveys / Interviews	Response Rate
Participant survey	Email	October 2024	8,257	160	1.9%

3.3 Estimation of Ex Post Savings

The impact of demand response events was analyzed using AMI interval energy use data provided by Ameren Missouri. Various data processing steps were applied to the data before being analyzed. These steps include:

- Validating that the files contain the anticipated data and are not corrupt.
- Extracting and transferring data from these files.
- Notifying Ameren Missouri with information regarding any remaining data needs (i.e., if files were missing or corrupted).

After the necessary files were validated, the data was cleaned and prepared for analysis by checking the data for completeness.

Local temperature data was retrieved from the National Oceanic and Atmospheric Administration (NOAA). Each account was assigned to the nearest of five designated weather stations, listed in Table 3-4.

Table 3-4 Weather Stations Providing Local Temperature Data

Location	USAF/WBAN Code
St. Louis	72531403960
Jefferson City	72445003945
Kirksville	72445514938
Cape Girardeau (Paducah)	72435003816
Bethany	72446453916

Temperature values were converted to cooling degree hours (CDH) and heating degree hours (HDH) using the method outlined by Equation 3-1.

Equation 3-1 Temperature to CDH/HDH Conversion for Season-Level Analysis

$$CDH_t = \begin{cases} 0 & if\ temp_t < cddbase \\ (temp_t - cdhbase) & if\ temp_t \geq cddbase \end{cases}$$

$$HDH_t = \begin{cases} 0 & if\ temp_t > hddbase \\ (temp_t - hdhbase) & if\ temp_t \leq hddbase \end{cases}$$

Where,

$temp_t$ = temperature at time t

cdhbase = determined CDH base temperature

hdhbase = determined HDH base temperature

To calculate CDH and HDH values, the optimal base temperatures for each—CDH and HDH— were determined by running several possible base temperature values through the following process, separately for CDH and HDH:

- Temperature values were converted to CDH and HDH using various hypothetical base temperatures.

- A linear regression model was fit to predict energy use during the months of the demand response event season, using only the CDH or HDH values.
- The model was scored by calculating the root mean squared error of its predictions.
- The optimal base temperature for CDH and, separately, for HDH, that produced the model with the smallest root mean squared error score will be the value chosen.

3.3.1 Estimation of Event Demand Savings

The ADM Team estimated baseline energy use by comparing treatment group energy use data with weather-normalized comparison group energy use data.

A propensity score matching approach was used to establish a comparison group of non-participant customers to support baseline development. Through Euclidean distance matching, the ADM Team selected a set of match days to act as proxies for each event day. These match days, chosen from non-holiday, seasonal weekdays during the program year, were determined based on the weather and energy usage of non-participant residential customers. For each event date, the ADM Team identified the three days with the most similar average usage and weather conditions as match days. During this process, a match day might have been selected multiple times for different events, but an event day was not to serve as a match day for another event.

Following the determination of match days, for each event, the ADM Team compared the energy usage of participants on non-event days with that of non-participants on non-event days to establish a matched comparison group match for each participant.

To facilitate the creation of the matched comparison group, variables were constructed to enable accurate comparisons. These variables included:

- kWh_00_02: Mean hourly kWh during 12:00 AM – 2:00 AM.
- kWh_03_05: Mean hourly kWh during 3:00 AM – 5:00 AM.
- kWh_06_08: Mean hourly kWh during 6:00 AM – 8:00 AM.
- kWh_09_11: Mean hourly kWh during 9:00 AM – 11:00 AM.
- kWh_12_14: Mean hourly kWh during 12:00 PM – 2:00 PM.
- kWh_15_17: Mean hourly kWh during 3:00 PM – 5:00 PM.
- kWh_18_20: Mean hourly kWh during 6:00 PM – 8:00 PM.
- kWh_21_23: Mean hourly kWh during 9:00 PM – 11:00 PM.
- kWh: Total mean hourly kWh across all hours.

These variables were used to calculate the Euclidean distance between treatment and comparison group customers, ensuring that the comparison group had similar energy use patterns.

A distance variable for each potential matched comparison account (*i*) for each treatment account was then calculated as provided in the example below.

Equation 3-2 Euclidean Distance Calculation

$$Distance = ((kWh\_00\_02_{treatment} - kWh\_00\_02_{i})^2 + (kWh\_03\_05_{treatment} - kWh\_03\_05_{i})^2 + (kWh\_06\_08_{treatment} - kWh\_06\_08_{i})^2 + (kWh\_09\_11_{treatment} - kWh\_09\_11_{i})^2 + (kWh\_12\_14_{treatment} - kWh\_12\_14_{i})^2 + (kWh\_15\_17_{treatment} - kWh\_15\_17_{i})^2 + (kWh\_18\_20_{treatment} - kWh\_18\_20_{i})^2 + (kWh\_21\_23_{treatment} - kWh\_21\_23_{i})^2 + (kWh_{treatment} - kWh_{i})^2)^{0.5}$$

For each treatment account, the potential matched comparison account with the minimum distance was selected as the match account, with a tie-breaking procedure applied if necessary.

Once the matched comparison group was selected, the average hourly event day usage was determined. The matched comparison group's average usage served as a preliminary baseline.

The preliminary baseline was adjusted to account for weather differences between the treatment and matched comparison groups.

Weather normalization was performed by adjusting the matched comparison group usage data based on the differences in cooling degree hours (CDH) or heating degree hours (HDH) between the treatment and matched comparison groups. This adjustment ensured that the baseline accurately reflected the weather conditions experienced by the treatment group.

CDH and HDH variables were derived from temperature data using the method outlined in Equation 3-1, and used as inputs in the regression models specified below.

Equation 3-3 Initial Matched Comparison Group kW Estimation

$$kW_t = \alpha_0 + \beta_{\mathrm{CDH}} * CDH_t + \beta_{\mathrm{CDHt\text{-}2}} * CDH_{t-2} + \varepsilon_t \text{ (for summer events)}$$

$$kW_t = \alpha_0 + \beta_{\mathrm{HDH}} * HDH_t + \beta_{\mathrm{HDHt\text{-}2}} * HDH_{t-2} + \varepsilon_t \text{ (for winter events)}$$

Where,

α_0 = Intercept
t = the 1-hour interval for which kW level is being predicted
CDH_t and HDH_t = cooling and heating degree hours at time t, respectively
β_{CDH} and β_{HDH} = coefficients of CDH_t and HDH_t variables, respectively
CDH_{t-2} and HDH_{t-2} = cooling and heating degree hours two hours before t, respectively
$\beta_{\mathrm{CDHt\text{-}2}}$ and $\beta_{\mathrm{HDHt\text{-}2}}$ = coefficients of CDH_{t-2} and HDH_{t-2} variables, respectively
ε_t = Error term

Using the regression coefficients derived from the regression models specified above, hourly kW was adjusted to account for weather for each hour *t* on the event day.

Equation 3-4 Weather-Adjusted Matched Comparison Group kW Estimation

$$kW_{t,matched} = kW_{t,matched\_preliminary} + \beta CDH * (CDH_{t,treatment} - CDH_{t,matched}) \text{ (for summer events)}$$

$$kW_{t,matched} = kW_{t,matched\_preliminary} + \beta HDH * (HDH_{t,treatment} - HDH_{t,matched}) \text{ (for winter events)}$$

With the baseline profiles thus determined, demand reduction was calculated for each treatment group participant as the difference between baseline and actual energy use that occurred during each applicable hour. Equation 3-5 shows the formula for calculating demand reduction during each time period.

Equation 3-5 Demand Reduction Calculation

$$kW_{t\_reduction} = kW_{t\_matched} - kW_{t\_treatment}$$

Where,

$kW_{t\_reduction}$ = kW reduction during time *t*
$kW_{t\_matched}$ = Weather-adjusted matched comparison group kW demand during time *t*
$kW_{t\_treatment}$ = Actual treatment group kW demand during time *t*

3.3.2 Estimation of Event Day Energy Impacts

Event day impacts were calculated by taking the difference between the summed hourly energy use of the treatment group and the summed hourly energy use over the 24-hour period on event days.

3.3.3 Calculation of Aggregate Reduction and Cumulative Demand Response Capability

The ADM Team calculated and reported the Cumulative Demand Response Capability. The steps for calculating the residential Cumulative Demand Response Capability are:

- Calculate demand response event demand savings for each event.
- Adjust the demand response event to reflect normal weather during peak conditions (normalized for a peak temperature of 99℉ - winter demand response events would use a different normalization temperature).
- Calculate the average normalized demand savings per participant and multiply it by the number of participants enrolled at the end of the program year.

3.3.4 Calculation of Orchestrated Energy kWh Energy Savings

The residential demand response program deployed Uplight's Orchestrated Energy (OE) software that uses algorithms and a home energy simulation model to alter the participants' thermostat set points to reduce energy use. The software was deployed on qualified Sensi thermostats.

To evaluate the impact of OE on participant energy usage, the ADM Team conducted an analysis using AMI interval energy usage, weather, and thermostat operating state data.

3.3.4.1 Data Processing and Thermostat State Identification

AMI data was preprocessed to ensure completeness and paired with thermostat operating state data identifying the following thermostat control assignments:

- DEMAND_RESPONSE – Thermostats actively participating in DR events.
- COUNTERFACTUAL – Accounts held in reserve as potential comparison observations.
- CONTINUOUS_DEMAND_MANAGEMENT – Participants subject to OE adjustments outside of discrete DR events.
- AVAILABLE – Thermostats that were eligible but not necessarily controlled.

3.3.4.2 Establishing Baseline and Treatment Groups

The OE treatment group consisted of participants in the CONTINUOUS_DEMAND_MANAGEMENT group subject to OE adjustments. To estimate the program's impact, a matched comparison group approach was used, where treatment group customers were compared to participants in the COUNTERFACTUAL group.

Customers in the treatment and comparison groups were matched based on:

- Geographic Location: Participants were matched within the same ZIP code to control for local weather conditions.
- Temporal Factors: Matching was performed by date and time of day to ensure comparable conditions.
- Data Completeness: Only customers with complete interval energy use data (e.g., 96 observations per day for 15-minute data) were included in the analysis to ensure data quality.).

3.3.4.3 Estimating Energy Impacts

A fixed-effects panel regression was used to estimate hourly energy impacts, controlling for temperature and time of day. The model specification is as follows.

Equation 3-6 Orchestrated Energy Savings Estimation

$$kW_t = \alpha_0 + \beta_{CDH} * CDH_t + \beta_{Treatment} * Treatment_t * + \beta_{TreatmentHour} \sum Hour * Treatment_t) + \varepsilon_t$$

Where,

kW_t = The electric demand (in kW) at hourly interval t
α_0 = Intercept term, representing the baseline demand level when all other predictors are zero
t = The 1-hour interval for which kW level is being predicted
CDH_t = Cooling degree hours at hour t
β_{CDH} = Coefficient for the *CDH* variable, representing the effect of temperature on demand
$Treatment_t$ = A dummy variable, equal to 1 if Orchestrated Energy (OE) is engaged at time t and 0 otherwise
$\beta_{Treatment}$ = Coefficient for the *Treatment* variable, representing the direct effect of OE engagement on demand
Hour = A set of dummy variables for the hour of the day, equal to 1 if the current hour matches, otherwise 0
$\beta_{TreatmentHour}$ = Coefficient for the interaction term, capturing the combined effect of hour of the day and OE engagement on demand
ε_t = Error term

By using matched comparison customers from the same weather zone, the analysis controlled for temperature variability without requiring explicit weather normalization adjustments in the baseline.

The model coefficients were used to calculate the energy savings attributed to the engagement of OE.

3.3.5 Ex Post Savings Results

Table 3-5 summarizes the demand and energy impacts of the Residential Demand Response Program. Additional details on the impact results are presented in the subsequent sections.

Table 3-5 Summary of PY2024 Demand and Energy Impacts

Metric	Result
Participant count	50,563
Event day demand impact (MW)	31.16
Event day energy impact (MWh)	18.30
Non-event day energy impact (MWh)	586.56

3.3.5.1 Event Season Demand Impacts

Table 3-6 presents the demand events by event and manufacturer. Table 3-7 follows, summarizing the aggregated demand impacts for each device and the program as a whole.

Across all manufacturers, the demand response program engaged an average of 18,421 accounts, reducing total load by 31.16 MW. The average per-account impact was 0.83 kW, with an overall load reduction of 28%. Nest devices had the highest participation, with an average of 11,772 accounts per event, delivering a total load reduction of 20.31 MW. The per-account reduction for Nest devices averaged 0.87 kW, resulting in a 29% load impact. Ecobee devices contributed a total load reduction of 6.11 MW, with an average per-account reduction of 0.76 kW and a 24% load impact. Sensi devices had a slightly higher per-account reduction of 0.78 kW, contributing 4.45 MW in total and achieving a 27% load impact.

Honeywell devices had the lowest participation, with an average of 148 accounts per event. However, they achieved the highest per-account reduction at 0.98 kW, resulting in a 31% load impact.

Table 3-6 Demand Impacts by Event and Device Manufacturer

Event	Event Duration (Hours)	Event Type	Manu-facturer	Number of Enrolled Accounts	Total Number of Accounts Participating in Event	Aggregate (MW)		Per Account (kW)		% Load Impact	Average Event Hour Temp (°F)
						Baseline Load	Load Impact	Baseline Load	Load Impact		
Event 1: 5/21/2024	2	Locational	Nest	30,899	1,973	5.58	2.26	2.83	1.15	41%	90
			ecobee	11,086	585	1.74	0.68	2.97	1.16	39%	
			Sensi	7,878	370	1.02	0.35	2.74	0.96	35%	
			Honeywell	478	2	n/a	0.00	n/a	0.00	n/a	
			Total	50,341	2,930	8.34	3.29	2.85	1.12	40%	
Event 2: 6/13/2024	4	Test	Nest	31,071	30,291	94.22	26.93	3.11	0.89	29%	93
			ecobee	11,113	10,920	36.24	10.15	3.32	0.93	28%	
			Sensi	7,838	7,509	22.63	6.59	3.01	0.88	29%	
			Honeywell	527	519	1.68	0.50	3.24	0.97	30%	
			Total	50,549	49,239	154.78	44.17	3.14	0.90	29%	
Event 3: 6/17/2024	2	Locational	Nest	31,102	3,726	12.60	5.11	3.38	1.37	41%	93
			ecobee	11,106	1,166	4.20	1.48	3.60	1.27	35%	
			Sensi	7,783	567	1.86	0.64	3.27	1.13	34%	
			Honeywell	542	65	0.23	0.09	3.48	1.37	39%	
			Total	50,533	5,524	18.87	7.32	3.42	1.33	39%	
Event 4: 6/21/2024	4	Staggered	Nest	31,000	29,383	94.80	24.74	3.23	0.84	26%	92
			ecobee	11,088	9,986	34.26	5.65	3.43	0.57	17%	
			Sensi	7,756	6,578	20.51	6.27	3.12	0.95	31%	
			Honeywell	541	279	0.96	0.25	3.44	0.91	27%	
			Total	50,385	46,226	150.53	36.91	3.26	0.80	25%	
Event 5: 6/25/2024	2	Locational	Nest	31,005	3,695	14.00	5.29	3.79	1.43	38%	101
			ecobee	11,117	1,162	4.64	1.51	4.00	1.30	32%	
			Sensi	7,685	563	2.12	0.72	3.76	1.28	34%	
			Honeywell	554	64	0.25	0.07	3.83	1.09	28%	
			Total	50,361	5,484	21.00	7.60	3.83	1.39	36%	
	2	Locational	Nest	31,156	3,644	13.29	5.04	3.65	1.38	38%	95

Event	Event Duration (Hours)	Event Type	Manu-facturer	Number of Enrolled Accounts	Total Number of Accounts Participating in Event	Aggregate (MW) Baseline Load	Aggregate (MW) Load Impact	Per Account (kW) Baseline Load	Per Account (kW) Load Impact	% Load Impact	Average Event Hour Temp (°F)
Event 6: 7/15/2024			ecobee	11,150	1,153	4.51	1.55	3.91	1.34	34%	
			Sensi	7,630	554	1.95	0.65	3.52	1.18	33%	
			Honeywell	562	64	0.25	0.09	3.90	1.34	34%	
			Total	50,498	5,415	20.00	7.32	3.69	1.35	37%	
Event 7: 7/16/2024	4	Test	Nest	31,149	29,453	48.57	11.97	1.65	0.41	25%	74
			ecobee	11,147	10,010	18.30	4.76	1.83	0.48	26%	
			Sensi	7,623	6,345	10.22	1.97	1.61	0.31	19%	
			Honeywell	562	286	0.48	0.12	1.68	0.43	25%	
			Total	50,481	46,094	77.58	18.82	1.68	0.41	24%	
Event 8: 7/30/2024	4	Staggered	Nest	31,306	29,657	96.37	26.64	3.25	0.90	28%	91
			ecobee	11,193	10,063	34.03	5.16	3.38	0.51	15%	
			Sensi	7,615	6,444	19.68	4.20	3.05	0.65	21%	
			Honeywell	566	301	1.03	0.34	3.43	1.13	33%	
			Total	50,680	46,465	151.11	36.34	3.25	0.78	24%	
Event 9: 7/31/2024	2	Locational	Nest	31,298	3,625	12.69	4.81	3.50	1.33	38%	92
			ecobee	11,185	1,146	4.28	1.53	3.73	1.34	36%	
			Sensi	7,604	545	1.81	0.58	3.33	1.06	32%	
			Honeywell	565	64	0.25	0.10	3.87	1.56	40%	
			Total	50,652	5,380	19.03	7.02	3.54	1.30	37%	
Event 10: 8/5/2024	2	Locational	Nest	31,667	3,616	13.88	4.60	3.84	1.27	33%	96
			ecobee	11,279	1,144	4.63	1.43	4.04	1.25	31%	
			Sensi	7,627	543	1.94	0.61	3.56	1.12	31%	
			Honeywell	616	63	0.25	0.08	4.00	1.26	32%	
			Total	51,189	5,366	20.70	6.72	3.86	1.25	32%	
Event 11: 8/6/2024	2	Locational	Nest	31,657	3,615	11.35	4.41	3.14	1.22	39%	93
			ecobee	11,278	1,140	3.81	1.31	3.34	1.15	34%	
			Sensi	7,618	541	1.62	0.54	3.00	1.00	33%	
			Honeywell	616	62	0.19	0.06	3.04	0.98	32%	
			Total	51,169	5,358	16.97	6.32	3.17	1.18	37%	
Event 12: 8/16/2024	4	Test	Nest	31,730	29,787	96.85	25.92	3.25	0.87	27%	90
			ecobee	11,281	10,075	33.45	8.68	3.32	0.86	26%	
			Sensi	7,618	6,318	19.20	5.40	3.04	0.85	28%	
			Honeywell	629	384	1.25	0.38	3.25	0.98	30%	
			Total	51,258	46,564	150.75	40.38	3.24	0.87	27%	
	2	Locational	Nest	31,672	3,569	11.59	4.80	3.25	1.35	41%	96

Event	Event Duration (Hours)	Event Type	Manu-facturer	Number of Enrolled Accounts	Total Number of Accounts Participating in Event	Aggregate (MW)		Per Account (kW)		% Load Impact	Average Event Hour Temp (°F)
						Baseline Load	Load Impact	Baseline Load	Load Impact		
Event 13: 8/29/2024			ecobee	11,253	1,137	3.97	1.47	3.49	1.29	37%	
			Sensi	7,568	540	1.74	0.65	3.22	1.20	37%	
			Honeywell	628	63	0.21	0.08	3.37	1.29	38%	
			Total	51,121	5,309	17.51	7.00	3.30	1.32	40%	
Event 14: 12/3/2024	2	Test	Nest	31,347	297	1.02	0.41	3.44	1.38	40%	21
			ecobee	11,217	151	0.70	0.29	4.64	1.94	42%	
			Sensi	7,375	53	0.17	-0.02	3.21	-0.42	-13%	
			Honeywell	659	0	n/a	0.00	n/a	0.00	n/a	
			Total	50,598	501	1.89	0.68	3.78	1.36	36%	
Event 15: 12/5/2024	4	Test	Nest	29,241	256	0.97	0.19	3.78	0.75	20%	20
			ecobee	11,338	151	0.69	0.19	4.59	1.24	27%	
			Sensi	7,373	54	0.16	0.04	2.89	0.70	24%	
			Honeywell	674	0	n/a	0.00	n/a	0.00	n/a	
			Total	48,626	461	1.82	0.42	3.94	0.91	23%	

Table 3-7 Demand Impacts by Device Manufacturer

Manufacturer	Average Number of Enrolled Accounts	Average Number of Accounts Participating in Event	Aggregate (MW)		Per Account (kW)		% Load Impact	Average Event Hour Temp. (F)
			Baseline Load	Load Impact	Baseline Load	Load Impact		
Nest	31,153	11,772	74.47	20.31	2.99	0.87	29%	82
ecobee	11,189	3,999	27.28	6.11	3.16	0.76	24%	
Sensi	7,639	2,502	16.67	4.45	2.84	0.78	27%	
Honeywell	581	148	0.98	0.29	3.17	0.98	31%	
All	50,563	18,421	119.39	31.16	3.01	0.83	28%	

Table 3-8 Demand Impacts by Event Type

Event Type	Average Number of Enrolled Accounts	Average Number of Accounts Participating in Event	Average Aggregate (MW)		Average Per Account (kW)		Average % Load Impact	Average Event Hour Temp. (F)
			Baseline Load	Load Impact	Baseline Load	Load Impact		
Locational	50,733	5,096	18.39	6.78	3.49	1.29	37%	94
Test	50,763	47,299	128.38	34.69	2.70	0.73	27%	86
Staggered	50,533	46,346	150.82	36.63	3.25	0.79	24%	92
Winter	49,612	481	1.86	0.56	3.85	1.14	30%	21
All	50,563	18,421	119.39	31.16	3.01	0.83	28%	82

Table 3-9 summarizes the load impacts across hours by manufacturer. The percentage change in load impacts from Hour 1 to Hour 2 shows the largest reduction for ecobee (-30%) and Nest (-26%), while Sensi and Honeywell experience smaller declines (-22%). From Hour 2 to Hour 3, Nest and ecobee saw the most significant drops, at -36% and -37%, respectively, whereas Sensi and Honeywell showed more moderate decreases of -17% and -27%. In the final hour, Nest, Sensi, and Honeywell continued to decline, with reductions of -32%, -35%, and -31%, respectively. However, ecobee is an exception, showing a 4% increase from Hour 3 to Hour 4, indicating a slight rebound in its load impact during the last hour.

This sustaining of impacts across hours 3 and 4 for the ecobee thermostats is also seen when the impacts are aggregated for all events (2+Hours) and for the longer 4 hour event in Figure 3-1.

Table 3-9 Change in Load Impacts Across Hours by Manufacturer

Manufacturer	% Change in Impacts Hour 1 to Hour 2	% Change in Impacts Hour 2 to Hour 3	% Change in Impacts Hour 3 to Hour 4
Nest	-26%	-36%	-32%
ecobee	-30%	-37%	4%
Sensi	-22%	-17%	-35%
Honeywell	-22%	-27%	-31%

Figure 3-1 Per-Account Impact Reduction by Event Duration, Manufacturer and Hour by Event

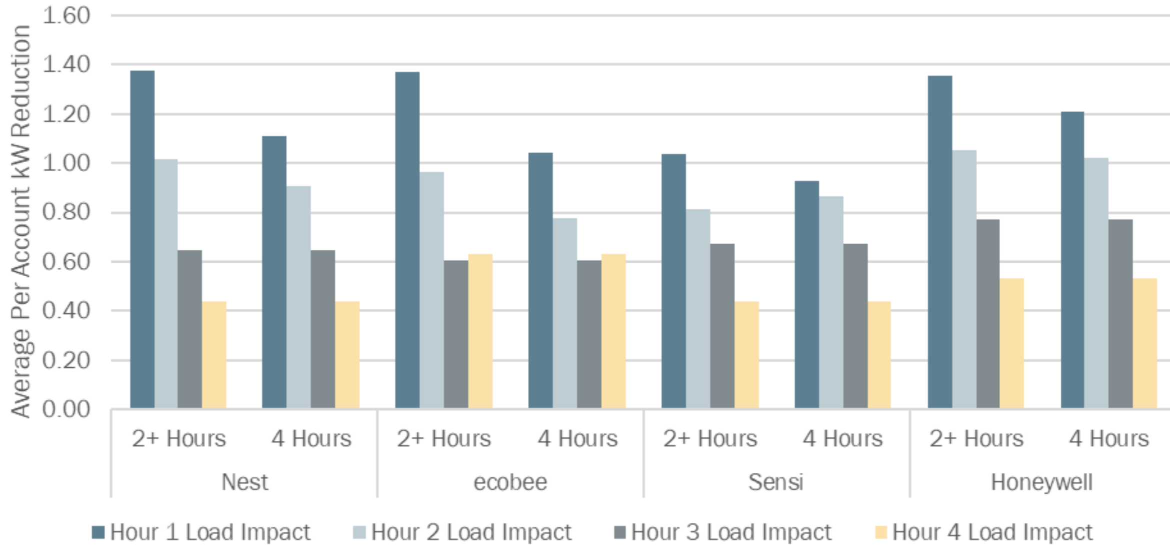


Figure 3-2 and Figure 3-3 show the impacts of the staggered group events. As shown, demand reductions declined in the later hours of the event, even as new devices initiated demand reductions. These results suggest that to maintain a more consistent load reduction, additional devices may need to be withheld during the early hours and deployed later.

Figure 3-2 Staggered Event – June 21, 2024

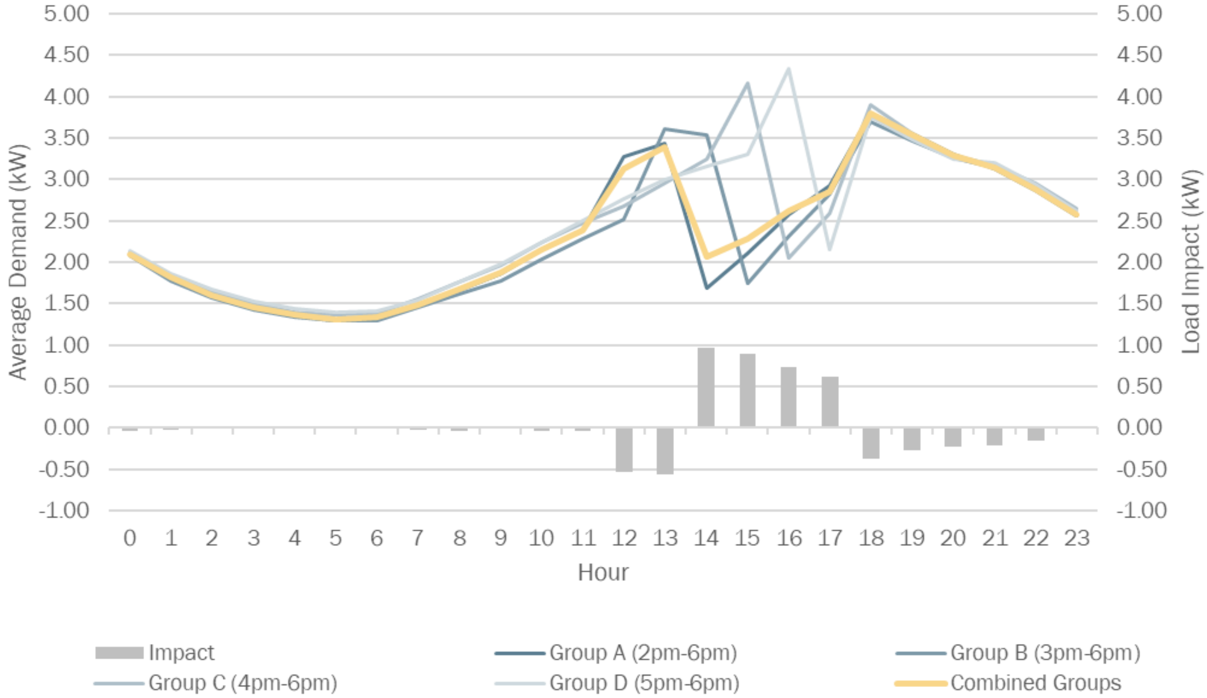


Figure 3-3 Staggered Event – July 30, 2024

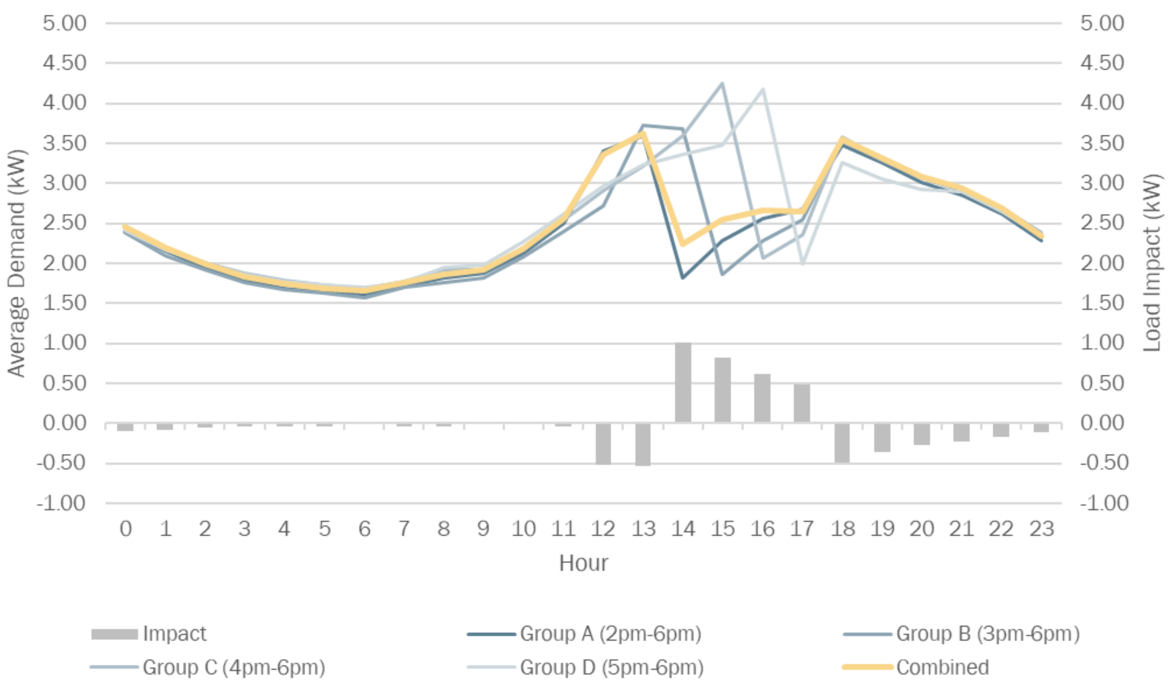


Table 3-10 presents the percentage change in load reduction impacts by event type, comparing hourly variations during each event. External factors, such as differences in weather conditions on event days, were not accounted for in this comparison.

The staggered events demonstrated a more gradual decline in load reduction impacts compared to the test events, which dispatched all devices simultaneously. This suggests that staggering event activation may help mitigate the sharp drop-off in impact observed in other event types.

Table 3-10 Comparison of Hourly Impact Changes by Event Type

Event Type	% Change in Impacts Hour 1 to Hour 2	% Change in Impacts Hour 2 to Hour 3	% Change in Impacts Hour 3 to Hour 4
Test	-12%	-23%	-28%
Locational	-29%	NA	NA
Staggered	-20%	-16%	-14%
Winter	-32%	-51%	-39%

3.3.5.2 Resource Capability Estimates

The ADM Team calculated the Cumulative Demand Response Capability, which represents the potential load reduction based on program participation. This calculation involved determining demand savings for each event, normalizing savings to reflect typical peak weather conditions (99°F for summer events, with a different normalization temperature for winter events), and applying the average normalized demand savings per participant to the total number of enrolled participants at the end of the program year. The results are summarized in Table 3-11.

Table 3-11 Resource Capability Impacts

Manufacturer	Total Number of Accounts Enrolled	Aggregate (MW)		Per Account (kW)		% Load Impact
		Baseline Load	Load Impact	Baseline Load	Load Impact	
Nest	29,467	99.67	25.21	3.38	0.86	25%
ecobee	11,332	40.50	10.00	3.57	0.88	25%
Sensi	7,201	23.70	6.13	3.29	0.85	26%
Honeywell	688	2.42	0.63	3.52	0.91	26%
All	48,688	166.30	41.96	3.42	0.86	25%

*Applies Nest Impacts

Table 3-12 compares the cumulative demand response resource capability to the PY2024 goal.

Table 3-12 Comparison of Impacts to Goal/Target

Metric	Result
Resource capability load impact (MW)	41.96
Cumulative PY2024 MEEIA III goal/target (MW)	67.67
Percent of PY2024 goal/target	62%

3.3.5.3 Cumulative DR Capability

The cumulative DR capability for the Residential DR Program in PY2024 reflects resource capability and is shown in Table 3-13.

Table 3-13 Cumulative DR Capability

Metric	Result
Cumulative DR capability (MW)	41.96
PY2024 target (MW)	67.67
Percent of PY2024 target	62%

3.3.5.4 Energy Impacts

The ADM Team calculated energy impacts resulting from the events and from the operation of Uplight's Orchestrated Energy (OE) on Sensi devices. Event day impacts were calculated by taking the difference between the summed hourly energy use of the treatment group and the summed hourly energy use over the 24-hour period on event days. The analysis of the residential demand response program assessed the impact of Uplight's Orchestrated Energy (OE) software in adjusting thermostat set points to reduce energy use during the event season. Using AMI interval energy usage, weather data, and thermostat operating state data, the evaluation employed a matched comparison group approach to estimate energy savings.

Table 3-14 summarizes the energy impacts resulting from event day savings and the energy optimization software (OE). The total savings were 605 MWh.

Table 3-14 Summary of Energy Impacts

Metric	Result (MWh)
Event season energy savings	605
Event day energy savings	*19*
Energy savings from the optimization component	*587*
PY2024 MEEIA III goal/target	6,547
Percent of goal/target	9%

3.3.5.4.1 Day of Event Energy Savings Detail

Table 3-14 summarizes the event day energy impacts by the day of the event and the device manufacturer.

Table 3-15 Energy Savings by Event and Device Manufacturer

Event	Manufacturer	Number of Enrolled Accounts	Total Number of Accounts Participating in Event	Aggregate (MWh)		Per Account (kWh)		% Load Impact	Average Event Hour Temp (°F)
				Baseline Usage	Energy Savings	Baseline Usage	Energy Savings		
Event 1: 5/21/2024	Nest	30,899	1,973	93.94	-0.83	47.61	-0.42	-1%	90
	ecobee	11,086	585	29.78	-0.41	50.90	-0.71	-1%	
	Sensi	7,878	370	16.81	-1.09	45.42	-2.95	-6%	

Event	Manufacturer	Number of Enrolled Accounts	Total Number of Accounts Participating in Event	Aggregate (MWh)		Per Account (kWh)		% Load Impact	Average Event Hour Temp (°F)
				Baseline Usage	Energy Savings	Baseline Usage	Energy Savings		
	Honeywell	478	2	0.00	0.00	0.00	0.00	n/a	
	Total	50,341	2,930	140.53	-2.33	47.96	-0.80	-2%	
Event 2: 6/13/2024	Nest	31,071	30,291	1,585.81	13.95	52.35	0.46	1%	93
	ecobee	11,113	10,920	608.73	5.46	55.74	0.50	1%	
	Sensi	7,838	7,509	376.68	-10.15	50.16	-1.35	-3%	
	Honeywell	527	519	27.47	-0.13	52.92	-0.25	0%	
	Total	50,549	49,239	2,598.68	9.13	52.78	0.19	0%	
Event 3: 6/17/2024	Nest	31,102	3,726	238.11	-0.62	63.91	-0.17	0%	93
	ecobee	11,106	1,166	78.15	-0.66	67.03	-0.57	-1%	
	Sensi	7,783	567	34.49	-1.11	60.83	-1.95	-3%	
	Honeywell	542	65	4.21	-0.16	64.83	-2.50	-4%	
	Total	50,533	5,524	354.97	-2.55	64.26	-0.46	-1%	
Event 4: 6/21/2024	Nest	31,000	29,383	1,652.70	22.52	56.25	0.77	1%	92
	ecobee	11,088	9,986	599.96	10.30	60.08	1.03	2%	
	Sensi	7,756	6,578	353.87	-7.62	53.80	-1.16	-2%	
	Honeywell	541	279	15.83	-0.16	56.74	-0.58	-1%	
	Total	50,385	46,226	2,622.35	25.03	56.73	0.54	1%	
Event 5: 6/25/2024	Nest	31,005	3,695	252.27	2.93	68.27	0.79	1%	101
	ecobee	11,117	1,162	82.97	0.06	71.40	0.05	0%	
	Sensi	7,685	563	36.20	-1.28	64.29	-2.28	-4%	
	Honeywell	554	64	4.58	0.05	71.60	0.74	1%	
	Total	50,361	5,484	376.02	1.75	68.57	0.32	0%	
Event 6: 7/15/2024		0	0	0.00	0.00	70.16	-0.18	n/a	95
	ecobee	11,150	1,153	86.09	0.49	74.67	0.42	1%	
	Sensi	7,630	554	36.25	-1.52	65.43	-2.74	-4%	
	Honeywell	562	64	4.42	-0.38	69.04	-5.93	-9%	
	Total	19,342	1,771	126.76	-1.41	71.58	-0.80	-1%	
Event 7: 7/16/2024	Nest	31,149	29,453	1,357.67	-22.75	46.10	-0.77	-2%	74
	ecobee	11,147	10,010	504.50	8.38	50.40	0.84	2%	
	Sensi	7,623	6,345	279.72	-12.99	44.09	-2.05	-5%	
	Honeywell	562	286	13.11	-0.07	45.85	-0.24	-1%	
	Total	50,481	46,094	2,155.01	-27.43	46.75	-0.60	-1%	
Event 8: 7/30/2024	Nest	31,306	29,657	1,728.47	46.93	58.28	1.58	3%	91
	ecobee	11,193	10,063	617.28	8.20	61.34	0.81	1%	
	Sensi	7,615	6,444	354.21	-12.95	54.97	-2.01	-4%	
	Honeywell	566	301	17.90	0.29	59.45	0.95	2%	

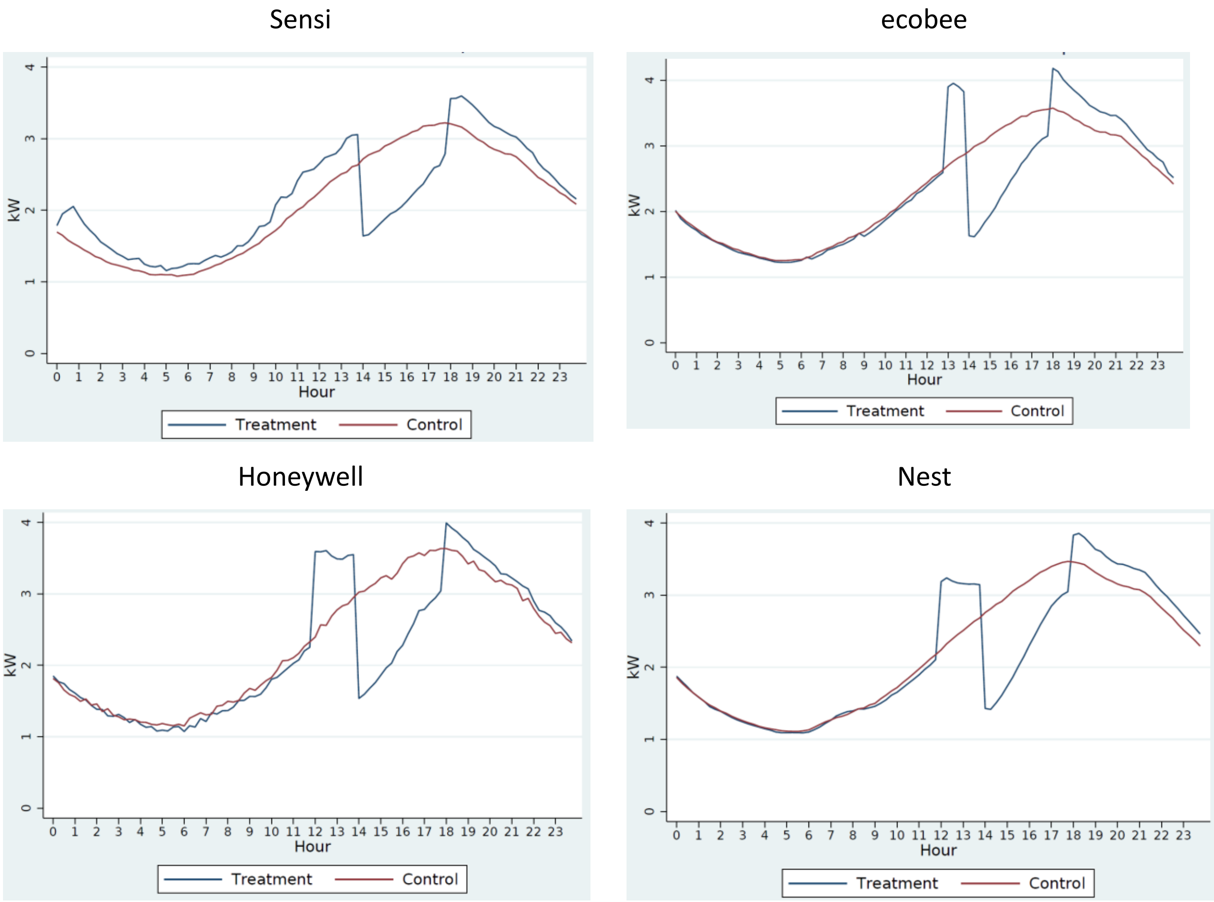
Event	Manufacturer	Number of Enrolled Accounts	Total Number of Accounts Participating in Event	Aggregate (MWh)		Per Account (kWh)		% Load Impact	Average Event Hour Temp (°F)
				Baseline Usage	Energy Savings	Baseline Usage	Energy Savings		
	Total	50,680	46,465	2,717.86	42.46	58.49	0.91	2%	
Event 9: 7/31/2024	Nest	31,298	3,625	217.46	0.57	59.99	0.16	0%	92
	ecobee	11,185	1,146	74.11	0.36	64.67	0.31	0%	
	Sensi	7,604	545	30.83	-0.87	56.58	-1.59	-3%	
	Honeywell	565	64	3.90	-0.11	60.90	-1.69	-3%	
	Total	50,652	5,380	326.30	-0.05	60.65	-0.01	0%	
Event 10: 8/5/2024	Nest	31,667	3,616	235.29	-3.16	65.07	-0.87	-1%	96
	ecobee	11,279	1,144	80.07	-0.06	69.99	-0.06	0%	
	Sensi	7,627	543	32.50	-1.39	59.86	-2.56	-4%	
	Honeywell	616	63	4.24	-0.17	67.34	-2.75	-4%	
	Total	51,189	5,366	352.10	-4.79	65.62	-0.89	-1%	
Event 11: 8/6/2024	Nest	31,657	3,615	206.92	-6.72	57.24	-1.86	-3%	93
	ecobee	11,278	1,140	69.43	-1.03	60.90	-0.90	-1%	
	Sensi	7,618	541	28.94	-1.72	53.49	-3.17	-6%	
	Honeywell	616	62	3.36	-0.55	54.24	-8.90	-16%	
	Total	51,169	5,358	308.65	-10.02	57.61	-1.87	-3%	
Event 12: 8/16/2024	Nest	31,730	29,787	1,609.84	5.69	54.04	0.19	0%	90
	ecobee	11,281	10,075	576.70	1.24	57.24	0.12	0%	
	Sensi	7,618	6,318	324.32	-10.11	51.33	-1.60	-3%	
	Honeywell	629	384	21.07	0.45	54.88	1.16	2%	
	Total	51,258	46,564	2,531.93	-2.74	54.38	-0.06	0%	
Event 13: 8/29/2024	Nest	31,672	3,569	215.12	-4.03	60.28	-1.13	-2%	96
	ecobee	11,253	1,137	73.25	-0.95	64.42	-0.83	-1%	
	Sensi	7,568	540	31.38	-0.98	58.11	-1.81	-3%	
	Honeywell	628	63	3.86	-0.34	61.22	-5.44	-9%	
	Total	51,121	5,309	323.61	-6.29	60.95	-1.19	-2%	
Event 14: 12/3/2024	Nest	31,347	297	20.32	0.25	68.43	0.84	1%	21
	ecobee	11,217	151	13.39	-0.22	88.65	-1.44	-2%	
	Sensi	7,375	53	3.02	-0.28	56.94	-5.31	-9%	
	Honeywell	659	0	0.00	0.00	0.00	0.00	n/a	
	Total	50,598	501	36.73	-0.25	73.31	-0.50	-1%	
Event 15: 12/5/2024	Nest	29,241	256	18.95	-0.31	74.03	-1.19	-2%	20
	ecobee	11,338	151	14.54	-0.50	96.31	-3.33	-3%	
	Sensi	7,373	54	3.38	-0.77	62.54	-14.32	-23%	
	Honeywell	674	0	0.00	0.00	0.00	0.00	n/a	
	Total	48,626	461	36.87	-1.58	79.98	-3.43	-4%	

Table 3-16 summarizes the event day energy savings by device manufacturer. Energy savings were negative for two manufacturers, Sensi and Honeywell, with a greater negative impact for Sensi devices. Figure 3-4 illustrates the reason for the negative event savings for Sensi devices by showing the treatment and comparison group energy use during the June 13, 2024, event. As shown, Sensi devices appear to operate in a pre-cooling mode starting in the first hour of the event day, leading to sustained higher energy use up until the event period. A similar effect is seen on other event days as well, and figures for all event days by device are presented in Volume 2 of the Demand Response Portfolio Evaluation Report.

Table 3-16 Event Day Energy Savings by Device Manufacturer

Manufacturer	Average Number of Enrolled Accounts	Average Number of Accounts Participating in Event	Aggregate (MWh)		Per Account (kWh)		% Savings
			Baseline Usage	Energy Savings	Baseline Usage	Energy Savings	
Nest	31,153	11,772	9,688.53	53.79	822.98	4.57	1%
ecobee	11,189	3,999	3,508.95	30.64	877.40	7.66	1%
Sensi	7,639	2,502	1,942.58	(64.83)	776.54	(25.92)	-3%
Honeywell	581	148	123.95	(1.30)	839.03	(8.78)	-1%
All	**50,563**	**18,421**	**15,264.01**	**18.30**	**828.62**	**0.99**	**0%**

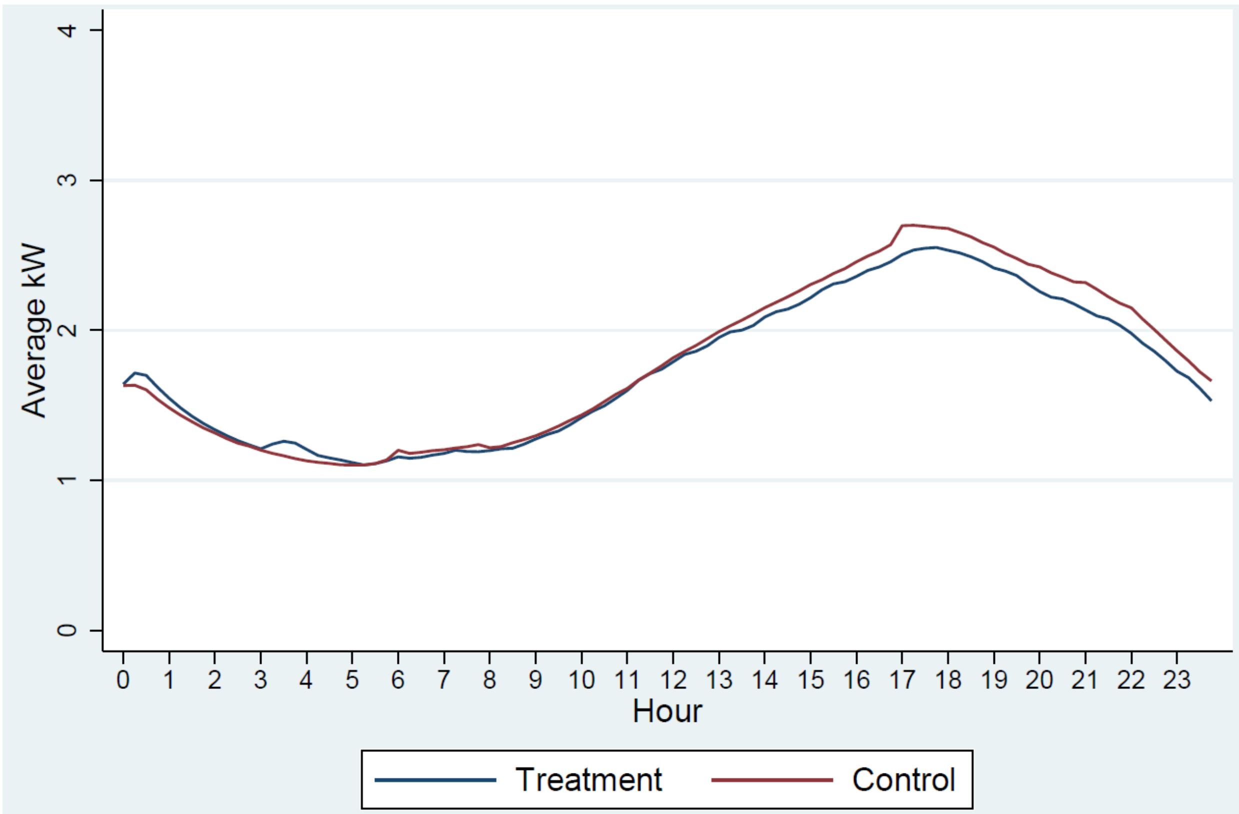
Figure 3-4 Load Impact for June 13, 2024 Event by Manufacturer



3.3.5.4.2 Energy Optimization

The energy optimization savings totaled 586.56 MWh. Figure 3-5 presents the average energy use during the evaluation period for the energy optimization treatment group and the comparison group.

Figure 3-5 Comparison of Energy Optimization Treatment and Comparison Energy Use During the Evaluation Period



3.4 Process Evaluation Findings

3.4.1 Required Process Evaluation Questions

This section presents findings related to addressing the five process evaluation questions required by Missouri Code of State Regulations section 20 CSR 4240-22.070(8).

3.4.1.1 What are the primary market imperfections that are common to the target market segment?

The primary market imperfections common to the target market segment in the Residential Demand Response Program include:

- **Limits on Customer Participation:** The program is open only to Ameren Missouri electric customers who have central air conditioning or electric heating systems—such as electric resistance heating or heat pumps—controlled by eligible smart thermostats. Customers must also have Wi-Fi internet access. These requirements limit the potential pool of participants, which can affect the overall effectiveness and scalability of the program.
- **Randomization Limits Demand Response Potential:** Historically, the program has employed a randomized control trial approach, which randomly assigned devices to treatment and matched comparison groups for each event. The use of a randomized matched comparison group limits the number of devices that participate in an event and thereby reduces the

reduction in load that can be achieved. A matched comparison group evaluation strategy was adopted for PY2024.

- **Technological Dependence:** The program relies on specific smart thermostat brands (Google Nest, Copeland Sensi, Honeywell, Ecobee) and energy optimization software (Orchestrated Energy) to manage load and drive energy savings. This dependence on particular technologies may limit the program's flexibility and adaptability to new or alternative solutions.

3.4.1.2 Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?

The target market segment for the Residential Demand Response Program is defined as Ameren Missouri electric customers who possess central air conditioning systems or electric heating controlled by eligible smart thermostats. This segment is appropriately defined for the program's objectives, which include managing load and achieving energy savings through the use of smart thermostats.

We note that the market segment is narrowly defined in that it focuses on customers with central cooling and electric heating loads that are controlled by a smart thermostat, rather than broadly focusing on residential demand response.

3.4.1.3 Does the mix of end-use measures included in the program appropriately reflect the diversity of end-use energy service needs and existing end-use technologies within the target market segment?

The Residential Demand Response Program reflects the diverse energy service needs and technologies within its target market. The program targets Ameren Missouri electric customers with central air conditioning or electric heating systems managed by smart thermostats, such as Google Nest, Copeland Sensi, Honeywell, and Ecobee. These thermostats enable load management and energy savings through randomized control trials, with devices assigned to treatment and matched comparison groups. By incorporating both summer and winter events, the program addresses seasonal energy needs, while peak-load shaving and test events enhance its adaptability to varying scenarios.

Expanding the target market segment to include all customers with central air conditioning, even those without smart thermostats or required internet service, could broaden participation by incorporating other end-use measures. For example, using a load control switch system could effectively reach this wider customer base. However, this approach may result in higher program costs due to the need for additional device installations.

If the target market were further expanded to encompass all residential loads suitable for demand response, additional measures could include water heater demand response and behavioral demand response initiatives.

3.4.1.4 Are the communication channels and delivery mechanisms appropriate for the target market segment?

The communication channels and delivery mechanisms for the Residential Demand Response Program are tailored to effectively reach Ameren Missouri electric customers who have central air conditioning systems or electric heating managed by qualifying smart thermostats. The program utilizes a mix of communication channels, including direct mail, email, and online platforms, ensuring wide-reaching engagement and comprehensive dissemination of program information. The top three sources of awareness reported by 61 survey respondents who enrolled in 2024 were Email from Ameren Missouri

(51%), bill insert/mailer (25%), and the Ameren Missouri website (18%) indicating that the channels are all effectively reaching customers.

The program incentivizes participation through financial rewards. The integration of smart thermostats and energy optimization software (Orchestrated Energy) facilitates energy savings for those customers with eligible thermostats as well.

A minority of customers that enrolled in 2024, 25%, reported that they had concerns about participating when they enrolled, primarily about comfort and the ability of the utility to control the temperature.

Table 3-17 summarizes the program and delivery metrics and suggests that the communication processes and delivery of the program are effective, with some potential for improvement noted below.

- There may be some opportunities to improve program information since not all participants thought this addressed their questions. Questions not addressed included how much control participants have over the temperature setting, whether changing the temperature would prevent them from getting a discount, and what the goals of the program are. We note that the program website provides an extensive FAQ that addresses most of these topics.
- A small share of customers (14%) were not aware that they could opt-out of events by changing the thermostat temperature.

Table 3-17 Communication and Delivery Metrics

Metric	Percent of Respondents
The information about the program completely or mostly met their needs (participants who rated it 4 or 5 on the survey item, n = 59).	64%
Enrolling the thermostat was very easy or pretty easy (participants who rated it 4 or 5 on the survey item, n = 61).	92%
Received event notifications (n=160).	93%
Understands that they can opt-out of events by changing temperature (n=158)	86%
Understands home will be pre-cooled (n = 158)	95%

Program staff identified sustaining demand response for the full event period as a key challenge. To address this, the program has experimented with staggering events, starting them at different times for subsets of participants and running them for shorter durations. While this staggered approach may help level load reductions across the full event period, it also limits the total achievable reduction potential.

3.4.1.5 What can be done to more effectively overcome the identified market imperfections and to increase the rate of customer acceptance and implementation for select end-uses/measure groups included in the Program?

To more effectively overcome the identified market imperfections and increase the rate of customer acceptance and implementation for select end-uses/measure groups included in the Residential Demand Response Program, these strategies can be considered:

- **Technology Diversification:** Expanding the range of technologies for demand response such as HVAC switches, water heater demand response devices, or behavioral demand response can expand the reach to customers who don't have a smart thermostat or do not want to limit cooling during hot weather.

- **Improved Communication on Customer Flexibility and Opting Out.** Survey responses suggest some customers were not aware of how they could change their thermostat settings or the implications of opting out. Additional communication on this, such as through emails sent prior to events, could help build customer knowledge and understanding.

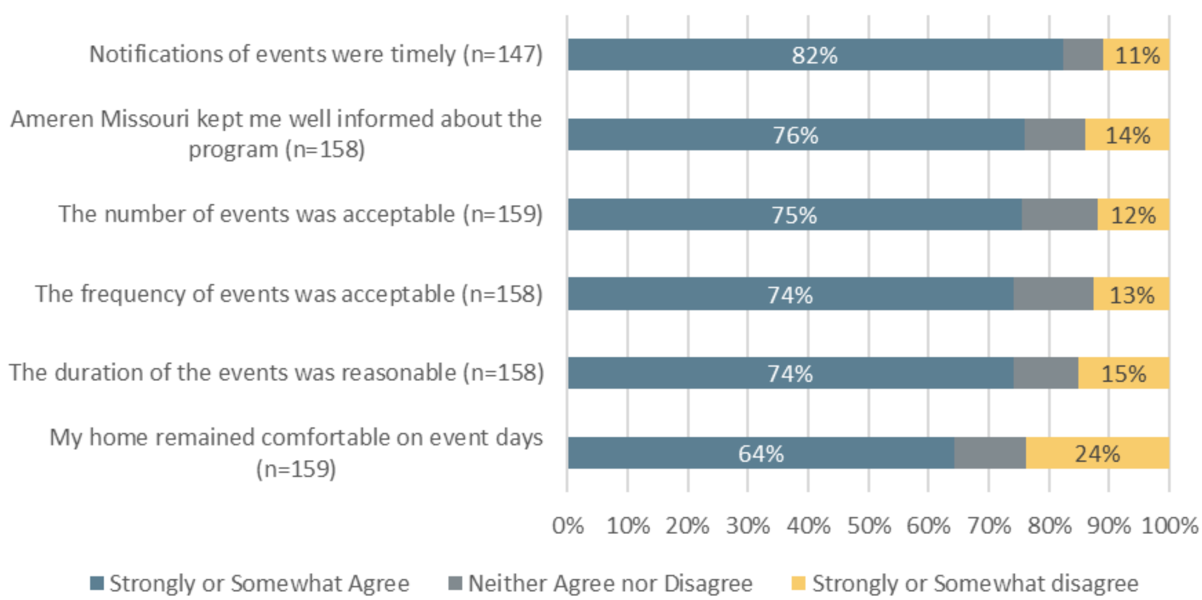
3.4.2 Additional Process Evaluation Findings

Customers generally found the number, frequency, and duration of events to be acceptable. As shown in Figure 3-6, approximately three-quarters of respondents reported no issues with these aspects of the program. Among those who did not find the number of events acceptable, preferences varied widely, with some wanting very few events (e.g., 0-3) and others desiring significantly more events (e.g., 10, weekly, or more than 15). Similarly, customers who felt the length of events was unreasonable often suggested durations that aligned with the actual length of program events (e.g., 2-4 hours), indicating possible confusion about the event timing.

While many participants were satisfied with home comfort during events, it remained a concern for 24% of respondents, highlighting an area for potential improvement.

Communication about events was rated positively by most participants. Seventy-six percent of respondents felt well-informed by Ameren Missouri, while 14% did not share that sentiment. Furthermore, 82% of respondents agreed that event notifications were timely, with only 11% expressing dissatisfaction.

Figure 3-6 Customer Acceptability Responses



Most participants were highly satisfied with the program and expressed a strong likelihood of participating again next year. Table 3-18 demonstrates respondents' likelihood of continued participation and overall program satisfaction. Specifically, 73% of respondents reported being very or somewhat satisfied with the program, indicating overall positive experiences. Additionally, 76% rated their likelihood of participating next year as 8 or higher on a 10-point scale, reflecting strong retention potential. These findings suggest that the program meets participant expectations for many participants. Some participants (13%, not shown) were somewhat or very dissatisfied with the program.

Table 3-18 Continued Participation and Program Satisfaction

Metric	Percent of Respondents
Rated likelihood of participating next year as 8 or higher (n = 160).	76%
Very or somewhat satisfied with the program (n = 159).	73%

* Rated on a 0 (not at all likely) – 10 (very likely) scale.

3.5 Key Findings and Recommendations

The following are the main findings and recommendations from the evaluation of the program.

- **The event day impacts were 31.16 MW, while the cumulative DR capability reached 41.96 MW (62% of the savings target).** Program enrollment increased from an average of 43,340 accounts in PY2023 to 50,563 in PY2024, reflecting both broader participation and the addition of new device types, including Honeywell thermostats, which made up a small portion of the total. While the average number of accounts participating in an event declined from 28,985 to 18,421, this was primarily due to a shift in event strategy: the number of locational events increased from three in PY2023 to eight in PY2024. Participation in non-locational summer events remained strong, averaging 46,918 accounts per event in PY2024 — exceeding the 42,756 to 43,854 account range observed across 10 demand response events in PY2023.
- **The program delivered a total energy savings impact of 605 MWh, with the majority (587 MWh) attributed to the energy optimization software running on Sensi devices.** Day-of-event energy savings contributed an additional 18 MWh, though performance varied across device manufacturers. Notably, Sensi devices exhibited atypically high load during the pre-event period, leading to inconsistencies in observed savings.
- **Program communication processes have generally been effective.** Most participants reported receiving event notifications and understood both that their homes were pre-cooled prior to events and that they could opt out of the program by adjusting their thermostat temperature. However, some customers who enrolled in 2024 indicated that the information provided about program operations did not meet their needs. Specifically, they expressed confusion about how adjusting the thermostat temperature would impact their participation, despite this information being available on the program website. Additionally, 14% of all respondents did not understand that they could opt out of events by changing their thermostat settings.

  Recommendation 1: Enhance participant communication about adjusting the thermostat during events and the implications for receiving program credits.

  - Send clear, concise emails prior to events that explain how participants can adjust their thermostats and the impact on program credit eligibility.
  - Include step-by-step instructions or visuals for common thermostat models.
  - At the start of the summer, distribute a comprehensive guide via email or mail detailing how the program works, including pre-cooling, event participation, and opt-out procedures.

- Provide tailored emails or text messages to new participants that explain program features in detail.

- **Discomfort during events was the primary pain point for participating customers.** Twenty-four percent of participants disagreed that the home remained comfortable during the event.

  Recommendation 2: Develop strategies to improve customer acceptance.

  - Consider tiered participation with varying bill credits based on how long an event customers agree to participate in (e.g., 2, 3, or 4 hours).
  - Provide educational support to customers to help them manage their comfort during the event such as recommending the use of fans, dehumidifiers, and closing blinds during summer events and wearing additional layers during winter events.
  - Provide references to the Pay As You Save® Program to assist customers with improving the thermal resilience of the home to maintain comfortable temperatures during events.

- **Sustaining demand response performance for the full duration of events has been a challenge.** To address this, program staff have implemented staggered event starts to help maintain a consistent response throughout the event period. However, program staff noted that they have not removed customers who opt out during events, which may also contribute to difficulties in sustaining demand response throughout the full event duration.

  Recommendation 3: Adopt enforcement strategies to encourage sustained event participation.

  - Enforce the program provision that allows for the removal of customers who opt out of three or more events, as this could encourage greater adherence to program requirements.
  - Explore alternative incentive structures, such as a per-event credit tied to participation in a specified portion of the event (e.g., 50%, 75%, or 100%). This approach could motivate participants to remain engaged for longer periods while ensuring fairness and flexibility.

  Recommendation 4: Evaluate the role of seasonal events in future EM&V planning.

  - Clarify the objectives of each event type (e.g., operational vs. test) and determine whether season-specific test events – such as winter tests – should be accounted for in Resource Capability estimates.
  - Consider incorporating a seasonally adjusted evaluation framework aligned with MISO's coincident peak definitions for summer, fall, winter, and spring.

4 Business Demand Response

The Business Demand Response Program is designed to reduce loads during peak demand periods. The program aggregator handles customer recruitment and enrollment, load reduction nominations, creation of customized load curtailment strategies, demand response event dispatch, and customer relationship maintenance for participating businesses. Businesses may use direct load control or manual response to reduce load during events. Participation in the program is voluntary and participants may choose not to engage in an event. Customers who have opted out of participating in demand side management programs may participate in the Business Demand Response Program.

4.1 Program Activity Summary

Table 4-1 summarizes the Business Demand Response Program at the end of PY2024.

Table 4-1 Summary of Program Activity – Business Demand Response

Metric	Cumulative MEEIA III Goal	Enrollment	Percent of Goal
Accounts		1,040	
Enrolled Nominated Capacity (MW)	137.04	207.92	152%

Table 4-2 summarizes the events called during PY2024. The program called three events, two during the summer event season and one winter event in December. All events lasted for one hour. The low participation rate in the winter event was because it was only conducted with new enrollments who had not participated in the August or September events.

Table 4-2 Summary of Events – Business Demand Response

Event Date	Duration	Number of Customer Accounts	Nominated Capacity (MW)
8/20/2024	2:00 - 3:00 PM	1,013	193.58
9/12/2024	2:00 - 3:00 PM	1,017	194.88
12/10/2024	2:00 - 3:00 PM	15	11.12

Participants spanned a range of industries (Table 4-3). The distribution of participant nominations by industry shows that while education accounts for the highest percentage of total accounts (33%), it represents only 10% of nominations, with a relatively low average nomination per account (59.20 kW). Conversely, manufacturing, which comprises 13% of accounts, has the highest proportion of nominations (35%) and an average nomination per account of 535.71 kW.

Industries such as agriculture and mining (6% of accounts, 20% of nominations) and healthcare, pharmaceuticals, and biotech (<1% of accounts, 5% of nominations) have high average nominations per account (710.08 kW and 1,081.22 kW, respectively), indicating significant energy usage among fewer participants.

Smaller industries, including retail (3% of accounts, 2% of nominations) and government (2% of accounts, 2% of nominations), have lower average nominations per account (115.00 kW and 183.89 kW, respectively). Some sectors, such as primary and secondary education (2% of accounts, <1% of nominations) and business and consumer services (16% of accounts, 5% of nominations), also show relatively low energy demand per account.

Table 4-3 Summary of Participant Distribution by Industry

Industry	Percent of Accounts	Percent of Nominations	Average Nomination per Account (kW)
Manufacturing	13%	34%	535.71
Agriculture and Mining	6%	20%	710.08
Education	33%	10%	59.20
Energy and Utilities	18%	7%	74.44
Business and Consumer Services	16%	5%	64.15
Healthcare, Pharmaceuticals and Biotech	<1%	5%	1,081.22
Wholesale and Distributors	<1%	2%	465.00
Retail	3%	2%	115.00
Government	2%	2%	183.89
Real Estate and Construction	1%	1%	213.64
Media and Entertainment	<1%	<1%	185.00
Primary and Secondary Education	2%	<1%	32.19
Nonclassifiable Establishments Class	<1%	<1%	85.00
Laboratory Apparatus & Analytical	<1%	<1%	295.00
Transportation and Storage	<1%	<1%	255.00
Travel and Recreation	<1%	<1%	37.50
Nonclassifiable Establishments	<1%	<1%	20.00
Miscellaneous Plastics Products	<1%	<1%	20.00
Motor Vehicle Parts Manufacturing	<1%	<1%	10.00
Other	2%	10%	1,264.25

4.2 Data Collection Activities

The ADM Team administered the survey to a census of unique contacts with contact information available at the time the surveys were fielded.

Table 4-4 Summary of Data Collection – Business Demand Response

Data Collection Activity	Mode	Time Frame	Population Targeted	Completed Surveys / Interviews	Response Rate
Participant survey	Email	October 2024	265	18	6.8%

4.3 Estimation of Ex Post Savings

The ADM Team utilized the program's established baseline methodology to assess participant performance during demand response events. This methodology employs a "highest 4 of 5" approach, wherein the total daily energy consumption from the four highest consumption days out of the most recent five non-holiday, non-event, weekdays preceding the event day will be used to estimate baseline energy use. Excluded from this calculation are NERC holidays.

Additionally, a symmetrical baseline adjustment was applied. This adjustment is derived from the average difference in demand, assessed on an hourly interval basis, between the actual metered demand on an event day and the provisional baseline demand during the specified baseline adjustment window (the two-hour period immediately preceding the start of the hour in which dispatch instructions are sent to participants). The baseline adjustment was capped at 75% of the provisional baseline estimated via the high 4 of 5 approach.

The calculation of the hourly demand reduction is shown below in Equation 4-1.

Equation 4-1 Hourly Demand Reduction

$$kW(savings, hr = i\ ) = kW_{base,hr=i} \times \left(\frac{kW_{norm}}{kW_{base,norm}}\right) - kW_{hr=i}$$

Where,

$kW(savings, hr = i\ )$= kW savings for hour i

$kW_{base,hr=i}$ = Average of qualifying baseline days' kW values for hour i

kW_{norm}= kW value of the normalizing period on the event day

$kW_{base,norm}$= Average kW value for baseline days during the normalizing period

$kWhr\ =\ i$ = kW value during hour i as determined from interval meter data

4.3.1 Calculation of Event kWh Energy Savings

Demand reduction during events, precooling periods, and snapback periods were referenced to calculate average annual energy savings. The equation for this, shown below (Equation 4-2), is based on reference to hourly data. The summation was for all periods during the event and for two hours before and after the event (to cover precooling/load shifting and snapback periods).

Equation 4-2 Energy Savings (kWh) Calculation

$$kWh_{saved} = \sum_{t} kW_t^{reduction}$$

Where,

t = the hourly interval for which energy savings is calculated

EventPeriod = all time intervals from event start to two hours after the event end

$kW_t^{reduction}$ = demand reduction calculated at time t

4.3.2 Calculation of Average Reduction and Cumulative Demand Response Capability

4.3.2.1 Weather Sensitivity Analysis

The ADM Team calculated the average kW reduction, as estimated above, during events as the Event kW savings.

Additionally, the ADM Team calculated the Cumulative Demand Response Capability. The cumulative demand response capability is the evaluated MW from customers enrolled during each year's summer demand response events plus the tested MW reductions from new enrollees after the summer event period but before the end of the program year. The ADM Team used the sum of the average kW reduction for customers that participated during events and the test event performance of new customers that did not participate in any of the demand response events. The calculation steps are:

- Calculate demand response event kW savings for each event.
- Calculate the average event performance for event participants and the test event performance for customers that enrolled after the event season.
- If applicable, adjust the customer's demand response event performance to reflect normal weather during peak conditions (normalized for a peak temperature of 99°F in summer. Winter demand response participation data did not exhibit weather sensitivity as discussed below).
- Calculate the average normalized demand response savings per participant and multiply it by the number of participants enrolled at the end of the program year. Equation 4-3

The ADM Team applied a weather-sensitive regression to each customer to test for weather sensitivity. The regression model was a simple linear model based on 65 °F base CDH (calculated using the method outlined in Equation 3-1) and with the regression models specified below.

Equation 4-4 Weather-Sensitivity Adjustment Model

$$kW_t = \alpha_0 + \beta_{\mathrm{CDH}} * CDH_t + \varepsilon_t \text{ (for summer events)}$$

$$kW_t = \alpha_0 + \beta_{\mathrm{HDH}} * HDH_t + \varepsilon_t \text{ (for winter events)}$$

Where,

α_0 = Intercept

t = the 1-hour interval for which kW level is being predicted

CDH_t and HDH_t = cooling and heating degree hours at time t, respectively

β_{CDH} and β_{HDH} = coefficients of CDH_t and HDH_t variables, respectively

ε_t = Error term

The regression model above is similar to the weather-sensitive adjustment customer baseline load modifier used by PJM and can take the place of the symmetrical baseline adjustment described in Section 4.3.3.1. For each participant, ADM reviewed model fit parameters including the model coefficient of determination (R^2) and the normalized root-mean-square error (RMSE). Participants whose corresponding models provided reasonable fits[1] were characterized as potentially weather sensitive. For these customers, ADM developed an alternative baseline estimate by replacing the symmetrical baseline adjustment with the weather-sensitive adjustment (which is the product of the slope of the linear fit and the difference between event-day temperatures and comparison-day temperatures). There were three major findings from this study.

- **Most customers, as weighted by event impacts, are not weather-sensitive**. The majority of program impacts are attributable to industrial, agricultural, mining, and otherwise non-weather-sensitive customers. While 47% of customers were identified as weather sensitive, they represented just 17% of program demand reductions.
- **The symmetrical baseline adjustment adequately accounts for weather impacts**. The overall difference in the demand reduction as measured by the standard and weather-sensitive baseline models was just 3%. Moreover, since the 3% applies to 17% of program impacts, the program-level difference is approximately 0.6%. This is well within the margin of overall measurement uncertainty.
- **None of the participants in the winter events exhibited weather-sensitivity**. There were only 14 participants in the December event, and none of their models passed the selection criteria for weather sensitivity.

For program year 2024, there is no reason to adjust measured impacts for weather sensitivity. However, as the makeup of participants can change over time, we recommend to screen for weather sensitivity and potentially include the weather-sensitive-adjustment as an evaluation option for certain participants[2].

4.3.2.2 Weather Indexing for Seasonal Resource Capability Determination

While both the symmetrical baseline adjustment and weather-sensitive adjustment can adequately model customer baseline loads, the weather-sensitive adjustment can be used to extrapolate measured impacts to different temperatures. For example, while the ADM scaled observed event impacts in the two summer events to a 99 °F day, the weather-sensitive customers are expected to save almost twice as much on a 99 °F day compared to the events in 2024, which were called during average temperatures in the low 80s °F. For the purpose of scaling program-level impacts, it is not appropriate to scale each individual participant's baseline to those that would prevail on a 99 °F day, since their event-hour usage would presumably also change compared to performance observed in 2024. Rather, ADM modeled the aggregate response of weather-sensitive customers as a function of event-day CDH and extrapolated to a 99 °F day. In doing so, ADM preserved the 75% of baseline cap that is applied to the symmetrical baseline adjustment. For the customers that participated in summer 2024, the resource capability indexed to 99 °F capacity estimate is 162 MW, compared to the 144 MW demonstrated during the comparably mild summer days. The winter event participants were not found to be weather sensitive, so their resource capability contribution remains at 6.5 MW, for a total sum of 168.25 MW as of the end of 2024.

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[1] The selection criteria were R^2 of at least 0.5 and an NRMSE under 20%. Alternate specifications, such as an R^2 of at least 0.7 and an NRMSE under 25% did not produce appreciably different results.

[2] For example, both baseline algorithms can be developed for each participants, and the one with the lower NRMSE can be selected.

4.3.3 Ex Post Savings Results

4.3.3.1 Event Season Demand Savings

The event season achieved an overall performance of 143.63 MW, which represents 73% of the total nominated capacity of 197.01 MW. Performance varied slightly across the two individual events, with the highest achievement occurring on September 12, 2024, when 76% of the nominated capacity was met (147.79 MW out of 194.88 MW). The event on August 20, 2024, achieved 72% of the nominated capacity (139.16 MW out of 193.58 MW).

On average, each account contributed 141.23 kW in demand savings across the season, with individual event averages of 137.37 kW on August 20 and 145.32 kW on September 12.

Table 4-5 Event Season Event Performance Summary, Demand Savings

Event	Event Date	Time	Total Nominated Capacity (MW)	Event Season Performance (MW)	% of Nominated Capacity Achieved	Average Per Account Performance (kW)
1	8/20/2024	2-3 PM	193.58	139.16	72%	137.37
2	9/12/2024	2-3 PM	194.88	147.79	76%	145.32
Overall Event Season Result			197.01	143.63	73%	141.23

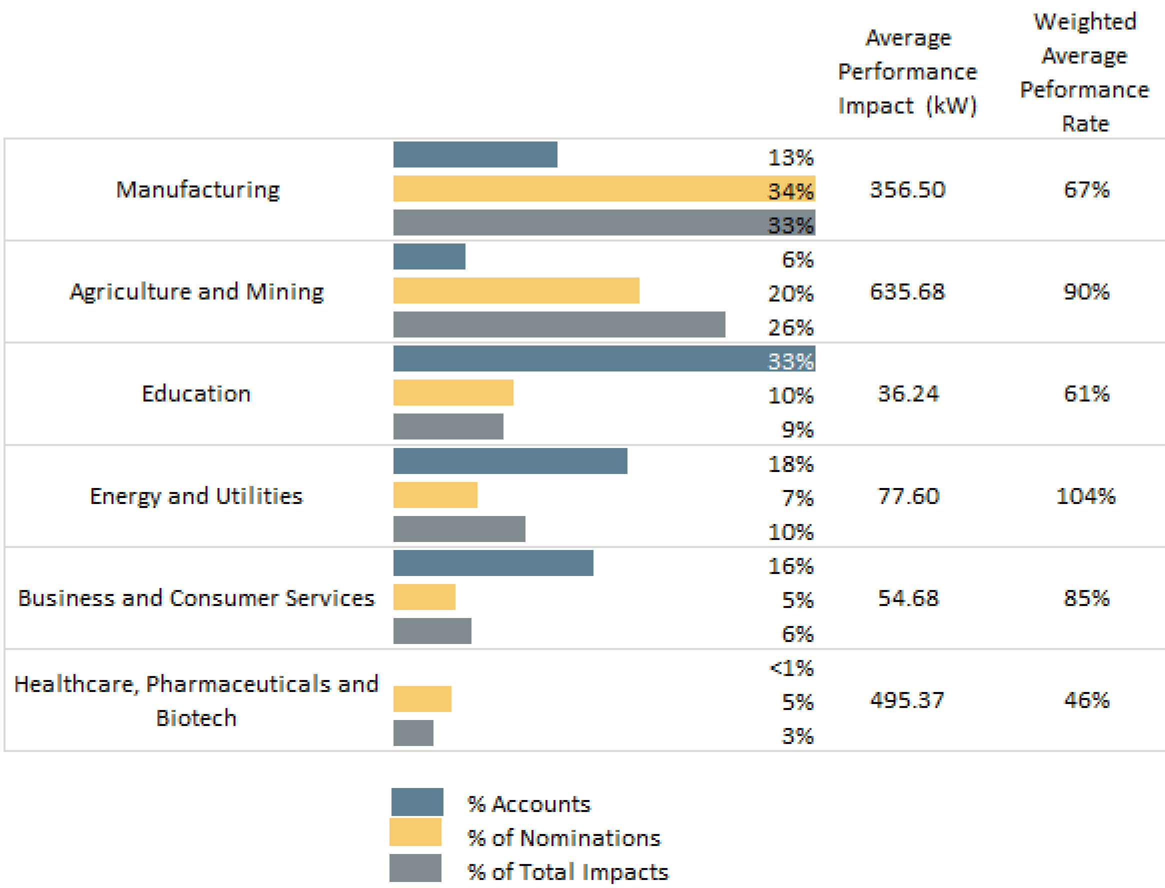
Figure 4-1 summarizes performance during the events for the industries contributing the most to the total reductions.

The weighted average performance rate represents the total summed demand reductions divided by the total summed nominations for each industry group, indicating how effectively each sector met or exceeded its nominated capacity.

- Energy and Utilities had the highest performance rate at 104%, meaning it exceeded its total nominated capacity.
- Agriculture and Mining achieved a strong performance rate of 90%, demonstrating high efficiency in meeting demand reduction targets.
- Business and Consumer Services also performed well with an 87% rate, indicating reliable performance relative to its nominations.
- Manufacturing, a major participant, achieved 67% of its nominated capacity, showing a moderate response level.
- Education, despite having the highest number of accounts, had a 61% performance rate, reflecting lower demand savings relative to its nominations.
- Healthcare, Pharmaceuticals, and Biotech had the lowest performance rate at 46%, suggesting challenges in meeting its nominated reduction targets.

The average performance impacts largely tracked with nominations but varied significantly across industries, reflecting differences in energy usage and demand reduction capacity. Agriculture and Mining had the highest average performance impact at 635.68 kW, followed by Healthcare, Pharmaceuticals, and Biotech at 495.37 kW, despite its lower participation rate. Manufacturing, a key contributor in both nominations and total impacts, had an average performance impact of 356.50 kW, while Business and Consumer Services achieved 54.68 kW. Energy and Utilities had a lower average impact of 76.87 kW. Education, which represented the largest share of accounts, had the lowest average performance impact at 36.24 kW, indicating lower per-account reductions.

Figure 4-1 Performance by Industry



* Weighted average performance rate was equal to the total summed reductions divided by the total summed nominations for the industry group.

4.3.3.2 December Event Demand Savings

One event lasting one hour was called during December. Fourteen accounts participated in the December event. The load drop during the event was 6.53 MW, or 59% of the nominated capacity.

Table 4-6 December Event Savings

Event Date	Time	Total Nominated Capacity (MW)	Event Season Performance (MW)	% of Nominated Capacity Achieved	Average Per Account Performance (kW)
12/10/2024	2-3 PM	11.12	6.53	59%	435.32

4.3.3.3 Energy Savings

Table 4-7 summarizes the energy savings for each event and in total. The energy savings achieved during the three events was 27% of the cumulative MEEIA III goal.

Table 4-7 Energy Savings Comparison to Goal

Event	Event Date	MEEIA III Goal / Target (MWh)	Energy Savings (MWh)	Percent of Goal/Target
1	8/20/2024		247	
2	9/12/2024		291	
3	12/10/2024		11	
	Total	2,000	549	27%

The energy savings performance across events resulted in a total reduction of 549 MWh, with an average per-account savings of 0.53 MWh, representing 10% of baseline load. The event on September 12, 2024, achieved the highest total energy savings at 291 MWh, with an average of 0.29 MWh per account, corresponding to 11% of baseline load. The August 20, 2024, event delivered 247 MWh in savings, averaging 0.24 MWh per account and 10% of baseline load. The December 10, 2024, event had significantly fewer participating accounts (15), but those participants achieved a higher per-account savings of 0.73 MWh, though total savings were lower (11 MWh) and represented 8% of baseline load. These results suggest that while larger events achieved greater total energy savings, smaller events with fewer participants could still deliver notable per-account reductions.

Table 4-8 Energy Savings Performance Summary

Event	Event Date	Time	Participating Accounts	Total Energy Savings (MWh)	Average Per Account Energy Savings (MWh)	Savings as a Percent of Baseline Load
1	8/20/2024	2-3 PM	1,013	247	0.24	10%
2	9/12/2024	2-3 PM	1,017	291	0.29	11%
3	12/10/2024	2-3 PM	15	11	0.73	8%
			Overall Result	549	0.53	10%

4.3.3.4 Resource Capability Estimate

The ADM Team calculated the Cumulative Demand Response Capability, which represents the total evaluated demand reduction (MW) from customers enrolled during the summer demand response events, along with tested MW reductions from new enrollees who joined after the summer event period but before the end of the program year. This metric provides a more comprehensive estimate of the program's full demand response potential.

Table 4-9 PY2024 Resource Capability Estimate

Metric	Result
Total accounts enrolled as of the end of 2024	1,031
Total nominated capacity (MW)	205.35
PY2024 resource capability estimate (MW)	168.23
PY2024 per-account resource capability estimate (kW)	163.17

Table 4-10 presents a comparison of the resource capability estimate to the cumulative MEEIA III goal. The program's resource capability was equal to 123% of the goal.

Table 4-10 Comparison of Resource Capability to Goal/Target

Metric	Result
PY2024 resource capability estimate (MW)	168.23
PY2024 target	137.04
Percent of PY2024 target	123%

4.3.3.5 Cumulative DR Capability Estimate

Table 4-11 presents the cumulative DR capability in comparison to the target savings.

Table 4-11 Comparison of Cumulative DR Capability to Target

Metric	Result
PY2024 cumulative DR capability (MW)	168.23
PY2024 target	137.04
Percent of PY2024 target	123%

4.4 Process Evaluation Findings

4.4.1 Required Process Evaluation Questions

This section presents findings related to addressing the five process evaluation questions required by Missouri Code of State Regulations section 20 CSR 4240-22.070(8).

4.4.1.1 What are the primary market imperfections that are common to the target market segment?

Market imperfections that may prevent full participation or optimal event response include:

- Low energy costs may suppress interest in earning performance incentives for curtailing load during events.
- Businesses may lack sufficient knowledge about the benefits of DR programs or the financial incentives offered. They may also not fully understand the operational flexibility needed to participate or how DR can align with their business objectives.
- Non-residential customers may perceive the time and effort to enroll in DR programs, set up automation, or manually manage loads during events as too high relative to the benefits.
- Businesses might be hesitant to participate in DR programs due to concerns about potential disruptions to their operations.
- Some facilities may not have the necessary technology, such as building energy management systems (BEMS), or automated demand response (ADR) systems, to respond effectively to DR events.

4.4.1.2 Is the target market segment appropriately defined, or should it be further subdivided or merged with other market segments?

The target market for the program is business customers within the Ameren Missouri service area. This market is effectively subdivided into two primary groups: managed customers, who have an assigned key account representative, and unmanaged customers, who do not. Additionally, the program collaborates with aggregators to recruit small and medium-sized businesses, leveraging the aggregators' existing relationships and expertise to engage these customers.

The segmentation strategy outlined is well-suited for a non-residential demand response program. Larger, managed customers typically have the capacity for significant load reductions and possess the internal resources needed to identify, plan, and execute demand response efforts. These customers' established relationships with Ameren Missouri account managers further support recruitment and build trust in the program. Conversely, unmanaged accounts require a distinct recruitment strategy including cold calling by the implementer, who possesses expertise in demand response for a variety of industries. Engaging smaller customers through aggregators offers an efficient and scalable solution, eliminating the need for resource-intensive, customized demand response solutions for numerous small businesses. This approach ensures broader program reach while maintaining cost-effectiveness.

4.4.1.3 Does the mix of end-use measures included in the program appropriately reflect the diversity of end-use energy service needs and existing end-use technologies within the target market segment?

The program's approach to load reduction is appropriately customized to the specific facility and operational requirements of participating customers. This flexibility ensures that the program accommodates the diverse range of end-use energy needs and existing technologies within the target market segment. For smaller customers, including retail chains, the program leverages aggregators who have knowledge of effective load-shedding strategies tailored to these businesses.

4.4.1.4 Are the communication channels and delivery mechanisms appropriate for the target market segment?

Yes, the communication channels and delivery mechanisms are well suited to the target market segment. For managed customers, outreach is facilitated by Ameren Missouri through introductions to EnelX, ensuring a seamless initiation of customer engagement. For unmanaged accounts, EnelX utilizes a combination of existing relationships—often established through work in other service areas—and proactive outreach, including cold calling, to inform potential participants about the program.

EnelX's industry expertise plays a critical role in effectively engaging customers and tailoring curtailment strategies to their specific operations. For instance, in agricultural operations, they focus on opportunities like managing water pumps, while for cryptocurrency mining facilities, they might explore air conditioning adjustments or schedule shifts for mining processes. This targeted approach addresses key market imperfections, such as information gaps, perceived effort, and concerns about operational disruptions.

Program staff have also reported that event notifications and subsequent customer communications have been effective, further demonstrating the appropriateness of the communication and delivery mechanisms for the program. Survey responses indicate this as well. All respondents reported that they received a notification and most received them from multiple sources (i.e., email, text, and telephone). Additionally, 94% of respondents reported that they received enough notice to implement their DR plan and one respondent reported that they sometimes receive enough notice.

At the time of the survey, the program had called two events. Seventy-eight percent of respondents reported responding to both, while 22% reported responding to only one.

4.4.1.5 What can be done to more effectively overcome the identified market imperfections and to increase the rate of customer acceptance and implementation for select end-uses/measure groups included in the Program?

Survey results indicate that a majority of respondents (94%) do not have an automated demand response (ADR) system in place. Assisting participants with implementing ADR systems could enhance the consistency and reliability of energy curtailment during demand response events. ADR systems automate the process of reducing energy use, minimizing the need for manual intervention, which can improve response times and reduce operational burdens for participants. Additionally, ADR systems provide participants with better visibility into their energy consumption patterns, helping them identify opportunities for further efficiency improvements.

Although only one respondent without ADR expressed interest in adopting such a system, this low interest may stem from a lack of familiarity with ADR technology and its benefits. To address this, the program could explore offering education, technical assistance, and financial incentives. Similar initiatives by utilities like Pacific Gas and Electric have been used to encourage ADR adoption by reducing upfront costs and providing hands-on support for implementation. [3]

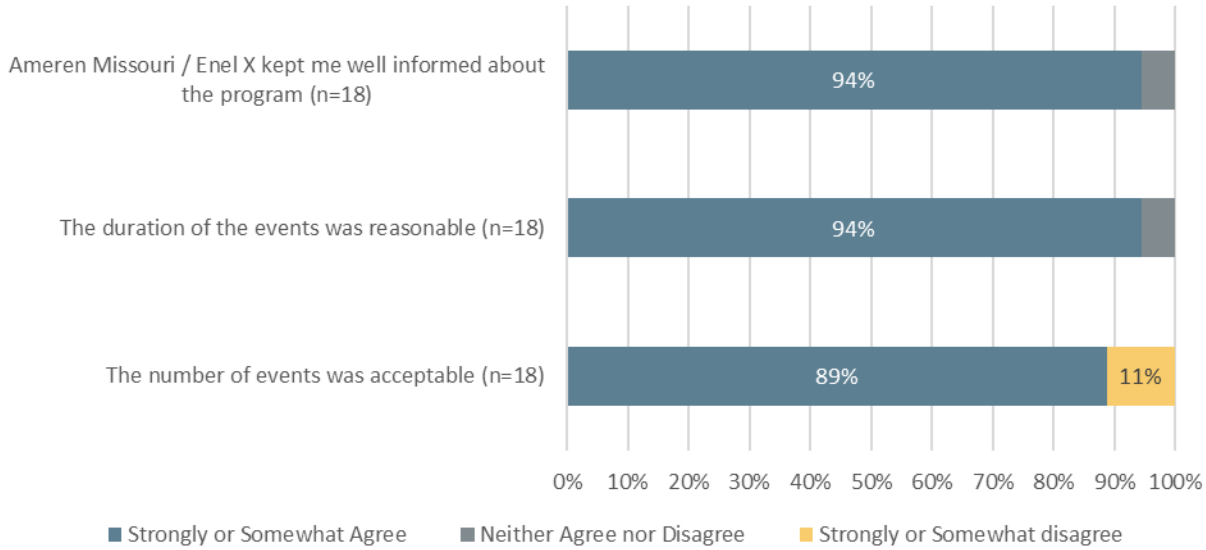
Additionally, other utilities have successfully implemented smart thermostat-based demand response programs with small businesses, achieving measurable energy reductions. Smart thermostats are user-friendly and cost-effective, making them an attractive option for smaller customers who may not be ready to invest in full-scale ADR systems. This approach could be considered as a scalable strategy for increasing demand response participation in the small business sector.

4.4.2 Additional Process Evaluation Findings

Customers generally found the number, frequency, and duration of events to be acceptable. As shown in Figure 4-2, approximately 90% of respondents reported no issues with these aspects of the program. In terms of preferred number of events, one respondent stated a preference for two to three real events, but only one test event.

[3] https://www.pge.com/assets/pge/docs/save-energy-and-money/energy-savings-programs/adr-program-manual.pdf

Figure 4-2 Customer Acceptability Responses



Nearly all participants were satisfied with the program and expressed a strong likelihood of participating again next year. Table 4-12 highlights participants' high level of satisfaction and likelihood of future participation. Specifically, 94% of respondents reported being very or somewhat satisfied with the program, indicating overall positive experiences. Additionally, 100% rated their likelihood of participating next year as 8 or higher on a 10-point scale, reflecting strong retention potential. These findings suggest that the program meets participant expectations for many participants. One participant expressed some dissatisfaction with the program.

Table 4-12 Continued Participation and Program Satisfaction

Metric	Percent of Respondents
Rated likelihood of participating next year as 8 or higher (n = 18).	100%
Very or somewhat satisfied with the program (n = 18).	94%

* Rated on a 0 (not at all likely – 10 (very likely) scale.

4.5 Key Findings and Recommendations

The following are the main findings and recommendations from the evaluation of the program.

- **The Business DR program is well positioned to achieve its demand reduction targets.** During the event season, the program delivered 143.63 MW of load reduction, achieving 73% of the total nominated capacity of 197.01 MW. Performance varied across events, with the highest achievement on September 12, 2024, when 76% of the nominated capacity was met (147.79 MW out of 194.88 MW). The August 20, 2024, event achieved 72% of the nominated capacity (139.16 MW out of 193.58 MW).

  Beyond individual events, the total PY2024 resource capability estimate reached 168.23 MW, exceeding the program goal by 23% (123% of the PY2024 goal). This estimate accounts for demand reductions from customers enrolled during the summer event season and tested reductions from new enrollees who joined after the event period but before the end of the program year. These results demonstrate the program's ability to deliver substantial and reliable load reductions.

- **The program's flexibility, coupled with implementer expertise, supports participants in identifying effective curtailment strategies that work best for their organization.** The program's design allows participants to adopt curtailment strategies that align with their unique operational needs. This targeted approach effectively addresses key market imperfections, such as information gaps and concerns about operational disruptions. Expanding the program to formally incorporate automated demand response (ADR) systems and smart thermostats could further streamline participation and improve overall performance.

  Recommendation 1: Expand program offerings to include ADR systems and smart thermostat options for small businesses.

  - Offer financial incentives and technical support to help businesses adopt ADR systems, improving curtailment consistency while reducing manual effort.
  - Pilot a smart thermostat-based demand response option for small businesses to provide a cost-effective and user-friendly alternative to ADR systems.
  - Highlight the program's flexibility in communications to emphasize that curtailment strategies can be customized to fit the unique needs of each business.
- **Program communication processes have been effective.** All survey respondents reported receiving event notifications, with most receiving them through multiple channels (email, text, and phone). Additionally, 94% reported receiving enough notice to implement their curtailing plans. While managed accounts are supported by assigned key account representatives, unmanaged customers are engaged through outreach by aggregators and implementers. Tailoring communication and support for unmanaged customers could enhance participation consistency.
- **Respondents are satisfied with the program and likely to continue participating.** Ninety-four percent of respondents reported being satisfied with the program, and 100% expressed a high likelihood of participating again. This positive feedback reflects the program's ability to meet participant expectations. Additionally, the program's segmentation and outreach efforts appear to support recruitment and retention goals effectively.