COMMONWEALTH OF KENTUCKY

BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

THE ELECTRONIC APPLICATION OF DUKE ENERGY KENTUCKY, INC. TO AMEND ITS DEMAND SIDE MANAGEMENT PROGRAMS	)))	CASE NO. 2025-00272

APPLICATION OF DUKE ENERGY KENTUCKY, INC. TO AMEND ITS DEMAND SIDE MANAGEMENT PROGRAMS

Comes now Duke Energy Kentucky, Inc. (Duke Energy Kentucky or the Company), pursuant to KRS 278.285, and other applicable law, and does hereby request the Commission to approve an amendment of the Demand Side Management (DSM) programs as ordered by this Kentucky Public Service Commission ("Commission").[1] In support of its Application, Duke Energy Kentucky respectfully states as follows:

I. INTRODUCTION

1. Pursuant to 807 KAR 5:001, Section 14(2), Duke Energy Kentucky is a Kentucky corporation that was originally incorporated on March 20, 1901, is in good standing and, as a public utility as that term is defined in KRS 278.010(3), is subject to the Commission's jurisdiction. The Company attests that it is currently in good standing and is subject to the Commission's jurisdiction. A certified copy of Duke Energy Kentucky's certificate of good standing from the Kentucky Secretary of State and a certificate for the following assumed name: "Duke Energy" is on file with the Kentucky Secretary of State

[1] *In the Matter of the Application of Duke Energy Kentucky, Inc. for the Annual Cost Recovery Filing for Demand Side Management,* Case No. 2012-00495, Order (Ky. P.S.C. Apr. 11, 2013).

and on file with the Commission in Case No. 2024-00354.[2] In addition, the Company has attached, as Appendix A, a certified Certificate of Existence dated August 4, 2025. Duke Energy Kentucky is engaged in the business of furnishing natural gas and electric services to various municipalities and unincorporated areas in Boone, Bracken, Campbell, Gallatin, Grant, Kenton, and Pendleton Counties in the Commonwealth of Kentucky.

2. Duke Energy Kentucky's business address is 139 East Fourth Street, Cincinnati, Ohio 45202. The Company's local office in Kentucky is Duke Energy Erlanger Ops Center, 1262 Cox Road, Erlanger, Kentucky 41018. Duke Energy Kentucky's email address is: KYfilings@duke-energy.com.

3. On November 15, 2012, Duke Energy Kentucky filed an application for the cost recovery of DSM programs. The Company's application was docketed as Case No. 2012-00495. On April 11, 2013, this Commission approved that Application and ordered Duke Energy Kentucky to file, by August 15, annually, an application requesting any program expansion(s) and to include: (1) an Appendix B, setting forth the Cost Effectiveness Test Results of DSM programs,[3] (2) an Appendix C[4], setting forth the recovery of program costs, lost revenues, and shared savings that are used in determining the true-up of proposed DSM factors; and (3) a signed and dated proposed Rider DSMR,

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[2] *In the Matter of the Electronic Application of Duke Energy Kentucky, Inc. for: 1) An Adjustment of the Electric Rates; 2) Approval of New Tariffs; 3) Approval of Accounting Practices to Establish Regulatory Assets and Liabilities; and 4) All Other Required Approvals and Relief*, Case No. 2024-00354, Application (Dec. 2, 2024).

[3] The Company provides Cost Effectiveness Test Results for all its programs in its November filings, with the most recent available results being available in Case No. 2024-00352, Application, Appendix C (Nov. 15, 2023). Appendix B to this Application contains the projected Cost Effectiveness Test Results for the only proposed new program. Other programs' results remain unchanged.

[4] This total includes a 12-month program and lost revenues not included in Appendix C of this proceeding, which is only a six-month review and does not include lost revenues due to the Company's pending base rate case and lost revenues for the forecast timeframe (July 1, 2025 – June 30, 2026) therefore being set to zero.

DSM rate, for electric customers, Appendix D.[5]

II. CURRENT DSM PROGRAMS

4. Duke Energy Kentucky has a long history of successful DSM implementation and has been a leader in the industry with respect to Energy Efficiency (EE) and peak Demand Response (DR) programs, having offered such programs since the mid-90's. Its existing portfolio of DSM programs was approved by the Commission in Case No. 2024-00264, by Order dated December 30, 2024.[6] This current portfolio of programs are as follows:

- Program 1: Income Qualified Services Program
- Program 2: Residential Energy Assessments Program
- Program 3: Residential Smart $aver® Efficient Residences Program
- Program 4: Residential Smart $aver® Energy Efficient Products Program
- Program 5: Non-Residential Smart $aver® Program
- Program 6: Power Manager® Program
- Program 7: PowerShare®
- Program 8: Income Qualified Neighborhood Energy Saver Program
- Program 9: Home Energy Report
- Program 10: Non-Residential Business Energy Saver Program
- Program 11: Non-Residential Pay for Performance[7]
- Program 12: Peak Time Rebate Pilot Program

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[5] *See* Order, para. 4. No update is proposed to be made to the natural gas DSMR rate.

[6] *In the Matter of the Electronic Application of Duke Energy Kentucky, Inc. to Amend Its Demand Side Management Programs,* Case No. 2024-00264, Order (Ky. P.S.C. Dec. 30, 2024).

[7] Marketed as Smart $aver® Performance.

5. Consistent with the Commission's previous Orders, the Company is proposing programmatic changes in this year's annual amendment filing, and budgetary management proposals to allocate funding more effectively among programs based upon customer interest mid-stream, which will then be reflected in the financial true-ups and forecasts to be included in the annual cost recovery filing for DSM:

- This Application proposes to respond to market conditions and enhance the robustness of the following program:
  - Residential Smart $aver®
- This Application will provide an update on the following program:
  - Home Energy Report
- The Company is also requesting to begin offering an additional program, the Energy Efficiency in Education Program.
- The Company is submitting an updated program tariff for the Non-Residential Business Energy Saver Program.

6. The Residential Collaborative[8] and the Commercial and Industrial Collaborative[9] (The Collaborative) have received the Company's proposed changes and had the opportunity to provide comments. An email was sent on July 28, 2025, reviewing the proposed changes requested within this Application.

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[8] The Residential Collaborative members receiving the information: John Horne, Michael West, and Lawrence Cook (Office of the Kentucky Attorney General), Jock Pitts (People Working Cooperatively), Catrena Bowman-Thomas (Northern Kentucky Community Action Commission), Laura Pleiman (Boone County), Kenya Stump (Kentucky Energy and Environment Cabinet), and Tim Duff and Trisha Haemmerle (Duke Energy).

[9] The Commercial & Industrial Collaborative members receiving the information: John Horne, Michael West, and Lawrence Cook (Office of the Kentucky Attorney General), Jock Pitts (People Working Cooperatively), Kenya Stump (Kentucky Energy and Environment Cabinet), Christine Baker (Kenton County Schools), and Tim Duff and Trisha Haemmerle (Duke Energy).

III. AMENDMENTS TO EXISTING PROGRAMS

7. Duke Energy Kentucky is seeking approval to expand the scope of the Residential Smart $aver® program. Specifically, the request is to add measures to expand the available finish options for customers to choose from through upgrades within the Save Energy and Water Kit Program. The kits currently offer aerators and showerheads in chrome but will extend this offer to include matte black and brush nickel finishes. The program will also include the option for a showerhead thermostatic valve device combo upgrade.

The customer currently has the option of two different kits depending on the size of the home.

Free Kit 1

(1) 1.5 GPM Showerhead with pipe tape

(1) 1.5 GPM kitchen faucet aerator

(2) 1.0 GPM bathroom faucet aerators

(2) 3 ft lengths of water heater pipe wrap insulation with clips

(1) Rubber jar opener and installation guide for easy installation

Free Kit 2

(2) 1.5 GPM Showerheads with pipe tape

(1) 1.5 GPM kitchen faucet aerator

(2) 1.0 GPM bathroom faucet aerators

(2) 3 ft lengths of water heater pipe wrap insulation with clips

(1) Rubber jar opener and installation guide for easy installation

The program is proposing to increase customer incentives to offer more discount options to the customers. If approved, customers will be able to upgrade their showerhead(s) to a handheld showerhead, or showerhead with different finish, or the thermostatic valve showerhead by paying a copay.[10]

The Company is not requesting an increase to the current approved budget to allow for the additional measures being requested. Since there are no requests to increase the budget, the Cost Effectiveness Test Results have not changed from the current scores that were filed in Case No. 2024-00352.

8. The Home Energy Report (HER) compares household electric usage to similar, neighboring homes, and provides recommendations and actionable tips to lower energy consumption. The report also informs a customer of the Company's other energy efficiency programs when applicable. The purpose of this program is to provide comparative usage data for similar residences in the same geographic area to motivate customers to better manage and reduce energy usage. In this Application, the Company proposes to add notifications to inform customers of upcoming targeted opportunities to become more energy efficient and save energy including but not limited to encouraging efficient customer behaviors during system peak days.

If approved, the Company will provide customers with notifications associated specifically with system peak days within 48 hours of Peak Day. Customers may elect to receive notifications by phone, email, and/or text message.

The Company does not request a change in the current approved budget for existing programs. The forecasted budget for July 2025 – June 2026 to accommodate the baseline increases will be reflected in the annual cost recovery filing for DSM filed that will be filed

[10] The customer pays the difference between the standard kit items and requested upgrade.

by November 3, 2025.[11]

Since there are no requests to increase the budget for existing programs, the Cost Effectiveness Test Results have not changed from the current scores that were filed in Case No. 2024-00352.[12]

IV. NEW PROGRAM REQUEST

9. The Company is requesting to add an additional program to the current EE/DSM portfolio in response to comments referencing the 807 KAR 5:058, Section 8(2)(b) requirement that Duke Energy Kentucky evaluate potential DSM programs.[13] The Company conducts a review on an annual basis and proposes measures and programs that meet Kentucky standards of passing the Total Resource Cost test (TRC) at a 1.0 or higher when applicable.

Accordingly, Duke Energy Kentucky seeks approval to offer the Energy Efficiency in Education Program (Program). This program offers participating customers the opportunity to lower their electric bill by reducing their electric usage by providing Company-designed energy saving measures. The Company has previously offered a similar program, the Energy Efficiency Education Program for Schools, which the

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[11] The Commission has directed the Company to begin filing its annual cost recovery filings by November 1 each year, instead of November 15. *See In the Matter of the Electronic Application of Duke Energy Kentucky, Inc. to Amend its Demand Side Management Programs*, Case No. 2022-00251, Order, p. 6 (Ky. P.S.C. Feb. 21, 2024) ("Additionally, the Commission finds that Duke Kentucky will file all future DSM annual filings on November 1 instead of November 15."). November 1, 2025 falls on a Saturday, so the annual cost recovery application will be due by the following Monday, November 3, 2025.

[12] *In the Matter of the Electronic Annual Cost Recovery Filing for Demand Side Management by Duke Energy Kentucky, Inc.*, Case No. 2024-00352, Application, Appendix B (Nov. 1, 2024).

[13] *In the Matter of the Electronic 2024 Integrated Resource Plan of Duke Energy Kentucky, Inc.*, Case No. 2024-00197, Joint Intervenors' Initial Comments at 6-7 (Nov. 6, 2024); Joint Intervenors Post-Hearing Comments at 5-6 (Feb. 20, 2025).

Commission ordered to be terminated in 2018.[14] The Program currently proposed is intended to have a broader reach, among other potential differences.

This Program primarily targets children in grades K-12 enrolled in public and private schools within the Duke Energy Kentucky service territory but may be offered via other community educational/awareness programs where the curriculum would be relevant.

The Program provides an educational component (for example: a theatrical performance or informational seminar) centered around EE with a variety of versions and themes tailored to different grade levels and ages, between K-12. Individuals are provided with materials that supplement the educational elements of the program that focus on topics such as types of energy, resources, the relationship between energy and resources, ways energy is wasted and how children and their families can be more energy efficient.

The Program also offers attendees the opportunity to request free energy efficient measures that may be bundled as a part of a kit. These measures/kits are free to eligible Duke Energy Kentucky customers who attend or have children that attend a school or communal facility that hosted a theatrical performance or educational seminar. The kit offer includes specific energy efficiency measures to reduce home energy consumption.

Once an eligible customer submits a complete kit request, it is shipped for delivery within two to four weeks.

In addition to developing and producing theatrical performances and/or educational seminars, the implementation vendor is responsible for marketing the Program to develop a pipeline of participating schools and facilities and promotion of the free EE measure

[14] *See In the Matter of the Electronic Annual Cost Recovery Filing for Demand Side Management by Duke Energy Kentucky, Inc.*, Case No. 2017-00427, Order, p. 16 (Ky. P.S.C. Sept. 13, 2018).

offer. Marketing channels include, but are not limited to the following:

- Direct Mail
- Email
- In-person visits
- Program website
- Printed materials for students and teachers

These marketing efforts engage participants in energy conservation behavior and provide energy saving opportunities through the Program's measures. To help encourage participation, the program vendor provides various rewards for participants to champion the Program and encourage additional measure requests.

Duke Energy Kentucky requests funding for the Program to begin after Commission approval. Billing system revisions and other preparations for Program implementation will begin after Commission approval.

The Company requests approval by December 31, 2025, to implement the changes immediately. The Company includes a proposed program tariff (Appendix E) to reflect the program offerings. The Company will true-up the costs and include the cost effectiveness scores within the Annual Cost Recovery Filing for DSM to be filed by November 2, 2026, recovering the July 1, 2025 – June 30, 2026, costs within that timeframe.

The projected Program cost effectiveness scores and Program costs ($113,962 in 2025-2026) are included in Appendix B and Appendix C, respectively.

10. Pursuant to KRS 278.285(1)(b) and the Commission's Order, Appendix B includes the projected Cost Effectiveness Test Results for the proposed new program.

11. Pursuant to KRS 278.285(1)(c) and the Commission's Order, Appendix C

includes the calculations to recover program costs, lost revenues, and shared shavings, that are used in determining the true-up of proposed DSM factor(s).

12. A signed and dated proposed Rider DSMR, Sheet No. 78 Demand Side Management Rider, for electric customers, is attached hereto as Appendix D. No update is proposed to be made to the natural gas DSMR rate.

13. Pursuant to KRS 278.285(1)(c) and the Commission's Order in Case No. 2012-00495, the Company is filing an evaluation schedule and program evaluations within this application. The following evaluations are included in Appendices F – I:

Appendix F: Evaluation, Measurement, and Verification Schedule;

Appendix G: Non-Residential Smart $aver® - Prescriptive;

Appendix H: Power Manager® Summer 2023; and

Appendix I: Home Energy Report.

The PowerShare® report was not finalized in time to include within this application. The Company plans to submit the PowerShare® report as an appendix in the annual cost recovery filing for demand side management to filed by November 3, 2025.

14. The Company is also submitting an updated tariff for the Business Energy Saver Program, redlined and clean versions of Third Revised Sheet No. 118, attached as Appendix J.

15. Finally, Duke Energy Kentucky respectfully requests that the Commission's Order in this proceeding approve any tariff modifications to be effective so to align with the Company's first billing cycle in the month following the Commission's Order. The Company is unable to implement tariff changes immediately upon approval and outside of a billing cycle under its current billing system. The Company needs at least five

business days from the issuance of an Order to implement rate changes and appropriately test the calculations.

WHEREFORE, Duke Energy Kentucky respectfully requests that the Commission approve this Application as filed.

Respectfully submitted,

DUKE ENERGY KENTUCKY, INC.

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CERTIFICATE OF SERVICE

This is to certify that the foregoing electronic filing is a true and accurate copy of the document in paper medium; that the electronic filing was transmitted to the Commission on August 15, 2025; that there are currently no parties that the Commission has excused from participation by electronic means in this proceeding; and that submitting the original filing to the Commission in paper medium is no longer required as it has been granted a permanent deviation.[15]

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[15] *In the Matter of Electronic Emergency Docket Related to the Novel Coronavirus COVID-19,* Case No. 2020-00085, Order (July 22, 2021).

Commonwealth of Kentucky
Michael G. Adams, Secretary of State

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Secretary of State
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Certificate of Existence

Authentication number: 340626
Visit https://web.sos.ky.gov/ftshow/certvalidate.aspx to authenticate this certificate.

I, Michael G. Adams, Secretary of State of the Commonwealth of Kentucky, do hereby certify that according to the records in the Office of the Secretary of State,

DUKE ENERGY KENTUCKY, INC.

DUKE ENERGY KENTUCKY, INC. is a corporation duly incorporated and existing under KRS Chapter 14A and KRS Chapter 271B, whose date of incorporation is March 20, 1901 and whose period of duration is perpetual.

I further certify that all fees and penalties owed to the Secretary of State have been paid; that Articles of Dissolution have not been filed; and that the most recent annual report required by KRS 14A.6-010 has been delivered to the Secretary of State.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my Official Seal at Frankfort, Kentucky, this 4th day of August, 2025, in the 234th year of the Commonwealth.

COMMONWEALTH OF KENTUCKY
OFFICE OF SECRETARY OF STATE

Michael G. Adams

Michael G. Adams
Secretary of State
Commonwealth of Kentucky
340626/0052929

Appendix B
Cost Effectiveness Test Results - 2025-26 Forecast
as amended 8/15/25 for modified programs

Program Name	UCT	TRC	RIM	PCT
Residential Programs				
Energy Efficiency in Education Program	9.20	8.91	2.03	10.53

Kentucky DSM Rider
Comparison of Revenue Requirement to Rider Recovery
2023-2024 Status Update

Residential Programs	(1) Projected Program Costs 7/2023 to 6/2024 (A)	(2) Projected Lost Revenues 7/2023 to 6/2024 (A)	(3) Projected Shared Savings 7/2023 to 6/2024 (A)	(4) Program Expenditures 7/2023 to 6/2024 (B)	(5) Program Expenditures (C) Gas	(6) Program Expenditures (C) Electric	(7) Lost Revenues 7/2023 to 6/2024 (B)	(8) Shared Savings 7/2023 to 6/2024 (B)	(9) 2023 Reconciliation Gas (D)	(10) 2023 Reconciliation Electric (D)	(11) Rider Collection (E) Gas	(12) Rider Collection (E) Electric	(13) (Over)/Under Collection Gas (F)	(14) (Over)/Under Collection Electric (G)
Income Qualified Neighborhood	$ 512,928	$ -	$ (27,182)	$ 484,377	$ -	$ 484,377	$ 9,143	$ (21,565)						
Income Qualified Services	$ 940,323	$ -	$ (55,087)	$ 500,362	$ 238,922	$ 261,440	$ 7,930	$ (20,612)						
Home Energy Report	$ 275,858	$ -	$ 34,165	$ 93,770	$ -	$ 93,770	$ 32,699	$ 15,479						
Residential Energy Assessments	$ 286,985	$ -	$ 17,859	$ 322,548	$ -	$ 322,548	$ 25,702	$ 13,768						
Residential Smart $aver®	$ 520,248	$ -	$ 39,668	$ 530,726	$ -	$ 530,726	$ 82,719	$ 19,069						
Power Manager®	$ 1,104,092	$ -	$ 101,191	$ 843,133	$ -	$ 843,133	$ -	$ 125,853						
Peak Time Rebate Pilot Program	$ 216,000	$ -	$ -	$ 105,254	$ -	$ 105,254	$ -							
Revenues collected											($417,814)	$3,688,487		
Total	$ 3,856,433	$ -	$ 110,615	$ 2,880,170	$ 238,922	$ 2,641,248	$ 158,192	$ 131,992	$ (898,895)	$ (3,439,347)	$ (417,814)	$ 3,688,487	$ (242,159)	$ (4,196,402)

(A) Amounts identified in report filed in Case No. 2023-00269
(B) Actual program expenditures, lost revenues (for this period and from prior period DSM measure installations), and shared savings for the period July 1, 2023 through June 30, 2024
(C) Allocation of program expenditures to gas and electric in accordance with the Commission's Order in Case No. 2014-00354
(D) Recovery allowed in accordance with the Commission's Order in Case No. 2023-00354
(E) Revenues collected through the DSM Rider between July 1, 2023 and June 30, 2024
(F) Column (5) + Column (9) - Column(11)
(G) Column (6) + Column (7) + Column (8) + Column (10) - Column(12)

Commercial Programs	(1) Projected Program Costs 7/2023 to 6/2024 (A)	(2) Projected Lost Revenues 7/2023 to 6/2024 (A)	(3) Projected Shared Savings 7/2023 to 6/2024 (A)	(4) Program Expenditures 7/2023 to 6/2024 (B)	(5) Lost Revenues 7/2023 to 6/2024 (B)	(6) Shared Savings 7/2023 to 6/2024 (B)	(7) 2023 Reconciliation (C)	(8) Rider Collection (D)	(9) (Over)/Under Collection (E)
Business Energy Saver	$ 879,517	$ -	$ 126,001	$ 784,158	$ 122,891	$ 67,268			
Smart $aver® Non-Residential	$ 2,090,665	$ -	$ 473,988	$ 888,499	$ 106,720	$ 480,267			
Total	$ 2,970,183	$ -	$ 599,988	$ 1,672,658	$ 229,611	$ 547,535	$ 2,752,187	$ 5,295,887	$ (93,896)
PowerShare®	$ 1,063,284	$ -	$ 93,220	$ 726,232	$ -	$ 64,776	$ 460,639	$ 1,135,775	$ 115,873
Total All Programs	$ 7,889,900	$ -	$ 803,823	$ 5,279,059	$ 387,803	$ 744,303			

(A) Amounts identified in report filed in Case No. 2023-00269
(B) Actual program expenditures, lost revenues (for this period and from prior period DSM measure installations), and shared savings for the period July 1, 2023 through June 30, 2024
(C) Recovery allowed in accordance with the Commission's Order in Case No. 2023-00354
(D) Revenues collected through the DSM Rider between July 1, 2023 and June 30, 2024
(E) Column (4) + Column (5) + Column (6) + Column (7) - Column(8)

Kentucky DSM Rider

2025-2026 Projected Program Costs, Lost Revenues, and Shared Savings
as amended 8/15/2025

Residential Program Summary (A)

	Costs	Lost Revenues	Shared Savings	Total	Allocation of Costs (B) Electric	Gas	Electric Costs	Budget (Costs, Lost Revenues, & Shared Savings) Electric	Gas Costs
Income Qualified Neighborhood	$ 543,458	$ -	$ 30,662	$ 574,119	100.0%	0.0%	$ 543,458	$ 574,119	$ -
Income Qualified Services	$ 790,933	$ -	$ (8,216)	$ 782,717	57.9%	42.1%	$ 458,011	$ 449,796	$ 332,922
Energy Efficiency in Education Program	$ 62,622	$ -	$ 51,340	$ 113,962	100.0%	0.0%	$ 62,622	$ 113,962	$ -
Home Energy Report	$ 427,951	$ -	$ 395,075	$ 823,026	100.0%	0.0%	$ 427,951	$ 823,026	$ -
Residential Energy Assessments	$ 565,123	$ -	$ 123,819	$ 688,941	100.0%	0.0%	$ 565,123	$ 688,941	$ -
Residential Smart $aver®	$ 740,748	$ -	$ 203,498	$ 944,246	100.0%	0.0%	$ 740,748	$ 944,246	$ -
Power Manager®	$ 1,915,273	$ -	$ 965,978	$ 2,881,250	100.0%		$ 1,915,273	$ 2,881,250	$ -
Peak Time Rebate Pilot Program	$ 454,045	$ -	$ -	$ 454,045	100.0%		$ 454,045	$ 454,045	$ -
Total Costs, Net Lost Revenues, Shared Savings	$ 5,500,152	$ -	$ 1,762,155	$ 7,262,307			$ 5,167,230	$ 6,929,386	$ 332,922

NonResidential Program Summary (A)

	Costs	Lost Revenues	Shared Savings	Total	Allocation of Costs (B) Electric	Gas	Electric Costs	Budget (Costs, Lost Revenues, & Shared Savings) Electric	Gas
Business Energy Saver (C)	$ 1,147,569	$ -	$ 965,555	$ 2,113,123	100.0%	0.0%	$ 1,147,569	$ 2,113,123	NA
Smart $aver® Non-Residential	$ 2,202,969	$ -	$ 980,198	$ 3,183,166	100.0%	0.0%	$ 2,202,969	$ 3,183,166	NA
PowerShare®	$ 775,232	$ -	$ 743,459	$ 1,518,691	100.0%	0.0%	$ 775,232	$ 1,518,691	NA
Total Costs, Net Lost Revenues, Shared Savings	$ 4,125,770	$ -	$ 2,689,211	$ 6,814,981			$ 4,125,770	$ 6,814,981	NA
Total Program	$ 9,625,922	$ -	$ 4,451,367	$ 14,077,288					

(A) Costs, Lost Revenues (for this period and from prior period DSM measure installations), and Shared Savings for Year 11 of portfolio.
(B) Allocation of program expenditures to gas and electric in accordance with the Commission's Order in Case No. 2014-00388.
(C) Small Business Energy Saver and SmartPath are indiviual sets of measures that are part of a single and larger program referred to as Business Energy Saver beginning July 1, 2023.

Duke Energy Kentucky
Demand Side Management Cost Recovery Rider (DSMR)
Summary of Calculations for Programs

July 2025 to June 2026

	Program Costs (A)
Electric Rider DSM	
Residential Rate RS	$ 6,929,386
Distribution Level Rates Part A DS, DP, DT, GS-FL, EH & SP	$ 5,296,290
Transmission Level Rates & Distribution Level Rates Part B	$ 1,518,691
Gas Rider DSM	
Residential Rate RS	$ 332,922

(A) See Appendix B, page 2 of 7

Duke Energy Kentucky
Demand Side Management Cost Recovery Rider (DSMR)
Summary of Billing Determinants

Year	July 2025 - June 2026
Projected Annual Electric Sales kWH	
Rate RS	1,528,978,659
Rates DS, DP, DT, GS-FL, EH, & SP	2,234,118,997
Rates DS, DP, DT, GS-FL, EH, SP, & TT	2,435,477,997
Projected Annual Gas Sales CCF	
Rate RS	62,283,513

Kentucky DSM Rider

Duke Energy Kentucky
Demand Side Management Cost Recovery Rider (DSMR)
Summary of Calculations

July 2025 to June 2026

Rate Schedule Riders	True-Up Amount (A)	Expected Program Costs (B)	Total DSM Revenue Requirements	Estimated Billing Determinants (C)		DSM Cost Recovery Rider (DSMR)	
Electric Rider DSM							
Residential Rate RS	$ (4,420,838)	$ 6,929,386	$ 2,508,547	1,528,978,659	kWh	$ 0.001641	$/kWh
Distribution Level Rates Part A DS, DP, DT, GS-FL, EH & SP	$ (98,918)	$ 5,296,290	$ 5,197,371	2,234,118,997	kWh	$ 0.002326	$/kWh
Transmission Level Rates & Distribution Level Rates Part B TT	$ 122,070	$ 1,518,691	$ 1,640,761	2,435,477,997	kWh	$ 0.000674	$/kWh
Distribution Level Rates Total DS, DP, DT, GS-FL, EH & SP						$ 0.003000	$/kWh
Gas Rider DSM							
Residential Rate RS	$ (255,111)	$ 332,922	$ 77,811	62,283,513	CCF	$ 0.001249	$/CCF
Total Rider Recovery			$ 9,424,491				

(A) (Over)/Under of Appendix B page 1 multiplied by the average three-month commercial paper rate for 2024 to include interest on over or under-recovery in accordance with the Commission's order in Case No. 95-312. Value is: **1.053483**
(B) Appendix B, page 2.
(C) Appendix B, page 4.

Allocation Factors based on July 2023-June 2024

Summary of Load Impacts July 2023 Through June 2024 (1)

Residential Programs	kWh	% of Total Res Sales	ccf	% of Total Res Sales	Elec % of Total % of Sales	Gas % of Total % of Sales
Income Qualified Neighborhood	557,394	0.0385%	-	0.0000%	100%	0%
Income Qualified Services	139,965	0.0097%	4,669	0.0088%	52.25%	47.75%
Home Energy Report	13,487,188	0.9313%	-	0.0000%	100%	0%
Residential Energy Assessments	757,381	0.0523%	-	0.0000%	100%	0%
Residential Smart $aver®	1,000,832	0.0691%	-	0.0000%	100%	0%
Power Manager®	-	0.0000%	-	0.0000%	100%	0%
Peak Time Rebate Pilot Program	-	0.0000%	-	0.0000%	100%	0%
Total Residential	15,942,760	1.1009%	4,669	0.0088%		
Total Residential (Rate RS) Sales For July 2023 Through June 2024	1,448,219,877	100%	52,858,356	100%		

(1) Load Impacts Net of Free Riders at Meter

Summary of Load Impacts July 2025 Through June 2026 (1)

Allocation Factors Projected

Residential Programs	kWh	% of Total Res Sales	ccf	% of Total Res Sales	Elec % of Total % of Sales	Gas % of Total % of Sales
Income Qualified Neighborhood	652,056	0.0426%	-	0.0000%	100%	0%
Income Qualified Services	194,705	0.0127%	5,765	0.0093%	57.9%	42.1%
Energy Efficiency Program for Schools	364,010	0.0238%	-	0.0000%	100%	0%
Home Energy Report	13,448,569	0.8796%	-	0.0000%	100%	0%
Residential Energy Assessments	1,028,107	0.0672%	-	0.0000%	100%	0%
Residential Smart $aver®	1,506,409	0.0985%	-	0.0000%	100%	0%
Power Manager®	-	0.0000%	-	0.0000%	0%	0%
Total Residential	17,193,857	1.1245%	5,765	0.0093%		
Total Residential (Rate RS) Sales Projected	1,528,978,659	100%	62,283,513	100%		

(1)Load Impacts Net of Free Riders at Meter

RIDER DSMR

DEMAND SIDE MANAGEMENT RATE

The Demand Side Management Rate (DSMR) shall be determined in accordance with the provisions of Rider DSM, Demand Side Management Cost Recovery Rider, Sheet No. 75 of this Tariff.

The DSMR to be applied to residential customer bills is $0.002418 001641 per kilowatt-hour. (IR)

A Home Energy Assistance Program (HEA) charge of $0.30 will be applied monthly to residential customer bills.

The DSMR to be applied to non-residential distribution service customer bills is $0.003409 003000 per kilowatt-hour. (R)

The DSMR to be applied for transmission service customer bills is $0.000674 per kilowatt-hour. (I)

Duke Energy Kentucky
1262 Cox Road
Erlanger, KY 41018

RIDER DSMR

DEMAND SIDE MANAGEMENT RATE

The Demand Side Management Rate (DSMR) shall be determined in accordance with the provisions of Rider DSM, Demand Side Management Cost Recovery Rider, Sheet No. 75 of this Tariff.

The DSMR to be applied to residential customer bills is $0.001641 per kilowatt-hour. (R)

A Home Energy Assistance Program (HEA) charge of $0.30 will be applied monthly to residential customer bills.

The DSMR to be applied to non-residential distribution service customer bills is $0.003000 per kilowatt-hour. (R)

The DSMR to be applied for transmission service customer bills is $0.000674 per kilowatt-hour.

Issued by authority of an Order by the Kentucky Public Service Commission dated ___ in Case No. 2025-00272.

Issued: August 15, 2025
Effective: September 15, 2025
Issued by Amy B. Spiller, President /s/ Amy B. Spiller

RESIDENTIAL ENERGY EFFICIENCY IN EDUCATION PROGRAM

APPLICABILITY

Available to residential customers in the Company's electric service area with individually metered, single-family residences receiving concurrent service from the Company and choose to participate by enrolling through the marketing channels utilized by the program.

PROGRAM DESCRIPTION

The Energy Efficiency in Education Program is part of Duke Energy Kentucky’s portfolio of programs offered through Rider Demand Side Management Program (Rider DSM) and recovered through the Company’s Rider DSMR (Demand Side Management Rate).

The purpose of this program is to educate students about energy efficiency in homes and schools through energy-related curriculum and energy efficiency measures.

This program is available, at the Company’s option, to K-12 public and private schools but may be offered via other community educational/awareness programs where the curriculum would be relevant.

Each eligible student who participates in the program and submits a request will receive energy efficiency measures for their home.

SERVICE REGULATIONS

The provisions contained in this tariff sheet do not supersede or replace any of the charges and terms contained in the standard base rate and rider tariff sheets. The standard base rate and rider charges apply to all customers.

The supplying of, and billing for, service and all conditions applying thereto, are subject to the jurisdiction of the Kentucky Public Service Commission, and to the Company’s Service Regulations currently in effect, as filed with the Kentucky Public Service Commission, as approved by law.

Issued by authority of an Order by the Kentucky Public Service Commission dated ____ in Case No. 2025-00272.

Issued: August 15, 2025
Effective: September 15, 2025
Issued by Amy B. Spiller, President /s/ Amy B. Spiller

Status Update for Duke Energy Kentucky Energy Efficiency and Demand Response Programs; 2025-2027

Planned[1] Evaluation, Measurement and Verification Activities and Evaluation Reports

Residential Customer Programs	Program/Measure	Last Evaluation completion	Next Evaluation ==>	Q1 2025	Q2 2025	Q3 2025	Q4 2025	Q1 2026	Q2 2026	Q3 2026	Q4 2026	Q1 2027	Q2 2027	Q3 2027	Q4 2027
Low Income Neighborhood	Neighborhood	12/20/2022							M&V	M&V	M&V	M&V	M&V	M&V	Report
Low Income Services	Refrigerator Replace	7/31/2013	TBD												
	Weatherization/Payment Plus	7/31/2013													
	Pay For Performance	N/A													
My Home Energy Report	MyHER	12/12/2024												M&V	M&V
Residential Energy Assessments	HEHC	8/7/2020		M&V	M&V	M&V	Report								
Residential Smart Saver®	HVAC	9/26/2023			M&V	M&V	M&V	M&V	M&V	M&V	M&V	Report			
	Specialty Bulbs/Online Savings Store	10/6/2022								M&V	M&V	M&V	M&V	Report	
	Water Measures	7/19/2024											M&V	M&V	M&V
	Multi-Family	1/30/2024											M&V	M&V	M&V
Power Manager		2/1/2025		Report								M&V	M&V	M&V	M&V
Peak Time Rebate Pilot	Peak Time Rebate	5/18/2023								M&V	M&V	M&V	M&V	Report	

Non-Residential Customer Programs	Program/Measure	Last Evaluation completion	Next Evaluation ==>	Q1 2025	Q2 2025	Q3 2025	Q4 2025	Q1 2026	Q2 2026	Q3 2026	Q4 2026	Q1 2027	Q2 2027	Q3 2027	Q4 2027
Small Business Energy Saver		11/10/2022										M&V	M&V	M&V	Report
Smart $aver® Non-Res, Custom		1/18/2022						M&V	M&V	M&V	Report				
Smart $aver® Non-Res, Prescriptive		6/13/2025		M&V	Report										
PowerShare		2/14/2017		M&V	M&V	Report									

[1] Future Evaluation Report dates are projections only. Actual report dates will vary depending on program participation, time to achieve a significant sample and the time needed to collect adequate data.

LEGEND	
M&V	Data collection (surveys, interviews, onsite visits, billing data) and analysis
Report	Evaluation Report

Opinion **Dynamics**

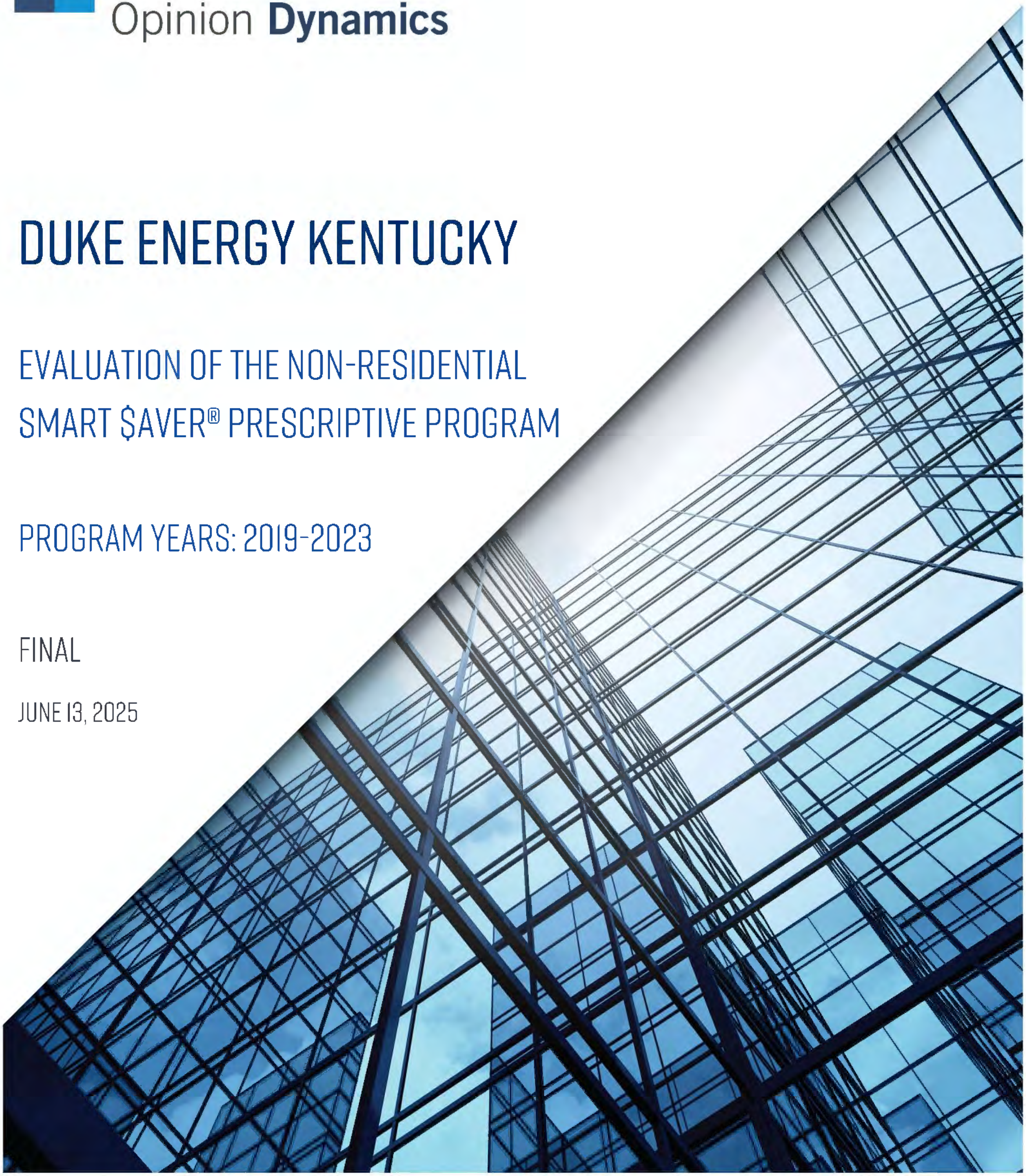
DUKE ENERGY KENTUCKY

EVALUATION OF THE NON-RESIDENTIAL SMART $AVER® PRESCRIPTIVE PROGRAM

PROGRAM YEARS: 2019-2023

FINAL

JUNE 13, 2025



CONTENTS

TABLES & FIGURES

I. Executive Summary

1.1 Program Summary

The Duke Energy Kentucky (DEK) Smart $aver Prescriptive Program provides incentives for electric commercial and industrial customers to purchase and install a variety of high-efficiency equipment, including lighting; HVAC, food service, and process equipment; and pumps and drives. The program also uses incentives to encourage maintenance of existing equipment to reduce energy usage. Incentives are available for new construction, existing equipment retrofits, and failed equipment replacements. Prescriptive incentives under the program are limited to 75% or less of the customer cost.

The program has four delivery channels:

- The **main channel** is application-based and primarily delivered through trade allies.
- The **Business Savings Store** on the Duke Energy website offers customers a limited number of qualified products for which they can receive an instant discount.
- The **midstream channel** allows distributors to provide incentives directly to prequalified customers on applicable equipment and receive reimbursement for those incentives from Duke Energy.
- The **upstream channel** was introduced in 2023. It works directly with HVAC, food service, and lighting manufacturers to provide discounted equipment to customers and increase participation in these technologies.

The incentives/discounts offered are consistent across the four delivery channels. The program period under evaluation is January 1, 2019, to December 31, 2023.

1.2 Evaluation Objectives

This evaluation included an assessment of gross impacts only. Given the small number of program participants during the evaluation period (fewer than 225 across the main and midstream channels), the evaluation did not include primary research activities to support a net impact or a process evaluation. Instead, we leveraged net-to-gross ratios (NTGRs) from the previous DEK Smart $aver Prescriptive Program evaluation.[1]

Our evaluation addressed the following key objectives.

Gross Impacts

- Verify deemed savings estimates for key program measures through a review of measure assumptions and calculations.
  - Document drivers of differences between ex ante and ex post (evaluated) savings estimates.
- Verify installed quantities and measure characteristics for a sample of main channel projects through desk reviews.
  - Document the causes of differences between tracked and verified information.

[1] Opinion Dynamics Corporation. Duke Energy Kentucky – Non-Residential Smart $aver® Prescriptive Program Evaluation Report. July 24, 2019.

- Develop in-service rates (ISRs), by technology (i.e., lighting, HVAC, food service, process, and pumps and drives).
- Estimate verified gross energy and peak demand savings (both summer and winter), by technology, via engineering analysis.
- Develop an overall gross realization rate for each technology.

NET IMPACTS

- Develop net energy and peak demand savings (both summer and winter), by technology, based on NTGRs used in the previous DEK Smart $aver Program evaluation.

1.3 KEY FINDINGS

During the evaluation period, DEK non-residential customers completed 432 projects through the main channel,[2] generating approximately 35.1 GWh of ex post gross energy savings (96% of total program savings over the five years). In addition, the Business Savings Store, the midstream channel, and the new upstream channel contributed a combined 1.6 GWh in ex post gross energy savings (see Table 1).

Table 1. Summary of Ex Post Gross Energy Savings

Delivery Channel	MWh	Percent
Main Channel	35,133	96%
Business Savings Store	809	2%
Midstream Channel	567	2%
Upstream Channel	179	<1%
Total	**36,688**	**100%**

Across all delivery channels, lighting accounted for the vast majority of program energy savings (81%), followed by HVAC (16%) and food service equipment (3%). Process equipment and pumps and drives contributed less than 1% each to ex post gross energy savings.

Overall, program savings showed declining trends, both during the evaluation period and over the prior two evaluation periods (2016-2023), with considerable swings in savings, both year-to-year and across channels. According to program staff, declining budgets and the discontinuation in 2017 of Duke Energy's energy efficiency programs in neighboring Ohio were key contributors to this trend.

GROSS IMPACT FINDINGS

Our gross impact analysis found overall gross realization rates for energy, summer demand, and winter demand savings of 135%, 120%, and 127%, respectively. These results were driven by the following:

- Our **deemed savings review** made large upward adjustments to per unit savings of many reviewed lighting measures, resulting in lighting deemed savings realization rates ranging from 137% for summer demand to 155% for energy savings. These were primarily the result of updated baseline wattage assumptions, which we aligned with assumptions used in other Duke Energy jurisdictions. Our review of high volume low speed fans resulted in

[2] For the purposes of this evaluation, projects are defined by customer, location, installation date, and technology.

HVAC deemed savings realization rates of 110% for energy savings but less than 100% for demand savings. The source of the discrepancy is unknown since the evaluation team did not receive source documentation for the ex ante savings of this measure.

- Our **desk reviews** of main channel projects found relatively few data tracking issues with respect to the types and quantities of installed measures, making adjustments for only 5 of 60 sampled projects. The resulting ISRs were 100% for HVAC equipment, process equipment, and pumps and drives; 99.4% for food service equipment; and ranged from 92.4% to 95.1% for lighting projects.

Table 2 and Table 3 summarize the overall gross energy and demand impacts, respectively.

Table 2. Overall Gross Energy Impacts

Technology	Ex Ante MWh	Realization Rate	Ex Post MWh
Lighting	20,773	143%	29,678
Non-Lighting	6,465	108%	7,010
HVAC	*5,240*	*110%*	*5,790*
Food Service	*956*	*99%*	*950*
Process	*153*	*100%*	*153*
Pumps and Drives	*117*	*100%*	*117*
Total	**27,239**	**135%**	**36,688**

Table 3. Overall Gross Demand Impacts

Technology	Ex Ante MW	Realization Rate	Ex Post MW
Summer Demand Impacts			
Lighting	3.18	131%	4.16
Non-Lighting	1.42	95%	1.35
HVAC	*1.26*	*94%*	*1.19*
Food Service	*0.11*	*99%*	*0.11*
Process	*0.04*	*100%*	*0.04*
Pumps and Drives	*0.01*	*100%*	*0.01*
Total	**4.61**	**120%**	**5.51**
Winter Demand Impacts			
Lighting	2.22	133%	2.95
Non-Lighting	0.40	98%	0.39
HVAC	*0.24*	*97%*	*0.24*
Food Service	*0.11*	*99%*	*0.11*
Process	*0.04*	*100%*	*0.04*
Pumps and Drives	*0.01*	*100%*	*0.01*
Total	**2.62**	**127%**	**3.34**

NET IMPACT FINDINGS

Based on the lighting and non-lighting NTGRs used in the previous DEK evaluation (87.9% and 81.8%, respectively), the savings-weighted, program-level NTGR for this evaluation period is 86.7%. Table 4 presents the individual net-to-gross (NTG) components, i.e., free-ridership (FR), participant spillover (PSO), and trade ally spillover (TASO) and the resulting NTGRs, for lighting and non-lighting measures. The NTGR is calculated as 1 – FR + PSO + TASO.

Table 4. Summary of NTG Assumptions

Technology	Free-Ridership	Participant SO	Trade Ally SO	NTGR [A]
Lighting	17.7%	0.04%	5.6%	87.9%
Non-Lighting	23.9%			81.8%
Total [B]	**18.9%**	**0.04%**	**5.6%**	**86.7%**

[A] Due to rounding, the NTGR might not exactly equal 1 – FR + PSO + TASO.

[B] Savings-weighted average of lighting and non-lighting values.

Table 5 summarizes ex post gross and net savings for the evaluation period.

Table 5. Summary of Ex Post Gross and Net Savings

Technology	Ex Post Gross			NTGR	Ex Post Net		
	Energy Savings (MWh)	Summer Peak Demand (MW)	Winter Peak Demand (MW)		Energy Savings (MWh)	Summer Peak Demand (MW)	Winter Peak Demand (MW)
Main Channel	35,133	5.31	3.21	86.7%	30,472	4.58	2.79
Lighting	*28,408*	*3.96*	*2.82*	*87.9%*	*24,971*	*3.48*	*2.48*
HVAC	*5,508*	*1.19*	*0.23*	*81.8%*	*4,505*	*0.97*	*0.19*
Food Service	*947*	*0.11*	*0.11*	*81.8%*	*775*	*0.09*	*0.09*
Process	*153*	*0.04*	*0.04*	*81.8%*	*125*	*0.03*	*0.03*
Pumps and Drives	*117*	*0.01*	*0.01*	*81.8%*	*96*	*0.01*	*0.01*
Business Savings Store	809	0.09	0.06	86.4%	699	0.08	0.06
Lighting	*604*	*0.09*	*0.06*	*87.9%*	*531*	*0.08*	*0.05*
Non-Lighting	*205*	*0.00*	*0.01*	*81.8%*	*168*	*0.00*	*0.00*
Midstream Channel	567	0.09	0.06	87.9%	498	0.08	0.05
Lighting	*567*	*0.09*	*0.06*	*87.9%*	*498*	*0.08*	*0.05*
Upstream Channel	179	0.01	0.01	85.2%	153	0.01	0.01
Lighting	*99*	*0.01*	*0.01*	*87.9%*	*87*	*0.01*	*0.01*
Non-Lighting	*80*	*-*	*<0.01*	*81.8%*	*65*	*-*	*<0.01*
Total	**36,688**	**5.51**	**3.34**	**86.7%**	**31,821**	**4.76**	**2.91**

1.4 EVALUATION RECOMMENDATIONS

Based on the results of our gross impact evaluation, we identified the following opportunities for program improvement:

- **Consider focusing available resources on fewer delivery channels.** Program-tracking data over the past two evaluations (2016-2023) show considerable swings in savings, both year-to-year and across channels, and a discontinuation of the midstream channel for a 4-year period. Such changes in program availability and funding tend to create uncertainty in the marketplace and can impede the long-term success of energy efficiency programs. We encourage the program team to explore ways to maintain consistency and minimize program channel disruptions. For example, the program may consider focusing available resources on fewer delivery channels, which would allow for more continuous funding in those channels and lead to improved market certainty and more consistency in program offerings. We acknowledge that regulatory and budgetary constraints outside of the program's control may not allow for such changes at any/all times. In addition, flexibility of program funds to support DEK customers is an important consideration, recognizing that the overall performance of the non-residential market supersedes the performance of individual program channels.

- **Consider additional QA/QC steps to improve the fidelity between invoices and tracking data.** While our desk reviews found relatively few discrepancies between tracked data and supporting documentation, differences in three sampled lighting projects resulted in an 8% and 5% reduction in lighting energy and demand savings, respectively. We recommend reviewing QA/QC processes to determine if improvements could be made.

2. PROGRAM DESCRIPTION

This section describes key elements of program design, implementation, and performance. The evaluation period addressed in this report is January 1, 2019, to December 31, 2023.

2.1 PROGRAM DESIGN

The DEK Smart $aver Prescriptive Program provides incentives for electric commercial and industrial customers to purchase and install a variety of high-efficiency equipment, including lighting; HVAC, food service, and process equipment; and pumps and drives. The program also uses incentives to encourage maintenance of existing equipment to reduce energy usage. Incentives are available for new construction, existing equipment retrofits, and failed equipment replacements. Prescriptive incentives under the program are limited to 75% or less of the customer cost.

The program has four delivery channels:

- The **main channel** is application-based and primarily delivered through trade allies.
- The **Business Savings Store** on the DEK website offers customers a limited number of qualified products for which they can receive an instant discount.
- The **midstream channel** allows distributors to provide incentives directly to prequalified customers on applicable equipment and receive reimbursement for those incentives from DEK.
- The **upstream channel** was introduced in 2023. It works directly with HVAC, food service, and lighting manufacturers to provide discounted equipment to customers and increase participation in these technologies.

The incentives/discounts offered are consistent across the four delivery channels.

2.2 PROGRAM IMPLEMENTATION

Duke Energy's staff implement the Smart $aver Program with contractor support for specific program components. The program is also offered in other Duke Energy territories, and most program staff share responsibilities across the territories. The program is managed by four program staff, with support from Duke Energy marketing staff, a trade ally outreach team, a team of Business Energy Advisors (BEAs), and operational support for processing applications. In addition, Large Business Account Managers and Local Government and Community Relations staff assist with outreach efforts.

The program is marketed to commercial and industrial customers through targeted outreach and communications by the program. Marketing approaches during the evaluation period primarily included email and online marketing. Additional outreach was conducted by Large Business Account Managers, BEAs, and Community Relations staff.

2.3 PROGRAM PERFORMANCE

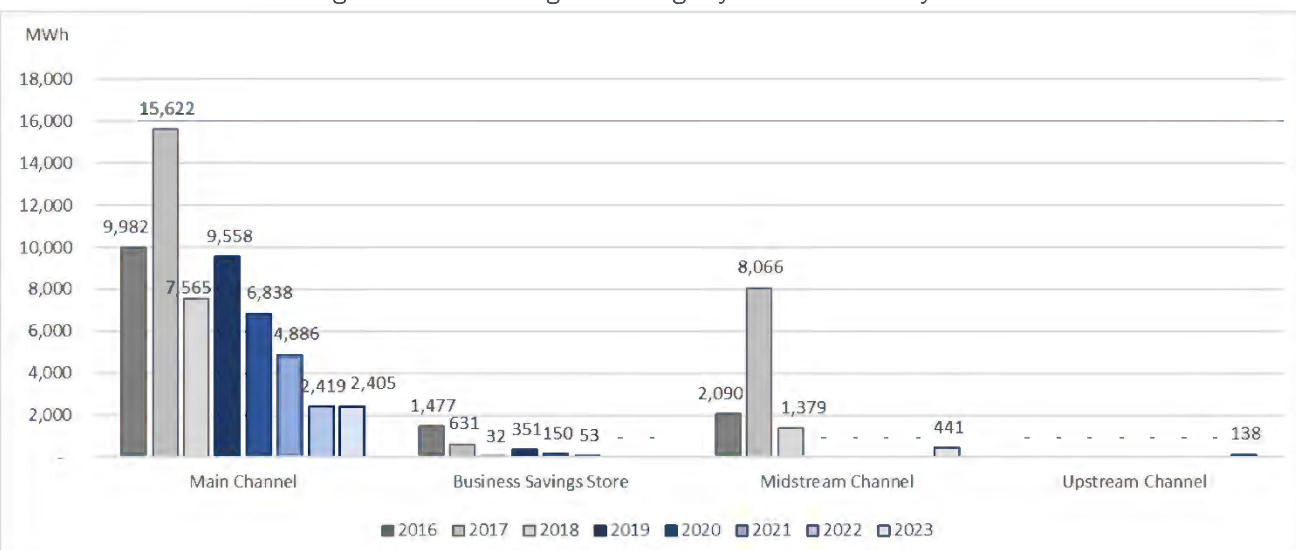
Based on the program-tracking database, the program incentivized 432 main channel projects during the evaluation period, accounting for 96% of ex ante program savings. Main channel savings decreased over the 5-year evaluation period, from 9.6 GWh in 2019 to 2.4 GWh each in 2022 and 2023. According to the program team, a combination of regulatory budget limits and the effects of the COVID-19 pandemic caused these declines. Low contributions to program savings by the Business Savings Store and the midstream channel (2% each) resulted from suspensions of those two channels for large parts of the evaluation period. The new upstream channel was launched in 2023 and contributed to savings for the first time. Table 6 summarizes savings by year and channel.

Table 6. Summary of Ex Ante Gross Savings by Year and Channel

Year	Ex Ante Gross Energy Savings (MWh)				
	Main Channel	Business Savings Store	Midstream	Upstream	Total
2019	9,558	351	-	-	9,909
2020	6,838	150	-	-	6,987
2021	4,886	53	-	-	4,939
2022	2,419	-	-	-	2,419
2023	2,405	-	441	138	2,985
Total	**26,106**	**553**	**441**	**138**	**27,239**

The decrease in program savings during the evaluation period is particularly stark when compared to savings during the prior evaluation period (2016-2018) and viewed over the 8-year period that spans both evaluations (2016-2023). This longer-term view shows considerable swings in savings, both year-to-year and across channels (see Figure 2). Notably, 2017 accounted for 33% of savings during the 8-year period, and the midstream channel accounted for 25% of savings in the prior evaluation period (2016-2018) but was suspended from 2019 to 2022.

Figure 1. Ex Ante Program Savings by Year and Delivery Channel



3. Overview of Evaluation Activities

To address the objectives outlined in Section 1.2, the evaluation team performed a range of data collection and analytic activities, including:

- Program staff interviews (n=1)
- Program material review
- Program-tracking database review
- Deemed savings review of select measures
- Engineering desk reviews (n=60)

3.1 Program Staff Interviews

We conducted an in-depth interview with the Smart $aver Program manager in January 2023. The purpose of the interview was to collect information on the Smart $aver Program, including changes in program design and implementation since the last evaluation and the program's goals, successes, and challenges during the evaluation period.

3.2 Program Material Review

We reviewed program materials, including application materials and documentation of incented technologies and incentive levels. In support of the gross impact evaluation, we also reviewed a variety of secondary materials documenting Duke Energy's ex ante deemed savings assumptions as well as supporting documentation for projects selected for the desk reviews (see description below).

3.3 Program-Tracking Database Review

We received a data extract from the program-tracking database that contained the data needed to support our evaluation. Our team of energy data scientists and engineers cleaned the data and created two evaluation datasets (one at the measure level and one at the project level) that reflected program activity during the evaluation period and were used for the gross impact analysis (i.e., the desk reviews). Key data-cleaning activities included verification of installation dates, removal of duplicate and otherwise invalid records (e.g., zero savings), identification of ineligible measures (based on Federal standards), development of project IDs, and development of ex ante savings (by multiplying per-unit savings by measure quantities).

3.4 DEEMED SAVINGS REVIEW OF SELECT MEASURES

To assess ex ante per-unit savings values, our engineering team performed a deemed savings review, which included nine measure groups[3] (seven lighting, one HVAC, and one food service) that either accounted for a large amount of savings or had not been evaluated in the past and were of interest to program staff.

For each of the nine selected measure groups, we reviewed existing program documents, program-tracking data, sources of savings assumptions, Technical Reference Manuals (TRMs), and other resources as applicable to determine the appropriateness of the per-unit savings values. We then recommended changes to per-unit savings, based on our review of these materials.

An Excel workbook providing the details of the deemed savings review—including ex ante and ex post calculations as well as assumptions and measure-level realization rates—was provided under separate cover.

3.5 MAIN CHANNEL ENGINEERING DESK REVIEWS

To verify measure quantities reported in the program-tracking database, our engineering team performed 60 desk reviews of main channel projects, sampled by technology. The desk reviews consisted of a thorough examination of all available program documentation for the projects, including applications, invoices, and specification sheets to ensure that the program-tracking data contained correct information about the incented measure(s), including both measure type and quantity.

SAMPLE DESIGN

To select projects for desk reviews, we used a stratified random sampling approach, stratifying by technology and project savings (see Table 7). We targeted a precision level of 10% at 90% confidence for the resulting ISRs, by technology.

Table 7. Summary of Main Channel Desk Reviews

Technology	Number of Projects	
	Population	Desk Reviews
Lighting	355	30
HVAC	47	14
Food Service	21	7
Process	4	4
Pumps and Drives	5	5
Total	**432**	**60**

[3] A measure group consists of related measures, e.g., LED tube lighting of different tube lengths and replacing different types of baseline equipment. Between one and seven unique measures comprised each measure group.

4. GROSS IMPACT EVALUATION

4.1 METHODOLOGY

Our gross impact evaluation included three key evaluation activities: (1) a program-tracking database review; (2) a deemed savings review to verify per unit savings for select measures; and (3) engineering desk reviews to verify measure types and quantities for main channel projects.

The evaluation team used these activities to develop ex post (verified) gross savings and realization rates at the technology level. The methodology consisted of three general steps:

- **Step 1: Ineligibility Adjustment**
  - Based on the program-tracking database review, we verified that the program did not provide incentives for ineligible measures based on existing Federal standards. Ineligible measures receive zero ex post savings and are excluded from subsequent steps of the impact analysis. Based on the findings, we calculated an eligibility realization rate, by technology, based on a comparison of ex ante savings for eligible measures to ex ante savings of all measures.
- **Step 2: Deemed Savings Adjustment**
  - Based on the deemed savings review, we developed updated per-unit savings values for measures that are part of the nine reviewed measure groups. For measures not part of the deemed savings review, ex post per unit savings were set to equal ex ante savings. We calculated a deemed savings realization rate, by technology, based on a comparison of total savings using ex post deemed savings values to total savings using ex ante deemed savings values (holding quantities constant).
- **Step 3: ISRs**
  - For the main channel, we developed technology-specific ISRs based on a sample of 60 engineering desk reviews. We applied the ISRs to the main channel measure quantities in the program-tracking database.
  - We also applied the main channel ISRs to savings from the Business Savings Store, the midstream channel, and the new upstream channel, by technology.

To develop ex post gross savings, we applied the ineligibility and deemed savings adjustments and the ISRs to ex ante savings. Note that ex ante savings embed ISRs from the prior evaluation. In order to not double-apply ISRs, the prior ISRs were removed from ex ante savings before the new quantity adjustments were applied. Figure 2 depicts this process. Section 3 provides additional information on the evaluation activities conducted in support of this analysis.

Figure 2. Gross Impact Evaluation Approach

4.2 GROSS IMPACT RESULTS

Table 8 summarizes the ex ante and ex post gross energy impacts for the evaluation period (including savings from all delivery channels) resulting from the three-step approach described above. The following subsections provide more detailed results from the analyses.

Table 8. Overall Gross Impacts

Technology	Ex Ante Gross Savings			Ex Post Gross Savings		
	Energy Savings (MWh)	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy Savings (MWh)	Summer Peak Demand (MW)	Winter Peak Demand (MW)
Lighting	20,773	3.18	2.22	29,678	4.16	2.95
Non-Lighting	6,465	1.42	0.40	7,010	1.35	0.39
HVAC	*5,240*	*1.26*	*0.24*	*5,790*	*1.19*	*0.24*
Food Service	*956*	*0.11*	*0.11*	*950*	*0.11*	*0.11*
Process	*153*	*0.04*	*0.04*	*153*	*0.04*	*0.04*
Pumps and Drives	*117*	*0.01*	*0.01*	*117*	*0.01*	*0.01*
Total	**27,239**	**4.61**	**2.62**	**36,688**	**5.51**	**3.34**

4.2.1 INELIGIBILITY ADJUSTMENT

Our program-tracking database review did not identify any ineligible measure (based on Federal standards) provided by the program during the evaluation period. As such, the ineligibility adjustment for all technologies is 1.0, i.e., no adjustment.

4.2.2 DEEMED SAVINGS ADJUSTMENT

The purpose of the deemed savings review was to update per-unit savings assumptions for select measures incented through the Smart $aver Prescriptive Program. Measures were chosen by Duke Energy program staff and included high-impact measures and priority measures that had not been studied in past evaluations. Table 9 presents the measures included in the deemed savings review and their total program ex ante energy savings, by technology.

Table 9. Summary of Measures Reviewed

Technology	Reviewed Measures	Measure Unit	Ex Ante kWh
Lighting	LED 4ft Tube 1-LED replace or in lieu of T8 fluor	Per Lamp	5,419,572
	LED 2ft Tube 1-LED replace or in lieu of T8 fluor		86,842
	LED 4ft Tube 1-LED replacing in lieu of T5HO fluor		182,438
	LED 4ft Tube 1-LED replacing in lieu of T5SO fluor		7,449
	LED Highbay replacing 251-400W HID	Per Fixture	2,465,787
	LED Highbay replacing greater than 400W HID		1,744,983
	LED Highbay Fixture replacing 6-lamp 4ftT8 fixture		1,521,144
	LED Highbay Fixture replacing 4-L 4ft T5HO fixture		1,671,295
	LED Highbay Fixture replace 2-lamp 8ft T12 fixture		39,791
	LED Highbay replacing greater than 400W HID Lamp	Per Lamp	190,955
	LED Highbay replacing 251-400W HID Lamp		237,495
	LED FLD rplcng or ILO up to 100W HAL, INCD, or HID	Per Fixture	2,496
	LED FLD rplcng or ILO GRT 100W HAL, INCD, or HID		183,638
	LED FLD rplcng or ILO greater 500W HAL INCD or HID	Per Lamp	3,178,428
	LED Panel 2x4 replacing or in lieu of T8 FL	Per Fixture	1,833,715
	LED Panel 2x2 replacing or in lieu of T8 FL		78,718
	LED Panel 1x4 replacing or in lieu of T8 FL		56,032
	LED A Lamps	Per Lamp	524,062
	LED PAR - BR - MR Lamps	Per Lamp	551,603
	LED Decorative Globe 3-Way Lamps	Per Lamp	256,406
HVAC	High Volume Low Speed Fan	Per Fan	1,083,487
Food Service	Zero Energy Doors_Med-Temp Cooler	Per Door	800,797

The deemed savings review resulted in modifications to per-unit savings assumptions for eight of the nine selected measure groups within the lighting, HVAC, and food service technology categories. To develop technology-level deemed savings realization rates, we (1) multiplied revised per-unit savings values by ex ante quantities, at the measure-level, to calculate deemed savings-adjusted gross savings (for all measures that were not included in the deemed savings review, ex post per unit values were set to equal ex ante values); and (2) divided these adjusted gross savings by ex ante savings, by technology.

Table 10 summarizes the realization rates resulting from the deemed savings review, by technology.

Table 10. Deemed Savings Review Realization Rates

Technology	Energy Savings (kWh)	Summer Peak Demand (kW)	Winter Peak Demand (kW)
Lighting	155%	137%	140%
HVAC	110%	94%	97%
Food Service	100%	100%	100%
Process	100%	100%	100%
Pumps and Drives	100%	100%	100%
Total	**144%**	**124%**	**133%**

Key drivers of these realization rates include:

- **Lighting Measures.** An adjustment to base and efficient wattages, based on updated assumptions to align with other Duke Energy jurisdictions, was the key contributor to the high realization rates for lighting measures. In addition, we updated average hours of use values based on program-tracking data and waste heat and coincidence factors based on building types in the program-tracking data and Commercial Buildings Energy Consumption Survey (CBECS) data. For several of the reviewed lighting measures, source documentation for ex ante values was not available.
- **HVAC Measures.** Source documentation for the sole reviewed HVAC measure, High Volume Low Speed Fans, was not available. As such, the drivers of differences between ex ante and ex post savings are unknown.

An Excel workbook providing the details of the deemed savings review, including sources for algorithms and inputs and the resulting ex post per-unit values, was provided under separate cover.

4.2.3 IN-SERVICE RATES

The purpose of the desk reviews was to verify measure types and quantities included in the program-tracking database. We performed desk reviews for a sample of 60 main channel projects, sampling by technology (see Section 3.5).

Based on these desk reviews, we adjusted only five of the 60 sampled projects. The discrepancies and resulting project-level ISRs are summarized in Table 11.

Table 11. Summary of Main Channel Projects with Desk Review Adjustments

Sample Project #	Technology	Discrepancy	Ex Ante kWh	Project-Level ISR		
				Energy Savings (kWh)	Summer Peak Demand (kW)	Winter Peak Demand (kW)
1	Lighting	Invoice showed 3 of 59 A-lamps and 25 of 50 LED 2ft tubes. Other ~17,000 lamps were verified in documentation.	966,052	99.9%	99.9%	99.8%
2	Lighting	Two of four records appear to be duplicates: same address, measures, invoice #, and date.	770,135	50.0%	n/a	50.0%
3	Lighting	Measures for several records not found in invoices. Project shares enrollment number with another lighting project at the same address.	53,556	27.1%	29.2%	30.3%
4	HVAC	Slight discrepancy because of incorrect rounding of ex ante units (tons).	2,091	97.4%	97.4%	n/a
5	Food Service	Invoice showed 21 of 22 zero energy doors.	30,800	95.5%	95.5%	95.5%

Based on the project-level ISRs, we developed technology-level ISRs, weighting by savings. For all technologies but lighting, we found no or very small discrepancies, resulting in ISRs very close to or equal to 100% (see Table 12). The lighting ISRs were 92.4% for energy savings and about 95% for summer and winter demand savings due to discrepancies in three of the 60 reviewed projects, two of them substantial. The relative precision of these results, at 90% confidence, was 9% for lighting and better than 1% for all non-lighting technologies.

Table 12. Main Channel ISRs

Technology	Energy Savings (kWh)	Summer Peak Demand (kW)	Winter Peak Demand (kW)
Lighting	92.4%	95.1%	95.0%
HVAC	100.0%	100.0%	100.0%
Food Service	99.4%	99.4%	99.4%
Process	100.0%	100.0%	100.0%
Pumps and Drives	100.0%	100.0%	100.0%
TOTAL	**94.2%**	**96.6%**	**95.8%**

We applied the main channel ISRs to savings from the Business Savings Store, the midstream channel, and the new upstream channel, by technology. These channels contributed only 4% to overall program ex post savings (see Table 1).

4.2.4 OVERALL GROSS REALIZATION RATES

Based on the analyses summarized above, the overall program-level realization rates for energy savings, summer peak demand, and winter peak demand are 135%, 120%, and 127%, respectively (see Table 13). The following were the main drivers for technology-level realization rates substantially different from 100%:

- **Lighting:** The high realization rates are driven by deemed savings adjustments to per unit savings of reviewed lighting measures, ranging from 137% for summer demand to 155% for energy savings. These are primarily the result of updated baseline wattage assumptions, which we aligned with assumptions used in other Duke Energy jurisdictions. These upward adjustments are partially offset by ISRs below 100%.
- **HVAC:** Realization rate differences are the result of the deemed savings review, which increased energy savings but decreased summer and winter demand savings for high volume low speed fans.
- **Food Service:** ISRs slightly below 100% are the only contributor to the small adjustment in food service realization rates.

Table 13. Overall Gross Realization Rates

Technology	Energy Savings (kWh)	Summer Peak Demand (kW)	Winter Peak Demand (kW)
Lighting	142.9%	130.6%	132.8%
HVAC	110.5%	94.2%	97.1%
Food Service	99.4%	99.3%	99.3%
Process	100.0%	100.0%	100.0%
Pumps and Drives	100.0%	100.0%	100.0%
Total	**134.7%**	**119.5%**	**127.5%**

5. NET IMPACT ANALYSIS

5.1 METHODOLOGY

Our net impact analysis included application of a net-to-gross ratio (NTGR) to ex post gross savings. The NTGR includes consideration of free-ridership (FR), participant spillover (PSO), and trade ally spillover (TASO). These concepts are defined as follows:

- Free-riders are program participants who would have completed the same energy efficiency upgrade without the program. FR scores represent the percentage of savings that would have been achieved in the absence of the program. FR scores can range from 0% (not a free-rider; the participant would not have completed the project without the program) to 100% (a full free-rider; the participant would have completed the project without the program). FR scores between 0% and 100% represent partial free-riders, i.e., participants who were to some degree influenced by the program to complete the energy efficiency upgrade.
- PSO refers to additional energy efficiency upgrades participants made at the time of or after their participation in the Smart $aver® Prescriptive Program that were influenced by the program but for which they did not receive a program incentive. PSO is estimated at the program level and expressed as a percentage of program savings.
- TASO refers to non-incented energy efficiency upgrades made by customers who were influenced by a participating trade ally who was in turn influenced by the Smart $aver® Prescriptive Program. TASO is estimated at the program level and is expressed as a percentage of program savings.

Due to the small number of participants during the evaluation period, the scope of this evaluation did not include NTGR research. We relied on FR, PSO, and TASO values from the last evaluation of the Duke Energy Ohio (DEO) Smart $aver® Prescriptive Program,[4] which were also used in the prior DEK evaluation.[5]

The NTGR is calculated using the following equation:

$$NTGR = 1 - FR + PSO + TASO$$

5.2 NET IMPACT RESULTS

Based on the lighting and non-lighting NTGRs used in the previous DEK evaluation (87.9% and 81.8%, respectively), the savings-weighted, program-level NTGR for this evaluation period is 86.7%. Table 14 presents the individual NTG components (i.e., FR, PSO, and TASO) and the resulting NTGRs, for lighting and non-lighting measures. These NTGRs were applied to ex post gross savings from all delivery channels.

Table 14. Summary of NTG Assumptions

Technology	Free-Ridership	Participant SO	Trade Ally SO	NTGR [A]
Lighting	17.7%	0.04%	5.6%	87.9%
Non-Lighting	23.9%			81.8%
Total [B]	**18.9%**	**0.04%**	**5.6%**	**86.7%**

[A] Due to rounding, the NTGR might not exactly equal 1 – FR + PSO + TASO.

[B] Savings-weighted average of lighting and non-lighting values.

[4] Opinion Dynamics Corporation. Duke Energy Ohio – Non-Residential Smart $aver® Prescriptive Program Evaluation Report. December 7, 2018.

[5] Opinion Dynamics Corporation. Duke Energy Kentucky – Non-Residential Smart $aver® Prescriptive Program Evaluation Report. July 24, 2019.

Table 15 presents the ex post net impacts that result from applying the evaluation NTGRs to ex post gross savings.

The program realized net energy savings of approximately 31.8 GWh during the evaluation period. The main channel contributed 30.5 GWh to this total while Business Savings Store contributed 0.7 GWh, the midstream channel contributed 0.5 GWh, and the new upstream channel contributed 0.2 GWh.

Table 15. Summary of Net Program Savings

Technology	Ex Post Gross			NTGR	Ex Post Net		
	Energy Savings (MWh)	Summer Peak Demand (MW)	Winter Peak Demand (MW)		Energy Savings (MWh)	Summer Peak Demand (MW)	Winter Peak Demand (MW)
Main Channel	35,133	5.31	3.21	86.7%	30,472	4.58	2.79
Lighting	*28,408*	*3.96*	*2.82*	*87.9%*	*24,971*	*3.48*	*2.48*
HVAC	*5,508*	*1.19*	*0.23*	*81.8%*	*4,505*	*0.97*	*0.19*
Food Service	*947*	*0.11*	*0.11*	*81.8%*	*775*	*0.09*	*0.09*
Process	*153*	*0.04*	*0.04*	*81.8%*	*125*	*0.03*	*0.03*
Pumps and Drives	*117*	*0.01*	*0.01*	*81.8%*	*96*	*0.01*	*0.01*
Business Savings Store	809	0.09	0.06	86.4%	699	0.08	0.06
Lighting	*604*	*0.09*	*0.06*	*87.9%*	*531*	*0.08*	*0.05*
Non-Lighting	*205*	*0.00*	*0.01*	*81.8%*	*168*	*0.00*	*0.00*
Midstream Channel	567	0.09	0.06	87.9%	498	0.08	0.05
Lighting	*567*	*0.09*	*0.06*	*87.9%*	*498*	*0.08*	*0.05*
Upstream Channel	179	0.01	0.01	85.2%	153	0.01	0.01
Lighting	*99*	*0.01*	*0.01*	*87.9%*	*87*	*0.01*	*0.01*
Non-Lighting	*80*	*-*	*< 0.01*	*81.8%*	*65*	*-*	*<0.01*
Total	**36,688**	**5.51**	**3.34**	**86.7%**	**31,821**	**4.76**	**2.91**

6. RECOMMENDATIONS

Based on the results of our gross impact evaluation, we identified the following opportunities for program improvement:

- **Consider focusing available resources on fewer delivery channels.** Program-tracking data over the past two evaluations (2016-2023) show considerable swings in savings, both year-to-year and across channels, and a discontinuation of the midstream channel for a 4-year period. Such changes in program availability and funding tend to create uncertainty in the marketplace and can impede the long-term success of energy efficiency programs. We encourage the program team to explore ways to maintain consistency and minimize program channel disruptions. For example, the program may consider focusing available resources on fewer delivery channels, which would allow for more continuous funding in those channels and lead to improved market certainty and more consistency in program offerings. We acknowledge that regulatory and budgetary constraints outside of the program's control may not allow for such changes at any/all times. In addition, flexibility of program funds to support DEK customers is an important consideration, recognizing that the overall performance of the non-residential market supersedes the performance of individual program channels.
- **Consider additional QA/QC steps to improve the fidelity between invoices and tracking data.** While our desk reviews found relatively few discrepancies between tracked data and supporting documentation, differences in three sampled lighting projects resulted in an 8% and 5% reduction in lighting energy and demand savings, respectively. We recommend reviewing QA/QC processes to determine if improvements could be made.

7. SUMMARY FORM

DUKE ENERGY KENTUCKY
NON-RESIDENTIAL SMART $AVER® PRESCRIPTIVE PROGRAM
COMPLETED EM&V FACT SHEET

PROGRAM DESCRIPTION

The Duke Energy Kentucky Non-Residential Smart $aver® Prescriptive Program provides incentives to commercial and industrial customers for a range of measures, including lighting, HVAC systems, food service products, process equipment, and pumps and drives. The program's main channel works with trade allies to promote the program and drive participation. The program also offers three alternative channels where customers can purchase a subset of products at comparable incentive levels either online through the Business Savings Store, directly from distributors (midstream), or from manufacturers (upstream).

Date:	June 13, 2025
Region(s):	Duke Energy Kentucky (DEK)
Evaluation Period:	January 1, 2019 – December 31, 2023
Annual MWh Savings (ex post net):	31,821
Coincident MW Impact (ex post net):	4.76 (Summer Peak) 2.91 (Winter Peak)
Measure Life:	Not Evaluated
Net-to-Gross Ratio:	Main Channel Lighting: 87.9% Main Channel Non-Lighting: 81.8%
Process Evaluation:	No
Previous Evaluation(s):	DEI Smart $aver® Prescriptive Program - Kentucky, July 24, 2019.

EVALUATION METHODOLOGY

In support of the **gross impact evaluation**, we first reviewed program-tracking data and developed a comprehensive database of program measures and ex ante savings. We then checked the program data for ineligible measures and reviewed and adjusted, where warranted, per-unit "deemed" savings for a subset of measures. To verify measure installations, we conducted desk reviews. Finally, we estimated ex post gross energy and demand savings, by delivery channel and technology, based on per-unit deemed savings adjustments and in-service rates.

The **net impact evaluation** relied on lighting and non-lighting free-ridership, participant spillover, and trade ally spillover estimates from the 2018 evaluation of the Duke Energy Ohio Non-Residential Smart $aver® Prescriptive Program (which were also used in the prior DEK evaluation). We estimated ex post net savings by multiplying the net-to-gross ratios by the ex post gross savings, for all delivery channels.

This evaluation did not include an assessment of program processes.

8. DSMORE TABLE

The Excel spreadsheet containing measure-level inputs for Duke Energy Analytics is provided below. Per-measure savings values in the spreadsheet are based on the gross and net impact analyses reported above. The evaluation scope did not include updates to measure life assumptions.

NR
Prescriptive_DEK202

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2023 Summer Power Manager Program Evaluation Report

Submitted to Duke Energy Kentucky

Prepared by Resource Innovations

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FINAL

resource innovations

Table of Contents

Executive Summary

This report presents the results of Resource Innovations' 2023 Summer Power Manager impact and process evaluations for the Duke Energy Kentucky (DEK) territory.

Power Manager is a voluntary demand response program that offers financial incentives to residential customers in Duke Energy's Kentucky service territory. By enrolling in Power Manager, customers allow Duke Energy to reduce the use of their central air conditioner's outdoor compressor during summer days with high energy usage. The primary role of the program is to provide emergency load demand relief to Duke Energy's electric grid by calling events at times when extreme temperatures are expected, and household cooling needs are highest. Customers in the DEK territory can enroll in the Moderate or High cycling options, with differing amounts of incentive offered for each. During normal events, a remote signal is sent to participating load control devices that reduce customers' air conditioner use at levels determined by the individual customer's cycling option; customers enrolled in the Moderate option are cycled at 60%, while customers enrolled in the High option are cycled at 75%. During emergency operations, all devices are instructed to instantaneously shed loads at 75% cycling in order to deliver larger demand reductions.

Resource Innovations' (RI) evaluation of Duke Energy Kentucky's 2023 Power Manager program includes two main components: impact evaluation and process evaluation. The impact evaluation is designed to quantify the performance of the program in Summer 2023 through ex post impact estimation, as well as develop a set of ex ante estimates that can be used to predict the program's impacts for hypothetical events. The process evaluation is designed to gain insights into the customer's experience with the program, identify strengths and weaknesses, and improve overall program operations.

1 Key Findings

The following sections summarize results and key findings from the 2023 Summer Duke Energy Kentucky Power Manager program impact and process evaluations.

1.1 Impact Evaluation

The impact evaluation is based on a randomized control trial (RCT) analysis design. All Power Manager program participants who had a load control device installed by the start of the 2023 summer event season were randomly assigned to one of five groups, each made up of approximately 20% of the total population. Under the RCT design, at least one group is withheld from each event dispatch as a control group in order to provide an estimate of energy load profiles absent curtailment, i.e., the reference load. During the summer of 2023, approximately 12,500 households were actively participating in Power Manager and had load control devices.

Table 1-1 presents summary results of the 2023 summer events.

Table 1-1: Load Impacts for 2023 Events

Event Type	High/Moderate/Low Shed Level	# Dispatches	Avg. Per Customer Impact (kW)	Avg. Per Device Impact (kW)	Maximum Per Customer Impact (kW)	Maximum Per Device Impact (kW)
Regular	75%/60%/25%	22	0.38	0.36	0.54	0.52
Emergency	75%/75%/66%	12	0.41	0.39	0.58	0.56
Average of 2023 DEK Events		**34**	**0.39**	**0.38**	**0.58**	**0.56**

A few key findings are worth highlighting:

- Emergency shed event impacts were slightly larger on average (0.41 kW) compared to regular shed events (0.39 kW); however, emergency shed events were called at lower temperatures
- The greatest event impact observed in 2023 was 0.58 kW per customer and occurred twice, on August 11 and August 24
  - Both events were one-hour emergency shed events called at similar temperatures of 86°F and 87°F, respectively
- Impacts grow with temperature - events called on hotter days produce greater load reductions
- Events beginning later in the day generate greater impacts compared to earlier events

1.1.1 Demand Reduction Capability

One of the primary objectives of the Summer 2023 impact evaluation was to estimate Power Manager's load reduction capability under emergency conditions. This was accomplished by developing a user-driven tool that applies observed relationships between load impacts, temperature, hour-of-day, and event dispatch option(s). The end product, referred to as the Time-Temperature Matrix, allows users to predict the program's load reduction capability under a wide range of user-input event conditions.

Duke Energy Kentucky uses a 1-hour emergency event starting at 4:00 PM and with a daily maximum temperature of 98°F to define emergency conditions. Under these conditions, individual customers are expected to deliver 1.33 kW of demand reduction per household (1.28 kW per device) over a one-hour event window. Because there are approximately 45,000 customers enrolled in Power Manager, the expected aggregate reduction is approximately 60 MW.

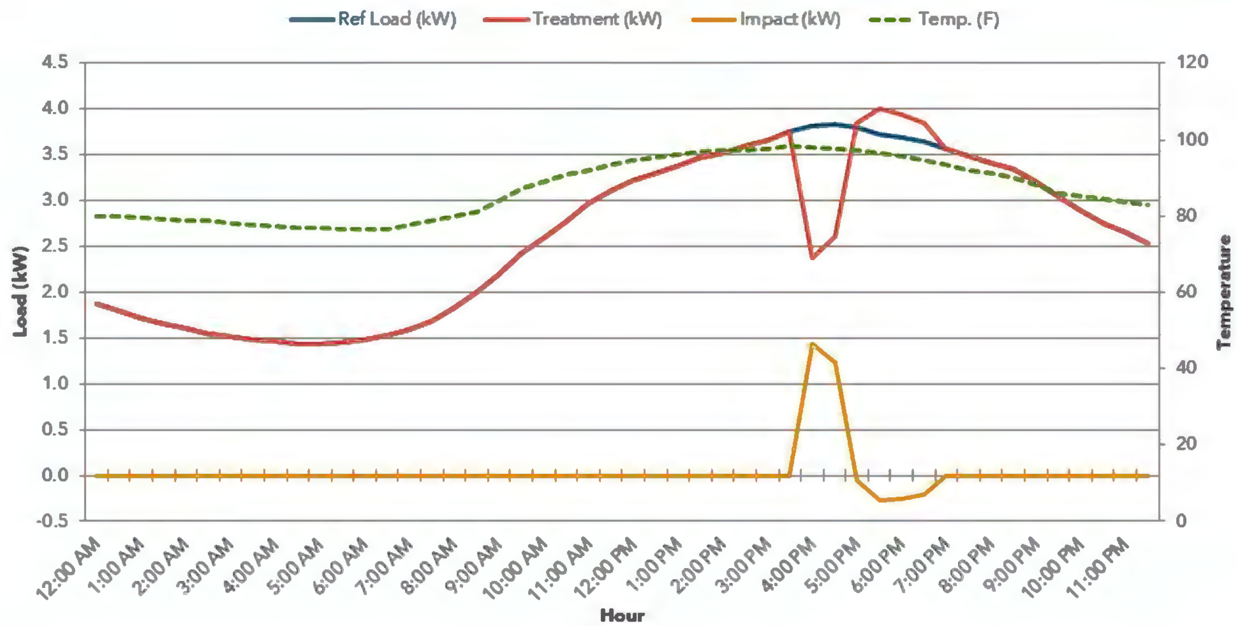
Figure 1-1: Summer Load Reduction Capability Under Extreme Conditions

GLOBAL INPUTS	
Daily Maximum Temperature	98
Month	July
Day Type	Weekday
Aggregate (MW) | Per-Customer (kW)	Per-customer

SUMMARY OUTPUT OPTIONS	
Event Start	4:00 PM
Event Duration (hours)	1
Event End	5:00 PM
Maximum Temp (F)	98.2

PROGRAM SPECIFIC INPUTS	Power Manager
Event Start	4:00 PM
Event Duration (Hours)	1
Event End	5:00 PM
Number of Customers	45,000
Setback Strategy	Emergency Shed

SUMMARY EVENT WINDOW AVERAGE	
Ref Load (kW)	3.83
Treatment (kW)	2.50
Impact (kW)	1.33
% Impact	34.8%
Snapback (kW)	-0.20



1.2 Process Evaluation

The process evaluation is designed to inform efforts to continuously improve the program by identifying strengths and weaknesses, opportunities to improve program operations, adjustments likely to increase overall effectiveness, and sources of satisfaction or dissatisfaction among participating customers. The process evaluation consisted of telephone interviews with key program managers and implementers, a post-event survey of participants implemented immediately after an event, and a non-event survey of participants implemented on the same day as the post-event survey, where the participants invited to the non-event survey did not experience the load control event.

Key findings from the process evaluation are summarized as follows:

Power Manager Participant Background

- Survey data shows that Power Manager participants are frequent users of air conditioning on both weekends and weekdays – between 82% and 95% of respondents report that they use their air conditioner either every weekday or every weekend afternoon or evening.
- A slim majority (54%) of participants still have at least one manual thermostat in the home. Most participants (82%) have only one air conditioner of any type in their home.
- About half (52%) of survey respondents keep their air conditioner set at a constant temperature. Only 18% of respondents state that their thermostat runs a program that automatically changes the temperature setpoints at different times.

Power Manager Event Awareness

- Customer survey responses came from two groups of randomly-selected Power Manager participants: one group that experienced a Power Manager event the day they received the survey invitation (the "post-event" respondents) and another group that did not (the "non-event" respondents).
- A majority of respondents, said they "didn't know" when asked if they thought a Power Manager event had been dispatched recently. There is no statistically significant (at the 90% level of confidence) difference between the response distributions of the post-event and non-event survey groups, indicating that Power Manager participants generally can't tell when load control events are dispatched. Specifically:
    - Well more than half, 59%, of the post-event respondents reported that they didn't know if a Power Manager event had recently occurred. A quarter (25%) of respondents believe there had been a recent event, and 16% of respondents did not think an event had recently occurred. Responses from the non-event survey group followed a similar pattern: 63% said "don't know", 25% said "yes", and 12% said "no" when asked if they believed a Power Manager event had recently been dispatched.
- The most commonly reported way that DLC customers could tell there was an event, if they indicated on the survey that they thought one recently occurred, was that the temperature in their home went up. About a third of respondents report using this heuristic for detecting an event: 39% of post-event group respondents and 33% of non-event group respondents responded thusly. Hot weather outside was the second-most reported way participants judged that there was a recent Power Manager event – 39% of post-event and 24% of non-event respondents gave this response.
- Also, among the customers that believed there was a Power Manager event dispatched recently and were at home at the time of the perceived event, only 16% of all respondents reported taking action. The most commonly reported action taken (by 50% of respondents) is using fans that they do not normally use.

In-home Thermal Comfort

- When inquiring among DEK Power Manager program participants as to thermal comfort on event days, it is important to use a survey framework that compares thermal comfort among participants that did experience an event to those that didn't, since on hot event-like days many residential program participants would report thermal discomfort even without an event occurring.
- A minority of survey respondents from either the post-event or non-event groups reported thermal discomfort. Only 12% of post-event survey respondents reported that they experienced in-home thermal discomfort on the event day and only 18% of non-event survey respondents reported in-home thermal discomfort on the same day (when they did not actually experience a Power Manager event). The difference in response distributions to the thermal comfort survey question between the post-event and non-event survey groups is not significantly different than zero at the 90% level of confidence. Therefore, there is no evidence in this survey data that in-home thermal discomfort can be attributed to Power Manager events that would not otherwise be occurring on a hot day.
- Respondents that reported thermal discomfort were asked to rate their discomfort on a scale of one to five. Discomfort ratings among post-event and non-event participants did not show statistically significant differences at the 90% level of confidence. This finding indicates that among those customers whose homes felt hot on the Power Manager event day, there is no uplift in the reported severity of their discomfort that can be attributed to Power Manager.

Motivations to Enroll, Satisfaction, and Barriers to Satisfaction

- Historically, the most commonly cited primary reason to enroll in Power Manager by Power Manager participants is the financial participation incentive. That is still the case according to the survey data collected for the 2023 Summer program evaluation in Kentucky – 43% of post-event and 37% of non-event respondents cite the bill credits as the primary motivator for enrolling. However, another reason also makes a strong showing in the survey data in this evaluation: "supporting the grid during times of high system demand" garnered 27% of the post-event and 29% of the non-event survey respondents as the primary cited reason to enroll.
- Large proportions, ranging between 73% and 87%, of participants have positive views on many aspects of the program including ease of enrollment, convenience of DLC device installation, the number of events called, the effect of events on home comfort, and willingness to refer the program to others.
- Two other aspects of the program represent the current barriers to satisfaction, which may impact participants' enrollment longevity: the participation incentive and program communications. Only 32% of respondents agree that the financial incentive is sufficient. And only 39% of respondents agree that program communication is sufficient.
- Only 27% of respondents, according to their survey responses, would not recommend the program to others. A follow-up question for those respondents inquired why that is the case. The most common response category is an "other" category of miscellaneous comments, which represented many different opinions such as not believing the program works as intended and believing that demand side management programs are inferior to T&D grid assets. The second most common response category is that the bill credits are not large enough.
- Respondents who do not agree that the program communications are sufficient were asked to describe in their own words what communications they would like. The most common respondent request was notification of program enrollment (to provide confirmation to the customer that they are enrolled), followed by event notifications by email or text and material on how the program works.
- Finally, Kentucky Power Manager participant survey respondents indicate high willingness to stay enrolled, and the stated willingness to stay enrolled does not significantly differ (at the 90% level of confidence) depending on whether the respondent was in the post-event or non-event group. More than three-quarters of respondents indicate high likelihood of staying enrolled: 77% of post-event and 79% of non-event survey respondents reported that they are "very likely" to stay enrolled in Power Manager.

1.3 Key Recommendations

The 2023 summer season Power Manager evaluation provided insights into program performance from both a load impact and a customer experience perspective. The following recommendations have been developed based on the key findings from the evaluation.

- Continue to promote the Power Manager program to DEK residential customers who exhibit high peak load consumption. Customers with higher-than-average peak loads remain the best candidates for program participation and have the greatest potential to contribute to demand savings.
- Continue investigations into potential operational issues to determine if factors such as device failures in the field and/or problems with over-the-air programming and device reception contributed to the reduced program capabilities.
    - Consider increased on-site quality control inspections of customer devices, targeting accounts identified by the device operability analysis.
- Participant survey data in the 2023 Summer evaluation shows that Power Manager events as dispatched using the framework long used by the program – with typical cycling strategies of either 60% or 75% depending on the enrolled option, duration of one hour, dispatched in the late afternoon – do not cause an uplift in thermal discomfort or degree of discomfort more than would otherwise occur on hot summer days. Additionally, participants are not shown in the data collected for this evaluation to be able to distinguish on a hot day whether an event is happening or not. Future changes to program design or approach, such as running events in longer duration or at different times of day should be rolled out in a way that enables collecting customer feedback before widespread adoption by the program.
- Broadly, event awareness and thermal comfort did not factor strongly in the survey findings in this evaluation. However, a recurrent theme in the responses to the survey questions inquiring about aspects of the program that relate closely to satisfaction are Duke Energy program communications with program participants and the financial participation incentives. While not diminishing the importance of prioritizing participant comfort during events, Duke Energy's greatest opportunities for improving customer satisfaction and engagement with the program are through program communications and the incentives provided to participants.
    - Duke Energy should consider evaluating opportunities for increasing financial incentives if such evaluations have not been made in recent years. Cost-effectiveness is a critical aspect of program management, but cost-effectiveness also depends on retaining customers' ongoing participation with a positive value proposition that continues to hold up for customers after experiencing load control events. The incentive may be enough to attract enrollment, however, the current incentive levels may not be high enough to maintain enrollment longevity.
    - Likewise, program participants provided a number of suggestions in the surveys conducted for this evaluation for improved communication from Duke Energy, ranging from notifications or confirmations of program enrollment,

text or email event notifications, and providing more information on how the program works. Duke Energy should strongly consider adding some or all of these most-requested communication enhancements.

2 Introduction

This report presents the results of the 2023 Summer Power Manager program evaluation for the Duke Energy Kentucky (DEK) jurisdiction. Power Manager is a voluntary demand response program that provides incentives to residential customers who allow Duke Energy to reduce the use of their central air conditioning on summer days with high energy usage. The 2023 program evaluation involves two primary components: the impact evaluation is aimed at measuring the benefits and capability of the program through kW load reductions, while the process evaluation is designed to assess the customer's experience with the program, as well as identify key successes and/or hindrances with program operations.

The impact evaluation is based on a randomized control trial (RCT) that utilizes household-level advanced metering infrastructure (AMI) electricity usage data. All participating customers are randomly assigned to one of five different research groups. During each event, at least one of the groups is withheld to serve as a control group and to provide an estimate of participants' load usage profiles absent a Power Manager event. The randomized control trial approach was applied to all Power Manager operations where a valid control group was available, as well as to test events designed to address a set of specific research questions. In addition to estimating load impacts during 2023 summer events, the impact evaluation enables the estimation of the program's demand reduction capability under a range of hypothetical weather and dispatch conditions. Average customer load reductions, as well as aggregate program capacity, is estimated as a function of event type, control option, event start time, event duration, and event temperature.

The process evaluation uses survey responses obtained from two groups of program participants – participants that had recently experienced a non-emergency Power Manager load control event and participants that had not recently experienced an event. We refer to these two groups of surveyed participants as the post-event and non-event survey groups, respectively. As in the impact analysis, responses from non-event group of survey respondents serves as a baseline to which survey responses from the post-event group may be compared. In addition, this evaluation uses interview data and analyses of program documentation and the program database to offer context for evaluating survey results, as well as to develop and put forward insights into program operations.

2.1 Key Research Questions

The data collection and analysis activities were designed to address the following impact and process evaluation questions:

2.1.1 Impact Evaluation Research Questions

- What were the demand reductions achieved during each event called in Summer 2023?
- Do impacts vary for customers enrolled in the moderate vs. high load control options?
- Do impacts vary based on the hour(s) of dispatch?
- Do impacts vary based on temperature conditions?
- What is the impact of post-event snapback?
- What is the magnitude of the program's aggregate load reduction capability during extreme conditions?

2.1.2 Process Evaluation Research Questions

- Are participants aware of events, bill credits, and other key program features?
- What is the participant experience during events, particularly relating to thermal comfort?
- What actions do participants take in response to events?
- What are the motivations and potential barriers for participation?
- What are the processes associated with operations and program delivery?
- What are program strengths and areas for potential improvement?

2.2 Program Description

Power Manager is a voluntary demand response program that provides incentives to residential customers who allow Duke Energy to reduce their cooling and/or heating energy use on days with high energy usage.

All Power Manager participants have a direct load control (DLC) device installed on the outdoor unit of qualifying air conditioners. If customers have more than one air conditioner, all units must be equipped with a load control device. The DLC device (also sometimes referred to as a switch) causes the air conditioner's compressor to be cycled off and on to reduce load when a Power Manager event is called by reducing the total runtime of the compressor during events. Duke Energy initiates Power Manager events by sending a signal to the relevant DLC devices through a proprietary paging network.

Power Manager events typically occur from May through September in Kentucky but are not limited to only these months. Participants receive financial incentives for their participation based on the cycling option they are enrolled in. Upon program enrollment, Power Manager customers select either moderate or high load control. Participants receive incentives in the form of a one-time installation credit plus monthly bill credits, which are divided equally across each month of the program event season.[1] For customers enrolled in the high control option, incentives include a $35 installation credit plus $18 in monthly bill credits. Customers enrolled in the moderate control option receive a $25 installation credit plus $12 in monthly bill credits. As of 2023, approximately 63% of Power Manager devices in Kentucky are enrolled in the moderate load control option and the remaining 37% are enrolled in the high load control option.[2]

Duke Energy's Power Manager DLC devices use a cycling algorithm known as TrueCycle. The algorithm uses learning days to estimate air conditioner compressors' runtime (or duty cycle) as a function of hour-of-day and temperature at each specific site and aims to curtail load demand by a specified amount. In general, Power Manager events fall into two categories: regular shed events, during which customers are cycled at 60% and 75% for moderate and high control customers, respectively; and emergency shed events during which both moderate and high customers are cycled at 75%. At least once per program year, Duke Energy's regional transmission operator (RTO), PJM Interconnection, requires Duke Energy to launch a test event, where the full population of program participants are dispatched under emergency shed cycling conditions. For purposes of regulatory reporting, emergency shed is used to estimate program capability.

Table 2-1: Cycling Options for Normal and Emergency Shed

Event Type	Low Option	Moderate Option	High Option
Normal Shed	25%	60%	75%
Emergency Shed	66%	75%	75%

2.3 Participant Characteristics

Duke Energy serves approximately 135,000 residential customers in DEK service territory, providing service to customers in Boone, Campbell, Grant, Kenton and Pendleton counties in Kentucky. The jurisdiction is located along Kentucky's northern border, adjacent to both Ohio and Indiana.

[1] The event season is May through September; however, customers receive credits on their bills for June through October.
[2] In the past, a low load control option was offered to customers who request to be removed from the program, as a tactic for minimizing attrition; at the time of this report, a very small number of customers are enrolled in the low control option, representing only 0.1% of all enrolled devices.

Figure 2-1: Duke Energy Kentucky Service Territory

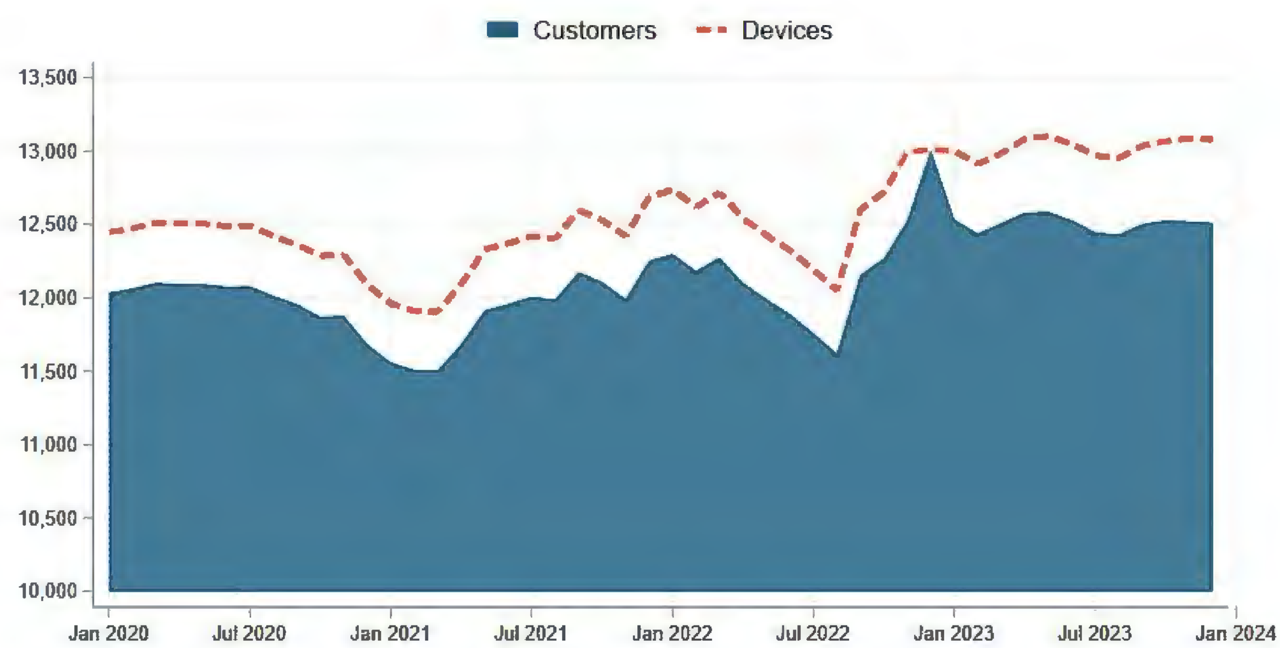
By the start of 2023 summer event season, 12,586 devices were part of Power Manager. Of those units, approximately 63% were enrolled in the moderate load control option. Table 2-2 displays the participant counts by cycling option. Due to the low enrollment numbers for the low cycling option, this report will focus on the results for the moderate and high cycling options only, which together comprise 99.9% of the program.

Table 2-2: Device Counts by Control Option

Control Option	# Devices	% of Program
Low	14	0.1%
Moderate	7,844	62.3%
High	4,728	37.6%
Total	12,586	100%

Figure 2-2 shows the program enrollments from 2020-2023 by number of households and number of devices installed. As of the start of the 2023 event season (May 2023), the ratio of devices to households among DLC participants was 1.04 devices per household.

Figure 2-2: DLC Participation (2020-2023)



2.4 Event Characteristics

Duke Energy dispatched Power Manager events 36 times on 12 different days in 2023. Events were held between 2:00 PM and 7:00 PM and ranged in duration from one to two hours. Event period temperatures ranged from 78°F to 92°F. Duke Energy overlaid emergency shed events alongside normal shed events on two occasions to help assess how the magnitude of the emergency shed compares to traditional operations. Table 2-3 summarizes 2023 Power Manager event conditions.

Table 2-3: 2023 Event Operations and Characteristics

Date	Start	End	Event Type	Dispatch	Control	Event Period Temp.	Daily Max Temp.
6/29/2023	2:00 PM	4:00 PM	Emergency	All	None	84.3	85
7/14/2023	4:00 PM	5:00 PM	Regular	All	None	87.8	88
7/27/2023	2:00 PM	3:00 PM	Regular	E	A	86.8	89
	3:00 PM	4:00 PM	Regular	D	A	88.8	89
	4:00 PM	5:00 PM	Regular	B	A	88.3	89
	5:00 PM	6:00 PM	Regular	C	A	88.5	89
7/28/2023	4:00 PM	5:00 PM	Regular	B,D,E	A,C	89.0	95
8/4/2023	4:00 Pm	6:00 PM	Regular	A,B,D,E	C	87.4	88
8/11/2023	4:00 PM	5:00 PM	Emergency	E	B	86.0	86
	4:00 PM	5:00 PM	Regular	C	B	86.0	86
	4:00 PM	6:00 PM	Emergency	D	B	86.0	86
	4:00 PM	6:00 PM	Regular	A	B	86.0	86
8/17/2023	3:00 PM	4:00 PM	Regular	E	D	80.3	81
	4:00 PM	5:00 PM	Emergency	B	D	80.3	81
	4:00 PM	5:00 PM	Regular	A	D	80.3	81
	5:00 PM	6:00 PM	Emergency	C	D	77.5	81
8/23/2023	3:00 PM	4:00 PM	Regular	E	C	91.3	92
	3:00 PM	5:00 PM	Regular	A	C	91.6	92
	4:00 PM	5:00 PM	Regular	D	C	92.0	92
	4:00 PM	6:00 PM	Regular	B	C	92.0	92
8/24/2023	3:00 PM	4:00 PM	Emergency	A	E	84.8	87
	4:00 PM	5:00 PM	Emergency	B	E	87.0	87
	5:00 PM	6:00 PM	Emergency	C	E	87.0	87
	6:00 PM	7:00 PM	Emergency	D	E	86.8	87
9/5/2023	3:00 PM	4:00 PM	Regular	E	D	91.8	92
	4:00 PM	5:00 PM	Regular	A	D	89.5	92
	5:00 PM	6:00 PM	Regular	C	D	85.3	92
	6:00 PM	7:00 PM	Regular	B	D	85.5	92
10/3/2023	3:00 PM	4:00 PM	Regular	A	B	85.0	85
	3:00 PM	5:00 PM	Regular	C	B	85.0	85
	4:00 PM	5:00 PM	Regular	D	B	85.0	85
	4:00 PM	6:00 PM	Regular	E	B	84.9	85
10/4/2023	2:00 PM	4:00 PM	Emergency	A	E	83.6	85
	3:00 PM	5:00 PM	Emergency	C	E	84.1	85
	4:00 PM	6:00 PM	Emergency	B	E	84.1	85
	5:00 PM	7:00 PM	Emergency	D	E	82.3	85

3 Methodology

This section details the study design, data sources, sample sizes, and analysis protocols used for the impact and process evaluations.

3.1 Data Sources

3.1.1 Impact Evaluation Data Sources

The impact analysis relied on four primary datasets:

- Participant data identifying customer account numbers and group assignments;
- Premise-level AMI data in 30-minute intervals for all participants spanning May 2023 through October 2023;
- Event tracking data for all DEK Power Manager events called in 2023, including treatment and control group assignments, event scenarios, start/end times for each event;
- Hourly weather data for the full event season, used to inform proxy day selection for the within-subjects analysis, as well as to establish relationships between impacts and weather conditions.

All primary datasets were provided by Duke Energy following the summer 2023 Power Manager event season. All subsequent datasets used for analysis were compiled by the evaluation team from a combination of these primary datasets.

3.1.2 Process Evaluation Data Sources

The process analysis relied on four primary datasets:

- Program tracking and documentation database
- In-depth interviews with key program stakeholders
- Post-event program participant surveys
- Nonevent program participant surveys

3.2 Impact Analysis Methodology

The 2023 impact evaluation applied two analysis methodologies. The primary methodology is a randomized control trial (RCT), which involves comparing event day loads among customers who were dispatched to those who were not. The secondary approach is referred to as a within-subjects methodology, which is applied in cases where no control group is available. The RCT and within-subjects methodologies are described in more detail in the following sections.

3.2.1 RCT Analysis Design

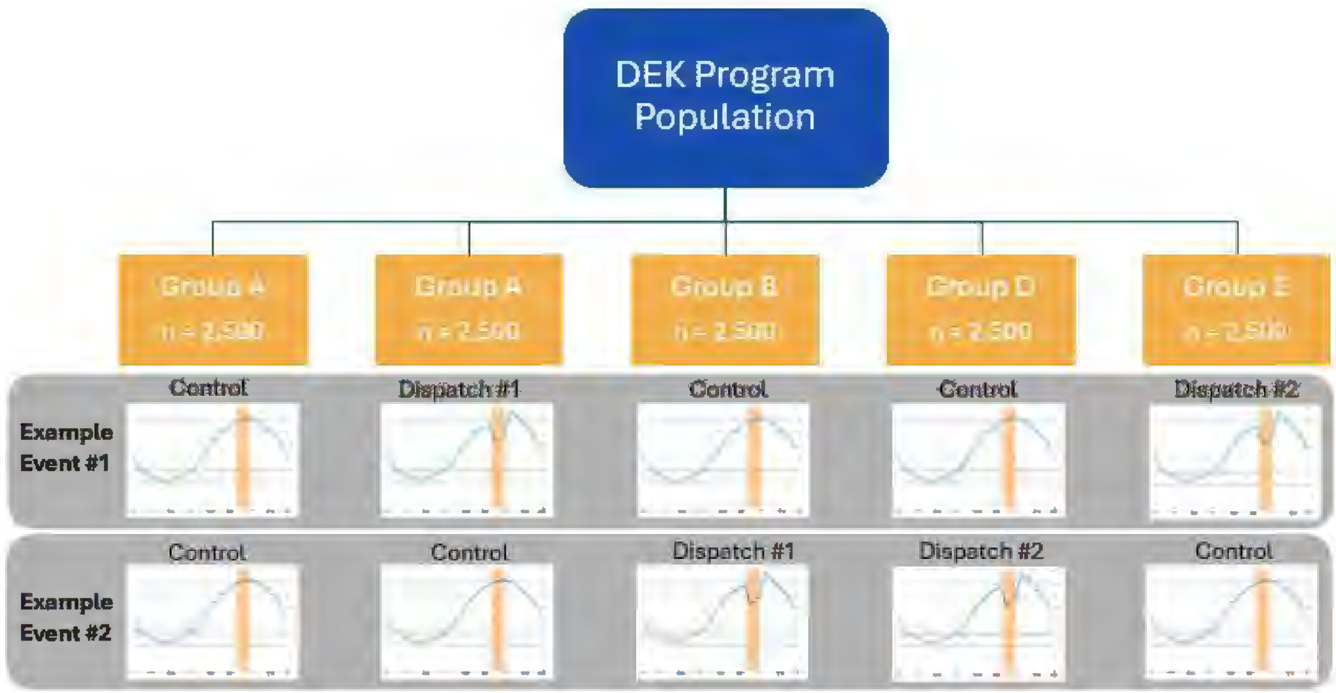
A randomized control trial (RCT) study design is well-recognized as the gold standard for obtaining accurate impact estimates. RCTs have several advantages over other analytical methods, including:

- They require fewer assumptions than engineering-based calculations;
- They allow for simpler modeling procedures that are effectively immune to model specification and estimation errors; and
- They are guaranteed to produce accurate and precise estimates, provided proper randomization and large sample sizes.

The RCT design randomly assigns the Power Manager population into five groups, each consisting of equal shares of the population. For each event, groups are assigned as either treatment or control according to Duke Energy's operational plan. All devices assigned to the treatment group are controlled during the event window, while devices assigned to the control group are withheld and continue to operate normally. As a result of random group assignment, the only systematic difference between the treatment and control groups is that one set of customers is curtailed while the other group was not.

Figure 3-1 shows the conceptual framework of the random group assignment.

Figure 3-1: Randomized Control Trial Design



All customers who were enrolled in the program and had the required equipment installed at their homes by the start of the 2023 summer were randomly assigned into five groups. The table below summarizes the number of households assigned to each group.

Table 3-1: RCT Group Sizes

Group	# of Accounts
Group A	2,243
Group B	2,305
Group C	2,284
Group D	2,271
Group E	2,257

The purpose of creating multiple, randomly assigned groups was twofold. First, it allowed for side-by-side testing of cycling strategies, event start times, or other operational aspects to help optimize the program. Second, it allowed Duke Energy to alternate the group being withheld as control for each event, increasing fairness and helping to avoid exhausting individual customers by dispatching them too often solely for research purposes.

For each event, at least one of the groups was withheld to serve as a control group and establish the electricity load patterns in the absence of curtailment, i.e., the baseline. Within the experimental framework of an RCT, the average usage for control group customers provides an unbiased estimate of what the average usage for treatment customers would have been if an event had not been called. Therefore, estimating event day load impacts requires simply calculating the difference in loads between the treatment and control groups during each interval of the event window, as well as for the hours immediately following the event when snapback can occur. Demand reductions calculated in this way reflect the net impacts and inherently account for offsetting factors, such as device failures, paging network communication issues, and customers' use of fans to compensate for curtailment of air conditioners.

Additional statistical metrics, such as standard error, are calculated to evaluate whether these differences are meaningful, as well as whether different cycling strategies could produce significantly different impacts. The standard error is then used to calculate 90% confidence bands, which are additional measures used to describe the statistical accuracy of the impact estimate.

$$Std.Error\ of\ Difference\ between\ Means_i = \sqrt{\frac{sd_c^2}{n_c} + \frac{sd_t^2}{n_t}}$$

Where:

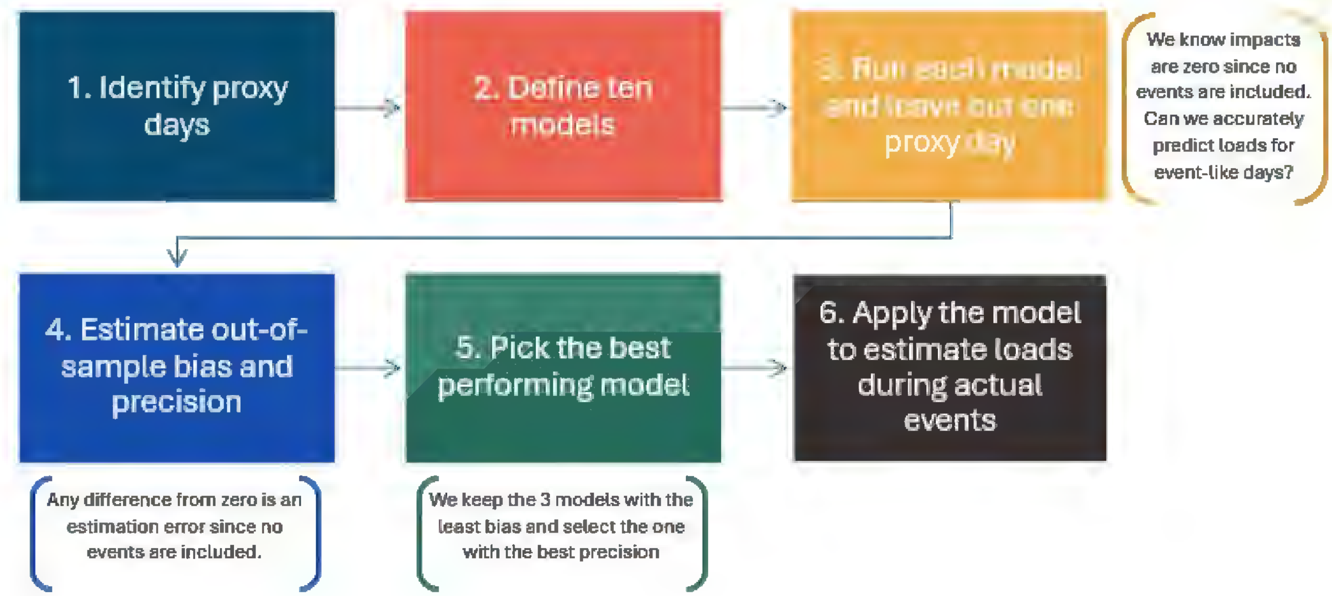
sd = standard deviation
n = sample size
t = indicator for treatment group
c = indicator for control group
i = individual time intervals

3.2.2 Within-Subjects Analysis Design

Although an RCT approach has many implicit advantages that make it the preferred method for estimating impacts, it is not applicable when no valid control group is available to establish the counterfactual. In these cases, when events were called absent a control group, a within-subjects approach is used, whereby customer loads observed on similar non-event days are used to establish the counterfactual against which to compare treatment loads. This approach works because the program intervention is introduced on some days and withheld on other days that could otherwise be considered event-worthy, allowing for comparison of load patterns with and without load control.

A key consideration of the within-subjects design is how to select a model that generates the most precise and accurate counterfactual. In many cases, multiple counterfactuals may be plausible, but result in varying estimations of impacts. Using non-event days with similar temperature conditions, regression modeling was applied to estimate the demand reduction as the difference between the predicted baseline loads and the actual event day loads. To identify the regression model that best predicts the counterfactual, a rigorous model selection process is applied, whereby ten distinct model specifications were tested and ranked using various accuracy and precision metrics. The best performing model was selected and used to estimate the counterfactual for actual event days. Figure 3-2 summarizes the regression model selection process.

Figure 3-2: Model Selection Process



Bias metrics measure the tendency of different approaches to over- or under-predict and are measured over multiple out-of-sample days. The mean percent error (MPE) describes the relative magnitude and direction of the bias. A negative value indicates a tendency to under-predict, and a positive value indicates a tendency to over-predict. The precision metrics describe the magnitude of errors for individual event days and are always positive. The closer they are to zero, the more precise the model prediction. The absolute value of the mean percentage error is used to select the three model candidates with the lowest bias. The coefficient of variation of the root mean square error, or CV(RMSE), metric is used to identify the most precise model from the three models with the least bias.

Metric Category	Metric	Description	Mathematical Expression
Bias	Average Error	Absolute error, on average	$AE = \frac{1}{n}\sum_{i=1}^{n}(\hat{y}_i - y_i)$
	Mean Percentage Error (MPE)	Indicates the percentage by which the measurement, on average, over or underestimates the true demand reduction	$MPE = \frac{\frac{1}{n}\sum_{i=1}^{n}(\hat{y}_i - y_i)}{\bar{y}}$
Precision	Root Mean Squared Error (RMSE)	Measures how close the results are to the actual answer in absolute terms, penalizes large errors more heavily	$RMSE = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(\hat{y}_i - y_i)^2}$
	CV(RMSE)	Measures the relative magnitude of errors across event days, regardless of positive or negative direction (typical error)	$CV(RMSE) = \frac{RMSE}{\bar{y}}$

3.3 Process Evaluation Methodology

The following table summarizes the primary data collection tasks and analysis objectives included in the process evaluation.

Table 3-2: Summary of Process Evaluation Activities

Data Collection Technique	Description of Analysis Activities Using Collected Data	Sample Size	Precision / Confidence Level
Document and database review	Review of program documentation, including program manuals, customer communications, as well as the program database. These materials provide evidence of program operations, as well as how these operations are aligned with program savings and other goals.	NA	NA
Interviews of key contacts	Interviews with DEK Duke Energy staff document program processes, identify strengths/weaknesses and provide a foundation for understanding the customer experience.	3	NA
Post-event survey	Web survey of DEK Power Manager customers who experienced an event, to assess event awareness, satisfaction, customer experience and comfort during events, and motivations for participation.	112	90/8
Non-event survey	Web survey of DEK Power Manager customers for whom an event was not called. Non-event survey data provide a baseline with which to compare post-event responses, to establish levels of event awareness, satisfaction, customer experience and comfort during events, and motivations for participation.	111	90/8

Review program documentation and analyze program database – Process evaluation should be guided by a thorough understanding of the primary activities of any program, the marketing messages used to recruit and support participants, and any formal protocols that guide processes. For demand response programs, it is particularly important to understand the event notification procedures, any opt-out processes that exist, and how bill credits are communicated and applied. It is also important to understand how the program opportunity (i.e., the benefits of program participation and also what the program requires of participating customers) is communicated and the types of encouragement provided to participating households. These communications are often the source of program expectations, which can affect participant satisfaction. To support this task, Resource Innovations requested copies of internal program manuals and guidelines as well as copies of marketing materials. The program database analysis consisted of an examination of program tenure, load curtailed per household, and other variables that inform indications of program progress.

In-depth interviews with key program stakeholders – Program stakeholders include program staff and implementation contractors with insight into program plans and operations, emerging issues, and the expected customer experience. The interviews conducted for the 2023 Summer evaluation informed the customer survey design and confirmed the evaluation team's understanding of key program components.

Goals of the interviews include:

- Understand marketing and recruitment efforts, including lessons learned about the key drivers of enrollment
- Identify "typical" Power Manager households, including characteristics of households that successfully participate for multiple years
- Describe event processes
- Understand opt-out procedures
- Confirm enrollment incentive levels and how event incentives are explained to customers
- Understand the customer experience
- Identify any numeric or other program performance goals (kW enrollment, number of households, notification timelines) established for Power Manager
- Describe the working relationship between Duke Energy and the program implementers, including the allocation of program responsibilities
- Understand emergent and future concerns, and plans to address them

Post-event surveys – Guided by information obtained from stakeholder interviews and a review of program guidance documents (including any notification protocols), Resource Innovations developed a survey for participating customers that was deployed immediately following a Power Manager event. The survey was designed to be deployed on the web to maximize response rate in the 24- to 48-hour window following an event. The post-event survey addressed the following topics:

- Awareness of the specific event day and comfort during the event;
- Any actions taken during the event to increase household comfort: Do participants report changing AC settings, using other equipment (including window units, portable units, or ceiling fans) to mitigate heat buildup? Were participants home during the event? Are they usually home during that time period?
- Satisfaction with the DEK Power Manager program, the event bill credits earned, and the number of events typically called;
- Expectations and motivations for enrolling: What did participants expect to gain from enrollment? To what extent are they motivated to earn incentive payments versus altruistic motivations such as helping to address electricity shortfalls during

periods of high peak demand and/or reducing the environmental effects of energy production?; and

- Retention and referral: Do participants expect to remain enrolled in the program in future years? Would they recommend the program to others?

To ensure that the survey accurately assessed the experiences of customers during a curtailment event, questions were finalized and fully programmed prior to the event, to enable deployment within 24 hours after an event. Working with Duke Energy and the impact evaluation team, Resource Innovations prepared a random sample of DEK Power Manager participants for whom Duke Energy has an email address on file to receive the survey invitations. This sample was linked to the survey software and ready to deploy as soon as the event ended. Participants selected in the random sample received an email invitation with a link to the survey URL. To ensure adequate response rates a relatively short period of time following the events, survey invitations included an offer for a post-completion incentive of a $25 Amazon e-gift card. Post-event surveys were deployed immediately following an event and closed within four days.

Non-event program surveys – In addition to the post-event survey, the evaluation team conducted a non-event survey that was completed by DEK Power Manager participants that did not recently experience a Power Manager event. These surveys launched on the same day as the post-event survey and were identical to the post-event surveys; the only difference is that non-event survey respondents did not experience the event and post-event survey respondents did experience the event. Like the post-event surveys, customers invited to complete the non-event survey were offered a $25 Amazon e-gift card post-completion incentive. The non-event survey was developed, approved, and programmed prior to the demand response season to enable immediate deployment at the same time as the post-event survey. Like the post-event survey, the non-event survey was closed four days after opening. The non-event survey invitation list was a random sample of participants for whom Duke Energy has an email address on file and was developed prior to the demand response season and linked to the programmed survey; participants included in the non-event survey sample also received an email invitation with a link to the survey URL.

4 Randomized Control Trial Results

One of the primary goals of the impact evaluation is to understand the load impacts associated with the Power Manager program under a variety of temperature and event conditions. This section presents overall program results for all events called in 2023.

4.1 Events Impacts

The load impact estimates resulting from the RCT analysis for the 2023 events are presented in Table 4-1. The load impacts presented for each event are the average per household changes in load during the indicated dispatch windows. The snapback is the average of household changes in load for the two hours after an event ends.

Table 4-1: 2023 RCT Event Impacts

Date	Group	Start Time	Duration	Type	Ref. Load	Impact (kW)	% Impact	Snapback (kW)	Event Period Temp.
7/27/2023	E	2:00 PM	1 hour	Regular	2.94	0.43	14.5%	0.00	86.8
7/27/2023	D	3:00 PM	1 hour	Regular	3.10	0.39	12.7%	-0.03	88.8
7/27/2023	C	4:00 PM	1 hour	Regular	3.26	0.42	12.8%	-0.11	88.3
7/27/2023	B	5:00 PM	1 hour	Regular	3.30	0.38	11.4%	-0.14	88.5
7/28/2023	B, D, E	4:00 PM	1 hour	Regular	3.00	0.39	13.1%	-0.02	89.0
8/4/2023	A, B, D, E	4:00 PM	2 hours	Regular	3.05	0.44	14.3%	-0.08	87.4
8/11/2023	E	4:00 PM	1 hour	Emergency	2.75	0.58	21.0%	0.03	86.0
8/11/2023	C	4:00 PM	1 hour	Regular	2.75	0.35	12.8%	-0.03	86.0
8/11/2023	A	4:00 PM	2 hours	Emergency	2.83	0.50	17.8%	-0.10	86.0
8/11/2023	D	4:00 PM	2 hours	Regular	2.83	0.39	13.9%	-0.06	86.0
8/17/2023	E	3:00 PM	1 hour	Regular	2.07	0.22	10.9%	-0.01	80.3
8/17/2023	B	4:00 PM	1 hour	Emergency	2.23	0.33	14.7%	-0.19	80.3
8/17/2023	A	4:00 PM	1 hour	Regular	2.23	0.20	8.8%	-0.06	80.3
8/17/2023	C	5:00 PM	1 hour	Emergency	2.22	0.32	14.4%	-0.15	77.5
8/23/2023	E	3:00 PM	1 hour	Regular	3.13	0.47	15.1%	0.04	91.3
8/23/2023	A	3:00 PM	2 hours	Regular	3.24	0.51	15.7%	-0.03	91.6
8/23/2023	D	4:00 PM	1 hour	Regular	3.35	0.48	14.4%	0.04	92.0
8/23/2023	B	4:00 PM	2 hours	Regular	3.45	0.54	15.7%	-0.08	92.0
8/24/2023	A	3:00 PM	1 hour	Emergency	2.64	0.47	17.9%	-0.13	84.8
8/24/2023	B	4:00 PM	1 hour	Emergency	2.92	0.57	19.5%	-0.20	87.0
8/24/2023	C	5:00 PM	1 hour	Emergency	3.14	0.58	18.5%	-0.17	87.0
8/24/2023	D	6:00 PM	1 hour	Emergency	3.16	0.57	18.1%	-0.12	86.8

Date	Group	Start Time	Duration	Type	Ref. Load	Impact (kW)	% Impact	Snapback (kW)	Event Period Temp.
9/5/2023	E	3:00 PM	1 hour	Regular	3.03	0.44	14.5%	-0.03	91.8
9/5/2023	A	4:00 PM	1 hour	Regular	3.07	0.35	11.4%	-0.05	89.5
9/5/2023	C	5:00 PM	1 hour	Regular	3.15	0.38	12.0%	-0.07	85.3
9/5/2023	B	6:00 PM	1 hour	Regular	3.11	0.33	10.7%	-0.09	85.5
10/3/2023	A	3:00 PM	1 hour	Regular	2.06	0.25	12.1%	0.03	85.0
10/3/2023	C	3:00 PM	2 hours	Regular	2.16	0.26	12.1%	-0.03	85.0
10/3/2023	D	4:00 PM	1 hour	Regular	2.26	0.31	13.5%	0.03	85.0
10/3/2023	E	4:00 PM	2 hours	Regular	2.35	0.34	14.6%	-0.02	84.9
10/4/2023	A	2:00 PM	2 hours	Emergency	1.88	0.22	11.8%	-0.17	83.6
10/4/2023	C	3:00 PM	2 hours	Emergency	2.03	0.27	13.3%	-0.18	84.1
10/4/2023	B	4:00 PM	2 hours	Emergency	2.16	0.25	11.5%	-0.32	84.1
10/4/2023	D	5:00 PM	2 hours	Emergency	2.20	0.25	11.2%	-0.26	82.3

Per customer load impacts under regular shed conditions ranged between 0.20 kW and 0.54 kW, with an average of 0.38 kW per household (0.36 kW per device). Emergency shed events produced load impacts ranging from 0.22 kW to 0.58 kW per household, with an average of 0.41 kW (0.39 kW per device).

Table 4-2: Average Impacts by Event Type

Event Type	High/Moderate/Low Shed Level	# Dispatches	Avg. Per Customer Impact (kW)	Avg. Per Device Impact (kW)	Maximum Per Customer Impact (kW)	Maximum Per Device Impact (kW)
Regular	75%/60%/50%	22	0.38	0.36	0.54	0.52
Emergency	75%/75%/66%	12	0.41	0.39	0.58	0.56
Average of 2023 DEK Events		**34**	**0.39**	**0.38**	**0.58**	**0.56**

At least one of the groups was held back as a control group during each event (excluding the two program-wide events) to establish the baseline. While withholding a control group is an essential component of the RCT research design, it adversely affects the aggregate performance of the program since customers being withheld do not contribute load reduction to the total impact. To extrapolate the total load reduction achieved by the entire program during a given event, the average per household impact is multiplied by the total number of enrolled participants.

Event impacts are displayed graphically in a series of figures that follow, with the average customer load profiles shown for the treatment and control groups. The black line represents the average load from control group customers, the solid-colored lines reflect the average load of each treatment group participating in the event, and the dashed colored lines show the average load impact (the difference between the control group and participant customer loads) for the respective treatment groups. All of the events show a clear drop in treatment group loads during the event dispatch period, as well as a small snapback in energy usage during the hours immediately following the events. Furthermore, most events show an instantaneous and prominent load drop during the first 30-minute interval of the dispatch period, underpinning the collective response of the load control devices once the event signal is received.

Figure 4-1: Per Household Event Performance July 27

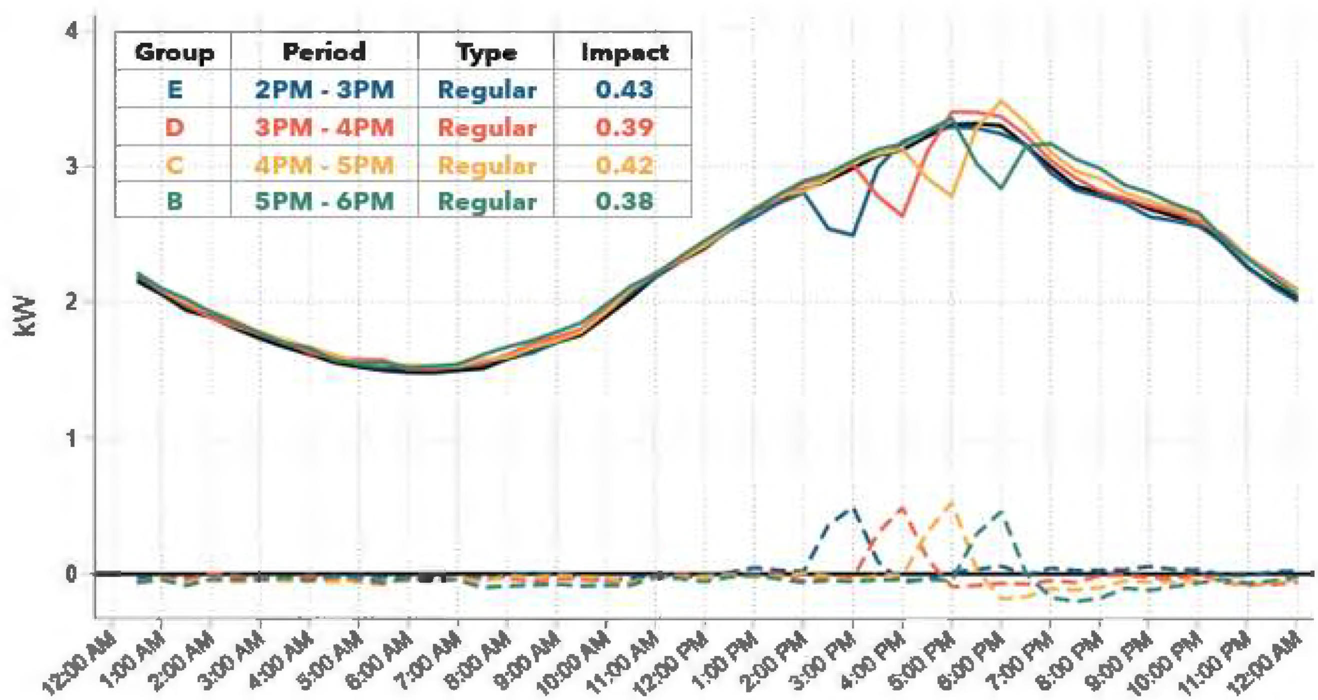


Figure 4-2: Per Household Event Performance, July 28th

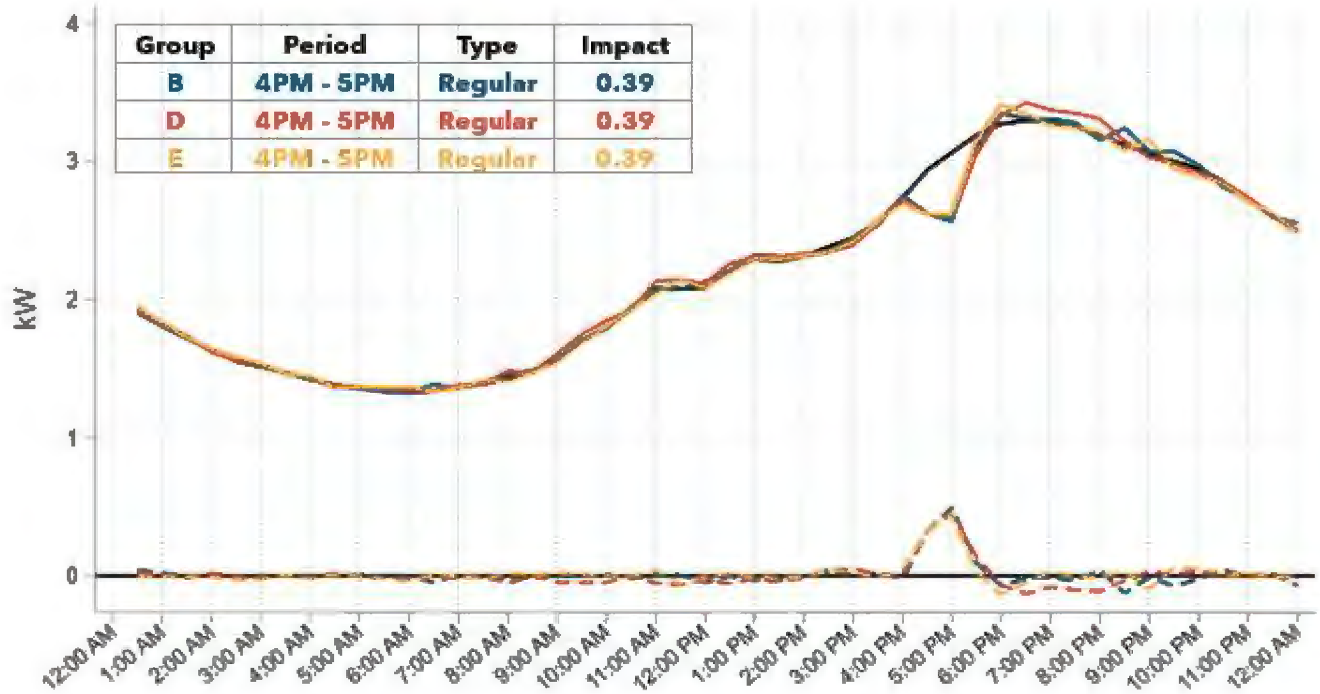


Figure 4-3: Per Household Event Performance, August 4

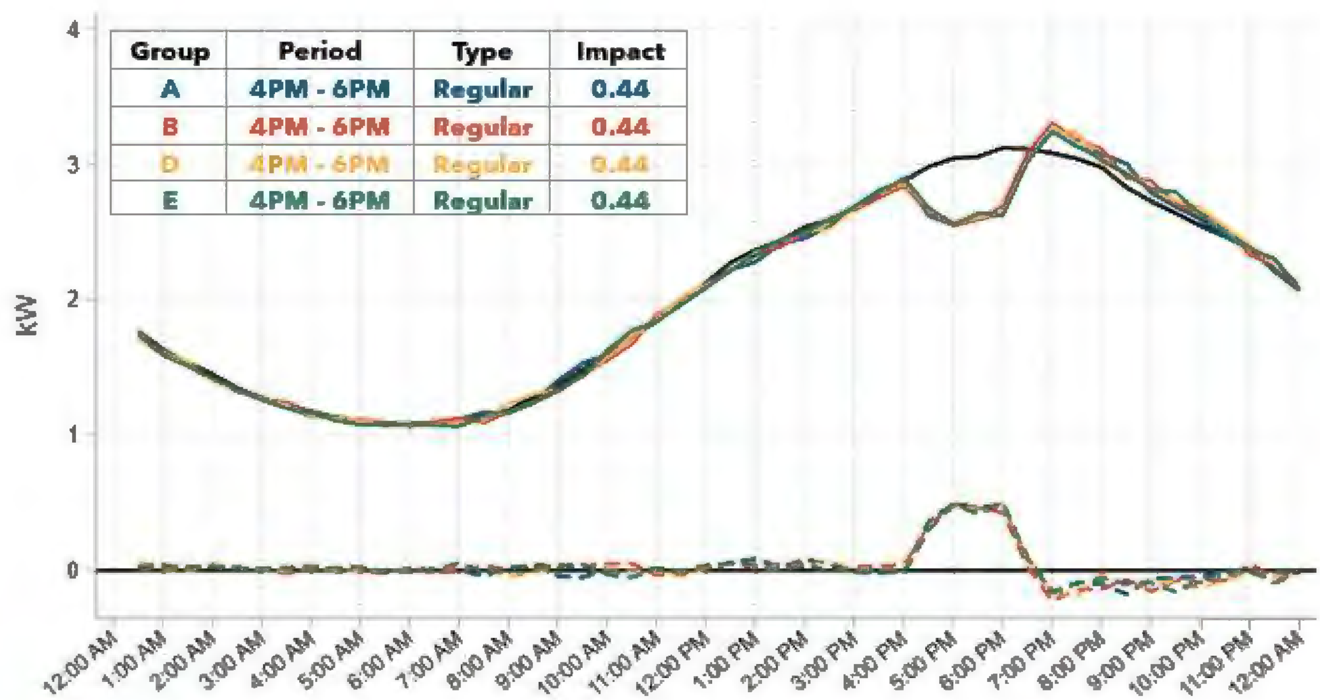


Figure 4-4: Per Household Event Performance, August 11

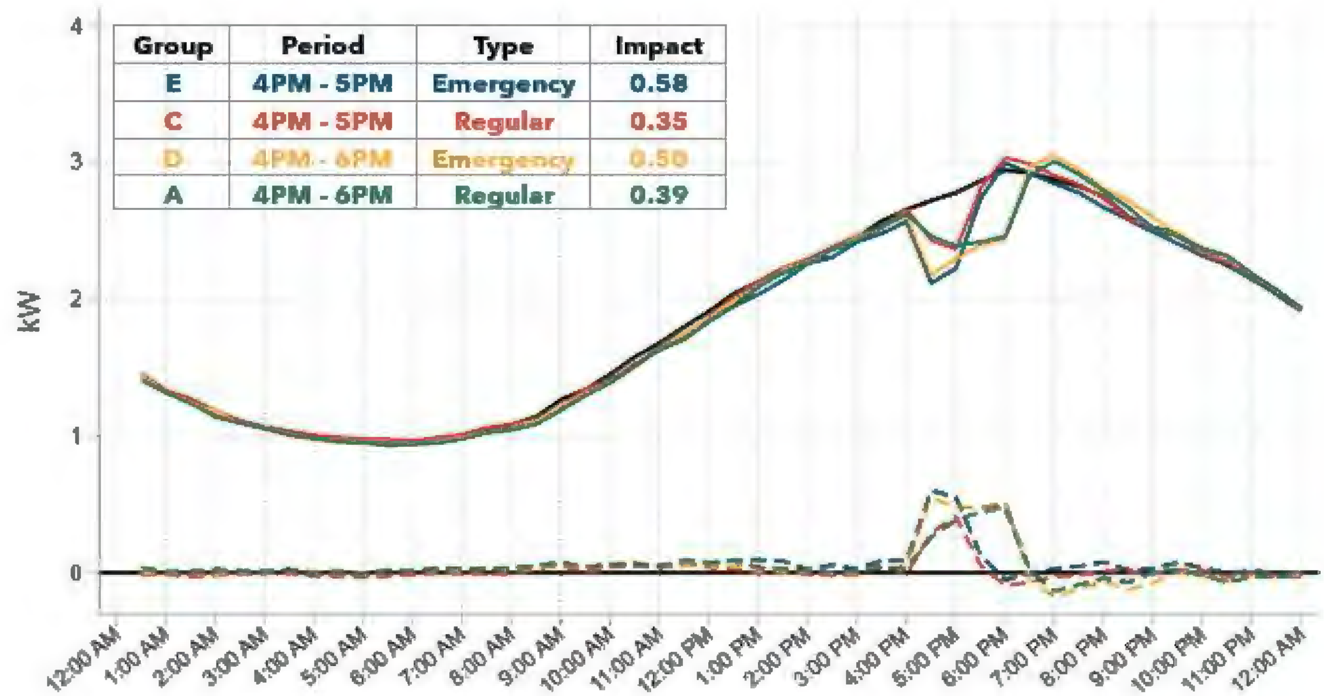


Figure 4-5: Per Household Event Performance, August 17

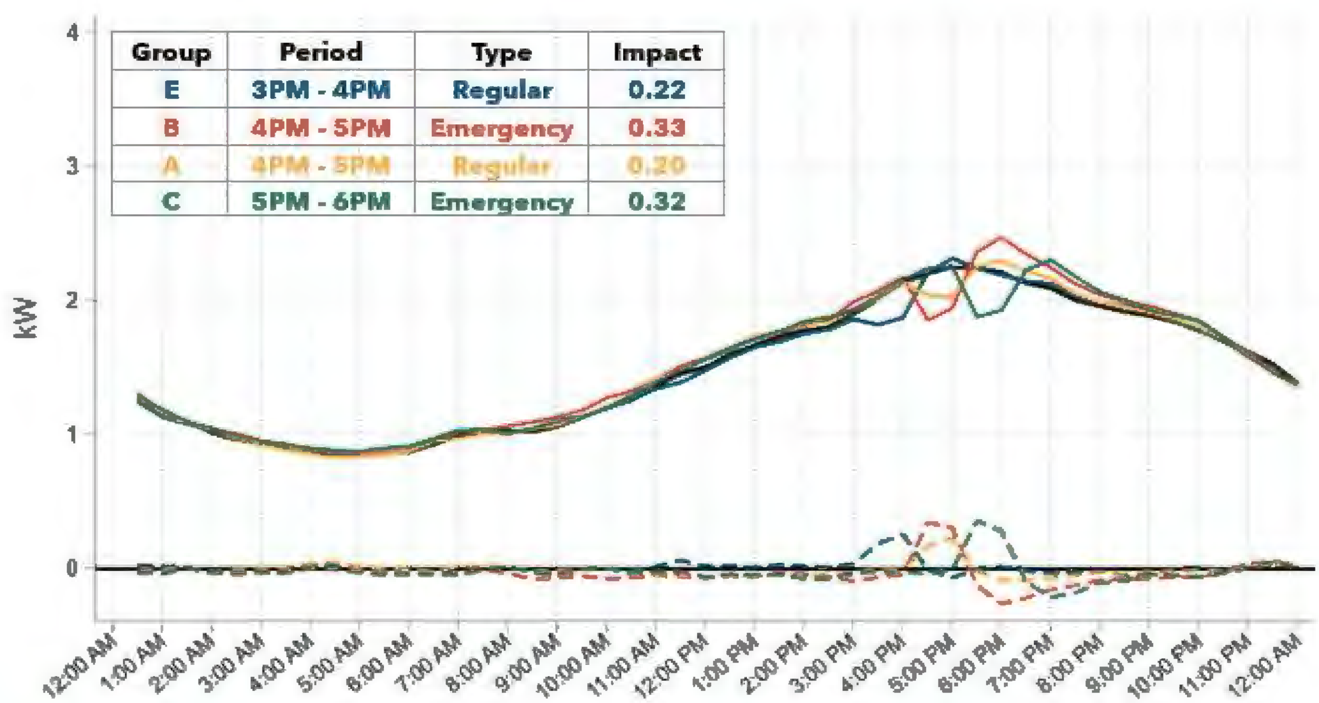


Figure 4-6: Per Household Event Performance, August 23

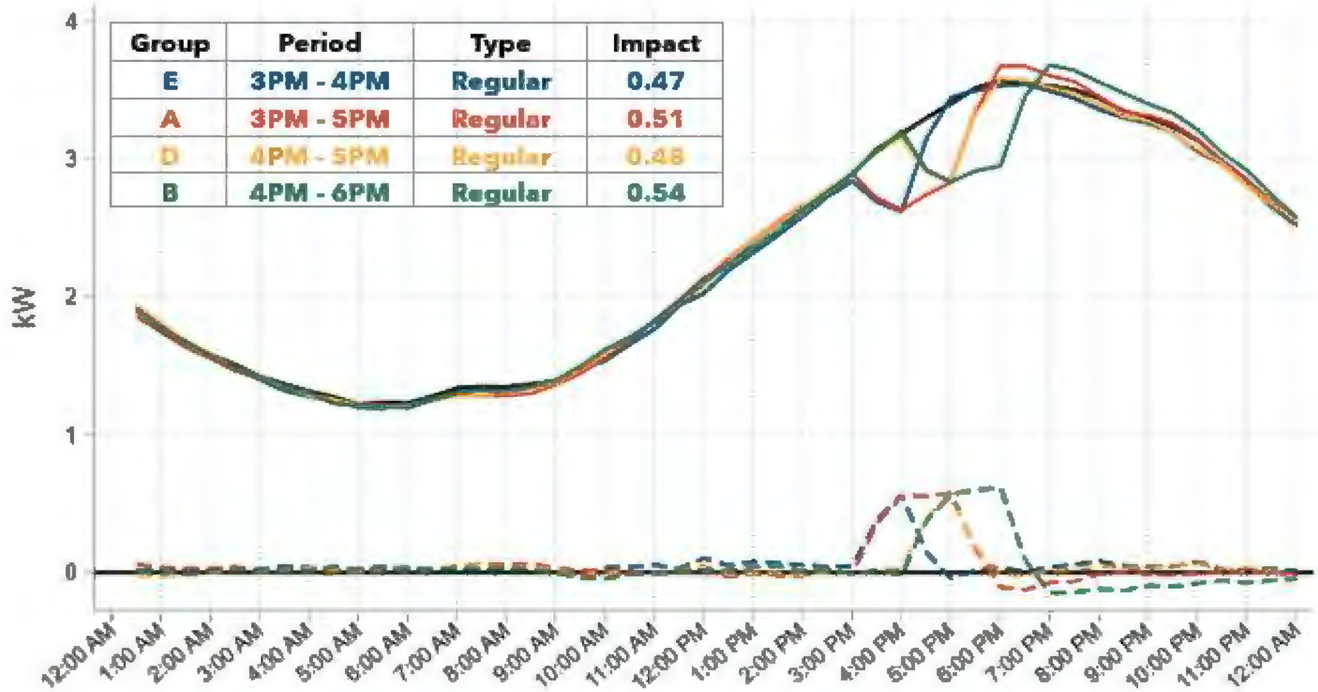


Figure 4-7: Per Household Event Performance, August 24

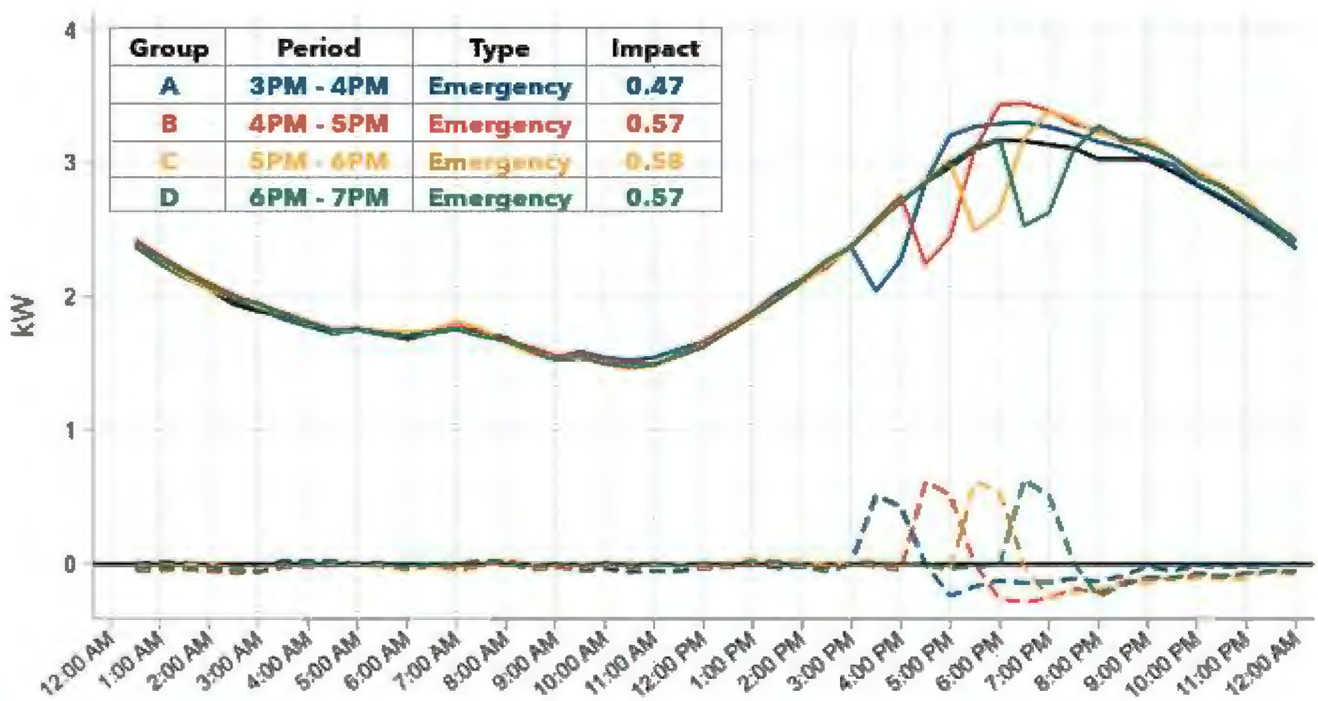


Figure 4-8: Per Household Event Performance, September 5

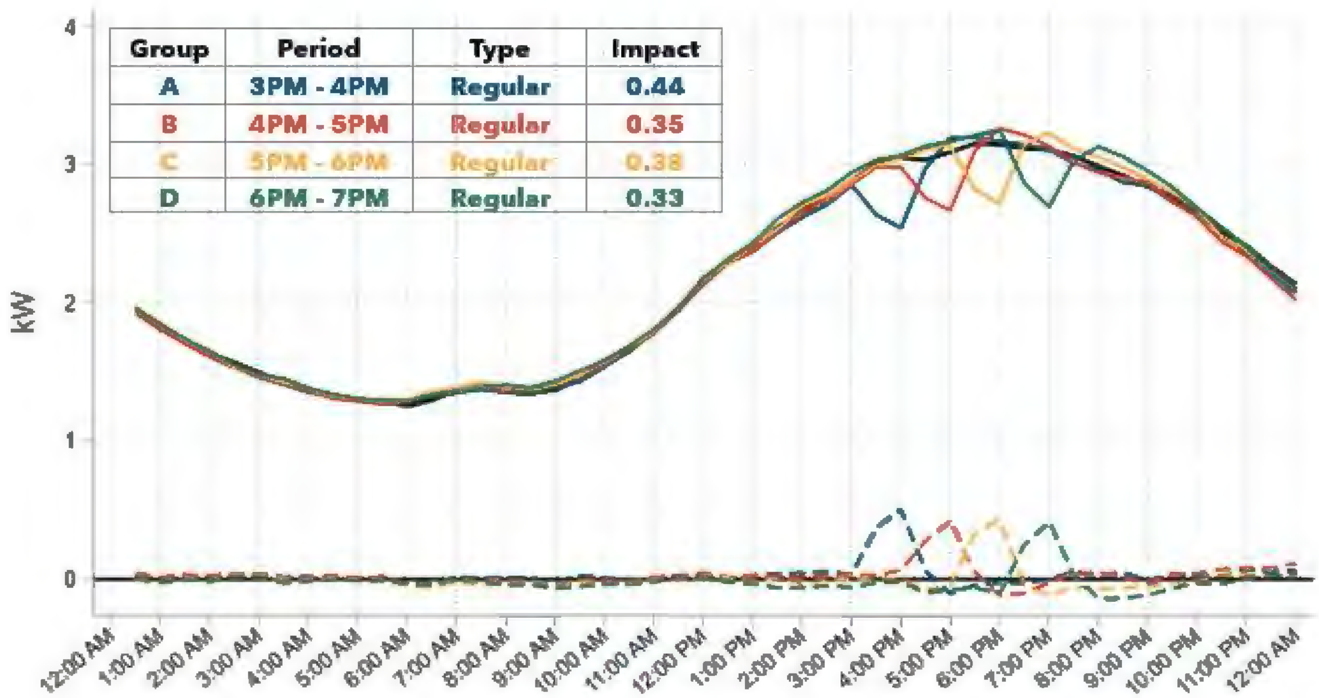


Figure 4-9: Per Household Event Performance, October 3

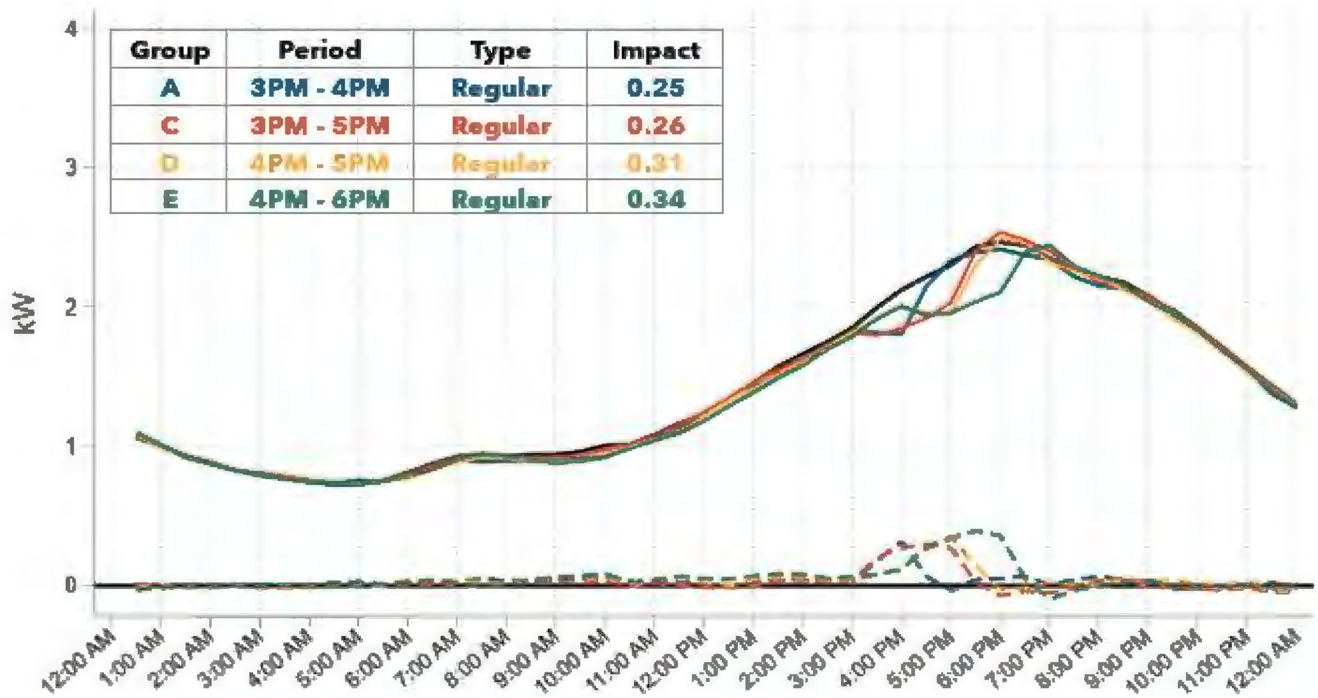
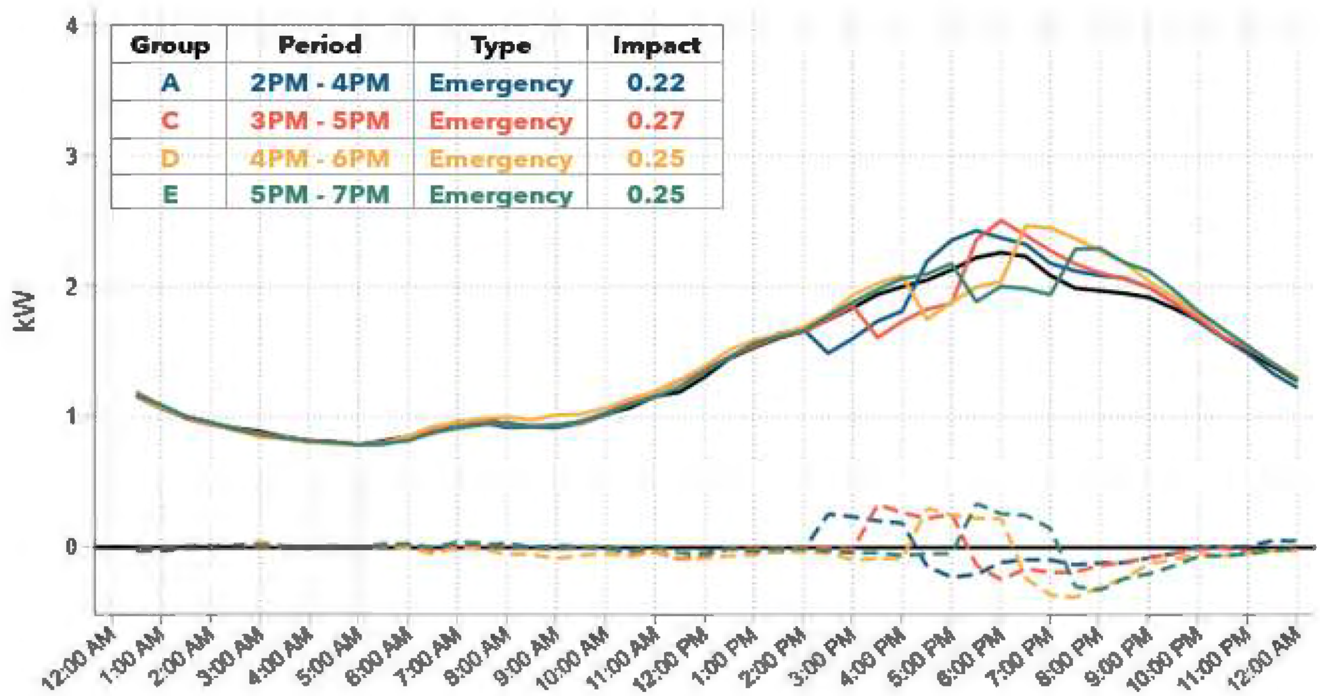


Figure 4-10: Per Household Event Performance, October 4

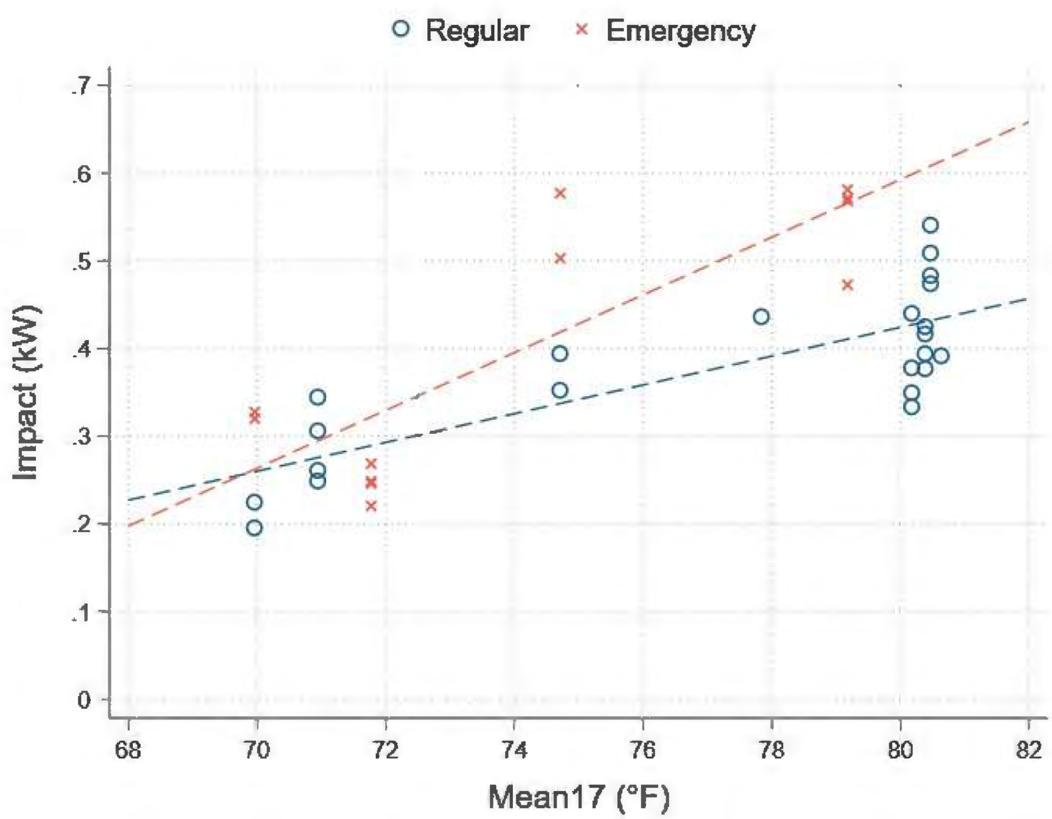


Group	Period	Type	Impact
A	2PM - 4PM	Emergency	0.22
C	3PM - 5PM	Emergency	0.27
D	4PM - 6PM	Emergency	0.25
E	5PM - 7PM	Emergency	0.25

4.2 Weather Sensitivity

The amount of load reduction during events is dependent on weather conditions. The figure below shows estimated per customer impacts for each event as a function of mean17 temperature. Mean17 is defined as the average temperature observed between 12:00 AM midnight and 5:00 PM on a given day (average across hours ending 1 through 17). The mean17 value captures the heat build-up throughout the day and is highly correlated with load impact magnitude. There is a distinct relationship between higher temperatures and load reduction, with higher impacts on hotter days.

Figure 4-11: Weather Sensitivity of Event Impacts



The key finding is simple: demand reductions grow larger in magnitude when temperatures are hotter, and resources are needed most. Because peak loads are driven by central air conditioner use, the magnitude of air conditioner loads available for curtailment grows in parallel with the need for resources. Not only are air conditioner loads higher, but the program performs at its best when it is hotter

4.3 Device Operability

Through the course of the 2023 evaluation, Resource Innovations observed patterns of certain customer groups not responding to event signals. In response to this finding, the evaluation team undertook more rigorous investigation of the data to attempt to determine the underlying source of the observed patterns.

- **Device Operability** - Resource Innovations sought to determine whether the observed patterns were limited to certain events or prevalent across all events. RI used two different approaches to determine if devices were responding incorrectly to events. The first method was an analysis comparing the average load during the event to the average load immediately prior to the event. This was done by calculating average kW across the event intervals and the average kW during the 1-hour period before the event window, then flagging accounts whose event loads are greater than pre-event loads. The second approach consisted of examining the relative change in load from the prior interval. For this analysis, RI flagged all accounts that did not show load reductions at the event start. The results of these analyses showed that a substantial number of devices appeared to be responding in the hour or half hour interval before the true event time and that a large portion of devices were showing no response when they should have been dispatched. Further investigation into the potential "early curtailment" accounts indicate this phenomenon is naturally occurring and might be attributable to a certain portion of customers manually adjusting their thermostats. Notably, while the pattern of "early curtailment" was observed for a portion of customers on each event day, it was always for a different set of customers and was also observable in load patterns on non-event days. There were, however, approximately one-thousand accounts, around eight percent of the population, that showed no load response during the events, which is likely due to either device or paging system related issues.

- **Enrollment Option** - RI calculated average event day loads by response bin and enrollment option. The goal was to see if medium or high option customers saw load drops 30 minutes early, 60 minutes early or no load drops at all, and if there were load drop patterns associated with each option. The analysis found that customer enrollment option does not influence event response.
- **Year of Device Installation** - Next, Resource Innovations sought to determine whether the issue was related to the age of load control devices. This involved examining the event response times by year of device installation. This analysis found that the age of the device had no influence on event response.
- **Geography** - Finally, RI examined the geographical makeup of the groups of accounts that were found to be missing expected curtailment. The goal was to attempt to discern whether any particular region(s) within the DEK territory were disproportionately represented in the groups of customers that did not show load curtailment when they should, which would indicate event signal reliability issues in and around those particular areas. RI found that a high numbers of inoperable devices and large percents of inoperable devices are found all across the DEK territory, and that these findings exist across all groups and events.

Resource Innovations has coordinated with Duke Energy regarding the investigations and provided support when possible. As of the writing of this report, Duke Energy has taken the lead on further investigations including examination of device failures in the field and over-the-air programming and device reception of event signals. These investigations are currently ongoing. Based on the findings in this evaluation and the ongoing investigations, it appears that operational issues have likely reduced the capabilities of program. That said, it is also possible that other factors such as recent installation of more efficient air conditioning units and/or increased adoption of smart thermostats, which may involve built-in timed controls, are contributing to load patterns inconsistent with event expectations.

4.4 Key Findings

- Event impacts ranged from 0.20 kW to 0.58 kW for RCT events from a relatively cool season with a maximum event period temperature of 92°.
- Impacts under emergency conditions were, on average, only slightly larger than those under normal conditions, averaging 0.41 kW per household compared to 0.39 kW per household under normal conditions.
- Many of the emergency dispatches were at cooler temperatures than the normal dispatches, which partially obscures the true difference in performance between the two options. Weather normalized impacts will be presented in the Demand Reduction Capability section.
- The magnitude of baseloads and impacts tend to increase with temperature.

5 Within-Subjects Results

In addition to the events described in the previous section, two events were called in 2023 that could not be estimated using RCT approach because they were called for the full program population and did not withhold a control group. Load impacts for these events were estimated using the within-subjects approach described in Section 3.2.2.

5.1 Event Impacts

For each of the two events that were called for the full population, a different set of proxy days was selected and used to generate the baseline loads. Baselines were found that closely resembled the load patterns of the treatment groups during the pre-event hours, and accurately simulated the event period loads absent curtailment.

The load impact estimates resulting from the within-subjects analysis for the 2023 events are presented in Table 5-1.

Table 5-1: 2023 Within-Subjects Event Impacts

Date	Group	Start Time	Duration	Type	Ref. Load	Impact (kW)	% Impact	Snapback (kW)	Event Period Temp.
6/29/2023	ALL	2:00 PM	2 hours	Emergency	2.14	0.31	14.6%	-0.21	83.3
7/14/2023	ALL	4:00 PM	1 hour	Regular	2.99	0.59	19.6%	-0.09	87.5

Event day loads and impacts for the two within-subjects events are shown graphically in Figure 5-1 and Figure 5-2 below.

Figure 5-1: Within-Subjects Event Performance, June 29

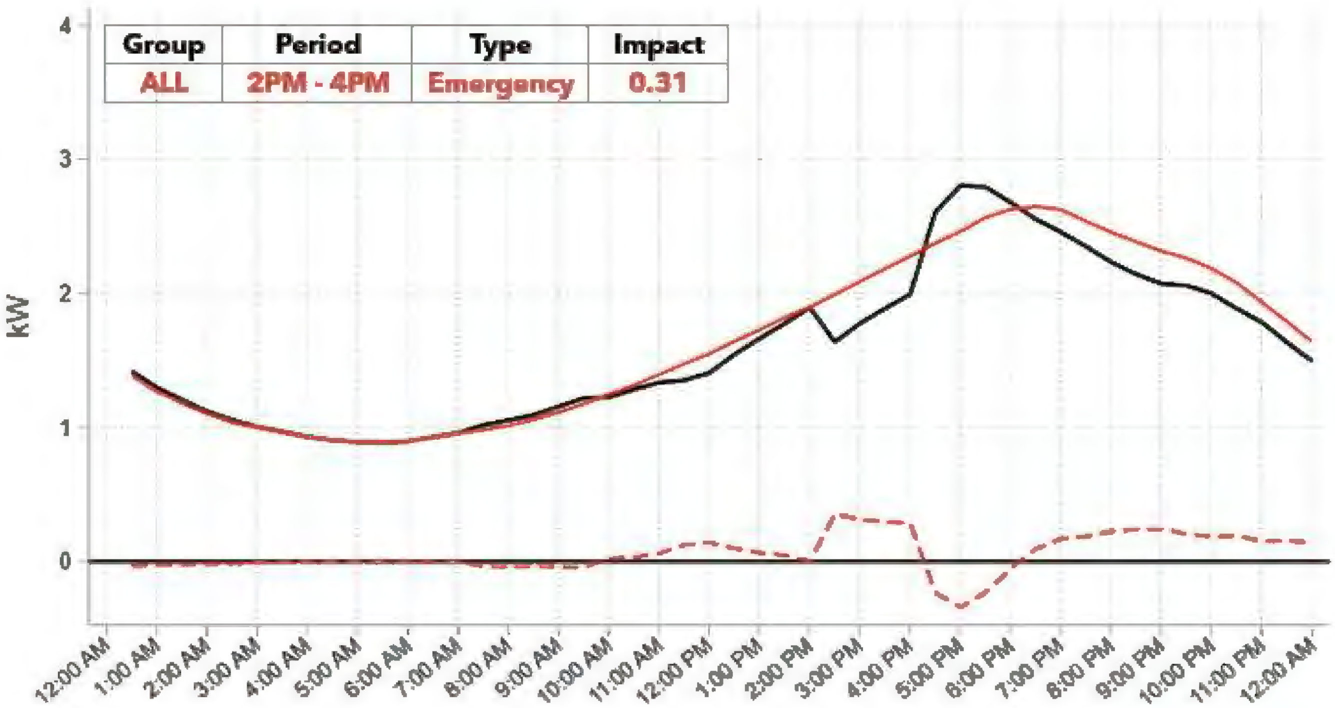
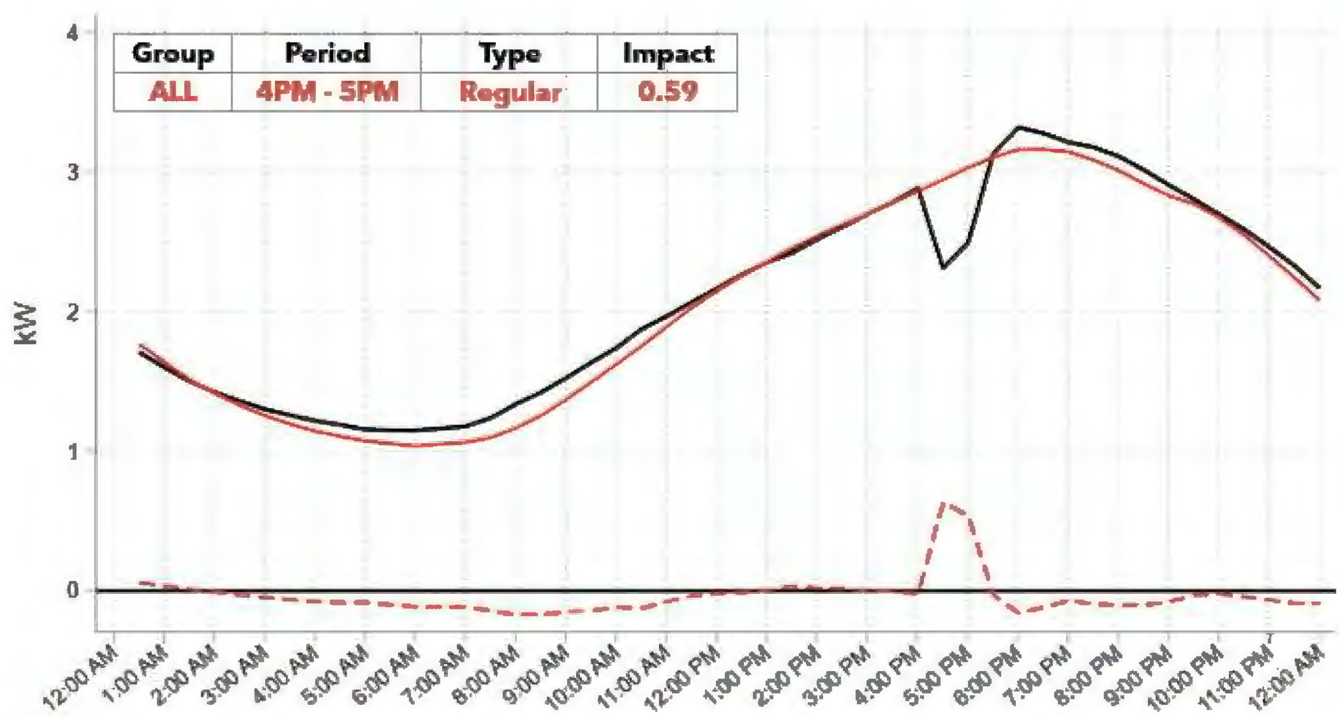


Figure 5-2: Within Subjects Event Performance, July 14



5.2 Key Findings

- Models developed via out-of-sample testing were used to produce baseline loads against which event loads were compared.
- Per customer event impacts for the two within-subjects events were 0.31 kW and 0.59 kW, respectively.

6 Demand Reduction Capability

One of the primary objectives of the Summer 2023 impact evaluation was to estimate Power Manager's load reduction capability under emergency conditions. This was accomplished by developing a user-driven tool that applies observed relationships between load impacts, temperature, hour-of-day, and event dispatch option(s). The end product, referred to as the Time-Temperature Matrix, allows users to predict the program's load reduction capability under a wide range of user-input event conditions.

The Summer DLC Time-Temperature Matrix allows Duke Energy users to predict the per household and program-level load impacts that would be expected under a wide array of input combinations. The tool allows users to select six primary inputs:

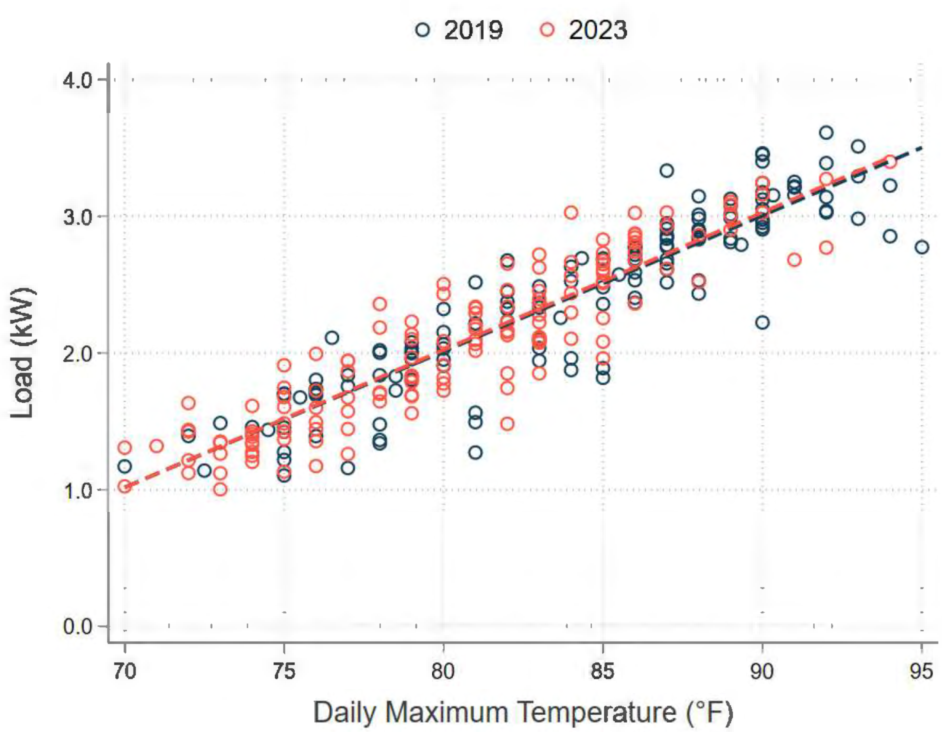
- **Control strategy** defines the cycling level used during the event window. Options include Normal Shed and Emergency Shed cycling.
- **Start time** defines specific time of day the event period is set to begin. Options include all 30-minute increments from 12:00 PM to 6:00 PM.
- **Duration** defines the length of the event, in hours. Options include 30-minute increments from 30-minutes to 4 hours.
- **Month** defines the calendar month of the event date. Options include months from May through September.
- **Day type** defines weekend vs. weekday event.
- **Daily maximum temperature** sets the maximum temperature observed during the day of the event. Options range from 76°F to 100°F in single degree increments.

These six user input options are enabled in the tool because adjustments made to any one of them may influence the magnitude of reference loads and/or event load impacts. For example, events called in July and August are typically called at hotter temperatures and therefore involve larger reference loads and impacts compared to events called in May or September when temperatures are cooler.

In an ideal program year, Duke Energy would have opportunities to dispatch a large number of DLC events under a variety of weather conditions, dispatch windows, and cycling strategies. In reality, opportunities for events can be sporadic and based on uncertain weather predictions. In these cases, the consequence is a more limited dataset of actual events with which to inform the tool's predictions. To help mitigate the potential for obstacles stemming from limited event data, Resource Innovations combined two summers (2019 and 2023) of impact evaluation results and used this joint dataset to inform the 2023 Summer DLC Time-Temperature Matrix. Incorporating the 2019 Summer DLC impact evaluation's event data allowed 11 additional event dispatches to be used in the regression modeling and resulted in improved predictive power of the tool.

The decision to include 2019 evaluation results in current year predictions was carefully considered. In particular, the four-year gap between evaluations raises concerns over potential "hidden" differences in the program that may have occurred gradually over time, such as changes in the program's population, switch degradation, the impacts of the COVID pandemic, etc. To mitigate these concerns, the first step was to ensure that customers' daily loads (kW) were similar in 2023 to the customer loads observed in 2019. Figure 6-1 compares average per customer loads at 4:00 PM in 2019 and 2023. The close alignment of the two years suggests that the magnitude of Power Manager customers' daily peak loads, and their responsiveness to changes in temperature, are consistent.

Figure 6-1: Household Loads at 4:00 PM, 2019 vs. 2023



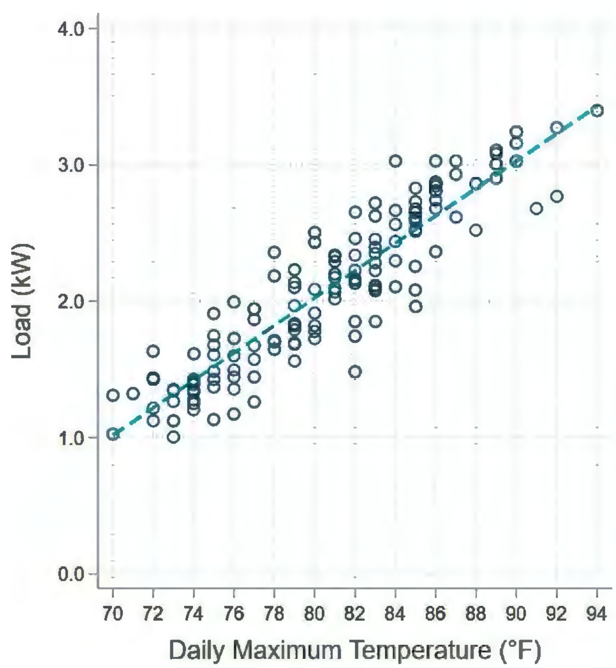
In addition, no material changes to program operations, enrollment/eligibility, event dispatch strategies, and/or evaluation methodologies have taken place since the 2019 evaluation season.

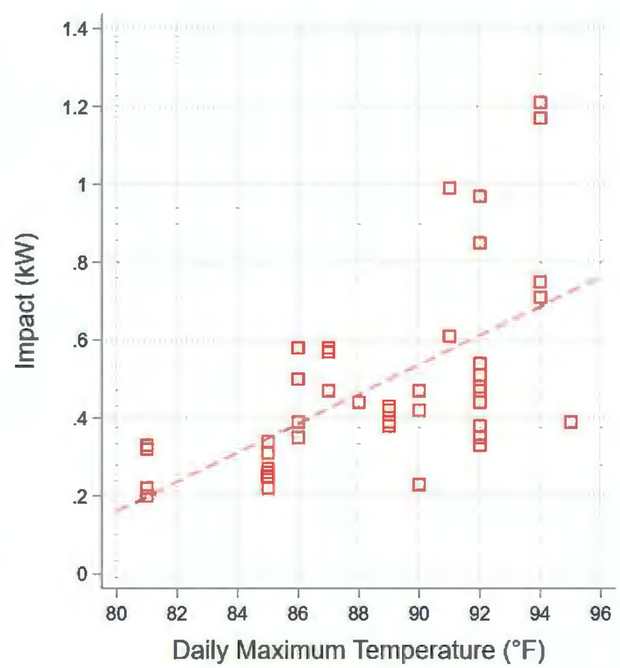
Including 2019 events in the impact estimation also provides specific advantages. First, it enlarges the pool of empirical data used to inform the model predictions, improving the predictive power of the tool and delivering more precise estimates. Second, it provides impact observations for events called under more extreme conditions. Event day temperatures were notably warmer in 2019 compared to 2023; the addition of 2019 events expands the range of temperature scenarios that are within sample when modeling. Weighing the known advantages against the potential disadvantages in collaboration with Duke Energy, the evaluation team ultimately opted to include 2019 events in developing the 2023 Time-Temperature Matrix forecasting tool.

6.1 Methodology

The methodology used to develop the DLC Time-Temperature Matrix is rooted in the weather sensitivity trends of reference loads and load impacts. The underlying premise is that households require more electric load to cool their homes during peak periods as temperatures rise. Because more cooling load is available for curtailment, Power Manager's event impacts also increase with temperatures. The implication is that larger reductions are attainable from larger loads when temperatures are highest.

Figure 6-2: Weather Sensitivity of Customer Load and Event Impacts

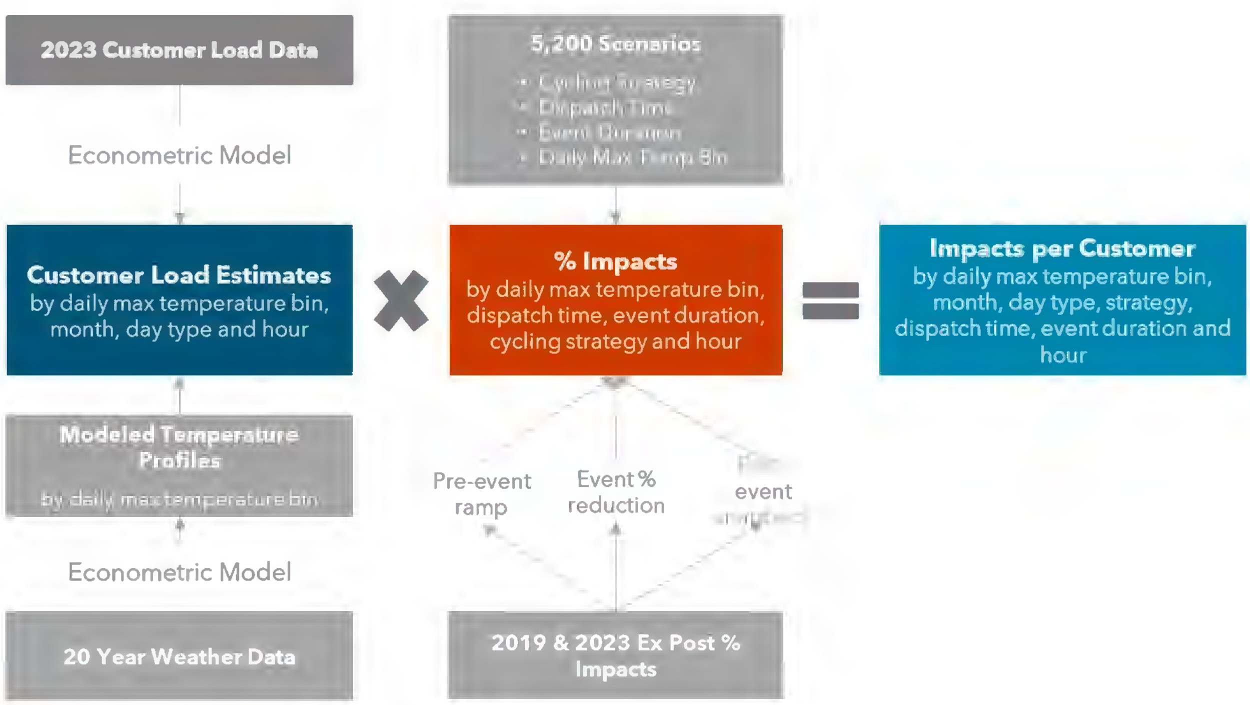




Using these weather relationships as a guiding principle, the process for constructing the Time-Temperature Matrix forecasting tool involved the following steps:

- Using 20 years of historical weather data for the DEK region, "typical" daily temperature profiles were modeled for single-degree daily maximum temperature bins, ranging from 76°F to 100°F.
- Estimates of daily reference loads were modeled for each temperature bin using customers' AMI data from the Summer 2023 event season. Load (kW) values were estimated for each 30-minute interval of the day by applying the relationship observed in 2023 between customer load and temperature to the modeled temperature profiles for each bin, the month, and the day type (weekday or weekend).
- Percent load reductions were estimated using distinct econometric models for each phase of the event horizon. The models were based on the percent impacts and temperatures experienced on the 2019 and 2023 event days. Estimates were modeled separately for each shed level (normal shed vs. emergency shed).
- A total of 5,200 scenarios were developed to reflect all possible combinations of parameters that define the event scenario. These parameters include: shed level, event start time, event duration, and daily maximum temperature.
- Estimates of per customer load (kW) impacts were produced by combining the estimated reference loads, estimated percent reductions, and the array of event scenarios.
- The resulting dataset includes per household reference loads and event period load impacts in 30-minute intervals for the vast range of hypothetical event scenarios. After a series of quality control checks, this dataset is exported to Microsoft Excel and serves as the basis for the forecasts shown by the Time-Temperature Matrix.

Figure 6-3: DLC Time-Temperature Matrix Tool Flow Diagram



6.2 Demand Reduction for Emergency Conditions

While Power Manager is normally dispatched for economic or research purposes, its primary function is to deliver grid relief during extreme conditions, when demand is high and capacity is constrained. Extreme temperature conditions can trigger emergency operations by Duke Energy, which are designated to deliver larger demand reductions than normal event cycling. During emergency conditions, all program devices are instructed to instantaneously shed loads by curtailing participating homes' cooling systems for the full duration of the event period. While emergency operations are rare and ideally avoided, they represent the full demand reduction capability of Power Manager.

Duke Energy Kentucky uses a 1-hour emergency event starting at 4:00 PM and with a daily maximum temperature of 98°F to define emergency conditions. Under these conditions, individual customers are expected to deliver 1.33 kW of demand reduction over a one-hour event window. Because there are approximately 45,000 customers enrolled in Power Manager, the expected aggregate reduction is approximately 60 MW. The predicted event response under these emergency conditions is shown in the figure below. Specific event inputs (shown in blue boxes) and event outputs (shown in orange boxes) are set to represent Duke Energy's extreme event scenario. The line graph shows the predicted reference load (blue line), treatment load (orange line), and impact (yellow line), as well as a secondary, right-hand y-axis for the day's estimated temperature profile (dashed green line).

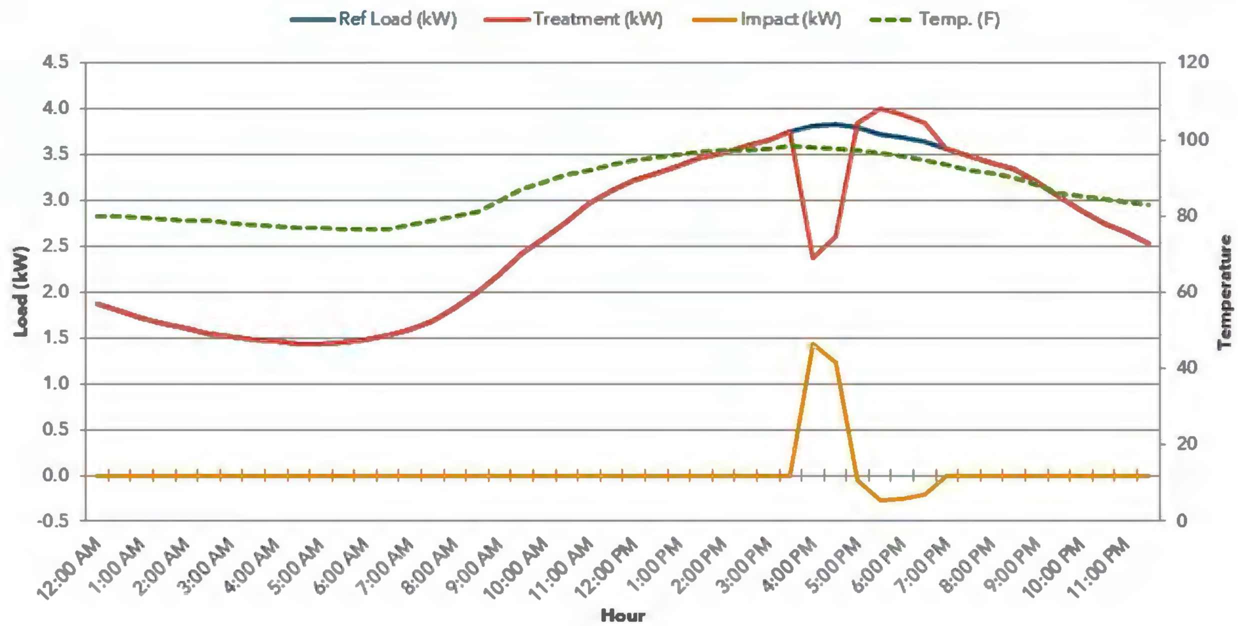
Figure 6-4: Emergency Demand Reduction Capability of DLC Event

GLOBAL INPUTS	
Daily Maximum Temperature	98
Month	July
Day Type	Weekday
Aggregate (MW) | Per-Customer (kW)	Per-customer

SUMMARY OUTPUT OPTIONS	
Event Start	4:00 PM
Event Duration (hours)	1
Event End	5:00 PM
Maximum Temp (F)	98.2

PROGRAM SPECIFIC INPUTS	Power Manager
Event Start	4:00 PM
Event Duration (Hours)	1
Event End	5:00 PM
Number of Customers	45,000
Setback Strategy	Emergency Shed

SUMMARY EVENT WINDOW AVERAGE	
Ref Load (kW)	3.83
Treatment (kW)	2.50
Impact (kW)	1.33
% Impact	34.8%
Snapback (kW)	-0.20



6.3 Key Findings

- Reference loads and impacts are correlated to temperature. Larger impacts are achievable with greater loads when temperatures are hottest.
- Under emergency conditions, Power Manager's Summer DLC program can deliver 1.33 kW of demand reduction per household (1.28 kW per device). Using the population of the program as of Summer 2023 that equates to approximately 60 MW of peak load relief.

7 Process Evaluation

Process evaluation, particularly when combined with the insight obtained from impact evaluation, informs efforts to continuously improve programs by identifying program strengths and weaknesses, opportunities to improve program operations, program adjustments likely to increase overall effectiveness, and sources of satisfaction or dissatisfaction among participating customers. The primary objectives for the process evaluation component of the evaluation include:

- Assess the extent to which particpants are aware of events, bill credits, and other key program features
- Understand the participant experience during events, including comfort, occupancy, and strategies employed to mitigate heat
- Identify motivations and potential barriers for participation, including expectations, sources of confusion or concern, intention to stay enrolled, and likelihood of recommending the program to others
- Document the operations, recruitment, enrollment, outreach, notification, and curtailment activities associated with program delivery
- Identify program strengths and potential areas for improvement

Section 7.1 describes the survey disposition and post-event and non-event days. Section 7.2 details the results and findings of the surveys. Findings from the in-depth interviews are contained in Section 7.3 and Section 7.4 summarizes the key findings from the process evaluation.

7.1 Survey Disposition

To evaluate the extent to which Power Manager events have an effect on program participants, a survey was sent to random samples of the DEK participant population. Two different samples of Power Manager participants received invitations for the survey – customers that did experience an event just prior to the survey launch and customers that did not. The survey results from the respondents that experienced the event are called post-event survey results; the survey results from the respondents that did not experience the event are called non-event survey results. Table 7-1 presents a summary of temperature, survey completions, and other information specific to the survey day.

The survey was completed by 223 customers asking about the July 27, 2023 event; the survey was launched in the evening hours after the load control event concluded, at 7 PM. The average event-period temperature was moderately hot: 88 °F.

Table 7-1: Participant Survey Summary

Jurisdiction & Technology	Event Type	Survey Type	Date	Completes	Survey Start Time	Event Temp. (°F)
DEK DLC	60 minutes, Regular cycling	Post-event	7/27/2023	112	7/27/2023 7 PM EDT	88
DEK DLC	None	Non-event	7/27/2023	111	7/27/2023 7 PM EDT	88

Table 7-2 presents the response rates for the survey, representing total response rates rather than valid response rates that take into account survey invitations to email addresses that are not deliverable. Post-completion incentives were used to ensure that sufficient completions were received in a relatively short period of time while respondent recall of thermal comfort and actions taken during events is highest. Both the post-event and non-event survey groups achieved a 12% response rate.

Table 7-2: Survey Response Rates

Jurisdiction & Technology	Event Type	Post-event	Non-event
DEK DLC	60 minutes, Regular cycling	12%	12%

7.2 Survey Results

7.2.1 Participant Background

Aside from occasional program communications to participants, the primary way that Duke Energy customers experience the Power Manager program is during load control events. Nearly all survey respondents, 93%, stated that there is normally someone home between the hours of 1:00 PM and 7:00 PM on weekdays. Similarly, large proportions of respondents also reported that they are frequent users of their air conditioning systems. Table 7-3 shows the percentage of respondents that reported they use their air conditioners every day for four different time period and day type combinations. Between 82% and 91% of DEK Power Manager survey respondents reported using their air conditioners every day during weekday afternoon and evenings. During the weekend, the proportions of customers that use their air conditioners everyday increases; between 92% and 95% of customers stated that they run their units during both weekend afternoons and evenings. Statistically significant differences in response patterns between post-event and non-event respondents were not observed.

The survey responses indicate that Power Manager participants are largely at home and using their air conditioners during the times that the program is likely to be launched as a resource, which is a positive indication for the potential of the program to deliver meaningful demand response for Duke Energy. Additionally, high air conditioning usage among participants means that monitoring participant comfort levels is an important evaluation activity so that thermal comfort can be maintained at high enough levels to retain customer participation.

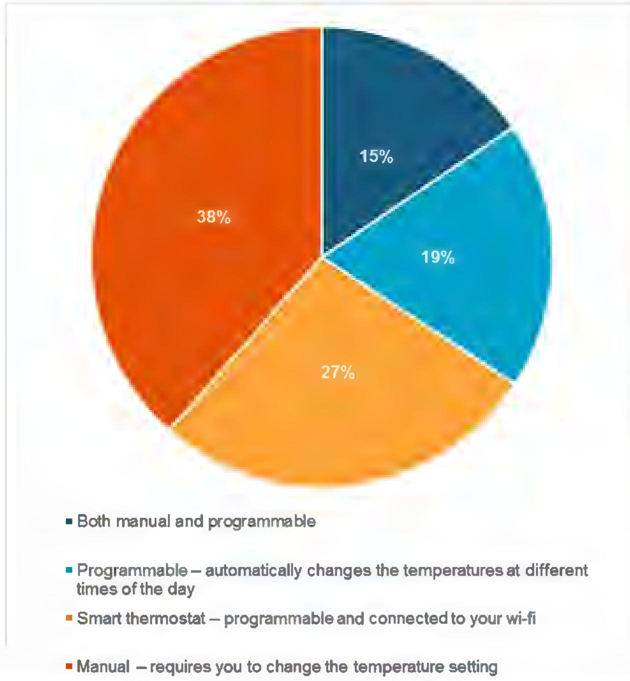
Table 7-3: Air Conditioning Usage: Percent of Respondents Reporting Air Conditioning Usage "Every Day"

Day and Time	% of Post-event Respondents (n = 107)	% of Non-event Respondents (n = 106)
Weekday afternoons 1 PM - 7PM	86%	91%
Weekend afternoons 1 PM - 7 PM	95%	95%
Weekday evenings 7 PM - Midnight	82%	85%
Weekend evenings 7 PM - Midnight	92%	92%

In addition to occupancy patterns and frequency of air conditioning usage, Power Manager participants' experience with the program is affected by how they operate their air conditioning systems. Survey responses show that there is a mix of both manual and programmable thermostats installed in the homes of Power Manager participants.

Figure 7-1 summarizes the types of thermostat(s) that survey respondents reported are in their homes. The majority of respondents have a manual thermostat in the home, either as the only thermostat or as one of multiple thermostats: 54% of respondents at least one manual thermostat.

Figure 7-1: Type(s) of Thermostat in the Home



Survey respondents largely report that they have one air conditioner of any kind (82% of respondents) and that they have one thermostat (90% of respondents).

Our survey also collected information on Power Manager participants' customary manner of air conditioning usage; respondents were asked which of several statements best describes how they use their air conditioning. The most commonly-reported practice is keeping thermostats set at a constant temperature – 52% of respondents indicate this air conditioning usage practice. The next most common response is manually setting the temperature at different times of day, such as when leaving the home or going to bed: 24% of respondents report using this approach. No statistically significant (90% level of confidence) differences in response patterns between post-event and non-event respondents were observed. Table 7-4 presents a summary of all responses to this survey question.

Table 7-4: Air Conditioning Usage Practices

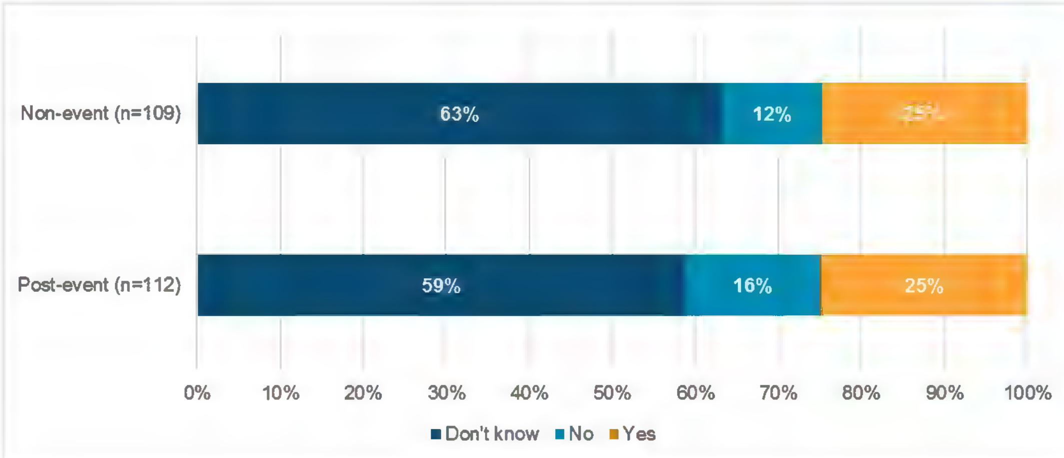
Jurisdiction & Technology	Never use it	Manually turn the AC on and off when needed	Allow the program to automatically change the temperature at different times	Manually adjust the temperature setting at different times such as when you leave your home or go to bed at night	Keep it set at a constant temperature, so it runs whenever the temperature goes above it	Total
DEK DLC	0%	6%	18%	24%	52%	100%

7.2.2 Program and Event Awareness

Survey respondents were asked if they were aware of the Power Manager program. Of all participants surveyed, 70% of participants responded that they are familiar with Power Manager. Respondents from the non-event survey group were more likely to report familiarity with the program (76% of non-event survey group respondents state that they are familiar with Power Manager vs. 63% of post-event survey group respondents), but it is the only significant (at the 90% level of confidence) difference pertaining to baseline behaviors or attitudes between the two groups).

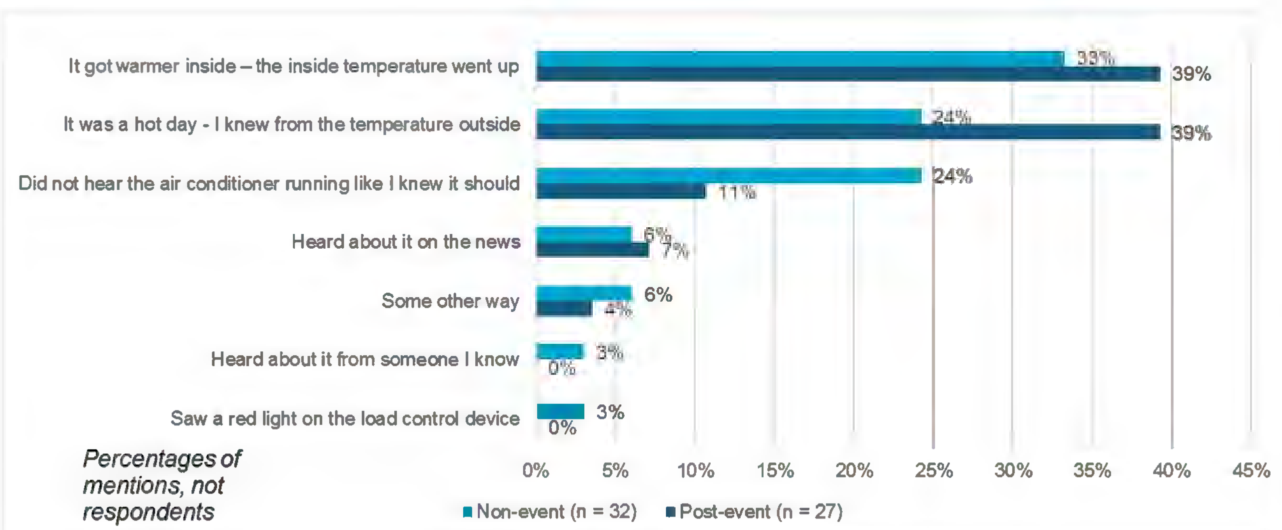
Both post-event and non-event respondents were asked if they believed a Power Manager event occurred in the past few days prior to being surveyed. Majorities of DLC respondents answered that they didn't know whether an event had recently occurred: 59% of the post-event and 63% of the non-event survey respondents, respectively, state they they don't know if they were recently subject to a Power Manager event. **Error! Reference source not found.**Figure 7-2 shows the full response pattern, broken out by post-event and non-event survey respondents. Of the respondents who answered either yes or no to the question of whether the believe a Power Manager event had recently been launched, post-event survey respondents were no more likely (at the 90% level of confidence) to believe there was recently a Power Manager event than non-event customers do, evidence that participants are generally not aware of actual Power Manager events when they occur.

Figure 7-2: Respondent Belief that a Power Manager Event Had Recently Occurred



Respondents who perceived a Power Manager event were asked how they determined an event was occurring. The most common reasons that respondents gave for their belief that an event recently occurred is that it was warmer than usual inside or hotter than usual outside. The third most common reason was not hearing the air conditioner running as expected. A summary of survey responses on event perception rationale is presented in Figure 7-3.

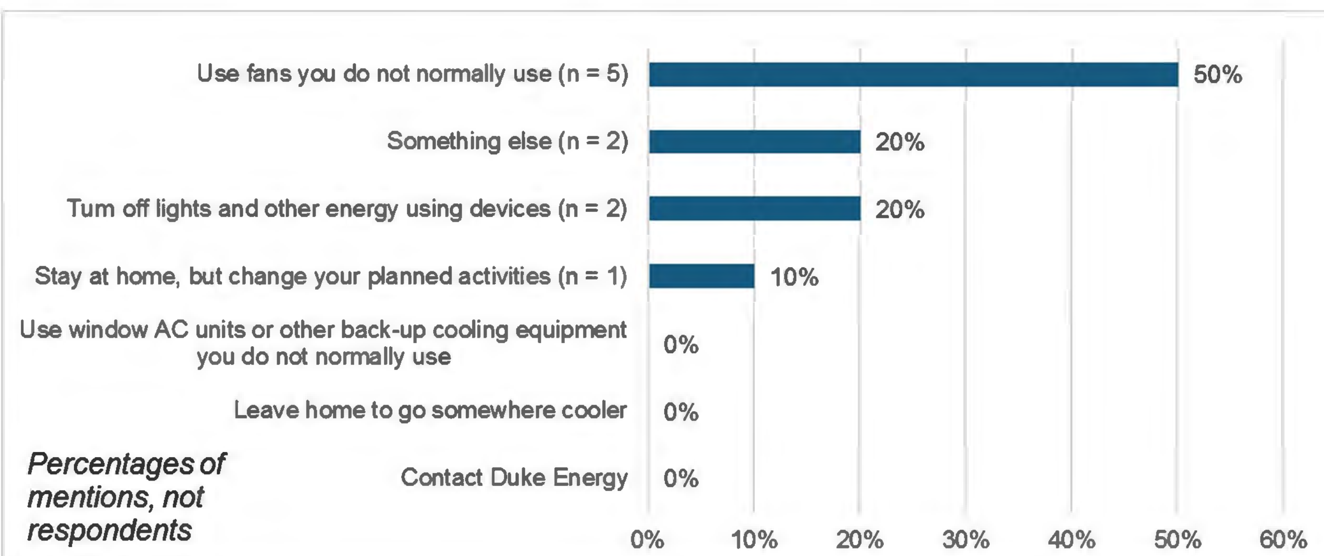
Figure 7-3: Reasons for Believing a Power Manager Event had been Called



Respondents who believed that an event occurred were also asked which day they believed the event happened, relative to the day they were surveyed. This question was asked to assess the accuracy of respondents' event awareness. About half (41%) of the post-event respondents who believed an event occurred correctly identified the event day, however, the same proportion (42%) of non-event respondents identified the same day as an event day when in fact they did not experience an event that day.

Of the respondents who stated that they believed an event happened, 69% said that they were home during the real or perceived event. Respondents who believed an event had occurred and were home during the perceived event were then asked whether they took any action in response, regardless of if an actual event occurred or not. Only 16% of all respondents said that they took any action(s) because of the event. There are no significant (at the 90% level of confidence) differences in the proportions of respondents who believed an event happened, were home at the time of the perceived event, or who reported taking actions because of the perceived event between post-event and non-event participants. However, note that there were few customers whose prior responses qualified (believed an event happened recently, were home for the event, and state that they took action in response) them to see this question on the survey. Figure 7-4 shows the distribution of responses describing actions customers took in response to a perceived Power Manager event.

Figure 7-4: Actions Taken in Response to Perceived Event



7.2.3 Thermal Comfort

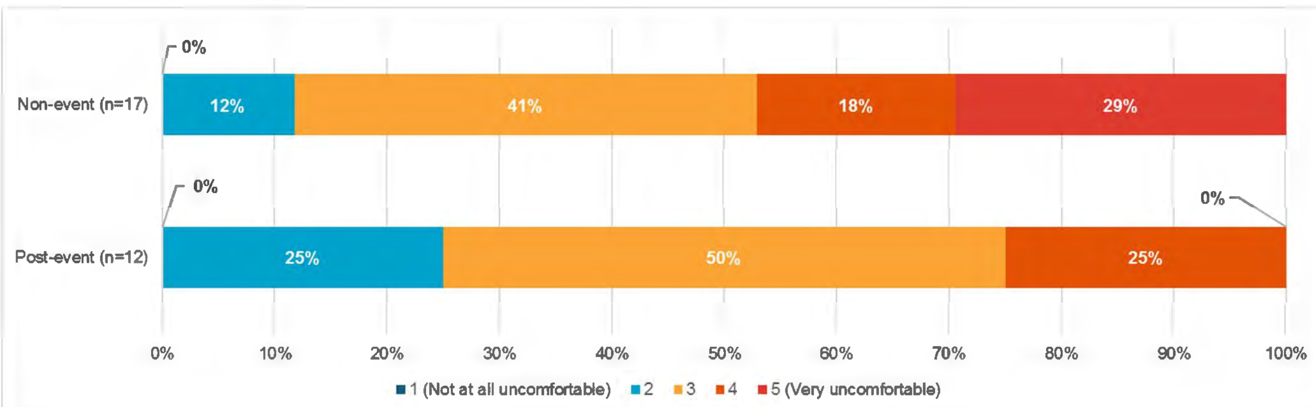
To measure if Power Manager participants experience thermal discomfort during events, post-event and non-event survey respondents were asked several questions about their comfort during the event day. First, respondents were asked if they experienced any thermal discomfort during the event day (which was actually a non-event day for the non-event survey respondents). Less than a quarter of all respondents said they experienced thermal discomfort in their homes at any time during the day in question. Specifically, 12% of the post-event survey respondents reported thermal discomfort and 18% of the non-event survey respondents reported thermal discomfort. The percentage of respondents who reported discomfort did not statistically differ at the 90% level of confidence between non-event and post-event survey respondents. Figure 7-5 shows the percentages of respondents reporting thermal discomfort.

Figure 7-5: Percent of Respondents Reporting Thermal Discomfort

The respondents who reported any discomfort on the day in question were asked when their discomfort started and ended. Respondents in the post-event survey did not differ significantly from those in the non-event survey in the hours during which they reported feeling uncomfortable, indicating that participants' discomfort was not tied to Power Manager event hours.

Customers who responded that they experienced some discomfort on the event (or non-event day) were asked to rate their discomfort on a scale of 1-5. A response of 1 represented "not at all uncomfortable" while a response of 5 represented "very uncomfortable". Figure 7-6 displays the results. The majority of respondents that did report discomfort did not describe their discomfort as severe, with most respondents rating their discomfort as a 2 or 3 – 51% of non-event respondents and 75% of post-event respondents. 29% of non-event respondents chose the highest discomfort rating of 5, and no post-event respondents selected 5 as their discomfort rating. The distributions of discomfort ratings do not significantly differ at the 90% level of confidence. Note that relatively few customers were presented this question in the survey (12 post-event respondents and 17 non-event respondents).

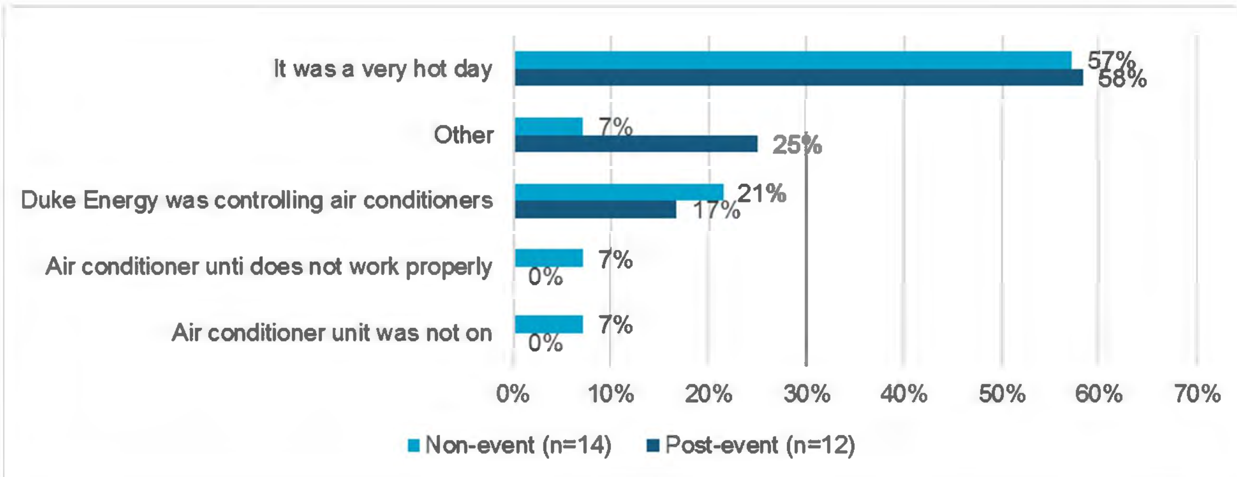
Figure 7-6: Thermal Discomfort Ratings



Respondents who stated they were uncomfortable during the event or non-event day were asked to what they attributed their discomfort. This question was asked before any discussion of Power Manager events, to build an understanding of how customers perceive events without yet having introduced the program into the survey.

Figure 7-7 displays respondents' attributions of their thermal discomfort. Most respondents reasoned that their home was uncomfortably hot due to hot weather: 58% of the post-event respondents and 57% of the non-event respondents gave this response. A few customers provided miscellaneous responses categorized as "other", which included "trying to save energy", "house isn't efficient with keeping air and or heat in", and "too small AC unit". The third most common response was belief that Duke Energy was controlling their air conditioners – 21% of non-event respondents and 17% of post-event respondents gave this response.

Figure 7-7: Thermal Discomfort Explanations

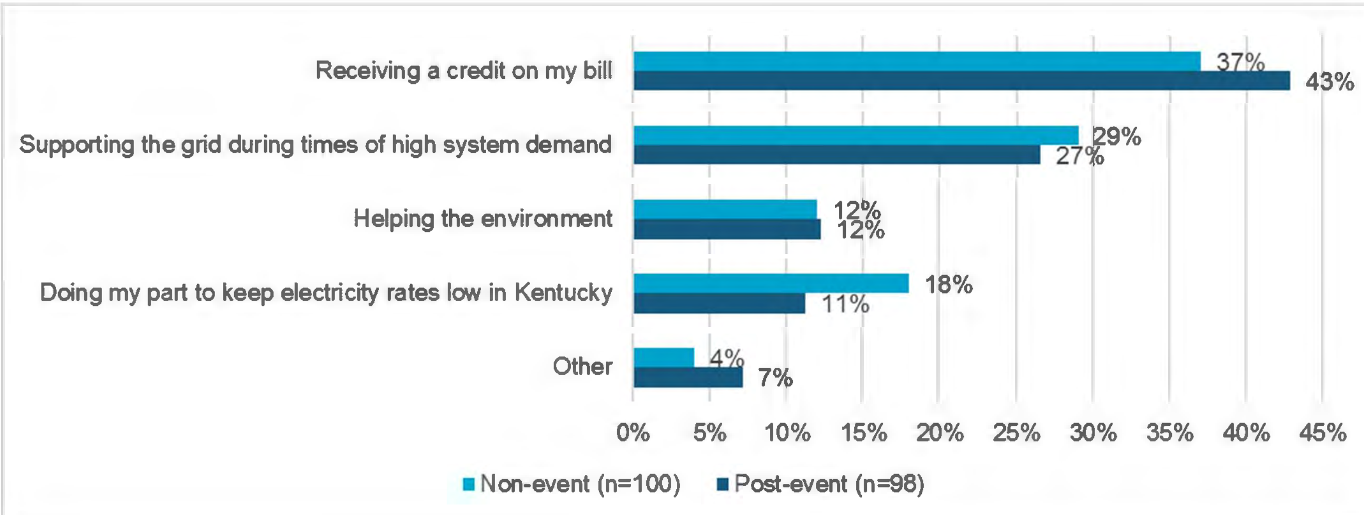


Overall, respondents in the post-event survey group were no more likely to describe their home as uncomfortably hot than respondents in the non-event survey do. Importantly, this indicates that Power Manager load control events do not cause any more thermal discomfort for customers than they would otherwise experience on a hot day. Of the respondents who did state that they felt uncomfortable on an actual event day, the majority attributed their discomfort strictly to hot weather, and not to Power Manager itself. These results reinforce the findings from the questions asking whether respondents believe there was an event called recently that Power Manager participants do not know when events occur and that when events are called, they do not interfere with participants' daily lives.

7.2.4 Motivation, Satisfaction, and Barriers

Participants of the DLC program option in the surveys were asked to choose their primary motivation for enrolling in Power Manager. The most common reason identified, as we have seen in prior evaluations of this program, is "earning a credit on my bill", with 43% of the post-event respondents and 37% of the non-event respondents choosing this reason as their primary motivator. The next most common primary reason for enrolling is "supporting the grid during times of high system demand", with 27% of post-event and 29% of non-event survey group respondents answering thusly. Smaller proportions (4%-12%) of respondents selected from the other response options, "helping the environment", "doing my part to keep electricity rates low in Kentucky", and "other". Those most common "other" response referred to "automatically being enrolled" which likely refers to the move-in-move-out enrollment process detailed later in this section of the report. Figure 7-8 shows the full distribution of responses for both survey groups.

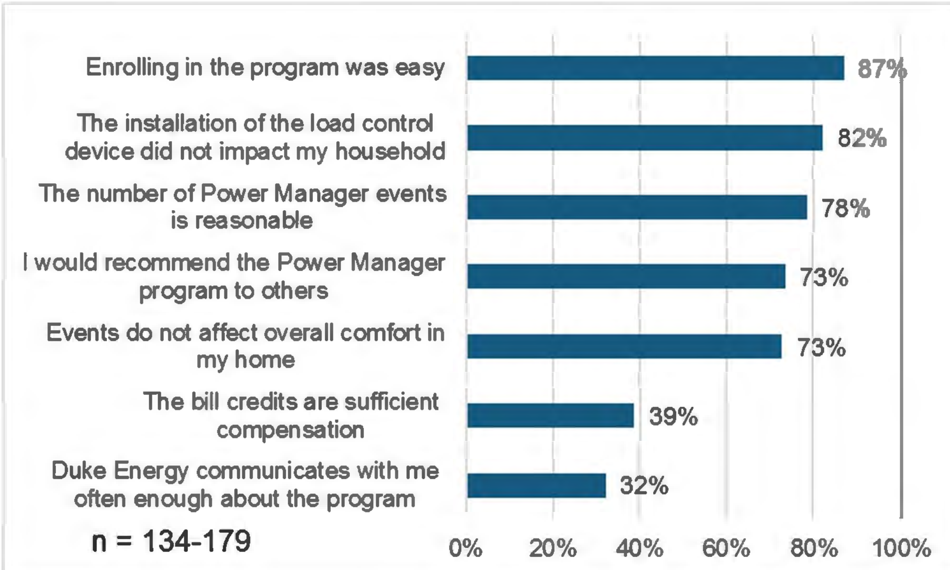
Figure 7-8: Primary Motivations to Enroll in Power Manager



Respondents were asked about how strongly they agreed or disagreed with a series of statements pertaining to satisfaction with Power Manager. Figure 7-9 shows the percentage of respondents that agree or strongly agree (top-two of five box scores) with statements associated with program participant satisfaction.

At least a majority of respondents agree with most of the statements. Two aspects of the program score the highest, with over 80% of respondents agreeing that "enrolling in the program was easy" and "the installation of the device did not impact my household." Three other aspects of the program garner agreement with more than 70% but less than 80% of respondents – there may be room for improvement in these areas: "the number of Power Manager events is reasonable", "I would recommend Power Manager to others", and "Events do not impact overall comfort in my home". Finally, two other areas show agreement scores of less than 50%, indicating plenty of room for improvement - less than half of respondents agree that "the bill credits are sufficient compensation" and "Duke Energy communicates with me often enough about the program". Only 39% of respondents agreed that the bill credits are sufficient compensation for participating and even fewer respondents, 32%, agree that Duke Energy communicates with them enough about the program.

Figure 7-9: Agreement Scores (Top-two of Five) for Statements Associated with High Program Satisfaction



Two follow-up questions were presented to those respondents that indicated non-agreement with the statements about referral and sufficiency of communications. The most common type of response as to why a respondent would not recommend Power Manager to others is an "other" category designated for miscellaneous responses. Some examples of these responses are "This program shouldn't} even exist. Build a grid that suitably meets the needs of your customers", and "Don't believe it works." Table 7-5 presents a summary of all reasons given for respondents' unwillingness to recommend the program to others.

Table 7-5: Reasons for Unwillingness to Refer Power Manager to Others

Response Category	Percent of Total Mentions (n = 17)
Other	35%
Not enough bill credit	18%
Lack of communication on program information	12%
Never received bill credits	12%
Lack of event notifications	6%
Causes discomfort	6%
Prefer not to give up control	6%
Causes them to use more energy	6%
Too many events	0%
Difficult to opt-out	0%
Total	100%

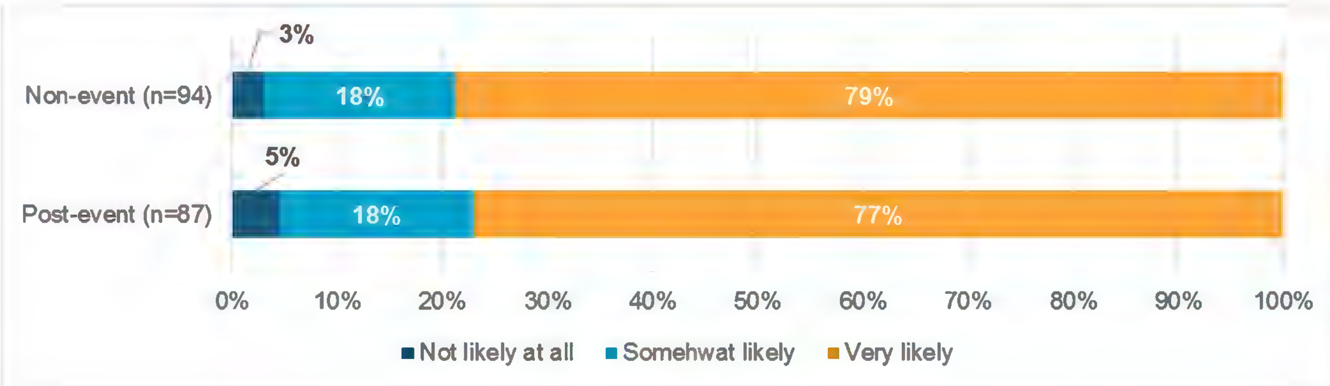
As another follow-up on the satisfaction score questions, the survey asked respondents who indicated dissatisfaction with program communications what kind of communication they desire. The top-two most requested communication topics are notifications of enrollment (35% of requests) and event notifications by text or email (19%). Requests for material on how Power Manager works also garnered 19% of the communication requests. Table 7-6 tabulates the categorized communication requests provided by survey respondents as open-ended responses.

Table 7-6: Requested Program Communications

Response Category	Percent of Total Mentions (n = 31)
Notification of enrollment	35%
Event notifications via text or email	19%
Material on how program works	19%
Report on energy savings	13%
How to opt-out of program	10%
Total	100%

Participants responding to the survey were asked how likely they were to stay enrolled in Power Manager. Strong majorities of survey respondents state that they are “very likely” to remain enrolled in the program: 79% of non-event survey group respondents and 77% of post-event survey group respondents indicate that they are very likely to stay enrolled in Power Manager. Figure 7-10 displays survey respondents’ self-reported likelihood of staying enrolled. The differences in the response distributions between post-event and non-event survey groups is not statistically different at the 90% level of confidence.

Figure 7-10: Likelihood of Staying Enrolled in Power Manager



At the end of the survey, participants were given the option to provide suggestions and feedback in an open-ended format. Respondents provided a diversity of comments for Duke Energy – all responses are categorized and tallied in Table 7-7. Aspects of the program receiving the most suggestions are participation incentives and communication with program participants.

Table 7-7: Open-ended Suggestions for Improving Power Manager

Response Category	Percent of Total Mentions (n = 54)
Incentives: Increase or change them	22%
Communications: How PM works	17%
Communications: More frequent or better	15%
Communications: Event notifications	9%
Expressed frustration	7%
Other	7%
Increase services/reach of program	6%
Incentives: Communicate them clearly	4%
Advertise the program	4%
Periodic report on energy savings	4%
Communications: Benefits or alleviate concerns	2%
Less setback/different event times	2%
Expressed appreciation	2%
Communications: Enrollment status	0%
Allow opt-outs	0%
Total	100%

Example verbatims follow below for the top six comment categories:

- "Worthwhile credit incentive. A few bucks spread over the year is no incentive. Not good for homebound people - a lot {o}f remote workers these day{s} too!"

- "More communication to better understand program use."
- "It's a workable program as it is but reminding customers, perhaps through a brief reminder when the bills are sent out."
- "Honestly I have not noticed when the power is being managed, but I would like to know when it is being managed."
- "I purchased a programmable thermostat for the home. My A/C installer was unable to get it to work."
- "Need better coordination with HVAC service providers. When new equipment was installed at my house they disconnected the Power Manager equipment. And don't promote its use."

7.3 Interview Findings

Power Manager is an established Duke Energy demand-side resource that is actively used in the course of operating the Indiana electric system. The demand savings delivered by Power Manager are made possible through the teamwork of internal and external stakeholders. The team manages program budget and goals, assists with managing marketing campaigns, communicates with participants, maintains the event dispatch software, and manages to event dispatch protocols. The Power Manager team also interacts with the customer at every stage of the program lifecycle, from enrollment, device installation, to device removal. Three primary stakeholder groups – the Duke Energy program management team, Eaton Power Systems, and Franklin Energy – work together to deliver Power Manager to Duke Energy Kentucky customers. Resource Innovations interviewed three individuals from all three organizations. Through our conversations with the Power Manager team, we observe that Power Manager continues to maintain customer-focused and team-oriented program operations.

The remainder of this section describes the Power Manager customer offering in Kentucky and what Duke Energy's activities are to bring in new program participants and deliver demand response load impacts to the system. A description of program operations follows immediately below, which is followed in turn by an outline of work that continues after each load control season concludes to ensure Power Manager's continued success. This section concludes with a review of the activities that are planned or currently underway to further improve program operations and participating customer experience.

7.3.1 Program Recruitment and Enrollment

Duke Energy's 2023 enrollment and operational objectives are driven by their integrated resource plan (IRP) and carbon plan. Recruitment of Duke Energy Kentucky customers into Power Manager takes place year-round in order to meet program objectives. As of year-end 2023, Duke Energy had about than 12,500 customers in Kentucky enrolled in the program.

Although customers are sometimes recruited via other channels, outbound calling channel through a third-party call center provider, CustomerLink, is the predominant and most effective participation recruitment source for the Power Manager program. The CustomerLink outbound call center is prepared to address common questions or concerns that Duke Energy customers who are not familiar with the program may have, in addition to the primary recruitment need to speak to the basic features and benefits of the program. Outbound callers are ready to explain that Power Manager's program features are friendly to the customer:

- The majority of participants home during Power Manager events don't notice it;
- A limited number of events are called each summer (5-7);
- Events typically end by 6 PM, when many customers are just coming home from work;
- Air conditioning units enrolled in the program are cycled rather than completely curtailed (excepting events called for emergencies);
- Events are not called on weekends or weekday holidays (excepting events called for emergencies);
- Load control devices are a proven technology that does no harm to the customer's air conditioner or the home's electric distribution system;
- Load control devices are a convenient pathway to participation since they do not require technicians to enter the home for installation or service.

Additionally, Duke Energy provides CustomerLink with customer participation data in their other residential energy-efficiency programs. Having the ability to refer to this customer-specific information during recruitment calls helps CustomerLink staff increase the effectiveness of their communications and demonstrate credibility. Most of CustomerLink's outbound calling is a "cold call" or initial contact for program recruitment. CustomerLink also does some calling as follow-up to an initial contact sent via email. Generally, Duke Energy has found that a person-to-person recruitment conversation is the most effective approach to generating enrollments since it provides customers a chance to get answers to their questions. However, in 2023, Duke Energy also used direct mail marketing for the for the first time after several years' hiatus. The new direct mail marketing is testing enrollment aides such as QR codes that customers can use to navigate directly to the Duke Energy Power Manager website. QR codes may be more effective in generating enrollment leads than the Business Reply cards used in past direct mail marketing campaigns.

Another Power Manager enrollment channel is a move-out-move-in (MOMI) process whereby DLC switches installed at participating households are not automatically removed when customers unenroll from the program. If a customer doesn't request that the DLC device be removed when unenrolling, the device is remotely deactivated and left in place. When a new customer moves in, the DLC switch remains deactivated if the former customer requested unenrollment. If the former customer was a program participant at the time of their move-out, the DLC switch is deactivated when the new customer moves in. New customers are mailed a postcard explaining the program and instructing them to call if they do not wish to participate. Figure 7-11 shows an image of the postcard sent for this communication.

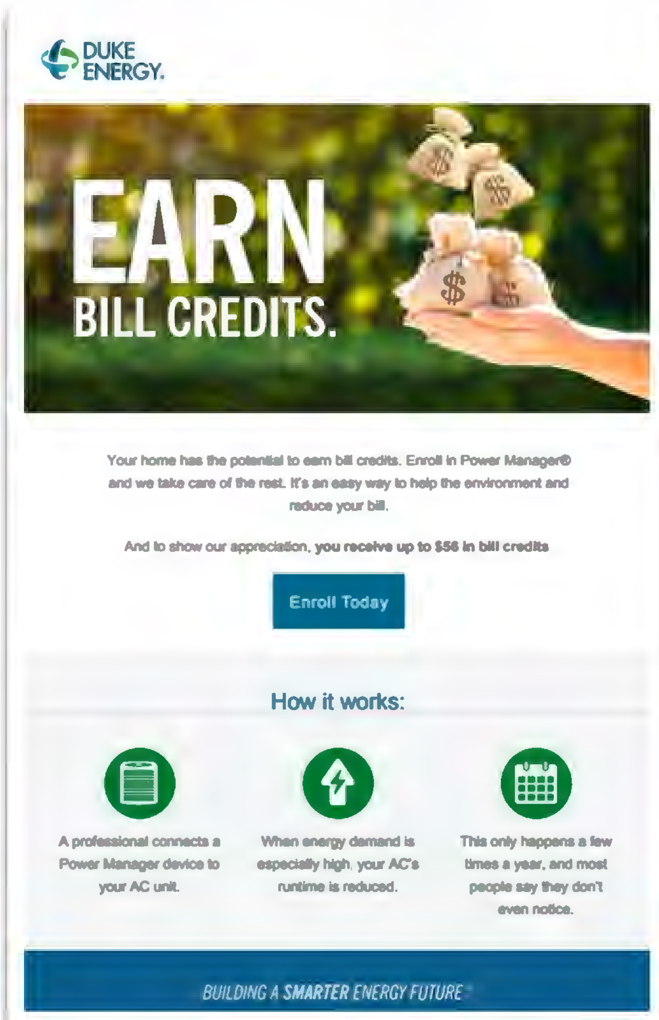
Figure 7-11: Duke Energy Kentucky Power Manager MOMI Postcard

Power Manager provides a one-time installation bill credit of $25 for the moderate load control enrollment option and $35 for the high load control option. Participants also receive monthly bill credits after cycling events occur – the total annual bill credit for 2023 participation is $12 for customers enrolled in the moderate option and $18 for customers enrolled in the high option. Duke Energy also emphasizes messaging around community and environmental benefits to motivate customer interest in and enrollment in the program.

Franklin Energy is another partner, in addition to CustomerLink, that supports Power Manager. Franklin Energy manages Power Manager customer care and handles participants' inquiries about the program and requests for customer service. Franklin Energy is responsible for all Power Manager fieldwork which ranges from scheduling and routing DLC switch installations, managing an inventory of switches (supplied by Eaton Power) and preparing them for installation, training and managing a staff of device installers, responding to any device service calls, and fulfilling customer requests to remove load control devices. Installations for newly enrolled customers take place within 30 days of the enrollment, but Franklin Energy works to complete those orders faster than that while the enrollment is fresh in the customer's mind. Franklin Energy also manages and staffs all DLC device quality assurance inspections. Duke Energy and Franklin Energy work together to develop targeted recruitment lists used by CustomerLink to allow efficient routing of installations for field technicians.

Duke Energy also directly promotes Power Manager (both the DLC and BYOT options) on their website, in home energy reports (HERs), and emails. Duke Energy's website has a feature that allows customers to enroll themselves on a self-serve basis. **Error! Reference source not found.** shows an email marketing example for Power Manager in Kentucky.

Figure 7-12: Power Manager Email Promotion



7.3.2 Power Manager Program Operations

Most Power Manager events are scheduled by the DEK Power Manager program manager, mainly considering Kentucky system and weather conditions in addition to EM&V testing needs. Duke Energy's Energy Control Center (ECC) also has access to dispatch Power Manager's DLC option. The ECC has the responsibility of balancing the supply and demand of electricity on the grid. Power Manager is rarely used in an emergency shed capacity, but the ECC may have cause to use that option on occasion. Because Power Manager represents a low-cost, reliable, and quickly dispatchable asset, it is designated as a "virtual power plant" resource and contributes to the system's operating reserve margins.

Under normal operations, the Power Manager program manager includes staff from ECC and Fuel and Systems Optimization in event decision making, including discussions in anticipation of days where events are possible. Advance event discussion and preparation makes the day-of event calling process operate smoothly. The Power Manager program manager maintains control of the decision to call nonemergency events. Power Manager is viewed as an important resource for the Duke Energy Kentucky system that depends on the participating customers' willingness to remain enrolled. Therefore, all events are called with the program manager's view towards whether or not it will be a detriment to the experience of the participants and their continued participation. Considerations taken in this area are the number of events that have already been called during the current summer, during that week, at what hours events are taking place, and the depth of the load shed under consideration (i.e., thermostat setbacks, cycling level).

Preparations for the cooling season begin in the spring each year. Three primary activities occur in the spring to prepare program participants and the operational team for the summer. Participants receive a reminder/thank you postcard before the summer load control season begins. Duke Energy sends these communications annually to remind and thank customers for their participation in the program, provide tips for having a comfortable experience during events, and to recognize the benefits of the program in terms of reducing system load and providing environmental benefits. In 2023 the seasonal reminder was delivered as an email, shown in Figure 7-13.

Figure 7-13: Seasonal Reminder and Thank You Email

Beyond the monthly credits that are present on customer's bills during load control season, the seasonal reminders are usually the only communication customers receive from the program each year.

Another important springtime activity for the DLC program option is programming or addressing active DLC devices for the upcoming season. This activity is primarily undertaken to support the Resource Innovations impact evaluation, which relies on randomized control trials (RCTs) to facilitate impact estimation. A number of different randomly assigned groups of devices are defined each spring so that when an event is launched, at least one group of devices does not experience load control and can serve as a control group in the RCT. Devices are programmed by Duke Energy using the Eaton Power Systems Yukon software. Duke Energy staff are responsible for device programming each year using Yukon. Consultants from Eaton Power Systems also play a role as the provider of the DLC devices and Yukon software. They serve as a resource to assist Duke Energy in maintaining the Yukon software system, managing occasional device firmware issues, addressing the DLC devices, and training Franklin Energy's device installers.

An annual all-hands Spring Training event hosted by Duke Energy brings together Eaton Power Systems, Franklin Energy, and Duke Energy to discuss the upcoming load control season. The Spring Training is cited by all stakeholders that Resource Innovations interviewed as a crucial aspect of program operations. Not only do these meetings allow for in-depth coverage of emerging issues, but they are also critical in maintaining the overall collegiality and professionalism that facilitates effective communication amongst many contributors to program operations, enabling quick resolution problems when they arise. Spring Training keeps stakeholders aware of each other's responsibilities, knowledge base, and workload, and are thus able to efficiently troubleshoot and find the appropriate staff for solving problems. Weekly meetings are held between Duke Energy and Franklin Energy, with Eaton Power Systems joining once a month.

When a non-emergency event is launched, the DLCs use the Eaton Power Systems TrueCycle algorithm, which assesses participants' actual AC usage patterns to determine the cycling pattern needed that will yield a 60% reduction of the air conditioner's compressor runtime during a cycling event, for those customers enrolled in the "moderate" load control option. Customers enrolled in the "high" load control option are cycled at 75%. During emergency shed events, all enrolled units experience 75% shed.

Duke Energy has also worked with Eaton Power Systems to implement the "Assets" dispatch feature of Yukon software. Yukon Assets ties Franklin Energy's program participation data to Duke Energy's customer information and program dispatch capabilities to provide greater flexibility in managing Power Manager events. With help of this upgrade, Duke Energy can develop the capability to dispatch Power Manager based on the geographic location of active DLC devices.

Duke Energy does not notify participants either in advance of or during event dispatches. However, Duke Energy maintains a toll-free hotline that program participants may call to get updates on the status of whether or not the program is planning to dispatch an event or whether an event is in progress. Franklin Energy notes that the highest volume of calls come in the summertime. Their phone center operations include placing an "ambush message" at the beginning of their telephone interactive voice response (IVR) menu so as to notify callers that Power Manager has called an event. Like Franklin Energy, Duke Energy also notes the pattern of most customer inquiries occurring in the early summer when customers turn on their air conditioning for the first time. If there are issues with the functionality of a customer's air conditioning unit, those issues can be conflated potential issues with the DLC device. Franklin Energy's staff helps distinguish between air conditioner issues versus DLC device issues and, if necessary, send a technician to investigate.

Participants may opt of Power Manager events prior to or during an event via telephone call to Franklin Energy. Additionally, starting in 2022, Duke Energy places a notification on their website to indicate when a Power Manager event is in effect.

7.3.3 Program Monitoring and Postseason Maintenance

Franklin Energy, as the third-party contractor that manages DLC option customer service, has service level agreements in place with Duke Energy that outline service benchmarks, with both penalties for nonperformance and opportunities for incentives when benchmarks are exceeded. There are specific benchmarks in place to ensure that, during event days in particular, customer calls coming into Franklin Energy are handled quickly, efficiently, and that accurate information is provided to the customers calling in. The Duke Energy program manager monitors the number of calls coming into the toll-free notification line. The program manager also monitors the number of calls coming into the Franklin Energy call center to detect any emerging issues associated with the program experience. Device removal requests are also tracked for this purpose.

During and after the cooling season, Duke Energy and Franklin Energy work together to carry out quality assurance (QA) inspections of a number of DLC devices each year. Duke Energy provides Franklin Energy with a targeted group of DLC option participating homes. The homes on the QA list are identified through analysis of participant AMI data designed to identify participants that likely have a non-functioning DLC device. Franklin Energy visits the homes on the QA list to inspect the DLC device(s) for connectivity and operability.

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7.3.4 Upcoming Program Changes and Initiatives

Duke Energy and their partners are implementing a number of program enhancements that leverage a prior investment that maintain Power Manager as a cost-effective system resource for Kentucky.

Duke Energy is looking to operationalize the use of AMI-informed QC inspection of Power Manager DLC devices. In the past, annual QC fieldwork was prioritized based on time elapsed since the last inspection of a given device. Now, Duke Energy's data team can query the AMI data of Power Manager participants following load control events to identify participants most likely to have non-functional DLC devices. Program Management conducted this style of QC inspection management twice in 2023, and looks to run three QC fieldwork projects each year in this manner in the future. Fruitful site visits resulting in repair, reconnection, or replacement of DLC devices using an AMI analysis-based prioritization list have been found to be more likely than the prior methods of prioritizing QC site visits.

Upcoming Power Manager system enhancement scheduled for 2024 includes upgrades and replacements of the paging transmitters and cabling located on towers across the Kentucky service territory. Additionally, starting in 2024 Duke Energy swill start a gradual process of migrating DLC communications capabilities from paging to cellular data, to enable two-way communications with DLC devices. Replacing the entire fleet of DLCs is a long-term project expected to take 8-10 years to complete. Note that the Duke Energy paging network is not dedicated to Power Manager, it is used in other utility and grid systems operations and so will not necessarily be retired when the transition of DLC device technology is completed in the next decade.

Finally, Duke Energy and its Power Manager partners are researching a potential new "low friction" program option to offer participants whereby the low cycling option that is currently only in place for a very small number of customers is expanded as a promoted program option. The low friction option would provide Duke Energy with more participants who experience minimal load cycling specifically at the times when demand ramping on the grid is the steepest. The program concept would be for DLCs to provide ramping support frequently but with low enough cycling strategies that customers would not detect that the cycling is occurring. This offering is currently under discussion and development by the program team.

8 Conclusions and Recommendations

The 2023 evaluation of Power Manager led to the following conclusions and recommendations.

8.1 Impact Evaluation Conclusions and Recommendations

Conclusion: Overall, the Power Manager DLC program produces peak load demand reduction for Duke Energy's residential customers. On average, events called during the 2023 summer season under emergency shed achieved load impacts of 0.41 kW per household.

> **Recommendation:** Continue to promote the Power Manager program to DEK residential customers who exhibit high peak load consumption. Customers with higher-than-average peak loads remain the best candidates for program participation and have the greatest potential to contribute to demand savings.

Conclusion: The device operability analysis identified a portion of accounts that appeared to not reduce load in response to event curtailment signals.

> **Recommendation:** Duke Energy may benefit from further investigation into these accounts. In particular, on-site visits to a stratified random sample of accounts that have been identified as likely non-performers would help to validate the analysis and better quantify the proportion of non-performing devices within the population. This information can help inform Duke Energy's plans for maintenance and program improvement.

Conclusion: The Time-Temperature Matrix predicts per household load reduction of 1.33 kW under extreme conditions, defined as a 1-hour emergency event starting at 4:00 PM and with a daily maximum temperature of 98°F. Because there are approximately 45,000 customers enrolled in Power Manager, the expected aggregate reduction is approximately 60 MW.

> **Recommendation:** Continue to consider and openly communicate the desired capabilities and intended uses of the Time-Temperature Matrix for program and/or resource planning purposes. Resource Innovations will continue to work closely with Duke Energy to cater evaluation planning and data collection to ensure the desired functionality of future tools.

8.2 Process Evaluation Conclusions and Recommendations

Conclusion: Significant (80% and greater) percentages of Power Manager participants, as indicated by participant surveys, use their air conditioning all afternoons and evenings every day of the workweek and weekend in the summertime. About half (52%) of participants report keeping their thermostat setpoint set at a constant temperature.

> **Recommendation:** Power Manager participants are frequent air conditioning users that, in aggregate, represent meaningful demand response potential to benefit the electric grid. However, Power Manager participants' regular air conditioning usage also represents an important resource for the comfort and convenience of Duke Energy customers that should be protected by keeping participant comfort and satisfaction top of mind in program operations.

Conclusion: Significant proportions of participants (including customers that both did and did not actually experience a recent event) surveyed answer "don't know" when asked if they believe Power Manager had dispatched a load control event recently: 59% of post-event survey group respondents and 63% of non-event survey group respondents answered "don't know" when asked if they believed a Power Manager event had recently been dispatched. Leaving out "don't know" responses and only considering "yes" and "no" responses, the proportion of post-event group respondents that believed there was a recent event is not statistically different (at the 90% level of confidence) than the proportion of non-event groups that believed there was a recent event. Power Manager participants do not currently get direct notifications when an event is called or will soon be called, as a result, it is not unusual that many surveyed Power Manager participants indicate that they are not aware of events.

Conclusion: The financial participation incentive, delivered via bill credits, is still a primary motivator for participation, according to participant survey data. However, "supporting the grid during times of high system demand" is the primary motivation for about a quarter of participants.

> **Recommendation:** Consider highlighting or communicating to participants and potential participants the benefits to the grid that Power Manager delivers; similarly, consider further communicating more information on how the program works so that participants better understand how the benefits are realized, not just what the benefits are.

Conclusion: Power Manager continues to earn participants' high agreement scores in survey questions asking about many areas of program enrollment, operations, and participation: between 73% and 87% of survey respondents agree that the program is easy to enroll in, that the DLC device installation is not inconvenient, the number of events called is acceptable, and that impacts do not affect the overall comfort of the home.

Furthermore, large proportions of survey respondents say that they are "very likely" to remain enrolled: 77%-79% of respondents reporting thusly. There is no difference in the likelihood of stating intention to stay enrolled by post-event or non-event survey group status.

But, two other aspects of the program do not score as high in agreement scores: sufficiency of financial incentives and program communications. These areas only garner 32%-39% of DLC and BYOT survey respondents' agreement.

Conclusion: For the quarter or so of respondents that reported that they are unwilling to recommend Power Manager to others, a significant portion of responses (35%) ranged broadly across a number of topics. The response categories that received the most comments after "other" spoke to an insufficient bill credit (18% of responses) and not enough program communication (12% of responses).

> **Recommendation:** Duke Energy should examine, especially if it has not done so for a number of years, opportunities to increase participation incentives – insufficiency of incentives is consistently the lowest-scoring satisfaction aspect of the program and if avenues exist to increase the incentive, it may be helpful with encouraging program enrollment longevity. Additionally, survey respondents were vocal and specific in their open-ended responses inquiring about what program communications they would like to receive. At the top of the list are notifications or confirmations of enrollment, event notifications via text or email, and material on how the program works.

2023 Home Energy Reports Impact Evaluation Report

Submitted to Duke Energy Kentucky

Prepared by Symmetry Projects for Resource Innovations

December 12, 2024

Table of Contents

1 Introduction and Summary of Findings

This memorandum presents the findings of an impact evaluation of the Duke Energy Kentucky (DEK) Home Energy Report (HER) program. HER is a residential behavioral conservation program that has been operating on an opt-in basis since June 2019.

We find that during the 12-month period February 2022 to January 2023, Duke Energy can claim 176.9 kWh on a per customer basis as verified energy savings for HER. We also find that Duke Energy can claim 0.0458 kW in summer on-peak demand on a per customer basis as demand savings, but winter on-peak demand savings estimates are non-significant at the 90% level of confidence. Both the energy and demand claimable savings represent impacts adjusted for attribution to enrolled customers who received reports each month and also have been adjusted to omit impacts attributable to uplift in participation in other Duke Energy energy efficiency programs. Table 1-1 below presents the evaluated net energy and demand impacts for DEK's opt-in HER program, along with the program's deemed savings values. Evaluated net energy savings of 176.9 per participating household represents a realization rate of 87% and the evaluated net summer demand savings of 0.0458 kW per participating household represents a realization rate of 76%. A realization rate for winter demand is not applicable since the evaluated net winter demand impacts are not statistically significant at 90% level of confidence. Evaluated net winter demand impacts are therefore reflected in Table 1-1 as 0. The evaluated DEK opt-in HER impacts are inclusive of all program components – the email and/or paper reports and the online Interactive portal. There are no additive impacts estimated for the Interactive portal since all HER participants are granted access to the Interative portal when they opt-in to the program.

Table 1-1: DEK Opt-in HER Deemed and Evaluated (Net) Energy Impacts per Participating Household

Impact Type	Energy (kWh)	Confidence / Precision (kWh)	Winter Demand (kW)	Confidence / Precision Winter (%)	Summer Demand (kW)	Confidence / Precision Summer (%)
DEK SF Evaluated Impacts	176.9	90/16	0	N/A	0.0458	90/37
DEK SF Deemed Impacts	204.0	N/A	0.0662	N/A	0.0602	N/A

We provide the details of these impact estimates and our methodology in calculating them in the remainder of this memorandum. The next section describes the opt-in HER program and the section after that describes the impact evaluation. The impact evaluation section has a methodology subsection where we describe our analysis methodology, energy savings and demand savings estimation results subsections, and a subsection presenting adjusted energy and demand savings that are claimable as verified savings for the program. Finally, we include a brief appendix that includes evaluation savings estimates formatted for ready entry into Duke Energy's DSMore program tracking database.

2 Home Energy Report Program Description

The Duke Energy Kentucky (DEK) My Home Energy Report (HER) program is a behavioral demand-side management (DSM) program that aims to generate energy savings by increasing participating customers' awareness of their household energy usage and by providing them with timely information and suggestions for reducing household energy use. The information is provided to program participants on a regular basis through monthly reports, called Home Energy Reports, delivered directly to participants via email each month of the year. Paper reports are additionally sent to participants via U.S. Mail twice a year.

2.1 Features of Home Energy Reports

The key features of Duke Energy's HERs are prominent infographics that are customized to each participant's home electricity usage from prior months: a comparison of the participant's monthly energy usage to that of peer homes, an estimated disaggregation by end-use of the participant's energy usage – both for the most recent prior month – and a presentation of the participant's monthly energy usage over the past 13 months. Figure 2-1 presents an example (for a fictional customer) of the portion of the HER that shows the home comparison infographic. The cutomer's prior-month electricity usage (in blue) is compared to that of an efficient home (in green) and the average home (in orange). Beneath the comparison is a summary of information Duke Energy uses in determining which homes to compare the customer to, such as space heating fuel type and presence of a swimming pool, among other factors.

Figure 2-1. HER Infographics – Peer Home Comparisons

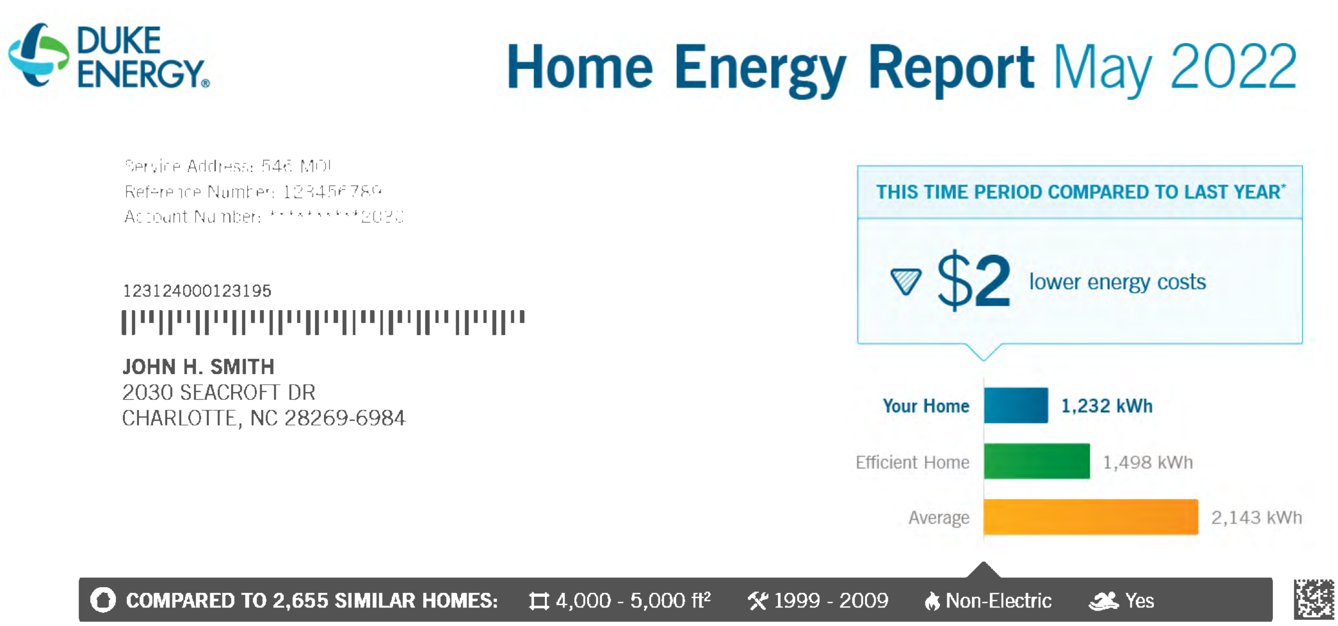


Figure 2-2 follows below illustrating the HER's end-use disaggregation module, which shows an estimate of the cost of the prior month's electricity consumption disaggregated by end-use category (e.g., lighting, cooling, kitchen, and laundry). The purpose of the end-use category disaggregation is to highlight for the customer the areas of home electricity consumption that are the most impactful targets for reducing electricity usage and bills.

Figure 2-2: . HER Infographics – End-use Disaggregation

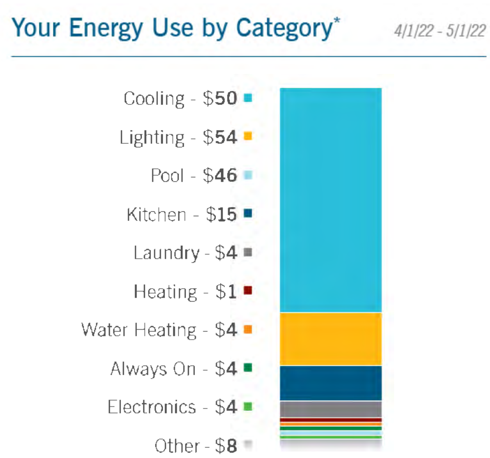
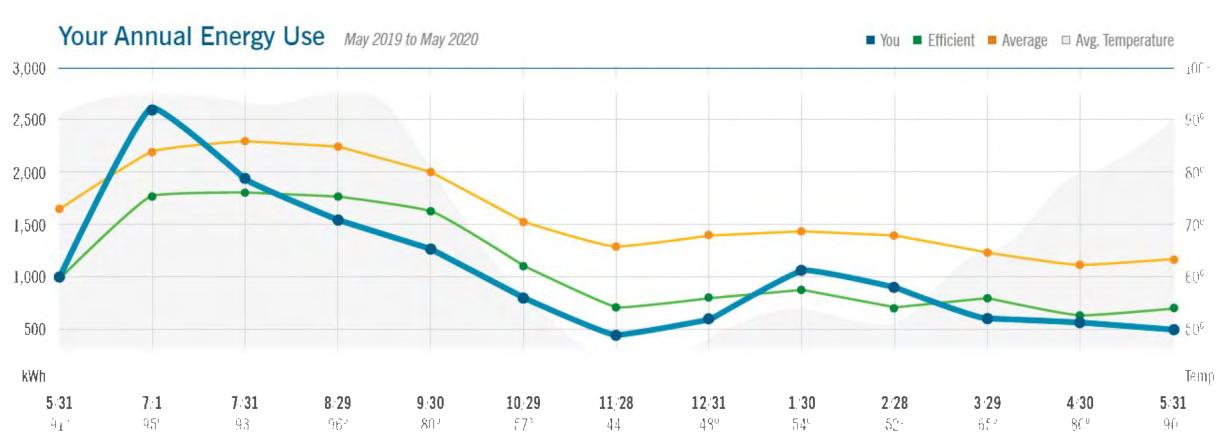


Figure 2-3 provides an example of the HER's usage history graphic that shows the prior 13 months of the customer's monthly usage, which indexed on the left-side axis. The right-side axis indexes average outdoor temperatures for each month – temperatures are shown as the grey shaded area. Like the neighbor comparison shown above, the customer's monthly usage history (in blue) is compared to the monthly usage history for efficient homes in their comparison group (in green) and to the monthly usage history for the average home in their comparison group (in orange).

Figure 2-3: HER Infographics – Monthly Electricity Usage History



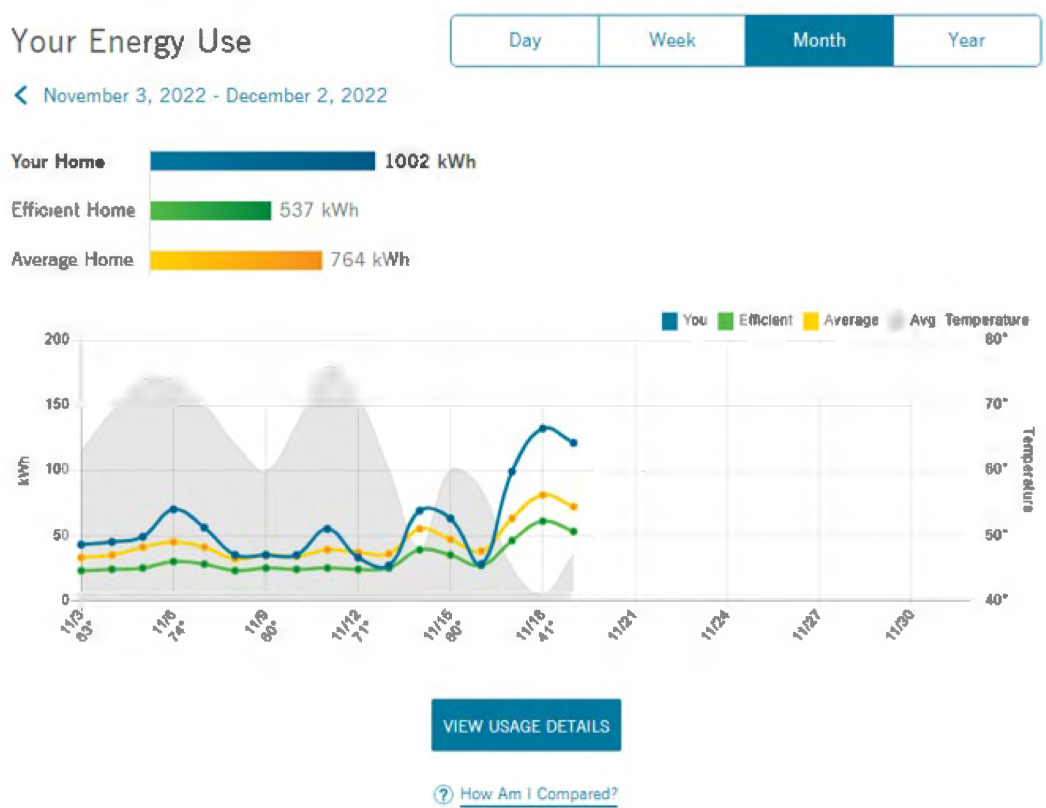
HERs also contain additional content modules that present projections of the participant's energy usage during the next month for the customer's highest usage category, expert advice on ways to save energy, and energy-saving tips that are personalized to the participant based on their energy usage history and other customer information.

2.2 Online HER Interactive Portal

HER offers an enriched online participant experience through a web portal that all HER participants have access to via any internet browser, called HER Interactive. Participants are invited to use the HER Interactive portal to provide information to Duke Energy such as home square footage and presence of specific end-uses like pools. Participant-provided information is then used by Duke Energy for more accurate peer group comparisons and more relevant expert advice and participant-specific energy savings tips in HERs.

Additionally, HER Interactive includes flexible data visualization tools for participants' use to compare their energy usage to that of average and efficient peer homes on various bases of granularity – annual, monthly, weekly and daily – made possible by the DEK advanced metering infrastructure (AMI) deployment that was largely completed in 2018. **Figure 2-4** presents an example image of the usage viewing tool available on HER Interactive. The image captures an example of the user's choice of a monthly view, where a projection of the participant's monthly usage is shown (along with that of efficient and average peer group homes) as well as actual daily electricity consumption for the month to date. Average daily temperatures (indicated in grey) are also shown to illuminate the weather-responsiveness of many homes' electricity usage patterns.

Figure 2-4: HER Interactive – Example Energy Usage Viewing Tool, "Your Energy Use"



2.3 Opt-in Program Launch and Enrollment

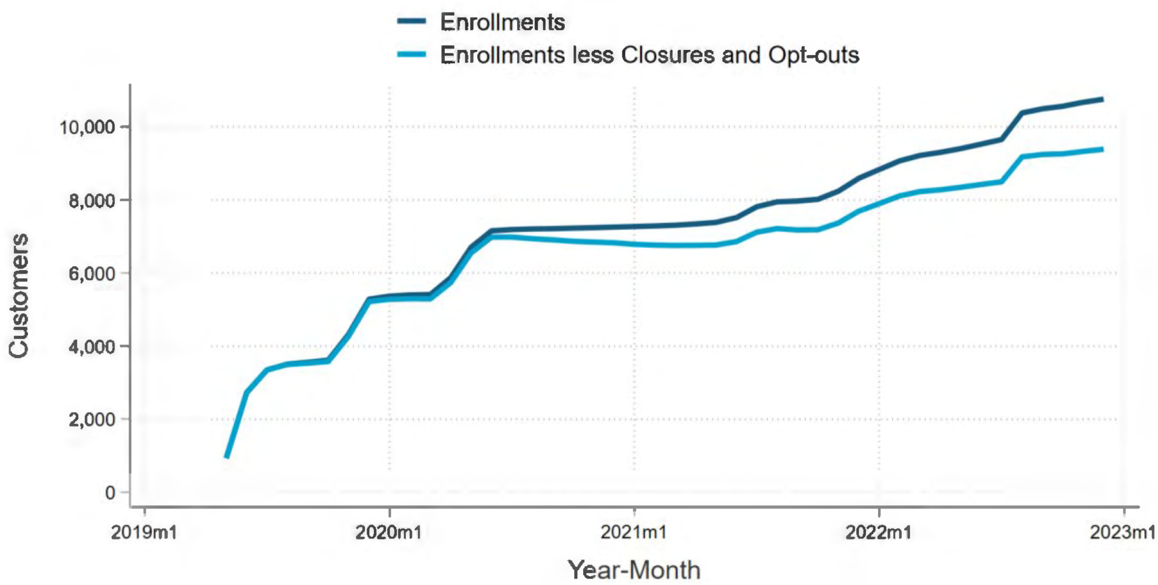
Most utility behavioral conservation programs like HER are implemented as a default, or opt-out, program whereby a target portion or the entirety of a residential customer population are simultaneously and automatically enrolled in the program.[1] Duke Energy operated HER in Kentucky as a default program from 2012 to 2018. Duke Energy relaunched HER in Kentucky in mid-2019 as an opt-in program, whereby the eligible population of residential DEK customers was invited to opt-in to participate in HER.[2] Invitations to enroll were sent via email to those eligible residential customers for whom Duke Energy has an email address on file and via U.S. Mail for eligible customers for whom Duke Energy does not have an email address. Figure 2-5 illustrates content included in the email invitations to the opt-in program.

[1] Typically, less a group of customers randomly selected from the population of eligible customers to serve as a control group for evaluation, measurement, and verification (EM&V) purposes.
[2] The chief eligibility requirement for HER is 13 months of usage history. Other technical eligibility requirements include customer electricity usage history that is comparable to a minimum number of peer homes and email address/mailing address deliverability.

Figure 2-5: Example Email Invitation for DEK Opt-in HER

Enrollments began in May 2019 and continued throughout the duration of the opt-in implementation, albeit at a slower place. Figure 2-6 is a graph depicting cumulative enrollments beginning May 2019 and ending in December 2022. The dark blue curve indicates total cumulative enrollments over time; the lighter blue curve indicates cumulative enrollments but takes into account closures and opt-outs of the program. By December 2019, 5,220 customers were enrolled in HER, increasing to 6,828 enrollees by December 2020 and 7,693 enrollees by December 2021. At the last enrollment month included in this evaluation period, 9,388 customers were enrolled in opt-in HER. All the foregoing enrollment figures are enrollments less account closures and opt-outs.

Figure 2-6: Opt-in HER Enrollments



Regarding opt-outs, it is possible for DEK customers to opt-in to participate in HER and then decide to opt-out at a later date. Only 11 DEK customers have opted out of HER during the period May 2019 to January 2023.

3 Impact Evaluation

This section details the study design, data sources, and analysis protocols used for the impact evaluation.

3.1 Impact Estimation Methodology

The monthly energy and peak demand usage of HER participants, after they enroll in the program and begin receiving reports, is already known through the Duke Energy AMI revenue meters that are installed at participants' homes. What is not known is what program participants' monthly energy and peak demand usage would have been during the evaluation period, in the absence of receiving the reports. Energy and demand in the absence of the program is referred to as "reference load". The primary objective of the impact evaluation is to estimate reference load for both energy and peak demand. Load impact is defined as the difference between the reference load and actual metered load after enrollment, for both monthly energy usage and peak demand usage.

North American residential behavioral conservation programs like HER typically generate between 1% to 2% of energy savings among customers of natural gas and electricity utilities, which are relatively small in magnitude compared to most energy efficiency and demand response programs. For that reason, residential behavioral conservation programs like HER are ordinarily implemented as randomized control trials (RCTs), whereby enrollment is assigned by default for customers eligible to participate (and where participants may opt-out if they wish). The default mechanism allows the utility to randomly select a relatively small group of customers that are otherwise eligible to participate in the program, but who are not defaulted onto the program. Those randomly selected customers do not receive the intervention (i.e., HERs) and thus serve as a control group. The control group is used as the most effective and reliable way of estimating HER impacts, using simple estimation techniques. Importantly, a well-carried out RCT permits evaluation without any need to model participants' energy use. Such models often have margins of error that are of relatively large magnitude compared to the 1-2% energy savings HERs generate. Residential behavioral programs for utility customers, such as HER programs, are therefore ideally implemented as opt-out programs.

The opt-in HER program in Kentucky is not an RCT, since every eligible customer in Kentucky was invited to participate, so there was no randomly selected group of individuals to use as a control group in this impact evaluation. To avoid the challenges of obtaining statistically significant impact estimates when modeling participants' electricity usage and predicting their usage during the evaluation period with the models, we select a matched control group to use for impact estimation.

The matched control group is comprised of residential DEK customers that do not participate (as of the conclusion of this evaluation period, January 2023) in HER. As a group, they are the collection of customers that have each been selected as the closest match with respect to monthly energy usage to at least one DEK HER participant. The monthly energy usage of each HER participant was compared to that of all residential DEK non-HER participants that have the requisite energy usage history needed for the basis of comparison: 12 months of usage history prior to the start of the customer's participation in HER. The 12-months of usage history for all potential matched controls for each participant is used to calculate a "distance metric", and the non-participant with the smallest distance metric is selected as the matched control customer for the participant under consideration. Specifically, the distance metric used is known as Euclidian Distance, the mathematical representation of which is given in **Equation 3-1**, where d, the Euclidian Distance, between two customers p and q is given as the square root of the sum of squared differences in their monthly energy usage in pre-treatment month i, where i ranges across the 12 months preceding the treatment customer's first month of participation. Using the distance metric approach for finding the best-matched non-participant for each participant can result in any non-participant being selected as a matched control customer for more than one participant, in our evaluation the most that any non-participant was used was for four participants.

Equation 3-1: Euclidian Distance

$$d(p,q) = \sqrt{\sum_{n=1}^{12}(q_i - p_i)^2}$$

The matched control group's accuracy in representing the HER participants' electricity usage in the absence of the HER reports is assessed by examining the equivalence of the matched control group and the treatment group (the HER participants) during the 12 months before the onset of treatment. **Table 3-1** presents the average monthly usage for the matched control and treatment groups and the difference between the two. The monthly differences between the matched control group and the HER participant group range from -0.3% to 0.1%. On average, across the 12 pre-treatment months, the groups average daily usage of electricity differs by 0.2%.

Table 3-1: Pre-treatment Comparison during 12 Months before Start of MyHER Participation between Matched Control Group and Treatment Group

Months before Enrollment	Matched Control Group Average Daily Usage (kWh)	Treatment Group (Participants) Average Daily Usage (kWh)	Difference (kWh)	Difference (%)
11	40.47	40.61	-0.14	-0.3%
10	39.95	40.05	-0.10	-0.2%
9	37.73	37.78	-0.05	-0.1%
8	35.37	35.38	-0.01	0.0%
7	34.02	34.10	-0.08	-0.2%
6	35.98	36.05	-0.07	-0.2%
5	38.48	38.58	-0.10	-0.3%
4	38.35	38.44	-0.10	-0.3%
3	35.40	35.49	-0.09	-0.2%
2	32.27	32.24	0.03	0.1%
1	32.57	32.57	0.00	0.0%
0	36.54	36.57	-0.03	-0.1%
Average	**36.43**	**36.49**	**-0.06**	**-0.2%**

With the matched control group selected, the impact evaluation proceeds much as it would if HER were implemented as an RCT. The estimation approach uses a difference-in-differences methodology whereby the pre-existing difference in energy usage between the treatment and control groups is deducted from the post-treatment (i.e., period of time after which HER participation begins) differences between the treatment group (HER participants) and control group energy usage. . The differences-in-differences calculation is accomplished through fixed effects regression modeling, with time fixed effects to improve the precision of the estimate. Standard errors are clustered at the customer level. **Equation 3-2** provides the fixed effects model specification and **Table 3-2** provides the definition of terms found in **Equation 3-2**.

Equation 3-2: Fixed Effects Regression Model for Difference-in-differences Estimation

$$\text{kWh}_{i,t} - \text{kWh}_{i,t\_pre} = \alpha \text{pre-treatment year}_i + \beta \text{treatment}_i + \varepsilon_{i,t}$$

Table 3-2: Definition of Variables for Equation 2

Variable	Description
$\mathbf{kWh}_{i,t}$, $\mathbf{kWh}_{i,t\_pre}$	Customer i's average daily energy usage in post-treatment month t, pre-treatment month t_pre
α	Estimated coefficient for the pre-treatment year for customer i
β	Estimated treatment effect
$\varepsilon_{i,t}$	The error term

3.2 Energy Impacts

The difference-in-differences regression estimates were carried out for each month starting in July 2019, which is the first month after HERs were sent to customers that opted-in to the program in either May or June 2019. Table 3 follows below, tabulating monthly energy impacts (kWh) and associated information. Included in Table 3 is average monthly metered consumption of the participants and average monthly consumption reference load. The reference load is the average monthly metered consumption of the matched control group, corrected for differences between the participant and matched control group observed in the pre-treatment period. Continuing to move left to right across the columns of Table 3-3 average monthly consumption impact expressed in terms of kWh and as a percent of reference load follow next. The 90% confidence interval bounds of the monthly impact follow next, with a Yes/No indicator in the final column on the right referring to statistical significance of the impact estimate at the 90% level of confidence. Nearly all impact estimates beginning October 2019 are statistically significant. Reference loads range from about 800-900 kWh in the shoulder months to about 1,300-1,400 kWh in the summer months. Note that reference load for HER participants may not resemble that of the general residential DEK population since it is an opt-in program. Statistically significant (at the 90% level of confidence) impacts range from 0.9% in December 2020 to 3.4% in May 2020 and August 2022, with most monthly impact estimates ranging between 1% and 2%.

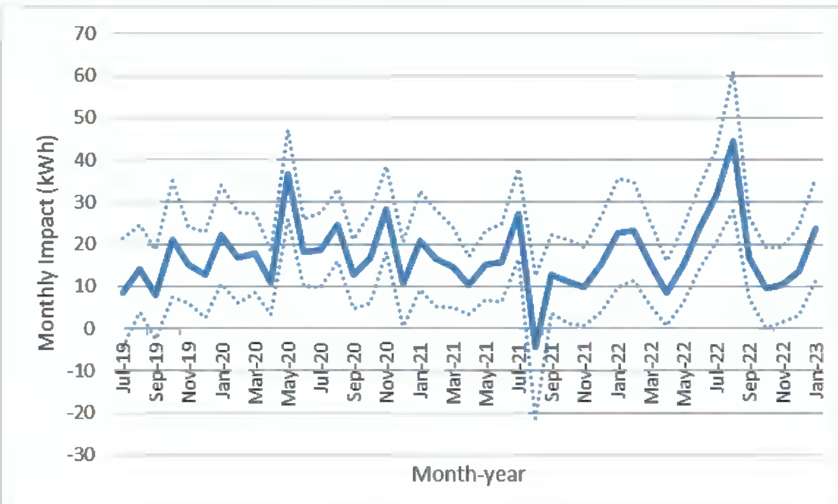
Figure 3-1 follows with graphical presentations of the monthly energy (kWh) impacts with the 90% confidence interval (top image) and monthly energy impacts expressed as a percentage of reference load.

Table 3-3: Monthly Opt-in HER Energy Impacts (per Customer) – July 2019 through January 2023

Month-Year	Average Monthly Consumption (kWh) - Treatment	Average Monthly Consumption (kWh) - Reference	Average Monthly Consumption Impact (kWh)	Average Monthly Consumption Impact (%)	90% CI Lower	90% CI Upper	Stat. Significant? (90%)
Jul-19	1,380.6	1,389.2	8.6	0.6%	-4.4	21.5	N
Aug-19	1,259.0	1,273.2	14.2	1.1%	3.9	24.6	Y
Sep-19	1,099.3	1,107.3	8.0	0.7%	-2.5	18.6	N
Oct-19	853.7	875.0	21.2	2.4%	7.5	34.9	Y
Nov-19	872.7	887.8	15.1	1.7%	6.0	24.1	Y
Dec-19	1,029.9	1,042.7	12.8	1.2%	2.7	23.0	Y
Jan-20	1,052.8	1,075.1	22.3	2.1%	10.6	34.0	Y
Feb-20	992.8	1,009.6	16.7	1.7%	6.0	27.5	Y
Mar-20	901.5	919.4	17.9	1.9%	8.4	27.4	Y
Apr-20	823.5	834.3	10.8	1.3%	3.4	18.3	Y
May-20	1,046.5	1,083.2	36.6	3.4%	26.0	47.2	Y
Jun-20	1,154.2	1,172.3	18.1	1.5%	10.1	26.0	Y
Jul-20	1,425.9	1,444.5	18.6	1.3%	9.7	27.5	Y
Aug-20	1,283.3	1,307.8	24.5	1.9%	16.0	33.1	Y
Sep-20	973.9	986.8	12.9	1.3%	4.8	21.0	Y
Oct-20	810.1	826.9	16.8	2.0%	6.0	27.6	Y
Nov-20	1,003.9	1,032.4	28.5	2.8%	18.3	38.7	Y
Dec-20	1,139.0	1,149.6	10.6	0.9%	0.5	20.7	Y
Jan-21	1,239.0	1,259.9	20.9	1.7%	9.2	32.6	Y
Feb-21	1,138.6	1,155.2	16.6	1.4%	5.3	28.0	Y
Mar-21	916.8	931.3	14.6	1.6%	5.0	24.1	Y
Apr-21	741.3	751.6	10.3	1.4%	3.4	17.2	Y
May-21	853.0	868.1	15.1	1.7%	7.0	23.3	Y
Jun-21	1,096.1	1,111.7	15.6	1.4%	6.5	24.8	Y
Jul-21	1,296.1	1,323.4	27.3	2.1%	16.6	38.0	Y
Aug-21	1,710.6	1,706.3	-4.4	-0.3%	-21.3	12.6	N
Sep-21	1,086.6	1,099.4	12.8	1.2%	3.6	22.1	Y
Oct-21	836.6	847.8	11.2	1.3%	1.3	21.0	Y
Nov-21	882.5	892.4	9.9	1.1%	0.6	19.1	Y
Dec-21	1,051.1	1,066.2	15.2	1.4%	4.0	26.3	Y
Jan-22	1,235.0	1,257.7	22.7	1.8%	9.9	35.5	Y
Feb-22	1,063.9	1,087.1	23.1	2.1%	11.5	34.8	Y
Mar-22	903.5	918.6	15.1	1.6%	5.2	25.0	Y
Apr-22	787.2	795.7	8.4	1.1%	0.8	16.1	Y
May-22	959.1	974.4	15.3	1.6%	6.2	24.3	Y
Jun-22	1,204.9	1,228.8	23.8	1.9%	14.1	33.6	Y

Month-Year	Average Monthly Consumption (kWh) - Treatment	Average Monthly Consumption (kWh) - Reference	Average Monthly Consumption Impact (kWh)	Average Monthly Consumption Impact (%)	90% CI Lower	90% CI Upper	Stat. Significant? (90%)
Jul-22	1,328.9	1,360.5	31.6	2.3%	20.7	42.6	Y
Aug-22	1,278.7	1,323.2	44.6	3.4%	27.9	61.2	Y
Sep-22	898.6	915.3	16.7	1.8%	7.0	26.4	Y
Oct-22	750.9	760.6	9.7	1.3%	0.1	19.3	Y
Nov-22	920.7	931.1	10.4	1.1%	1.6	19.2	Y
Dec-22	1,148.3	1,162.0	13.7	1.2%	3.1	24.2	Y
Jan-23	1,098.5	1,122.2	23.7	2.1%	11.5	35.9	Y

Figure 3-1: Monthly Energy Impacts (kWh) with 90% Confidence Intervals and Monthly Impacts as a Percentage of Reference Load (per Customer) – July 2019 through January 2023



Annual impacts are found in Table 3-4 except the first row only includes six months. The final row represents the impacts from the final 12 months of this load impact evaluation's analysis period: On average, HER reference load for the period February 2022 through January 2023 is 12,579.6 kWh and HER participants saved 236.1 kWh, or 1.9% of their annual energy usage. The annual estimates of energy savings are statistically significant at the 90% level of confidence.

Table 3-4: Annual Opt-in HER Impacts (per Customer) – July 2019 through January 2023

Year	Average Annual Consumption (kWh) - Treatment	Average Annual Consumption (kWh) - Reference	Average Consumption Impact (kWh)	Average Annual Consumption Impact (%)	90% CI Lower	90% CI Upper	Stat. Significant? (90%)
Jul-19 through Jan-20*	7,548.0	7,650.2	102.2	1.3%	19.2	132.1	Y
Feb-20 through Jan-21	12,793.6	13,026.6	233.0	1.8%	149.8	266.4	Y
Feb-21 through Jan-22	12,844.1	13,011.1	166.9	1.3%	67.2	204.0	Y
Feb-22 through Jan-23	12,343.4	12,579.6	236.1	1.9%	145.7	273.4	Y

* 6 month period

3.3 Demand Impacts

The same difference-in-differences estimation regression is used for estimating demand impacts, where the variables $\mathrm{kWh}_{i,t}$ and kWh_{i,t_pre} shown in Equation 2 would be replaced with $\mathrm{kW}_{i,t}$ and kW_{i,t_pre}, where they represent average non-holiday weekday on-peak demand for customer i in month t. For summer demand impacts, the month is restricted to July and for winter demand impacts the month is restricted to January. Additionally, on-peak demand is defined as demand at hour-ending 17 in summer and hour-ending 20 in winter. The matched control group used in the energy impact analysis was also used for the demand impact analysis.

Table 3-5 and Table 3-6 present monthly on-peak demand estimates at the per customer level for the winter and summer seasons, respectively. Only the summer impacts are statistically significant at the 90% level of confidence (with the exception of summer 2019 demand impacts which are not significant). The statistically significant (90% level of confidence) summer demand impacts range from 1.1% to 2.2%, representing a range of impacts from 0.029 kW to 0.057 kW. Overall, summer on-peak demand reference load ranges from 2.47 to 2.73 kW. All of the winter on-peak demand estimates are under 1%. Winter on-peak reference load is also lower, ranging from 1.67 kW to 2.02 kW.

Figure 3-2 illustrates the monthly on-peak demand estimates, expressed as a percentage of reference load, for summer (top) and winter (bottom).

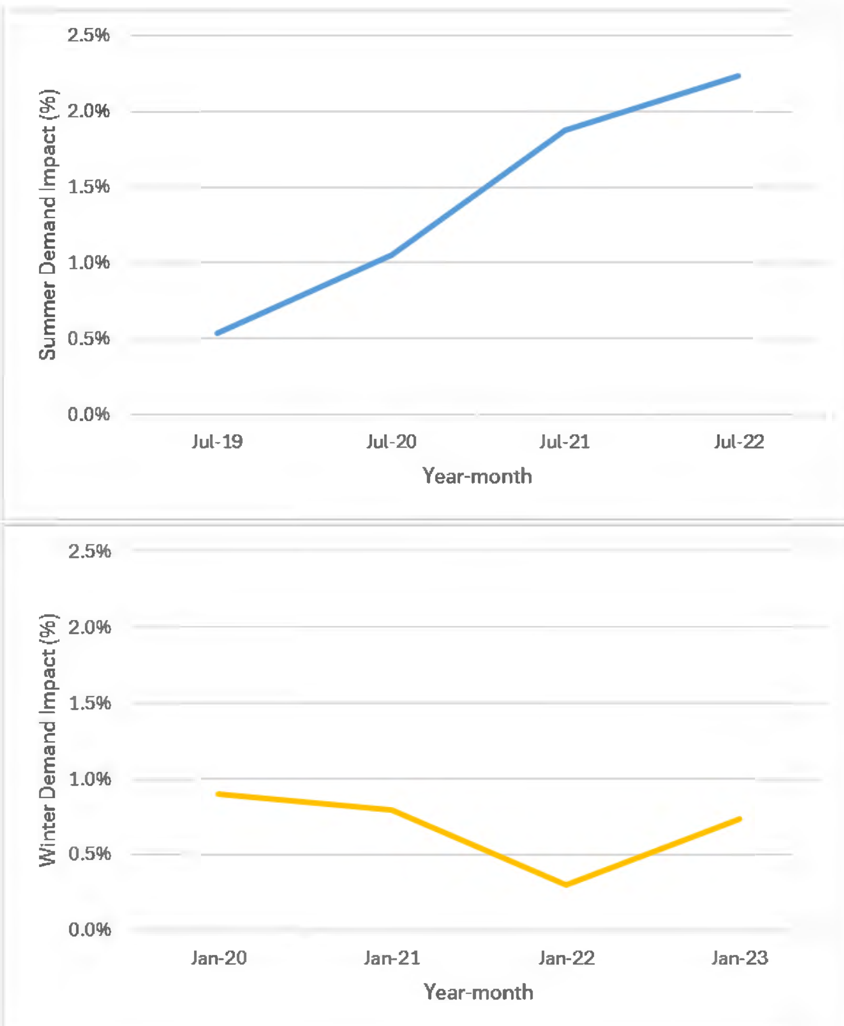
Table 3-5: Opt-in HER Summer Demand Impacts (per Customer) – July 2019 through January 2023

Month-Year	Average On-peak Demand (kW) - Treatment	Average On-peak Demand (kW) - Reference	Average On-peak Demand Impact (kW)	Average On-peak Demand Impact (%)	90% CI Lower	90% CI Upper	Statistically Significant (90%)
Jul-19	2.45	2.47	0.013	0.5%	-0.015	0.042	N
Jul-20	2.70	2.73	0.029	1.1%	0.009	0.048	Y
Jul-21	2.46	2.51	0.047	1.9%	0.025	0.069	Y
Jul-22	2.50	2.56	0.057	2.2%	0.036	0.079	Y

Table 3-6: Opt-in HER Winter Demand Impacts (per Customer) – July 2019 through January 2023

Month-Year	Average On-peak Demand (kW) - Treatment	Average On-peak Demand (kW) - Reference	Average On-peak Demand Impact (kW)	Average On-peak Demand Impact (%)	90% CI Lower	90% CI Upper	Statistically Significant (90%)
Jan-20	1.66	1.67	0.015	0.9%	-0.010	0.040	N
Jan-21	1.88	1.89	0.015	0.8%	-0.009	0.039	N
Jan-22	2.01	2.02	0.006	0.3%	-0.019	0.031	N
Jan-23	1.67	1.68	0.012	0.7%	-0.012	0.036	N

Figure 3-2: Monthly Demand Impacts as a Percentage of Reference Load (per Customer) July 2019 through January 2023



3.4 Evaluated Energy and Demand Impacts

The energy and demand impacts presented in the above two sections represent the total energy and demand impacts attributable to the HER program for all participants that enrolled in the program. Duke Energy will claim energy and demand impacts for all customers that received reports each month (through an intent-to-treat factor that accounts for the difference between counts of reports sent each month and actual program enrollment), with an additional adjustment for uplift in energy efficiency program participation attributable to HER. While the energy efficiency uplift deduction negatively impacts the claimed savings value, it is a positive attribute of the HER program to induce an uplift in energy efficiency program participation. The deduction is only made so that Duke Energy does not inadvertently claim the same savings twice. Table 3-7 presents the evaluated energy savings for opt-in HER. The total program impact on a per customer basis is 236.1 kWh for the period February 2022 through January 2023. The fraction of treated customers among all enrolled customers during this period is 94.37%, yielding a per-customer energy impact for treated homes of 250.2 kWh. The energy efficiency overlap is calculated to be 73.3 kWh, yielding an impact net of EE overlap of 176.9 kWh per treated home. The EE overlap is relatively high due to the fact that this is an opt-in implementation of a HER program, which makes it far more likely that participants are engaged and amenable to messaging on other energy efficiency programs – energy efficiency overlap for default HER programs is typically much lower. On average, 8,237 participants received reports during the period February 2022 to January 2023, yielding a total program energy impact for opt-in HER of 1.457 GWh.

Table 3-7: Evaluated Opt-in HER Energy Savings

12-month Period	Energy Impact per Customer (kWh)	% Treated	Energy Impact in Treated Homes per Customer (kWh)	EE Overlap (kWh)	Impact Net of EE Overlap per Customer (kWh)	Participants Receiving Reports	Impact Net of EE Overlap Program (GWh)
February 2022-January 2023	236.1	0.9437	250.2	73.3	176.9	8,237	1.457

Table 3-8 presents the evaluated demand savings for opt-in HER. The total per-customer summer on-peak demand estimate is 0.0572 kW. During the summer on-peak period, approximately 96% of participants were treated, yielding summer demand impact in treated homes of 0.0597 kW. There is 0.0139 kW of HER uplift in EE, so the final impact net of HER's uplift in EE program participation is 0.0458 kW. Winter on-peak demand impacts were not found to be statistically significant at the 90% level of confidence, so the evaluated winter demand impacts are shown in Table 9 to be 0.

Table 3-8: Evaluated Opt-in HER Demand Savings

Season	Demand Impact per Customer (kW)	% Treated	Demand Impact in Treated Homes per Customer (kW)	EE Overlap (kW)	Impact Net of EE Overlap per Customer (kW)	Participants Receiving Reports	Impact Net of EE Overlap Program (GW)
Summer 2022	0.0572	0.9582	0.0597	0.0139	0.0458*	8,141	0.000372
Winter 2023	0	0.9635	0	N/A	0	9,092	0

* Rounding present - Use 0.045755 to see GW value

The evaluated annual energy savings of 176.9 kWh represents an 87% realization rate of the program's deemed savings of 204 kwh per year, per household. The evaluated peak summer demand savings of 0.458 kW represents a 76% realization rate of the program's deemed summer on-peak demand savings of 0.0602 kW. Evaluated and deemed savings are presented below in Table 3-9. A realization rate for winter demand is not applicable since the evaluated net winter demand impacts are not statistically significant at 90% level of confidence. Evaluated net winter demand impacts are therefore reflected in Table 3-9 as 0.

Table 3-9: DEK Opt-in HER Deemed and Evaluated (Net) Energy Impacts per Participating Household

Impact Type	Energy (kWh)	Confidence / Precision (kWh)	Winter Demand (kW)	Confidence / Precision Winter (%)	Summer Demand (kW)	Confidence / Precision Summer (%)
DEK SF Evaluated Impacts	176.9	90/16	0	N/A	0.0458	90/37
DEK SF Deemed Impacts	204	N/A	0.0662	N/A	0.0602	N/A

Appendix A DSMore Data Table

Duke Energy requires program impacts to be made available in a format compatible for entry into their DSMore demand-side management reporting tool. Table A-1 presents gross and net estimates of energy and demand impacts, which are the same for experimental and quasi-experimental evaluation frameworks for energy efficiency/conservation programs such as HER. HER Interactive estimates are not included in this evaluation since HER is an opt-in program in Kentucky. Any impacts in excess of the "base" HER reports that are due to usage of the Interactive portal are not possible to evaluate with the current program configuration.

Table A-1: DSMore Energy and Demand Savings Estimates – Gross and Net

Measure Category	Prod Code	Jurisdiction	Gross Energy Savings (kWh)	Gross Summer Coincident Demand (kW)	Gross Winter Coincident Demand (kW)	Net to Gross Ratio	Net Energy Savings (kWh)	Net Summer Coincident Demand (kW)	Net Winter Coincident Demand (kW)	Measure Life
SF_Home Energy Report	HECR	DEK	176.9	0.0458	0	100%	176.9	0.0458	0	1
SF_Home Energy Report Interactive	HECR	DEK	176.9	0.0458	0	100%	176.9	0.0458	0	1

DSMore_DEK 2023.xlsx

Table A-2 presents the claimed 176.9 kWh per customer impacts, representing annual per-customer impacts for participants receiving reports net of EE overlap, for each month of the period February 2022 through January 2023.

Table A-2: Monthly Impacts Net of EE Overlap for Participants Receiving Reports February 2022 through January 2023

Month-year	Participants Receiving Reports	kWh Impact Net of EE Overlap	GWh Impact Net of EE Overlap
Feb-22	7,615	20.8	0.2
Mar-22	7,789	11.9	0.1
Apr-22	7,941	4.0	0.0
May-22	8,001	10.8	0.1
Jun-22	8,052	19.3	0.2
Jul-22	8,141	27.1	0.2
Aug-22	8,185	43.7	0.4
Sep-22	8,885	10.5	0.1
Oct-22	8,949	2.9	0.0
Nov-22	8,970	3.3	0.0
Dec-22	9,038	6.4	0.1
Jan-23	9,092	16.4	0.1
12-month Total		**176.9**	**1.5**

HER Kentucky Single-family

Completed EMV Fact Sheet

Description of program

Duke Energy provides the Home Energy Report to residential customers on an opt-in program offering basis. HER relies on principles of behavioral science to encourage customer engagement with home energy management and energy efficiency. The program accomplishes this primarily by delivering a personalized report comparing each customer's energy use to a peer group of similar homes.

Date	September 12, 2024
Region(s)	Kentucky
Evaluation Period	February 2022 – January 2023
Annual kWh Savings	Base HER: 1,457,435 kWh HER Interactive: Not estimatable
Per Participant kWh Savings	Base HER: 176.9 kWh/home HER Interactive: Not estimatable
Summer kW Impact	Base HER: 0.0458 kW HER Interactive: Not estimatable
Winter kW Impact	Base HER: Non-significant HER Interactive: Not estimatable
Net-to-Gross Ratio	Not Applicable
Process Evaluation	No
Previous Evaluation(s)	None

Evaluation Methodology

Impact Evaluation Activities

- *HER in Kentucky operated as an opt-in program during this evaluation period, which launched in June 2019.*
- *The impact evaluation begins with selecting a matched control group to use for establishing reference load, which is used for calculating energy and demand impacts: Reference load – Metered load = load impacts. Reference load is calculated as the difference between average control group load less the pre-existing difference between treatment and matched control group load during the 12 months prior to program enrollment.*

Impact Evaluation Findings

- *Total program energy impacts are found to be 236.1 kWh for the 12 month period February 2022 through January 2023. Energy impacts attributable to enrolled customers who received reports are 250.2 kWh.*
- *Total program impacts attributable to enrolled customers who received reports should be adjusted for purposes of claiming energy savings since programs like HER usually produce uplifts in energy savings program participation. As an opt-in program, Kentucky HER's participants are highly engaged with other Duke Energy energy efficiency programs: 73.3 kWh is deducted from the 250.2 kWh resulting in 176.9 kWh of annual claimable savings.*
- *Even though uplift energy efficiency is deducted from the energy savings claimed, it is still an important benefit of the program, it is only deducted to ensure Duke Energy does not claim those savings twice.*
- *Total summer on-peak demand impacts are found to be 0.0573 kW. Demand savings attributable to participants who received reports are 0.0597 kW, and with energy efficiency uplift deducted, 0.04758 kW are claimable summer on-peak demand impacts. Winter on-peak demand impacts are non-significant.*
- *Since all opt-in DEK HER participants are also Interactive users during this evaluation period, separate estimates of impacts attributable to the Interactive portal cannot be obtained in this evaluation period.*

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SMALL BUSINESS ENERGY SAVER PROGRAM (T)

APPLICABILITY

The program is available to existing Duke Energy Kentucky non-residential customer accounts who qualify. with an actual average annual electric demand of 180 kilowatts or less. An individual business entity's participation is limited to no more than five premises on the Company's system during a calendar year. Where the customer is not the owner of the property, the owner must give satisfactory written consent for the customer to participate in this program. (T) (T) (T)

PROGRAM DESCRIPTION

The Small Business Energy Saver (SBES) is available to non-residential customer accounts with an actual average annual electric demand of 180 kilowatts or less. The Small Business Energy Saver Program (SSBES) facilitates the installation of high efficiency equipment in existing small non-residential facilities. SBES is designed to target the small non-residential customer segment using the direct install program model which makes the energy efficiency upgrade process as streamlined and convenient as possible. (T) (T) (T)

SBES will provide free, no-obligation energy assessments of qualifying non-residential customer facilities which result in recommendations of energy efficiency measures to be installed at the facility along with the projected energy savings, costs of all materials and installation, and the upfront incentive amount from Duke Energy Kentucky. Upon receiving the results of the assessment, if the customer chooses to move forward, the customer makes the final determination of project scope prior to installation. Duke Energy Kentucky then provides upfront incentives to discount the installation costs of select energy efficiency improvements in lighting; process; refrigeration; and heating ventilation and air conditioning. (T)

The SBES program incentives are calculated per project, based upon the deemed estimated energy savings of the energy-efficiency improvements and the conditions found within the customer's facility. Duke Energy Kentucky may provide an upfront customer incentive for up to 80 percent of the total cost of installed measures. Incentives are provided based on the Duke Energy Kentucky's cost-effectiveness modeling to ensure cost-effectiveness over the life of the measure.

The Company also offers SmartPath. This option is available to all eligible non-residential customer accounts. The program is implemented by a qualified Trade Ally network who complete energy assessments, develops proposals, and implements the turnkey projects on the program's behalf. SmartPath offers customers financing through funding partners. All financing is between the customer and the funding partner and is offered by the Trade Allies. (T) (T) (T) (T) (T) (T) (T)

All aspects of the program will be managed by a Duke Energy Kentucky authorized program administrator(s). Duke Energy Kentucky will Kentucky will provide a list of customers who meet the program eligibility requirements to the Company-authorized program administrator in order for the program administrator to perform the work described above. Duke Energy Kentucky's incentive payment for any installed measures shall be paid directly to the Company-authorized program administrator, Trade Ally, or Customer upon verification that the energy efficiency measure(s) have been installed. All project costs above the incentive amount shall be the responsibility of the Customer and shall be paid based upon payment terms arranged between Customer and program administrator (T) (T) (T)

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or Trade Ally. (T)

PROGRAM DESCRIPTION (Contd.)

Participating customers agree to allow both Duke Energy Kentucky and the Company- authorized vendor(s) the right of ingress and egress to the Customer's premises at all reasonable hours for the purpose of pre-installation and/or post-installation inspection of the project to verify installation.

SERVICE REGULATIONS

The provisions contained in this tariff sheet do not supersede or replace any of the charges and terms contained in the standard base rate and rider tariff sheets. The standard base rate and rider charges apply to all customers.

The supplying of, and billing for, service and all conditions applying thereto, are subject to the jurisdiction of the Kentucky Public Service Commission, and to Company's Service Regulations currently in effect, as filed with the Kentucky Public Service Commission, as approved by law.

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BUSINESS ENERGY SAVER PROGRAM (T)

APPLICABILITY

The program is available to existing Duke Energy Kentucky non-residential customer accounts who qualify. Where the customer is not the owner of the property, the owner must give satisfactory consent for the customer to participate in this program. (T) (T) (T)

PROGRAM DESCRIPTION

The Small Business Energy Saver (SBES) is available to non-residential customer accounts with an actual average annual electric demand of 180 kilowatts or less. (SBES) facilitates the installation of high efficiency equipment in existing small non-residential facilities. SBES is designed to target the small non-residential customer segment using the direct install program model which makes the energy efficiency upgrade process as streamlined and convenient as possible. (T) (T) (T)

SBES will provide free, no-obligation energy assessments of qualifying non-residential customer facilities which result in recommendations of energy efficiency measures to be installed at the facility along with the projected energy savings, costs of all materials and installation, and the upfront incentive amount from Duke Energy Kentucky. Upon receiving the results of the assessment, if the customer chooses to move forward, the customer makes the final determination of project scope prior to installation. Duke Energy Kentucky then provides upfront incentives to discount the installation costs of select energy efficiency improvements in lighting; process; refrigeration; and heating ventilation and air conditioning.

The SBES program incentives are calculated per project, based upon the deemed estimated energy savings of the energy-efficiency improvements and the conditions found within the customer's facility. Duke Energy Kentucky may provide an upfront customer incentive for up to 80 percent of the total cost of installed measures. Incentives are provided based on the Duke Energy Kentucky's cost-effectiveness modeling to ensure cost-effectiveness over the life of the measure. (T)

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