KyPSC Case No. 2024-00264
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VERIFICATION

STATE OF NORTH CAROLINA	)	
	)	**SS:**
COUNTY OF WAKE	)	

The undersigned, Melissa Adams, Director Analytics, being duly sworn, deposes and says that she has personal knowledge of the matters set forth in the foregoing rebuttal testimony and that it is true and correct to the best of her knowledge, information and belief.

Melissa Adams

Melissa Adams, Affiant

Subscribed and sworn to before me by Melissa Adams on this 2nd day of October, 2024.

PEGGY HOLTON NOTARY PUBLIC WAKE COUNTY, NC

Peggy Holton

NOTARY PUBLIC

My Commission Expires: 12/22/2026

VERIFICATION

STATE OF NORTH CAROLINA)

) SS:

COUNTY OF MECKLENBURG)

The undersigned, Cara Wells, Senior Products and Service Manager, being duly sworn, deposes and says that she has personal knowledge of the matters set forth in the foregoing data requests, and that the answers contained therein are true and correct to the best of her knowledge, information and belief.

Cara Wells

Cara Wells, Affiant

Subscribed and sworn to before me by Melissa Adams on this 3rd day of October, 2024.

ASHISH K C NOTARY PUBLIC CABARRUS COUNTY, NC

NOTARY PUBLIC

My Commission Expires: 04/03/2027

VERIFICATION

STATE OF NORTH CAROLINA)
) **SS:**
COUNTY OF MECKLENBURG)

The undersigned, Mark Meetsma, Senior Products and Services Manager, being duly sworn, deposes and says that he has personal knowledge of the matters set forth in the foregoing data requests, and that the answers contained therein are true and correct to the best of his knowledge, information and belief.

Mark Meetsma, Affiant

Subscribed and sworn to before me by Melissa Adams on this 1st day of October, 2024.

CHRISTINE HARTUNG NOTARY MY COMMISSION EXPIRES Nov. 30, 2026 PUBLIC UNION COUNTY, N.C.

Christine Hartung
NOTARY PUBLIC

My Commission Expires: Nov. 30, 2026

VERIFICATION

STATE OF OHIO)
) **SS:**
COUNTY OF HAMILTON)

The undersigned, Trisha Haemmerle, Lead Strategy & Collaboration Manager, being duly sworn, deposes and says that she has personal knowledge of the matters set forth in the foregoing data requests, and that the answers contained therein are true and correct to the best of her knowledge, information and belief.

Trisha Haemmerle
Trisha Haemmerle, Affiant

Subscribed and sworn to before me by Trisha Haemmerle on this 14th day of October, 2024.

Emilie Sunderman
NOTARY PUBLIC

My Commission Expires: July 8, 2027

EMILIE SUNDERMAN
Notary Public
State of Ohio
My Comm. Expires
July 8, 2027

VERIFICATION

STATE OF NORTH CAROLINA	)	
	)	SS:
COUNTY OF WAKE	)	

The undersigned, Jean Williams, Manager DSM Analytics, being duly sworn, deposes and says that she has personal knowledge of the matters set forth in the foregoing data requests, and that the answers contained therein are true and correct to the best of her knowledge, information and belief.

Jean Williams

Jean Williams, Affiant

Subscribed and sworn to before me by Jean Williams on this 8 day of October, 2024.

NOTARY PUBLIC

My Commission Expires: Feb. 5, 2029

SHANE CARTER NOTARY PUBLIC BRUNSWICK COUNTY, NC

Duke Energy Kentucky
Case No. 2024-00264
STAFF First Set of Data Requests
Date Received: September 27, 2024

STAFF-DR-01-001

REQUEST:

Refer to the Application, pages 5–6 and Appendix A.

a. Explain how Duke Kentucky models the cost-effectiveness of each program.

b. Provide the avoided costs used to model the cost-effectiveness scores

RESPONSE:

a. Duke Energy Kentucky models cost-effectiveness by multiplying each measure's forecasted participation by the NPV of avoided costs for that measure. Cost-effectiveness is modeled by program by comparing each program's avoided cost benefits to the total program costs, excluding EM&V costs.

b. The table below provides the avoided costs used to model the cost-effectiveness scores.

Cost Effectiveness Test Results - 2024-25 Forecast
as amended 8/15/24

Program Name	UCT	TRC	RIM	PCT	NPV Avoided Costs
Residential Programs					
Residential Smart $aver®	1.38	1.20	0.54	5.13	824,058
Peak Time Rebate Pilot Program	0.15	0.15	0.15		62,566
Non-Residential Programs					
Business Energy Saver	2.61	1.72	0.75	3.51	2,788,470
PowerShare®	2.07	5.21	2.07		1,500,316

PERSON RESPONSIBLE: Melissa Adams

STAFF-DR-01-002

REQUEST:

Refer to the Application, page 7. Explain which standards have changed for Duke Kentucky to modify or expand its The Non-Residential Smart $aver® Incentive Program. Also include in the response, if possible, which new efficient technology Duke Kentucky considered including in its proposal but did not ultimately choose to include, and why Duke Kentucky chose to exclude the technology.

RESPONSE:

Federal standards have changed regarding minimum efficiency requirements for HVAC equipment which caused Duke Energy Kentucky to modify measures based on those changes. The Company undertakes an annual review of technologies and efficiency levels through internal sources and with the assistance of outside technical experts to assure compliance with federal standards. The review includes the existing technology categories as well as other emerging areas for energy efficiency.

Below are the measures that were reviewed but not requested as part of the application due to not passing the TRC at a 1.0 or higher.

- Computer network EMC
- EFM Cooler Motor Controls - EFM replacing ECM
- EFM Freezer Motor Controls - EFM replacing ECM
- EMS control on HVAC DX AC 135-240kBtuh

- EMS control on HVAC DX AC 240-760kBtuh
- EMS control on HVAC DX AC 65-135kBtuh
- EMS control on HVAC DX AC grtr 760kBtuh
- EMS control on HVAC DX AC less than 65kBtuh
- EMS control on HVAC DX HP 135-240kBtuh
- EMS control on HVAC DX HP 65-135kBtuh
- EMS control on HVAC DX HP grtr 240 kBtuh
- EMS control on HVAC DX HP Packaged lt. 65kBtuh
- EMS control on HVAC DX HP Split lt. 65kBtuh
- Freezer - Ultra Low Temp
- Freezer H.E. High Performance Lab Grade
- Ground Source Heat Pump Closed Loop Wtr to Air
- Ground Source Heat Pump Closed Loop Wtr to Wtr
- Ground Source Heat Pump Direct Geoexchange Wtr to Wtr
- Ground Source Heat Pump Open Loop Water to Air
- Ground Source Heat Pump Open Loop Wtr to Wtr
- Heat Pump Chiller
- LED Greenhouse SUP (250 to 399W) rplc or ILO 600 W HID
- LED Greenhouse SUP (400 to 699W) rplc or ILO 1000 W HID
- LED Greenhouse SUP (lt. 250W) rplc or ILO 400 W HID
- Refrigerator H.E. High Performance Lab Grade
- Solar Water Heater with Electric Backup

- Vertical Unit Ventilators (VUV)

In its April 27, 2020, Order in Case No. 2019-277, on pages 13-14, the Commission stated:

> In Case No, 2017-00427, the Commission stated that the cost-effectiveness of Duke would be closely reviewed in the 2019 DSM filing. Hence, the Commission finds that the individual modifications that are not cost-effective, as demonstrated by a TRC score of less than one, are unreasonable and should not be approved. The Commission further finds that the proposed modifications that are cost effective, as demonstrated by a TRC score greater than one, are reasonable and thus should be approved.

Given this guidance from the Order in Case No. 2019-00277, Duke Energy Kentucky does not request approval for any measures that do not meet the TRC threshold of 1.0 or higher. The Company evaluated a variety of lighting, food service and HVAC measures to add to the program but did not request the addition of any measure that did not pass TRC.

PERSON RESPONSIBLE: Cara Wells

STAFF-DR-01-003

REQUEST:

Refer to the Application, page 11. Provide the percentage of energy reduction to qualify for each proposed incentive tier.

RESPONSE:

The program's Summer 2022 test of different incentive levels found that the average hourly load impact for all test participants was 10.7%. This data was used as a guide point to develop the incentive tiers.

- The base incentive tier ($1.00/kWh) would be earned for 0%-9.99% in energy reduction compared to the customer's baseline usage.
- The next incentive tier ($1.25/kWh) would be earned for 10%-19.99% in energy reduction compared to the customer's baseline usage.
- The highest incentive tier ($1.50/kWh) would be earned for 20%+ in energy reduction compared to the customer's baseline usage.

The company proposes that it reserves the opportunity to recalibrate the tier levels and accompanying incentives (in customers' favor) if it is deemed necessary to gain further insights into the relationship between incentive levels, customer usage reductions, and customer adoption / enrollment.

When the Company has gathered enough information for its electric reliance assessment model, the Company may modify the tiers to consider information from the model.

For additional information about the Summer 2022 test, please see STAFF-DR-01-003 Attachment, page 2 – 1.1.1 Load Impacts section.

PERSON RESPONSIBLE: Mark Meetsma

Peak Time Credit Pilot Evaluation

Summer 2022 Incentive Test

Prepared for Duke Energy Kentucky

May 18, 2023

Prepared by Resource Innovations in partnership with Apex Analytics

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Contents

1 Executive Summary

In the summer of 2020, Duke Energy Kentucky (DEK or Company) launched the "Peak Time Credit" (PTC) Pilot, which offers customers the opportunity to lower their electric bill by reducing electric usage during Critical Peak Events (CPE). Designed for residential customers, the Pilot is an incentive-based demand response (DR) program based on a Peak Time Rebate (PTR) rate design. The Pilot was approved by the Kentucky Public Service Commission on April 27, 2020, under Case Number 2019-00277 and approved for a research extension for Summer 2022.

The pilot was designed to include up to eight summer CPEs (May to October), two winter CPEs (November to April), and two flexible CPEs (January – December). Summer events were from 3 PM to 7 PM, and winter events were from 6 AM to 10 AM. CPE notifications were generally provided to customers on the day prior to the event, but events could be called with as little as one hour notification. The Company agreed to implement at most one event per year with less than one day prior notice. Baseline usage estimates were determined from the usage history, and credits were paid for any net reduction in usage as compared to the baseline usage that occurred during the CPE. Participants enrolled in the first evaluation phase, conducted between August 2020 and October 2021, each received a $0.60 cents per kWh credit and are referred to as original participants in this report. To evaluate the impact of differing incentive levels in the second evaluation phase, new participants were enrolled before the Summer 2022 season and are referred to as incentive test participants. Approximately half of the new participants received $0.60 per kWh credit while the remainder of new participants received $1.20 per kWh credit. If no reduction occurred, the participant did not receive a credit, but was not penalized. Findings from the Summer 2022 season of the Pilot are documented in this evaluation report.[1]

1.1 Overall Findings

The primary research objective for the incentive test phase of the Pilot was to determine if customers receiving the $1.20 incentive produced larger load reduction impacts than the customers receiving the $0.60 incentive.

As part of the evaluation plan approved, the following additional research questions were investigated in order to provide context to the findings and facilitate a deeper understanding of impact performance drivers and customer experience:

- Were customers effectively educated and motivated to use the program?
- Did event notifications reach the customer such that they could effectively respond to the event?
- What were the most common actions participants took to reduce usage during summer events?

[1] Summer 2022 load impacts from the Original Participant group are provided in Appendix A.

- What were the most common reasons participants gave for not reducing usage during summer events?
- What were the participants most frequently identified program improvement recommendations?
- How satisfied were participants with the Pilot, and did it vary by incentive level?

The following subsections provide an additional level of detailed key findings to the research questions presented above.

1.1.1 Load Impacts

In Summer 2022, a new subset of participants was tested to determine the impact of different incentive levels on average hourly load impacts per participant. Incentive test customers received either $0.60 per kWh or $1.20 per kWh. Original participants enrolled in 2020 receive $0.60 per kWh and are included in the table below for reference. In Summer 2022, seven events were called between 3 PM – 7 PM for incentive test customers and three events were called between 3 PM – 7 PM for original Pilot participants. Table 1-1 displays average hourly load impacts per customer, by incentive segment. Incentive test customers provided an overall average hourly load impact per customer in Summer 2022 of 0.23 kW or 10.7% while participants receiving $0.60 per kWh provided a reduction of 0.22 kW (9.9%) and participants receiving $1.20 per kWh provided a 0.25 kW reduction (11.6%). The difference in load reductions was not statistically significant. For original Pilot participants, average hourly load impacts per customer during the Summer 2022 season were 0.15 kW or 6.0%.

Table 1-1: Summary of Average Hourly Load Impacts - Summer 2022[2]

Segment	Load w/o DR* (kW)	Load w/ DR (kW)	Impact (kW)	Impact (%)
$0.60/kWh	2.21	1.99	0.22	9.9%
$1.20/kWh	2.12	1.87	0.25	11.6%
All Incentive Test Participants	2.16	1.93	0.23	10.7%
Original Participants	2.53	2.38	0.15	6.0%

*DR represents Demand Response (i.e., a PTC critical peak event).

[2] The primary focus of the evaluation was estimating impacts for the incentive test customers. Impacts from the original participants group were included to provide point of comparison. Note, the event dates for the Incentive Test and Original Participant treatment groups were different. See Section 3.3 for a comparison of impacts across the same set of days.

Key findings pertaining to load impacts from the Pilot include:

- Statistically significant load impacts were detected across both incentive levels for customers in Single-family and Multi-family homes.
- At the population level, participants receiving the $1.20 per kWh incentive had slightly larger load impacts (0.25 kW) than participants receiving $0.60 per kWh (0.22 kW), however the difference in impacts were not statistically significant.
- At the population level, participants receiving the $1.20 per kWh incentive had slightly lower reference loads than that of participants receiving $0.60 per kWh though the difference was not statistically significant.
- Single-family participants receiving $1.20 per kWh consistently provided larger load impacts (0.29 kW) than single-family participants receiving $0.60 per kWh (0.24 kW), though the difference was not statistically significant. Multi-family participants receiving $1.20 per kWh provided smaller load impacts (0.15 kW) than multi-family participants receiving $0.60 per kWh (0.18 kW) at the segment level, however the difference was not statistically significant.
- As Summer 2022 was the incentive test participants first event season, impacts were larger than that of original participants (i.e., 2022 was the third summer of participation for the original group) on the three common event days in Summer 2022. This is consistent with what was observed in the original pilot population in prior seasons, with their first event season (Summer 2020) producing load impacts 2.7 times larger than that of Summer 2021.
- Original participants' load impacts were comparable in Summer 2022 to Summer 2021 at the population level.

1.1.2 Process Evaluation

Key findings and recommendations pertaining to the process evaluation include:

Participation Awareness and Motivation

- Most respondents were aware of their participation in the Pilot with 99.6% of participants recalling their participation.
- The most important reason provided by participants for joining the Pilot was to save money on their electricity bill, with an average rating of 9.3 out of 10 on average.

Peak Time Credit Awareness and Notification Satisfaction

- In the post-event survey, the majority (82.4%) of respondents recalled the event and a majority became aware through email notifications from Duke Energy (73.2%).
- Respondents generally agreed that Duke Energy notified them in a timely manner (9.2 out of 10), provided them with helpful information (8.9 out of 10), and gave

them confidence of which hours they can earn credits on Peak Days (9.5 out of 10).

Response to Peak Time Credit Event

- In the post-event survey, 80.6% of the respondents reported being home during the event and 82.4% of respondents took action or changed their behavior due to the event.
    - Customers in the $0.60 per kWh group were home more frequently (84.9%) during the event than customers in the $1.20 per kWh group (76.7%), a statistically significant difference.
- The most commonly reported actions taken by participants were turning off lights in unoccupied rooms, increasing temperature on their thermostat, and shifting large appliance use. There were no statistically significant differences between the two incentive groups in terms of actions taken.
- Participants generally find responding to an event to be relatively easy, giving an average rating of 8.5 out of 10. There was no statistically significant difference in this rating between the two incentive groups.
- Commonly reported challenges to event response included not being able to think of any additional actions to take (25.3%), not having any barriers to shifting usage (14.8%), and already using very little energy (14.0%). There were no statistically significant differences between the incentive groups in terms of challenges to reduce usage.

Satisfaction with Peak Time Credit and Incentive Test

- Participants were generally satisfied with Pilot implementation overall (7.7 out of 10), but customers receiving $1.20 per kWh bill credit were statistically significantly more satisfied (8.1 out of 10) compared to $0.60 per kWh bill credits (7.3 out of 10).
- Customers would generally recommend the Pilot to others (8.4 out of 10) and would continue participating in future seasons (88.8%).
    - The $1.20 per kWh group was statistically significantly more likely to recommend the Pilot to others (8.6 out of 10) than the $0.60 per kWh group (8.1 out of 10).
    - The $0.60 per kWh group was statistically significantly more likely to respond “No” or “Don’t know” when asked if they would continue participating in the Pilot in the future (12.7%) than the $1.20 per kWh group (9.3%).
- The Net Promoter Score[3] (NPS) for the full set of incentive test customers is 46.7. The NPS for the $0.60 per kWh group is 38.4 while the NPS for the $1.20 per

[3] Net Promoter Score is a popular metric used to estimate how likely a customer is to promote a program. It is calculated by subtracting the percentage of customers who rate their likelihood to recommend the program from 1 to 6 (detractors) from the percentage of customers who rate their likelihood to recommend the program 9 or 10 (promoters).

kWh group is 53.7. The difference in scores between the two groups is statistically significant – however, the positive magnitude of the scores indicate that there is a large proportion of customers in both groups that would recommend the Pilot to others.

- Participants receiving $0.60 per kWh bill credits are statistically significantly less satisfied (6.1 out of 10) with the credits earned than customers receiving $1.20 per kWh bill credits (7.2 out of 10).
- Out of the customers receiving the $0.60 per kWh bill credit and who planned on discontinuing their participation in later seasons (12.7% of the overall $0.60 per kWh group), over two-thirds (8.6% of the overall $0.60 per kWh group) said they would stay in the Pilot if the credit increased.
- Out of the customers receiving the $1.20 per kWh bill credit and who planned on continuing their participation in later seasons (90.4% of the overall $1.20 per kWh group), over one-third (30.3% of the overall $1.20 per kWh group) said they would stay in the Pilot if the credit decreased.

Recommendations from Participants

- Respondents were given the opportunity to provide free-form response recommendations to improve the Peak Time Credit Pilot. In total, 28.8% of respondents provided suggestions. The bullets below provide a summary of the suggestions offered by participants.
  - Out of the 124 suggestions provided by participants, 24% were to increase the credit. This represents 6.9% of all survey respondents. While the bill credit is the primary motivation for enrollment (9.3 out of 10), customers are the least satisfied with the credit (6.7 out of 10) and would work harder to reduce usage if the credit were higher (9.0 out of 10). It is worth noting that a quarter of participants stated that they cannot think of any other actions to reduce their usage.
    - Of the suggestions provided, 26.7% of respondents in the $1.20 per kWh group suggested increasing the bill credits, compared to 21.1% of the $0.60 per kWh group.
  - Several participants (8.9% of 124 suggestions provided) suggested communicating the credits earned swiftly and clearly following an event, even if no credit was earned. This represents 2.6% of all survey respondents.
    - Of the suggestions provided, 8.0% of respondents in the $1.20 per kWh group suggested communicating the credits earned swiftly and clearly following an event, compared to 9.9% of the $0.60 per kWh group.
  - A common recommendation (19.9% of 124 suggestions provided) was to provide in-depth information on energy savings methods and give examples of how they may translate to bill credits. This represents 5.7% of all survey respondents.

    - Of the suggestions provided, 20% of respondents in the $1.20 per kWh group suggested providing information on energy savings methods, compared to 19.7% of the $0.60 per kWh group.
- Several customers (11.6% of 124 suggestions provided) suggested creating a Peak Time Credit website or app that tracks participants' usage, provides Pilot information and event notifications, and tracks and contextualizes Peak Day performance. This represents 3.3% of all survey respondents.
    - Of the suggestions provided, 10.7% of respondents in the $1.20 per kWh group suggested creating a Peak Time Credit website or app, compared to 12.7% of the $0.60 per kWh group.

2 Introduction

In the summer of 2020, Duke Energy Kentucky launched the "Peak Time Credit" Pilot, which offers customers the opportunity to lower their electric bill by reducing electric usage during Critical Peak Events (CPE). Designed for residential customers, the Pilot is an incentive-based demand response (DR) program based on a Peak Time Rebate (PTR) rate design. The first phase of the Pilot's evaluation documented impacts and findings from the first three event seasons, August 2020 through August 2021. This report documents the second phase evaluation covering the Summer 2022 season, which aimed to examine the influence of incentive levels on customer participation and load impacts. This report contains background information on the Pilot including the Pilot design and the evaluation methodology in addition to load impacts and process evaluation findings.

The load impact evaluation section presents event-period load reductions for each event day by customer segment. The process evaluation section presents results from a post-event survey for Summer 2022. Findings from the Pilot evaluation can inform future decisions regarding the current pilot or future peak time rebate program.

2.1 Summary of Pilot

The Pilot was approved by the Kentucky Public Service Commission on April 27, 2020, under Case Number 2019-00277. The Pilot was approved for a research extension for the Summer of 2022 to evaluate the impact of differing customer incentive levels. Customers in the eligible population were randomly assigned to receive either the $0.60 or the $1.20 offer and were unaware of the other incentive level. Approximately 1,350 participants were enrolled in 2022 for incentive testing, with about half under each incentive level. This resulted in each incentive group consisting of over 650 participants, which was sufficient to obtain statistically significant load impacts for the duration of the Pilot.

In Summer 2022, seven events were called between 3 PM – 7 PM for incentive test customers. CPE notifications were generally provided to customers on the day prior to the event, but events could be called with as little as one hour notification. Baseline usage estimates were determined from the usage history, and for any net reduction in usage as compared to the baseline usage that occurred during the CPE, each participant received a $0.60 per kWh or $1.20 per kWh credit. If no reduction occurred, the participant did not receive a credit, but was not penalized. Customers who earned credits received email or text messages regarding earned credit amounts within five business days following each CPE during the term of the pilot.

2.2 Participant Summary

Duke Energy started recruitment for incentive test customers in May 2022. Participants were recruited randomly from a list of eligible customers, which included those that were not enrolled on another demand response program and did not have a past due bill on their account. All program outreach was conducted through email marketing to reduce cost and ensure customers that enrolled would respond to email event notifications once the program began. The recruitment emails included general information about the program offering and a link to a webpage with further details and an enrollment form. In total 1,346 customers enrolled, with 679 enrolling at the $0.60 per kWh level and 667 at the $1.20 per kWh level. Both incentive groups had similar acquisition rates.

Table 2-1: Recruitment Summary

Incentive Level	Recruitment Emails Sent	Customers Enrolled	Acquisition Rate
$0.60/kWh	31,598	679	2.2%
$1.20/kWh	31,630	667	2.1%

Table 2-2 displays customer participation in DEK's PTC Pilot by dwelling and primary heating fuel type as of the Summer 2022 event season. Approximately the same number of customers were enrolled in each of the two incentive groups. A significant portion of newly enrolled customers had unknown heating types. 70.8% of $0.60 per kWh incentive Pilot participants live in single-family residences, while more than 71.1% of $1.20 per kWh incentive customers live in single-family residences.[4] In both incentive groups, roughly 49% of participants have gas heating.

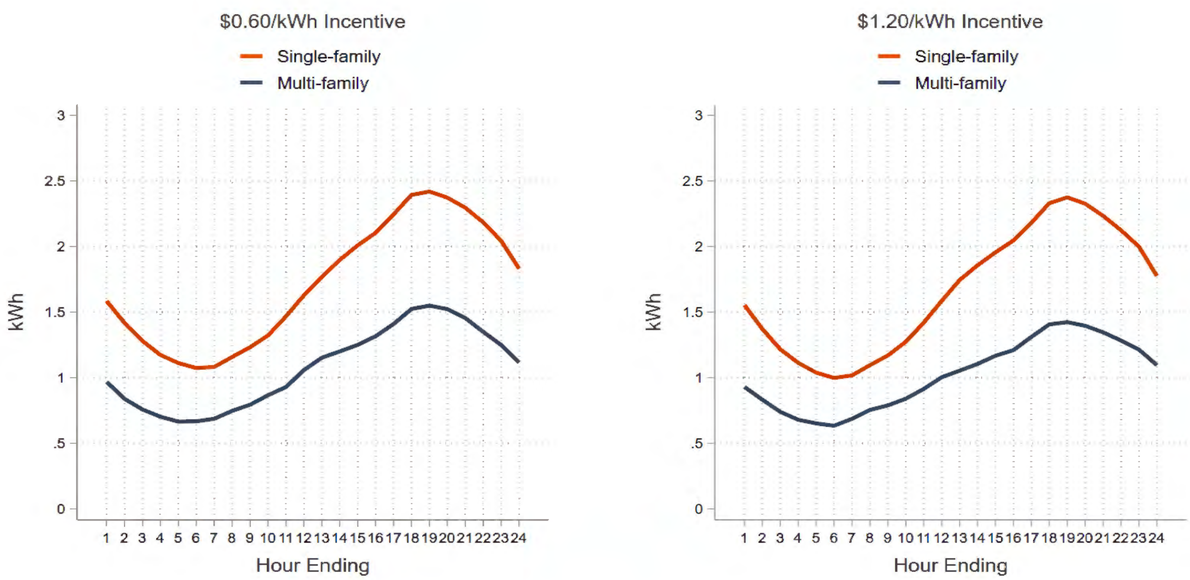
Table 2-2: Counts by Customer Segment – Summer 2022 Incentive Test

Segment	$0.60/kWh Incentive Participant Count	$0.60/kWh Incentive Percent	$1.20/kWh Incentive Participant Count	$1.20/kWh Incentive Percent
Residential Single-Family Combined	**481**	**70.8%**	**474**	**71.1%**
Residential Single-Family (Electric Heat)	111	16.4%	117	17.5%
Residential Single-Family (Gas Heat)	283	41.7%	282	42.3%
Residential Single-Family (Unknown Heat)	87	12.8%	75	11.2%
Residential Multi-Family Combined	**198**	**29.2%**	**193**	**28.9%**
Residential Multi-Family (Electric Heat)	91	13.4%	87	13.0%
Residential Multi-family (Gas Heat)	56	8.3%	49	7.4%
Residential Multi-Family (Unknown Heat)	51	7.5%	57	8.6%
Total	**679**	**100.0%**	**667**	**100.0%**

[4] Customer counts and results are presented at the customer segment level including the electric versus gas heating distinction across all seasons to allow for comparison across these groups between seasons. Customers with electric versus gas heating may have different building characteristics that could lead to differences in impacts during the summer seasons as well.

Figure 2-1 illustrates average hourly energy use during event-like days in Summer 2022. Average summer demand is separated by incentive level and dwelling type, showing single and multi-family customers separately. Single-family customers have much higher loads than multi-family customers at all times of the day in both incentive groups. Generally, multi-family customers' loads are flatter throughout the day. Both customer segments experience afternoon peaks during the summer season. Customers receiving a $1.20 per kWh incentive had very similar loads on event-like days when compared to participants receiving a $0.60 per kWh incentive. This indicates there were no major differences in energy consumption patterns between the customers who accepted the $0.60 offer and the $1.20 offer.

Figure 2-1: Summer Average Hourly Demand on Event-Like Days



2.3 Event Summary

Table 2-3 provides a summary of the Summer 2022 event season. Over the course of the Summer 2022 season, seven events were called between 3 PM – 7 PM for Incentive Test customers. Original Pilot participants only experienced three of the seven Summer 2022 events. The DEK PTC Pilot events were called on hot days. Daily minimum temperatures ranged from 59°F to 75°F, while daily maximum temperatures ranged from 87°F – 94°F. The Summer 2022 event season averaged about 669 $0.60 per kWh incentive customers, 665 $1.20 per kWh incentive customers, and 698 original Pilot customers.

Table 2-3: Summer 2022 Season Event Summary (3 PM – 7 PM Events)

Event Date	$0.60/kWh Participants	$1.20/kWh Participants	Original Participants	Min Temp (°F)	Max Temp (°F)
6/14/2022	676	668	703	75.0	94.0
6/15/2022	676	668	703	75.0	91.0
6/21/2022	676	668	-	59.0	92.0
7/6/2022	665	668	-	73.0	94.0
7/20/2022	666	663	-	73.0	91.0
7/28/2022	662	660	-	71.0	87.0
8/3/2022	662	658	689	68.0	90.0
Average	**669**	**665**	**698**	**70.6**	**91.3**

3 Load Impact Evaluation

One of the primary objectives of the PTC Pilot evaluation is to estimate the load reduction during the event days for PTC participants. For the Summer 2022 season, a new objective was to compare the load impacts across the $0.60 per kWh and $1.20 per kWh incentive level customers. This section summarizes the methodology used to estimate load impacts and the resulting load impacts for the Pilot and for each incentive level, dwelling type, and primary heating fuel type. The Summer 2022 load impacts of original pilot participants were also evaluated and detailed in the Appendix.

This section utilizes two terms that may require clarification. Demand Response (DR) denotes a program like the Peak Time Credit Pilot, which incentivizes customers to reduce their load during specified event periods. When this report displays load with and without DR in figures and tables, it represents customer load during CPE hours for customers enrolled or not enrolled in the Pilot, respectively. Figures including hourly load shapes illustrate kW demand on an hourly basis, which is equivalent to kWh.

3.1 Methodology

The primary challenge in estimating load impacts for opt-in programs, where there is no randomized controlled trial, is estimating how much electricity participants would have consumed in the absence of the treatment. The estimated usage in the absence of the treatment is referred to as the reference load or counterfactual. To estimate load impacts, Resource Innovations compared participant load to a matched control group during each hour during the events and selected proxy days. The matched control group was selected from a pool of customers not enrolled in the PTC Pilot. Resource Innovations matched participants with nonparticipant customers – the control group – based on similar usage during proxy days and customer class (dwelling and primary heating fuel type). The impact estimates represent the difference in loads for the participant and control group customers during the event period minus any difference in load between the two groups during the same hour on proxy days– this approach is referred to as a difference-in-differences analysis.

3.1.1 Control Group and Proxy Day Selection

Resource Innovations developed matched control groups via propensity score matching. A matched control group is the primary source for reference loads which are used to estimate impacts. The method used to assemble the matched control group is designed to ensure that the control group's load on event days is an accurate proxy for Pilot customer load, had an event not taken place. First, a pool of potential control customers was established. There were approximately 20,000 potential control customers chosen for the incentive test Pilot population of around 1,300 customers. The potential control customers were selected to have similar monthly usage, geographic locations, household size, and customer segments as the treatment customers.

Then, the actual control group was selected using a propensity score matching model to find customers in the control group pool who had load shapes most similar to Pilot customers.

A probit model was used to estimate a propensity score for each treatment customer and potential control candidate. Observed characteristics such as customer class and load profiles are explanatory variables that are used to predict whether or not a particular customer enrolled in the treatment or not. The probit model outputs propensity scores for each customer indicating how likely they are to be in the treatment group given the observable characteristics used in the model. Treatment customers are matched to a customer in the control group with the most similar propensity score. This process helps eliminate the difference between the treatment and match-controlled group on the matching variables.

To select the probit model which picked the best match for each treatment customer, we evaluated several model specifications. For each model, the customer load shapes for both the treatment and the control customers on proxy days were checked against each other to find the closest match. This was done separately for the four customer classes: single-family space heat, single-family non-space heat, multi-family space heat, and multi-family non-space heat. During this process, we tested fifteen model specifications using different observable variables, including usage during typical event hours, average total daily usage, morning usage, and usage during pre-event hours. During the matching process, the treatment customer is matched to the control customer who has the most similar propensity score. If the difference between a treatment customer's and a control customer's propensity score is higher than a set caliper, the treatment customer will not be matched. The model producing the best matched control group for each customer segment was selected, which resulted in a mixture of specifications that were used to determine the best-matched pairs and included the usage during events hours, average total daily usage, pre-event usage, and morning usage.

Figure 3-1 and Figure 3-2 show the Summer 2022 results of the matched control group for all $0.60 per kWh and $1.20 per kWh treated customers, respectively. The load profiles compare control and treatment groups' use during the average proxy day.

Figure 3-1: Average Hourly Demand (kW) for All $0.60 per kWh Incentive Treatment and Control Customers on Proxy Days

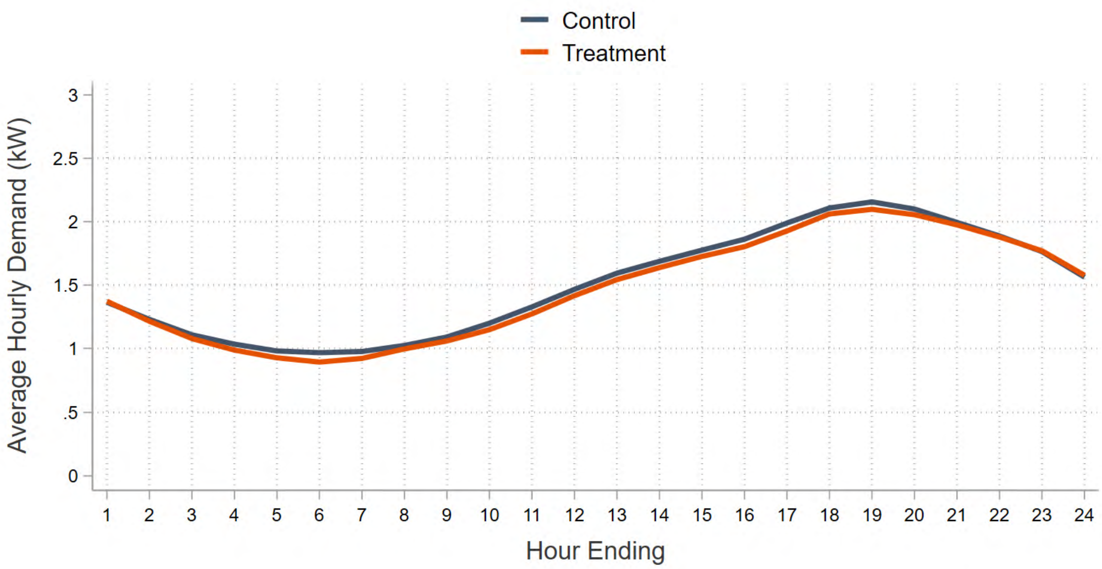
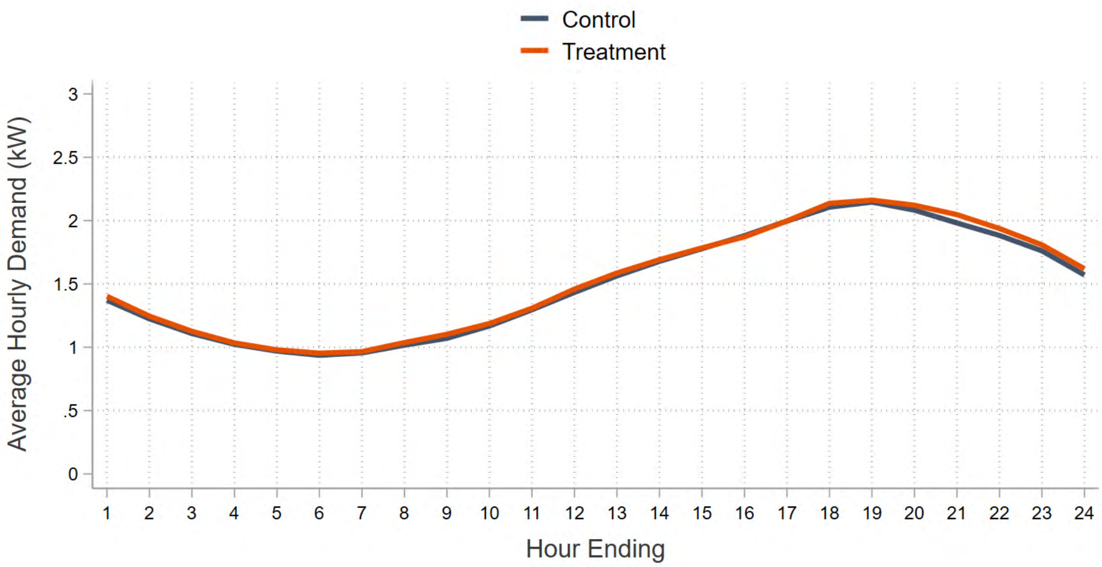


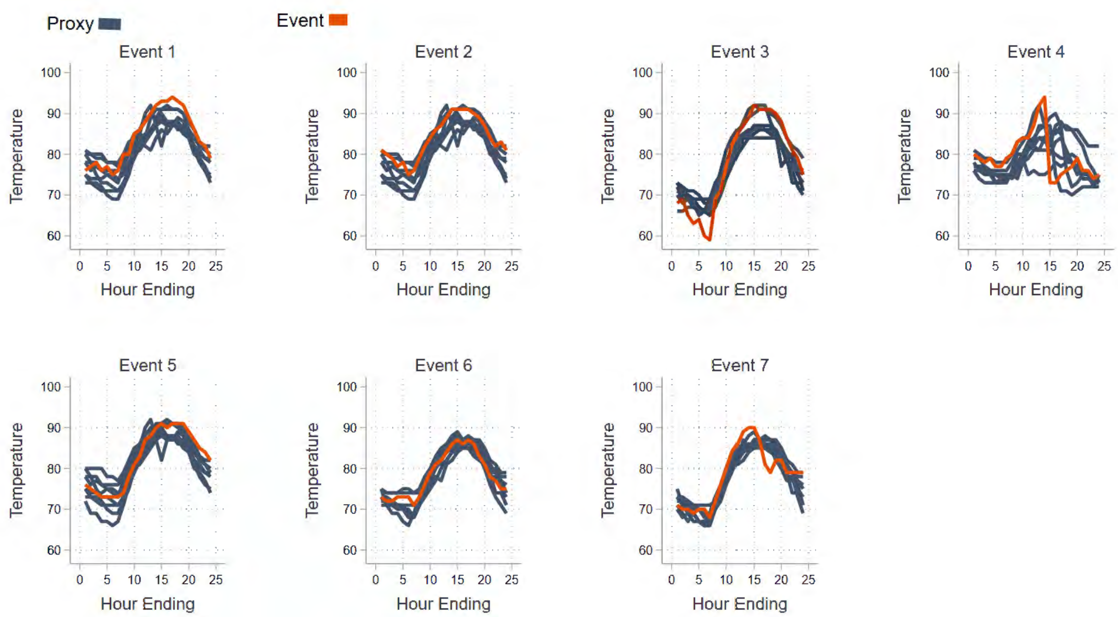
Figure 3-2: Average Hourly Demand (kW) for All $1.20 per kWh Incentive Treatment and Control Customers on Proxy Days



Proxy days were selected to ensure treatment and control customers' usage on event days were compared to similar non-event days. Each of the event days were matched with eight additional proxy days, based on the hourly temperature profile from 12 AM – 8 PM. This process ensured that we compare like-to-like days, so that the load impacts are not biased by large differences in temperature between event days and non-event days.

Figure 3-3 displays hourly temperature for all seven Summer 2022 event days and each of their respective proxy days. Event temperature is displayed in orange while the proxy days' temperatures are in blue.

Figure 3-3: Average Hourly Temperature (°F) on Event and Proxy Days



3.1.2 Load Impact Estimation

The load impacts were estimated using a difference-in-differences (DiD) analysis. This method estimates impacts by subtracting treatment customers' loads from control customers' loads in each hour after the treatments are in place. Then, the difference in loads between treatment and control customers for the same period on proxy days is subtracted from the first difference. Subtracting any difference between treatment and control customers prior to the treatment going into effect adjusts for any pre-existing differences between the two groups that might occur due to random chance.

The DiD calculation can be done arithmetically using simple averages or it can be done using a regression analysis. Customer fixed-effects regression analysis allows each customer's mean usage to be modeled separately, which reduces the standard error of the impact estimates by taking into account the fact that it is a single customer with multiple observations, without changing their magnitude. Additionally, standard statistical software allows for the calculation of standard errors, confidence intervals, and significance tests for load impact estimates that correctly account for the correlation in customer loads over time. Implementing a DiD through simple arithmetic would yield the same point estimate, but the confidence intervals would be wider than ones estimated by a fixed-effects regression. The regression model was run separately for each hour of the day, each incentive level, and each of the six customer classes. This model specification is shown in Equation 3-1 below:

Equation 3-1: Difference-in-Difference Model with Fixed Effects

$$kW_{i,t} = a + \delta \text{treat}_i + \gamma \text{post}_t + \beta(\text{treat} \times \text{post})_{i,t} + v_i + u_t + \varepsilon_{i,t\ for\ i \in \{1,\dots,ni\}\ and\ t \in \{1,\dots,nt}$$

In the above equation, the variable $kW_{i,t}$ equals electricity usage during the time period of interest, which is measured at an hourly level in this analysis. The index *i* refers to customers and the index *t* refers to the time period of interest. The variable *treat* denotes whether customers are enrolled in the PTC Pilot, while the variable *post* denotes whether it is an event or proxy day. The *treatpost* term is the interaction of treat and post and its coefficient β is a difference-in-differences estimator of the treatment effect that makes use of the pretreatment data. The primary parameter of interest is β, which provides the estimated load impacts of the new rate during each event hour. The parameter u_t is the time fixed-effects, controlling for differences in usage between days, common to all customers. The v_i term is the customer fixed-effects variable that controls for unobserved factors that are time-invariant and unique to each customer. Parameter a is the model constant. $\varepsilon_{i,t}$ is the error term for each individual customer and time period.

We estimated the model using both event days and proxy days. Any differences in loads between the treatment and the control groups for the event period hours on proxy days are subtracted from differences on PTC event hours to adjust for any differences between the treatment and the control groups due to random chance.

3.2 Event Impacts

The estimated load impact averaged across all incentive test pilot participants for the Summer 2022 season was 0.23 kW or 10.7%. Across both incentive levels, single-family customers had an average load impact of 0.26 kW (10.7%) while multi-family customers had an average load impact of 0.16 kW (10.9%) during the event hours of 3 PM to 7 PM. The average impact across all participants receiving $0.60 per kWh was 0.22 kW or 9.9% while the average impact across all participants receiving $1.20 per kWh was 0.25 or 11.6%.

3.2.1 Summer 2022 Season – Incentive Test

Table 3-1 displays average hourly load impacts per customer during the event hours of 3 PM – 7 PM by segment for participants that received a $0.60 per kWh incentive in Summer 2022. As discussed in Section 2, single-family and multi-family customers have very different load profiles. As a result, the load impacts from these two groups are also very different. Some participants had an unknown heat type, resulting in six customer segments within the incentive test population. Average hourly impacts per customer for $0.60 per kWh incentive participants were 0.22 kW or 9.9% overall, while single-family participant impacts were 0.24 kW (9.5%), and multi-family participants were 0.18 (11.5%).

Table 3-1: Average Hourly Load Impact (kW) $0.60 per kWh Incentive (Summer 2022)

$0.60/kWh Incentive Customer Segment	Load w/o DR (kW)	Load w/ DR (kW)	Impact (kW)	Impact (%)
Residential Single Family Combined	**2.48**	**2.25**	**0.24**	**9.5%**
Residential Single Family (Electric Heat)	2.09	1.93	0.17	8.0%
Residential Single Family (Gas Heat)	2.71	2.42	0.29	10.6%
Residential Single Family (Unknown Heat)	2.23	2.08	0.15	6.6%
Residential Multi-family Combined	**1.54**	**1.36**	**0.18**	**11.5%**
Residential Multi-family (Electric Heat)	1.39	1.22	0.17	12.5%
Residential Multi-family (Gas Heat)	1.71	1.49	0.22	12.7%
Residential Multi-family (Unknown Heat)	1.62	1.48	0.14	8.4%
All Events Participants	**2.21**	**1.99**	**0.22**	**9.9%**

Table 3-2 presents the average hourly load impacts per customer during the event hours of 3 PM – 7 PM by segment for the $1.20 per kWh participants in Summer 2022. Average hourly load impacts per customer during Summer 2022 for all participants in the $1.20 per kWh incentive group were 0.25 kW or 11.6%, while single-family impacts were 0.29 kW (11.9%), and multi-family impacts were 0.15 kW (10.3%).

Table 3-2: Average Hourly Load Impact (kW) $1.20 per kWh Incentive (Summer 2022)

$1.20/kWh Incentive Customer Segment	Load w/o DR (kW)	Load w/ DR (kW)	Impact (kW)	Impact (%)
Residential Single Family Combined	**2.40**	**2.12**	**0.29**	**11.9%**
Residential Single Family (Electric Heat)	2.08	1.80	0.27	13.2%
Residential Single Family (Gas Heat)	2.64	2.31	0.33	12.4%
Residential Single Family (Unknown Heat)	2.02	1.88	0.14	7.2%
Residential Multi-family Combined	**1.41**	**1.27**	**0.15**	**10.3%**
Residential Multi-family (Electric Heat)	1.26	1.11	0.15	12.1%
Residential Multi-family (Gas Heat)	1.77	1.61	0.17	9.3%
Residential Multi-family (Unknown Heat)	1.32	1.21	0.12	8.8%
All Events Participants	**2.12**	**1.87**	**0.25**	**11.6%**

Table 3-3 compares the average hourly load impacts by segment across the two incentive levels in Summer 2022. Overall, $1.20 per kWh incentive participants achieved slightly higher load impacts than $0.60 per kWh participants at 0.25 kWh (11.6%) and 0.22 kWh (9.9%), respectively. Single-family participants in the $1.20 per kWh incentive group outperformed single-family participants in the $0.60 per kWh incentive group at 0.29 (11.9%) and 0.24 (9.5%), while multi-family participants in the $1.20 per kWh incentive group achieved slightly smaller load impacts than that of the $0.60 per kWh incentive group at 0.15 (10.3%) and 0.18 (11.5%). Overall, the combined incentive test population achieved load impacts of 0.23 kW or 10.7%, with the largest impacts seen in the single-family gas heat segment at 0.31 kW (11.5%) and the smallest impacts in multi-family unknown heat segment at 0.13 kW (8.6%).

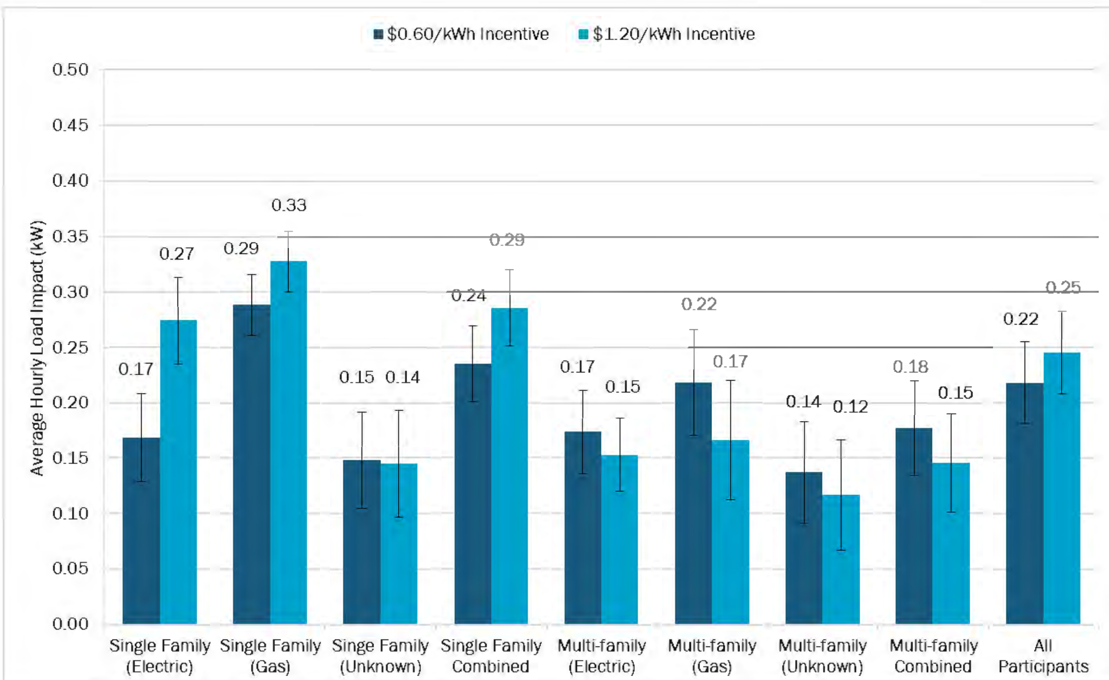
Table 3-3: Average Hourly Load Impact (kW) Comparison Across Incentives (Summer 2022)

Customer Segment	$0.60/kWh Incentive		$1.20/kWh Incentive		All Incentive Test	
	Impact (kW)	Impact (%)	Impact (kW)	Impact (%)	Impact (kW)	Impact (%)
Residential Single Family Combined	**0.24**	**9.5%**	**0.29**	**11.9%**	**0.26**	**10.7%**
Residential Single Family (Electric Heat)	0.17*	8.0%*	0.27*	13.2%*	0.22	10.7%
Residential Single Family (Gas Heat)	0.29	10.6%	0.33	12.4%	0.31	11.5%
Residential Single Family (Unknown Heat)	0.15	6.6%	0.14	7.2%	0.15	6.9%
Residential Multi-family Combined	**0.18**	**11.5%**	**0.15**	**10.3%**	**0.16**	**10.9%**
Residential Multi-family (Electric Heat)	0.17	12.5%	0.15	12.1%	0.16	12.3%
Residential Multi-family (Gas Heat)	0.22	12.7%	0.17	9.3%	0.19	11.1%
Residential Multi-family (Unknown Heat)	0.14	8.4%	0.12	8.8%	0.13	8.6%
All Events Participants	**0.22**	**9.9%**	**0.25**	**11.6%**	**0.23**	**10.7%**

* Indicates a statistically significant difference between the $0.60 and $1.20 group load impacts.

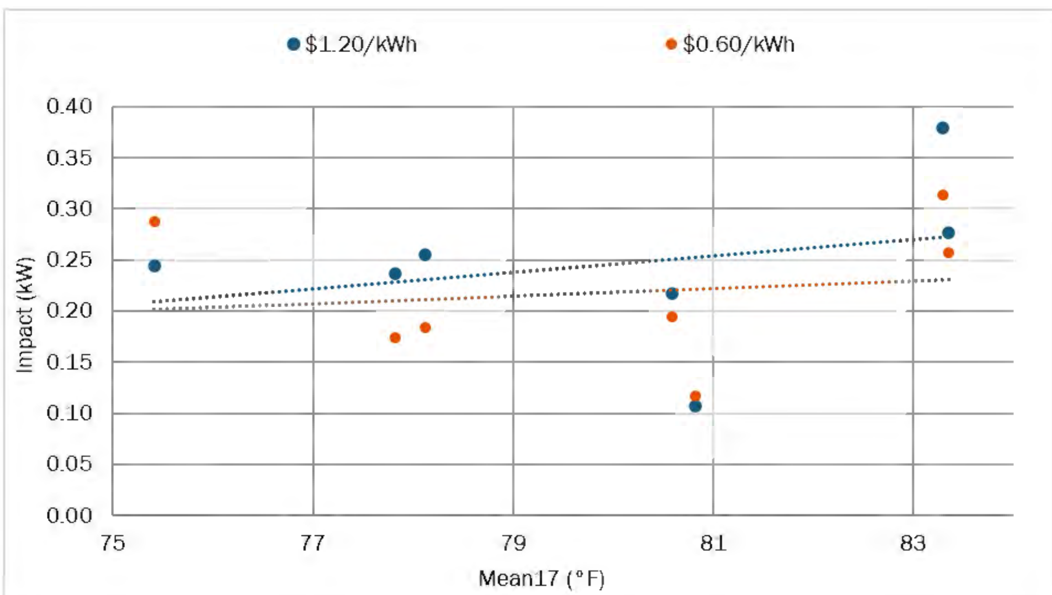
Figure 3-4 displays the magnitude and statistical significance of each of the six customer classes, as well as that of all participants, all single-family, and all multi-family groups separated by incentive level. The 90% confidence interval is displayed for each group of customers as an error bar over their impact. If the error bar crosses zero, the impact is not statistically significant from zero at the 90% level of confidence. All customer classes display statistical significance. In the single-family electric segment, the higher incentive level produced larger load impacts. Comparing between the two incentive groups, this is the only segment that displays a statistically significant difference between observed load impacts. However, in the multi-family segment, the lower incentive level produced larger load impacts, although the difference between the two incentive levels is not statistically significant. See Figure 3-8 for additional details at the individual event day level to further explore drivers for this observed outcome.

Figure 3-4: Average Hourly Load Impact (kW) by Customer Class (Summer 2022)



To examine how event day temperature may impact load impacts, Figure 3-5 compares the kW impacts from each of the seven event days with the weather variable *mean17*, which represents the average hourly temperature between midnight and 5 PM. This variable captures the heat buildup overnight and is strongly correlated with weather-sensitive premise-level consumption data. Therefore, it is helpful in predicting premise-level energy usage, particularly for customers with air conditioning. This figure shows that Summer 2022 events were generally called on warm days but also included some hotter days. The figure displays a weak but noticeable relationship between *mean17* temperature buildup on event days and load impacts. The incentive levels are separated out on the Figure to further examine the impact of incentive level on event response. The $1.20 per kWh incentive level shows a slightly stronger positive correlation between *mean17* and average hourly load impact. The July 6th event had unusual weather, yielding relatively low load impacts. This event is reflected in the two dots just below 81°F and just above 0.10 kW. While July 6th had a moderately high *mean17,* the temperature dropped by over 20°F just prior to the event. Impacts for each of the events conducted in Summer 2022 are covered in greater detail in the following section.

Figure 3-5: Comparison of kW Impact and Average Hourly Temperature (°F) between Midnight and 5 PM (Mean17)



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Load Impacts by Event Day

Figure 3-6 and Figure 3-7 show the average hourly load impact for single-family and multi-family customers for each event. The events are broken into two figures with the first reflecting the $0.60 per kWh incentive level and the second reflecting the $1.20 per kWh incentive level. Error bars represent the 90% confidence interval. When the black bars cross zero on the y-axis, the results are not statistically different from zero with 90% confidence, and therefore are insignificant. For $0.60 per kWh incentive customers, the largest impacts are observed on the first event day (6/14/2022) in both the single-family and multi-family segments at 0.32 kW and 0.29 kW, respectively. The second-largest event impacts are observed on the third event (6/21/2022) in both single- and multi-family segments at 0.30 kW and 0.26 kW. The smallest event impacts were observed on the fourth event (7/6/2022) in both segments at 0.12 kW and 0.10. The multi-family segment impacts are not statistically significant on 7/6/2022 and load shape and temperature suggest there may have been a storm on that event date, while single-family impacts were statistically significant on all event days.

Figure 3-6: Average Hourly Load Impact per Customer - $0.60 per kWh

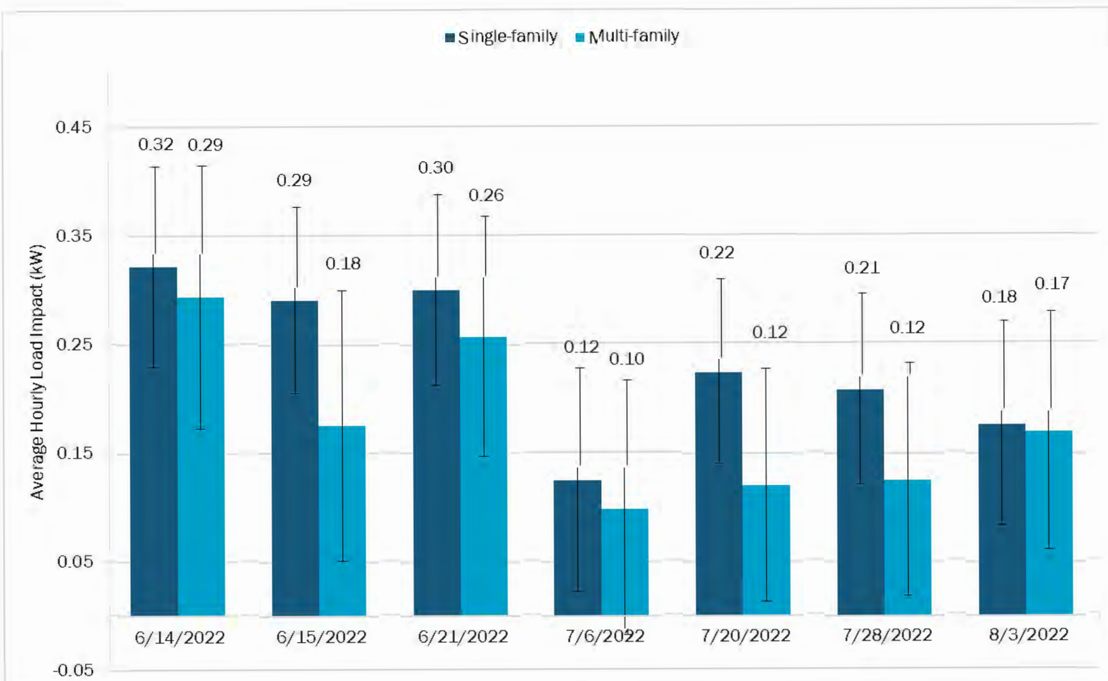

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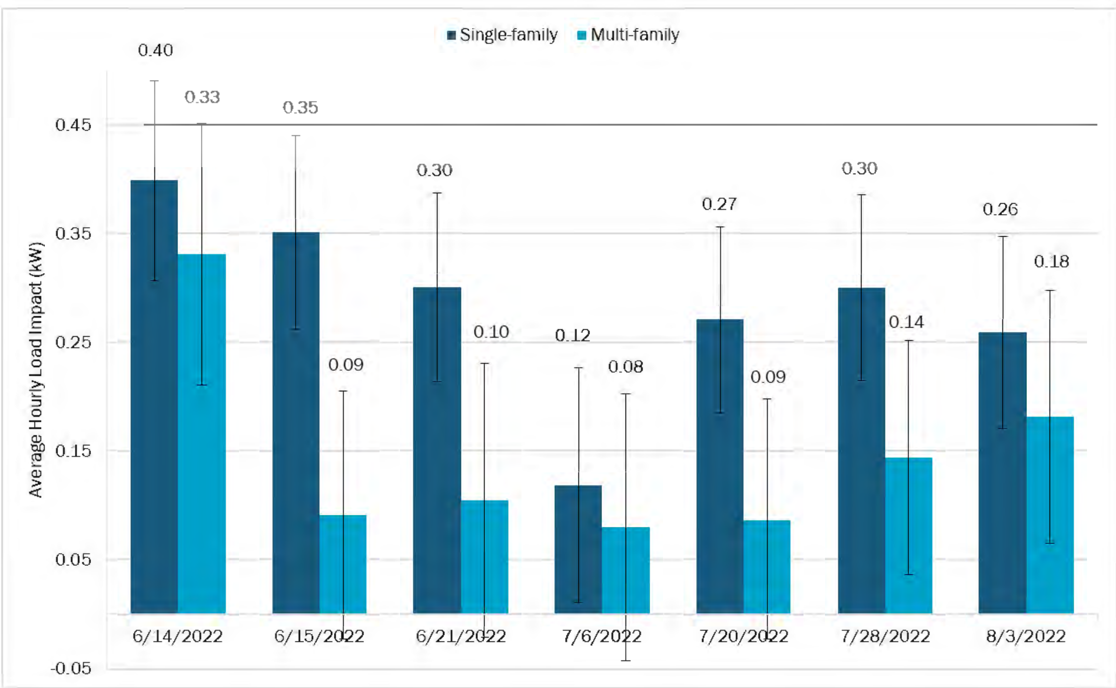
Figure 3-7 displays the average hourly load impact for single-family and multi-family customers for each event for the $1.20 per kWh incentive level customers. The higher incentive group follows a similar pattern to that of the $0.60 per kWh incentive customers, with the largest impacts are observed on the first event day (6/14/2022) in both the single-family and multi-family segments at 0.40 kW and 0.33 kW. The second-largest single-family event impacts are observed on the second event (6/15/2022) at 0.35 kW. The third greatest event impacts for single-family customers were observed on the third and sixth events (6/21/2022 and 7/28/2022) at 0.30 kW, while the second largest event impacts for multi-family customers were observed on the last event date (8/3/2022) at 0.18 kW. The smallest event impacts for both segments were observed on the fourth event (7/6/2022) in both segments at 0.12 kW and 0.08. The multi-family segment impacts are not statistically significant on the second, third, fourth, and fifth events while single-family impacts were statistically significant on each of the seven event days.

Figure 3-7: Average Hourly Load Impact per Customer - $1.20 per kWh



To further investigate the reversal of trend in the load impacts among the multi-family segments, Figure 3-8 displays the average hourly load impact for the multi-family combined segment by event date and incentive level. The June 15th and 21st events appear to be the main drivers of the relatively smaller load impacts among multi-family $1.20 per kWh incentive participants. The impacts for these event dates are not statistically significant for the $1.20 per kWh incentive group when evaluated alone. During three of the event days, the $1.20 per kWh incentive multi-family combined segment had statistically significant load impacts that were higher than the $0.60 per kWh incentive multi-family combined segment, while on four event days, the $1.20 kWh incentive multi-family combined segment had lower impacts that were not statistically significant. The difference in average hourly load impacts between the two incentive groups are not statistically significant on any event day. Overall, the multi-family segments have smaller sample sizes than their single-family counterparts which could be driving noise in the data.

Figure 3-8: Average Hourly Load Impact (kW) Multi-family Segment by Event and Incentive

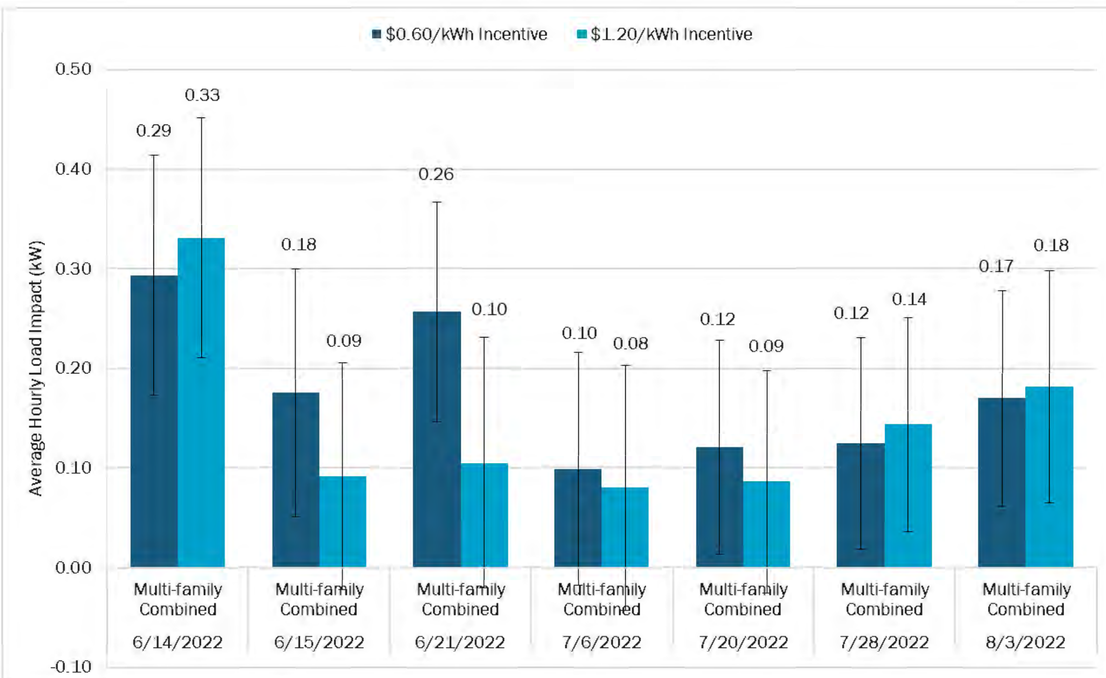


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Figure 3-9 displays the average hourly load impact for the single-family combined segment by event date and incentive level. Customers receiving $1.20 per kWh had higher load impacts than customers receiving $0.60 per kWh on all event days except for the July 7th event, although the difference in single-family load impacts by event day between incentive levels is never statistically significant.

Figure 3-9: Average Hourly Load Impact (kW) Single-family Segment by Event and Incentive

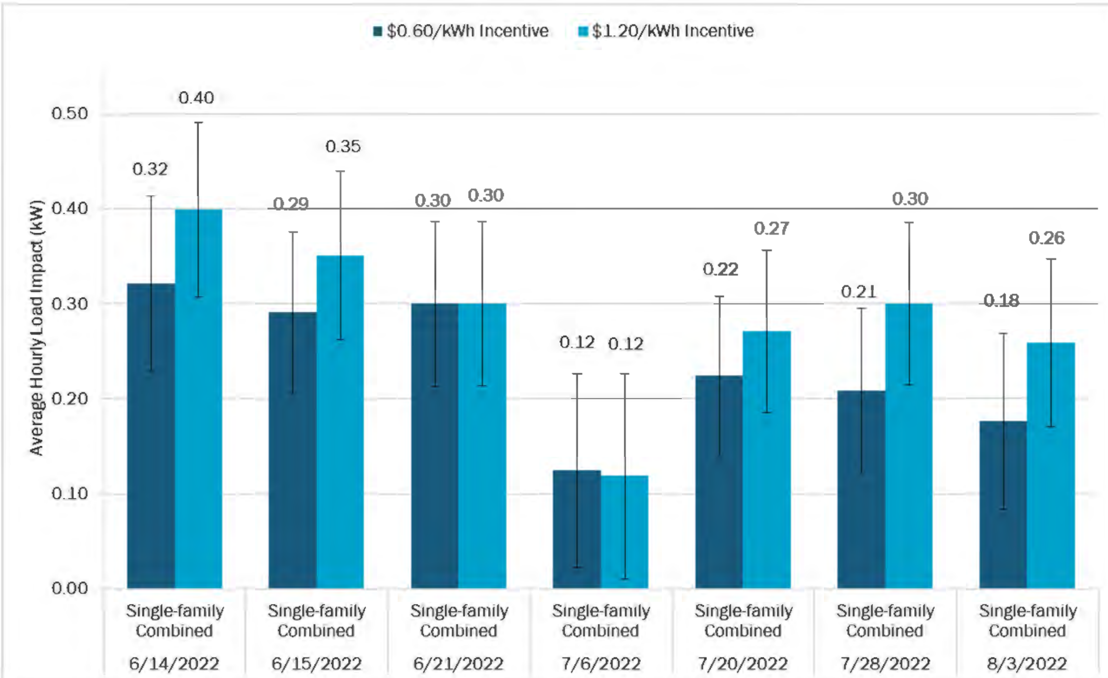

Table 3-4 and Table 3-5 display summaries of all seven Summer 2022 PTC Pilot events. Table 3-4 presents the results for the $0.60 per kWh incentive level customers while Table 3-5 presents results for the $1.20 per kWh incentive level customers. Each event's average event period temperature, control load, treatment load, average hourly load impact per customer, percentage impact, and 5th and 95th percentiles are displayed. Across all participants receiving $0.60 per kWh, all daily event impacts were statistically significant at the 90% confidence level. The largest impacts in magnitude and percentage were seen on June 14th, the hottest event day with an event period temperature of 94 °F, at 0.31 kW or 12.7%. The average event day had an event period temperature of 86.8 °F and impacts of 0.22 kW or 9.9%. Variation in magnitude and percentage impact is highly dependent on reference load and temperature.

Table 3-4: Average Hourly Load Impact by Event Day (Summer 2022) - $0.60 per kWh

Event Date	Event Temp.	Load w/o DR (kW)	Load w/ DR (kW)	Impact (kW)	Impact (%)	5th Percentile	95th Percentile
6/14/2022	93.0	2.46	2.14	0.31	12.7%	0.21	0.41
6/15/2022	90.3	2.47	2.21	0.26	10.4%	0.16	0.36
6/21/2022	90.8	2.17	1.88	0.29	13.3%	0.19	0.38
7/6/2022	75.3	1.60	1.48	0.12	7.3%	0.01	0.22
7/20/2022	90.8	2.41	2.21	0.19	8.1%	0.10	0.29
7/28/2022	85.5	2.09	1.91	0.18	8.8%	0.09	0.28
8/3/2022	82.3	2.26	2.09	0.17	7.7%	0.08	0.27
Avg. Event	**86.8**	**2.21**	**1.99**	**0.22**	**9.9%**	**0.18**	**0.26**

Across all participants receiving $1.20 per kWh, all daily event impacts except for July 6 were statistically significant at the 90% confidence level. Like the $0.60/kW incentive group, the largest impacts in magnitude and percentage were seen on June 14th, the hottest event day, at 0.38 kW or 15.8%. The average event day had an event period temperature of 86.8 °F and impacts of 0.25 kW or 11.6%. Notably, participants receiving a $1.20 per kWh incentive had larger load impacts in magnitude than those receiving $0.60 per kWh on all event days except June 21st, despite having a lower reference load on all event days.

Table 3-5: Average Hourly Load Impact by Event Day (Summer 2022) - $1.20 per kWh[5]

Event Date	Event Temp.	Load w/o DR (kW)	Load w/ DR (kW)	Impact (kW)	Impact (%)	5th Percentile	95th Percentile
6/14/2022	93.0	2.40	2.02	0.38	15.8%	0.28	0.48
6/15/2022	90.3	2.39	2.11	0.28	11.6%	0.18	0.37
6/21/2022	90.8	2.06	1.82	0.24	11.9%	0.15	0.34
7/6/2022	75.3	1.48	1.37	0.11	7.3%	0.00	0.22
7/20/2022	90.8	2.32	2.11	0.22	9.4%	0.12	0.31
7/28/2022	85.5	2.01	1.75	0.26	12.7%	0.16	0.35
8/3/2022	82.3	2.17	1.93	0.24	10.9%	0.14	0.33
Avg. Event	**86.8**	**2.12**	**1.87**	**0.25**	**11.6%**	**0.21**	**0.28**

[5] Cells shaded in blue denote results that were not statistically significant at the 90% confidence level.

Figure 3-10, Figure 3-11, and Figure 3-12 show the average per-customer load with demand response, load without demand response (reference load), load impact, and hourly temperature for the average event day for all PTC incentive test participants, the $0.60 incentive participants, and the $1.20 incentive participants, respectively. Very little, if any, “snapback” occurred after the completion of each event. Snapback is defined as customer energy usage being higher after an event than what would be expected if an event had not taken place. For example, snap-back sometimes occurs if customers turned off their ACs or set their thermostats higher during the event and consequently the temperature inside the house increased. At the end of the event, the AC will sometimes need to run more than usual in order to bring the inside temperature back to within the customers’ preferred range; assuming the thermostat is returned to its pre-event setting shortly after the event concludes. This can result in increased load in the hours following an event compared to what would typically be expected on a similar non-event day.

Figure 3-10 shows the average load profile for all PTC incentive test participants ($0.60 per kWh and $1.20 per kWh combined) across all Summer 2022 event days. The average load without DR during all event hours was 2.16 kW. The average load with DR during event hours was around 1.93 kW. This resulted in an average load reduction of 0.23 kW per customer, or a 10.7% reduction relative to the reference load. Average event temperature was 86.82° F.

Figure 3-10: Average Hourly Load Impacts per Customer on Average Event Day (Summer 2022)

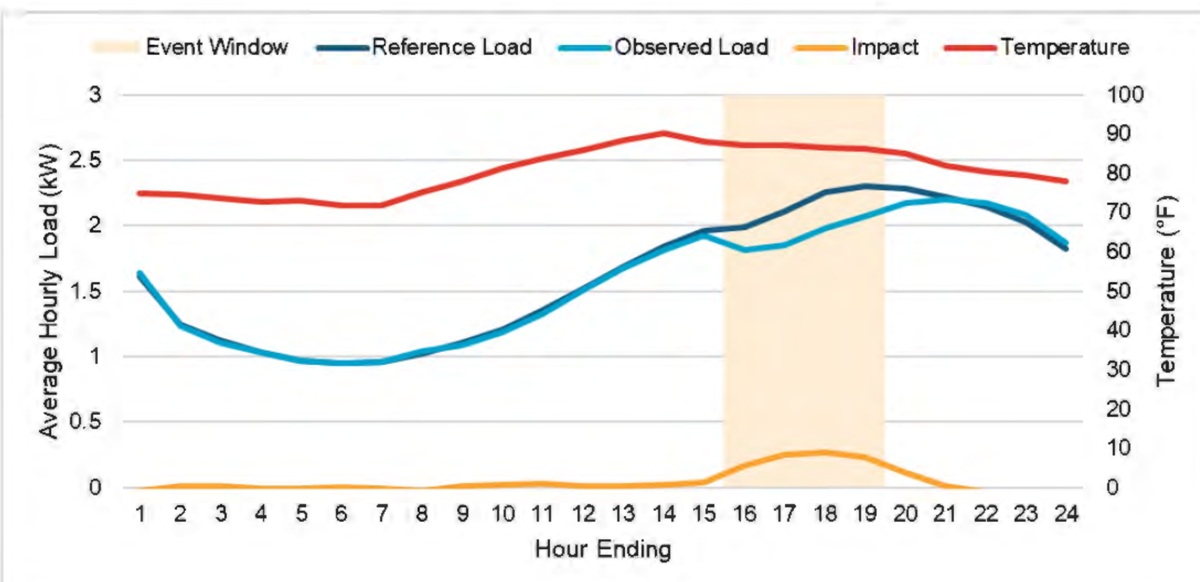

Figure 3-11 shows the average load profile for the $0.60 per kWh incentive level participants and Figure 3-12 shows the average load profile for the $1.20 per kWh incentive level participants across all Summer 2022 events. Average load without DR during all event hours for the $0.60 per kWh incentive participants was 2.21 kW, and 2.12 kW for the $1.20 per kWh participants, indicating the $0.60 and $1.20 participants were similar to each other. The average load with DR during event hours for the $0.60 per kWh participants was 1.99 kW, and 1.87 kW for the $1.20 per kWh participants. Average load reductions of 0.22 kW (9.9%) for the $0.60 per kWh participants and 0.25 kW (11.6%) for the $1.20 per kWh incentive participants were observed.

Figure 3-11: Average Hourly Load Impacts per Customer on Average Event Day (Summer 2022) - $0.60 per kWh Incentive

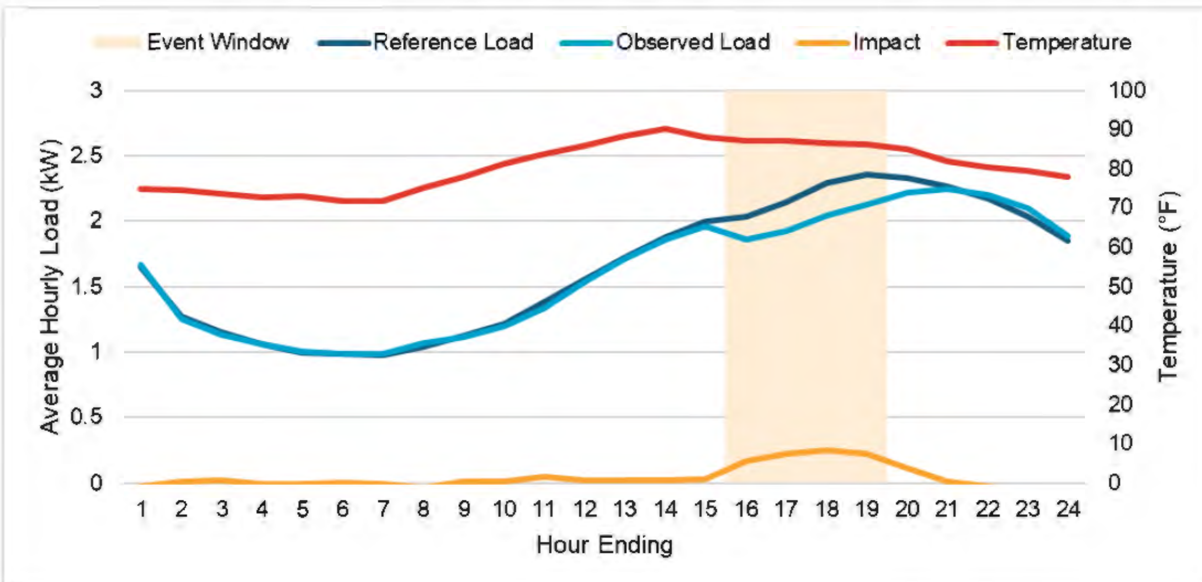

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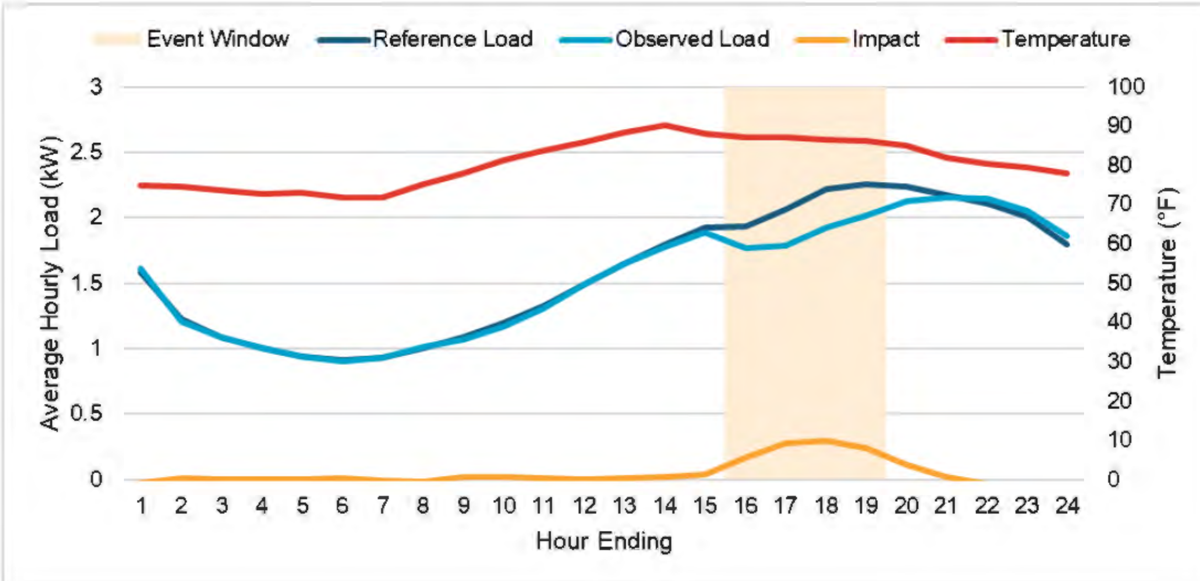
Figure 3-12: Average Hourly Load Impacts per Customer on Average Event Day (Summer 2022) - $1.20 per kWh Incentive



3.3 Load Impacts Comparison with Original Participants

Original group participants produced significant responses to events throughout the past four event seasons Summer 2022, Summer 2021, Winter 2021, and Summer 2020. In Summer 2022, a new subset of participants was tested to determine the impact of different incentive levels on load impacts. Incentive test customers received either $0.60 per kWh or $1.20 per kWh. In Summer 2022, seven events were called between 3 PM – 7 PM for incentive test customers and three events were called between 3 PM – 7 PM for original Pilot participants. Summer 2021 had sixteen events called between 3 PM – 7 PM. Winter 2021 had two events called between 6 AM – 10 AM and Summer 2020 experienced two events called between 3 PM – 7 PM. Table 3-6 displays average hourly load impacts per customer, by event season. On the three event days that overlapped with the Original Participants the Incentive Test customers provided an overall average hourly load impact per customer in Summer 2022 of 0.27 kW or 11.5% while participants receiving $0.60 per kWh provided a reduction of 0.25 kW (10.3%) and participants receiving $1.20 per kWh provided a 0.30 kW reduction (12.8%).

For original Pilot participants, average hourly load impacts per customer during the Summer 2022 season were 0.15 kW or 6.0%. Average hourly impacts per customer during the Summer 2021 events were 0.14 kW or 6.1% while Summer 2020 impacts were much larger at 0.38 kW or 15.4%. Average hourly impacts per customer across the two Winter 2021 events were 0.12 kW or 5.6%. Original participants began their participation in the Pilot during the COVID-19 pandemic, which may have contributed to the large load impacts estimated during the Summer 2020 season. While original participants load impacts are smaller than in the first season, they have remained similar in the last three event seasons.

Incentive test participants also produced relatively large load impacts in their first event season, Summer 2022. Note that original participants were only called for a subset of Summer 2022 events. Differences in temperature and reference load also impact average hourly load impacts displayed below, through time.

Table 3-6: Summary of Average Hourly Load Impacts by Season[6]

Season	Load w/o DR* (kW)	Load w/ DR (kW)	Impact (kW)	Impact (%)
Summer 2022 $0.60/kWh Participants	2.40	2.15	0.25	10.3%
Summer 2022 $1.20/kWh Participants	2.32	2.02	0.30	12.8%
Summer 2022 All Incentive Test Participants	2.36	2.08	0.27	11.5%
Summer 2022 Original Participants	2.53	2.38	0.15	6.0%
Summer 2021 Original Participants	2.37	2.22	0.14	6.1%
Winter 2021 Original Participants	2.04	1.93	0.12	5.6%
Summer 2020 Original Participants	2.49	2.11	0.38	15.4%

*DR represents Demand Response, or a PTC event.

[6] Impacts from the Summer 2022 are limited to the three common event days to allow for a direct comparison between Incentive Test Participants and Original Participants. Impacts from 2021 and 2020 reflect all events from each season.

3.4 Load Impact Conclusions

Key findings pertaining to load impacts from the Pilot include:

- Statistically significant load impacts were detected across both incentive levels for customers in Single-family and Multi-family homes.
- At the population level, participants receiving the $1.20 per kWh incentive had slightly larger load impacts (0.25 kW) than participants receiving $0.60 per kWh (0.22 kW), however the difference in impacts were not statistically significant.
- At the population level, participants receiving the $1.20 per kWh incentive had slightly lower reference loads than that of participants receiving $0.60 per kWh though the difference was not statistically significant.
- Single-family participants receiving $1.20 per kWh consistently provided larger load impacts (0.29 kW) than single-family participants receiving $0.60 per kWh (0.24 kW), though the difference was not statistically significant. Multi-family participants receiving $1.20 per kWh provided smaller load impacts (0.15 kW) than multi-family participants receiving $0.60 per kWh (0.18 kW) at the segment level, however the difference was not statistically significant.
- As Summer 2022 was incentive test participants first event season, impacts were larger than that of original participants on the three common event days in Summer 2022, their fourth event season. This is consistent with what was observed in the original pilot population in prior seasons, with their first event season (Summer 2020) producing load impacts 2.7 times larger than that of Summer 2021.
- Original participants' load impacts were comparable in Summer 2022 to Summer 2021 at the population level.

4 Process Evaluation

Leveraging insights from the impact evaluation, Resource Innovations' process evaluation goals were to develop insights into the pilot's strengths and weaknesses, to identify opportunities for improving pilot operations, and to identify any other additional measures or other strategies that Duke Energy can adopt that are likely to increase the effectiveness of Peak Time Credit if it is continued. More specifically, the survey data collection strategy was designed towards answering the following research questions which are consistent with those required in this study:

- Does the Pilot's bill credit motivate behavior change? Does it vary by incentive level?
- Did event notifications reach the customer such that they could effectively respond to the event?
- What were the most common actions participants are taking to reduce usage during events? Does it vary by incentive level?
- What were the most common reasons or barriers participants are giving for not reducing usage during events? Does it vary by incentive level?
- What enhancements should be made to the Pilot from participants perspective? Do the enhancements suggested vary by incentive level?
- How satisfied were participants with the Pilot? Does it vary by incentive level?

Resource Innovations addressed these research questions by collecting data from participants through a post-event survey. The results from these post-event surveys are presented in the following subsections.

4.1 Post-Event Survey

Resource Innovations fielded a post-event survey for PTC Pilot participants about their experience following a Peak Day event. This survey aimed to obtain feedback from participants to estimate awareness of the event and to collect information on actions customers took to reduce load and their motivations for those actions. The post-event survey also collected information on participants' assessment and opinions on Duke Energy's role in empowering and motivating participants to reduce load, in addition to educating participants on how the Pilot works. The post-event survey also assessed satisfaction with the bill credit offering, with the event notification process, and of the pilot overall. In conjunction with the survey results, the Resource Innovations team's process evaluation focused on the comparison of the post-event survey responses of participants who received a $0.60 per kWh bill credit and participants who received a $1.20 per kWh bill credit.

The post-event survey was conducted following the Peak Day event that occurred in the afternoon on August 3rd, 2022. PTC incentive test participants were sent emails to complete the survey on the web and received follow-up phone calls providing them with the opportunity to complete the survey over the phone. The survey completion rates are shown in Table 4-1. In total, 221 out of the 662 customers in the $0.60 per kWh incentive group responded to the survey yielding a response rate of 33.4%. Out of the participants in this group who completed the survey, 155 responded on the web and 66 responded over the phone. For the $1.20 per kWh incentive group, 261 out of the 660 customers responded to the survey yielding a response rate of 39.5%. These response rates are relatively high for a Pilot participant survey, suggesting that Peak Time Credit participants are engaged and willing to provide feedback to Duke Energy. Out of the participants in this group who completed the survey, 191 responded on the web and 70 responded over the phone. The survey was open from August 10th, 2022, to August 21st, 2022.

Table 4-11: Survey Completion Rates by Method

Group	Event Date	Event Start Time	Event Finish Time	Survey Start	Survey Close	Phone Responses	Web Responses	Number of Responses	Valid Response Rate
$0.60/kWh	8/3/2022	3:00 PM	7:00 PM	8/10/2022	8/21/2022	66	155	221	33.4%
$1.20/kWh						70	191	261	39.5%

Survey questions covered the following main topics:

- Participation Awareness and Motivation
- Peak Time Credit Event Awareness and Notification Satisfaction
- Responding to Peak Time Credit Events
- Satisfaction with the Peak Time Credit Pilot and Incentive Test

Participation Awareness and Motivation

Peak Time Credit participants were first asked if they recalled their participation in the Pilot. For the 2022 survey, 99.6% of the full set of respondents were aware of their participation in the Pilot. Furthermore, all the $0.60 per kWh incentive respondents recalled their participation while 99.2% of $1.20 per kWh incentive customers recalled their participation.

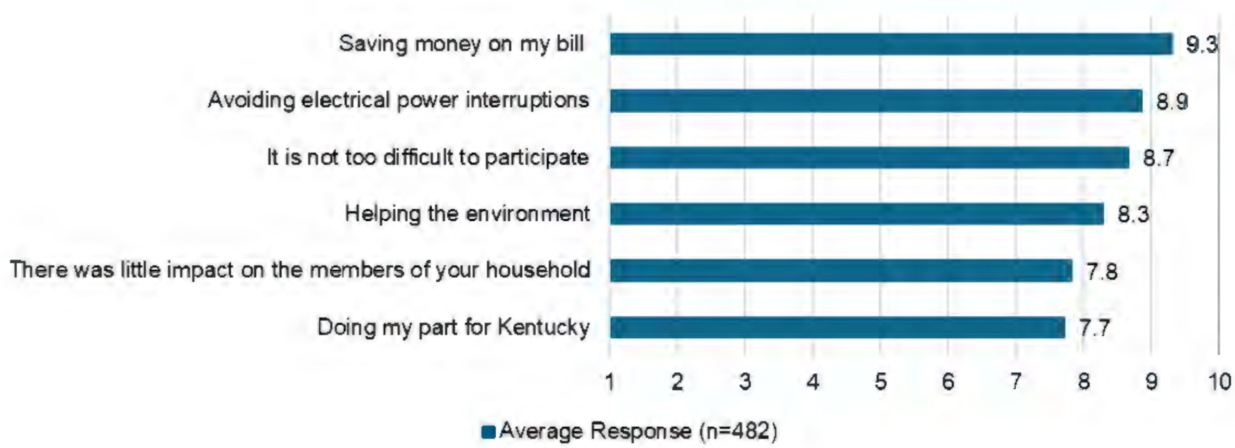
This question was followed by asking participants if they had recalled a Peak Day event happening in the past month. Overall, 82.4% of respondents recalled that an event occurred with 84.2% of the $0.60 per kWh incentive respondents recalling the event and 80.8% of the $1.20 per kWh incentive respondents recalling the event. These results are shown in Table 4-2. The difference in percentage of respondents that recalled the event between the $0.60 per kWh group and the $1.20 per kWh group is not statistically significant at a 90% confidence level.

Table 4-2: Participants Who Recalled a Peak Day Event

Group	Yes	No	Don't Know	Refused
$0.60 per kWh (n=221)	84.2%	4.5%	11.3%	0.0%
$1.20 per kWh (n=261)	80.8%	5.8%	13.0%	0.4%
Total (n=482)	**82.4%**	**5.2%**	**12.2%**	**0.2%**

Participants were asked to rate how important potential benefits were to their decision to participate in the Pilot. The potential benefits were rated on a scale from 1 to 10 with 10 being "extremely important" and 1 being "not at all important". As shown in Figure 4-1, the most motivating potential benefit is the financial incentive which had an average rating of 9.3. The second most influential benefit is the avoidance of electrical power interruptions which had an average rating of 8.9. There were no statistically significant differences in ratings between the two incentive groups.

Figure 4-1: Participant Motivation Ratings



Peak Time Credit Awareness and Notification Satisfaction

The next group of questions was related to the notification methods that Duke Energy used to alert Pilot participants about the event. Participants who recalled a Peak event occurring were asked what method Duke Energy used to notify them of the event. Recalled notification methods are recorded in Table 4-3 where the majority of all participants (73.2%) said that they recalled an email from Duke Energy to alert them of the Peak Day event. Furthermore, a sizeable proportion of participants were notified by text (13.1%) or noticed that it was a hot day (12.5%). All other notification methods were recalled by less than 1% of the participants. The differences between the $0.60 per kWh and $1.20 per kWh groups were not statistically significant at a 90% confidence level.

Table 4-3: Peak Event Notification Method (n=397)

Group	I got an email from Duke	I got a text from Duke	It was a hot day	Some other way	I saw it on Duke Energy's website	Heard about it from someone I know	I got a phone call from Duke
$0.60/kWh	69.7%	12.9%	15.8%	1.2%	0.0%	0.0%	0.4%
$1.20/kWh	76.6%	13.3%	9.4%	0.0%	0.4%	0.4%	0.0%
Total	**73.2%**	**13.1%**	**12.5%**	**0.6%**	**0.2%**	**0.2%**	**0.2%**

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The survey also presented the respondents who were notified by text or email with various statements about the notification method. As shown in Table 4-4, the participants overwhelmingly agreed with statements saying that Duke Energy notified them in a timely manner, provided them with helpful information, and gave them confidence of which hours they can earn credits on Peak Days. The average ratings of customers in the $1.20 per kWh incentive group were consistently higher than those in the $0.60 per kWh incentive group but were not statistically significant except for one question. Participants in the $1.20 per kWh group gave statistically significantly higher ratings (with 90% confidence) for the timeliness of the peak day notification than those in the $0.60 per kWh group.

Table 4-4: Participant Agreement with Statements Concerning the Notification Method

How much do you agree with the following...	Average Rating		
	$0.60/kWh (n = 183)	$1.20/kWh (n = 206)	Total (n = 389)
The timeliness of the peak day notification	9.0	9.3	9.2
Duke Energy has given me helpful information on how to respond to Peak Days	8.8	9.0	8.9
I feel confident that I know which hours of the day I can earn credits during Peak Days	9.4	9.6	9.5

* Blue shaded cells are responses which are statistically different between the $0.60 per kWh and $1.20 per kWh incentive groups at the 90% level

Participants who recalled being notified by an email, text, or phone call were asked if Duke Energy notified them through their preferred communication channel. As shown in Table 4-5, 87.9% of participants were notified by their preferred communication channel. Those who were not notified by their preferred channel generally would have rather been notified by text or email. The differences between the $0.60 per kWh and $1.20 per kWh group were not statistically significant.

Table 4-5: Were you notified through your preferred communication channel?

Group	Yes	No; prefer email	No; prefer text	No; prefer phone call	Don't know
$0.60/kWh (n=183)	86.9%	5.5%	7.1%	0.0%	0.5%
$1.20/kWh (n=206)	88.8%	4.4%	5.8%	0.0%	1.0%
Total (n=389)	**87.9%**	**4.9%**	**6.4%**	**0.0%**	**0.8%**

Response to Peak Time Credit Event

The next section in the survey asked participants about how they responded to the August 3rd, 2022, event. These questions were only asked to participants who had recalled that there was an event in the past month (82.4% of respondents), as they would have not had the opportunity to respond to the event if they did not know it happened. The first question asked participants if they were home during the Peak Day event. The responses are recorded in Table 4-6, which shows that most of the participants reported that they were home during the event. Furthermore, customers in the $0.60 per kWh incentive group were home more frequently than those in the $1.20 per kWh group. The portion of respondents that were home during the event is statistically significant at the 90% confidence level between participants receiving $0.60 per kWh and those receiving $1.20 per kWh.

Table 4-6: Was the Participant Home During the Peak Time Credit Event?

Group	Yes	No
$0.60/kWh (n=186)	84.9%	15.8%
$1.20/kWh (n=211)	76.7%	23.3%
Total (n=397)	**80.6%**	**19.4%**

* Blue shaded cells are responses which are statistically different between the $0.60 per kWh and $1.20 per kWh incentive groups at the 90% level

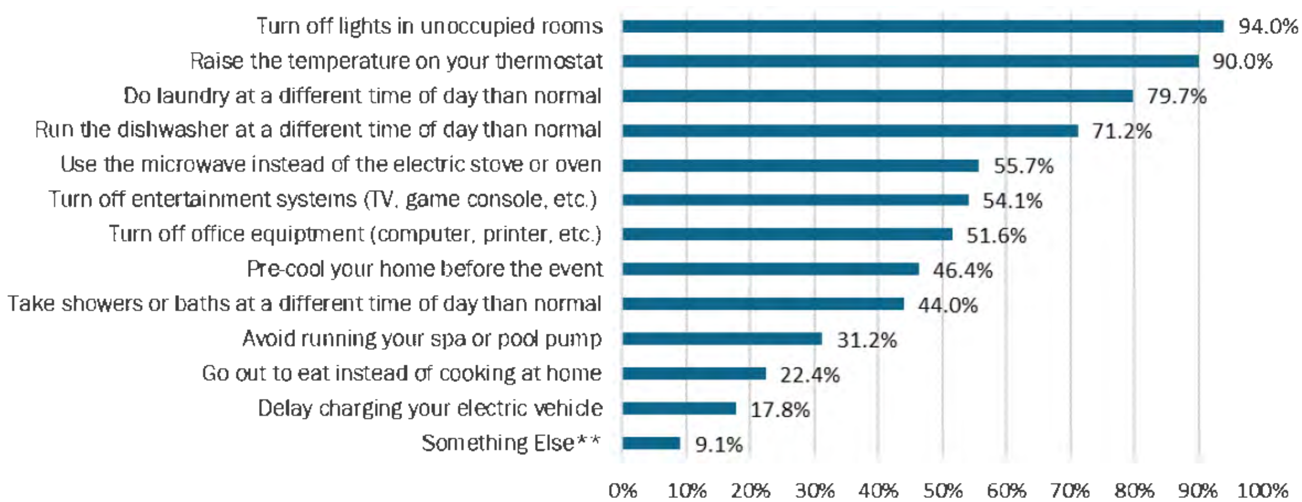
The same participants were later asked if they took action to lower their electricity usage during the Peak Time Credit event. The responses and accompanying bill credit incentives are presented in Table 4-7. Most of the participants responded that they did take action to reduce electricity usage during the peak times. Slightly more $1.20 per kWh incentive participants reported taking action but the difference between the groups is not statistically significant at the 90% confidence level.

Table 4-7: Did the Participant Take Action to Reduce Electric Usage During the Peak Time Credit Event?

Group	Yes	No
$0.60/kWh (n=186)	84.3%	15.7%
$1.20/kWh (n=211)	85.2%	14.8%
Total (n=397)	**84.8%**	**15.2%**

Participants who responded that they took action during the Peak Day event were presented with various actions that they may have taken to reduce electric usage during Peak Day events and asked to identify which actions they took. Figure 4-2 presents their responses. The most cited action was turning off lights in unoccupied rooms with 94% of participants responding that they took this action. The second most cited action was raising the temperature on their thermostat, with about 90% of participants saying they took this action. Participants were also able to provide their own response about what actions they took that were not originally listed in the survey, the most common free response was from customers saying they unplugged other appliances. For the non-free responses, there were no statistically significant differences between the two incentive groups in terms of recalled actions taken.

Figure 4-2: Recalled Actions Taken by Participants to Reduce Electric Usage During the Peak Day Event (n=335)



** Asterisks represent statistical significance difference between the $0.60 per kWh and $1.20 per kWh incentive groups at the 90% level

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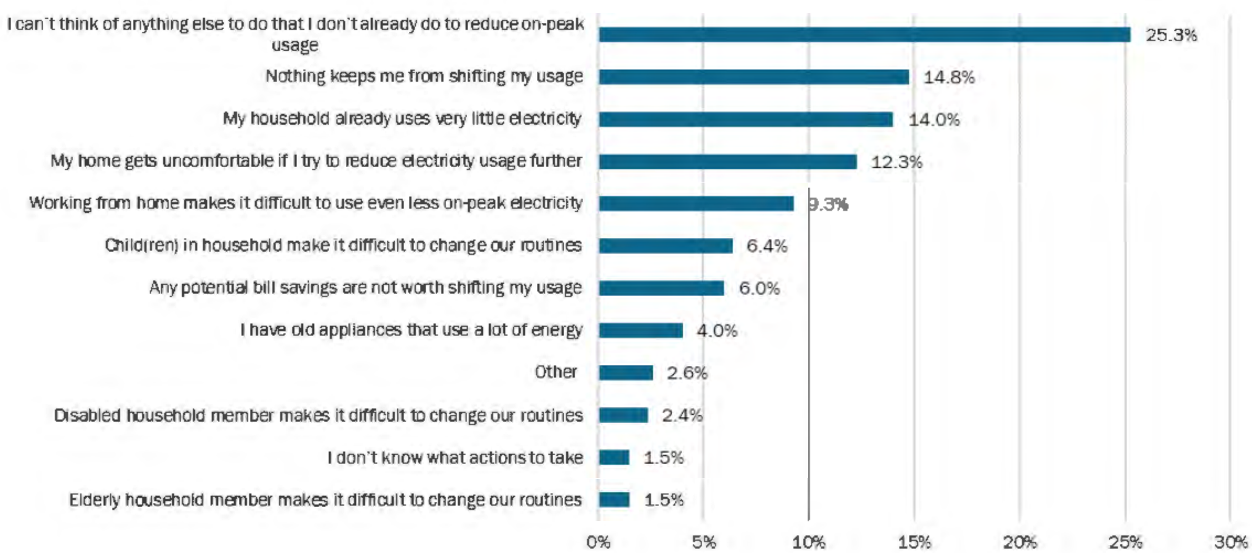
The final question in the event response section asked all participants what challenges they faced when they were reducing usage during any of the Peak Day events over the summer. Participants reported that it is generally easy for them to take action during Peak Day events with the average customers rating the ease of response being 8.5 out of 10. There was not a statistically significant difference (with 90% confidence) in the responses between the $0.60 per kWh and $1.20 per kWh groups. As shown in Figure 4-3 most customers said that they did not have many challenges in reducing their electricity during peak times with a plurality of participants reporting that they couldn't think of any other actions to reduce usage (25.3%), nothing stopped them from shifting usage (14.8%), or their household already uses very little electricity during peak hour (14.0%). The most commonly reported challenges were that participants at home would get uncomfortable if they reduced usage further (12.3%) and working from home limits the amount a customer can reduce their usage (9.3%). About 3% of participants stated "Other" which includes being away from guests, pet's comfort, and poor insulation.

Figure 4-3: Which of the Following Made it Difficult to Reduce Electricity Usage During Peak Day Events? (n=482)



Satisfaction with Peak Time Credit and Incentive Test

The next section in the survey presented various questions to Pilot participants and asked them how much they agreed with the statements on a scale from 1 to 10, with 1 meaning "Do not agree at all" and 10 meaning "Completely agree". Responses and the customers' associated incentive group are recorded in Table 4-8, participants generally agreed that the Pilot was easy to understand, the number of Peak Days is reasonable and the Peak Days work with their household schedule. Participants in the $1.20 per kWh group reported that they were more likely to recommend the Pilot than participants from the $0.60 incentive group at 8.6 and 8.1 out of 10, respectively. The Net Promoter Score[7] for the $0.60 per kWh group is 38.4 while the Net Promoter Score for the $1.20 per kWh group is 53.7. The Net Promoter group for the full set of customers is 46.7. The difference between groups was statistically significant at a 90% level of confidence. Similarly, customers in the $0.60 per kWh group agreed significantly more than the $1.20 per kWh group that they would make additional efforts to reduce Peak Day usage if the bill credit was greater at 9.3 and 8.7 out of 10, respectively.

Table 4-8: Participant Agreement with Provided Statements by Incentive Group

Statement	Average Response		
	$0.60/kWh (n=221)	$1.20/kWh (n=261)	Total (n=482)
The number of Peak Days is reasonable	8.7	8.9	8.8
The Peak Time Credit Pilot is easy to understand	9.2	9.2	9.2
The Peak Days work with my household's schedule	8.2	8.4	8.3
I would recommend the Peak Time Credit Pilot to friends or family	8.1	8.6	8.4
I would make additional effort to reduce my usage during Peak Days if the bill credit was greater	9.3	8.7	9.0

* Blue shaded cells are responses which are statistically different between the $0.60 per kWh and $1.20 per kWh incentive groups at the 90% level

[7] Net Promoter Score is a popular metric used to estimate how likely a customer is to promote a program. It is calculated by subtracting the percentage of customers who rate their likelihood to recommend the program from 1 to 6 (detractors) from the percentage of customers who rate their likelihood to recommend the program 9 or 10 (promoters).

The next question asked the participants to rate their satisfaction with the Pilot, the information provided by Duke Energy, and the bill credits that they have earned from the Pilot. As shown in Table 4-9, the full set of customers were generally very satisfied with the Pilot, giving the Pilot an average rating of 7.7 out of 10. The participants earning $1.20 per kWh were generally more satisfied with the Pilot, giving it an average score of 8.1 while the participants earning $0.60 per kWh gave an average score of 7.3. Note the difference between groups is significantly different with 90% confidence. Participants were generally very satisfied with the information provided by Duke Energy, giving an average score of 8.9. Customers were generally satisfied by the bill credits they earned through the Pilot, giving an average rating of 6.7. There was a significantly higher satisfaction rating among customers earning $1.20 per kWh than those earning $0.60 per kWh.

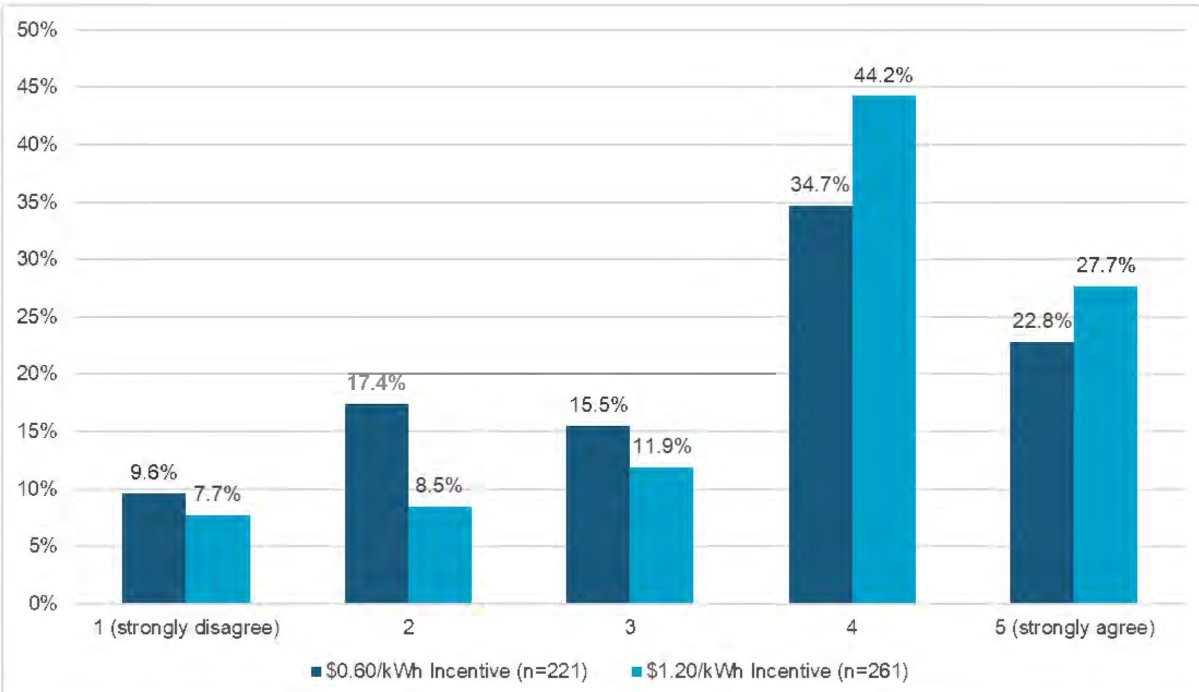
Table 4-9: Participant Average Satisfaction (n=192)

Statement	Average Response		
	$0.60/kWh (n=221)	$1.20/kWh (n=261)	Total (n=482)
The Peak Time Credit Pilot	7.3	8.1	7.7
Duke Energy's provided information on how the PTC works	8.7	9.0	8.9
The bill credits you have earned through the Peak Time Credit Pilot	6.1	7.2	6.7

* Blue shaded cells are responses which are statistically different between the $0.60 per kWh and $1.20 per kWh incentive groups at the 90% level

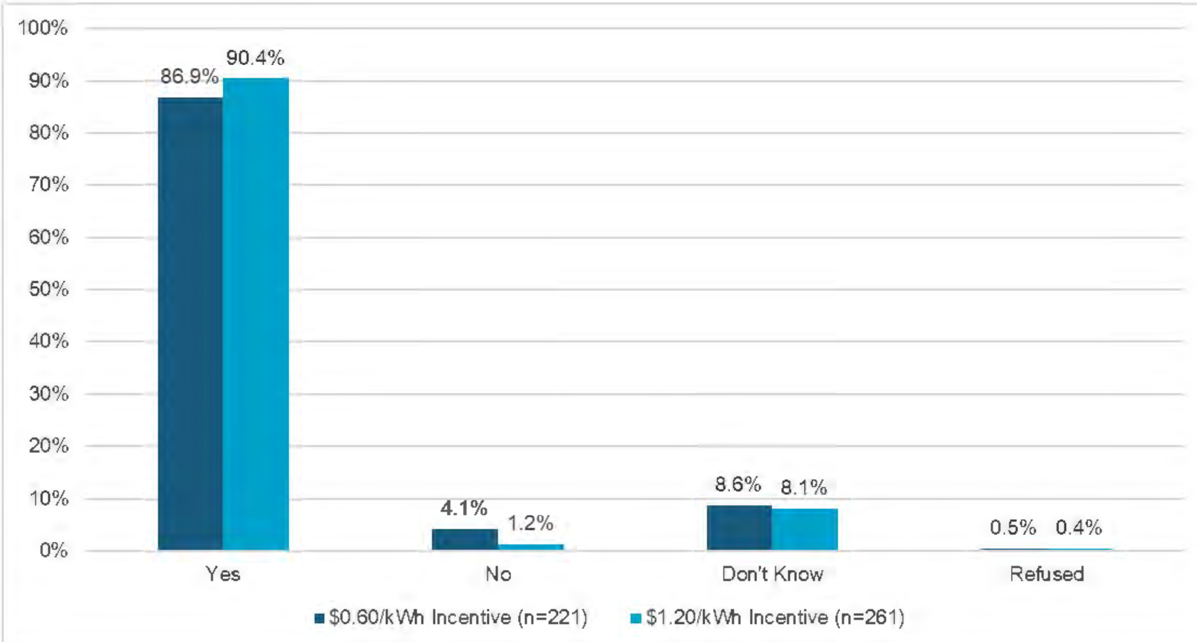
The same participants were later asked if receiving the current credit amount on Peak Days is enough to motivate them to reduce energy usage on a scale of 1 (strongly disagree) to 5 (strongly agree). These results are depicted in Figure 4-4. On average, participants receiving $0.60 per kWh ranked the credit earned at 3.4 while participants receiving $1.20 per kWh ranked the credit 3.8. Customers earning $0.60 per kWh find the bill credit statistically significantly less sufficient (with 90% confidence) than customers earning $1.20 per kWh, with average ratings of 3.5 and 3.8 out of 5, respectively.

Figure 4-4: Receiving the current incentive credit during the Peak Days is enough to motive the participant to reduce their usage



Participants were asked if they would continue to participate in this Pilot if it were to resume in future seasons. As shown in Figure 4-5, most participants said yes, however customers receiving the $0.60 per kWh incentive responded "No" and "Don't know" more frequently, a statistically significant difference. The 28 customers in the $0.60 per kWh incentive group who answered "No" and "Don't know" were then asked if they would participate in the Pilot if the bill credit was increased to $1.20 per kWh. The majority of such customers answered "Yes" (67.9%), with the second most frequent answer being "Don't Know" (25.0%), and "No" being the most uncommon response (7.1%). Similarly, the 236 participants earning $1.20 per kWh who said they would participate if the Pilot was offered in future seasons were asked if they would participate in the future if the bill credit were reduced to $0.60 per kWh. Their responses were roughly evenly split between "Yes", "No", and "Don't Know", with respective frequencies of 33.5%, 32.3% and 34.3%.

Figure 4-5: Participants would continue to participate if the Pilot were to continue in future winter and summer seasons



To close the survey, all customers were able to provide free-response recommendations for the Peak Time Credit Pilot. Participants in both the low and high incentive groups provided suggestions at around the same rate, 30.5% and 27.4% respectively. The Resource Innovations team summarized the responses into general topics, and results are presented in Table 4-10. A plurality of the recommendations related to bill credits as 36.3% (i.e., 11.0% of survey respondents) of the responses fall within the category, with the most frequent suggestion being to increase the bill credits. A further 21% of the responses (i.e., 7.5% of survey respondents) were about education, with the most frequent education suggestion being to offer more information on energy saving methods. The remaining suggestions fell into the categories of Track performance, Expansion of Pilot, Event notifications and Other/Expressed Frustration, each of which represents around 10% or less of the responses.

Table 4-10: Participants Recommendations for the Peak Time Credit Pilot

Category	Subcategory	Percent of $0.60/kWh Responses (n=61)	Percent of $1.20/kWh Responses (n=63)	Percent of Responses (n=124)	Percent of All Respondents (n=482)
Bill Credits	Increase them	21.1%	26.7%	24.0%	7.3%
	Communicate them	9.9%	8.0%	8.9%	2.7%
	Calculation/application of credits	5.6%	1.3%	3.4%	1.0%
Education	Energy saving methods	19.7%	20.0%	19.9%	6.0%
	How the program works	4.2%	5.3%	4.8%	1.5%
Track Performance		12.7%	10.7%	11.6%	3.5%
Expansion of Program		9.9%	12.0%	11.0%	3.3%
Other/Express Frustration		11.3%	6.7%	8.9%	2.5%
Event Notifications		5.6%	9.3%	7.5%	2.3%
Total		100.0%	100.0%	100.0%	-

4.2 Process Evaluation Conclusions and Recommendations

Key findings and recommendations pertaining to the process evaluation include:

Participation Awareness and Motivation

- Most respondents were aware of their participation in the Pilot with 99.6% of participants recalling their participation.
- The most important reason provided by participants for joining the Pilot was to save money on their electricity bill, with an average rating of 9.3 out of 10 on average.

Peak Time Credit Awareness and Notification Satisfaction

- In the post-event survey, the majority (82.4%) of respondents recalled the event and a majority became aware through email notifications from Duke Energy (73.2%).
- Respondents generally agreed that Duke Energy notified them in a timely manner (9.2 out of 10), provided them with helpful information (8.9 out of 10), and gave them confidence of which hours they can earn credits on Peak Days (9.5 out of 10).

Response to Peak Time Credit Event

- In the post-event survey, 80.6% of the respondents reported being home during the event and 82.4% of respondents took action or changed their behavior due to the event.
    - Customers in the $0.60 per kWh group were home more frequently (84.9%) during the event than customers in the $1.20 per kWh group (76.7%), with statistical significance.
- The most commonly reported actions taken by participants were turning off lights in unoccupied rooms, increasing temperature on their thermostat, and shifting large appliance use. There were no statistically significant differences between the two incentive groups in terms of actions taken.
- Participants generally find responding to an event to be relatively easy, giving an average rating of 8.5 out of 10. There was no statistically significant difference in this rating between the two incentive groups.
- Commonly reported challenges to event response included not being able to think of any additional actions to take (25.3%), not having any barriers to shifting usage (14.8%), and already using very little energy (14.0%). There were no statistically significant differences between the incentive groups in terms of challenges to reduce usage.

Satisfaction with Peak Time Credit and Incentive Test

- Participants were generally satisfied with Pilot implementation overall (7.7 out of 10), but customers receiving $1.20 per kWh bill credit were statistically significantly more satisfied (8.1 out of 10) compared to $0.60 per kWh bill credits (7.3 out of 10).

- Customers would generally recommend the Pilot to others (8.4 out of 10) and would continue participating in future seasons (88.8%).
    - The $1.20 per kWh group was statistically significantly more likely to recommend the Pilot to others (8.6 out of 10) than the $0.60 per kWh group (8.1 out of 10).
    - The $0.60 per kWh group was statistically significantly more likely to respond “No” or “Don’t know” when asked if they would continue participating in the Pilot in the future (12.7%) than the $1.20 per kWh group (9.3%).
- The Net Promoter Score (NPS) for the full set of incentive test customers is 46.7. The NPS for the $0.60 per kWh group is 38.4 while the NPS for the $1.20 per kWh group is 53.7. The difference in scores between the two groups is statistically significant – however, the positive magnitude of the scores indicate that there is a large proportion of customers in both groups that would recommend the Pilot to others.
- The Net Promoter Score (NPS) for the full set of incentive test customers is 46.7. The NPS for the $0.60 per kWh group is 38.4 while the NPS for the $1.20 per kWh group is 53.7. The difference in scores between the two groups is statistically significant – however, the positive magnitude of the scores indicate that there is a large proportion of customers in both groups that would recommend the Pilot to others.
- Participants receiving $0.60 per kWh bill credits are statistically significantly less satisfied (6.1 out of 10) with the credits earned than customers receiving $1.20 per kWh bill credits (7.2 out of 10).
- Out of the customers receiving the $0.60 per kWh bill credit and who planned on discontinuing their participation in later seasons (12.7% of the overall $0.60 per kWh group), over two-thirds (8.6% of the overall $0.60 per kWh group) said they would stay in the Pilot if the credit increased.
- Out of the customers receiving the $1.20 per kWh bill credit and who planned on continuing their participation in later seasons (90.4% of the overall $1.20 per kWh group), over one-third (30.3% of the overall $1.20 per kWh group) said they would stay in the Pilot if the credit decreased.

Recommendations from Participants

- Respondents were given the opportunity to provide free-form response recommendations to improve the Peak Time Credit Pilot. In total, 28.8% of respondents provided suggestions. The bullets below provide a summary of the suggestions offered by participants.
  - Out of the 124 suggestions provided by participants, 24% were to increase the credit. This represents 6.9% of all survey respondents. While the bill credit is the primary motivation for enrollment (9.3 out of 10), customers are the least satisfied with the credit (6.7 out of 10) and would work harder to reduce usage if the credit were higher (9.0 out of 10). It is worth noting that a quarter of participants stated that they cannot think of any other actions to reduce their usage.
    - Of the suggestions provided, 26.7% of respondents in the $1.20 per kWh group suggested increasing the bill credits, compared to 21.1% of the $0.60 per kWh group.
  - Several participants (8.9% of 124 suggestions provided) suggested communicating the credits earned swiftly and clearly following an event, even if no credit was earned. This represents 2.6% of all survey respondents.
    - Of the suggestions provided, 8.0% of respondents in the $1.20 per kWh group suggested communicating the credits earned swiftly and clearly following an event, compared to 9.9% of the $0.60 per kWh group.
  - A common recommendation (19.9% of 124 suggestions provided) was to provide in-depth information on energy savings methods and give examples of how they may translate to bill credits. This represents 5.7% of all survey respondents.
    - Of the suggestions provided, 20% of respondents in the $1.20 per kWh group suggested providing information on energy savings methods, compared to 19.7% of the $0.60 per kWh group.
  - Several customers (11.6% of 124 suggestions provided) suggested creating a Peak Time Credit website or app that tracks participants' usage, provides Pilot information and event notifications, and tracks and contextualizes Peak Day performance. This represents 3.3% of all survey respondents.
    - Of the suggestions provided, 10.7% of respondents in the $1.20 per kWh group suggested creating a Peak Time Credit website or app, compared to 12.7% of the $0.60 per kWh group.

Appendix A Summer 2022 Load Impacts: Original Participants

To: Bruce Sailers, Jean Williams, Duke Energy Kentucky
From: Eric Bell, Apex Analytics, George Jiang, Anna-Elise Smith, Resource Innovations
RE: Summer 2022 Original Participants Load Impacts

Original Pilot participants, enrolled in Summer 2020, experienced three events between 3 PM – 7 PM during the Summer 2022 season. Approximately 700 original participants experienced events during the Summer 2022 season. Methodology used to estimate load impacts for the original participants aligns with Section 3.

Table A-1 displays average hourly load impacts per customer during the event hours of 3 PM – 7 PM by segment for original participants during the Summer 2022 season. The estimated load impact averaged across all original Pilot participants for the Summer 2022 season was 0.15 kW or 6.0%. Single-family customers had an average load impact of 0.17 kW (5.9%) while multi-family customers had an average load impact of 0.10 kW (6.6%) during the event hours of 3 PM to 7 PM.

Table A-1: Average Hourly Load Impact (kW), Summer 2022 – Original Participants

Original Customer Segment	Load w/o DR (kW)	Load w/ DR (kW)	Impact (kW)	Impact (%)
Residential Single Family Combined	**2.93**	**2.76**	**0.17**	**5.9%**
Residential Single Family (Electric Heat)	2.87	2.67	0.20	6.9%
Residential Single Family (Gas Heat)	2.95	2.79	0.17	5.6%
Residential Multi-family Combined	**1.53**	**1.43**	**0.10**	**6.6%**
Residential Multi-family (Electric Heat)	1.49	1.34	0.15	10.0%
Residential Multi-family (Gas Heat)*	1.57	1.51	0.05	3.3%
All Events Participants	**2.53**	**2.38**	**0.15**	**6.0%**

*Blue highlighted cells are not statistically significant at the 90% level.

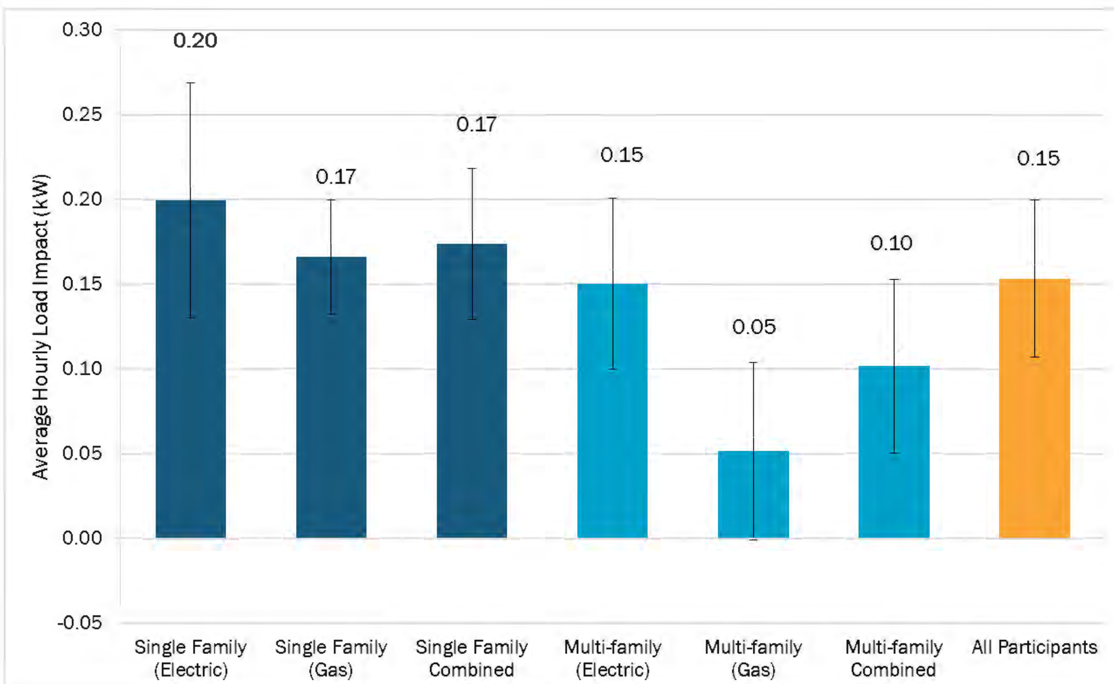
In Summer 2022, three events were called between 3 PM – 7 PM for original Pilot participants. Summer 2021 had sixteen events called between 3 PM – 7 PM. Winter 2021 had two events called between 6 AM – 10 AM and Summer 2020 experienced two events called between 3 PM – 7 PM. Table A-2 displays average hourly load impacts per customer, by event season. Original Pilot participants' average hourly load impacts per customer during the Summer 2022 season were 0.15 kW or 6.0%. Average hourly impacts per customer during the Summer 2021 events were 0.14 kW or 6.1% while Summer 2020 impacts were much larger at 0.38 kW or 15.4%. Average hourly impacts per customer across the two Winter 2021 events were 0.12 kW or 5.6%. Notably, the Summer 2020 event season coincided with the COVID-19 pandemic, leaving many folks at home. This may have impacted the load impacts observed. Next, each season experienced different event temperature, which is highly correlated with reference load and the magnitude of load impacts observed.

Table A-2: Average Hourly Load Impact (kW) Comparison Across Seasons - Original Participants

Season	Load w/o DR (kW)	Load w/ DR (kW)	Impact (kW)	Impact (%)
Summer 2022	2.53	2.38	0.15	6.0%
Summer 2021	2.37	2.22	0.14	6.1%
Winter 2021	2.04	1.93	0.12	5.6%
Summer 2020	2.49	2.11	0.38	15.4%

Figure A-1 displays the magnitude and statistical significance of each of the four customer classes, as well as that of all participants, all single-family, and all multi-family groups for original participants. The 90% confidence interval is displayed for each group of customers as an error bar over their impact. If the error bar crosses zero, the impact is not statistically significant from zero at the 90% level of confidence. All customer classes display statistical significance except the multi-family gas segment. In both the single-family and multi-family segments, customers with electric heating had larger load impacts, although the differences in impacts are not statistically significant. Single-family segments provided larger load impacts than multi-family segments.

Figure A-1: Average Hourly Load Impact (kW) by Customer Class (Summer 2022) - Original Participants



A.1 Load Impacts by Event Day

Figure A-2 shows the average hourly load impact for single-family and multi-family customers during each of the three events. Error bars represent the 90% confidence interval. When the black bars cross zero on the y-axis, the results are not statistically different from zero with 90% confidence, and therefore are insignificant. The largest impacts are observed on the third event day (8/3/2022) in both the single-family and multi-family segments at 0.24 kW and 0.11 kW, respectively. The second-largest event impacts are observed on the first and hottest event (6/14/2022) in both single- and multi-family segments at 0.16 kW and 0.10 kW. The smallest event impacts were observed on the second event (6/15/2022) in both segments at 0.12 kW and 0.09, although the impacts for the multi-family segment are not statistically significant.

Figure A-2: Average Hourly Load Impact per Customer - Original Participants

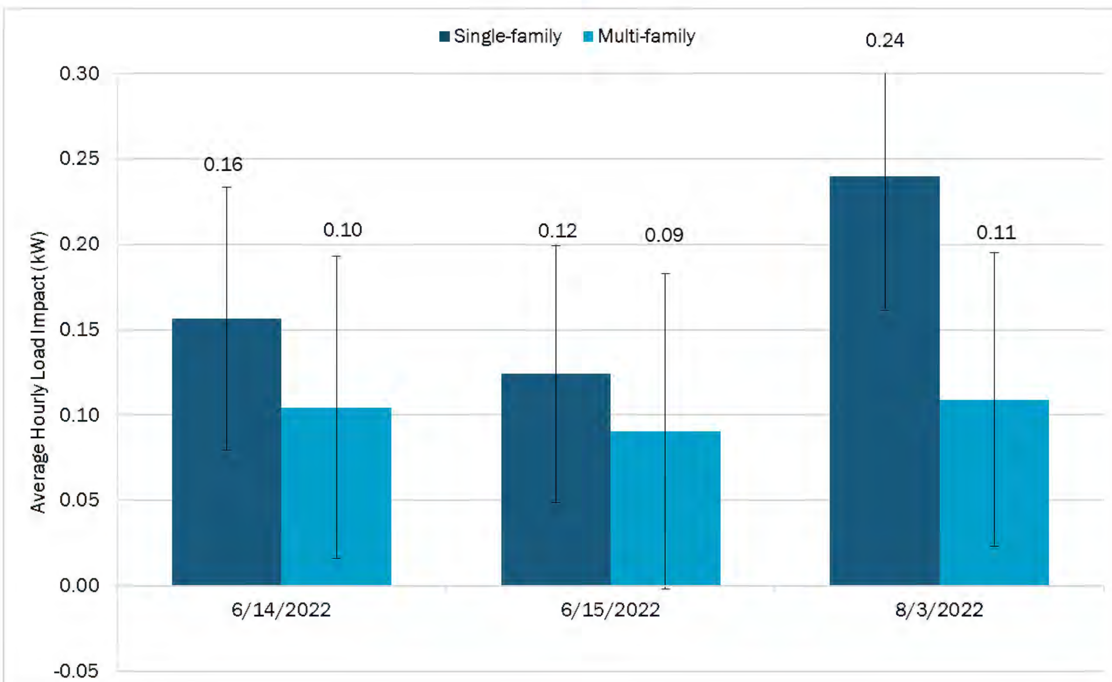


Table A-3 displays summaries of the three Summer 2022 PTC Pilot events for original participants. Each event's average event period temperature, control load, treatment load, average hourly load impact per customer, percentage impact, and 5^{th} and 95^{th} percentiles are displayed.

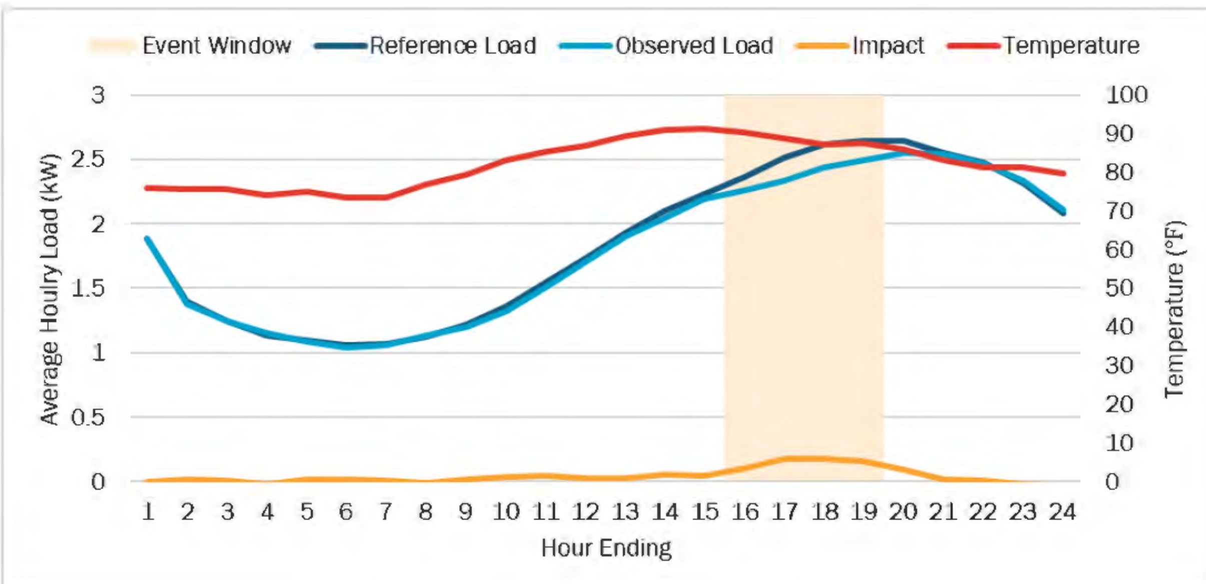
Aggregated to all original participants, all daily event impacts are statistically significant at the 90% confidence level. The average hourly load impacts per customer across all original participants in Summer 2022 was 0.15 kW or a 6.0% reduction to reference load. Interestingly, the load impacts have a negative relationship to event period temperature in the original participant segment.

Table A-3: Average Hourly Load Impact by Event Day (Summer 2022) - Original Participants

Event Date	Event Temp.	Load w/o DR (kW)	Load w/ DR (kW)	Impact (kW)	Impact (%)	5th Percentile	95th Percentile
6/14/2022	93.00	2.56	2.41	0.14	5.5%	0.06	0.22
6/15/2022	90.25	2.59	2.48	0.11	4.4%	0.03	0.19
8/3/2022	82.25	2.45	2.25	0.20	8.3%	0.12	0.28
Avg. Event	**88.50**	**2.53**	**2.38**	**0.15**	**6.0%**	**0.11**	**0.20**

Figure A-3 shows the average per-customer load with demand response, load without demand response (reference load), load impact, and hourly temperature for the event day with highest load impacts and the average event day, respectively, for all original PTC participants. The average load without DR during all event hours was 2.53 kW. The average load with DR during event hours was 2.38kW resulting in an average load reduction of 0.15 kW per customer, or a 6.0% reduction relative to the reference load.

Figure A-3: Average Hourly Load Impacts per Customer on Average Event Day (Summer 2022) - Original Participants



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Reimagining tomorrow with Nexant today

Duke Energy Kentucky
Case No. 2024-00264
STAFF First Set of Data Requests
Date Received: September 27, 2024

STAFF-DR-01-004

REQUEST:

Refer to the Application, page 12. In addition to email, direct mail, web enrollment, and call center promotion, specify any additional marketing efforts Duke Kentucky considered using.

RESPONSE:

Duke Energy Kentucky also considered all of the marketing efforts suggested in the Commission's order in Case No. 2022-00251, which included television advertisement and mass media outlets, such as radio. Currently the Company is also considering reaching customers through social media channels.

PERSON RESPONSIBLE: Mark Meetsma

Duke Energy Kentucky
Case No. 2024-00264
STAFF First Set of Data Requests
Date Received: September 27, 2024

STAFF-DR-01-005

REQUEST:

Refer to the Application, Appendix B, page 2. Regarding the Business Energy Saver Program, explain how Duke Kentucky is anticipating a 379 percent increase, or $138,944, in Shared Savings as compared to the actual Shared Savings of approximately $37,051 for the period 2022-2023.

RESPONSE:

The addition of the SmartPath channel is projected to increase kWh impacts by almost three times the actuals from 2022-2023, while only approximately doubling the costs. The increased participation at a lower cost per participant results in higher shared savings and a more cost-effective program.

PERSON RESPONSIBLE: Melissa Adams

CONFIDENTIAL STAFF-DR-01-006
(As to Attachment only)

REQUEST:

Refer to the Application, pages 10–13.

a. Provide the benchmark review from ESource in regard to reviewing the tiered incentives. Include in the response other jurisdictions or utilities that offer a Peak Time Rebate DSM Program, or something similar, and their program characteristics compared to Duke Kentucky.

b. Explain how offering incentive credits at higher levels may make cost-effectiveness challenging to achieve if participant count also increases.

c. If possible, provide an approximation for how many participants Duke Kentucky would need to make the Peak Time Rebate program cost-effective.

d. Provide a breakdown of the proposed budget increase for the PeakTime Rebate program.

e. Provide the projected impact on customer participation expected to result from increasing the PTR Pilot Program tiered incentive credits to $1.00, $1.25, $1.50. Include in the response how Duke Kentucky anticipates a $0.25 difference in tiers to be significant enough to evoke customer participation.

RESPONSE:

<u>CONFIDENTIAL PROPRIETARY TRADE SECRET (As to Attachment only)</u>

a. Please see STAFF-DR-01-006(a) Confidential Attachment.

b. In Summer 2022, a test was conducted to determine the impact of different incentive levels on average hourly load impacts per participant. The difference in load reductions between the $0.60/kWh incentive group and the $1.20/kWh incentive group was not statistically significant. It is possible that providing a higher level of incentives, while potentially increasing participation, will not drive an accompanying level of usage reduction, therefore reducing the potential for the achievement of cost-effectiveness.

For additional information about the Summer 2022 test, please see STAFF-DR-01-003 Attachment, page 2 – 1.1.1 Load Impacts section.

c. Duke Energy Kentucky would need approximately 4,500 participants to make the Peak Time Rebate cost effective after initial IT development is completed.

d. Please see table below:

Message Broadcast	$	13,000
Event Customer Credits	$	10,000
Marketing	$	106,200
Email	$	1,200
Direct Mail	$	80,000
Other	$	25,000
IT Development Costs	$	300,000
Total	$	429,200

e. The Company is assuming an eventual 5% adoption rate based on the $1.00/kWh tier. By including additional tiers up to $1.50/kWh and additional marketing channels, the Company hopes to achieve an eventual 10% adoption rate.

In its Application, the Company has also proposed that "[w]hen the Company has gathered a sufficient amount of information for its electric reliance assessment model, the Company will modify the tiers to consider information from the model." Thus, the tiers could be modified in the future if the model indicated that such modification could improve enrollment rates.

PERSON RESPONSIBLE: Mark Meetsma – a., b., d., e.
Melissa Adams – c.

CONFIDENTIAL PROPRIETARY TRADE SECRET

STAFF-DR-001-006(a)
CONFIDENTIAL ATTACHMENT

FILED UNDER SEAL

STAFF-DR-01-007

REQUEST:

Refer to the Application, page 13. Refer also to the Application, Appendix B, page 2. Reconcile the discrepancy between the proposed budget amounts for the PTR Program.

RESPONSE:

The dollar amount in the application should have been $429,000 and not the typo of $429,200. The amount in Appendix B, page 2 of $428,999 is a rounding issue. The correct amount is $428,999.

PERSON RESPONSIBLE: Trisha Haemmerle

CONFIDENTIAL STAFF-DR-01-008
(As to Attachment only)

REQUEST:

Refer to the Application, pages 14–15. Provide documentation supporting the calculation of the additional budget of $77,000 to the PowerShare® program to conduct an Evaluation, Measurement and Verification evaluation, including any contracts, responses to requests for proposals, or workpapers.

RESPONSE:

CONFIDENTIAL PROPRIETARY TRADE SECRET (As to Attachment only)

Please see STAFF-DR-01-008 Confidential Attachment for documentation that supports the additional budget of $77,000 for the PowerShare program to conduct an Evaluation, Measurement, and Verification evaluation. A cost summary for the evaluation is on page 13.

PERSON RESPONSIBLE: Jean P. Williams

Evaluation Plan for PowerShare® Program

June 2017 – May 2024

DRAFT

Prepared for:

DUKE ENERGY

Duke Energy Kentucky

Submitted by:

Guidehouse Inc.
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Charlotte, NC 28280
704.347.7621
Guidehouse.com

September 17, 2024

Table of Contents

1. Program Description

This document presents Guidehouse's evaluation plan for the Duke Energy Kentucky (DEK) PowerShare program. The PowerShare program is a demand response (DR) program offered to commercial and industrial customers that is part of the portfolio of demand side management and energy efficiency (DSM/EE) programs offered by Duke Energy. PowerShare offers participating customers a financial incentive to reduce their electricity consumption when called upon by Duke Energy.

The PowerShare program is designed to encourage the participating organizations to reduce their electricity consumption. Customers may qualify for the program if they can provide 100 kW in curtailable load. The PowerShare program offers customers two options for participation:[1]

- **CallOption:** The CallOption program requires participating customers to reduce and maintain a predetermined load during Emergency Curtailment Periods. Participants may either opt to participate in events for (1) the entire calendar year or (2) only during the summer months spanning May through October. Participants receive a monthly credit on their energy bill, and additional Load Reduction Credits are paid for load curtailed during events. Monthly credits for summer-only participants total to $36 per enrolled kW per year, and for year-round participants the monthly credit totals to $54 per enrolled kW per year. All CallOption participants must participate in an annual test event to remain in the program.

- **QuoteOption:** By enrolling in the QuoteOption program, participants can take part in voluntary Curtailment Periods on a per-event basis. If a participant elects to participate in an event, they should reduce and maintain load to a level they specify prior to the event. A QuoteOption event is initiated at Duke Energy's discretion and participants are typically provided with event notification on the morning of the event. When possible, an advisory is sent out a day in advance. Unlike CallOption participants, QuoteOption participants are not paid monthly credits and are only eligible for Load Reduction Credits for their performance during voluntary program events.

Duke Energy contracts with Schneider Electric to calculate monthly customer settlements for the PowerShare program. Schneider Electric is a firm, providing services in energy management and automation. The PowerShare settlements are calculated with the use of Schneider Electric's Energy Profiler Online (EPO), a third-party hosted software application. EPO uses participant interval data, Duke Energy-generated participant baselines and a set of program option-specific calculations to determine the event energy (kWh) and monthly capacity (kW) values that determine participant settlement payments.

[1] This summary of participation options was drawn directly from the PowerShare program brochure in July 2024. The PowerShare program brochure may be found here: https://www.duke-energy.com/-/media/pdfs/for-your-business/powersharebrochure-ky.pdf?rev=d5503b786684467686e50db626a76c79

2. Key Research Objectives

The research objectives of this evaluation are to estimate the demand response (kW) delivered by PowerShare participants. Data permitting, Guidehouse plans to estimate demand response impacts for events called between June 1, 2017 and May 31, 2024, specifically:

1. Estimate verified demand (kW) impacts using a baseline testing approach (including regression-based and customer baseline, or, CBL). These impacts will include:
    a. Average kW demand impact per customer for each event, and on average across all events
    b. Total program kW demand impact for each event, and on average across all events

In providing verified demand impacts, Guidehouse will validate that the demand response impact estimates for program events, including annual test events required for continued participation in the program.

3. Impact Evaluation Approach

To estimate impacts, Guidehouse will analyze participant interval consumption data using a regression baseline estimation approach.

3.1 Data Requirements

The data requirements for the evaluation include:

- **Participant Interval Consumption Data:** At minimum, hourly, or sub-hourly consumption data are required for all participants, for the period beginning at least 45 calendar days prior to the first curtailment event. If possible, Guidehouse would prefer data the entire evaluation period and for the 45 days immediately preceding (i.e., April 15, 2017 through May 31, 2024). These additional data can be helpful when ancillary analyses are desired – for example, comparing peak demand contributions (during events) to annual consumption, or validating hourly values against monthly billing data – but are not required for the deliverables in the scope of this evaluation.
- **Participant Cross-Sectional Data:** This data includes curtailment option, industry type, and other firmographic information, if Duke Energy wishes to have results aggregated by cross-sectional characteristic.
- **Event Settlement Data:** This data includes information for each participant for each event, showing any credits for curtailment and any buy-through or non-compliance penalties incurred.
- **Program Documentation:** This data includes information required to replicate DEK settlement calculations. Documentation provided to Guidehouse should include information on all settlement approaches that have been employed since June 1, 2017 up until May 31, 2024.
- **National Oceanic and Atmospheric Administration (NOAA) Weather Data:** Hourly dry bulb temperature and relative humidity collected from NOAA weather stations located near participants enrolled in the PowerShare program.

Upon receipt of data necessary for evaluation, Guidehouse will review all data received for sufficiency. Assessment will include ensuring all program participants have consumption data that is complete and accurate from June 2017 through May 2024. In addition, Guidehouse will screen the program documentation to ensure that the calculation approach is clearly outlined and replicable for all applicable program years from June 2017 through May 2024. Lastly, Guidehouse will review the settlement data to confirm that the CallOption and QuoteOption participants that participated in program events have associated settlement amounts available. If there are significant gaps in data received, Guidehouse will update this evaluation plan to reflect the evaluation activities that are possible with available data.

3.2 Estimating Verified Impacts Using a Baseline Testing Approach

The objective of this task is to estimate demand impacts using the most accurate baseline approach. Guidehouse will select the baseline approach by testing a variety of potential methods and selecting the best performing model in aggregate, based on predictive accuracy on "event-like" non-event days.[2] This process involves:

- **Testing of Candidate Baseline Methods.** Guidehouse will test a set of CBLs and regression specifications, with and without day-of-adjustment. This testing determines the final approach to be used for estimating verified impacts.
  - In total, Guidehouse will test seven different regression specifications (with and without adjustment): the core model and six models consisting of the core model with additional variables listed in Table 1. The models in Table 1 are described in greater detail in section 3.2.1.2.

Table 1. Additional Variables Included in Regression Specification Tested

Model	Var1	Var2	Var3
1	ema6dh		
2	ema24dh		
3	hbu		
4	hbu	ema6dh	
5	hbu	ema24dh	
6	hbu	ema6dh	ema24dh

- **Estimating Verified Impacts.** Guidehouse will apply the baseline approach determined in the testing phase to most accurately predict participant demand on non-event days that are as similar as possible to the true event days.

3.2.1 Testing of Candidate Baseline Methods

Guidehouse will perform the following steps to test candidate baselines and select the approach to be used for verifying DR impacts:

1. **Identify Test Days.** The first step is to identify an appropriate number of test days. Test days are non-event, non-holiday weekdays with a temperature profile as similar as possible to that of the actual event days. The number of test days will be determined once the evaluation data are in hand, for two reasons:
   a. It is only appropriate to test approaches on days that are reasonably similar to event days (in terms of weather, across both seasons). The approach that most accurately predicts demand on mild days, may not be the approach that most accurately predicts demand on extremely hot or cold (i.e., event) days.

[2] Event-like days are defined on the basis of the day's temperature profile. For each event, a test day is selected from the pool of non-event days which has a temperature profile most like the given event day.

   b. The team must maximize the number of test days (to more accurately determining the best method) while leaving some "event-like" days available to be included in models to accurately predict demand on test days.

2. **Estimate Baselines**. Based on the test days selected, Guidehouse will estimate the demand during the exposure period of the program (10 am to 10 pm in summer, 6 am to 9 pm in winter) on those test days using all approaches to be tested. Guidehouse may adjust these periods based on when events were called and based on feedback from Duke Energy.
3. **Quantify Accuracy and Select Approaches.** Each customer's baseline generated by each approach tested is assigned a metric of accuracy (e.g., mean absolute error). These metrics are aggregated across customers,[3] by approach to determine the overall accuracy rank (for the entire program) of each approach. Guidehouse will select the most accurate approach in aggregate in each season to calculate verified impacts. Should the most accurate approach also be one that uses a day-of-load adjustment (described below), Guidehouse will also determine the most accurate approach that does *not* use a day-of load adjustment. This approach may be employed in cases where notification occurs day-ahead.

The types of baselines to be tested by Guidehouse fall into two broad categories: customer baselines (CBLs) and regression-based baselines. These are described in greater detail below, and a menu of types that may be tested is listed.[4] Note that each approach listed below will be tested twice: once with a symmetric and additive day-of load adjustment, and once with no day-of load adjustment (i.e., assuming that notification was day-ahead).

The day-of-load adjustment is calculated as the average difference between the baseline and the actual demand during the three hours of demand observed starting one hour prior to customer notification of the event. For testing the adjustments, Guidehouse will use an appropriate assumed notification time, based on a review of actual notification times and through discussion with PowerShare program staff.

3.2.1.1 CBLs

The two most basic types of CBL are:

- **X-of-Y day CBLs**. In this case the baseline is delivered by the average event window demand on the X days in which that demand was highest within a Y day window preceding the event; and,
- **X-of-Y days of the same day-of-week CBLs.** In this case, the baseline delivered by the average event window demand on the X number of prior days in which demand was highest within the Y number of days that fall on the same day of the week as the event.

[3] Aggregation of metrics will explicitly account for customer loads to ensure that the baseline selected is the one that is most accurate for the program overall.

[4] The precise specification of CBLs and regressions that will be tested may differ from the list presented below based on the findings of an exploratory analysis of the data and discussions with Duke Energy.

Only non-event days may qualify for inclusion in the baseline. A day may qualify for inclusion in the baseline if and only if it is a non-holiday, non-event weekday.

Qualifying non-event days are eligible for inclusion in the look-back window (the period of Y days) in the baseline only if the participant's average demand during the event period on that day is 50% or more of the average demand across all Y days.

Days that fail to meet the eligibility criterion (i.e., days where the average demand during the event window are less than half of the average demand in that window across the Y days of the look-back period) are replaced by next most proximate previous qualifying and eligible day. If there are not three qualifying days out of the ten non-excluded days prior to the event, the algorithm reverts to using the three most immediate non-excluded days prior to the event.

Guidehouse will test the 23 CBLs listed in Table 2 below.

Table 2: CBLs to be Tested

CBL Number	CBL
1	2 of 2
2	2 of 3
3	3 of 3
4	2 of 4
5	3 of 4
6	4 of 4
7	3 of 5
8	4 of 5
9	5 of 5
10	3 of 6
11	4 of 6
12	5 of 6
13	6 of 6
14	4 of 7
15	5 of 7
16	6 of 7
17	7 of 7
18	2 of 2 of same day-of-week
19	2 of 3 of same day-of-week
20	3 of 3 of same day-of-week
21	2 of 4 of same day-of-week
22	3 of 4 of same day-of-week
23	4 of 4 of same day-of-week

3.2.1.2 Regression-Based Baselines

All regression specifications discussed below are variants of a core model that accounts for a base set of demand patterns. The base, or core, model specification of the regression model is presented below, with the assumption that it will be estimated using half-hourly frequency interval data. This specification may be modified depending on the frequency of interval data available.

Equation 1. Core Regression Model

$$y_t = \sum_{i=1}^{48} \beta_{1,i} hhour_{t,i} + \sum_{i=1}^{48} \beta_{2,i} hhour_{t,i} DHH_t + \sum_{d=1}^{D} \gamma_d C_{t,d} + errors$$

Where:

y_t = The average demand (kW) observed at the given meter in the half hour of sample *t*.

$hhour_{t,i}$ = A set of 48 dummy variables, one for each half-hour of the day. The given dummy takes a value of 1 when the half hour of sample is the i-th half hour of that day. For example: if half hour t is between midnight and 12:15 am, $hhour_{t,i=1}$ is equal to one and zero otherwise.

DHH_t = The cooling (in summer) or heating (in winter) degree half-hours (base 65F) in quarter hour of sample t. This variable accounts for that the heating or cooling demand influences energy consumption.

$C_{t,d}$ = A set of D dummy variables identifying each half-hour in which a curtailment event took place.

Guidehouse will also test specifications that include the following additional variables.

$EMA6dh_t$ = An exponential moving average of DHH_t observed in the six-hour period leading up to, and including, hour *t*.

$EMA24dh_t$ = Identical to $EMA6dh_t$, except for 24, instead of, six hours.

hbu_t = Heat index build-up observed in half-hour of sample *t*. This is a 72-hour geometrically decaying average of the NOAA-defined heat index.[5] It is calculated in the following manner:

$$cbu_t = \sum_{h=1}^{72} 0.96^h \cdot heatindex_{t-h} \Big/ 1{,}000 \; .$$

[5] National Oceanic and Atmospheric Administration, National Weather Service – Weather Prediction Center, *The Heat Index Equation*, accessed July 2023. http://www.wpc.ncep.noaa.gov/html/heatindex_equation.shtml. There are additional adjustments that are applied within certain temperature and humidity ranges.

Note in this case that the *t* subscript denotes hourly intervals. The hbu_t (normalized heat build-up) is a geometrically decaying 72-hour moving average of NOAA's heat index. That variable is calculated in the following manner:

$$heatindex_t = -42.379 + 2.049 \cdot drybulb_t + 10.1433 \cdot hum_t - 0.2248 \cdot drybulb_t \cdot hum_t - 0.0068 \cdot drybulb_t^2 - 0.0548 \cdot hum_t^2 + 0.0012 \cdot drybulb_t^2 \cdot hum_t + 0.0009 \cdot drybulb_t \cdot hum_t^2 - 0.000002 \cdot drybulb_t^2 \cdot hum_t^2$$

Where $drybulb_t$ is the drybulb temperature (in °F), hum_t is relative humidity (in percent) observed at half-hour *t,* and ws_t is the wind-speed in miles per hour observed at half-hour *t.* Note that although some of the NOAA's coefficients have been rounded for concision above, the complete unrounded values will be used in the analysis.

In total, Guidehouse will test seven different regression specifications (with and without adjustment): the core model and six models consisting of the core model with additional variables as listed in Table 3.

Table 3. Additional Variables Included in Regression Specifications Tested

Model	Var1	Var2	Var3
1	ema6dh		
2	ema24dh		
3	hbu		
4	hbu	ema6dh	
5	hbu	ema24dh	
6	hbu	ema6dh	ema24dh

3.2.2 Estimating Verified Impacts

Guidehouse will estimate the DR impacts using the selected approach from testing described in Section 3.2.1, and which applies given when event notification took place (i.e., if notification is day-ahead, then no day-of adjustment approach can be used). One approach (with or without a day-of-adjustment as appropriate) will be used for all participants. Negative DR impacts (where baseline demand is lower than actual demand) are not "zeroed out", but instead counted as increases in demand when impacts are aggregated across participants. This is to account and compensate for the random variation that will sometimes lead baselines to be too high (overestimating impacts), and other times to be too low (underestimating impacts).

Guidehouse will estimate demand impacts for each event called between June 1, 2017 and May 31, 2024, as well as the average across all events, for each customer and for all customers in aggregate (i.e. the program total).

4. Net-to-Gross Analysis

Evaluations of DSM/EE programs commonly estimate a net-to-gross (NTG) ratio based on the evaluated percentage of demand reductions which may be ascribed either to free-ridership (which reduces the NTG ratio) or program spillover (which increases the NTG ratio). Free ridership is typically defined as the percentage of demand reductions that would have occurred anyway, absent the presence of the program. Participant spillover is typically defined as incremental demand reductions undertaken by a program's participants that were influenced by program participation, though not directly incented or promoted by the program administrator.

In the case of demand response programs, such as PowerShare, there is no reason to expect that a customer would curtail loads during the event periods (the timing of which would be unknown to the customer absent participation in the program) without being enrolled in the program. Furthermore, since demand reductions are estimated relative to an estimated baseline, which captures expected participant behavior absent an event, the analysis inherently accounts for free ridership and participant spillover. That is, absent the PowerShare program, none of the observed demand reductions would have taken place. Based on the above considerations, the evaluation team considers the NTG ratio for the impact analysis of the PowerShare program to be 1.0.

5. Milestone Schedule

The following chart represents the schedule for the evaluation, including deliverables and deadlines. Payments will only be made after the Duke Energy review is complete and a milestone has been accepted.

Table 4. Milestone Schedule for DEK PowerShare Evaluation

Milestone	Deliverable	Deliverable Date	Duke Energy Review Date	DEK Milestone Payment/LD
A	Evaluation Plan	2024-07-23	15 days	[redacted]
B1	Survey Instruments			[redacted]
	Call Center Notification Form			[redacted]
B2	Spreadsheet and Summary Chart (Process)			[redacted]
C	Presentation (Process)			[redacted]
D	Deemed Savings Review Summary			[redacted]
E	Spreadsheet and Summary Chart (Impact)	2024-12-11	5 days	[redacted]
E1	On-Site Data Collection Plan	2024-07-22	15 days	[redacted]
F	Presentation (Impact)	2025-01-15	5 days	[redacted]
G	Presentation (Net to Gross)			[redacted]
H1	Draft Report	2025-01-31	8 weeks	[redacted]
H2	Final Report	2025-03-28	10 days	[redacted]
I	Completed Regulatory Response(s)	TBD		[redacted]
Total DEK Payments				[redacted]

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REQUEST:

Provide the number of participants for each current DSM program for 2022-2023 and for 2023-2024.

RESPONSE:

		Incremental Participation	
		July 2022 - June 2023	July 2023 - June 2024*
Residential Programs			
Income Qualified Neighborhood		565	762
Income Qualified Services		129	109
Home Energy Report	1	9,265	59,488
Residential Energy Assessments		1,246	1,755
Residential Smart $aver®		33,507	19,663
Power Manager®		12,323	13,019
Peak Time Pilot Program		644	598
Total Residential		**57,679**	**95,394**
Non-Residential Programs			
Business Energy Saver		1,608,462	2,607,582
Smart $aver® Non-Residential		17,253	27,667
PowerShare®		12	8
Total Non-Residential		**1,625,727**	**2,635,257**
Total		**1,683,406**	**2,730,651**

* The July 2023 – June 2024 participation numbers are under review and being finalized and will be included in the annual cost recovery filing for demand side management to be filed on November 1, 2024.

1 The Home Energy Report went from an opt-in program to an opt-out program in the July 2023 – June 2024 timeframe resulting in a higher participation.

PERSON RESPONSIBLE: Trisha Haemmerle