COMMONWEALTH OF KENTUCKY

BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

THE APPLICATION OF DUKE ENERGY KENTUCKY, INC. TO AMEND ITS DEMAND SIDE MANAGEMENT PROGRAMS	))))	Case No. 2022-00251

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, the Commission's April 11, 2013, Order in Case No. 2012-00495,[1] and other applicable law, and does hereby request the Commission to approve an amendment to its Demand Side Management (DSM) programs. In support of its Application, Duke Energy Kentucky respectfully states as follows:

Introduction

1. Pursuant to 807 KAR 5:001, Section 14(2), Duke Energy Kentucky is a Kentucky corporation, originally incorporated on March 20, 1901, is in good standing and, as a utility, as that term is defined in KRS 278.010(3), is subject to the Commission's jurisdiction. 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

[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) (April 11, 2013).

Kentucky. A copy of its articles of incorporation is on file with the Commission in Case No. 2013-00097.

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 demand side management 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 an application requesting program expansion(s) and to include: (1) an Appendix A, setting forth the Cost Effectiveness Test Results of all DSM programs with budget changes; (2) an Appendix B, 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, Demand Side Management rate, for both electric and natural gas customers, Appendix C, by August 15, annually.[2]

4. In this proceeding, there are no changes to cost effectiveness, program costs, lost revenues, or shared savings, as the Company is not requesting a change in the current approved budget for January – June 2023. Therefore, updated appendices A, B, and C, as defined above, are not included in this application. The appendices filed in Case No. 2021-00424 are still current and are being included in this application for reference purposes.

[2] *See* Order, para. 4.

Current DSM Programs

5. 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 reduction (DR) programs, having offered such programs since the mid-1990's. Its existing portfolio of DSM programs was approved by the Commission in Case No. 2021-00424,[3] by Order dated December 27, 2021. This current portfolio of programs are as follows:

- Program 1: Low Income 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: Smart $aver® Prescriptive Program
- Program 6: Smart $aver® Custom Program
- Program 7: Power Manager® Program
- Program 8: PowerShare®
- Program 9: Low Income Neighborhood
- Program 10: My Home Energy Report
- Program 11: Non-Residential Small Business Energy Saver Program

[3] *In the Matter of the Electronic Annual Cost Recovery Filing for Demand Side Management by Duke Energy Kentucky, Inc.*, Case No. 2021-00424, Order (December 27, 2021).

- Program 12: Non-Residential Pay for Performance[4]
- Program 13: Peak Time Rebate Pilot Program[5]

6. The Company is proposing programmatic changes in this year's annual amendment filing, but is not proposing any change to the current approved budget:

- This Application is providing an update to respond to market conditions and enhance the robustness of the following:
  - Residential Smart $aver®
  - Peak Time Rebate

7. The Residential Collaborative[6] and the Commercial and Industrial Collaborative[7] have received the Company's proposed changes and had the opportunity to provide comments. A meeting with the Collaborative was held on July 15, 2022, to discuss the updates included in this filing.

Amendments to Existing Programs

8. Duke Energy Kentucky would like to provide an update about SEER baseline increases for certain HVAC measures within the Residential Smart $aver® Energy Efficiency Residences program.

9. Beginning in 2023, all residential central air conditioners and air source heat pump systems will be required to meet new minimum energy efficiency standards of no less

[4] Marketed as Smart $aver® Performance
[5] Approved in Case No. 2019-00277.
[6] The Residential Collaborative members receiving the information: Larry Cook, John Horne and Michael West (Office of the Kentucky Attorney General), Jock Pitts (People Working Cooperatively), Catrena Bowman-Thomas and Brandon Holmes (Northern Kentucky Community Action Commission), Laura Pleiman (Boone County), Peter Nienaber (Northern Kentucky Legal Aid), Kenya Stump (Kentucky Energy and Environment Cabinet), and Tim Duff and Trisha Haemmerle (Duke Energy).
[7] The Commercial & Industrial Collaborative members receiving the information: Larry Cook, John Horne and Michael West (Office of the Kentucky Attorney General), Jock Pitts (People Working Cooperatively), Kenya Stump (Kentucky Energy and Environment Cabinet), Chris Baker (Kenton County Schools), and Tim Duff and Trisha Haemmerle (Duke Energy).

than 15 SEER in the southeast including the state of Kentucky. In addition, the new standards require an increase in the heating efficiency of air source heat pumps heating seasonal performance factor (HSPF). The minimum HSPF will be 8.8 HSPF compared with the 8.2 HSPF required by the current standard which went into effect in 2015.

10. Due to this increase in baseline, the program is working with a third party consultant to deliver models with updated electric energy and demand savings estimates for our current HVAC replacement measures, duct sealing, and smart thermostats. These models will use energy usage data (*i.e.*, billing data), housing stock characteristics, and other resources provided to define typical baseline housing characteristics for each model. The program will use these models to simulate baseline and efficient energy usage and impacts will be calculated as the difference between the energy usage of the baseline and efficient cases. Modeling deliverables and measure development are expected to be completed by September 2022.

11. The Company is not requesting a change in the current approved budget for January – June 2023. The forecasted budget for July 2023 – June 2024 to accommodate the baseline increases will be reflected in the annual cost recovery filing for demand side management filed in November.

12. The Peak Time Rebate (PTR) pilot program offers participating customers the opportunity to lower their electric bill by reducing their electric usage during Company-designated peak load periods known as Critical Peak Events (CPE). The Company has branded the program to customers under the name of Peak Time Credits and describes CPEs to participants as peak day events. The pilot program was launched on July 27, 2020, and has now completed the 2-year pilot period. However, the pilot is designed to continue

until the Company requests a final disposition of the pilot program and receives approval from the Commission. In this filing, the Company completes all pilot commitments, submits Resource Innovations'[8] EM&V report (Appendix E - Peak Time Rebate pilot program), provides additional pilot information in the Company's EM&V Companion report (Appendix F), and requests termination of the original pilot group. Approval of termination of the original pilot group will conclude the original pilot.

13. The Company recognizes that the PTR Pilot program currently has a research extension for the Summer of 2022. This research extension is evaluating the difference in load impacts between a credit of $0.60 / kWh reduced and a credit of $1.20 / kWh reduced. The EM&V results of this pilot extension will not be available until late 2022 or early 2023 and the EM&V report will be filed in the August 2023 amendment filing.

14. Given the Commission's guidance in past proceedings related to programs with low cost-effectiveness scores, the Company proposes to terminate the original group pilot. The Company will evaluate the results from the Summer 2022 pilot research extension when available (*i.e.*, December 2022 or January 2023). In addition, the Company will consider how PTR and other time-differentiated rates might be elements of a broader effort to effectively shape and reduce peak load. New considerations will be shared at annual meetings of the DSM collaborative. The Company is also currently evaluating a PTR research proposal from ESource to assist with investigating ways to effectively offer time differentiated rates that leverage AMI data. The Company will provide additional information on the potential use of PTR in a future DSM Amendment Filing or a future

[8] Formerly Nexant

rate case.

15. Pursuant to KRS 278.285(1)(b) and the Commission's Order, Appendix A typically includes the Cost Effectiveness Test Results. However; since there are no requests for budget changes, the Cost Effectiveness Test Results have not changed from the current scores that were filed in Case No. 2021-00424.

16. Pursuant to KRS 278.285(1)(c) and the Commission's Order, Appendix B typically 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). However; since there are no requests for budget changes, the calculations to recover program costs, lost revenues, and and shared savings have not changed from the current costs that were filed in Case No. 2021-00424.

17. A signed and dated (November 15, 2021) Rider DSMR, Sheet No. 78 Demand Side Management Rider for electric customers is attached hereto as Appendix C. This is simply the current approved sheet; no change to the Rider DSMR rate is being proposed in this Application.

18. Pursuant to KRS 278.285(1)(c) and the Commission's Order, the Company is filing program evaluations within this application. The following evaluations are included in Appendices D - G: Appendix D: Evaluation, Measurement, and Verification Schedule; Appendix E: Peak Time Credit Pilot Evaluation; Appendix F: Peak Time Credit Company EM&V Companion Report, Appendix G: Smart Saver® Non-Residential Custom Program Evaluation.

WHEREFORE, Duke Energy Kentucky respectfully requests that the Commission grant the relief requested herein.

Respectfully submitted,

/s/Larisa Vaysman

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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, 2022; 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.[9]

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

Appendix A
Cost Effectiveness Test Results

Program Name		UCT	TRC	RIM	PCT
Residential Programs					
Low Income Neighborhood		0.00	0.00	0.00	
Low Income Services		0.21	0.26	0.16	2.49
My Home Energy Report		2.60	2.60	0.66	
Residential Energy Assessments		2.04	1.97	0.52	36.29
Residential Smart $aver®		1.08	0.73	0.41	1.96
Power Manager®		3.14	4.77	3.14	
Peak Time Rebate Pilot Program		0.14	0.15	0.14	
Total		**1.36**	**1.25**	**0.68**	**2.61**
Non-Residential Programs					
Small Business Energy Saver		1.99	1.52	0.61	2.88
Smart $aver® Custom		0.50	0.45	0.31	3.66
Smart $aver® Prescriptive		3.36	2.65	0.68	4.90
Power Manager® for Business		4.40	21.85	4.40	
PowerShare®		2.63	8.79	2.63	
Total		**2.54**	**2.56**	**0.82**	**4.33**
Overall Portfolio Total		**1.95**	**1.87**	**0.76**	**3.54**

Kentucky DSM Rider

Comparison of Revenue Requirement to Rider Recovery

Residential Programs	(1) Projected Program Costs 7/2020 to 6/2021 (A)	(2) Projected Lost Revenues 7/2020 to 6/2021 (A)	(3) Projected Shared Savings 7/2020 to 6/2021 (A)	(4) Program Expenditures 7/2020 to 6/2021 (B)	(5) Program Expenditures (C) Gas	(5) Program Expenditures (C) Electric	(6) Lost Revenues 7/2020 to 6/2021 (B)	(7) Shared Savings 7/2020 to 6/2021 (B)	(8) 2020 Reconciliation Gas (D)	(8) 2020 Reconciliation Electric (E)	(9) Rider Collection (F) Gas	(9) Rider Collection (F) Electric	(10) (Over)/Under Collection Gas (G)	(10) (Over)/Under Collection Electric (H)
Low Income Neighborhood	$ 306,300	$ 3,758	$ (10,254)	$ 31,189	$ -	$ 31,189	$ -	$ (3,119)						
Low Income Services	$ 450,263	$ 1,662	$ (18,999)	$ 369,712	$ 147,287	$ 222,425	$ 1,013	$ (27,001)						
My Home Energy Report	$ 171,457	$ 91	$ 6,071	$ 52,775	$ -	$ 52,775	$ 21,185	$ 8,468						
Residential Energy Assessments	$ 272,353	$ 8,060	$ 19,308	$ 252,862	$ -	$ 252,862	$ 4,255	$ 19,283						
Residential Smart $aver®	$ 905,354	$ 10,949	$ 62,074	$ 1,054,468	$ -	$ 1,054,468	$ 14,088	$ 8,840						
Power Manager®	$ 585,261	$ -	$ 131,900	$ 554,581	$ -	$ 554,581	$ -	$ 115,158						
Peak Time Rebate Pilot Program	$ 377,189	$ -	$ -	$ 254,720	$ -	$ 254,720	$ -							
Revenues collected											$1,930,554	($3,618,453)		
Total	$ 3,068,178	$ 24,520	$ 190,100	$ 2,570,307	$ 147,287	$ 2,423,020	$ 40,540	$ 121,630	$ 2,532,504	$ (122,563)	$ 1,930,554	$ (3,618,453)	$ 749,237	$ 6,081,080

(A) Amounts identified in report filed in Case No. 2018-00370
(B) Actual program expenditures, lost revenues (for this period and from prior period DSM measure installations), and shared savings for the period July 1, 2020 through June 30, 2021.
(C) Allocation of program expenditures to gas and electric in accordance with the Commission's Order in Case No. 2014-00388.
(D) Recovery allowed in accordance with the Commission's Order in Case No. 2012-00085.
(E) Recovery allowed in accordance with the Commission's Order in Case No. 2012-00085.
(F) Revenues collected through the DSM Rider between July 1, 2020 and June 30, 2021.
(G) Column (5) + Column (9) - Column(11).
(H) Column (6) + Column (7) + Column (8) + Column (10) - Column(12).

Commercial Programs	(1) Projected Program Costs 7/2020 to 6/2021 (A)	(2) Projected Lost Revenues 7/2020 to 6/2021 (A)	(3) Projected Shared Savings 7/2020 to 6/2021 (A)	(4) Program Expenditures 7/2020 to 6/2021 (B)	(5) Lost Revenues 7/2020 to 6/2021 (B)	(6) Shared Savings 7/2020 to 6/2021 (B)	(7) 2020 Reconciliation (C)	(8) Rider Collection (D)	(9) (Over)/Under Collection (E)
Small Business Energy Saver	$ 763,524	$ 4,825	$ 123,224	$ 686,019	$ 22,427	$ 67,824			
Smart $aver® Custom	$ 707,158	$ 8,176	$ 241,184	$ 298,368	$ 1,235	$ (10,643)			
Smart $aver® Prescriptive	$ 548,785	$ 6,818	$ 85,745	$ 926,601	$ 22,478	$ 218,329			
Power Manager® for Business	$ -	$ -	$ -	$ 639	$ -	$ 217			
Total	$ 2,019,467	$ 19,819	$ 450,153	$ 1,911,627	$ 46,140	$ 275,727	$ (5,271,825)	$ 1,851,141	$ (4,889,472)
PowerShare®	$ 904,512	$ -	$ 147,510	$ 720,386	$ -	$ 117,598	$ (420,313)	$ 1,156,131	$ (738,460)

(A) Amounts identified in report filed in Case No. 2018-00370
(B) Actual program expenditures, lost revenues (for this period and from prior period DSM measure installations), and shared savings for the period July 1, 2020 through June 30, 2021.
(C) Recovery allowed in accordance with the Commission's Order in Case No. 2012-00085.
(D) Revenues collected through the DSM Rider between July 1, 2020 and June 30, 2021.
(E) Column (4) + Column (5) + Column (6) + Column (7) - Column (8)

2022-2023 Projected Program Costs, Lost Revenues, and Shared Savings

Residential Program Summary (A)

	Costs	Lost Revenues	Shared Savings	Total	Allocation of Costs (B) Electric	Allocation of Costs (B) Gas	Budget (Costs, Lost Revenues, & Shared Savings) Electric Costs	Budget (Costs, Lost Revenues, & Shared Savings) Electric	Budget (Costs, Lost Revenues, & Shared Savings) Gas Costs
Low Income Neighborhood	$ 503,214	$ 27,702	$ (20,137)	$ 510,779	100.0%	0.0%	$ 503,214	$ 510,779	$ -
Low Income Services	$ 698,215	$ 26,554	$ (26,796)	$ 697,973	73.1%	26.9%	$ 510,624	$ 510,383	$ 187,590
My Home Energy Report	$ 78,224	$ 83,976	$ 6,620	$ 168,820	100.0%	0.0%	$ 78,224	$ 168,820	$ -
Residential Energy Assessments	$ 284,858	$ 69,660	$ 9,820	$ 364,338	100.0%	0.0%	$ 284,858	$ 364,338	$ -
Residential Smart $aver®	$ 1,192,589	$ 240,313	$ 1,918	$ 1,434,820	100.0%	0.0%	$ 1,192,589	$ 1,434,820	$ -
Power Manager®	$ 855,519	$ -	$ 116,813	$ 972,332	100.0%	0.0%	$ 855,519	$ 972,332	$ -
Peak Time Rebate Pilot Program	$ 216,257	$ -	$ -	$ 216,257	100.0%	0.0%	$ 216,257	$ 216,257	$ -
Total Costs, Net Lost Revenues, Shared Savings	$ 3,828,877	$ 448,205	$ 88,239	$ 4,365,321			$ 3,641,287	$ 4,177,730	$ 187,590

NonResidential Program Summary (A)

	Costs	Lost Revenues	Shared Savings	Total	Allocation of Costs (B) Electric	Allocation of Costs (B) Gas	Budget (Costs, Lost Revenues, & Shared Savings) Electric Costs	Budget (Costs, Lost Revenues, & Shared Savings) Electric	Budget (Costs, Lost Revenues, & Shared Savings) Gas
Small Business Energy Saver	$ 771,723	$ 273,455	$ 70,371	$ 1,115,548	100.0%	0.0%	$ 771,723	$ 1,115,548	NA
Smart $aver® Non-Residential	$ 1,218,433	$ 527,401	$ 261,716	$ 2,007,549	100.0%	0.0%	$ 1,218,433	$ 2,007,549	NA
PowerShare®	$ 851,383	$ -	$ 67,100	$ 918,484	100.0%	0.0%	$ 851,383	$ 918,484	NA
Total Costs, Net Lost Revenues, Shared Savings	$ 2,841,540	$ 800,855	$ 399,187	$ 4,041,581			$ 2,841,540	$ 4,041,581	NA
Total Program	$ 6,670,417	$ 1,249,060	$ 487,425	$ 8,406,902					

(A) Costs, Lost Revenues (for this period and from prior period DSM measure installations), and Shared Savings for Year 9 of portfolio.
(B) Allocation of program expenditures to gas and electric in accordance with the Commission's Order in Case No. 2014-00388.
(C) Smart $aver® Prescriptive consists of the following technologies: Energy Efficient Food Service Projects, HVAC, Lighting, IT, Pumps and Motors, and Process Equipment.

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

July 2022 to June 2023

	Program Costs (A)
Electric Rider DSM	
Residential Rate RS	$ 4,177,730
Distribution Level Rates Part A DS, DP, DT, GS-FL, EH & SP	$ 3,123,098
Transmission Level Rates & Distribution Level Rates Part B	$ 918,484
Gas Rider DSM	
Residential Rate RS	$ 187,590

(A) See Appendix B, page 2 of 7

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

Year	July 2022 - June 2023
Projected Annual Electric Sales kWH	
Rate RS	1,482,230,250
Rates DS, DP, DT, GS-FL, EH, & SP	2,334,245,150
Rates DS, DP, DT, GS-FL, EH, SP, & TT	2,596,106,150
Projected Annual Gas Sales CCF	
Rate RS	63,944,369

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

July 2020 to June 2021

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	$ 6,160,135	$ 4,177,730	$ 10,337,865	1,482,230,250	kWh	$ 0.006975	$/kWh
Distribution Level Rates Part A							
DS, DP, DT, GS-FL, EH & SP	$ (4,953,036)	$ 3,123,098	$ (1,829,938)	2,334,245,150	kWh	$ (0.000784)	$/kWh
Transmission Level Rates & Distribution Level Rates Part B							
TT	$ (748,060)	$ 918,484	$ 170,424	2,596,106,150	kWh	$ 0.000066	$/kWh
Distribution Level Rates Total							
DS, DP, DT, GS-FL, EH & SP						$ (0.000718)	$/kWh
Gas Rider DSM							
Residential Rate RS	$ 758,977	$ 187,590	$ 946,567	63,944,369	CCF	$ 0.014803	$/CCF
Total Rider Recovery			$ 9,624,918				

(A) (Over)/Under of Appendix B page 1 multiplied by the average three-month commercial paper rate for 2019 to include interest on over or under-recovery in accordance with the Commission's order in Case No. 95-312. Value is: **1.013000**
(B) Appendix B, page 2.
(C) Appendix B, page 4.

Summary of Load Impacts July 2020 Through June 2021 (1)

Residential Programs	kWh	% of Total Res Sales	ccf	% of Total Res Sales	Allocation Factors based on July 2020-June 2021 Elec % of Total % of Sales	Gas % of Total % of Sales
Low Income Neighborhood	0	0.0000%	-	0.0000%	100%	0%
Low Income Services	129,702	0.0085%	3,415	0.0056%	60%	40%
My Home Energy Report	1,594,319	0.1043%	-	0.0000%	100%	0%
Residential Energy Assessments	557,051	0.0365%	-	0.0000%	100%	0%
Residential Smart $aver®	2,002,835	0.1311%	-	0.0000%	100%	0%
Power Manager®	-	0.0000%	-		100%	0%
Peak Time Rebate Pilot Program	-	0.0000%	-		100%	0%
Total Residential	4,283,907	0.2804%	3,415	0.0056%		
Total Residential (Rate RS) Sales For July 2020 Through June 2021	1,527,864,819	100%	60,754,974	100%		

(1) Load Impacts Net of Free Riders at Meter

Summary of Load Impacts July 2022 Through June 2023 (1)

Residential Programs	kWh	% of Total Res Sales	ccf	% of Total Res Sales	Allocation Factors Projected Elec % of Total Sales	Gas % of Total Sales
Low Income Neighborhood	362,459	0.0237%	-	0.0000%	100%	0%
Low Income Services	268,103	0.0175%	3,917	0.0064%	73%	27%
My Home Energy Report	1,660,636	0.1087%	-	0.0000%	100%	0%
Residential Energy Assessments	730,111	0.0478%	-	0.0000%	100%	0%
Residential Smart $aver®	2,245,994	0.1045%	-	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	5,267,302	0.3022%	3,917	0.0064%		
Total Residential (Rate RS) Sales Projected	1,482,230,250	100%	63,944,369	100%		

(1)Load Impacts Net of Free Riders at Meter

Duke Energy Kentucky
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Erlanger, KY 41018

KY.P.S.C. Electric No. 2
Thirty-First Revised Sheet No. 78
Cancels and Supersedes
Thirtieth Revised Sheet No. 78
Page 1 of 1

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 $0.006975 per kilowatt-hour. (I)

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 ($0.000718) per kilowatt-hour. (I)

The DSMR to be applied for transmission service customer bills is $0.000066 per kilowatt-hour. (R)

Issued by authority of an Order by the Kentucky Public Service Commission dated ____ in Case No. 2021-00424.

Issued: November 15, 2021
Effective: December 15, 2021
Issued by Amy B. Spiller, President /s/ Amy B. Spiller

Status Update for Duke Energy Kentucky Energy Efficiency and Demand Response Programs; 2022-2024

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

Residential Customer Programs	Program/Measure	Last Evaluation completion	Next Evaluation ==>	Q1 2022	Q2 2022	Q3 2022	Q4 2022	Q1 2023	Q2 2023	Q3 2023	Q4 2023
Low Income Neighborhood	Neighborhood	2/27/2015		M&V	M&V	M&V	Report*				
Low Income Services	Refrigerator Replace		TBD								
	Weatherization/Payment Plus	7/31/2013									
My Home Energy Report	MyHER	2/1/2014					M&V	M&V	Report		
Residential Energy Assessments	HEHC	8/7/2020						M&V	M&V	M&V	M&V
Residential Smart Saver®	HVAC	9/21/2015		M&V	M&V	M&V	Report				
	Specialty Bulbs/Online Savings Store	6/22/2015		M&V	M&V	Report					
	Water Measures	9/25/2020									
	Multi-Family	12/26/2019						M&V	M&V	M&V	M&V
Power Manager		8/13/2020			M&V	M&V	M&V	M&V	Report		
Peak Time Rebate Pilot	Peak Time Rebate	3/29/2022		Report	M&V	M&V	Report				

Non-Residential Customer Programs	Program/Measure			Q1 2022	Q2 2022	Q3 2022	Q4 2022	Q1 2023	Q2 2023	Q3 2023	Q4 2023
Small Business Energy Saver		4/7/2017		M&V	M&V	Report					
Smart $aver® Non-Res, Custom		3/1/2016, 1/18/22		Report							
Smart $aver® Non-Res, Prescriptive		7/24/2019						M&V	M&V	M&V	M&V
PowerShare		2/14/2017					M&V	M&V	Report		
Pay For Performance		N/A	TBD								

[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.
* Postponed timing due to pandemic program suspension

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

Peak Time Credit Pilot Evaluation

Submitted to Duke Energy Kentucky

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1 Executive Summary

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

The pilot was designed to include eight summer CPEs (May to October), two winter CPEs (November to April), and two flexible CPEs (January – December). Summer events were from 3 PM to 7 PM, and winter events were from 6 AM to 10 AM. CPE notifications were generally provided to customers on the day prior to the event, but events could be called with as little as one hour notification. The Company agreed to implement at most one event per year with less than day prior notice. Baseline usage estimates were determined from the usage history, and for any net reduction in usage as compared to the baseline usage that occurred during the CPE, each participant received a $0.60 cents/kWh credit. If no reduction occurred, the participant did not receive a credit, but was not penalized. Findings from the first three seasons of the Pilot are documented in this evaluation report. This report divides seasons as follows:

- Summer 2020 (August 2020 to October 2020)
- Winter 2021 (November 2020 through April 2021)
- Summer 2021 (May 2021 through October 2021)

1.1 Overall Findings

The Pilot evaluation has produced a large amount of information that can help guide decision making regarding future similar offerings to a broader population of customers. It is important to address that the Pilot was unavoidably conducted in the context of the global COVID-19 pandemic that began to impact North American economies in March 2020. Even in the pandemic, customers did respond to the incentive. That said, it is not possible to say if load impacts or other outcomes from the pilot would have been different without the influence of COVID-19.

The Order approving the Pilot and the associated Joint Stipulation and Recommendation document identified several research questions required to be addressed in the Pilot Evaluation. Table 1-1 provides a list of these research questions and associated findings from the evaluation. References to the relevant report sections are also included.

Table 1-1: Summary of Research Questions and Evaluation Findings

Research Question	Results
Was the marketing campaign successful?	Yes, the initial goal was to recruit 800 participants. In approximately two weeks, 899 participants enrolled (§4.3.1). The lack of any perceived downsides for participation was cited as an important factor by participants (§4.1.1).
What is the average kWh reduction (and estimated kW reduction) per participant, per event, broken down by summer events and winter events?	In Summer 2020, the average impact per participant during events was 0.38 kW, or 1.52 kWh[1] (§3.2.3). In Winter 2021, the average impact per participant was 0.12 kW, or 0.48 kWh (§3.2.2). In Summer 2021, the average impact per participant was 0.14 kW, or 0.56 kWh (§3.2.1).
On average, how many/what percentage of eligible participants earned a rebate, broken down by summer events and winter events?	In Summer 2020, an average of 562 out of 899 participants, or 63%, earned a rebate. In Winter 2021, an average of 417 out of 858 participants, or 49%, earned a rebate. In Summer 2021, an average of 430 out of 779 participants, or 55%, earned a rebate (§2.3).
Among participants who earned a rebate, what was the average rebate per participant per summer event? Per winter event?	Of participants that received a rebate, in Summer 2020, the average rebate earned per event was $1.88. In Winter 2021, the average rebate earned per event was $1.23. In Summer 2021, the average rebate earned per event was $1.52 (§2.3).
Did the chosen bill credit motivate behavior change?	Yes, customers showed significant responses to events in 2020 and 2021 (§3.2). In the marketing survey, a majority of participants responded that they strongly agree (49%) or agree (32%) that the incentive is enough to motivate them to reduce electric usage during events (§4.1.1).
Were customers properly identified for the bill credit and paid accordingly?	Yes, the bill credit amounts were consistent with the agreed upon baseline calculation methodology specified in AG-DR-01-010(a) (§4.4).
Were customers effectively educated and motivated to use the program?	Yes, when asked to rate their agreement with the statement that Duke Energy provided helpful information on how to respond to Peak Days, participants gave an average rating of 9.4 and 9.2 out of 10 in the winter (§4.2.1) and summer (§4.2.2) post-event surveys, respectively.
Did event notifications reach the customer such that they	Yes, when asked to rate their agreement with the statement that Duke Energy notified them through their preferred communication channel on Peak Days, participants gave an

[1] The kWh is the cumulative value for the 4-hour event.

Research Question	Results
could effectively respond to the event?	average rating of 9.7 out of 10 in both the winter (§4.2.1) and summer (§4.2.2) post-event surveys.
What are the most common actions participants are taking to reduce usage during: 1) summer events; and 2) winter events?	In both the summer (§4.2.2) and winter (§4.2.1) post-event surveys, the most commonly reported action taken by participants was adjusting their thermostat to reduce cooling/heating load (over 80% of respondents in both seasons). The majority of participants also reported turning off lights in unoccupied rooms.
What are the most common reasons participants are giving for not reducing usage during summer events? During winter events?	When asked about factors making it difficult to reduce usage during Peak Days, respondents in the summer post-event survey in June 2021 generally indicated that they were already doing all they could (§4.2.2). Respondents in the winter survey, which took place in February 2021, cited working from home making it difficult to reduce electric usage during Peak Day events (§4.2.1).
How satisfied are participants with the peak-time rebate program?	Participants were generally satisfied with the information provided by Duke Energy and the program as a whole, rating their satisfaction as 9.0 and 8.2 out of 10 on average in the winter (§4.2.1) and summer (§4.2.2) post-event surveys, respectively .
What are the participants' most frequently identified program improvement recommendations?	Approximately one-third of respondents who provided recommendations for the program requested text message alerts and more time to prepare for the events (§4.2.1and §4.2.2).
What reasonable enhancements, if any, could be made cost effectively to continue the PTR Program?	Overall, the load impact results from the Pilot were comparable to impacts from other opt-in PTR programs. Should Duke Energy Kentucky decide to expand the PTC Pilot to a broader population, it is recommended that enrollment remain on an opt-in basis due to the risk of free ridership under a default enrollment strategy (§4.5.4).

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

1.1.1 Load Impacts

Customers produced significant responses to events throughout the past three event seasons Summer 2021, Winter 2021, and Summer 2020. In Summer 2021, sixteen events were called between 3 PM – 7 PM.[2] Winter 2021 had two events called between 6 AM – 10 AM and Summer 2020 experienced two events called between 3 PM – 7 PM. Table 1-2 displays average hourly load impacts per customer, by event season. Average hourly impacts per customer during the Summer 2021 events were 0.14 kW or 6.09% while Summer 2020 impacts were much larger at 0.38 kW or 15.37%. Average hourly impacts per customer across the two Winter 2021 events were 0.12 kW or 5.64%.

Table 1-2: Summary of Average Hourly Load Impacts by Season

Season	Load w/o DR* (kW)	Load w/ DR (kW)	Impact (kW)	Impact (%)
Summer 2021	2.37	2.22	0.14	6.09%
Winter 2021	2.04	1.93	0.12	5.64%
Summer 2020	2.49	2.11	0.38	15.37%

*DR represents Demand Response, or a PTR event.

Key findings pertaining to load impacts from the Pilot include:

- Statistically significant load impacts were detected across all three event seasons and two program years, though impacts varied by season and customer type.
- Single-family customers provided higher average hourly load reductions than multi-family customers, and customers with electric heating provided higher load reductions than customers with gas heat across all season and program years evaluated.
- Single-family load impacts were highly seasonal, providing lower reductions to load in the winter and higher load reductions in the summer. Multi-family customer impacts remained more consistent across summer and winter events.
- The first two PTR pilot events in August 2020 produced load impacts 2.7 times higher than that of the subsequent summer. However, it is expected the impacts from the 2021 summer are more representative of typical load impacts.
- Notifying customers one-hour in advance of the event on June 18th 2021 instead of the night before did not appear to significantly affect the event's average hourly load impact.
- Overall, the load impact results from the Pilot were comparable to impacts from other opt-in PTR programs, as discussed in Section 4.5.3.

[2] Note that Summer 2021's events technically covered two program years, 8 Summer 2021 events occurred during the August 2020 – July 2021 program year, while 8 occurred during the August 2021- July 2022 program year.

1.1.2 Process Evaluation

Key findings and recommendations pertaining to the process evaluation include:

Motivation for Participation

- Program staff attributed the strong initial enrollment to the program having no downsides (penalties) and that the program rules are less complex than other rate programs.
- The most important reason provided by participants for joining the program was saving money on their electricity bill, with an average rating of 9.8 out of 10 on average.
- Of the non-participants who recalled the marketing materials, about half of them said they did not join the program because they felt the incentive to reduce electric usage was too low.

Incentive Amounts

- In the marketing survey, a majority of participants responded that they strongly agree (49%) or agree (32%) that the incentive of $0.60/kWh is enough to motivate them to reduce electric usage during events.
- Respondents to the post-event survey who recalled the event(s) occurring had an average bill credit of $1.54, while participants who did not recall the event(s) had an average bill credit of $0.55, showing that engaged participation resulted in much higher credits in percentage terms.
- The DEK Peak Time Credit program's incentive of $0.60/kWh is in the middle of the road compared to other utilities. Of the utilities included in the literature review, Ameren Illinois has the lowest incentive of $0.12/kWh, and a few different utilities had the highest incentive of $1.25/kWh.

Event Notifications

- Peak Time Credit participants rated the timeliness of the notification highly, with an average rating of 8.8 out of 10 on the winter post-event survey and an average of 9.1 out of 10 on the summer post-event survey.
- Participants overwhelmingly agreed with the statements saying that Duke Energy notified them through their preferred method, with an average rating of 9.7 out of 10 on both post-event surveys.
- Approximately one-third of respondents who provided recommendations for the program requested text message alerts and more time to prepare for the events. Duke Energy offers text message alerts but required pilot customers to setup this preference separately after the enrollment process. The Company discussed text message notifications as a potential improvement they can investigate should the program be commercialized, with the customer entering their event notification preference during the enrollment process rather than after the fact.

Event Response

- Eighty-two percent of the respondents in the winter post-event survey indicated that they were home during the preceding event, while 77% of the respondents in the summer post-event survey indicated they were home for the two preceding events.
- Most of the participants responded that they did take action to reduce electricity usage during the events (75% in the winter event and 81% in the summer events). In the winter event, participants who said they took action received an average bill credit of $2.08, compared to only $0.65 among customers who said they did not take action. In the summer events, participants who said they took action received an average bill credit of $0.98, opposed to only $0.53 among customers who said they did not take action. These differences within each season were statistically significant at the 90% confidence level.
- The most cited action taken during events was changing the temperature set point on the thermostat, with 82% of participants in the winter survey responding that they lowered the set point and 84% of participants in the summer survey responding that they raised the set point.
- Thirty percent of the respondents cited working from home making it difficult to reduce electric usage during Peak Day events in the winter. In the summer, only 22% of the customers in the summer survey said that working from home made it difficult to reduce electricity usage. This difference could reflect the changes in the COVID-19 situation between the winter survey period in February 2021 and the summer survey period in July 2021.

Program Satisfaction

- When asked how likely they would recommend the program to others, respondents in the winter survey gave an average rating of 8.4 out of 10 with a Net Promoter Score (NPS) of 46[3]. In the summer survey, respondents gave an average rating of 8.6 out of 10, with an NPS of 49, indicating that there are a much larger number of promoters that are happy with the program than detractors.
- Participants were generally satisfied with the information provided by Duke Energy and the program as a whole, rating their satisfaction as 9.0 and 8.2 out of 10 on average in the winter and summer surveys, respectively.
- Participants rate their lowest satisfaction with the bill credits that they earned from the program, rating their satisfaction a 6.8 out of 10.

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

2 Introduction

In the summer of 2020, Duke Energy Kentucky launched the “Peak Time Credit” Pilot, which offers customers the opportunity to lower their electric bill by reducing electric usage during Critical Peak Events (CPE). Designed for residential customers, the Pilot is an incentive-based demand response (DR) program based on a Peak Time Rebate (PTR) rate design. Findings from the first three seasons of the Pilot – August 2020 through August 2021 – are documented in this evaluation report. This report contains background information on the Pilot including the Pilot design and the evaluation methodology in addition to load impacts and process evaluation findings.

The load impact evaluation portion of the evaluation presents event-period load reductions for each event day, by season, and by customer segment. The process evaluation scope includes a marketing survey, post-event surveys for the summer and winter seasons, in-depth interviews with program staff, and a comparison with other PTR programs. Findings from the Pilot evaluation will be used to inform future decisions regarding the continuation of the current pilot or the potential for a broader rollout of a future peak time rebate program for all Duke Energy Kentucky customers with smart meters.

2.1 Summary of Pilot

The Pilot was approved by the Kentucky Public Service Commission on April 27, 2020 under Case Number 2019-00277. The pilot was to be implemented for two years, with an enrollment target of approximately 820 to begin the pilot. This target enrollment would allow for customer attrition with a target of 700 participants at the end of the Pilot. The Company was approved to exceed the 820 enrollment target by up to 100 participants. The participation target was established via a statistical power analysis and expected to be sufficient to obtain statistically significant load impacts for the duration of the Pilot. The Pilot was designed to include eight summer (May to October), two winter (November to April), and two flexible CPEs. Summer events were from 3 PM to 7 PM, and winter events were from 6 AM to 10 AM. Summer event criteria is any weekday, non-holiday where the temperature humidity index (THI) is expected to exceed 82, and winter event criteria is any weekday, non-holiday where the low THI goes below 0. Note that DEK expected to adjust these thresholds during the pilot to provide the 12 opportunities for customers to earn credits within each program year. CPE notifications were generally provided to customers on the day prior to the event, but events could be called with as little as one hour notification.

Baseline usage estimates were determined from the usage history, and for any net reduction in usage as compared to the baseline usage that occurred during the CPE, each participant received a $0.60 cents/kWh credit. If no reduction occurred, the participant did not receive a credit, but was not penalized. Customers who earned credits received email or text messages regarding earned credit amounts within five business days following each CPE during the term of the pilot.

2.2 Participant Summary

Duke Energy started recruitment in late July 2020 with a goal of 820 participants. Participants were recruited randomly from a list of eligible customers, which included those that were not enrolled on another demand response program and did not have a past due bill on their account. All program outreach was conducted through email marketing to reduce cost and ensure customers that enrolled would respond to email event notifications once the program began. The recruitment emails included general information about the program offering and a link to a webpage with further details and an enrollment form. Within about two weeks, 899 customers enrolled with an acquisition rate of 1.5%.

Table 2-1: Recruitment Summary

Recruitment Emails Sent	Enrollment Target	Customers Enrolled	Acquisition Rate
59,605	820	899	1.5%

Table 2-2 displays customer participation in DEK's PTR Pilot by dwelling and primary heating fuel type as of the Summer 2021 event season. Approximately 782 customers were enrolled* in the PTR Pilot program during the Summer 2021 event season. 75.5% of Pilot participants live in single-family residences, while more than 80% of customers had gas heating.[4]

Table 2-2: Counts by Customer Segment – Summer 2021

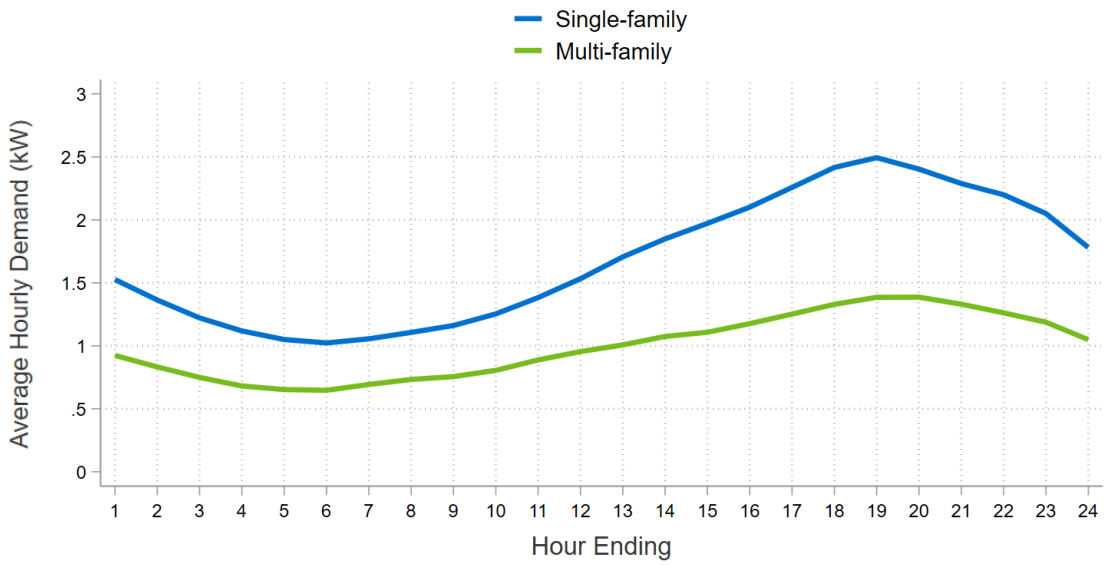
Segment	Participant Count	Percent
Residential Single-Family Combined	**590**	**75.5%**
Residential Single-Family (Electric Heat)	92	11.7%
Residential Single-Family (Gas Heat)	498	63.8%
Residential Multi-Family Combined	**192**	**24.5**
Residential Multi-Family (Electric Heat)	46	5.9%
Residential Multi-family (Gas Heat)	146	18.6%
Total	**782**	**100%**

*Participant counts reflect total participants enrolled at any point during the 2021 summer event season. One participant was marked gas heat, dwelling type unknown, and is therefore omitted from this table.

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

Figure 2-1 illustrates average hourly energy use during event-like days in Summer 2021. Average summer demand is separated by dwelling type, showing single and multi-family customers separately. Single-family customers have much higher loads than multi-family customers at all times of the day. Generally, multi-family customers' loads are flatter throughout the day. Both customer segments experience afternoon peaks during the summer season.

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



2.3 Event Summary

Table 2-3 provides a summary of the Summer 2021 event season. Over the course of the Summer 2021 season, sixteen events were called between 3 PM – 7 PM. Eight events were associated with the August 2020 – July 2021 program year, and eight events were associated with the August 2021 – July 2022 program year. The Summer 2021 season saw many more events than the Summer 2020 event season, which had only two events. The DEK PTR Pilot events were called on hot days. Daily minimum temperatures ranged from 64°F to 76°F, while daily maximum temperatures ranged from 84°F – 93°F. The Summer 2021 event season averaged about 774 customers, of which an average of 55% received a bill credit across the given events. The average bill credit across all events in the Summer 2021 season was $1.52.

Table 2-3: Summer 2021 Season Event Summary (3 PM – 7 PM Events)

Event Date	Event Participants	Number of Customers Receiving Credit	Percent Receiving Credit	Min Temp (°F)	Max Temp (°F)	Average Credit of those Receiving Credits
6/18/2021	797	556	70%	64	88	$1.57
6/28/2021	795	403	51%	72	91	$1.61
6/29/2021	795	382	48%	73	93	$1.61
7/72021	789	382	48%	69	88	$1.25
7/15/2021	785	426	54%	70	88	$1.26
7/20/2021	785	372	47%	67	85	$1.29
7/28/2021	781	495	63%	68	88	$1.48
7/29/2021	781	494	63%	71	88	$1.52
8/10/2021	774	596	77%	72	86	$2.31
8/11/2021	771	454	59%	75	92	$1.55
8/12/2021	771	435	56%	76	93	$1.64
8/23/2021	769	351	46%	70	91	$1.28
8/24/2021	769	340	44%	72	92	$1.32
8/25/2021	768	494	64%	72	84	$1.65
8/26/2021	768	328	43%	71	90	$1.48
8/27/2021	768	364	47%	71	90	$1.51
Average	**774**	**428**	**55%**	**71**	**89**	**$1.52**

*Note that events which took place between June 18th – July 29th occurred during the August 2020 – July 2021 Program Year, while events occurring August 10th – August 27th occurred during the August 2021 – July 2022 Program Year.

Table 2-4 provides a summary of the Winter 2021 event season. Over the course of the Winter 2021 season, two events were called between 6 AM – 10 AM. Minimum daily temperatures ranged from 17°F to 20°F, while maximum daily temperatures ranged from 32°F – 33°F. There were 858 participants during the Winter 2021 event season, and on average about half of them received a bill credit for a given event. Customers who received a bill credit had an average credit of about $1.23.

Table 2-4: Winter 2021 Season Event Summary (6 AM – 10 AM Events)

Event Date	Event Participants	Number of Customers **Receiving** Credit	Percent **Receiving** Credit	Min Temp (°F)	Max Temp (°F)	Average Credit of those Receiving Credits
1/29/2021	858	400	47%	17	33	$1.33
2/12/2021	857	434	51%	20	32	$1.12
Average	**858**	**417**	**49%**	**19**	**33**	**$1.23**

Table 2-5 provides a summary of the Summer 2020 event season. Over the course of the Summer 2020 season, two events were called between 3 PM – 7 PM. The DEK PTR Pilot events were called during hot days. Minimum daily temperatures ranged from 69°F to 72°F, while maximum daily temperatures ranged from 89°F – 90°F. There were 899 participants in both Summer 2020 events. About 63% of them received a bill credit across the two events, with an average amount of $1.88.

Table 2-5: Summer 2020 Season Event Summary (3 PM – 7 PM Events)

Event Date	Event Participants	Number of Customers Receiving Credit	Percent Receiving Credit	Min Temp (°F)	Max Temp (°F)	Average Credit of those Receiving Credits
8/25/2020	899	571	64%	72	90	$1.77
8/26/2020	899	552	61%	69	89	$1.99
Average	**899**	**562**	**63%**	**71**	**90**	**$1.88**

3 Load Impact Evaluation

One of the primary objectives of the PTR Pilot evaluation is to estimate the load reduction during the event days for PTR participants. This section summarizes the methodology used to estimate load impacts and the resulting load impacts for the program and for each dwelling and primary heating fuel type.

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

The estimated load impact averaged across all Pilot customers for the Summer 2021 season was 0.14 kW or 6.09%. Single-family customers had an average load impact of 0.15 kW (5.77%) while multi-family customers had an average load impact of 0.12 kW (7.89%) during the event hours of 3 PM to 7 PM. The average impact across all customer classes and all the Winter 2021 events from 6 AM to 10 AM was 0.12 kW and the average percent reduction was 5.64%.

3.1 Methodology

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

3.1.1 Control Group and Proxy Day Selection

Resource Innovations developed matched control groups via propensity score matching. A matched control group is the primary source for reference loads which are used to estimate impacts. The method used to assemble the matched control group is designed to ensure that the control group's load on event days is an accurate proxy for Pilot customer load, had an event not taken place. First, a pool of potential control customers was established. There were approximately 13,000 potential control customers chosen for the Pilot population of around 800

customers. The potential control customers were selected to have similar monthly usage, geographic locations, household size, and customer segments as the treatment customers.

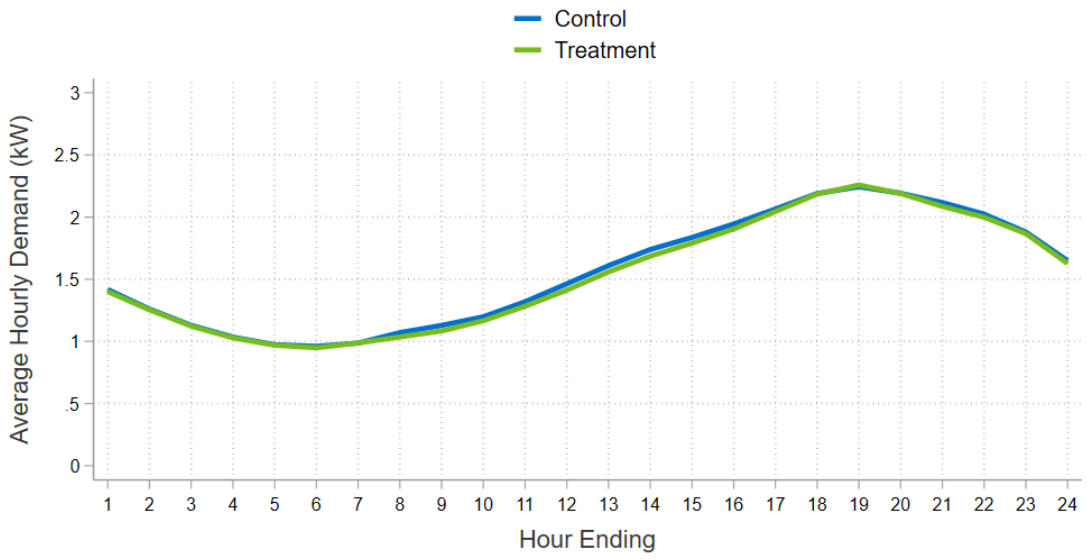
Then, the actual control group was selected using a propensity score matching model to find customers in the control group pool who had load shapes most similar to Pilot customers.

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

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

Figure 3-1 shows the Summer 2021 results of the matched control group for all treated customers. The load profiles compare control and treatment groups' use during the average proxy day.

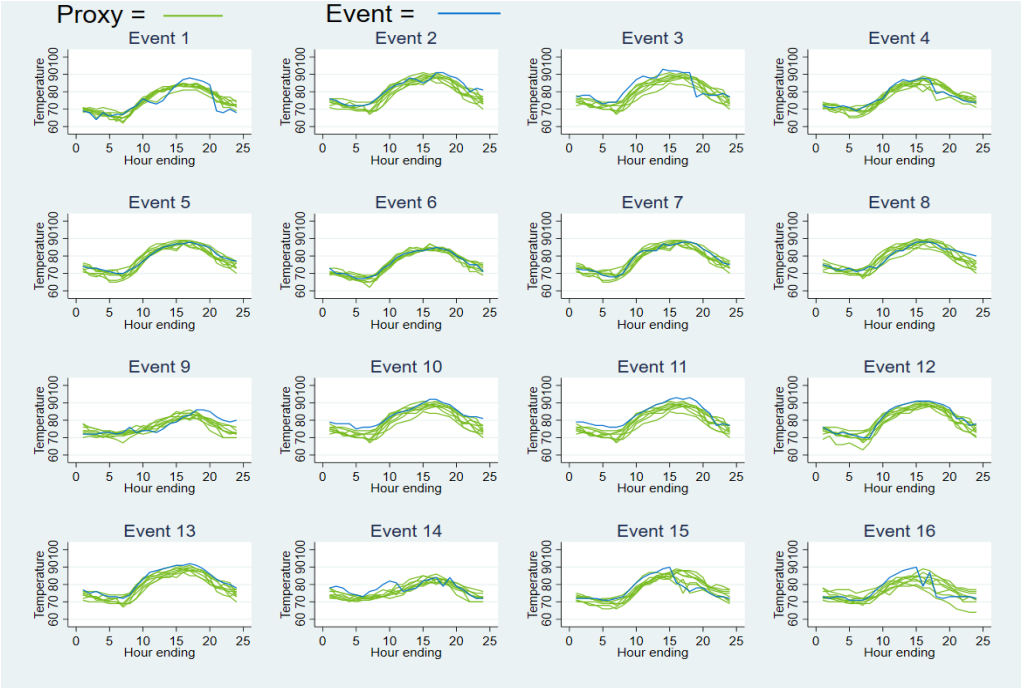
Figure 3-1: Average Hourly Demand (kW) for All Treatment and Control Customers on Proxy Days



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

Figure 3-2 displays hourly temperature for all sixteen Summer 2021 event days and each of their respective proxy days. Event temperature is displayed in blue while the proxy days' temperatures are in green.

Figure 3-2: Average Hourly Temperature (°F) on Event and Proxy Days



3.1.2 Load Impact Estimation

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

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

separately for each hour of the day and each of the four customer classes. This model specification is shown in Equation 3-1 below:

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

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

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

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

3.2 Event Impacts

3.2.1 Summer 2021 Season

Table 3-1 summarizes the estimated load impacts for each treatment group during the Summer 2021 season during the event hours of 3 PM – 7 PM. As discussed in Section 2, single-family and multi-family customers have very different load profiles. As a result, the load impacts from these two groups are also very different. Single-family customers have much higher loads than multi-family customers at all times of the day. Multi-family customers have a much flatter load shape compared to single-family customers but also peak during afternoon hours.

The kW load reductions were slightly larger for single-family customers (0.15 kW) than for multi-family customers (0.12 kW). However, the percent impact for single-family customers was 5.77% while the percent impact for multi-family customers was 7.89%. The impacts are more similar on a percent basis due to the significantly lower reference load for multi-family customers compared to the reference load for the single-family customers.

When comparing the customers in the two single-family customer classes, the percent load reductions and kW reductions varied. Single-family electric heat customers had lower reference loads but higher kW impact and percent impact than single-family gas heat customers. The same pattern persisted for multi-family customers, the electric heat customers had a much

higher kW impact and percent impact than those of the gas heat customers, but slightly lower reference loads.

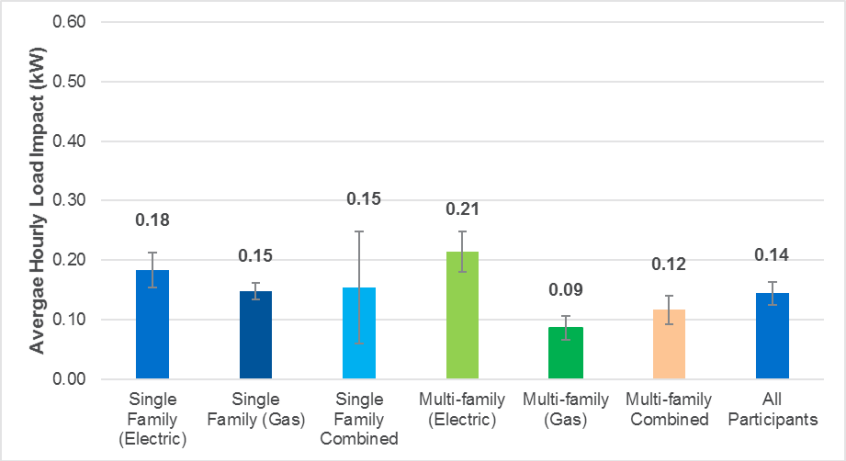
The average impact across all customer classes and all the Summer 2021 events was 0.14 kW and the average percent reduction was 6.09%. Load impact from the 2020 summer were considerably larger than the impacts observed in the summer of 2021. It is likely that a combination of factors led to the large impacts in 2020, notably the Pilot was new to customers, and more customers were presumably at home due to the COVID 19 pandemic. The impacts observed in 2021 were more in line with impacts seen from similar PTR programs at other utilities and are more in line with what the Resource Innovations team would expect to see in future years.

Table 3-1: Average Load Reduction per Customer from 3 PM to 7 PM (Summer 2021)

Customer Segment	Load w/o DR (kW)	Load w/ DR (kW)	Impact (kW)	Impact (%)
Residential Single Family Combined	**2.66**	**2.51**	**0.15**	**5.77%**
Residential Single Family (Electric Heat)	2.41	2.23	0.18	7.62%
Residential Single Family (Gas Heat)	2.70	2.56	0.15	5.46%
Residential Multi-family Combined	**1.48**	**1.36**	**0.12**	**7.89%**
Residential Multi-family (Electric Heat)	1.45	1.24	0.21	14.72%
Residential Multi-family (Gas Heat)	1.48	1.40	0.09	5.80%
All Events Participants	**2.37**	**2.22**	**0.14**	**6.09%**

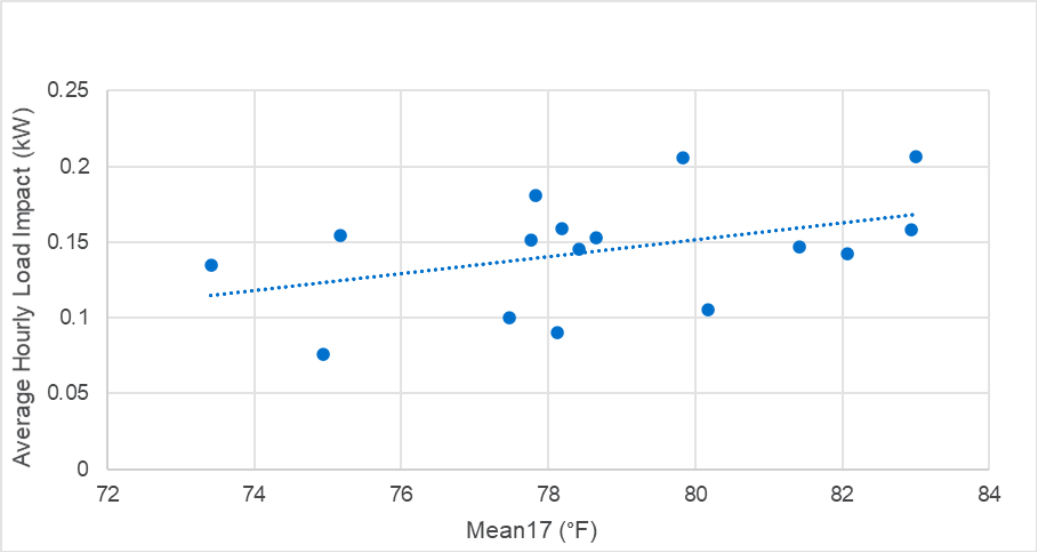
Figure 3-3 displays the magnitude and statistical significance of each of the four customer classes, as well as that of all participants, all single-family, and all multi-family groups. The 90% confidence interval is displayed for each group of customers as an error bar over their impact. If the error bar crosses zero, the impact is not statistically significant from zero at the 90% level of confidence. All customer classes display statistical significance.

Figure 3-3: Average Hourly Load Impact (kW) by Customer Class (Summer 2021)



To examine how event day temperature may impact load impacts, Figure 3-4 compares the kW impacts from each of the sixteen event days with the weather variable *mean17*, which represents the average hourly temperature between midnight and 5 PM. This variable captures the heat buildup overnight and is strongly correlated with weather-sensitive premise-level consumption data. Therefore, it is helpful in predicting premise-level energy usage, particularly for customers with air conditioning. This figure shows that Summer 2021 events were generally called on warm days but also included some hotter days. The figure displays a weak but noticeable relationship between *mean17* temperature buildup on event days and load impacts. Impacts for each of the events conducted in Summer 2021 are covered in greater detail in the following section.

Figure 3-4: Comparison of kW Impact and Average Hourly Temperature (°F) between Midnight and 5 PM (Mean17)



Load Impacts by Event Day

Figure 3-5 and Figure 3-6 show the average hourly load impact for single-family and multi-family customers for each event. The events are broken into two figures, since sixteen events did not fit cleanly into a single figure. Error bars represent the 90% confidence interval. When the grey bars cross zero on the y-axis, the results are not statistically different from zero with 90% confidence, and therefore are insignificant. The third event (6/29/2021) had the largest average hourly impact for single-family customers (0.23 kW), while the thirteenth event (8/24/2021) had the largest average impacts for multi-family customers (0.18 kW). The ninth event (8/10/2021) had the smallest average hourly impact for single-family customers (0.08 kW) and the eighth event (7/29/2021) had the smallest hourly impact for multi-family customers (-0.01 kW), but the multi-family results were not statistically significant. The eleventh event on August 12 was the hottest event with an average event-hour temperature of 92.25 degrees. The August 12 event had the third highest single-family impacts but did not perform strongly in the multi-family segment. Multi-family impacts on the four events occurring between July 29th and August 12th were not significant.

Figure 3-5: Average Hourly Load Impact per Customer, June - July Events

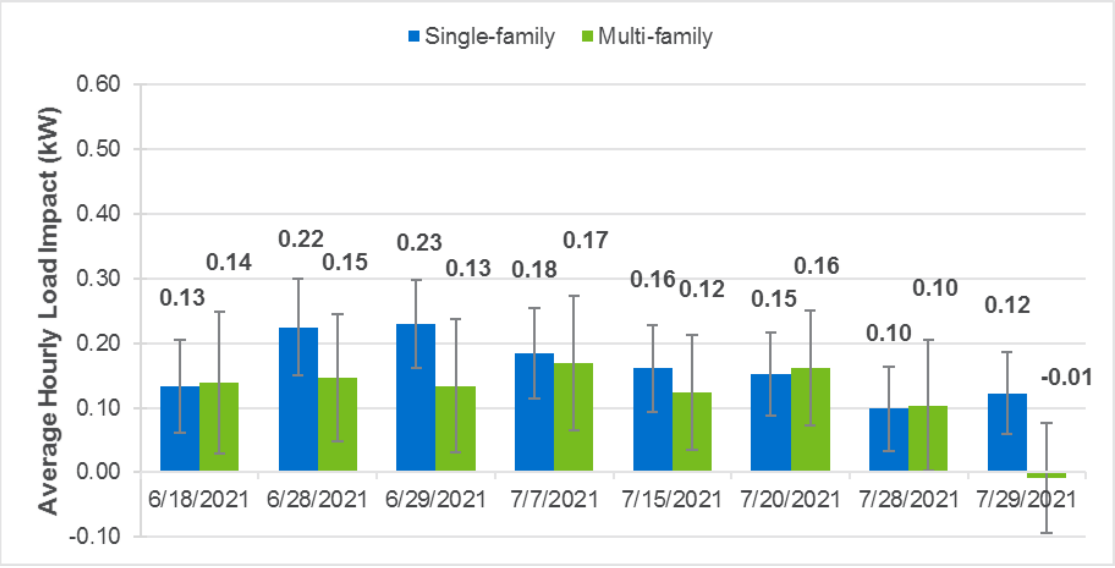


Figure 3-6: Average Hourly Load Impact per Customer, August Events

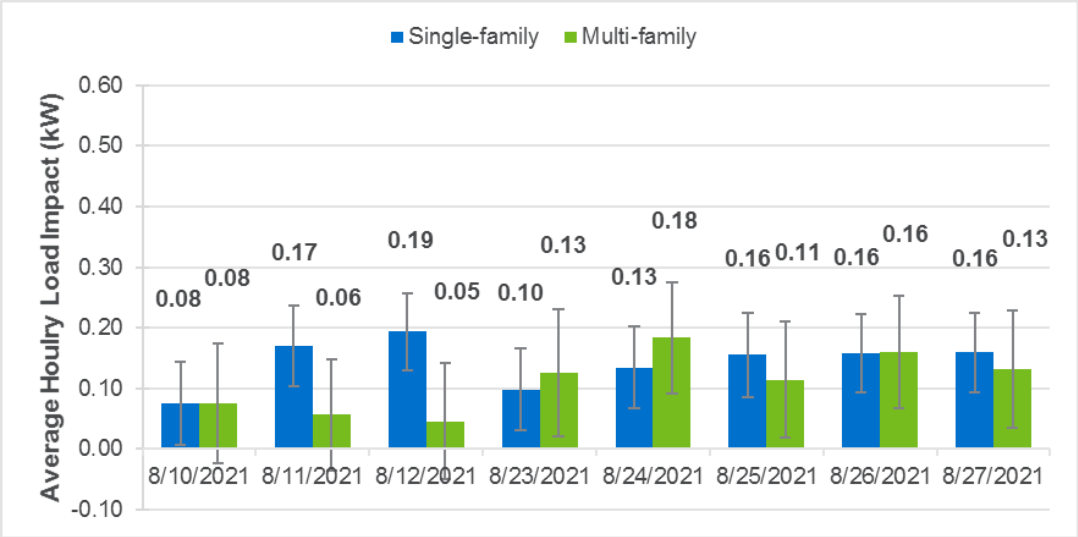


Table 3-2 displays summaries of all sixteen Summer 2021 PTR Pilot events. Each event's average event period temperature, control load, treatment load, average hourly load impact per customer, percentage impact, and 5th and 95th percentiles are displayed. Impacts averaged across all customers are statistically significant at the 90% level aside from the August 10th event. The August 10th event had the lowest reference load and average hourly load impact of all events. June 28th and June 29th tie for highest average hourly load impact per customer at 0.21 kW or 8.32% and 7.75% respectively. Both event days had moderate summer temperatures at 89.5 and 87.75°F. The average event day produced 0.14 kW of load impacts per customer or 6.09%. One event, June 18th, was called on the same day of the event. Calling the event on the same day did not appear to have a significant impact on load reductions. Compared to the average hourly load impact, June 18th's 0.13 kW is only slightly smaller. When compared to other event days with similar reference loads, June 18th's impact was slightly higher. Compared to event days with similar average event temperatures, June 18th's impact was slightly lower. Overall, small differences in reference load and average event temperature appropriately account for the differences in average hourly load impact between the June 18th event and other events, instead of it being attributable to the time of event notification.

Table 3-2: Average Hourly Load Impact by Event Day (Summer 2021)[5]

Event Date	Event Temp.	Load w/o DR (kW)	Load w/ DR (kW)	Impact (kW)	Impact (%)	5th Percentile	95th Percentile
18-Jun-21	87.00	2.05	1.92	0.13	6.57%	0.05	0.22
28-Jun-21	89.50	2.47	2.26	0.21	8.32%	0.12	0.29
29-Jun-21	87.75	2.66	2.46	0.21	7.75%	0.13	0.28
7-Jul-21	83.50	2.33	2.15	0.18	7.76%	0.10	0.26
15-Jul-21	87.00	2.38	2.22	0.15	6.38%	0.08	0.22
20-Jul-21	84.00	2.17	2.01	0.15	7.12%	0.08	0.23
28-Jul-21	87.50	2.35	2.25	0.10	4.25%	0.02	0.18
29-Jul-21	86.75	2.39	2.30	0.09	3.79%	0.02	0.16
10-Aug-21	84.25	1.86	1.78	0.08	4.08%	0.00	0.15
11-Aug-21	90.75	2.60	2.46	0.14	5.48%	0.07	0.22
12-Aug-21	92.25	2.75	2.59	0.16	5.75%	0.09	0.23
23-Aug-21	90.25	2.63	2.53	0.11	4.00%	0.03	0.18
24-Aug-21	90.75	2.70	2.56	0.15	5.42%	0.07	0.22
25-Aug-21	82.50	1.93	1.79	0.15	7.53%	0.07	0.22
26-Aug-21	78.50	2.36	2.20	0.16	6.73%	0.09	0.23
27-Aug-21	77.75	2.27	2.12	0.15	6.72%	0.08	0.23
Avg. Event	**86.25**	**2.37**	**2.22**	**0.14**	**6.09%**	**0.13**	**0.16**

Figure 3-7 and Figure 3-8 show the average per-customer load with demand response, load without demand response (reference load), load impact, and hourly temperature for the event day with highest load impacts and the average event day, respectively, for all PTR participants. Very little “snapback” occurred after the completion of each event. Snapback is defined as customer energy usage being higher after an event than what would be expected if an event had not taken place. For example, snap-back sometimes occurs if customers turned off their ACs or set their thermostats higher during the event and consequently the temperature inside the house increased. At the end of the event, the AC will sometimes need to run more than usual in order to bring the inside temperature back to within the customers’ preferred range; assuming the thermostat is returned to its pre-event setting shortly after the event concludes. This can result in increased load in the hours following an event compared to what would typically be expected on a similar non-event day.

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

Figure 3-7 shows the average load profile for all PTR participants on June 28, 2021. The average load without DR during event hours was around 2.47 kW. The average load with DR during event hours was around 2.26 kW. This resulted in an average load reduction of 0.21 kW per customer, representing an 8.3% reduction relative to the reference load. The average event temperature on June 28, 2021 was 89.5° F, and was associated with the highest load reduction for the Summer 2021 season.

Figure 3-7: Average Hourly Load Impact per Customer on June 28, 2021

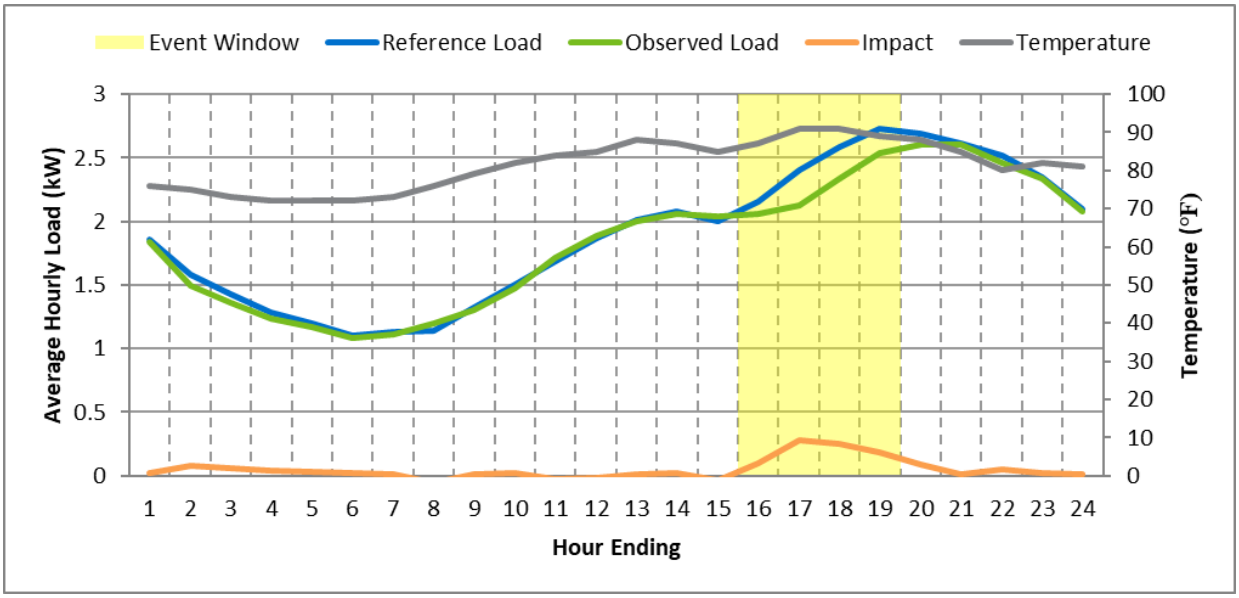
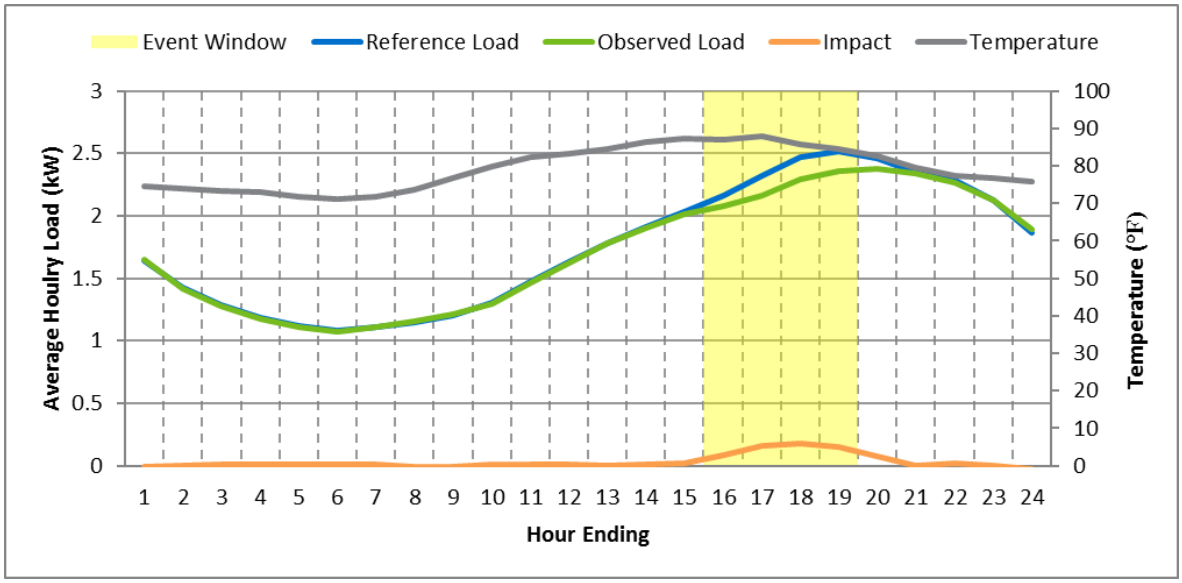


Figure 3-8 shows the average load profile for all PTR participants across all Summer 2021 event days. The average load without DR during all event hours was 2.36 kW. The average load with DR during event hours was around 2.22 kW. This resulted in an average load reduction of 0.14 kW per customer, or a 6.09% reduction relative to the reference load. Average event temperature was 86.25° F.

Figure 3-8: Average Hourly Load Impacts per Customer on Average Event Day (Summer 2021)



3.2.2 Winter 2021 Season

Table 3-3 summarizes the estimated load impacts for each treatment group during the Winter 2021 season during the event hours of 6 AM – 10 AM. As discussed in Section 2, single-family and multi-family customers have very different load profiles. As a result, the load impacts from these two groups are also very different. Single-family customers have much higher loads than multi-family customers at all times of the day.

The kW load reductions were slightly smaller for single-family customers (0.10 kW) than for multi-family customers (0.15 kW). The percent impact for single-family customers was 4.77% while the percent impact for multi-family customers was nearly double at 8.64%.

When comparing the customers in the two single-family customer classes, the percent load reductions and kW reductions varied greatly due to difference in reference load between heating fuel sources. Single-family electric heat customers had much higher reference loads and higher kW impact than single-family gas heat customers. However, their percentage impacts were similar at 5.16% and 4.61%, respectively. The same pattern persisted for multi-family

customers, the electric heat customers had a much higher kW impact and percent impact than those of the gas heat customers, at 12.32% and 7.03%, respectively.

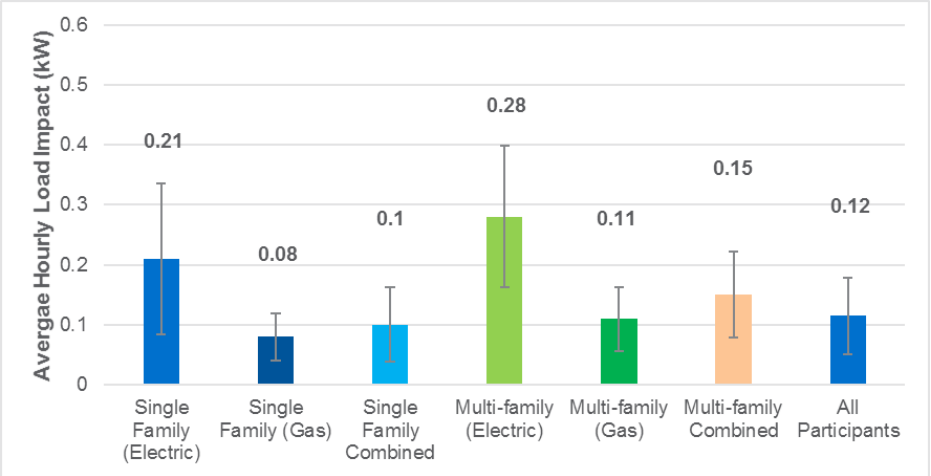
The average impact across all customer classes and all the Winter 2021 events was 0.12 kW and the average percent reduction was 5.64%.

Table 3-3: Average Load Reduction per Customer from 6 AM to 10 AM (Winter 2021)

Customer Segment	Load w/o DR (kW)	Load w/ DR (kW)	Impact (kW)	Impact (%)
Residential Single Family Combined	**2.17**	**2.07**	**0.10**	**4.77%**
Residential Single Family (Electric Heat)	4.11	3.90	0.21	5.16%
Residential Single Family (Gas Heat)	1.81	1.73	0.08	4.61%
Residential Multi-family Combined	**1.70**	**1.55**	**0.15**	**8.64%**
Residential Multi-family (Electric Heat)	2.26	1.98	0.28	12.32%
Residential Multi-family (Gas Heat)	1.53	1.42	0.11	7.03%
All Events Participants	**2.04**	**1.93**	**0.12**	**5.64%**

Figure 3-9 displays the magnitude and statistical significance of each of the four customer classes, as well as that of all participants, all single-family, and all multi-family groups. The 90% confidence interval is displayed for each group of customers as an error bar over their impact. If the error bar crosses zero, the impact is not statistically significant from zero at the 90% level of confidence. All customer classes display statistical significance.

Figure 3-9: Average Hourly Load Impact by Customer Class (Winter 2021)



Load Impacts by Event Day

Figure 3-10 shows the average hourly load impact for single-family and multi-family customers for each Winter 2021 event. During both winter events, multi-family households experienced larger impacts than single-family customers. The largest impacts for multi-family customers are seen on the first event on January 29th at 0.19 kW, while single-family customers saw the same level of load reduction on both event days, 0.10 kW. The first event was a slightly colder day than the second. Impacts on the second winter event, February 12th at 0.13 kW, were slightly lower for multi-family customers and the same for single-family customers. Average hourly load impacts were statistically significant on both event days for both single and multi-family customers in Winter 2021.

Figure 3-10: Average Hourly Load Impact per Customer (Winter 2021)

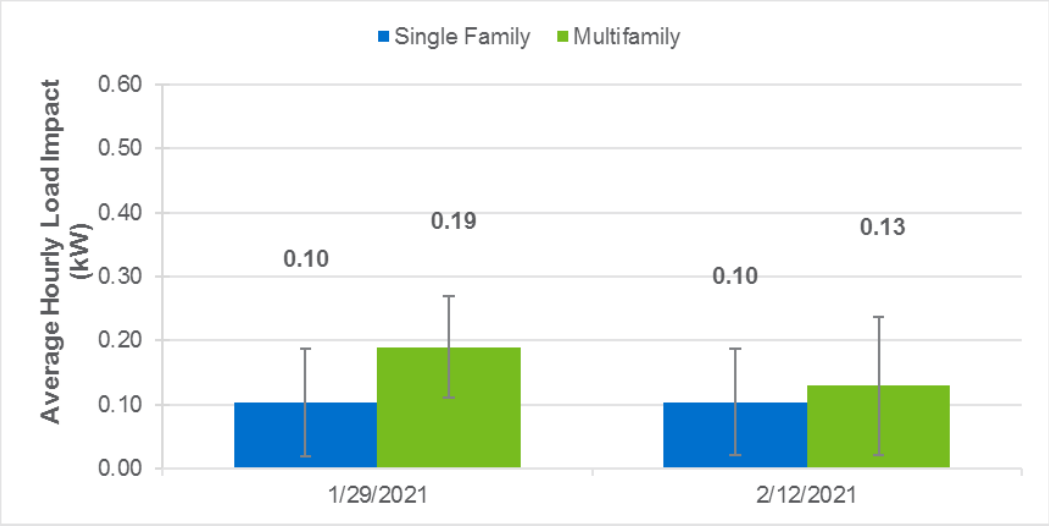


Figure 3-11 and Figure 3-12 show the average per-customer load with demand response, load without demand response (reference load), load impact, and hourly temperature for each of the event days for all PTR participants. Very little “snapback” occurred after the completion of each event. For example, snap-back sometimes occurs if customers turned off their heat supply during the event, then would turn it back on right after the event, causing more energy to be used directly following the event.

The average load profile for all PTR participants on January 29, 2021 is shown in Figure 3-11. The average load without DR during event hours was around 2.07 kW. The average load with DR during event hours was around 1.95 kW. This resulted in an average load reduction of 0.11 kW per customer, representing a 5.8% reduction relative to the reference load. The average temperature during the event period was 19.5° F.

Figure 3-11: Average Hourly Load Impact per Customer on January 29, 2021

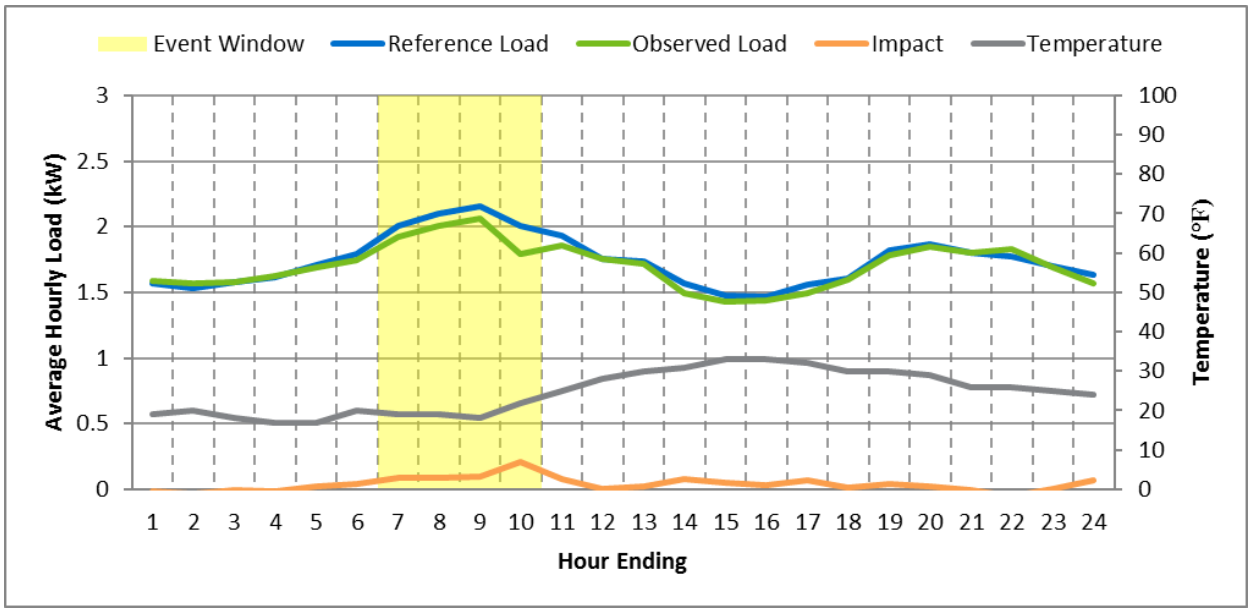
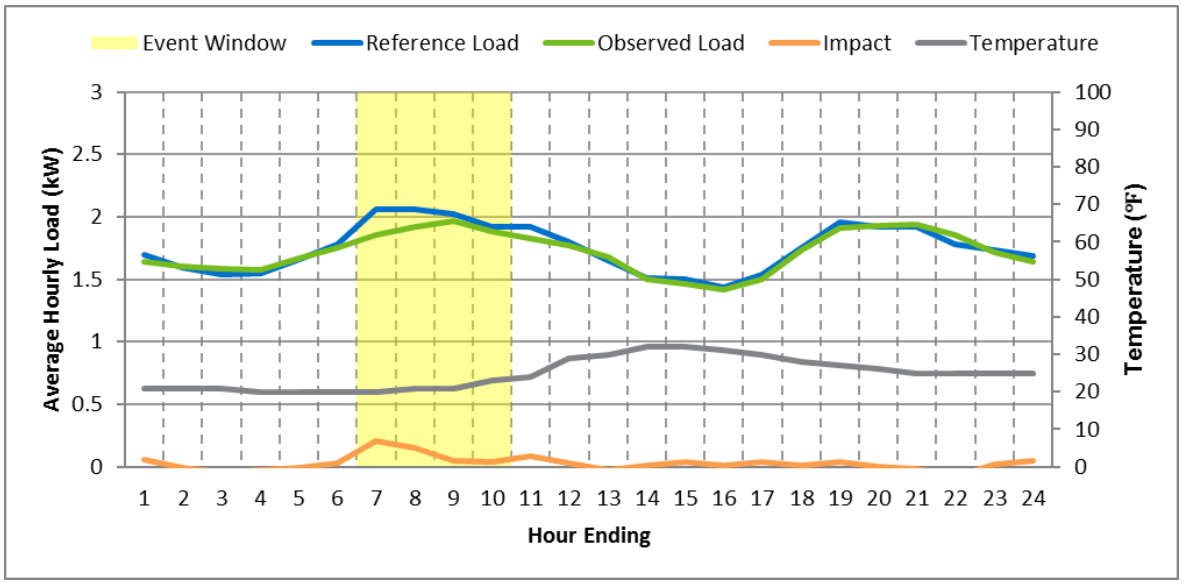


Figure 3-12 shows the average load profile for all PTR participants on February 12, 2021 The average load without DR during event hours was around 2.02 kW. The average load with DR during event hours was around 1.91 kW. This resulted in an average load reduction of 0.11 kW per customer, representing an 5.46% reduction relative to the reference load. Average event temperature was 21.3° F.

Figure 3-12: Average Hourly Load Impact per Customer on February 12, 2021



3.2.3 Summer 2020 Season

Table 3-4 summarizes the estimated load impacts for each treatment group during the Summer 2020 season during the event hours of 3 PM – 7 PM. As discussed in Section 2, single-family and multi-family customers have very different load profiles. As a result, the load impacts from these two groups are also very different. Single-family customers have much higher loads than multi-family customers at all times of the day. Multi-family customers have a much flatter load shape compared to single-family customers but also peak during afternoon hours.

The kW load reductions were slightly larger for single-family customers (0.41 kW) than for multi-family customers (0.31 kW). The percent impact for single-family customers was 14.43% while the percent impact for multi-family customers was significantly larger at 19.65%. This is typically because multi-family customers have smaller reference loads.

When comparing the customers in the two single-family customer classes, the percent load reductions and kW reductions were larger for customers with electric heating. Single-family electric heat customers had lower reference loads and higher kW and percentage impact than single-family gas heat customers. The same pattern persisted for multi-family customers, the

electric heat customers had lower reference loads, higher kW and percent impact than those of the gas heat customers.

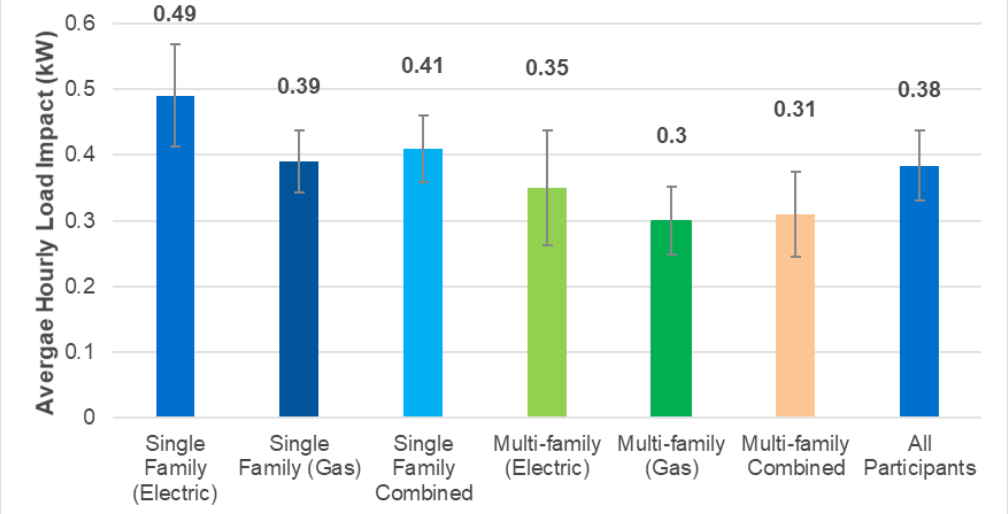
The average impact across all customer classes and all the Summer 2020 events was large at 0.38 kW and the average percent reduction was 15.37%.

Table 3-4: Average Load Reduction per Customer from 3 PM to 7 PM (Summer 2020)

Customer Segment	Load w/o DR (kW)	Load w/ DR (kW)	Impact (kW)	Impact (%)
Residential Single Family Combined	**2.85**	**2.44**	**0.41**	**14.43%**
Residential Single Family (Electric Heat)	2.71	2.22	0.48	17.83%
Residential Single Family (Gas Heat)	2.87	2.48	0.40	13.83%
Residential Multi-family Combined	**1.59**	**1.28**	**0.31**	**19.65%**
Residential Multi-family (Electric Heat)	1.49	1.14	0.35	23.40%
Residential Multi-family (Gas Heat)	1.62	1.32	0.30	18.55%
All Events Participants	**2.49**	**2.11**	**0.38**	**15.37%**

Figure 3-13 displays the magnitude and statistical significance of each of the four customer classes, as well as that of all participants, all single-family, and all multi-family groups. The 90% confidence interval is displayed for each group of customers as an error bar over their impact. If the bar crosses zero, the impact is not statistically significant from zero at the 90% level of confidence. All customer classes display statistical significance. Single-family customers had larger load impacts than multi-family customers, while electric heating customers in both dwelling types had larger impacts than gas heating customers.

Figure 3-13: Average Hourly Load Impact by Customer Class (Summer 2020)



Load Impacts by Event Day

Figure 3-14 shows the average hourly load impact for single-family and multi-family customers for each Summer 2020 event. During both summer events, single-family households experienced larger impacts than multi-family customers. The largest impacts for both single-family and multi-family customers are seen on the first event, August 25th at 0.45 and 0.35 kW, respectively. The first event was a slightly warmer day than the second. Impacts on the second summer event, August 26th, were slightly lower for both customer groups at 0.37 and 0.28 kW. Both event days provided statistically significant impacts for both single and multi-family customers in Summer 2020.

Figure 3-14: Average Hourly Load Impact per Customer (Summer 2020)

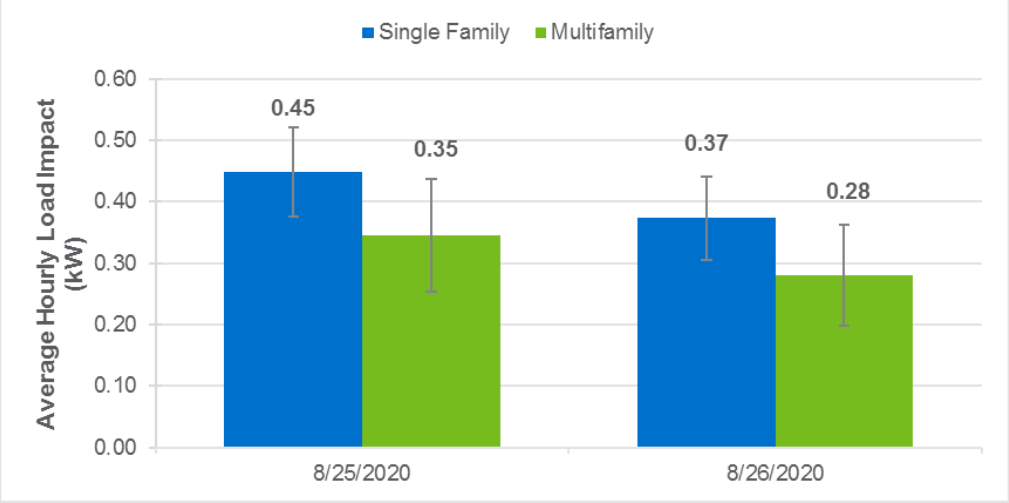


Figure 3-15 and Figure 3-16 show the average per-customer load with demand response, load without demand response (reference load), load impact, and hourly temperature for each of the sixteen event days for all PTR participants. Very little “snapback” occurred after the completion of each event.

The average load profile for all PTR participants on August 25, 2020 is shown in Figure 3-15. The average load without DR during event hours was around 2.54 kW. The average load with DR during event hours was around 2.12 kW. This resulted in an average load reduction of 0.42 kW per customer, representing a 16.49% reduction relative to the reference load. The average temperature during the event period was 85.5° F.

Figure 3-15: Average Hourly Load Impact per Customer on August 25, 2020

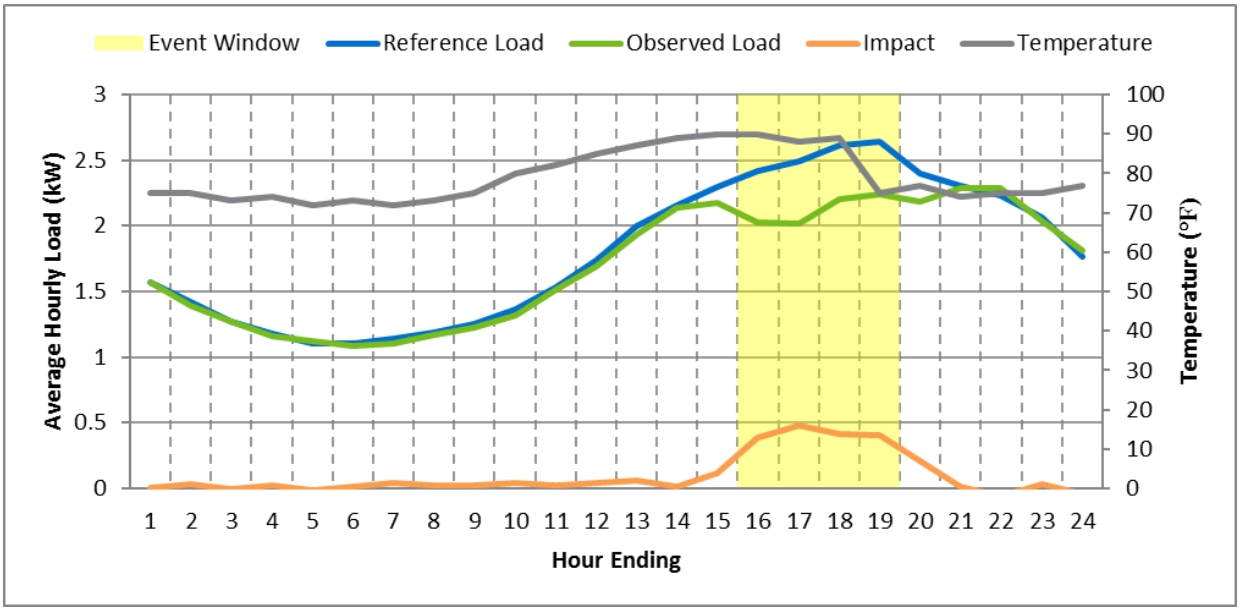
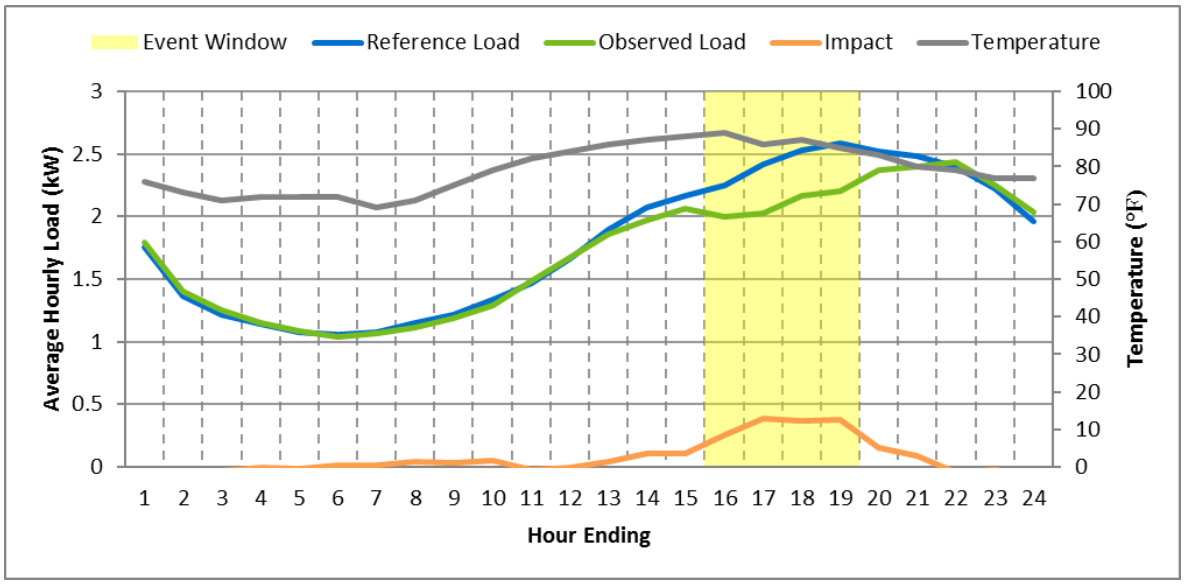


Figure 3-16 shows the average load profile for all PTR participants on August 26, 2020. The average load without DR during event hours was around 2.45 kW. The average load with DR during event hours was around 2.10 kW. This resulted in an average load reduction of 0.35 kW per customer, representing an 14.21% reduction relative to the reference load. Average event temperature was 86.8° F.

Figure 3-16: Average Hourly Load Impact per Customer on August 26, 2020



3.3 Load Impact Conclusions

Key findings pertaining to load impacts from the Pilot include:

- Statistically significant load impacts were detected across all three event seasons and two program years, though impacts varied by season and customer type.
- Single-family customers provided higher average hourly load reductions than multi-family customers, and customers with electric heating provided higher load reductions than customers with gas heat across all season and program years evaluated.
- Single-family load impacts were highly seasonal, providing lower reductions to load in the winter and higher load reductions in the summer. Multi-family customer impacts remained more consistent across summer and winter events.
- The first two PTR pilot events in August 2020 produced load impacts 2.7 times higher than that of the subsequent summer. However, it is expected the impacts from the 2021 summer are more representative of typical load impacts.

- Notifying customers one-hour in advance of the event on June 18th 2021 instead of the night before did not appear to significantly affect the event's average hourly load impact.
- Overall, the load impact results from the Pilot were comparable to impacts from other opt-in PTR programs, as discussed in Section 4.5.3.

4 Process Evaluation

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

- Does the Pilot's bill credit motivate behavior change?
- Did Duke Energy calculate baselines and bill credits correctly?
- Was the marketing campaign successful?
- Were customers effectively educated and motivated to use the program?
- Did event notifications reach the customer such that they could effectively respond to the event?
- What cost-effective, reasonable enhancements, if any, could be made to continue Peak Time Credit?
- How does the Peak Time Credit program compare with other Peak Time Rebate programs in terms of design, marketing, and results?

Resource Innovations addressed these research questions by collecting data from participants through three surveys during the first year of the program: a marketing survey, a non-summer post-event survey and a summer post-event survey. Table 4-1 summarizes which research questions were assessed in each of the three surveys. In addition to these customer surveys, Resource Innovations conducted in-depth interviews with Duke Energy program staff, validated Duke Energy's load reduction calculations, and compiled a literature review of other Peak Time Rebate programs in North America. The results from these process evaluation activities are presented in the following subsections.

Table 4-1: Research Questions Assessed in Each Survey

Process Evaluation Objective	Marketing Survey	Post-event Surveys	Interviews with Staff	Load Reduction Validation	PTR Programs Review
Does the bill credit motivate behavior change?	✓	✓			✓
Were baselines and bill credits calculated correctly?				✓	
Was the marketing campaign successful?	✓		✓		
Does the chosen bill credit motivate behavior change?	✓	✓	✓	✓	✓
Were participants effectively educated and motivated to use the program?	✓	✓	✓		
Did event notifications reach the customer such that they could effectively respond to the event?		✓	✓	✓	
What are the most common actions participants are taking to reduce usage during events?		✓			
What are the most common reasons participants are giving for not reducing usage during events?		✓			
What enhancements should be made to the program?	✓	✓	✓	✓	✓
How satisfied are participants with the program?	✓	✓	✓		
How does the Peak Time Credit program compare with other Peak Time Rebate programs?					✓

4.1 Marketing Survey

The marketing survey was conducted on the population that was targeted for enrollment prior to the onset of the program. Two sub-populations were surveyed: participants and non-participants. All pilot participants were invited to complete a survey that asked about what marketing channels they were aware of, what aspects of the pilot attracted them, and what motivated them to participate. A sample of non-participants were asked about whether they were aware of marketing for the pilot. “Non-aware” non-participants were briefly queried to collect information on what other marketing channels (if any) would have been more effective for communicating with them. Resource Innovations surveyed the “aware” non-participants for

reasons why they declined to participate, and to gauge the extent to which they have any interest in other Duke Energy DSM programs and pilots, and if so, what their interests are. The survey inquired whether the bill credit was sufficient or insufficient as an incentive for participating. The survey also inquired about satisfaction with Duke Energy to see how well it may correlate with the choice to participate, and what concerns both participants and non-participants may have with participating in the program.

Duke Energy Kentucky partnered with Resource Innovations and VuPoint Research to deploy the Peak Time Credit marketing survey from September 23rd to October 12th, 2020. The survey invites were sent to 2,685 participant and non-participant customers. Four hundred and one customers completed the survey, of which 259 were participants and 142 were non-participants, which led to a response rate of 29% and 8%, respectively. At the time of the survey, Peak Time Credit participants had experienced the two events from the Summer 2020 season (August 25th and 26th).

Table 4-2: Marketing Survey Dates and Response Rates

Group	Opened	Closed	# Responses	Response Rate	# Questions	Customer Type
Participant	September 23rd	October 12th	259	29%	19	Residential
Non-Participant			142	8%	18	

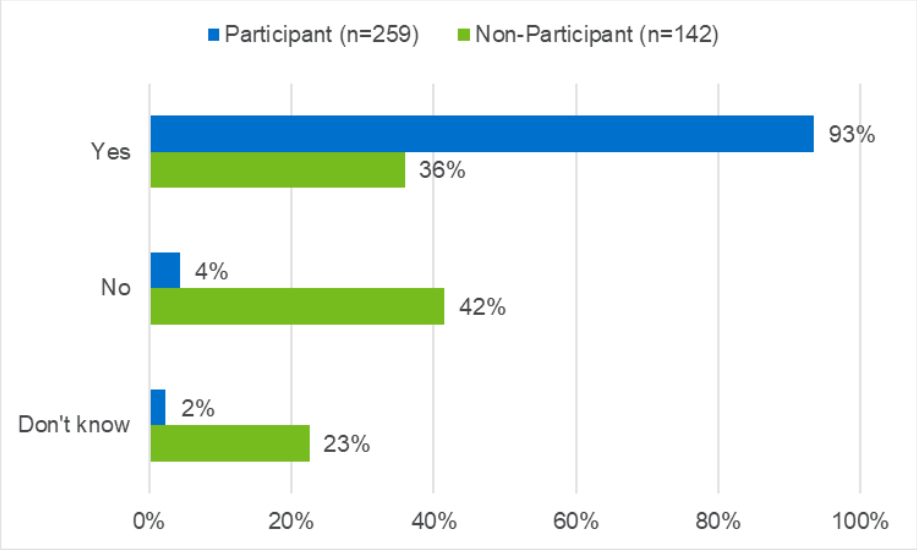
4.1.1 Survey Findings

The following sections summarize the survey findings as they relate to the research questions presented in the marketing survey.

Marketing Awareness

The DEK Peak Time Credit program was marketed by email to 59,605 DEK customers. Of these customers, 899 joined the PTR program. The survey asked both participants and non-participants if they recalled marketing materials announcing the PTR program. Responses to this question are recorded in Figure 4-1. Of the 259 participants who responded to the survey, 93% of them recalled receiving marketing materials from Duke Energy.

Figure 4-1: Recollection of PTR Marketing Materials from Duke Energy

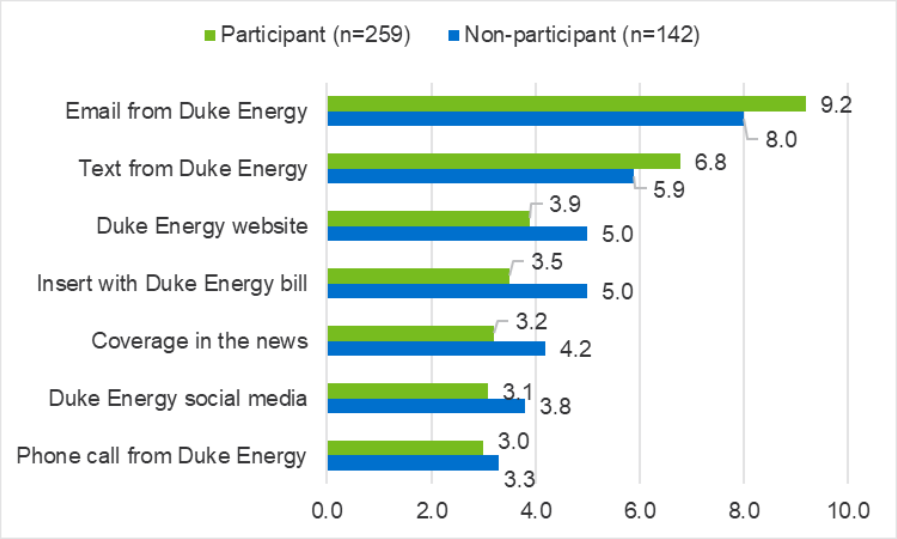


Participants and non-participants who recalled the marketing materials were asked a follow-up question about which marketing materials they received; 86% of participants and 71% of non-participants recalled a marketing email from DEK. A further follow-up question about effectiveness was asked to the participants and non-participants who responded that they recalled the marketing email from DEK. Participants rated the effectiveness of the marketing email a 9.2 out of 10 on average and the non-participants rated it a bit lower, at 7.2 out of 10 on average.

Preferred Marketing Methods

Participants and non-participants were presented with various methods for future communications and asked on a scale from 1 to 10 how strongly they would prefer that method for future communications. The results show the highest approval for digital marketing methods, with participants and non-participants rating their preference for an email from Duke Energy a 9.2 out of 10 and 8.0 out of 10 on average, respectively. The second most preferred communication was text messages from Duke Energy, which participants rated a 6.8 out of 10 and non-participants rated a 5.9 out of 10 on average.

Figure 4-2: Average Preference for Future Duke Energy Program Communications



Enrollment Decisions

The next battery of questions in the survey asked participants about what led them to join the program, or conversely asked non-participants who recalled the marketing materials what contributed to their decision not to join the PTR program.

Table 4-3 records participant ratings of potential benefits from joining the PTR program. As expected, the most important reason provided by participants for joining the program was saving money on their electricity bill, with an average rating of 9.8 out of 10.

Table 4-3: Participants Average Importance of Potential PTR Program Benefits (n=259)

Reason	Average
Save money on energy bill	9.8
Avoid electric service interruption	8.7
Help the environment	8.7
Do my part for Kentucky	8.3

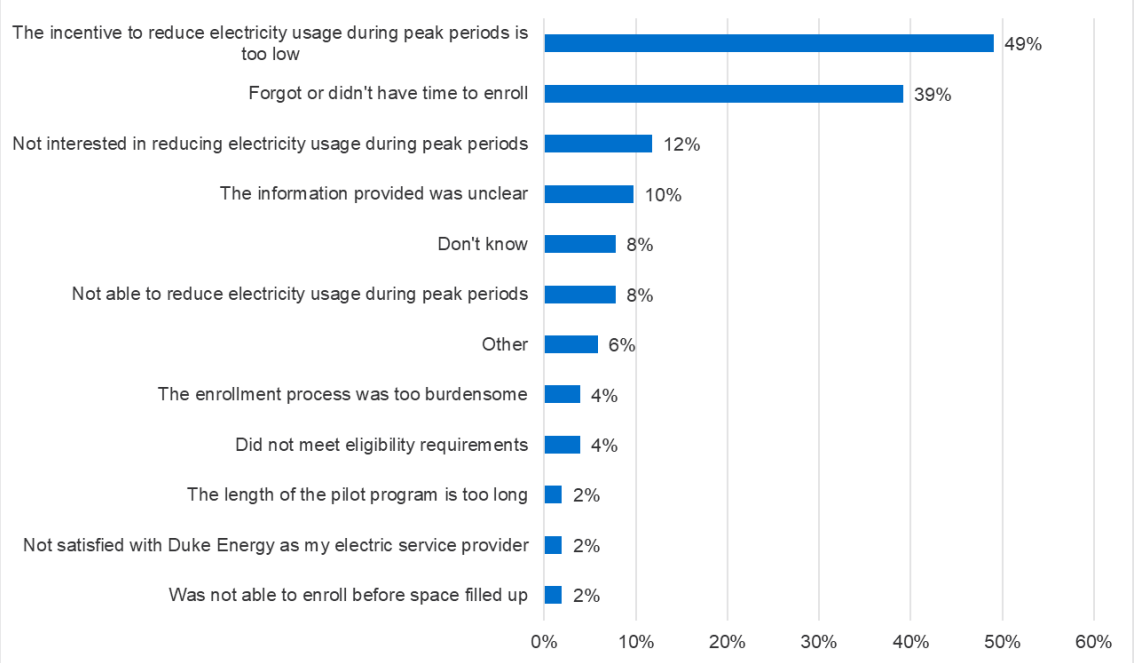
Participants were also asked to rate the importance of stated reasons for enrolling in the PTR program. Their responses are recorded in Table 4-4, where participants said that the most important characteristic to them was the absence of a penalty for not reducing their electric usage during the peak times. Participants also responded with above average importance ratings for being early adopters to the program and the relatively low number of peak days per year.

Table 4-4: Participants Average Importance of PTR Program Characteristics (n=259)

Reason	Rating
There is no penalty for not reducing usage	8.6
Try new offering before other customers	6.5
Relatively few peak days each year	6.2

Non-participants who recalled the program marketing materials were also asked about their decision to not join the PTR program. They were presented with 12 different responses and were able to select multiple reasons. Of the 51 non-participants who recalled the marketing materials, about half of them said they did not join the program because they felt the incentive to reduce electric usage was too low. A further 39% said that they forgot about the program or did not have time to enroll.

Figure 4-3: Non-Participant Reasons for not Joining PTR Program (n=51)

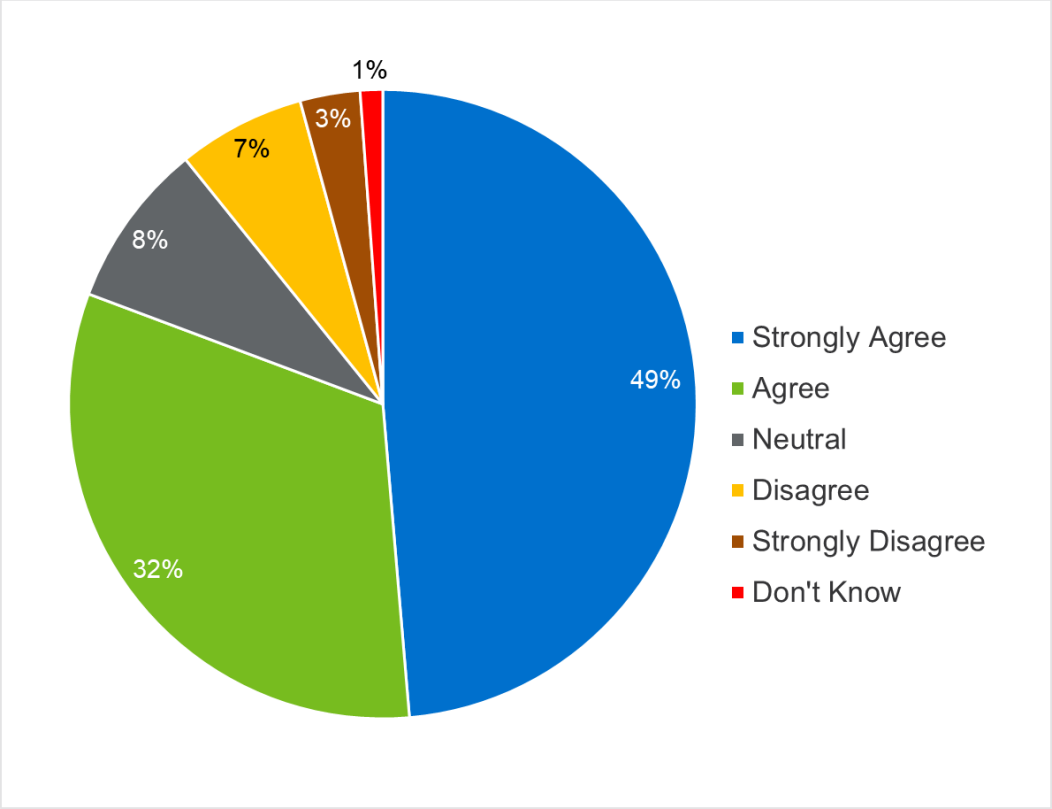


Incentives

The next battery of questions in the survey asked participants and non-participants about their opinions on the incentive of $0.60/kWh and how much it would motivate them to reduce their electricity usage during Peak Event Days. Participants were first asked if the incentive amount was enough for them to motivate a reduction in usage on peak days. Responses are recorded in Figure 4-4 where a majority of participants responded that they strongly agree (49%) or agree (32%) that the incentive is enough to motivate them to reduce electric usage during events. The 25 participants who disagreed that the incentive was enough to motivate them to reduce

electricity usage were asked a follow-up free response question about what incentive would be enough for them to reduce their electricity usage during peak days. Ten out of 25 respondents said $1.00/kWh would motivate them and five of the respondents said they did not know what amount would motivate them to reduce their electricity usage.

Figure 4-4: Participant Agreement that the Incentive Amount of $0.60/kWh is Enough to Motivate them to Reduce Their Usage on Peak Days (n=259)

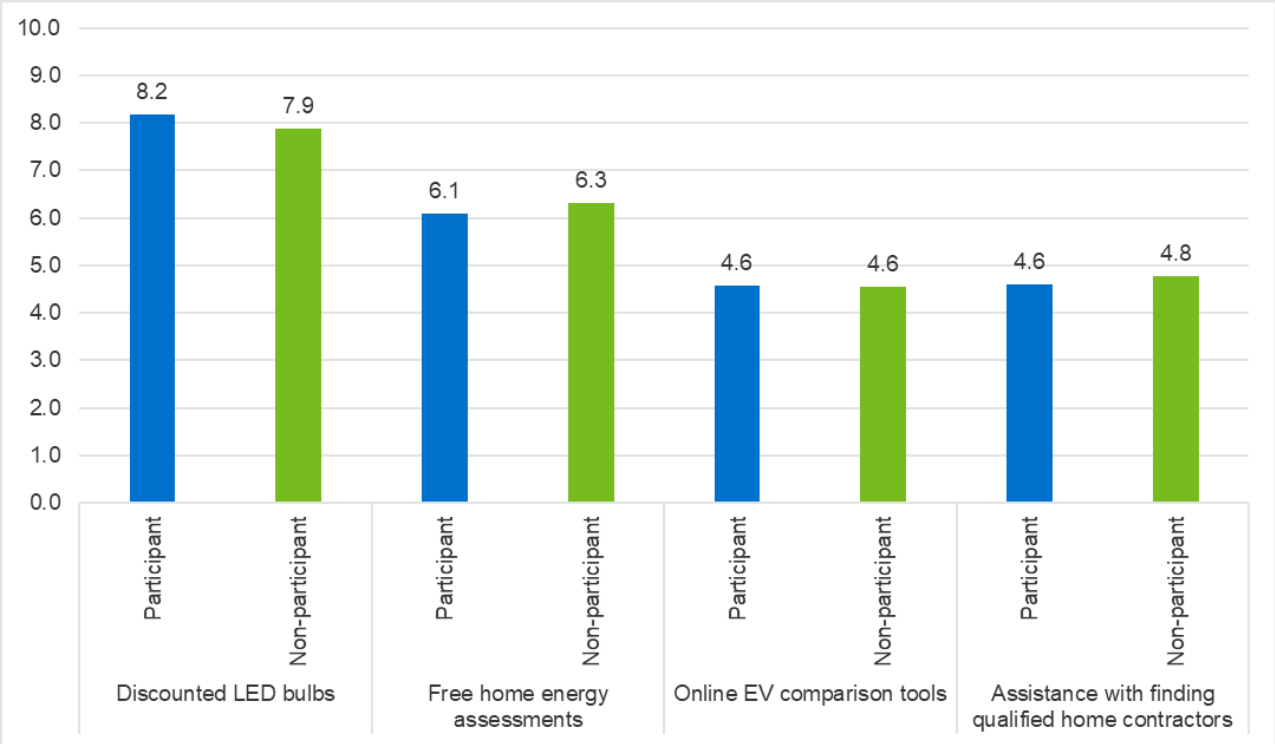


There were 19 non-participants who earlier stated that the incentive amount did not motivate them to join the PTR program. A majority of these non-participants (12 out of 19) said that they did not know what incentive amount would have encouraged them to join the PTR program.

Satisfaction and Interest in Other Duke Energy Programs

Participants and non-participants were presented with various Duke Energy programs and initiatives that would help them reduce their electricity usage and asked on a scale from 1 to 10 how interested they would be in them. Results for both participants and non-participants are presented in Figure 4-5. The results were mostly similar between the participants and non-participants, with both groups showing the biggest preference for discounted LED light bulbs followed by the free home energy assessments, indicating consumer preferences for obtaining free or discounted products and services.

Figure 4-5: Average Participant and Non-Participant Interest in Other Duke Energy Savings Programs (n=259 participants, 142 non-participants)



To close out the marketing survey, participants and non-participants were asked to rate their satisfaction with DEK as their electric supplier. Both groups rated their satisfaction with DEK an 8.5 out of 10 on average.

4.2 Post-Event Surveys

Resource Innovations fielded two post-event surveys for PTR program participants about their experience following a Peak Day event: one in winter, and one in summer. These surveys aimed to obtain feedback from participants to estimate awareness of the event and to collect information on actions customers took to reduce load and their motivations for those actions. The post-event surveys also collected information on participants' assessment and opinions on Duke Energy's role in empowering and motivating participants to reduce load, in addition to educating participants on how the program works. The post-event surveys also assessed satisfaction with the bill credit offering, with the event notification process, and of the pilot overall. In conjunction with the survey results, the Resource Innovations team also evaluated the bill credits earned by program participants and compared them with their post-event survey responses. The bill credits, which serve as an indicator of participant response, provide more context to the patterns seen in the load impact results when paired with their survey responses.

4.2.1 Winter Post-Event Survey

The winter post-event survey was conducted following the Peak Day event that occurred in the morning on February 12th, 2021. PTR participants were sent emails to complete the survey on the web and received follow-up phone calls providing them with the opportunity to complete the survey over the phone. Overall, 890 program participants received an email asking them to complete the survey, and a further 101 received the follow-up phone call.

One hundred eighty-three out of 890 customers completed the survey on the web, which is a completion rate of 23%. A further 70 out of 101 customers completed the survey on the phone, which is a completion rate of 69%. Combined, the completion rate for the survey was 253 out of 991, or 26%. The survey was open from February 17th, 2021 to February 22nd, 2021.

Table 4-5: Survey Completion Rates by Method

Survey Mode	Opened	Closed	Sample Size	# Completes	Response Rate	Customer Type
Phone	February 17, 2021	February 22, 2021	101	70	69%	Residential
Web			890	183	23%	

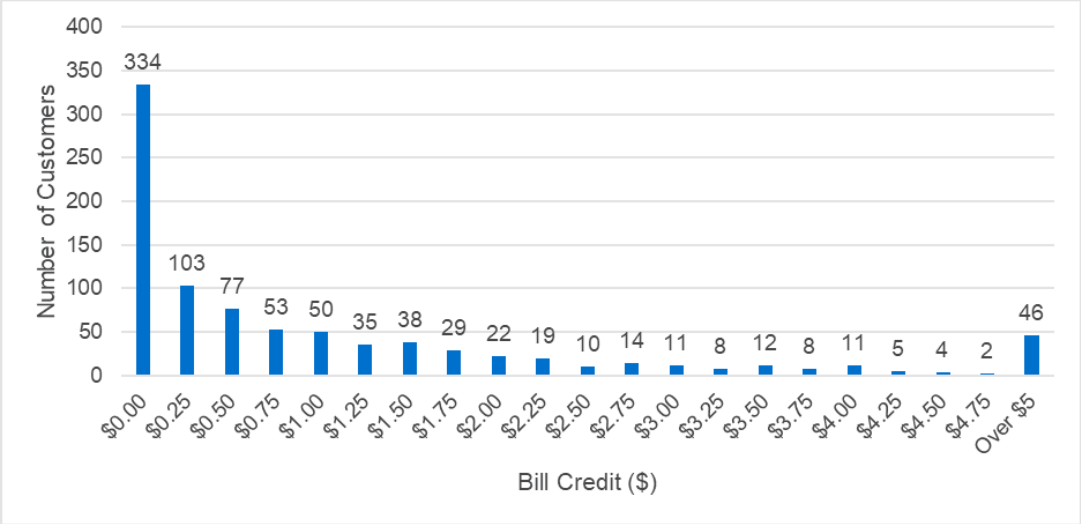
Survey questions covered the following main topics:

- Program participation and event awareness
- Response to Peak Day events
- Satisfaction with the Peak Time Credit program

As the survey was conducted in parallel with the bill credit analysis, notable findings from the bill credit analysis will be presented alongside the survey findings. Bill credits for all participants during the February 12th event are recorded in Figure 4-6. The average bill credit from the event was $1.19[6]. There were ten participants with bill credits greater than $10, with the highest being $24.50. Participants who took the survey had an average bill credit of $1.43, participants who did not take the survey had an average bill credit of $1.08. This difference in bill credits was statistically significant at the 90% confidence level.

[6] 245 participants with bill credits calculated below $0.06 were tabulated as $0.00, as these participants did not receive a bill credit for their participation for the event.

Figure 4-6: Distribution of Bill Credits for the Winter Peak Day Event (n= 891)



Peak Time Credit Participation and Event Awareness

Peak Time Credit participants were first asked if they recalled their participation in the program; 98% of respondents responded that they did recall their participation in the Peak Time Credit program. This question was followed by asking participants if they had recalled a peak day event happening in the prior week; 81% of respondents said that they did recall the event that was called in the previous week. The Resource Innovations team compared the event recollection to the bill credits from these customers and found that customers who recalled the events had higher bill credits than the customers who did not. As shown in Table 4-6, participants who recalled the event had an average bill credit of $1.54 for the event, while participants who did not recall the event had an average bill credit of $0.55. This difference was statistically significant at the 90% confidence level.

Table 4-6: Participant Recollection of Peak Event and Associated Average Bill Credits

Do you think a Peak Day occurred in the Past Week?	Response Count	Average Bill Credit
Yes	219	$1.54
No	20	$0.55
Don't Know	31	$1.14

Participants who recalled a Peak Event in the past week were asked follow-up questions about what day the event took place and what time of day the event took place. About a third of the participants correctly identified the event day of February 12th, 2021. About 34% of participants replied that they did not know when the event day was. It is notable that there was a large difference in customer responses depending on what method they used to complete the survey.

About 40% of the participants who completed the survey online correctly recalled the event day, while only 10% of participants who completed the survey over the phone correctly recalled the event day. Those who completed the survey online could have had more ready access to emails and calendars to verify their response, while those on the phone may have been more reliant on memory recall.

Table 4-7: Participants Recalled Event Day (n=219)

Date	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	2/7/2021	2/8/2021	2/9/2021	2/10/2021	2/11/2021	2/12/2021	2/13/2021
Percent	0.0%	0.5%	1.9%	2.3%	7.9%	**32.9%**	1.9%
Date	**2/14/2021**	**2/15/2021**	**2/16/2021**	**2/17/2021**	**2/18/2021**	**2/19/2021**	**Don't Know**
Percent	1.0%	7.9%	4.2%	0.5%	0.5%	1.4%	**34.2%**

Participants were also asked if they recalled which time of the day the event took place. While most customers did not recall the exact event day from the previous week, 85% of them correctly recalled that the event took place in the morning.

The next battery of questions was related to the notification methods that Duke Energy used to alert program participants about the event. Recalled notification methods are recorded in Table 4-8, where 86% of the participants said that they recalled an email from Duke Energy to alert them of the Peak Day event. Participants were also asked to rate the timeliness of the notification that they received from Duke Energy. The participants rated the timeliness of the notification highly, with an average rating of 8.8 out of 10.

Table 4-8: Participants Recalled Peak Event Notification Method (n=139)

Notification Method	Percent Recalled
Email from Duke Energy	86%
Text message from Duke Energy	9%
Cold day- I knew from low temperatures	4%
Other	1%
Don't Know	1%

The survey also presented the respondents with various statements about the notification method. As shown in Table 4-9, the participants overwhelmingly agreed with the statements

saying that Duke Energy notified them through their preferred method, provided them with helpful information, and gave them confidence of which hours they can earn credits on Peak Days.

Table 4-9: Participant Agreement with Statements Concerning the Notification Method (n=131)

How much do you agree with the following…	Average Rating)
Duke Energy notified me through my preferred communication channel	9.7
Duke Energy has given me helpful information on how to respond to Peak Days	9.4
I'm confident that I know which hours of the day I can earn credits during Peak Days	9.4

Response to Peak Time Credit Event

The next section in the survey asked participants about how they responded to the February 12th, 2021 Peak Day event. These questions were asked to participants who had previously stated that they recalled that there was an event in the past week, as they would have had the opportunity to respond to the event. The first question asked participants if they were home during the Peak Day event. The responses are recorded in Table 4-10, which shows that most of the participants reported that they were home during the event. The participants that were home also had higher bill credits than the participants who reported that they were not home. Although the difference is large (about $0.40) it is not statistically significant at the 90% confidence level, which may be a function of the low count of customers who responded that they were not home during the event.

Table 4-10: Was the Participant Home During the Peak Time Credit Event? (n=138)

Response	Count	Average Bill Credit
Yes	113	$1.79
No	22	$1.39
Don't Know	3	$1.46

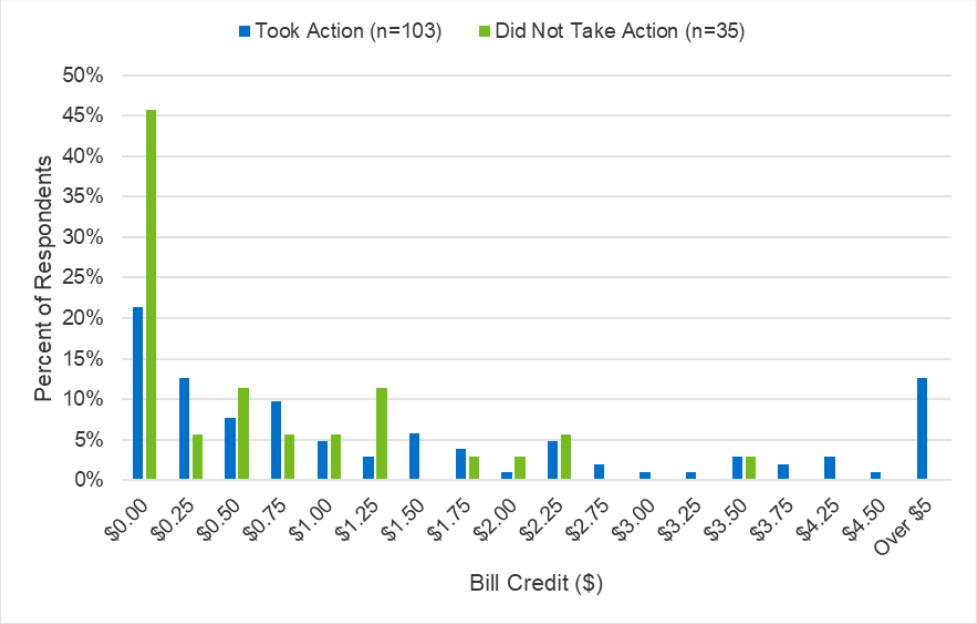
The same participants were later asked if they took action to lower their electricity usage during the Peak Time Credit Event. The responses and accompanying bill credits are presented in Table 4-11. Most of the participants responded that they did take action to reduce electricity usage during the peak times, and these participants also had much higher bill credits than ones who said they did not take action to reduce their electric usage during the Peak Day event. Participants who said they took action received an average bill credit of $2.08, opposed to only $0.65 among customers who said they did not take action. This difference was statistically significant at the 90% confidence level.

Table 4-11: Did the Participant Take Action to Reduce Electric Usage During the Peak Time Credit Event? (n=138)

Response	Count	Average Bill Credit
Yes	103	$2.08
No	35	$0.65

Figure 4-7 presents the distribution of bill credits earned by customers based on their responses recorded in Table 4-11, based on if they reported taking action to reduce electricity usage during the Peak Time Credit event. Almost half of the customers who did not take action during the event also did not receive a bill credit, this opposed to only 20% of customers who reported taking action but did not receive a bill credit. Among participants who did take action during the event, there is also a longer tail of customers who received large bill credits (generally $4 and above), while there were no participants who did not take action during the event with bill credits greater than $3.75.

Figure 4-7: Distribution of Bill Credits Based on Reporting Taking Action During Peak Time Credit Events



Participants who reported that they took action to reduce their electricity usage during the Peak Time Credit event were asked about what motivated them to take action during the event. The responses are recorded in Table 4-12. Program participants rated saving money on their energy

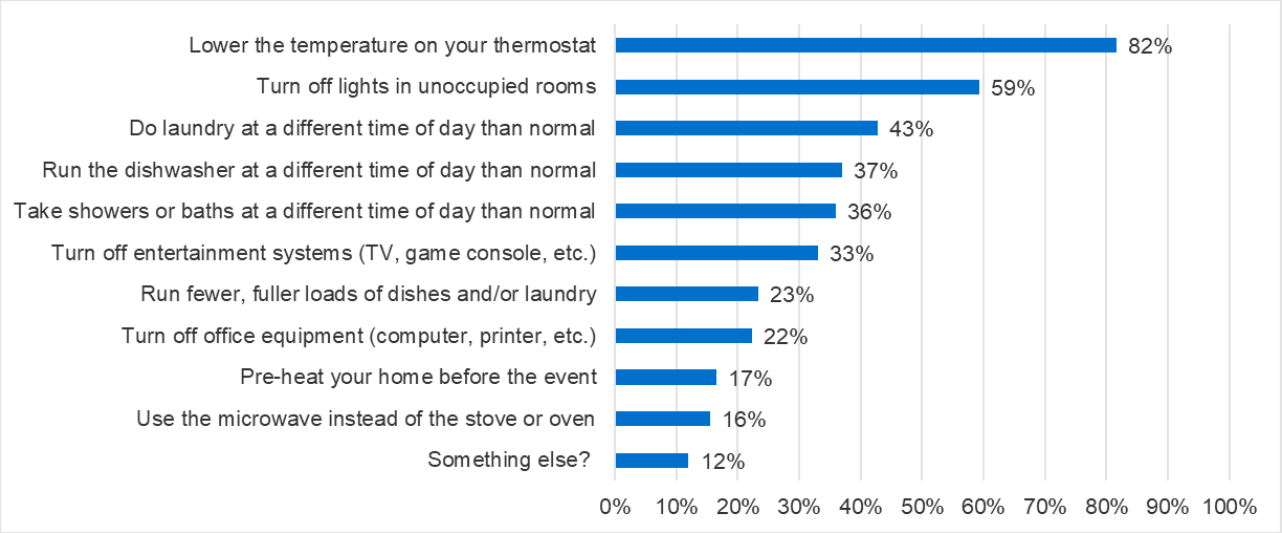
bill as the most important reason for taking action during the Peak Time Credit event. This response was closely followed by the ease of participation and a desire to help the environment.

Table 4-12: Participant Motivations for Taking Action During the Peak Day Event (n=102)

How important is the following…	Average Importance
Saving money on your energy bill	9.3
It was not difficult to participate	9.0
Saving energy and helping the environment	8.8
There was little impact on members of your household	8.2
A sense of obligation as a program participant	7.3

Participants who responded that they took action during the Peak Day event were presented with various actions that they may have taken to reduce electric usage during Peak Day events and asked to identify which actions they took. Figure 4-8 records their responses, the most cited action taken was lowering the temperature on their thermostat, with 82% of participants responding that they took this action. The second most cited action was turning off lights in unoccupied rooms, with about 59% of participants saying they took this action.

Figure 4-8: Recalled Actions Taken by Participants to Reduce Electric Usage During the Peak Day Event (n=103)



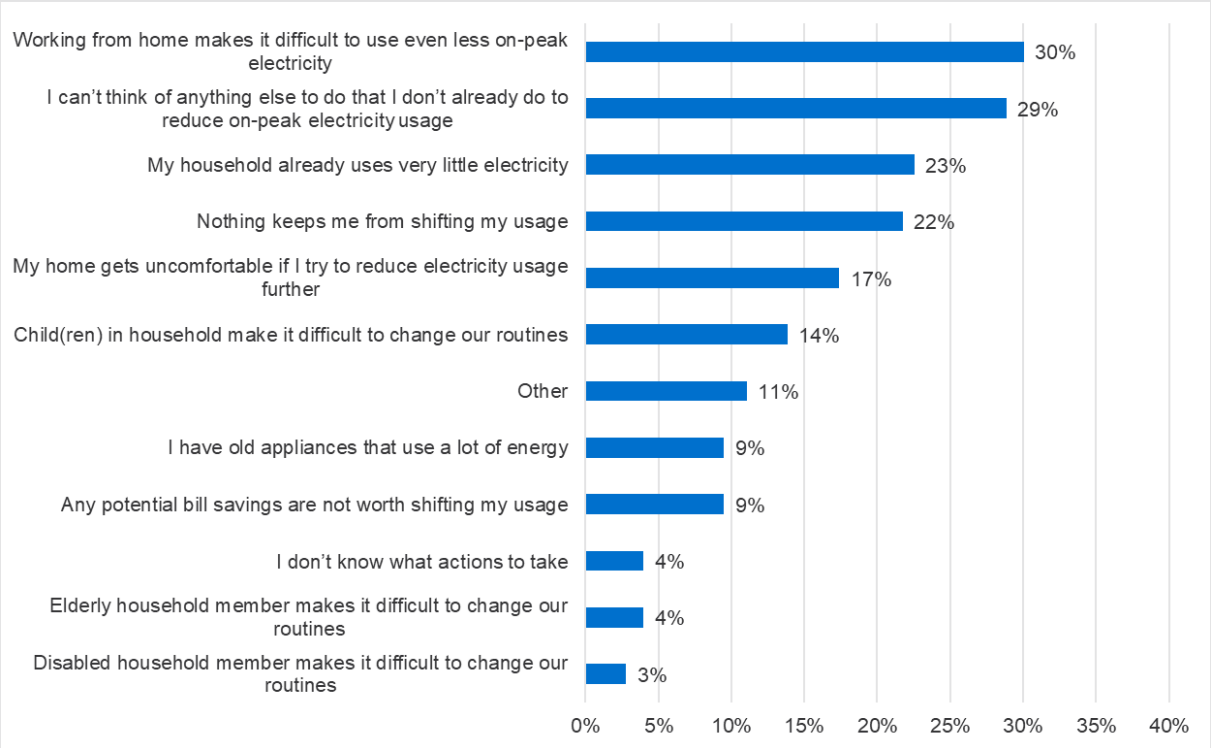
The Resource Innovations team also looked at the bill credits earned by customers and matched them to the responses of the respective actions taken in Figure 4-8. The number of responses per action and the associated average bill credit is reported in Table 4-13. The highest bill credits were awarded to customers who took actions that impact high electric usage devices. Customers who reported that they did not use their stove or oven had an average bill credit of $3.09 and participants who reported that they pre-heated their home before the event had an average bill credit of $3.08. There is a general trend that customers who curtailed usage of high usage appliances such as an oven or dishwasher had higher bill credits than customers who reported that they turned off low usage items, such as lights, office equipment, and entertainment systems. There were some customers with very high bill credits who responded that they took most of the actions to reduce electricity usage. With the small customer counts for actions (as low as n=16) the results for some of the actions may be skewed by one or two customers with very large bill credits that took a certain action.

Table 4-13: Reported Actions Taken During Peak Day Event and Associated Bill Credits, (n=103)

Action	Count	Average Credit
Use the microwave instead of the stove or oven	16	$3.09
Pre-heat your home before the event	16	$3.08
Take showers or baths at a different time of day than normal	37	$2.41
Run the dishwasher at a different time of day than normal	37	$2.30
Do laundry at a different time of day than normal	44	$2.28
Lower the temperature on your thermostat	83	$2.21
Run fewer, fuller loads of dishes and/or laundry	24	$1.98
Turn off office equipment (computer, printer, etc.)	23	$1.87
Turn off lights in unoccupied rooms	60	$1.84
Turn off entertainment systems (TV, game console, etc.)	34	$1.58

The final question in the event response section asked all participants what challenges they faced when they were reducing usage during any of the Peak Time Credit events over the winter. As shown in Figure 4-9, 30% of the respondents cited working from home making it difficult to reduce electric usage during Peak Day events. The next three response groups mentioned that they do not know what else they can do to reduce electricity usage, they already do not use much electricity, or nothing keeps them from reducing their electric usage.

Figure 4-9: Which of the Following Made it Difficult to Reduce Electricity Usage During Peak Day Events? (n=253)



Program Satisfaction and Recommendations

The next section in the survey presented various statements to program participants and asked them how much they agreed with the statements on a scale from 1 to 10, with 1 meaning "Do not agree at all" and 10 meaning "Completely agree".

Responses and the customers' associated bill credits are recorded in Table 4-14. Participants generally agreed that the program was easy to understand and that the number of Peak Days is reasonable. They also said that they would put more effort into the program if there was a greater incentive amount for reducing electric usage. The bolded statement in the table pertains to how likely a participant is to recommend the program to someone else. Participants highly agreed with this statement, rating it an 8.4 out of 10 with a Net Promoter Score (NPS)[7] of 46, meaning that there were more promoters (those who gave a rating of 9 or 10) of the program than detractors (those who gave a rating of 6 or below).

Across the responses below, participants who were in the "Promoter" group for a certain question also had higher bill credits than participants who were in the "Passive" or "Detractor"

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

groups. Participants who were considered promoters of the program earned higher bill credits than customers who were considered detractors. This difference was statistically significant at the 90% confidence level. The lowest rating in this battery of questions was the 8.0 out of 10 for agreeing that the Peak Days work with a person's household schedule. Customers who were detractors to that statement, and rated their agreement from 1 to 6, had average bill credits of $0.96. This is lower than customers who said that the program did work with their schedule, who had average bill credits of $1.70. This difference in bell credits was statistically significant at the 90% confidence level.

Table 4-14: Participant Agreement with Provided Statements and Associated Bill Credits by Promoter Group (n=241)

Statement	Average Rating	Detractors (Rating 1-6)	Passives (Rating 7-8)	Promoters (Rating 9-10)
The Peak Time Credit program is easy to understand	9.0	$1.00 (22)	$1.28 (32)	$1.53 (196)
I would make additional effort to reduce my usage during Peak Days if the bill credit was greater	8.6	$1.07 (40)	$1.52 (31)	$1.57 (75)
Number of Peak Days is reasonable	8.5	$0.88 (44)	$1.32 (43)	$1.72 (154)
I would recommend the Peak Time Credit program to friends or family	**8.4**	**$0.96 (43)**	**$1.25 (45)**	**$1.71 (155)**
Peak Days work with my household's schedule	8.0	$0.96 (61)	$1.36 (60)	$1.70 (125)

The next question was a similar format that asked the participants about their satisfaction with the program, the information provided by Duke Energy, and the bill credits that they have earned from the program. Participants were generally satisfied with the information provided by Duke Energy and the program as a whole, rating their satisfaction as 8.8 and 8.0 out of 10 on average, respectively. Customers who rated the program a 9 or 10 out of 10 had relatively high average bill credits of $1.87, compared to customers who rated their satisfaction with the program between 1 and 6 out of 10 who had average bill credits of $0.54. This difference in bill credits was statistically significant at the 90% confidence level, indicating that higher bill credits may have led to higher satisfaction with the program.

Table 4-15: Participant Average Satisfaction (n=237)

How satisfied are you with?	Average Rating	Detractors (Rating 1-6)	Passives (Rating 7-8)	Promoters (Rating 9-10)
Duke Energy's provided information about the pilot	8.8	$1.16 (28)	$1.33 (44)	$1.56 (173)
The Peak Time Credit program	8.0	$0.85 (54)	$1.28 (73)	$1.87 (120)
The bill credits you earned through the peak time credit program	7.0	$1.16 (91)	$1.71 (60)	$1.72 (87)

To close the survey, all customers were able to provide a free-response recommendation for the Peak Time Credit program. Overall, 63 out of 253 customers provided recommendations. The Resource Innovations team summarized the responses into general topics, and results are presented in Table 4-16. A third of the respondents who provided a recommendation mentioned that they wanted more text message notifications or more time to prepare for the event. The next two response groups mentioned wanting more information/savings tips and increasing the incentive amount.

Table 4-16: Summary of Peak Time Credit Program Recommendations

Bucketed Response	Percent (n=63)
Notification method or timing	33%
More program information/ savings tips from Duke Energy	16%
Increase Incentive	14%
Different peak times/ more events	13%
Rebates or Incentives for efficient items	11%
Follow-up from Duke Energy about bill credits/savings	8%
Other	5%

4.2.2 Summer Post-Event Survey

The summer post-event survey was conducted following two Peak Day events that occurred in the afternoon on June 28th and June 29th, 2021. PTR participants were sent emails to complete the survey on the web and received follow-up phone calls providing them with the opportunity to

complete the survey over the phone. 760 program participants received an email asking them to complete the survey, and a further 101 received the follow-up phone call.

123 out of 760 customers completed the survey on the web, which is a completion rate of 16%. A further 69 out of 128 customers completed the survey on the phone, which is a completion rate of 54%. Combined, the completion rate for the survey was 192 out of 888, or 22%. The survey was open from June 30th, 2021 to July 6th, 2021.

Table 4-17: Survey Completion Rates by Method

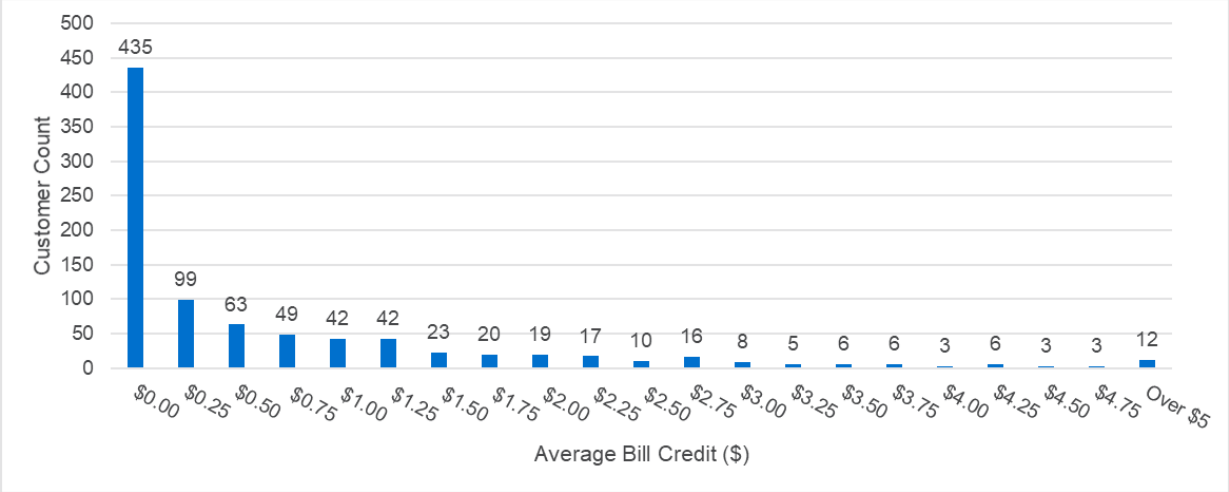
Survey Mode	Opened	Closed	Sample Size	# Completes	Response Rate	Customer Type
Phone	June 30, 2021	July 6, 2021	128	69	54%	Residential
Web			760	123	16%	

Survey questions covered the following main topics:

- Program participation and event awareness
- Response to Peak Day events
- Satisfaction with the Peak Time Credit program

As the survey was conducted in parallel with the bill credit analysis, notable findings from the bill credit analysis will be presented alongside the survey findings. A distribution of average bill credits earned across the two summer event days analyzed is presented in Figure 4-10. The average bill credit among all participants across the two events was $0.71. This is lower than the average bill credit of $1.19 for participants during the winter event. There were twelve participants who had average bill credits of $5.00 or greater in the summer events, with the highest credit of $8.73. Like the winter event, participants who took the survey had higher bill credits than those that did not. Survey takers had an average bill credit of $0.86 and non-survey takers had an average bill credit of $0.66. This difference was statistically significant at the 90% confidence level.

Figure 4-10: Average Bill Credit Earned During the June 28th and June 29th Peak Time Credit Events (n= 887)



Peak Time Credit Participation and Event Awareness

Peak Time Credit participants were first asked if they recalled their participation in the program, 99% of respondents responded that they did recall their participation in the Peak Time Credit program. This question was followed by asking participants if they had recalled a Peak Day event happening in the prior week, 95% of respondents said that they did recall an event that was called in the previous week, this is higher than the winter survey where 81% of participants recalled an event in the previous week. The Resource Innovations team compared the event recollection to the bill credits from these customers and found that customers who recalled the events had higher bill credits than the customers who did not. As shown in Table 4-18 participants who recalled the event had an average bill credit of $0.85 for the event, there was only one participant who did not recall an event and they had an average bill credit of $0.09.

Table 4-18: Participant Recollection of Peak Event and Associated Average Bill Credits

Do you think a Peak Day occurred in the Past Week?	Response Count	Average Bill Credit
Yes	205	$0.85
No	1	$0.09
Don't Know	9	$0.81

Participants who recalled a Peak Event in the past week were asked follow-up questions about what day the event took place and generally what time of day the event took place. About 77% of the participants correctly identified one of the event days of June 28th and June 29th, 2021. This is much higher than the winter survey where about 33% of participants correctly identified

the event day. A further 87% of the survey respondents correctly recalled that the summer events took place in the afternoon.

Table 4-19: Participants Recalled Event Day (n=199)

Date	Sunday	Monday	Tuesday	Wednesday	Thursday	Other/ Don't Know
	6/27/2021	6/28/2021	6/29/2021	6/30/2021	7/1/2021	
Percent	1%	**22%**	**55%**	11%	1%	11%

The next battery of questions was related to the notification methods that Duke Energy used to alert program participants about the event. Recalled notification methods are recorded in Table 4-20 where 87% of the participants said that they recalled an email from Duke Energy to alert them of the Peak Day event. Participants were also asked to rate the timeliness of the notification that they received from Duke Energy. The participants rated the timeliness of the notification highly, with an average rating of 9.1 out of 10.

Table 4-20: Participants Recalled Peak Event Notification Method (n=186)

Notification Method	Percent Recollected
Email from Duke Energy	87%
Text message from Duke Energy	12%
Other	2%
Hot day- I knew from the temperatures	1%
Don't Know	1%

The survey also presented the respondents with various statements about the notification method. As shown in Table 4-21, the participants overwhelmingly agreed with the statements saying that Duke Energy notified them through their preferred method, provided them with helpful information, and gave them confidence of which hours they can earn credits on Peak Days. These ratings were comparable to those from the winter post-event survey, although the ratings for the latter two statements were slightly lower (9.2 compared to 9.4).

Table 4-21: Participant Agreement with Statements Concerning the Notification Method (n=179)

How much do you agree with the following…	Average Rating
Duke Energy notified me through my preferred communication channel	9.7
Duke Energy has given me helpful information on how to respond to Peak Days	9.2
I'm confident that I know which hours of the day I can earn credits during Peak Days	9.2

Response to Peak Time Credit Event

The next section in the survey asked participants about how they responded to the June 28th and June 29th, 2021 events. These questions were asked to participants who had previously stated that they recalled that there was an event in the past week, as they would have had the opportunity to respond to the event if they did not know it happened. The first question asked participants if they were home during the Peak Day event. The responses are recorded in Table 4-22, which shows that most of the participants reported that they were home during the event. The participants that were home during the event also had higher bill credits than the participants who reported that they were not home. The difference in average bill credits is large (about $0.49) and statistically significant at the 90% confidence level.

Table 4-22: Was the Participant Home During the Peak Time Credit Event? (n=185)

Response	Count	Average Bill Credit
Yes	142	$1.00
No	38	$0.51
Don't Know	5	$0.47

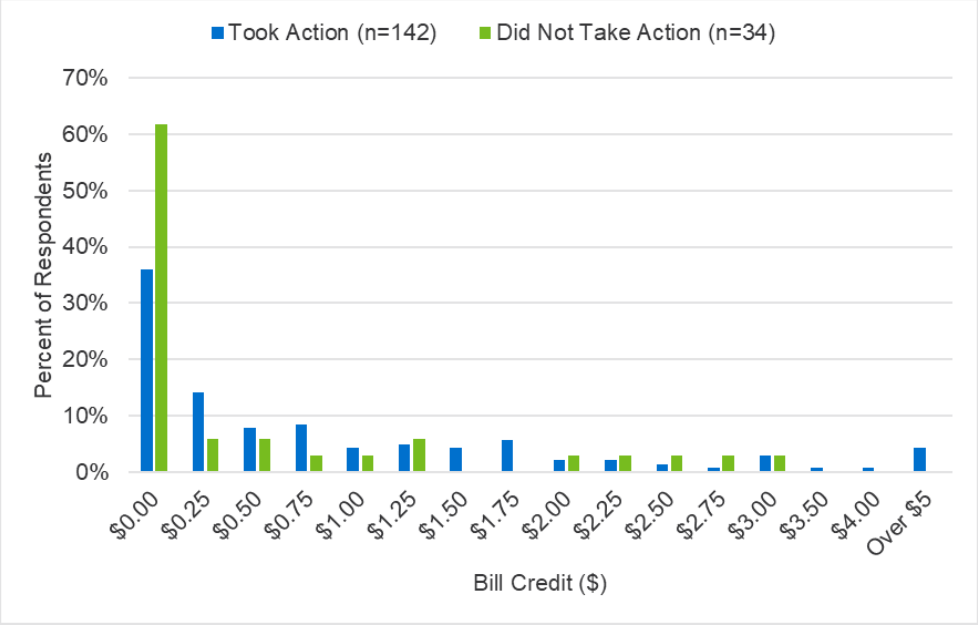
The same participants were later asked if they took action to lower their electricity usage during the Peak Time Credit event. The responses and accompanying bill credits are presented in Table 4-23. Most of the participants responded that they did take action to reduce electricity usage during the peak times, and these participants also had much higher bill credits than ones who said they did not take action to reduce their electric usage during the Peak Day Event. Participants who said they took action received an average bill credit of $0.98, opposed to only $0.53 among customers who said they did not take action. This difference was statistically significant at the 90% confidence level.

Table 4-23: Did the Participant Take Action to Reduce Electric Usage During the Peak Time Credit Event? (n=176)

Response	Count	Average Bill Credit
Yes	142	$0.98
No	34	$0.53

Figure 4-11 presents the distribution of bill credits earned by customers based on their responses recorded in Table 4-23, focusing on if the customers took action to reduce electricity usage during the Peak Time Credit event. Over 60% of the customers who did not take action during the Peak Time Credit event also did not receive a bill credit. Compared to the winter post-event surveys, there is a higher proportion of customers who did report taking action during the Peak Time Credit event who also did not receive a bill credit. Similar to the winter event, there is a longer tail of customers who took action that had very high bill credits when compared to participants who did not take action.

Figure 4-11: Distribution of Bill Credits Based on Reporting Taking Action During Peak Time Credit Events



Participants who reported that they took action to reduce their electricity usage during the Peak Time Credit event were asked about what motivated them to take action during the event. The responses are recorded in Table 4-24. Program participants rated saving money on their energy

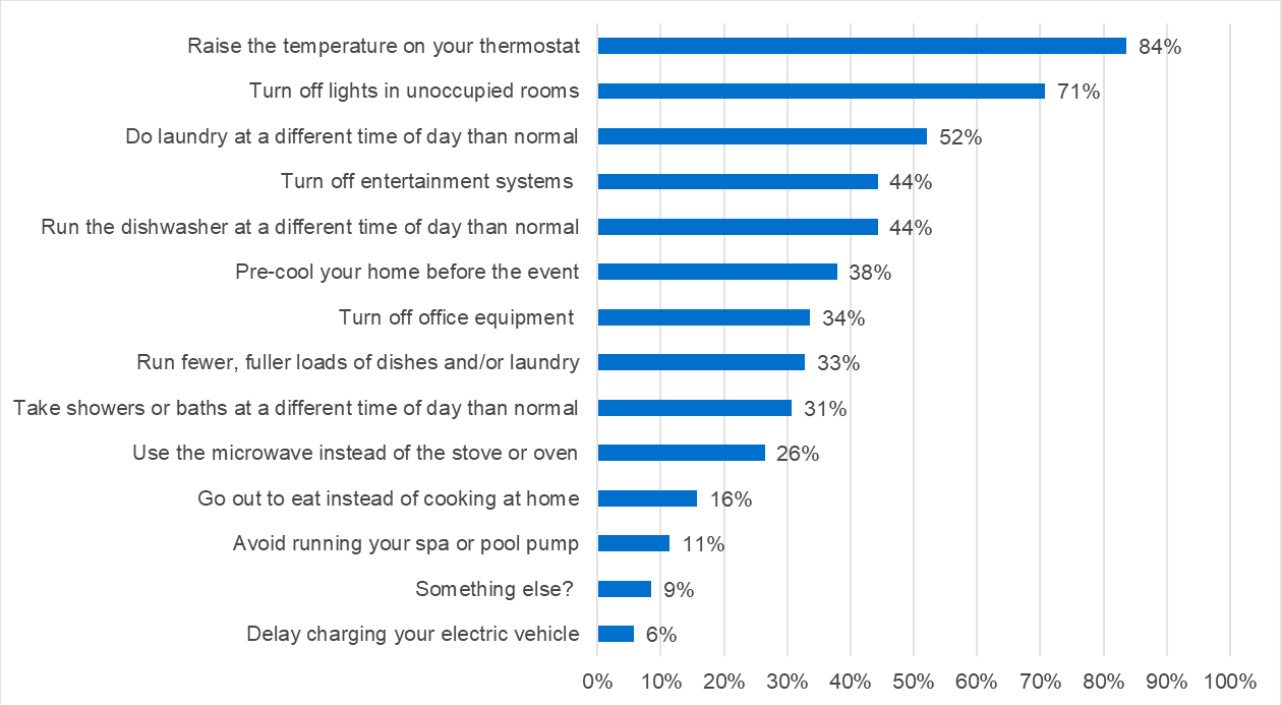
bill as the most important reason for taking action during the Peak Day event. This response was closely followed by a desire to help the environment and ease of participation.

Table 4-24: Participant Motivations for Taking Action During the Peak Day Event (n=140)

How important is the following…	Average Importance
Saving money on your energy bill	9.1
Saving energy and helping the environment	9.0
It was not difficult to participate	8.8
There was little impact on members of your household	8.0
A sense of obligation as a program participant	7.6

Participants who responded that they took action during the Peak Day event were presented with various actions that they may have taken to reduce electric usage during Peak Day events and asked to identify which actions they took. Figure 4-12 records their responses, the most cited action taken was raising the temperature on their thermostat, with 84% of participants responding that they took this action. The second most cited action was turning off lights in unoccupied rooms, with about 71% of participants saying they took this action. Participants were also able to provide their own response about what actions they took that were not originally listed in the survey, the most common free response was from customers saying they closed their blinds to keep the sun from heating their home. The responses were broadly similar to the winter survey, where 82% of respondents said that they changed the temperature on their thermostat and 59% said that they turned off lights in unoccupied rooms.

Figure 4-12: Recalled Actions Taken by Participants to Reduce Electric Usage During the Peak Day Event (n=140)



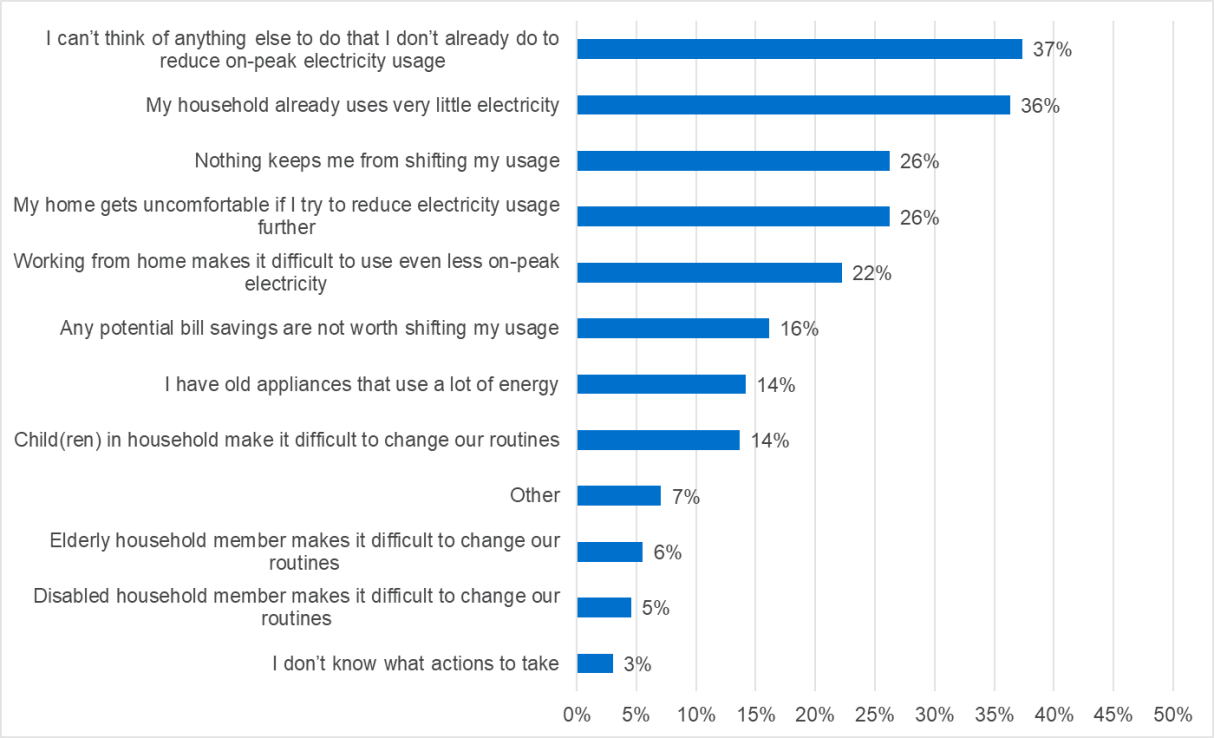
The Resource Innovations team also looked at the bill credits earned by customers and matched them to the responses of the respective actions taken in Figure 4-12. The number of responses per action and the associated average bill credit is reported in Table 4-25. The highest bill credits came from customers who took actions that impact high electric usage devices. Customers who reported that they delayed charging of their electric vehicle had the highest average bill credit of $1.46; this was followed by doing laundry ($1.26) and running their dishwasher at different times of the day ($1.18). It should be noted that some of the actions, such as delaying EV charging or pool pumps, had a small count of customers who took that action, and may be greatly influenced by one of two participants with large bill credits.

Table 4-25: Reported Actions Taken During Peak Day Event and Associated Bill Credits, (n=140)

Action	Count	Average Credit
Delay charging your electric vehicle	8	$1.46
Do laundry at a different time of day than normal	73	$1.26
Run the dishwasher at a different time of day than normal	62	$1.18
Avoid running your spa or pool pump	16	$1.09
Run fewer, fuller loads of dishes and/or laundry	46	$1.04
Pre-cool your home before the event	53	$1.03
Turn off lights in unoccupied rooms	99	$1.02
Use the microwave instead of the stove or oven	37	$0.96
Raise the temperature on your thermostat	117	$0.95
Go out to eat instead of cooking at home	22	$0.82

The final question in the event response section asked all participants what challenges they faced when they were reducing usage during any of the Peak Day events over the summer. As shown in Figure 4-13 most customers said that they did not have many challenges in reducing their electricity during peak times. It is notable that 22% of the customers in the summer survey said that working from home was making it difficult to reduce electricity usage. In the winter survey 30% of customers cited this as a reason. This difference could reflect the changes in the COVID-19 situation between the winter survey period in February 2021 and the summer survey period in July 2021.

Figure 4-13: Which of the Following Made it Difficult to Reduce Electricity Usage During Peak Day Events? (n=198)



Program Satisfaction and Recommendations

The next section in the survey presented various questions to program participants and asked them how much they agreed with the statements on a scale from 1 to 10, with 1 meaning "Do not agree at all" and 10 meaning "Completely agree".

Responses and the customers associated bill credits are recorded in Table 4-26, participants generally agreed that the program was easy to understand and that the number of peak days is reasonable. They also said that they would put more effort into the program if there was a greater incentive amount for reducing electric usage. The bolded statement in the table pertains to how likely a participant is to recommend the program to someone else. Participants highly agreed with this statement, rating it an 8.6 out of 10 with a Net Promoter Score (NPS)[8] of 49, meaning that there were more promoters (those who gave a rating of 9 or 10) of the program than detractors (those who gave a rating of 6 or below). The NPS was 46 in the winter post-event survey, meaning the customers have become slightly more likely to promote the program.

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

Unlike the summer survey, average rating of agreement with the provided statements did not correspond as much to the bill credits that a customer received. In the winter survey customers who had higher bill credits also had higher agreement ratings for every question. For the first question, pertaining to how easy the program is to understand, the customers with the highest rating of agreement actually had the lowest bill credits. Another interesting finding came from the second statement, about if an increased bill credit would lead to more effort during Peak Days, customers with the highest agreement also had the lowest bill credits. Meaning that they may be keen to increase their effort if the bill credit from the program was increased. One finding that was similar to the winter survey was in the final statement, about how the program works with a participant's household schedule. Customers who were promoters of the statement had an average bill credit of $1.79, which was higher than detractors who had an average bill credit of $0.80. This difference was statistically significant at the 90% confidence level, signaling that customers who feel they can work their program participation into their household schedule had higher average bill credits than customers who did not.

Like the winter survey, participants who were considered promoters of the program earned higher bill credits than customers who were considered detractors, but this difference was not statistically significant at the 90% confidence level.

Table 4-26: Participant Agreement with Provided Statements and Associated Bill Credits by Promotor Group (n=241)

Statement	Average Rating	Detractors (Rating 1-6)	Passives (Rating 7-8)	Promoters (Rating 9-10)
The Peak Time Credit program is easy to understand	9.2	$1.11 (13)	$1.01 (47)	$0.82 (150)
I would make additional effort to reduce my usage during Peak Days if the bill credit was greater	9.0	$0.93 (21)	$1.20 (41)	$0.75 (148)
Number of Peak Days is reasonable	8.9	$0.61 (20)	$1.28 (63)	$0.81 (127)
I would recommend the Peak Time Credit program to friends or family	**8.6**	**$0.74 (31)**	**$0.81 (54)**	**$0.90 (125)**
Peak Days work with my household's schedule	8.0	$0.80 (45)	$1.12 (71)	$1.79 (94)

The next question was a similar format that asked the participants about their satisfaction with the program, the information provided by Duke Energy, and the bill credits that they have earned from the program. Participants were generally satisfied with the information provided by Duke Energy and the program as a whole, rating their satisfaction as 9.0 and 8.2 out of 10 on average, respectively. Customers who rated the program a 9 or 10 out of 10 had relatively high average bill credits of $0.86, compared to customers who rated their satisfaction with the

program between 1 and 6 out of 10 who had average bill credits of $0.64. This difference in bill credits was not statistically significant at the 90% confidence level. Participants rate their lowest satisfaction with the bill credits that they earned from the program, rating their satisfaction a 6.8 out of 10. There was not a clear trend in bill credits for these customers.

Table 4-27: Participant Average Satisfaction (n=192)

How satisfied are you with?	Average Rating	Detractors (Rating 1-6)	Passives (Rating 7-8)	Promoters (Rating 9-10)
Duke Energy's provided information about the pilot	9.0	$0.90 (18)	$0.82 (55)	$0.86 (137)
The Peak Time Credit program	8.2	$0.64 (35)	$0.92 (71)	$0.88 (104)
The bill credits you earned through the peak time credit program	6.8	$0.76 (76)	$1.07 (72)	$0.72 (62)

To close the survey, all customers were able to provide a free-response recommendation for the Peak Time Credit program. Overall, 53 out of 193 participants provided recommendations. The Resource Innovations team summarized the responses into general topics, and results are presented in Table 4-28. About a third of the participants suggested increasing the incentive amount for reducing their electric usage. A further 21% of the responses were about the notification timing of method, with multiple participants mentioning that they would want more text alerts for peak times. Another 21% of the responses mentioned that they wanted more savings tips, with multiple participants mentioning that they wanted more live metering capabilities so they could see how their actions made an impact on their electricity usage.

Table 4-28: Participants Recommendations for the Peak Time Credit Program

Bucketed Response	Percent (n=53)
Increase incentive	30%
Notification method or timing	21%
More savings tips or program information	21%
Different peak times or more peak events	11%
Quicker notification of savings	9%
Other	8%

4.3 In-Depth Interviews

In-depth interviews with Duke staff members were conducted to provide perspective on the overall success of the pilot. Duke identified key stakeholders in pilot management, marketing, billing, and customer service, and other utility staff with insight into pilot planning, operations, emerging issues, and customer experience. Table 4-29 lists the Duke staff members that participated in the interviews for this process evaluation and their role related to the pilot.

Table 4-29: List of Duke Energy Staff Interviews

Interview Date	Stakeholder Group	Interviewees
10/13/2021	Regulatory, EM&V, and Credit Calculations	Bruce Sailers (Manager, Rates and Regulatory Strategy) Jeff Kern (Credit Calculations) Jean Williams (Manager, Duke Energy EM&V)
11/3/2021	Operations and Program Support	Amy Sadler (CPL Lead) Laura Price (Marketing and Webpage Coordinator) Mark Meetsma (Program Manager, Products & Services Lead) Tim Pike (CPL Technical Lead) Kimbelyn Chang (CPL, Primary Participant Contact)

The interviews were a primary source for identifying pilot strengths and weaknesses overall, but they also provided perspective about the success of the marketing campaign, participant education, event notification, and potential enhancements to the future of the program. The interviews were designed towards answering the following research topics and questions.

Program Recruitment: What was involved in the marketing, recruitment, and outreach efforts. What were the recruitment and/or load reduction targets and how were they established? What lessons were learned about the key drivers of enrollment?

Program Delivery: What are the primary concerns participants have with the program and how are those concerns addressed? What types of customers are generally interested in the program? What information are participating customers provided throughout the program?

Event Triggers and Processes: What factors determine when events are triggered? How many events have been called and what were the typical conditions? Did COVID-19 impact calling events? How were notifications sent to participants?

Expected Program Changes or Enhancements: Are there notable program successes or areas for improvement? What changes have been considered or proposed for upcoming seasons?

The following sections summarize the findings for each of the key research questions. The responses are taken from the two interviews conducted during this evaluation.

4.3.1 Program Recruitment

The Duke Energy staff were asked to describe the program recruitment process and whether it was successful. Prior to initiating recruitment efforts, Resource Innovations completed a power analysis of residential customers and determined that the minimum sample size needed to evaluate the pilot was 700 participants. Duke Energy did not establish an aggregate load impact (MW) target but assumed each customer would provide a load reduction of approximately 0.3 kW per event hour.

Recruitment started in late July 2020 with a goal of 800 participants. Participants were recruited randomly from a list of eligible customers, which included those that were not enrolled on another demand response program and did not have a past due bill on their account. All program outreach was conducted through email marketing to reduce cost and ensure customers that enrolled would respond to email event notifications once the program began. The recruitment emails included general information about the program offering and a link to a webpage with further details and an enrollment form. Within about two weeks, 899 customers enrolled with an approximate acquisition rate of 1.5 to 2%, which Duke staff felt was strong for an email-only campaign. The interviewees attributed the success of the recruitment effort to the program having no downsides (penalties) and that the program rules are less complex than other rate programs.

Since acquisition was done online, most correspondence with potential participants was done via email. During the recruitment period, the CPL team only received seven calls from customers requesting more information about the program. While no customers were denied from participating after completing enrollment, some customers that requested to join after the program already started were denied. No additional recruitment efforts have been conducted since the pilot began.

4.3.2 Program Delivery

Duke staff were asked to provide their perspective on the success of the program delivery. Overall, the interviewees said the program implementation has been successful, sharing feedback from pilot participants that completed surveys about their experience. While customers did not express major concerns about the program, about one third of survey respondents offered suggestions to improve the program. Some of the negative feedback from customers included the bill credits being too low and text message events notifications with more notice before the events start would be preferred. Further, some customers said the participation was challenging because events were called during the time of day when it was difficult to change behaviors. Customers also provided positive feedback, saying the program information they were provided was easy to understand, that the number of event days was reasonable, and they would recommend the program to other customers.

Event notifications are posted on the Duke webpage. The link to this page, which also includes an FAQ, suggestions to reduce load, and other program information, is included in email communications with participating customers. One lesson learned from this pilot is that many

customers prefer to receive event notifications via text message, rather than email. Duke Energy offers text message alerts but required pilot customers to setup this preference separately after the enrollment process. They have discussed text message notifications as a potential improvement they can investigate should the program be commercialized, with the customer entering their event notification preference during the enrollment process rather than after the fact.

Duke staff identified one potential improvement to streamline the process to collect customer contact preference information. After enrolling in the pilot, customers were given a link to go online and update their contact preferences. This contact preference information could be collected during enrollment, rather than requiring customers complete an additional step afterwards. This would cut down on the number of interactions and improve customer satisfaction.

One lesson learned during the pilot was that the amount of data being collected to calculate customer performance exceeded the maximum number of records allowed in their Excel-based tools. Due to this limitation, energy data was processed weekly, regardless of whether an event was called. Duke's IT team helped write a program to transpose the energy data from long to wide (rows to columns) so more data could be processed in the spreadsheet at once. This meant credit calculations could be performed whenever an event was called, rather than needing to maintain a database once a week to keep things up to date.

While the CPL team has not received many calls through the duration of the pilot, most are from customers asking how long it takes for bill credits to be applied, when event days will be called, which hours the event window will take place, or what measures they could take to increase their savings. Other customers have called asking general information, such as how long the program will operate. Most communication with participants has been through email.

After each event, customers that reduce load receive an email notifying them of the bill credit amount earned. The customers seemed satisfied with the summary emails, with Duke staff describing only one instance where a customer requested more detail about their event performance. Customers that do not reduce load and receive a bill credit are not sent emails after the event. Credits are typically applied within one billing cycle of the event, but when events are called towards the end of the month it can take up to two billing cycles to apply the credit. So far, there have been no instances of credits being applied later than two billing cycles after an event.

4.3.3 Event Triggers and Processes

The interviewees were asked to step through the process of calling events, as well as the triggers for summer and winter events. Duke staff analyze historical weather to set thresholds for event triggers. The decision to call an event is based on the number of recent and total events held so far in the season and the projected temperature and humidity index for the next day.

Duke staff were asked to provide an overview of the past seasons, including the number of events and average conditions. Since the pilot didn't officially launch until July 2020, the first summer season was split between the end of the summer 2020 and beginning of summer 2021. The program is limited to at most 4 winter events and at most 10 summer events per year with a total number of events annually not to exceed 12, with each event lasting four hours. During the first summer of the program, they only called two events in August 2020. The first winter season had two events called, with one in January 2021 and one in February 2021. There were 8 events called between June and July 2021, which, due to the delayed start of the program, served as the conclusion of the first summer season. There were 8 events called in August 2021, with five of them being on consecutive days. This leaves 2 events in the following winter and 2 in the summer before the end of July 2022. According to staff, COVID-19 pandemic did not have an impact on event triggers or the decision on when to call an event.

4.3.4 Expected Program Changes or Enhancements

Duke Energy staff were asked to share what they felt worked best about the program, as well as any changes they are contemplating for the remainder of the program. They felt the program has been successful because customers are satisfied with a program where they have nothing to lose (there is no penalty for underperformance). The program is also solely behavioral, so customers feel like they have a choice in how much they curtail. In terms of potential improvements, Duke Energy staff said they are proposing to do additional research to test various incentive levels. They were also surprised to see how many customers left the program, mostly due to account closures or going onto net metering, with about 100 of the 899 original customers moving within the last year.

4.4 Validation of Load Reduction Calculations

The Resource Innovations team reviewed the load reduction calculations in order to validate that customers were properly identified for the bill credit and paid accordingly. The review process started with obtaining the baseline calculation description Duke Energy filed in AG-DR-01-010(a). The baseline calculation methodology consists of three primary steps that are used to determine the baseline for bill credit calculations for each customer.

The steps are as follows:

1. Step 1: Identify the 10 Day Consideration Set:
    a. Using the customer's interval usage data, identify the last 10 non-event, non-holiday, weekdays for the participant; but do not go back prior to May 1 for summer season and not prior to November 1 for Winter season.
    b. Average the data identified by hour for all days in the consideration set. Store these values for future use as needed below.
2. Step 2: Event Like Days Set:
    a. Using the at most 10 days identified above, if the average Summer Heat Index (HI) between 3 pm and 7 pm or average Winter Temperature (WT) between 6 AM and 10 AM for any of the 10 selected consideration days is

not within +/- 1 HI/WT of the event day average HI/WT for the event period, then exclude that day.

b. Average by hour all days in the "event like days" consideration set to determine baseline. **This is an "event-like day" baseline and the baseline process ends unless there are no "event-like days" in the set**.

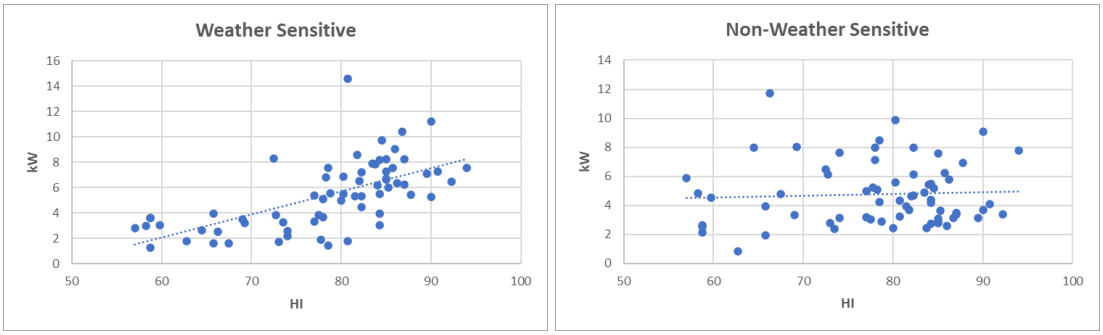
3. Step 3: When there are no Event Like Days:
   a. If there are no event like days, develop a weather sensitivity model for the participant to determine if the customer is weather sensitive.
   b. If the customer is NOT weather sensitive, average by hour the load on all days originally selected (at most 10) for baseline consideration. This value was calculated above in Step 1. **If the customer is not weather sensitive, this is the baseline; process ends.**
   c. If the customer is weather sensitive, then
      i. Use the value calculated in Step 1 as the starting / underlying baseline to which the weather adjustment is applied.
      ii. Average by hour the HI/WT on all days (at most 10) originally selected for baseline consideration. Keep these values for later.
      iii. Perform a regression on customer hourly loads on all non-event, non-holiday, weekdays during the summer/winter to obtain an HI/WT relationship to load during each event hour.
      iv. Subtract the average HI/WT (calculated above) for each event hour from the consideration days selected from the applicable event hour HI/WT on the CPE day.
      v. By hour, multiply the HI or WT difference calculated above by the HI or WT relationship values from the regression.
      vi. Add/subtract the hourly adjustments to the average load calculated in Step 1 above. **If the customer is weather sensitive, this is the baseline; process ends.**

Per the Resource Innovations request, Duke Energy provided the Resource Innovations team with two bill credit calculation workbooks for the validation, one from a summer event and one from a winter event. The bill credit calculation workbooks contained all of the data used for the bill credit calculations from the actual events, and traced back to each step outlined in the baseline calculation description. The validation activities included working through each step of the baseline calculation methodology in the workbooks. This involved tracing formulas, reviewing cell precedent and dependent references, and the data flow for the entire calculation starting with the weather and load data and finishing with the bill credit calculations across the worksheets in the workbooks.

The Resource Innovations team also examined the weather sensitivity model implemented by Duke Energy from Step 3a. The weather sensitivity model is used to determine whether each customer's energy usage patterns are correlated with weather. For example, if a customer

increases energy usage when the temperature is higher, they would be identified as weather sensitive. To validate the weather sensitivity model two customers were randomly selected from the population for each season, one who was identified as weather sensitive, and one who was not. Each of the customers' hourly load values and the corresponding HI for each hour were graphed in a scatter plot, as shown in Figure 4-14. The customer identified as weather sensitive shows a positive correlation between HI and kW, as indicated by the slope of the trend line that increases as the values of kW and HI increase. This shows that the customer increases energy consumption when HI increases and is weather sensitive. The customer identified as non-weather sensitive has a flat trend line, indicating that this customer's load does not vary based on temperature. These summer season examples show that the weather sensitivity model implemented by Duke Energy was reasonable and was able to effectively separate weather sensitive customers from non-weather sensitive customers for the bill credit calculations. The weather sensitivity model was also tested for the winter season and was able to effectively separate weather sensitive from non-weather sensitive customers.

Figure 4-14: Weather Sensitivity Validation- Summer Season



Based on the review of the bill credit calculation workbook provided to the Resource Innovations team, Duke Energy properly identified customers who earned bill credits. The weather sensitivity models were effective, there were no calculation errors, and the bill credit amounts specified in the workbook were consistent with the baseline calculation methodology specified in AG-DR-01-010(a).

4.5 Comparison with Other PTR Programs

The Resource Innovations team conducted a comparison of the DEK Peak Time Credit program with other PTR programs in North America. As described in the evaluation plan, the Resource Innovations team conducted a search of North American PTR programs to evaluate their program and marketing characteristics. The Resource Innovations team expanded the scope of the comparison and collected an assortment of PTR program evaluation results to allow for comparison to the DEK Peak Time Credit program. This section is split up into three parts: the first discussing the methods used by the Resource Innovations team to research information about the PTR programs, the second is an examination of the program information and

marketing materials, and the third is a collection of PTR program results that were available to the Resource Innovations team.

4.5.1 Research Methods

As there was no available database of PTR programs readily available, search criteria were developed to find current PTR programs and subsequently record their program characteristics and marketing strategies. The first step was identifying the range of utilities that were to be searched for the presence of an existing or recent PTR program.

The Resource Innovations team searched the 350 largest utilities in the United States by number of customers. This list of utilities was adapted from the Energy Information Agency (EIA) 2020 annual report[9] on United States utilities. The Resource Innovations team also narrowed the search toward large utilities and did not include results from PTR programs implemented by third party demand response providers. For each utility, a quick search of their website was performed to see if they run a PTR program. If a utility did have a program, various program characteristics were recorded such as incentive amount, event timing and length, peak notification timing, and marketing information. For a selection of programs, the Resource Innovations team also examined utility rate sheets and researched the baseline methodologies used by utilities when calculating PTR program savings.

The Resource Innovations team also collected PTR program impact evaluation results and summarized them for comparison with the DEK Peak Time Credit program. As these evaluations were more difficult to find, this information also includes results sourced from older pilots and defunct programs. While they may not be directly comparable to the DEK program, it provides helpful context of what to expect from both large scale and pilot PTR programs.

4.5.2 PTR Program Characteristics and Marketing Materials

An overview of the utility PTR programs that were found by the Resource Innovations team is presented in Table 4-30. There were 12 current utility programs that had sufficient information available to be included in this study, as well as five programs from electric cooperatives that are recorded in Table 4-31. One Canadian program, run by Quebec Hydro, is also included in the study. The DEK Peak Time Credit program is included in the top row of the table for comparison.

The first measure of comparison is the incentive awarded to PTR program participants. The DEK Peak Time Credit program has an incentive amount of $0.60/kWh, which is approximately in the middle of the road in terms of incentive amounts. Ameren Illinois has the lowest incentive of $0.12/kWh, and a few different utilities had the highest incentive of $1.25/kWh.

In terms of event characteristics, the DEK PTR program was one of the few that calls both winter and summer events. Portland General Electric and Holy Cross Energy were the only

[99] Annual Electric Power Industry Report 2020, Form EIA-861 detailed data files, https://www.eia.gov/electricity/data/eia861

other utilities to hold events in both the summer and winter, and Quebec Hydro exclusively holds peak time events in the winter. The Peak Time Credit event windows are standard when compared to other programs during the respective seasons. Winter events generally take place in the morning and summer events are generally in the afternoon and evening. The DEK event length of four hours was also common, as most utilities' event lengths were between one and eight hours, with many of them at about four hours. The DEK Peak Time Credit program aims to have 12 events per year, a metric which had a lot of variation across the utilities, where some had as few as 3 per year while others had up to 20 or no stated limit.

In terms of notification strategies, all of the utilities alert customers of events by some combination of email, phone calls, and text messages. The timing of the event notification is also generally the same across the utilities, with most of them sending out alerts the day before the event. Of the large utilities, ComEd and Ameren Illinois are the only ones who can send notifications the day of an event.

The Resource Innovations team closed with an examination of the marketing methods and materials that were provided to prospective or current PTR program participants. Every program in this analysis has a current/archived website or media coverage. Almost every utility reported on their website that they had emailed customers about the opportunity to participate in the program. All of them also had a website set up with basic program information and instructions for how to enroll. There was usually an additional FAQ section set up on this page, where general questions were answered. Some of the more unique materials found were calculators where a customer could see how much of a bill credit they would receive for performing a certain energy saving action. Another interesting marketing method was exclusive to Portland General Electric, who had a video on their website aimed at kids which explained the program and what actions they could take to reduce electricity usage during peak time events.

Table 4-30: Summary of North American Utility PTR Program Characteristics and Marketing

Utility	Program Name	Incentive Amount	Event Season	Event Window	Event Length	Number of Events Per Year	Peak Notification Timing	Marketing Channels	Marketing Materials
Duke Energy Kentucky	Peak Time Credit	$0.60/kWh	Summer (June-September), November-April	3 to 7 PM (Summer), 6 AM to 10 AM (Winter)	4 hours	12 per year	Typically, day prior by 8 PM, up to one hour before event	Email and Website	Website with infographics and FAQ; energy-saving tips; post-event email/text with credit amount
Baltimore Gas and Electric	Energy Savings Days	$1.25/kWh	June-September	12 to 8 PM	up to 8 hours	4 per year	Typically, day prior, discretion of BGE	Email and Website	Website with infographics, energy savings tips, post-event email/text with credit amount.
Southern California Edison (2018)	Peak Time Rebate	$0.75 base, $1.25 w/ enabling tech (AC-cycling, smart therm, etc.)	June-September	2 to 6 PM	4 hours	5 per year	Day before event and during event	N/A	N/A
Commonwealth Edison	Peak Time Savings	$1.00/kWh	June-October	11 AM to 7 PM	up to 8 hours	3 - 6 per year	Day of event, as early as 9 AM and up to 30 minutes before event	Email and Website	Website with infographics and FAQ, Savings calculator,
Consumers Energy Company	Peak Time Rewards	$0.95/kWh	June - September	2 to 6 PM	4 hours	Up to 14 days per year	24 hours in advance	News Reports and Website	Website with program information and FAQ
San Diego Gas and Electric	Reduce Your Use	$0.75 for normal customers; $1.25 if enrolled in other program such as AC cycling	June-September	2 to 6 PM	4 hours	No limit	Day before event	New Reports and Website	Website with FAQ, infographics, and savings tips
Ameren Illinois	Peak Time Rewards	$0.12/kWh	June-September	10 AM to 10 PM	2- 6 hours	1 - 20 event hours	Previous day, could be same day if emergency	Web, email	Website with infographics, event center, and FAQ. Participant portal with savings tips
Portland General Electric Company	Peak Time Rebates	$1.00/kWh	June-September, November-February	7 AM - 11 AM (Winter), 3 PM to 8 PM (Summer)	2-5 hours	12- 20 events annually	Previous day, if energy is forecasted in top 1% annual demand	News reports, emails, website	Tips for savings, infographics, information for kids,
Potomac Electric Power Co	Peak Energy Savings Credit	$1.25/kWh	June-September	12 to 8 PM	1- 6 hours	Flexible	9 PM, night before event	Website with an FAQ, energy savings tips, introduction to program	Website, FAQ, savings tips
Connexus Energy	Peak Time Rebate	*Up to $1.00/kWh (Depends on LMP)	June-August	4 to 9 PM	3 hours	3-5 days per month	9 PM, night before event	Website, local news	Website, FAQ, savings tips, customer portal for managing credits
Delmarva Power	Peak Savings Days	$1.25/ kWh	June-September	12 to 8 PM	2-4 hours	Discretion of utility, based on demand forecast	Day before an event	Website, local news	Website, FAQ, savings tips, customer portal for managing credits
Holy Cross Energy	Peak Time Payback	$0.50/ kWh during "High Events". $1.00 during "Critical Events"	Year Round	4 to 9 PM	2-3 hours	96 hours per year	Day before an event	Website	Website, FAQ sheet, registration instructions
Hydro Quebec	Winter Credit Option	$0.50 CAD/kWh ($0.77 USD)	December - March	Morning: 6-9 AM, Evening: 4-8 PM	3-4 hours	Up to 100 hours per season, up to 2 events per day	Day before an event	Emailed customers inviting them to join, currently limited to 60,000 customers	Website, FAQ page, sign up with terms sheet, savings tips, app with tool that calculates savings

Table 4-31: Summary of North American Electric Cooperative PTR Program Characteristics and Marketing

Electric Cooperatives	Program Name	Incentive Amount	Event Season	Event Window	Event Length	Number of Events Per Year	Peak Notification Timing	Marketing Channels	Marketing Materials
Holy Cross Energy	Peak Time Payback	$0.50/ kWh during "High Events". $1.00 during "Critical Events"	Year Round	4 to 9 PM	2 to 3 hours	96 hours per year	Day before an event	Website	Website, FAQ sheet, registration instructions
Capital Electric Cooperative (SD)	Peak Time Rebate	$0.75/kWh	Year round	8 AM to 10 PM	1 to 6 hours	2-5 days a month	Few hours before event	Website, Social Media, mail brochure	Website, FAQ, savings tips, brochure
Butte Electric Cooperative (SD)	Peak Time Rebate	$0.75/kWh	Summer (April 11-October 14); Winter (October 15 - April 10)	8 AM to 10 PM	1 to 6 hours	Up to 6 peaks per month	4-6 hours before event	Website, Social Media	Website, FAQ, savings tips
Sunflower Electric Cooperative (KS)	Peak Time Rebate	$0.75/kWh	Summer	12 PM to 9PM	6 hours	N/A	5-6 PM day before or 10 AM day of event, included reminder 20 minutes prior to event	Physical mail	Information brochure, enrollment form, return envelope
Heartland Rural Electric Cooperative (KS)	Peak Time Rebate	$1.00/kWh	Summer	12 PM to 9PM	1-2 hours	N/A	6 PM day before or 10 AM day of event, included reminder 20 minutes prior to the event	Email	Sent email to all cooperative members with invite and example savings
Flint Hills Electric Cooperative (KS)	Peak Alert Notification	$70 times the difference between your 12-month average kW usage per hour x 2.3, and your actual kW usage during the cooperative's highest summer peak hour.	July and August	3 to 6 PM	3 hours	N/A	N/A	Website	Website, Instructions for how to sign up

4.5.3 PTR Program Results

The Resource Innovations team expanded the scope of the PTR program comparison to include a selection of PTR program results to include along with the characteristics and marketing materials. The search process for program results was limited, as some of the programs described in the previous section did not have readily available evaluation reports, and some of the evaluations presented are for defunct programs where program characteristics were not readily available.

Seasonal Duke Energy Peak Time Credit results, along with results from 12 comparable PTR programs are presented in Table 4-32. The results from the Duke Energy Peak Time Credit program were in line with the results seen in other programs. The results in the DEK summer 2020 evaluation period were the highest seen in this analysis, with impacts of over 15%. This is comparable to the results found in the Portland General Electric PTR pilot which had summer impacts of 18%. The DEK winter 2021 load impacts were a bit lower, with an average impact of 5.6%. There were not many winter evaluations available for comparison, but this result is in line with the 2008 PEPCO results for the PowerCentsDC pilot program. The DEK Peak Time Credit program had average load impacts of about 6.1% in summer 2021. While this is lower than the first summer, it is in line with the results found in other PTR programs, such as the Baltimore Gas and Electric Energy Savings Days which had load impacts of 5.0% and the 2015 Southern California Edison Save Power Days which had load impacts of 4.1%.

There were some utilities with notably high per customer impacts, including Portland General Electric and the Sunflower and Heartland Electric Cooperatives. The Portland program provided customers with extensive marketing and savings materials including printable savings checklists, games for children to learn about reducing electricity usage, and a gift card raffle among participating customers. Notably, the cooperatives provided participants with a reminder notification 20 minutes before the event, which may have led to more actions being taken during the event. The cooperatives also had large reference loads during the peak hours, averaging about 4.1 kW, which is significantly higher than the Duke Energy Kentucky peak loads, which ranged from about 2.1 kW to 2.7 kW depending on the season. Larger reference loads provide more opportunity for PTR programs to achieve greater impacts. As noted in Section 4.2.2, when asked about reasons for not being able to reduce energy further during events, DEK Peak Time Credit customers' most cited reasons were that they could not do much more.

While collecting information for both the program characteristics and results, the Resource Innovations team recorded the baseline calculation that utilities use when calculating earned bill credits for PTR participants. Generally speaking, the DEK Peak Time Credit baseline method is as follows:

Take the last 10 non-holiday, non-event weekday usage during four-hour Peak Day period. Look for similar weather days. If there are no similar weather days, average of all 10 days with a weather adjustment.

This is a similar methodology as those employed by other IOUs for their PTR programs. For example, the Exelon utilities all employed a similar methodology, which averaged the last 14 non-holiday weekdays for the corresponding hours. One utility only averaged the three previous days of electricity usage, while another averaged the previous 30 days of electric usage per customer. While there was some variation in how many days of baselining were used, almost every utility had the same general model as DEK.

Table 4-32: Summary of PTR Program Results

Utility	Year	Program Name	Customers	Per Customer Impact	Percent Impact	Evaluator
Duke Energy Kentucky	Summer 2021	Peak Time Credit	800	0.14 kW	6.1%	Resource Innovations
Duke Energy Kentucky	Winter 2021	Peak Time Credit	800	0.12 kW	5.6%	Resource Innovations
Duke Energy Kentucky	Summer 2020	Peak Time Credit	800	0.38 kW	15.4%	Resource Innovations
Southern California Edison	2015	Save Power Days	324,681	0.08 kW	4.1%	Nexant
Southern California Edison	2016	Save Power Days	336,797	0.04 kW	2.0%	Nexant
Baltimore Gas and Electric	2013-present	Energy Savings Days	~1,100,000	0.2 kW	5.0%	Brattle Group
Commonwealth Edison	2015	Peak Time Savings	56,141	0.13 kW	9.3%	Nexant
Consumers Energy	2018	Peak Time Rewards	14,579	0.17 kW	10.0%	Cadmus
Oklahoma Gas and Electric	2015	Peak Time Rewards	429	0.05 kW	1.8%	Nexant
United Illuminating	2018-2020	Peak Time Rebate Pilot	10,000	0.08 kW	1.3%	N/A
San Diego Gas and Electric	2016	Peak Time Rebate Pilot	68,937	0.08 kW	8.3%	Itron
Portland General Electric[10]	2017/2018 Pilot	Peak Time Rebate	722	Summer: 0.41 kW Winter (AM): 0.23 kW Winter (PM): 0.13 kW	Summer:18% Winter (AM): 13% Winter (PM): 7%	Cadmus
Heartland Rural Electric Co-op (KS)	2012	Peak Time Rebate	2,345	0.34 kW	9.1%	Power Systems Engineering
Sunflower Electric Power Co-op (KS)	2015	Peak Time Rebate	350	0.41 kW	9.7%	Power Systems Engineering
Potomac Electric Power Company	2008-2009	PowerCentsDC	900	Summer: 0.12 kW Winter: 0.07 kW	Summer: 13% Winter: 5%	eMeter Consulting

[10] Reflects a pilot rate of $0.80/kW

4.5.4 PTR Program Enhancement Recommendations

Overall, the load impact results from the Pilot were comparable to impacts from other opt-in PTR programs, as discussed in Section 4.5.3. When comparing PTR performance across programs, the incentive amount, event duration, event hours, and number of events within a season are all important factors to consider. It is also worth noting that nearly all the PTR programs in the comparison section are based on opt-in enrollment. Automatic or default enrollment of all customers at a utility into a PTR program has been attempted. However, this approach presents a serious risk for erroneous payments to customers due to random usage variations relative to their baseline. For utilities with large populations of customers, this could lead to significant sums of money being paid in credits to customers who were unaware of the event, or even unaware of the program. In situations such as this, the bill credits paid may appear to reflect large load reductions from the program. However, the impacts estimated through a rigorous load impact evaluation can be significantly smaller.

Two examples of such an outcome are the default PTR programs at SCE and SDG&E. Both utilities launched default enrollment PTR programs following the deployment of smart meters in their respective service territories, and both utilities were ordered to transition their programs to opt-in only enrollment following a review of the load impact evaluations by the California Public Utilities Commission (CPUC) staff.

Following the staff review of the evaluations, the CPUC issued Decision 13-07-003[11] on July 11, 2013: "DECISION ADDRESSING COMMISSION STAFF REPORT ON 2012 DEMAND RESPONSE PROGRAM RESULTS". The decision contained discussion specific to the default PTR program performance on Pages 24 – 26:

> *"Upon review of 2012 ex-post PTR load impact data, Staff concludes that, in the case of both SCE and SDG&E, customers who actively opted to receive event alerts significantly decreased their load during events while those who were defaulted to receive email event notifications provided an insignificant load impact. SDG&E's customers not receiving any event alerts also provided an insignificant load impact. Moreover, SCE did not collect ex-post data load impact data for customers not receiving any alerts. Staff interprets this to mean that SCE customers not receiving event alerts provided no significant load impact. Table 1 below provides a comparison of the ex-post load impacts for each class of customer for each utility.*
>
> *Furthermore, Staff claims that in the case of SCE, 95 percent of all incentives were paid to customers who either were not expected to or did not reduce load significantly. Similarly, in the case of SDG&E 94 percent of PTR incentives were paid to customers who did not choose to receive notification of event alerts. Staff contends that this is a case of free ridership, where customers receive incentives without significantly reducing load. Staff argues that incentives should reward and encourage customer participation. Thus Staff*

[11] https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M071/K738/71738068.PDF

> *recommends that the PTR program be revised to a program that eliminates incentives to customers not actively participating in the program."*

Ordering Paragraph 7 on Page 40 then directed both utilities to transition to opt-in enrollment.

> *"7. San Diego Gas &Electric Company (SDG&E) and Southern California Edison Company (SCE) shall revise their Peak Time Rebate programs from default programs to programs that can be chosen by a residential customer. SDG&E and SCE shall complete the revisions no later than May 1, 2014."*

Should Duke Energy Kentucky decide to expand the PTC Pilot to a broader population, it is recommended that enrollment remain on an opt-in basis due to the risk of free ridership under a default enrollment strategy as discussed above. A number of utilities have shown that it is possible to recruit a large number of customers into a PTR program over time. In particular, Commonwealth Edison has been growing its PTR program since 2015 and has been very successful with targeted marketing of customers with high peak-period usage. Of the large utility PTR programs that the Resource Innovations team was able to locate information on, only BG&E appears to have a successful program (BG&E Smart Energy Rewards) operating under default enrollment. However, the Resource Innovations team was not able to locate any publicly available load impact evaluations of that program conducted by an independent 3rd party. Accordingly, should Duke Energy Kentucky pursue a default enrollment approach based on the success of the BG&E PTR program, the Resource Innovations team recommends determining if BG&E has had the program independently evaluated, if the evaluation examined the extent of free ridership, and if BG&E is willing to share the results to provide better insights into current default enrollment PTR program performance.

4.6 Process Evaluation Conclusions and Recommendations

Key findings and recommendations pertaining to the process evaluation include:

Motivation for Participation

- Within about two weeks, 899 customers enrolled with an approximate acquisition rate of 1.5%, which was strong for an email-only campaign. Program staff attributed the success of the recruitment effort to the program having no downsides (penalties) and that the program rules are less complex than other rate programs.
- The most important reason provided by participants for joining the program was saving money on their electricity bill, with an average rating of 9.8 out of 10 on average.
- Of the non-participants who recalled the marketing materials, about half of them said they did not join the program because they felt the incentive to reduce electric usage was too low.

Incentive Amounts

- In the marketing survey, a majority of participants responded that they strongly agree (49%) or agree (32%) that the incentive of $0.60/kWh is enough to motivate them to reduce electric usage during events.
- For the winter event included in the post-event surveys, the average bill credit was $1.19 per customer. For the two summer events in the post-event surveys, the average bill credit was $0.71 per customer.
- Respondents to the post-event survey who recalled the event(s) occurring had an average bill credit of $1.54, while participants who did not recall the event(s) had an average bill credit of $0.55. This difference was statistically significant at the 90% confidence level, showing that active participation resulted in much higher credits in percentage terms.
- The DEK Peak Time Credit program's incentive of $0.60/kWh is approximately in the middle of the road compared to other utilities. Of the utilities included in the literature review, Ameren Illinois has the lowest incentive of $0.12/kWh, and a few different utilities had the highest incentive of $1.25/kWh.

Event Notifications

- Peak Time Credit participants rated the timeliness of the notification highly, with an average rating of 8.8 out of 10 on the winter post-event survey and an average of 9.1 out of 10 on the summer post-event survey.

- Participants overwhelmingly agreed with the statements saying that Duke Energy notified them through their preferred method, with an average rating of 9.7 out of ten on both post-event surveys.
- Approximately one-third of respondents who provided recommendations for the program requested text message alerts and more time to prepare for the events. While Duke does provide the option of opting into text message alerts, they have discussed a potential improvement of allowing the customers to enter their event notification preference during the enrollment period rather than after the fact.

Event Response

- Eighty-two percent of the respondents in the winter post-event survey indicated that they were home during the event, while 77% of the respondents in the summer post-event survey indicated they were home for the two events. For the summer events, the participants that were home during the event had higher bill credits than the participants who reported that they were not home. The difference in average bill credits was large (about $0.49) and statistically significant at the 90% confidence level.
- Most of the participants responded that they did take action to reduce electricity usage during the events (75% in the winter event and 81% in the summer events).
- Participants who took action had much higher bill credits than ones who said they did not take action to reduce their electric usage during the events. In the winter post-event survey, participants who said they took action received an average bill credit of $2.08, opposed to only $0.65 among customers who said they did not take action. In the summer post-event survey, participants who said they took action received an average bill credit of $0.98, opposed to only $0.53 among customers who said they did not take action.
- The most cited action taken during events was changing the temperature set point on the thermostat, with 82% of participants in the winter survey responding that they lowered the set point and 84% of participants in the summer survey responding that they raised the set point.
- The highest bill credits were awarded to customers who took actions that impact high electric usage devices. In the winter survey, customers who reported that they did not use their stove or oven had an average bill credit of $3.09 and participants who reported that they pre-heated their home before the event had an average bill credit of $3.08. In the summer survey, customers who reported that they delayed charging of their electric vehicle had the highest average bill credit of $1.46; this was followed by doing laundry ($1.26) and running their dishwasher at different times of the day ($1.18).
- Thirty percent of the respondents cited working from home making it difficult to reduce electric usage during Peak Day events in the winter. In the summer, only

22% of the customers in the summer survey said that working from home made it difficult to reduce electricity usage. This difference could reflect the changes in the COVID-19 situation between the winter survey period in February 2021 and the summer survey period in July 2021. Also, according to Duke Energy staff, the pandemic did not have an impact on event triggers or the decision on when to call an event.

Program Satisfaction

- When asked how likely they would recommend the program to others, respondents in the winter survey gave an average rating of 8.4 out of 10 with a Net Promoter Score (NPS) of 46. In the summer survey, respondents gave an average rating of 8.6 out of 10, with an NPS of 49, indicating that there are a much larger number of promoters that are happy with the program than detractors.
- Participants were generally satisfied with the information provided by Duke Energy and the program as a whole, rating their satisfaction as 9.0 and 8.2 out of 10 on average in the winter and summer post-event surveys, respectively.
- Participants rate their lowest satisfaction with the bill credits that they earned from the program, rating their satisfaction a 6.8 out of 10.
- Duke Energy staff indicated that they were surprised to see how many customers left the program, mostly due to account closures or going onto net metering, with about 100 of the 899 original customers moving within the last year.

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Duke Energy Kentucky

Peak Time Credit EM&V Companion Report

August 2022

Introduction

Duke Energy Kentucky (DEK or Company) began a 2-year Peak Time Rebate pilot program called Peak Time Credit (PTC) in July 2020. This program enabled customers to receive a credit by reducing their electric energy consumption during Critical Peak Events (CPE). Resource Innovations (RI), formerly Nexant, performed the EM&V (Evaluation, Measurement, and Verification) and issued a report in March 2022. The RI report is included in this filing as Appendix E. Note that the RI report focuses on the original 2-year PTC pilot and does not include information on the PTC Summer 2022 incentive research pilot extension. Nor does this companion report, Appendix F, focus on the PTC Summer 2022 pilot extension. The EM&V report on the Summer 2022 incentive research pilot extension will be provided to the Company by RI on or before January 31, 2023.

The Company provides this companion report to Appendix E to address a handful of topics to fulfill pilot requirements stipulated with the Kentucky Attorney General. These topics include:

- Review of Customer Segments
- Price Responsive Demand (PRD) Review
- Cost Effectiveness Testing
- Company's Original Pilot Recommendation

Review of Customer Segments

Duke Energy Kentucky adopts the results of RI's EM&V report. RI has provided a robust analysis of pilot load impacts. The Company notes that differences inherently exist between the baseline method used for credit calculations, which are at the individual customer level, and the RI EM&V approach, which is more sophisticated and focuses on the group impact. Results below use the individual account level load impacts, unless otherwise noted, to review the WIFI Enabled Thermostat segment.

RI's report examined the differences between single-family and multi-family homes and electric heat versus gas heat. The Company adopts the RI results reported for these segments. However, RI did not dive into differences based on whether the customer has a WIFI enabled thermostat. Therefore, Duke ran a separate analysis to determine the load reduction for this segment of participants based on the Company's baseline driven event data. RI's report analyzed three seasons, Summer 2020, Winter 2020/21, and Summer 2021. Since there were only 2 events in each of the first two seasons and 16 events in the last, this report will focus its analysis on the Summer 2021.

WIFI Enabled Thermostats

A WIFI enabled thermostat gives customers the ability to adjust the temperature setting from anywhere by using their cell phone or other internet connected device. That ability could

enable more load reduction, especially for customers who are not home during the hours of the event. Therefore, it may be advantageous to target these customers to participate in a PTR style program. Of the original 899 customers in the pilot, about 19% have WIFI enabled thermostats.

Duke utilized the data that was generated to calculate the credits for customers in the pilot program to compare impacts between WIFI thermostat customers and non-WIFI thermostat customers. WIFI thermostat customers may respond to peak day events quite differently than other, non-WIFI thermostat customers.

To calculate the credits, Duke estimates a base load for each customer as previously described in filings for the PTC pilot. The table below shows the average daily load for customers and the average load during the four hours of an event with and without demand response (DR) (i.e., a measured load reduction impact) and the resulting difference, which represents the load reduction generated by the PTR.

Customer Segment	Avg Daily kWh	Load w/o DR (kW)	Load w/ DR (kW)	Impact (kW)	Impact (%)
WIFI Enabled Thermostat	37.9	2.74	2.59	0.14	5.56%
No WIFI Enabled Thermostat	31.6	2.25	2.15	0.10	4.60%
All Events Participants	32.9	2.34	2.24	0.11	4.82%

As can be seen from the table, the customers with WIFI enabled thermostats reduced load an average of about 0.04 kW more than customers without WIFI enabled thermostats. To determine whether this difference is statistically significant, the hypothesis that there is no difference between the two groups was tested at the 95% confidence level. Statistical results show that customers with WIFI enabled thermostats reduce load more than those without WIFI enabled thermostats.

However, it should be noted that our focus is to determine whether or not to allow only WIFI enabled thermostat customers to participate versus all customers. If we run the same analysis comparing the average reduction for customers with WIFI enabled thermostats to all event participants (i.e., including the WIFI enabled thermostat customers), no difference in the mean reduction is detected statistically. Coupled with the fact that only 19% of the customers in the pilot have WIFI enabled thermostats, which would significantly reduce participation if participation was limited to only WIFI enabled thermostat customers, there seems to be little advantage to only targeting the program towards this segment of customers.

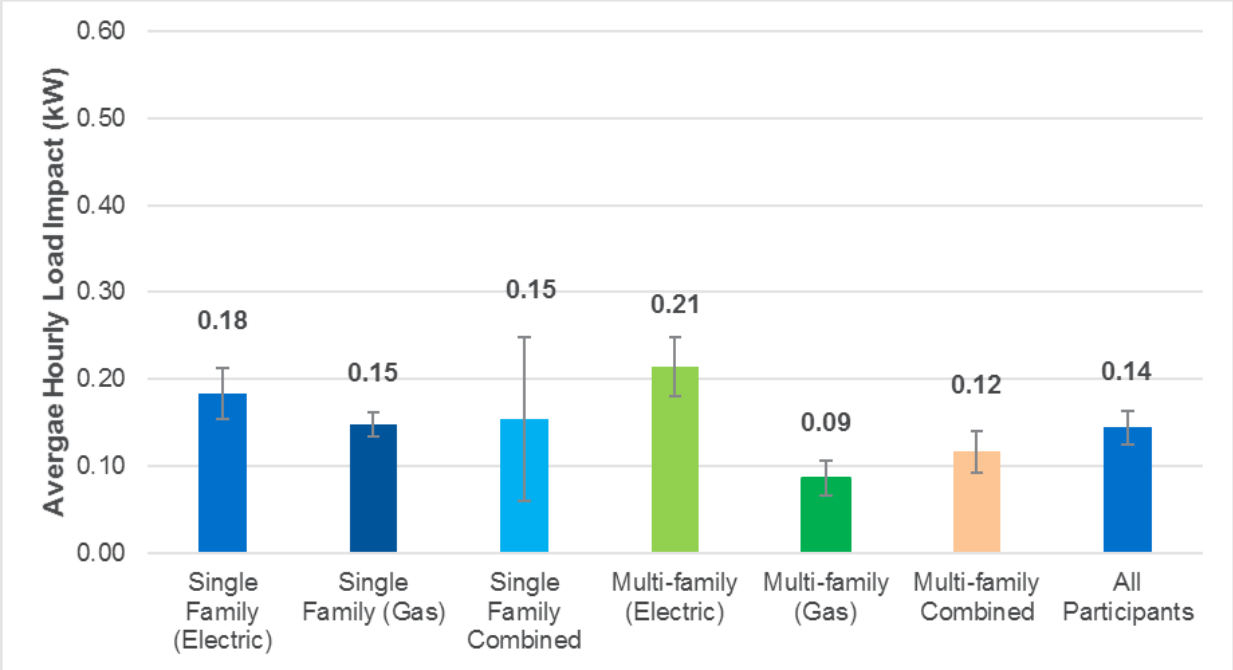
Home and Furnace Type

Since a single-family home tends to be larger than multi-family (mostly apartments), it is likely that housing type influences the ability to reduce load. What may be less obvious is the

load reduction results related to gas heat customers versus electric heat, especially in the summer. However, a home with electric heat, possibly a heat pump, may be more likely to have central air conditioning than a home with gas heat. In any event, the table below (reproduced from page 17 of the RI report) shows that single family homes reduced more than multi-family homes and homes with electric heat reduced more than homes with gas heat.

Customer Segment	Load w/o DR (kW)	Load w/ DR (kW)	Impact (kW)	Impact (%)
Residential Single Family Combined	**2.66**	**2.51**	**0.15**	**5.77%**
Residential Single Family (Electric Heat)	2.41	2.23	0.18	7.62%
Residential Single Family (Gas Heat)	2.70	2.56	0.15	5.46%
Residential Multi-family Combined	**1.48**	**1.36**	**0.12**	**7.89%**
Residential Multi-family (Electric Heat)	1.45	1.24	0.21	14.72%
Residential Multi-family (Gas Heat)	1.48	1.40	0.09	5.80%
All Events Participants	**2.37**	**2.22**	**0.14**	**6.09%**

In addition, RI provides a chart that included error bars for the 90% confidence level for each of these segments. The chart below is from page 18 of the RI report and shows the average hourly load impact in kW by customer segment for Summer 2021.



The error bars in the above chart show where the actual average is with 90% confidence. For example, although the average for single family homes in the study was 0.15

kW, we can be 90% confident that the true average is somewhere between 0.06 and 0.25. Therefore, where these error bars overlap, we cannot be sure that there is a statistically significant difference between the customer segments. The only differences that seem to be statistically significant are that multi-family homes with electric heat average more reduction than all participants and that multi-family homes with gas heat average less reduction than all participants.

This could indicate that targeting multi-family homes with electric heat could provide larger reductions in load. However, as can be seen on page 8 of the RI report, this segment made up only 5.9% of the total PTR participants in the Summer of 2021; a small portion of total participation.

WIFI Enabled Thermostat and Segmentation Conclusion

The differences between the various customer segments are rather small and mostly not statistically significant, especially when compared to the average of all participants. In addition, some segments which appear to demonstrate higher reductions in load are also smaller segments and if solely targeted, may impact the feasibility of an on-going program. Moving forward, while not changing the eligibility criteria for participation, the Company could focus marketing on single family households and all electric multi-family homes with mention of the natural fit between the pilot and WIFI enabled thermostat customers with central air conditioning.

Price Responsive Demand (PRD) Discussion

The Company reviewed the requirements for PJM Price Responsive Demand (PRD) resources to consider whether transitioning the PTC Pilot to a PRD would be beneficial as compared to the PSA (Peak Shaving Adjustment) option offered by PJM. A list of PRD requirements from PJM Manual M18 on pages 46 through 47 is provided below.

In order for load to be eligible to be considered as Price Responsive Demand, the end-use customer load must be:

- *served under a dynamic retail rate structure with an LSE or subject to a contractual arrangement with a PRD Provider where such rate or compensation arrangement can change on an hourly basis, is linked to or based upon a PJM real-time LMP trigger at a substation location within a transmission zone as electrically close as practical to the applicable load, and results in predictable response to varying wholesale electricity prices;*
- *subject to advanced metering capable of recording electricity consumption at an interval of one hour or less; and*
- *subject to Supervisory Control as defined in the Reliability Assurance Agreement to curtail the demand should PJM declare an emergency condition.*

A benefit of the PRD resource is the capacity value it provides relative to the PSA. However, PRD requirements demand the ability to adjust load based on real-time LMP. For residential customers, the potential variability of real time LMP and the resulting choppy pattern and number of load reduction periods may prove challenging. Such variability would not only need to be monitored and implemented (i.e., a new cost that would have to be supported solely by the PTC program in DEK) but it also lends itself to residential appliances that would not cause repeated and significant discomfort to customers. A program focused on the control of electric water heaters might be an example of a good fit for PRD. One approach to reduce this potentially onerous condition would be to set the LMP price trigger at such a high level that a PRD load reduction period would only occur and coincide with a PJM system emergency condition. However, such a program design, combined with the supervisory control discussed below, essentially makes the PRD very similar, if not the same, to the Company's direct load control program, Power Manager.

The last PJM requirement surrounding supervisory control is troublesome for the transition of the PTC Pilot into a PRD program. If a device is required that can provide the registered load reduction through supervisory control, the device will add cost to a program that is already challenged to be cost effective. Of course, it would also likely increase the load reduction capability of the program. In addition, it changes the nature of the PTC Pilot from customer driven and controlled load reduction to a utility-controlled device driven program. The Company already has a program called Power Manager that provides Demand Response capacity value and is not required to respond to hourly real time prices. Additional Demand Response programs may be offered in the future such as a thermostat control or water heater control program utilizing a cost-effective program design.

For these reasons, The PTC Pilot is not well positioned for a transition to PRD. However, a program linked to customers with very flexible load or appliances (i.e., electric water heaters) and who may be highly sensitive to pricing fluctuations, such as a crypto-currency mining company, may be well suited for the PRD option. In addition, the Company also recognizes that PTR could potentially be one part of a larger load reduction program.

Cost Effectiveness Testing

The Company developed 2 scenarios to evaluate the PTC Pilot through standard cost effectiveness testing using DSMore. The two scenarios are listed below.

1. Current pilot results
2. Non-pilot Forward Looking DSM program

The DSMore results are listed in the table below. While the first scenario represents the standard DSMore test results provided in the August DSM filing each year, a few comments provide insight for scenario two. In Scenario two, the Company leverages the pilot results but assumes a participation starting point based on the total participants in the Company's pilot and pilot extension, 2,051 participants. Accounting for expected attrition through August, the

scenario uses a participation level of 2,005 participants. This participation is assumed to stay level for 5 years. A small marketing cost is included to counter attrition from the program. Other costs included are based on pilot costs. The Company assumes the credit calculation process is automated and includes an estimated cost for this tool development. Therefore, the Company attempts to determine if transition of the current pilot to a non-pilot program could potentially be cost effective. As shown below, the forward-looking scenario based on an incentive of $0.60 per reduced kWh results in a TRC test = 0.32.

Table

Scenario	TRC Score
Pilot	0.20
Forward Looking PTR Program	0.32

To enhance cost effectiveness results, costs must decrease, or impacts must increase, or both. To investigate increasing impacts, the Company is currently researching the incentive level offered. In addition, segmentation options are discussed above. The Company will need to further consider how cost reductions could be captured through alternative design considerations.

Company's Pilot Recommendation

The Company recognizes that the PTR Pilot program currently has a research extension for the Summer of 2022. This research extension is evaluating the difference in load impacts between a credit of $0.60 / kWh reduced and a credit of $1.20 / kWh reduced. The results of this pilot extension will not be available until early 2023. However, at this time the Company can provide participation results. Using identical methods for acquiring customers, 667 customers enrolled in the $1.20 / kWh reduced offer. In comparison, 679 customers enrolled in the $0.60 / kWh reduced offer. The incentive amount did not appear to drastically impact the number of customers interested in participating. However, whether the two groups differ in the load reduction observed is yet to be determined.

Given the Commission's guidance in past proceedings related to programs with low cost-effectiveness scores, the Company proposes to terminate the original group pilot. The Company will evaluate the results from the Summer 2022 pilot research extension when available (i.e., December 2022 or January 2023). In addition, the Company will consider how PTR and other time-differentiated rates might be elements of a broader effort to effectively shape and reduce peak load. New considerations will be shared at annual meetings of the DSM collaborative. The Company is also currently evaluating a PTR research proposal from ESource to assist with investigating ways to effectively offer time differentiated rates that leverage AMI data. The Company will provide additional information on the potential use of PTR in a future DSM Amendment Filing or a future rate case.

Nexant
Reimagine tomorrow.

Smart $aver® Non-Residential Custom Program Years 2018-2019 Evaluation Report

Submitted to Duke Energy Kentucky
in partnership with Tetra Tech

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1 Executive Summary

1.1 Program Summary

Duke Energy's Non-Residential Smart $aver® Custom Incentive Program (NR Custom) offers financial assistance to qualifying commercial, industrial and institutional customers in the Duke Energy Kentucky (DEK) service territory to enhance their ability to adopt and install cost-effective electrical energy efficiency projects.

The program is designed to meet the needs of the Duke Energy's (the company's) non-residential customers with electrical energy saving projects involving more complicated or alternative technologies, or those measures not covered by the non-residential Smart $aver Prescriptive Program. The intent of the program is to encourage the implementation of energy efficiency projects that would not otherwise be completed without the company's technical or financial assistance.

The program engages numerous Duke Energy team members to support the program, including large account managers, business energy advisors (BEAs), energy efficiency engineers, and trade ally outreach representatives. Willdan is Duke Energy's authorized vendor for the New Construction Energy Efficiency Design Assistance (NCEEDA) portion of the Smart $aver program. Willdan acts as a client liaison with Duke Energy and discusses project technical issues with Duke Energy's energy efficiency engineers.

1.2 Evaluation Objectives and High Level Findings

This report presents the results and findings of evaluation activities for Duke Energy Kentucky's NR Custom program conducted by the evaluation team, collectively Nexant Inc. and their subcontracting partner, Tetra Tech, for the period of January 2018 through December 2019.

1.2.1 Impact Evaluation Objectives

The overarching goals for the NR Custom impact evaluation were to:

- Quantify accurate and supportable energy impacts (kWh) and summer and winter demand (kW) savings for energy efficient measures and equipment implemented in the participants' facilities.
- Assess the rate of free riders from the customer and contractor perspective.
- Determine spillover effects from the customer and contractor perspective.
- Consider and verify measure installation vintage aligned with measure baseline definitions, i.e. early replacement, burnout on failure, etc.

Evaluation activities included in-depth reviews and verification of a representative sample of projects including virtual or phone interviews with program participants; collecting trend, utility consumption data, and building automation system/energy management system (BAS/EMS)

data, and engineering analyses to estimate gross and net savings for all implemented measures attributed to the NR Custom Program.

1.2.2 Process Evaluation Objectives

Process evaluations are designed to support continuous program improvement by identifying successful program elements that can be expanded upon and underperforming/inefficient processes that could be holding back program performance. The process evaluation for the NR Custom Program sought to:

- Assess how participant characteristics compare to segments targeted for the program
- Assess the sources of customer engagement and most effective marketing source
- Assess the influence the program has on customers' decisions to install energy-efficient (EE) measures
- Assess Duke staff involvement in setting any organization policies
- Assess persistence of program engagement with participants
- Assess satisfaction with the program and its components, including suggestions for program changes

To meet these objectives, the evaluation team conducted interviews with key program staff, reviewed program documentation, interviewed third-party vendors, and utilized telephone surveys to ask program participants and trade allies about their experiences with the program.

1.2.3 High Level Findings

1.2.3.1 Gross Impact Evaluation Key Findings

The impact evaluation results indicate that program's internal processes for project review, savings estimation, and installation verification are producing quality estimates of project impacts. Energy realization rates exceed 100% for the two lighting strata (Lighting – Large and Lighting - Small) and the Non-lighting-Large strata. The realization rate for the Non-lighting-Small strata was 98.0%. Realization rates for summer and winter demand were above 100% for all strata and at the program level. Findings from the gross impact evaluation are summarized in Table 1-1, Table 1-2, and Table 1-3.

Table 1-1 DEK Program Reported and Verified Gross Energy Impacts

Measure Category	Strata	Gross Reported Energy Savings (kWh)	Gross Verified Energy Savings (kWh)	RR (%)
Lighting	Small (<342 MWh)	2,042,224	2,411,155	118.07%
	Large (≥342 MWh)	5,217,348	5,275,767	101.12%
Non-lighting	Small (<1,091 MWh)	1,312,227	1,286,465	98.04%
	Large (≥1,091 MWh)	6,196,344	6,196,344	100.00%
Total		**14,768,143**	**15,169,731**	**102.18%**

Table 1-2 DEK Program Reported and Verified Gross Summer Demand Impacts

Measure Category	Strata	Gross Reported Summer Demand Savings (kW)	Gross Verified Summer Demand Savings (kW)	RR (%)
Lighting	Small (<342 MWh)	293	332	113.17%
	Large (≥342 MWh)	459	472	102.79%
Non-lighting	Small (<1,091 MWh)	159	166	104.05%
	Large (≥1,091 MWh)	813	813	100.00%
Total		**1,725**	**1,783**	**102.74%**

Table 1-3 DEK Program Reported and Verified Gross Winter Demand Impacts

Measure Category	Strata	Gross Reported Winter Demand Savings (kW)	Gross Verified Winter Demand Savings (kW)	RR (%)
Lighting	Small (<342 MWh)	383	423	110.27%
	Large (≥342 MWh)	855	861	100.78%
Non-lighting	Small (<1,091 MWh)	103	105	102.33%
	Large (≥1,091 MWh)	568	568	100.00%
Total		**1,909**	**1,957**	**102.18%**

1.2.3.2 Net Impact Evaluation Key Findings

Duke Energy staff have a thorough process for evaluating applications. This process includes denying projects if customers already purchased equipment or started the building process in the case of new construction. The net impact evaluation results show that over 100% of the program's energy savings are attributable to the program's activities. There was little free-ridership identified and some nonparticipant spillover. Few customers reported they planned to complete any project or pay the additional incentive amount to complete the efficiency project. The free-ridership and nonparticipant spillover levels are likely due to the limited program funding and customer uncertainty about how long funding would be available.

Findings from the net impact evaluation are summarized in Table 1-4.

Table 1-4 Net-to-Gross Evaluation Results

Net-to-Gross Component	Rate
Free-ridership	6.81%
Net of Free-ridership	93.19%
Program-influenced Participant Spillover	0.00%
Program-influenced Nonparticipant Spillover	11.69%
Net-to-Gross	**104.88%**

1.2.3.3 Process Evaluation Key Findings

Overall, the program is operating as intended, and customers and trade allies are satisfied with their experiences with the program and Duke Energy. Contractors play a role in the program by making customers aware of the program offerings, and contractors have utilized the program to encourage customers to purchase high efficient equipment. Contractors felt the program, specifically the incentive, was influential in customers moving forward with projects where they would not have otherwise. That said, with the limited program funds and the uncertainty of the program, contractors were hesitant to utilize the program for specific projects because they did not know how long the program incentives would be available. Participants provide similar feedback in that they have appreciated the support they received from trade allies and Duke Energy and that the incentive was valuable in helping move projects forward.

Additional high-level findings include the following:

- The primary source of participants' program awareness was split between contractors, colleagues, and Duke Energy representatives.
- Satisfaction with the program overall and its components was high among participants and trade allies. The highest-rated program component for contractors was their interaction with Duke Energy program staff.
- The incentive was the most valuable program component as rated by participant respondents, followed by the contractor's technical assistance.
- The application processing was quicker than the four to six-week goal, and customers reported being satisfied with the application process.
- The calculation tools had a recent overhaul and most recently moved to an online platform. Three of seven participants indicated they used the calculators and provided a higher rating than what was reported during the last evaluation.
- Contractors valued the program and used the incentives as a sales tool to encourage customers to purchase high efficient equipment.

- The tracking data was missing some key customer-contact information for evaluation activities and program/project tracking.

- The COVID-19 pandemic had a moderately negative impact on contractors' business operations, with businesses implementing social distancing procedures. Furthermore, about one-third had a reduction in sales due to the pandemic.

1.3 Evaluation Conclusions and Recommendations

Based on evaluation activities and findings, the evaluation team concluded the following and provides several recommendations for program improvement.

1.3.1 Impact Recommendations

Conclusion 1: The evaluation team saw strong evidence the Duke Program team conducts detailed reviews of the project applications, has quality control checks and revises measure parameters to refine savings estimates. Engineering reviews by AESC[1] provides an additional level of quality control that helps to minimize most calculation errors or instances of over-claimed energy or demand savings. The strata-level realization rates indicate that an appropriate level of rigor is being applied to lighting projects and most non-lighting projects.

Recommendation 1: Continue the level of rigor being applied to projects as it goes through the NR Custom application process while considering the following recommendations to improve the program in specific areas.

Conclusion 2: Of the parameters needed to calculate lighting project savings, verified lighting operating schedules, or annual hours of use, were occasionally found to be slightly different than what was used to calculate reported savings. The main type of difference found was in the number of holidays accounted for in the verified savings and the operating hours during these holidays.

Recommendation 2: Improve the level of detail collected in the application on the hours of operation. Holidays and seasonal changes should also be captured in the annual hours of use.

Conclusion 3: Project reviews, both during the application process and the evaluation, benefit from documentation of all underlying assumptions, trend data, utility billing records and worksheets used for the calculations of savings. Photos serve as a valuable verification of the installed equipment and provide essential information regarding the condition and operating parameters of the old and new equipment. This applies to primarily small and larger non-lighting projects where trend data and manufacturer's specification sheets would allow more detailed analyses of the proposed measures. Analysis of trend data helps confirm that consumption estimates from models are realistic and appropriate. Lighting projects are very well documented but pictures of baseline equipment prior to it being removed would be useful to refine savings calculations.

Recommendation 3a: Collect and document enough information and photos of the project so the calculations of savings could be independently repeated.

[1] The Company contracts with Alternative Energy Systems Consulting (AESC) to perform technical review of applications.

Recommendation 3b: The estimates produced by the Duke HVAC/EMS calculator should be reviewed and compared against project trend data and historical utility consumption to ensure savings estimates are reasonable.

Conclusion 4: The Duke NCEEDA protocol defines how savings from new, high performance buildings shall be modeled and estimated. Assumptions on how the building is expected to be occupied and used are also required but do not always match how the new buildings are actually used or occupied. This can lead to the modeled consumption and savings not matching the actual consumption and savings.

Recommendation 4: The NCEEDA should incorporate a tiered post construction calibration requirement that uses the ASHRAE 14 tolerances to assess the level of uncertainty in the new construction models and make adjustments to the model in order to minimize the uncertainty.

Conclusion 5: Free-ridership is low (6.8%) and nonparticipant spillover exists in Kentucky (11.7%), leading to a NTG of 104.9%. There is evidence that the low free-ridership and existence of nonparticipant spillover could be a result of customer uncertainty regarding annual program funding levels and incentive availability. It is also impacted by Duke Energy LAM and TA Outreach Reps that work with customers and contractors, and contractors' use of the incentives in their pricing estimates.

Recommendation 5: Continue to engage early with customers to motivate them to choose eligible projects and submit applications. Support contractors in their efforts to recommend energy efficient equipment and include the program incentives in their pricing.

1.3.2 Process Recommendations

Conclusion 6: The program continues to operate as intended. Duke Energy staff work closely with contractors and customers, who both report high overall satisfaction with the program and many program aspects. The most common source of program awareness from customers was other businesses and colleagues, followed closely by Duke Energy staff and contractors. Contractor technical assistance also saw high satisfaction, underscoring the critical role they play.

Recommendation 6: Continue to engage contractors in the program and keep them informed of the program availability to increase awareness among customers and encourage the installation of program-qualifying equipment. Including builders and architects who may be utilizing the new construction design assistance will also benefit the program.

Conclusion 7: Customers who use third-party vendors to assist them with projects present a unique challenge. Some third-party vendors are highly involved in the projects and their contact information is included as the program participant. However, when it comes time to conduct verification or evaluation activities, talking with someone directly at the organization is essential.

Recommendation 7: Ensure organization-specific contact information is collected as part of the application process and include name, phone, and email. This should include a local contact as well as a contact who was part of the decision-making process.

Conclusion 8: Contractors continue to be one of the primary sources of program awareness and also reported using the program incentives as part of their pricing estimates. Contractors are satisfied with the program and appreciate the ability to use the incentives as a sales tool.

The main improvement recommended by contractors was to improve the application process and to increase the program offerings and transparency of the program. These contractors requested the program be offered in Ohio but also increase the transparency of the funds available and status of funds in Kentucky.

Recommendation 8: Identify a way to allow contractors and customers to see how much of the program funds remain available. This would alleviate situations where customers and contractors expected incentives, but they were no longer available.

Conclusion 9: The Duke team has an efficient and effective process in place for reviewing applications for preapproval in an effort to focus on projects that are eligible but not already committed. They offer both application and calculation assistance that provides third party assistance to customers and trade allies if needed for a fee. As part of the application, questions are included to identify projects where the customer has already identified or purchased program-qualifying equipment. The questions on the application are a great tool to use in talking with customers about their projects and plans in order to increase the scope and efficiency of projects. As applications are flagged, the program team can encourage customers to revise scope to implement more than what they would do otherwise.

Recommendation 9a: Continue to screen out projects with question E of the application to identify customers who have already selected, purchased, or committed to doing a project or building.

Recommendation 9b: Update question G on the application to 1) require customers to answer the question and 2) revise the wording to allow more response options to be presented to the customer. By requiring customers to answer the question, the project team will have a better understanding of the type of equipment customers are selecting and if the program assistance is responsible for the project. The response to this question can provide insight into the potential free-ridership on the project. The evaluation team recommends updating the question text to the following:

> G. Without the program assistance and incentive, you would…
>
> - ❑ Purchase and install the same high efficiency equipment
> - ❑ Purchase less of the high efficiency equipment
> - ❑ Purchase the high efficiency equipment at a later date
> - ❑ Purchase standard / code minimum efficiency
> - ❑ Neither purchase nor install any part of the project

The project team can then use this question to flag applications and follow-up with customers to discuss items such as the following: a) Would they consider more efficient equipment or more fixtures? b) How did they select the efficiency of the equipment on the application? c) Does the company have policies that encourage or require purchasing higher efficiency equipment or reducing GHGs or to meet sustainability goals? Answers to these questions will allow Duke Energy staff to determine if the project is a good candidate for an incentive and help further manage free-ridership.

2 Introduction and Program Description

2.1 Program Description

Duke Energy's Non-Residential Smart $aver® Custom Incentives program (NR Custom) offers financial assistance to qualifying commercial, industrial and institutional customers in the Duke Energy Kentucky (DEK) service territory to enhance their ability to adopt and install cost-effective electrical energy efficiency projects.

The Program is designed to meet the needs of Duke Energy's non-residential customers with electrical energy saving projects involving more complicated or alternative technologies, or those measures not covered by the non-residential Smart $aver Prescriptive Program. The intent of the Program is to encourage the implementation of energy efficiency projects that would not otherwise be completed without the company's technical or financial assistance. The program requires pre-approval prior to the project implementation. Proposed energy efficiency measures may be eligible for customer incentives if they clearly reduce electrical consumption and/or demand. As part of the preapproval process, the Duke Energy Kentucky team conducts thorough reviews of applications, rejecting applications that do not meet the program requirements.

The two approaches for applying for incentives for this program are Classic Custom and Custom-to-Go. The difference between the two approaches focuses on the method by which energy savings are calculated. The documents required as part of the application process vary slightly.

The custom application forms are located on the company's website under the Smart $aver® Incentives (Business and Large Business tabs). The application forms are offered in Microsoft Word (doc) and Adobe (pdf) format with the designated worksheet in Microsoft Excel format for projects saving more than 700,000 kWh annually. Customers can utilize provided calculation tools (Custom-to-Go, now Smart $aver Tools) for projects savings less than 700,000 kWh annually or submit worksheets in another format if preferred. Customers or their vendors submit the forms with supporting documentation. Forms are designed for multiple projects and multiple locations. Custom incentive application (doc or pdf) is submitted with one or more of the following worksheets:

Classic Custom approach (>700,000 kWh or no applicable Custom-to-Go calculator)

- Lighting worksheet (Excel)
- Variable Speed Drive (VFD) worksheet (Excel)
- Compressed Air worksheet (Excel)
- Energy Management System (EMS) worksheet (Excel)
- General worksheet (Excel), to be used for projects not addressed by or not easily submitted using one of the other worksheets

Custom-to-Go Calculators, now Smart $aver Tools (<700,000 kWh and applicable Custom-to-Go calculator)

- Lighting
- HVAC
- Compressed Air
- Fan
- Pump

The Company contracts with Alternative Energy Systems Consulting (AESC) to perform technical review of applications. Duke Energy contractors process applications as well as train and provide technical support to the Trade Ally (TA) network. All other analysis is performed internally at Duke Energy, including DSMore runs for every custom measure that is recorded by the program to ensure the project's cost effectiveness prior to implementation.

2.1.1 Participation Summary

Table 2-1 summarizes program participation and reported energy savings for the full evaluation period of January 2018 through December 2019. There was a total of 43 projects completed during the evaluation period. For the purposes of this report a project is defined as a unique enrollment ID. These 43 projects collectively accounted for a total of 90 unique database line items. Database line items typically represent single-measure projects, or an individual measure implemented as part of a multi-measure project. There are also a few instances where a line item in the tracking database represents a unique project site where a common scope of work was completed as part of a larger portfolio of sites (i.e. Speedway / Super America). Table 2-2 outlines the reported summer and winter demand (kW) for the evaluation period.

Table 2-1 DEK NR Custom Program Participation and Reported Energy Summary

Category & Strata		Database Line Items		Projects		Reported Savings	
		Custom-To-Go	Classic	Custom-To-Go	Classic	Custom-To-Go Gross kWh	Classic Custom Gross kWh
Lighting	Small (<342 MWh)	16	46	6	20	1,228,895	813,329
	Large (≥342 MWh)	2	15	2	5	2,257,212	2,960,136
Non-lighting	Small (<1,091 MWh)	1	7	1	7	9,917	1,302,309
	Large (≥1,091 MWh)	0	3	0	2	-	6,196,344
Total		**19**	**71**	**9**	**34**	**3,496,025**	**11,272,118**
Grand Total		**90**		**43**		**14,768,143**	

Table 2-2 DEK NR Custom Program Reported Demand Savings Summary

Category & Strata		Projects		Reported Summer Demand (kW) Savings		Reported Winter Demand (kW) Savings	
		Custom-To-Go	Classic	Custom-To-Go	Classic	Custom-To-Go	Classic
Lighting	Small (<342 MWh)	6	20	172	121	219	164
	Large (≥342 MWh)	2	5	331	128	331	524
Non-lighting	Small (<1,091 MWh)	1	7	4	156	-	103
	Large (≥1,091 MWh)	0	2	-	813	-	568
Total		**9**	**34**	**507**	**1,218**	**550**	**1,358**
Grand Total		**43**		**1,725**		**1,909**	

Figure 2-1, Figure 2-2, and Figure 2-3 summarize the distribution of reported energy (kWh) and demand (kW) savings at the program level by technology category.

Figure 2-1 Distribution of Reported Energy Savings from NR Custom Program Projects by Technology

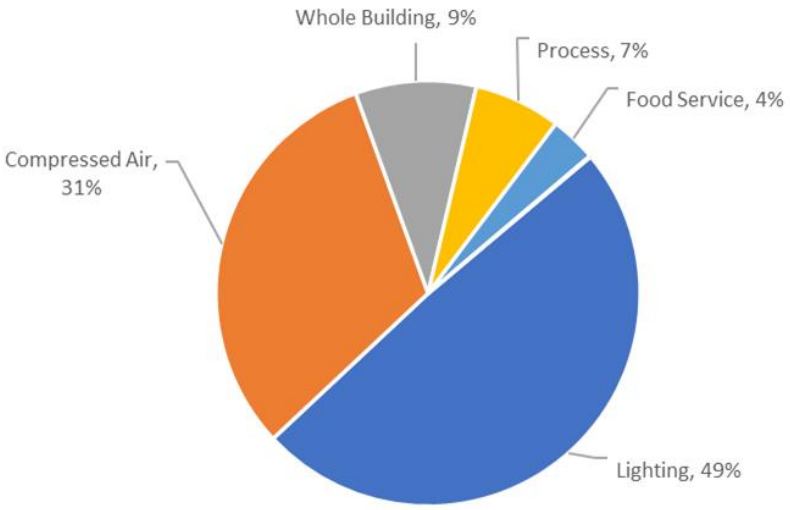


Figure 2-2 Distribution of Reported Summer Demand Savings from NR Custom Projects by Technology

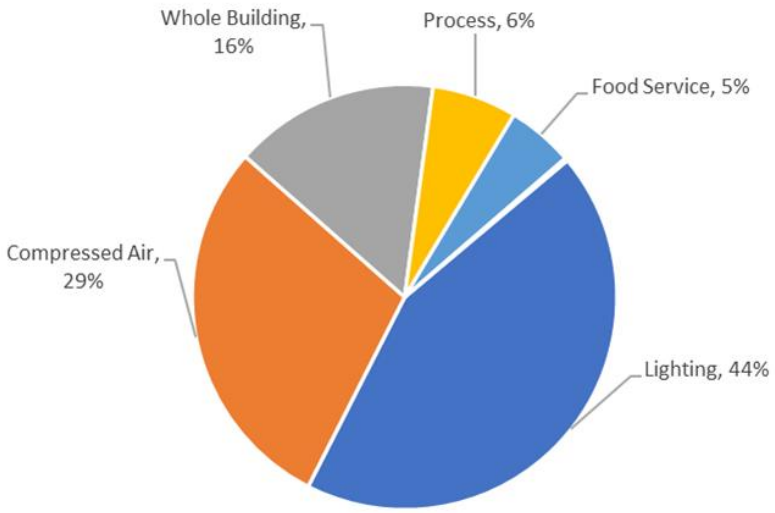
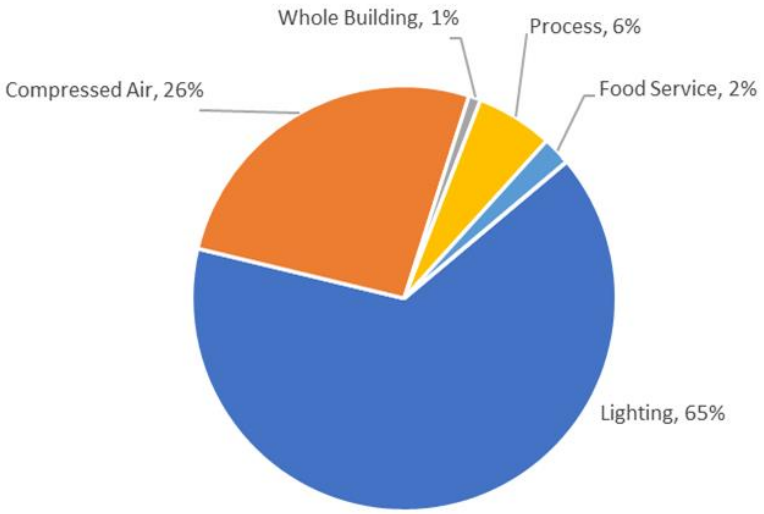


Figure 2-3 Distribution of Reported Winter Demand Savings (kW) from NR Custom Projects by Technology



3 Key Research Objectives

3.1 Gross Impact

The impact evaluation processes followed standard industry protocols and definitions, where applicable, and include the Department of Energy Uniform Methods Protocol[2], as an example. The overarching goals for the NR Custom impact evaluation were to:

- Quantify accurate and supportable energy impacts (kWh) and summer and winter demand (kW) savings for energy efficient measures and equipment implemented in participants' facilities.
- Assess the rate of free riders from a customer and contractor perspective.
- Determine spillover effects from a customer and contractor perspective.
- Consider and verify measure installation vintage aligned with measure baseline definitions, i.e. early replacement, burnout on failure, etc.

3.2 Net Impact

The goal of the net impact evaluation was to estimate the overall energy impacts attributable to the program. This estimate comprises two components: free-ridership and spillover.

Free-ridership estimates what proportion of the program's savings would have happened in the absence of the program. Free-ridership considers the customers' plans before engaging in the program and the various influences the program can have on the customer, such as incentives, the application process, and other interactions with the program staff, contractors, and marketing materials.

Spillover estimates additional energy savings for efficiency projects completed without receiving a program incentive but was influenced by the program in some other way. Spillover was captured from participants (participant spillover) and contractors (for nonparticipant spillover).

Net program results are calculated through a net-to-gross ratio, as shown in Equation 1.

Equation 1 Net Program Savings

$$Net\ Program\ Savings = \text{Net-to-gross}\ (\%) \times \text{Gross Verified Savings}$$

[2] The DOE's Uniform Methods Project for Determining Energy Efficiency Program Savings can be found at http://www1.eere.energy.gov/office_eere/de_ump.html.

3.3 Process

The evaluation team collected data from a variety of sources to address the researchable questions identified at the beginning of the study. Table 3-1 contains the list of research objectives and the data sources used to investigate each one.

Table 3-1 Process Evaluation Research Questions and Activities

Preliminary Research Questions	Document Review	Interviews with Key Contacts	Participant Survey	Trade Ally Survey
How is the program promoted? What role do Duke Energy account representatives (i.e., account executives, business energy advisors, energy efficiency engineers and trade ally outreach representatives) play in helping customers identify and complete projects? Are contractors or vendors identifying potential projects?	✓	✓	✓	✓
Understand participant experience. What steps are involved in identifying and scoping projects and obtaining pre-approval? What issues emerge during the process? How are these addressed?		✓	✓	✓
Why do potential projects drop out?[3] Are there opportunities to make the process simpler or more streamlined while maintaining robust quality control (QC)?		✓		✓
Is the uptake of custom vs. custom-to-go projects as expected? How do the projects and/or the customer experience differ between the two participation paths?	✓	✓	✓	✓
What is the customer's decision-making process regarding energy efficiency upgrades or equipment? How influential were various aspects of the program in their decision? How influential was the contractor they worked with?	✓		✓	✓

[3] Duke Energy determined the evaluation did not need to include data collection with drop-out customers.

4 Impact Evaluation

4.1 Impact Methodology

The primary determinants of impact evaluation costs are the sample size and the level of rigor employed in collecting the data used in the impact analysis. The accuracy of the study findings is in turn dependent on these parameters. Techniques used to conduct the evaluation, measurement and verification (EM&V) activities and to meet the goals for this evaluation include measure level data collection, utility billing analysis, telephone surveys, documentation review, best practice review, and interviews with implementation staff, trade allies, program participants, and general business customers.

The evaluation team's impact analysis focused on the energy and demand savings attributable to the NR Custom Program for the period of January 2018 through December 2019. A variety of techniques were used to develop independent assessments of gross and net energy savings for each sampled project. In order to estimate gross energy savings, all sampled custom projects received a desk review; project specific data collection, measurement and/or verification; and custom data analysis of savings. Data collection involved a combination of several activities, including: verifying equipment installation and operation; interviewing site contacts; and collecting building automation system/energy management system (BAS/EMS) data. The level of rigor conducted for the data analysis reflected the level of project documentation available prior to the evaluation (such as the data collected from existing metering and monitoring equipment), the uncertainty of the savings estimate, the magnitude of the project savings and the ability to collect additional data from the program participants. Figure 4-1 provides a high-level process flow diagram of all impact evaluation activities and brief summary of each step in the process is provided below.

Figure 4-1 Flow Diagram of Impact Evaluation Activities

The evaluation team verified energy and demand savings attributable to the program by conducting the following high-level impact evaluation activities:

Sample: Conduct review of NR Custom Program participant database and draw representative sample of projects.

Soft Recruit: Attempt to reach all sampled participants by phone or email, prior to conducting an in-depth review of project documentation or developing a site specific measurement and verification plan (SSMVP), to inform participants of the ongoing evaluation and request permission to conduct data collection for the analysis of savings. Nothing would be formally scheduled during this call.

Document Review: Review all project documentation available for those sites successfully recruited.

Develop SSMVP: Develop a plan that provides a general overview of the implemented measures, reported benefits and costs, proposed level of rigor, measurement & verification (M&V) equipment, and key data to be gathered. The Duke team reviews and approves all SSMVP. The purpose of the Duke team reviews was to verify that all measures were included in the plan, reported energy and demand savings were accurate, and proposed M&V approaches were appropriate.

Data Collection: Verify equipment installation and operation; interview site contacts; and collect building automation system/energy management system (BAS/EMS) data.

Analysis: Estimate gross verified energy and demand savings for sampled measures and projects using data collected.

Measurement & Verification Report: Compare gross-verified energy and demand savings to program-reported values to determine project-level realization rates and summarize findings for each sampled site in M&V report. The Duke team reviews and approves all M&V reports. The purpose of the Duke team reviews was to verify that all measures were included in the plan, reported energy and demand savings were accurate, and proposed M&V approaches were appropriate.

Gross Verified Savings: Summarize project-level results to stratum-level for determining program-level realization rates and verified gross energy and demand savings.

Net Verified Savings: Apply attribution survey data to estimate net-to-gross ratios and net-verified savings at the program level.

The following sections provide more details on the specific considerations made and methods used for the major evaluation activities.

4.1.1 Sampling

The gross and net verified savings estimates presented in this report were determined through the observation of key measure parameters among a sample of projects from the program population. A census evaluation would have involved surveying, measuring, or otherwise evaluating the entire population of projects. Although a census approach would eliminate any sampling uncertainty, when used effectively, the results from a sample of projects can be extrapolated to provide a reasonable and cost effective estimate of the population parameters.

The most important sampling objective was representativeness – that is projects selected in the evaluation sample were representative of the population and would produce unbiased estimates of population parameters. In order to obtain a representative sample the characteristics of the program population must be reviewed and understood. A participation database extract was requested and received that contained only projects with a Vendor Update Timestamp between January 2018 and December 2019. This database extract represented the program population for program years 2018 and 2019. The program participation database informed many of the evaluation activities including sample design, project-level savings review, and estimating program-level gross verified savings.

4.1.1.1 Stratification

The evaluation team used sample stratification with ratio estimation techniques for the NR Custom Program. Stratification is a departure from simple random sampling, where each sampling unit (customer/project/rebate/measure) has an identical likelihood of being selected in the sample. Stratified random sampling refers to the designation of two or more sub-groups (strata) from within a program population prior to the sample selection process.

The evaluation team felt that stratification was advantageous and utilized it in the sample design for a variety of reasons:

Increased precision of the within-stratum variability was expected to be small compared to the variability of the population as a whole. Stratification in this case allows for increased precision and smaller total sample sizes.

It enabled the evaluation team to ensure that a minimum number of units within a particular stratum were verified.

Two different characteristics of a project were used to define which strata a project would be in, the type of measures implemented and the relative amount of reported energy savings.

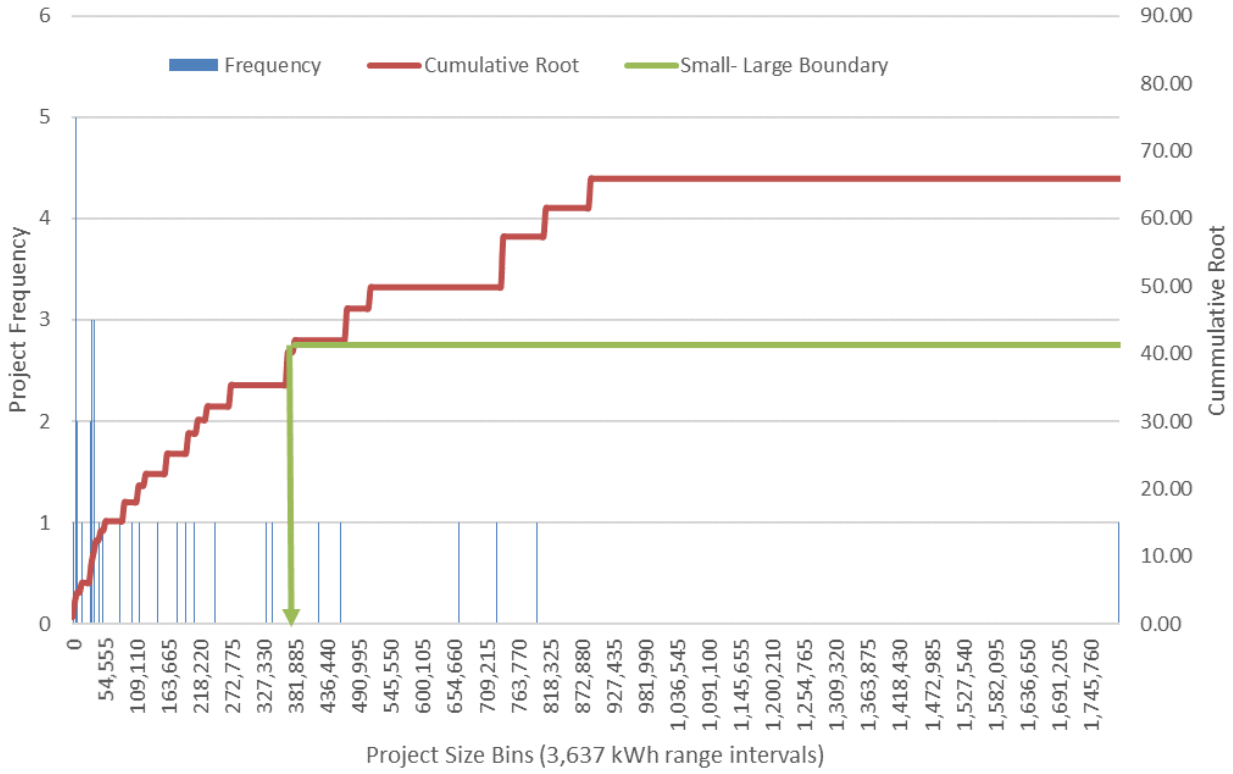
The evaluation team stratified the participant population by technology category (lighting vs. non-lighting) and relative amount of reported savings (kWh) to ensure the evaluated sample represented the population and in order to achieve higher statistical precision by reducing the variability within the sample. A project is defined as all lighting or non-lighting measures implemented during the evaluation period at a single address.

In order to then stratify by the amount of savings the evaluation team first defined a project as all like technology categories (lighting or non-lighting) implemented under a single application that were installed at the same address. The amount of reported savings for all measures in each project were then added together.

The Dalenius-Hodges method was used to define the optimal strata boundary between a “small” project and a “large” project. This method is the most common method of boundary determination for stratification by project size. An illustration of this method is presented in Figure 4-2 for the DEK Non-Lighting strata. The method uses the number of projects in specified project-size bins (frequency) along with the number of empty bins between each occupied bin (length) to assess the distribution of total strata savings. The cumulative square root of the product of the frequency and length is then used to determine the optimal strata

boundaries. For the NR Custom evaluation, two sub-strata (small and large) were needed so the mid-point of the cumulative indicated which project size (kWh) would define the boundary between a small project and a large non-lighting project.

Figure 4-2: Dalenius-Hodges Boundary Design for DEK 2018-2019 Lighting Projects



Using this method the evaluation team determined a savings threshold of 342 MWh for large lighting projects and 1,091 MWh for large Non-Lighting projects. All projects with savings less than these thresholds would be considered small projects.

4.1.1.2 Targeted Sample Size

With the population stratified the impact samples were then drawn randomly from each strata. The total number of sample projects drawn targeted a 90/10 confidence precision based on the total participation counts for the evaluation period and assuming an error ration (C_v) of 0.5. The distribution of the total sample across the four sub strata was determined using the number of projects in each strata, the amount of savings in each strata and the historical Cv values of the same strata from the 2016 - 2017 NC Custom evaluation. Our stratification approach and targeted sample sizes are summarized in Table 4-1.

Table 4-1 NR Custom Stratified Sampling Plan - Targeted

Strata	Population	Pop Reported Savings (kWh)	Targeted Sample Size
L-Small (<342 MWh)	28	2,042,224	13
L-Large (≥342 MWh)	7	5,217,348	7
NL-Small (<1,091 MWh)	8	1,312,227	6
NL-Large (≥1,091 MWh)	2	6,196,344	2
Total	**45**	**14,768,143**	**28**

4.1.2 Data Collection

Once a sample of projects was selected, the impact team requested detailed project documentation for each project and conducted a review of the information. This information was used to formulate any initial questions about the project that could be answered during the initial communications with the participants.

While reviewing project documentation, the evaluation team would also verify whether parameters such as reported energy and demand savings, energy conservation measure (ECM) quantities, and measure descriptions matched those indicated in the tracking database. Any identified discrepancies between the two sources were then identified in the SSMVP and later resolved based on feedback provided by the Duke program team.

As outlined in prior sections, the gross impact evaluation process began with a thorough review of project documentation. This information was provided upon formal request. Documents commonly provided by the program team include:

- Smart $aver Incentive Calculation workbooks
- DSMore Summary workbooks
- Custom Incentive Application Forms
- Contractor Proposals
- Detailed project narratives
- Product specifications and invoices
- Customer utility data (monthly billing history)
- Incentive payment request forms
- Email correspondence between members of the program management team and participants

Other documents commonly provided on lighting project include:

- Smart $aver Custom Incentive Program Lighting Calculators
- Specification sheets for retrofit lighting systems

Other documents commonly provided for non-lighting projects include:

- Customer submitted energy and demand savings calculations
- Detailed reports developed by third-party engineering consultants
- Building energy simulation model output files

After reviewing all program-supplied project documentation the evaluation team engineer assigned to each project then developed a SSMVP for each unique premise. These were developed in order to create a standardized, rigorous process for the verification of project claims. Each SSMVP was specifically tailored to verify the equipment that was installed and measures that were implemented per the provided project documentation. The SSMVP also identified baseline assumptions for verification with on-site personnel in order to validate ex-ante, forecasted savings estimates.

Each SSMVP also identified the specific parameters to be verified and gathered for each measure. These plans followed guidelines set forth in multiple Department of Energy Uniform Methods Project (DOE UMP) protocols including:

Chapter 2: Commercial and Industrial Lighting Evaluation Protocol

Chapter 8: Whole-Building Retrofit with Consumption Data Analysis Evaluation Protocol

Chapter 14: Chiller Evaluation Protocol

Chapter 15: Commercial New Construction Evaluation Protocol

Chapter 18: Variable Frequency Drive Evaluation Protocol

Chapter 19: HVAC Controls (DDC/EMS/BAS) Evaluation Protocol

Chapter 22: Compressed Air Evaluation Protocol

The plans also identify a preferred and one or two alternate analysis approaches (level of rigor) along with the critical data to be gathered for each. Table 4-2 provides a few examples of the data points typically gathered for several of the more commonly-encountered ECMs).

Table 4-2 Key Data Points Gathered for Commonly Encountered ECMs

Measure Name	Baseline or Retrofit
Interior Lighting Retrofits	Quantity of existing fixtures Fixture type of existing fixtures Quantity of retrofit fixtures Fixture type of retrofit fixtures Existing fixture controls, if any New fixture controls, if any Typical schedule and hours of operation Space set point temperature Type of heating and cooling equipment/specifications
HVAC Control/EMS	Determine baseline setpoints and schedules through customer interviews Determine post-retrofit setpoints and schedules through central BAS Obtain any available trend data Verify occupancy and equipment schedules Gather nameplate information from primary heating and cooling systems
Variable Speed Drive on Pump	Determine baseline method of pump control Determine conditions that dictate the speed of the VSD Determine whether loads modulate or are fairly constant If loads modulate, determine load profile (% load bins) Nameplate information from pump Nameplate information from VSD Gather any available trend data Perform spot power measurements (kW) of pump while running under normal operating conditions
VSD Air Compressor	Determine baseline method of control Gather information on baseline air compressor system (kW/CFM, hp, CFM output, system type, etc.) Determine how loads vary daily, weekly, seasonally, annually for VSD compressor Nameplate information from new air compressor Gather any operational parameters displayed on control panels Gather any available trend data from central controls system Determine whether compressor serves central plant with multiple compressors or is stand-alone. If part of multi-compressor plant determine role and sequences of operation (primary, secondary, trim, etc.)

Once completed each SSMVP was then submitted to the Duke EM&V and program teams for review and approval. Upon approval from Duke data collection activities were then scheduled

with the participant. Engineers would verify that measures were appropriately implemented in accordance with the SSMVP developed for the site. Engineers would request copies of equipment specifications and sequences of operation, as appropriate. Any available historic trend data (when available) was also obtained from existing HVAC control and central plant sequencing control systems.

4.1.3 Project Level Analyses

A variety of analysis approaches were utilized for the impact evaluation. The approach applied was decided based upon the methods used by the participant, trade ally, or program in generating the ex-ante[1] savings estimates, the availability of information, and the extent of interactive effects. An overview of each analysis approach applied is provided in Sections 4.1.3.1 through 4.1.3.3.

4.1.3.1 Basic Rigor: Simple Engineer Model (SEM) with On-site Measurement

Consistent with IPMVP Option A (Partially Measured Retrofit Isolation), this approach was used for the majority of lighting, custom process, and compressed air measures. This method uses engineering calculations, along with site measurements of a limited number of important parameters, to verify the savings resulting from specific measures. This was the most prevalent level of rigor applied for this evaluation.

4.1.3.2 Basic Rigor: Simple Engineer Model (SEM) with Verification Only

This approach is very similar to SEM with On-site Measurement, but without direct measurement of key parameters. This approach is generally applied to measures that are not conducive to direct measurement such as outdoor lighting or building envelope improvements but during this evaluation the restrictions on travel and health guidelines associated with the Covid-19 pandemic limited the evaluation team's ability to conduct many on-site activities. To adapt to these limitations the evaluation team used virtual site visit technology to allow engineers to directly observe the ECMs while being virtually escorted through the facilities by a site contact.

4.1.3.3 Enhanced Rigor: Billing Analysis

Consistent with IPMVP Option C (Whole Building), this approach was used for projects involving multiple HVAC control measures with interactive effects, when final ex ante building simulation models could not be obtained from the trade ally. It was also used for large industrial custom process measures involving equipment that could not be de-energized to accommodate installation of data logging equipment. This approach was only applied on projects where the reported gross energy savings exceeded 10% of annual energy consumption. This approach entailed a pre- and post-retrofit comparison of weather-normalized whole facility energy consumption. This approach adhered to guidelines set forth in the Department of Energy Uniform Methods Project Protocols for HVAC Controls (Chapter 19) and Whole-Building Retrofit with Consumption Data Analysis Evaluation Protocol (Chapter 8).

4.1.3.4 Enhanced Rigor: Whole Building Simulation

Consistent with IPMVP Option D (Calibrated Simulation), this analysis approach was used and is dependent on the evaluation team being able to obtain a complete set of the electronic files

[1] The term "ex ante" represents the forecasted energy and demand savings rather than the actual results.

for the building energy simulation model developed by the Willdan Group, Inc. to estimate ex-ante energy savings and verification of the as-built conditions.

The evaluation process entailed reviewing the inputs of the model(s) to verify baseline and post-installation conditions are specified correctly and modeled consumption was within ASHRAE criteria. The evaluation team leveraged any available post trend data from the building control system (BAS) or utility consumption data to inform and verify the calibration of the model. Nexant adhered to guidelines set forth in the Department of Energy Uniform Methods Project Protocols for Commercial New Construction (Chapter 15) when conducting this analysis.

4.1.3.5 Peak Period Definition

Demand savings were evaluated based on the definition of the peak period provided by Duke Energy, as summarized Table 4-3.

Table 4-3 Definition of Peak Demand Periods

	Summer	Winter
Month	July	January
Hour	4pm – 5pm	7pm – 8pm

4.1.3.6 Interactive Effects

How energy-efficiency projects change the energy use of other equipment, not associated directly with the projects themselves, should be a consideration in estimating the energy efficiency program benefits. These interactive energy changes can be challenging to quantify, but should be accounted for whenever possible.

Interactive energy changes come in a number of forms and affect different fuel types. A measure that directly saves electricity may cause another building system to consume less energy. Alternatively, a measure that directly saves electricity could cause another building system to consume more energy. Sometimes, a single project can have both positive and negative interactive effects on other systems. For example, upgrading to energy efficient lighting reduces the electricity that a participant uses on lighting; the associated reduction in waste heat reduces the burden on the cooling system in the summer – but increases the burden on the heating system in the winter.

The net change in energy use for a building should be quantified and attributed to the project as an increase or decrease in savings. Calculating this net change for lighting projects depends on the several factors which include:

- the type and efficiency of heating and cooling equipment,
- the number of hours the lights operate
- the physical configuration of fixtures being replaced and installed, and
- the wattages of the fixture being replaced and installed.

To calculate the net interactive savings the evaluation team used a method consistent with the algorithms outlined in Chapter 2 of the Uniform Methods Project (Commercial and Industrial Lighting Evaluation Protocol). This method defines interactive cooling and heating energy savings for interior lighting by

Equation 2 Interactive Cooling Energy Savings for Interior Lighting

$$Interactive\ kWh\ Savings_{Cooling} = kWh_{Lighting\ Savings} \times IF_{kWh,Cooling}$$

Where:

$kWh_{Lighting\ Savings}$ = *savings associated with the lighting measure*

$IF_{kWh,\ Cooling}$ = *Interactive cooling factor*

The interactive cooling factor is the ratio of cooling energy reduction per unit of lighting energy reduction. This is a dimensionless ratio calculated using Equation 3

Equation 3 Interactive Cooling Factor

$$IF_{kWh,Cooling} = \frac{\left(SHG_{base} - SHG_{efficient}\right)}{1000 \times EER}$$

Where:

SHG_{base} = *sensible heat gain associated with the operation of the base lighting equipment during the cooling season*

$SHG_{efficient}$ = *sensible heat gain associated with the operation of the efficient lighting equipment during the cooling season*

EER = *Energy Efficiency Ratio of the facilities HVAC equipment*

The sensible heat gain represents the thermal energy added to the conditioned space by the lights. It is calculated using parameters that are specific to the lighting load, hours of use, and the fixture's space fraction. The space fraction accounts for how much of thermal energy from the lamp enters the conditioned space.

Equations to calculate the interactive heating penalty, the additional heating required due to more efficient lighting, are very similar to Equation 2 and Equation 3. Instead of the EER value a Coefficient of Performance (COP) is used.

4.1.4 Measurement & Verification Reports

Once a savings analysis was complete all findings from on-site verification and each project-level savings analysis was summarized in a standalone Measurement and Verification Report. Each report contained the full contents of the original SSMVP as well as a section summarizing the data collection activities, the chosen approach for quantifying energy savings, the verified energy and demand savings, and commentary on reasons for differences between the reported and verified savings values. Each individual M&V Report was then submitted to the Duke EM&V

and Custom program teams for review, comment, and approval. The 24 individual M&V Reports developed as part of this evaluation were provided under separate cover.

4.1.5 Program Level Gross Verified Estimation

The evaluation team used a ratio estimation technique for this evaluation. This technique assumes that the ratio of the sum of the verified savings estimates to the sum of the reported savings estimates within the sample is representative of the program as a whole. This ratio is referred to as the realization rate and is calculated using .

Equation 4.

Equation 4 Realization Rate

$$Realization\ Rate = \frac{\sum_i^n Verified\ Savings}{\sum_i^n Reported\ Savings}$$

Where *n* is the number of projects in the evaluation sample. The realization rate is then applied to the claimed savings of each project in the population to calculate gross verified savings.

4.1.5.1 Presentation of Uncertainty

There is an inherent risk, or uncertainty, that accompanies sampling, because the projects selected in the evaluation sample may not be representative of the program population as a whole with respect to the parameters of interest. As the proportion of projects in the program population that are sampled increases, the amount of sampling uncertainty in the findings decreases. The amount of variability in the sample also affects the amount of uncertainty introduced by sampling. A small sample drawn from a homogeneous population will provide a more reliable estimate of the true population characteristics than a small sample drawn from a heterogeneous population. Variability is expressed using an error ratio for programs that use ratio estimation.

When ratio estimation is utilized, standard deviations will vary for each project in the population. The error ratio is an expression of this variability and is analogous to the coefficient of variation, C_v, for simple random sampling.

Equation 5 provides the formula for estimating error ratio.

Equation 5 Error Ratio

$$Error\ Ratio = \frac{\sum_{i=1}^N \sigma_i}{\sum_{i=1}^N \mu_i}$$

Equation 6 shows the formula used to calculate the required sample size for each evaluation sample, based on the desired level of confidence and precision. Notice that the *Error Ratio* term is in the numerator, so required sample size will increase as the level of variability increases.

Equation 6 Required Sample Size

$$n_0 = \left(\frac{z * Error\ Ratio}{P}\right)^2$$

Where:

n_0 = *Required sample size before adjusting for a finite population*

z = *Constant based on the desired level of confidence (equal to 1.645 for 90% confidence two-tailed test)*

P = *Desired relative precision*

The sample size formula shown in Equation 6 assumes that the population of the program is infinite and that the sample being drawn is reasonably large. In practice, this assumption is not always met. For sampling purposes, any population greater than approximately 7,000 may be considered infinite for the purposes of sampling. For smaller, or finite, populations, (such as the Duke Energy Kentucky NR Custom participant population) a finite population correction is warranted. This adjustment accounts for the extra precision that is gained when the sampled projects make up more than about 5% of the program savings. Equation 7 calculates the required sample size for a finite population.

Equation 7 Finite Population Correction

$$n^* = \frac{N * n_0}{N + n_0}$$

Where:

n^* = *Required sample size for a finite population*

N = *Size of the population*

n_0 = *Required sample size before adjusting for a finite population*

Verified savings estimates always represent the point estimate of total savings, or the midpoint of the confidence interval around the verified savings estimate for the program. Equation 8 shows the formula used to calculate the margin of error for a parameter estimate.

Equation 8 Error Bound of the Savings Estimate

$$Error\ Bound = SE * z$$

Where:

SE = *The standard error of the population parameter of interest (proportion of realization rate, total energy savings, etc.) This formula will differ according to the sampling technique utilized.*

z = *Constant based on the desired level of confidence (equal to 1.645 for 90% confidence two-tailed test)*

The 90% confidence level is a widely accepted industry standard for reporting uncertainty in evaluation findings. The confidence levels and precision values presented in this report are at the 90% confidence level. The z statistic constant associated with 90% confidence is 1.645.

When evaluators or regulators use the term “90/10”, the 10 refers to the relative precision of the estimate. The formula for relative precision shown in Equation 9 and is how actual strata and program level relative precision achieved is calculated.

Equation 9 Relative Precision of the Savings Estimate

$$Relative\ Precision_{Verified\ Savings} = \frac{Error\ Bound_{(kWh\ or\ kW)}}{Verified\ Impact_{(kWh\ or\ kW)}}$$

4.2 Impact Evaluation Analysis and Findings

4.2.1 Achieved Sample Size

As mentioned in Section 4.1.1.2, the initial impact sample sizes targeted a 90/10 confidence precision based on the project counts assuming an error ration (C_v) of 0.5 and the distribution of the total sample across the four sub strata was determined using the number of projects in each strata, the amount of savings in each strata and the historical Cv values of the same strata from the 2016 - 2017 NR Custom evaluation. Due to the relatively small size of the L-Large populations and some participants refusing to cooperate with the evaluation activities, the evaluation team was only able to complete analyses on 4 of the 7 L-Large sample. The evaluation team attempted to contact all projects in this strata population. Our achieved sample sizes are summarized in Table 4-4.

Table 4-4 NR Custom Stratified Sampling - Achieved

Strata	Initial Population	Initial Target Sample Size	Adjusted Population	Adjusted Target	Achieved Sample Size
L-Small (<342 MWh)	28	13	26	13	12
L-Large (≥342 MWh)	7	7	7	7	4
NL-Small (<1,091 MWh)	8	6	8	6	6
NL-Large (≥1,091 MWh)	2	2	2	2	2
Total	**45**	**28**	**43**	**28**	**24**

The evaluation team was able to achieve stratum-level sample targets for both the L-Small and NL-Small strata. As will be shown in the next section, the evaluation sample was still able to achieve the targeted 10% precision at the 90% confidence level since the Cv of the evaluated projects was lower than the Cv values used to determine the target sample size.

4.2.2 Gross Verified Impacts

Table 4-5, Table 4-6, and Table 4-7 summarize gross impact results for energy (kWh), summer demand (kW), and winter demand (kW). Detailed results for each sampled project are provided in the standalone M&V Reports.

Table 4-5 Gross Verified Energy Savings (kWh) by Stratum

Stratum	Gross Reported Energy Savings (kWh)	Gross Verified Energy Savings (kWh)	Realization Rate (%)	Relative Precision @ 90% Confidence
L-Small (<342 MWh)	2,042,224	2,411,155	118.07%	9.6%
L-Large (≥342 MWh)	5,217,348	5,275,767	101.12%	1.2%
NL-Small (<1,091 MWh)	1,312,227	1,286,465	98.04%	1.5%
NL-Large (≥1,091 MWh)	6,196,344	6,196,344	100.00%	0.0%
Program Total	**14,768,143**	**15,169,731**	**102.18%**	**1.1%**

Table 4-6 Gross Verified Summer Peak Demand Savings (kW) by Stratum

Stratum	Gross Reported Summer Demand Savings (kW)	Gross Verified Summer Demand Savings (kW)	Realization Rate (%)	Relative Precision @ 90% Confidence
L-Small (<342 MWh)	293	332	113.17%	4.9%
L-Large (≥342 MWh)	459	472	102.79%	4.1%
NL-Small (<1,091 MWh)	159	166	104.05%	3.4%
NL-Large (≥1,091 MWh)	813	813	100.00%	0.0%
Program Total	**4,933**	**1,783**	**102.74%**	**1.1%**

Table 4-7 Gross Verified Winter Peak Demand Savings (kW) by Stratum

Stratum	Gross Reported Winter Demand Savings (kW)	Gross Verified Winter Demand Savings (kW)	Realization Rate (%)	Relative Precision @ 90% Confidence
L-Small (<342 MWh)	383	423	110.27%	5.2%
L-Large (≥342 MWh)	855	861	100.78%	1.0%
NL-Small (<1,091 MWh)	103	105	102.33%	1.8%
NL-Large (≥1,091 MWh)	568	568	100.00%	0.0%
Program Total	**1,909**	**1,957**	**102.18%**	**0.9%**

The program achieved an overall energy realization rate of 102.18 %. Generally, the overall energy realization rate was a result of the higher verified lighting savings especially for Lighting-Large stratum with energy realization rate of 118.07%. Even though Non-lighting savings were slightly under 100%, overall energy realization rate stayed above 100%. Summer peak and winter peak demand savings followed a similar trend as energy savings. The following sections provide more details and insights into the contributing factors of each strata's results.

4.2.2.1 Small Lighting Projects

Twelve Lighting-Small projects were evaluated from the 2018-2019 NR Custom population. The Lighting-Small sample projects achieved 118.07% verified energy savings, 113.17% verified summer peak demand savings and 110.27% verified winter peak demand savings. The inclusion of interactive effects into the verified savings was the main contributing factor to the higher realization rates. Some differences between the reported hours of use (HOU) and the HOU verified with the participants were found. These differences in HOU were due to higher HOU during holidays and some reported savings calculations based off of 364 days of operation per year verse 365 days.

4.2.2.2 Large Lighting Projects

Four Lighting-Large projects were evaluated from the 2018-2019 NR Custom population. The Lighting-Large sample projects achieved 101.12% verified energy savings, 102.79% verified summer peak demand savings and 100.78% verified winter peak demand savings. Like the Lighting-Small stratum, the inclusion of interactive effects into the verified savings was the contributing factor to the higher realization rates.

4.2.2.3 Small Non-lighting Projects

Six Non-lighting-Small projects were evaluated from the 2018-2019 NR Custom population. The Non-lighting-Small projects achieved 98.04% verified energy savings, 104.05% verified summer peak demand savings and 102.33% verified winter peak demand savings. Four of the six projects had realization rates equal to 100%. The remaining two projects had realization rates or 81.79% and 88.59%. One sample project contributed most of the unverified savings.

This was a new construction project which had a model that was not calibrated to the building's actual utility bill consumption. The evaluation team made changes to the model inputs in order to calibrate the model and recalculate the verified savings. The second project was a very small HVAC project in which the Duke HVAC model overestimated savings during the summer months. For this project, the Duke CtG HVAC/EMS calculator estimated the HVAC consumption exceeded the entire facilities billed consumption for that month. The underlying assumptions and methods of this calculator were not accessible to understand what caused this overestimate of savings.

4.2.2.4 Large Non-lighting Projects

Two Non-lighting-Large projects were evaluated from the 2018-2019 NR Custom population. Both Non-lighting-Large sample projects achieved 100% verified energy savings, 100% verified summer peak demand savings and 100% verified winter peak demand savings.

4.2.3 Custom-to-Go vs. Custom Classic

This section provides a comparison of projects that used the Custom-to-Go worksheets and those that used the Classic Custom (Classic) worksheets. The following criteria determines which worksheet is used for NR Custom projects:

- Non-lighting projects with more than 700,000 annual kWh savings must use the appropriate Classic Custom worksheet.
- All lighting projects as well as other projects with less than 700,000 annual kWh savings may use the optional Custom-to-Go worksheets.

Table 4-8 presents the gross reported energy savings by worksheet and measure type. The majority (76%) of gross reported energy savings are submitted through Classic worksheets.

Table 4-8: Gross Reported Energy Savings by Worksheet Type

Worksheet Type	Measure Type	Gross Reported Energy Savings (kWh)	Percent of Program
Classic	Lighting	3,773,465	25.6%
	Non-lighting	7,498,653	50.8%
Custom-to-Go	Lighting	3,486,108	23.6%
	Non-lighting	9,917	0.1%
Program Total		**14,768,143**	

Lighting and Non-lighting categories had similar total program savings with close to 50%. Figure 4-3 shows the distribution of gross reported energy savings for classic custom projects broken

down by technology category. Figure 4-4 shows the distribution of gross reported energy savings for Custom-to-Go projects.

Figure 4-3 Distribution of Reported Energy Savings for Classic Custom Projects by Technology Category

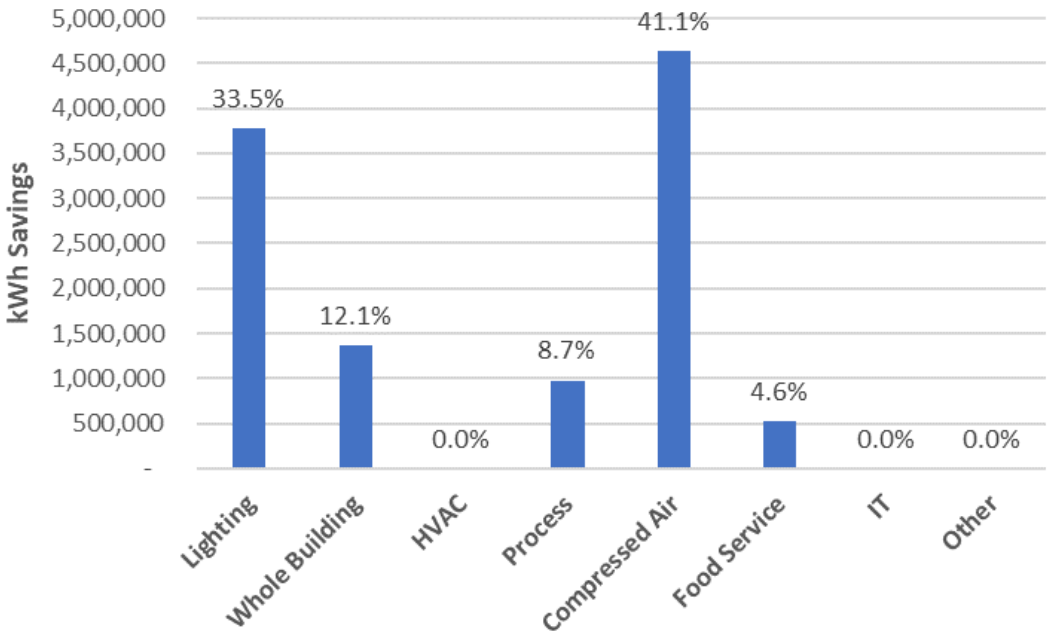


Figure 4-4 Distribution of Reported Energy Savings for Custom-to-Go Projects by Technology Category

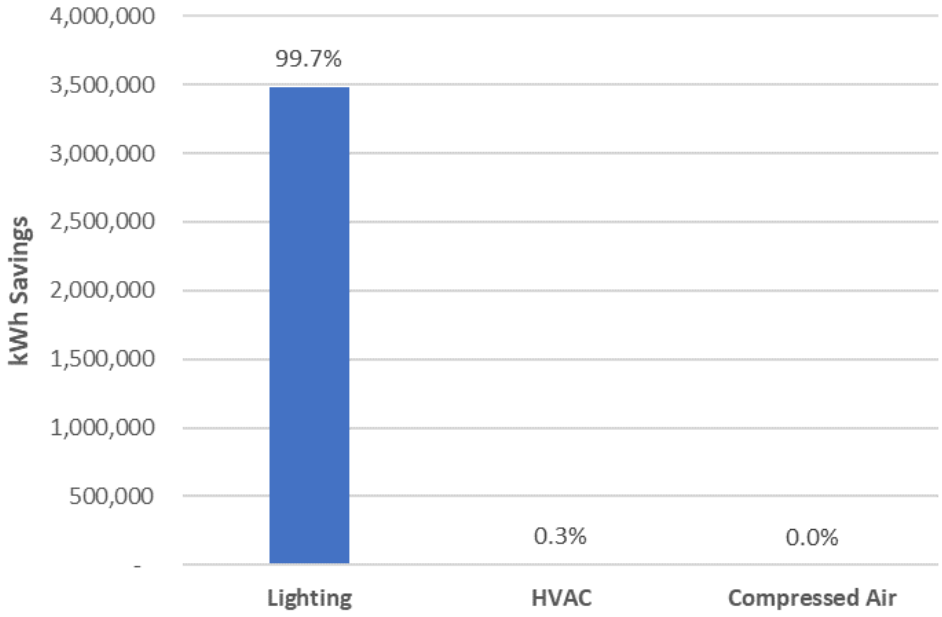


Table 4-9 indicates the reported and verified energy (kWh) savings stratified by technology category (lighting vs. non-lighting) and participation track (Classic vs. Custom-to-Go) for the evaluated sample. These realization rates were not used to estimate the program level verified savings. They are presented here to show any differences between the worksheet types.

Table 4-9 Comparison of Strata-Level Realization Rates - Classic vs. Custom-to-Go

Track	Measure Category	Population	Sample	Sample Reported (kWh)	Sample Verified (kWh)	Realization Rate (%)
Classic	Lighting	25	10	1,840,871	1,930,211	106.1%
	Non-lighting	9	7	6,895,000	6,882,896	99.7%
	Total	**34**	**17**	**8,735,871**	**8,813,107**	**101.8%**
Custom-to-Go	Lighting	8	6	2,779,509	2,955,121	106.3%
	Non-lighting	1	1	9,917	8,111	81.8%
	Total	**9**	**7**	**2,789,427**	**2,963,232**	**106.2%**

Realization rates for Classic lighting projects were nearly equal to Custom-to-Go lighting projects. The realization rates for the Classic and Custom-to-Go non-lighting sample should not

be compared since there was only one Custom-to-Go non-lighting project in the population and sample.

4.2.4 High Level Findings

4.2.4.1 Continue High Quality Reviews

The evaluation team saw strong evidence that the Duke NR Custom program team conducts detailed reviews of the project applications, quality control checks and revises measure parameters based on their engineering judgement and input from the participants or trade allies. Engineering reviews by AESC provides an additional level of quality control that helps to minimize most calculation errors or instances of over-claimed energy or demand savings.

The strata-level realization rates indicate that an appropriate level of rigor is being applied to lighting projects and most non-lighting projects. The level of rigor being applied to each project as it goes through the application process of the NR Custom Program is resulting in accurate estimates of energy and demand savings.

4.2.4.2 Lighting Schedules

Of the parameters needed to calculate lighting project savings, verified lighting operating schedules, or annual hours of use, were occasionally found to be slightly different than what was used to calculate reported savings. The main type of difference found was in the number of holidays accounted for in the verified savings and the operating hours during these holidays.

The Duke Classic lighting worksheet does have fields where a typical weekday, Saturday and Sunday schedule may be entered. Neither the Classic lighting worksheet nor the Custom-to-go worksheet ask specifically about observed holidays. Asking how many days a year the lights are not operating due to holiday closures and incorporating this information into the calculation of operating hours would help minimize these differences.

4.2.4.3 Documentation of Assumptions and Trend data

The project reviews, both during the application process and the evaluation, would benefit from more documentation of all the underlying assumptions and worksheets used for the calculations of savings. In many instances, during the evaluation of non-lighting projects, the model documentation and calculation worksheets were submitted as screenshots, which did not provide access to the algorithms or assumptions used to estimate the savings. Trend data of historical consumption and manufacturer's specification sheets that include detailed performance data would allow more detailed analyses for the proposed measures.

Moreover, project documents did not contain photos of baseline/pre-existing or retrofit equipment. Photos serve as a valuable verification of the installed equipment and provide essential information regarding the condition and operating parameters of the old and new equipment. For example, when retrofitting a pump with VFD, providing photos of the pump nameplate, new VFD, and the VFD panel showing run speed and all other available parameters would provide valuable information and serve as a proof on installation. Also, in cases of equipment replacement, photos of disposed/recycled equipment provide a proof that the inefficient equipment has been taken out of service, and would not be used anymore. These photos would also provide information which the evaluator would be able to verify otherwise.

4.2.4.4 Calibration of new construction models

There was one project in the non-lighting sample that was implemented using the NCEEDA protocol. This protocol defines how savings from new, high performance buildings that are built above code requirements shall be modeled and estimated. The goal of NCEEDA is to provide timely results on a wide range of design options early enough in design so that those options are still viable within the context of the project. NCEEDA in Duke's Kentucky Service Territory uses ASHRAE Standard 90.1-2007 for commercial buildings and multifamily buildings greater than three stories. Specifically, NCEEDA uses the methodology of Appendix G with modifications listed in the protocol for the determination of custom savings.

The models of the new buildings are developed using these standards and protocol; simulation software, design specifications and construction drawings; and site visits. The program team is doing a very good job at matching the models to the as-built conditions of the new buildings. The evaluation team found very few instances where an energy saving strategy was not implemented as it was specified in the model.

Assumptions on how the building is expected to be occupied and used are also required to be specified in the models and general values of the necessary parameters are provided by the standards and protocols. In some cases, professional judgement and information from participants is used to inform what values to use. These general occupancy and scheduling parameters do not always match how the new buildings are used or occupied and can lead to the modeled consumption levels and patterns that differ from how the new building's consumption levels and patterns.

Chapter 15 of the Uniform Methods Project (UMP), Commercial New Construction Evaluation Protocol, describes methods to quantify the uncertainty of the models used to estimate the reported savings. The evaluation team had access to additional post construction utility billing data that was not available during the development of the models. This data was used to determine the normalized mean bias error (NMBE) and the coefficient of variation of the root mean square error (CV_{RMSE}) between the modeled consumption of the new building and the actual monthly consumption of the new building. The UMP references ASHRAE 2002 acceptable tolerances for uncertainty in calibrated building models using monthly consumption data as ±5% NMBE and ±15% CV_{RSME}. The evaluation team found that the modeled consumption was outside of these tolerances for four of the five projects. Adjustments to the models were made to get revised models that produced predicted consumption that was within the ASHRAE tolerances and used those models to calculate the verified energy savings.

The realization rate for the one new construction project was 89%. This same issue has also been seen in the other Duke Energy territories. These results show the importance of calibrating the models with sufficient post construction data to validate the model level of uncertainty. The amount of post construction data needed to calibrate a model varies based on the type of building and the occupancy. Buildings with predictable or consistent consumption may only require as little as three to four months. Other buildings with variable loads and seasonal variability may require twelve months or more.

The evaluation team recommends that Duke incorporates a post construction calibration requirement that uses the ASHRAE 14 tolerances to assess the level of uncertainty in the new construction models and makes adjustments to the model in order to minimize the uncertainty.

The evaluator understands the importance of providing timely services to the participants, and the need for incentive payments as early as possible, thus it is recommended to have a tiered calibration process that depends on the project size and estimated incentives. For example, the implementer can start by using 3 months of utility data, and if the NMBE and CV_{RMSE} are within reasonable bounds (i.e. error bounds can be set be Duke Energy team or consistent with ASHRAE 14 standards) project can proceed, and if the data falls outside the error bounds, more data would need to be collected in an incremental manner (3, 6, and 9 months). Additionally, the evaluator recommends that the tiered approach consider the size of the project (i.e. estimated savings) and ensure that large projects (for example, savings greater than 1 GWh) collect at least 1 year of full data.

5 Net-to-Gross

5.1 Methodology

The evaluation team based the net-to-gross evaluation on customer self-report surveys, as described in the Uniform Methods Project, Chapter 23: Estimating Net Savings: Common Practices.[1] The survey was designed based on established methodologies outlined in the Pennsylvania Evaluation Framework.[2] This methodology was modified based on discussions with Duke Energy staff before data collection to include additional questions to better understand and incorporate the program's impact on customers' decisions.

Net-to-gross analysis for this program involved two calculations: free-ridership and spillover. The results of these calculations are combined to produce the program-level net-to-gross ratio as follows:

Equation 10 Net-to-Gross Equation

$$NTG_p = (1 - FR_p) + PSO_p + NPSO_p$$

Where:

NTG_p = *the program-level net-to-gross ratio*

FR_p = *the program-level free-ridership ratio*

PSO_p = *the program-level participant spillover ratio.*

$NPSO_p$ = *the program-level nonparticipant spillover ratio.*

The program net verified energy savings are calculated by multiplying the program net-to-gross ratio by the gross verified energy savings resulting from the impact evaluation activities described in Section 4.

Equation 11 Net Verified Energy Savings

$$kWh_{nv} = kWh_{gv} \times NTG_p$$

Where:

kWh_{nv} = *the net-verified kWh savings*

kWh_{gv} = *the gross-verified kWh savings*

NTG_p = *the program-level net-to-gross ratio*

[1] https://energy.gov/sites/prod/files/2015/02/f19/UMPChapter23-estimating-net-savings_0.pdf, Section 3.2.

[2] http://www.puc.state.pa.us/Electric/pdf/Act129/SWE_PhaseIII-Evaluation_Framework082516.pdf, Appendix B.

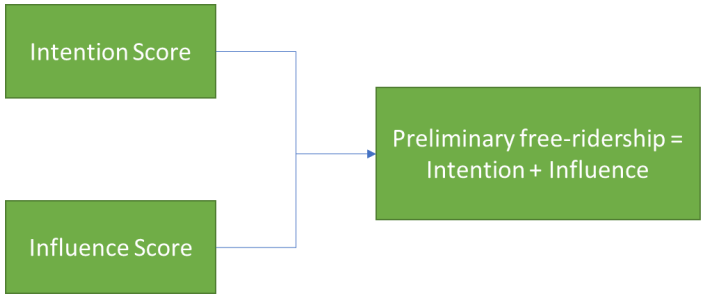
The calculations of the program-level free-ridership and spillover ratios are detailed in the following sections.

5.1.1 Free-Ridership

As mentioned above, free-ridership estimates what proportion of the program's savings would have happened in the absence of the program. Free-ridership considers the customers' plans before engaging in the program and the various influences the program can have on the customer, such as incentives and other interactions with the program staff, contractors, and marketing materials.

The evaluation calculated free-ridership for each survey respondent based on their answers to a series of questions. These questions collected information on the customers' *intention* before interacting with the program and its *influence* on changing those intentions. Each component (intention and influence) has a value ranging from zero to 50 and is then combined for a free-ridership score ranging from 0 to 100. A free-ridership value of 0 indicates that a customer would not have installed the energy-efficient equipment without the program, whereas a free-ridership value of 100 indicates that a customer would have done the same project on their own, at the same time in the absence of the program.

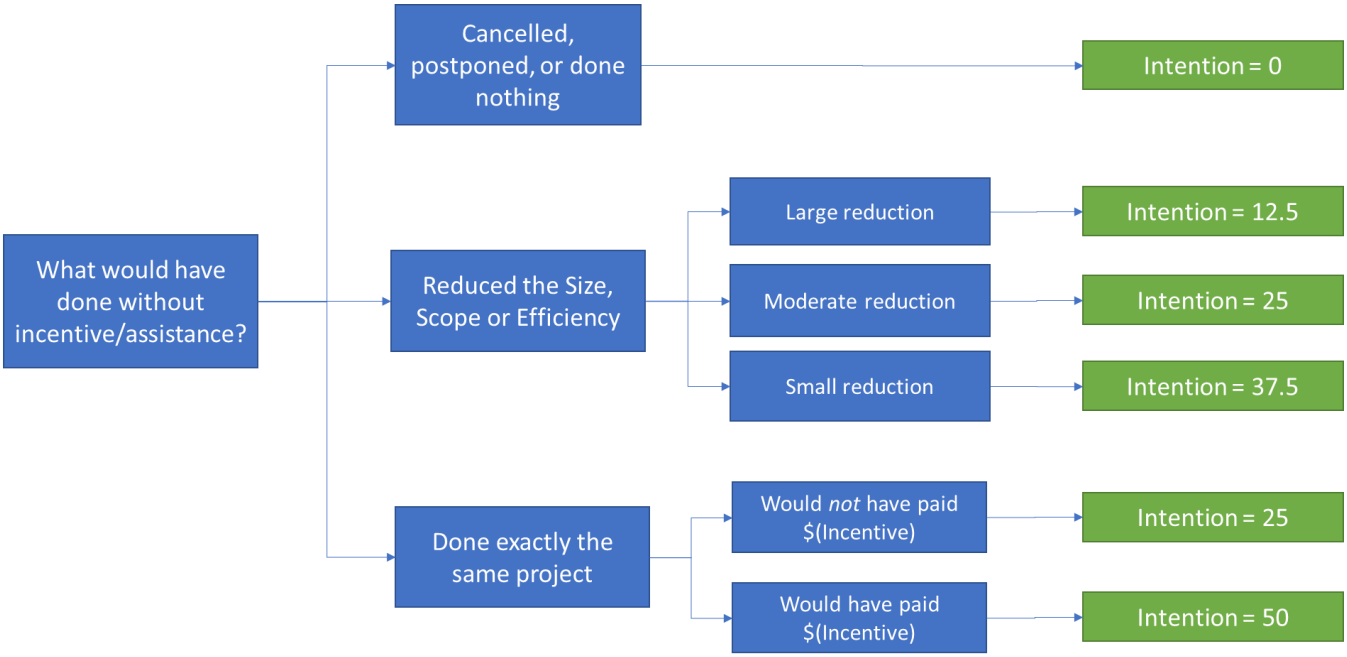
Figure 5-1: Preliminary Free-ridership Calculation



5.1.1.1 Intention

The intention score seeks to capture what most likely would have happened without the program assistance. The program assistance includes not just the incentive but any assistance from items such as audits, technical assistance, and program staff. Survey respondents were asked how the project would have changed if the incentive were not available. Responses were scored on a scale from 0 to 50, as shown in Figure 5-2.

Figure 5-2: Intention Score Flowchart



The initial question of the intention score asks respondents what they would have done without the program assistance. Respondents who indicated they would have canceled, postponed, or done nothing without the program get an immediate intention score of 0.

If the respondent indicated they would do a smaller or less efficient project, they were prompted to categorize it as a small, moderate, or large reduction in scope. This approach attempts to gather the respondent's best estimate of what would have happened without the program, or the counterfactual, recognizing that a precise estimate is not likely to be achieved. The question battery does not seek to follow-up with respondents to understand the exact change to scope or efficiency level to avoid response burden and reduce the risk of false precision.

Lastly, respondents who indicated they would have done the exact same project were asked if they would have paid the additional incentive amount. This question is added to give the program credit by reducing the intention score for customers who would not have had the funds to pay for the project on their own.

The response options and scoring for retrofit projects are outlined in Table 5-1 below.

Table 5-1 Net-to-Gross Intention Score Methodology – Retrofit Projects

Response	Intention Score
Done nothing	0
Canceled or postponed the project	0
Done a smaller or less efficient project	Small = 37.5 Moderate = 25 Large = 12.5 Don't know = 25
Done exactly the same project	Would have paid = 50 Would not have paid = 25 Don't know = 37.5

A similar but slightly different set of questions were asked for new construction projects. The question and response options reflect that a project would have occurred but worked to understand how the project would have been different without the program. Responses were scaled on the same 0 to 50 scale, as outlined in Table 5-2 below.

Table 5-2 Net-to-Gross Intention Score Methodology – New Construction Projects

Response	Intention Score
Installed all standard efficiency or code equipment	0
Installed some energy-efficient equipment, but not as much as you did through the program	Closer to standard efficiency or code = 12.5 Closer to what you ended up installing = 37.5 Somewhere in between = 25 Don't know = 25
Installed the same efficient equipment as you did with the program's assistance	Would have paid = 50 Would not have paid = 25 Don't know = 37.5

5.1.1.2 Influence

To recognize the direct points of influence that the program has on customers' decisions, survey respondents were asked to rate the influence of several program aspects. The evaluation team worked with program staff during the survey design stage to identify all the ways program staff work with customers to include all components as part of the influence question. Together, the team included ten different aspects that could have been influential for customers, as outlined in the table below.

Table 5-3 Net-to-Gross Program Influence Aspects

Program Aspect
Incentive provided by Duke Energy
The support provided by your Duke Energy business energy advisor
Smart $aver marketing materials or webinars
Previous experience with the Smart $aver program
The technical support provided by Duke Energy engineer staff
The support provided by your Duke Energy account manager
The energy design assistance provided for your new construction project
The bundle options provided for your new construction project
The calculators provided by Duke Energy
Contractor or vendor recommendation

For each aspect, respondents were asked to rate the influence of the aspect where 10 was extremely influential, and 0 was not at all influential. The highest aspect rating for each customer was scored on a scale of 0 to 50, similar to the intention score. The rationale is that if any aspect of the program is highly influential on a customer's decision, the program overall was equally influential (see Table 5-4).

Table 5-4 Net-to-Gross Influence Score Methodology

Max FR4 rating	Influence Score
9-10	0
8	6.25
7	12.5
6	18.75
5	25
4	31.25
3	37.5
2	43.75
0-1	50

If a customer indicated their contractor as influential in the project, that is, providing an influence rating of a six or higher, the evaluation team attempted to contact the contractor. We asked the contractor a similar question, asking about the influence the program had on the specific customer. The scoring of the influential vendor influence score is shown below, where contractors used a scale from one to five where one was 'not at all influential,' and five was 'extremely influential.'

Table 5-5 Net-to-Gross Influence Score Methodology – Influential Vendor

Program Aspect	Max Rating → Influence Score
The program incentive provided by Duke Energy	1 → 50 2 → 37.5 3 → 25 4 → 12.5 5 → 0
Your interactions with Duke Energy program staff, including technical assistance	
The support from your Duke Energy trade ally outreach representative	
The program marketing, training, or informational materials	
Your firm's past involvement in Duke Energy's programs	
The energy design assistance provided by Duke Energy	

When a customer indicated a contractor was influential in doing the project, and the evaluation team could not complete a survey with the contractor, the customer's influence score was used. In cases where we completed the contractor survey, the methodology indicates to take the highest rating (or lowest influence score) from either the customer or the contractor.

5.1.1.3 Calculation Steps

The intention and final influence scores are added together to produce each respondent's preliminary free-ridership ratio using Equation 12.

Equation 12 Respondent Preliminary Free-ridership Ratio

$$FR_p = \frac{Intention + Influence}{100}$$

Where:

FR_p = *the preliminary free-ridership score.*

In 2020, the evaluation team incorporated consistency checks in the survey to follow-up when respondents gave inconsistent responses between the Intention and Influence scores. The inconsistency was defined as one score (either Intention or Influence) being greater than or equal to 37.5 and the other score being less than or equal to 12.5. The evaluation team reviewed responses to an open-ended question asking respondents to describe the impact, if any, the Duke Energy assistance had on the decision to install the amount of energy-efficient equipment at the time they did.

If the response validated a higher free-ridership score, the preliminary free-ridership ratio is adjusted using the following calculation:

Equation 13 Consistency Checks Adjustment Supporting Higher Free-ridership

$$FR_{a1} = FR_p + (\frac{1 - FR_p}{2})$$

Where:

FR_a = *the adjusted free-ridership score.*

If the response validated a lower free-ridership score, the preliminary free-ridership ratio is adjusted using the following calculation:

Equation 14 Consistency Checks Adjustment Supporting Lower Free-ridership

$$FR_{a1} = \frac{FR_p}{2}$$

If the response is ambiguous, the preliminary score is not adjusted. There are also no adjustments if the Intention and Influence scores were consistent and in cases where we incorporated influential vendor responses.

A second adjustment further looks at the impact of the program and incentives. Two questions are reviewed to adjust the free-ridership score. The first question asks respondents if they

learned about Duke Energy's assistance before or after selecting the specific type of equipment that received the incentive. Suppose the respondent indicated they had chosen the equipment before they heard about the incentive. In that case, the free-ridership score is adjusted upwards to reflect that the customer had already selected program-eligible equipment.

Equation 15 Respondent Final Free-ridership Ratio

$$FR_{a2} = FR_{a1} + \frac{1 - FR_{a1}}{2}$$

The second question asks respondents if their experiences with Duke Energy's program caused their organization to change its purchasing policies or energy-efficient equipment guidelines. If the organization indicated their policies had changed because of Duke Energy, their free-ridership score is adjusted downwards.

Equation 16 Respondent Final Free-ridership Ratio

$$FR_{a3} = FR_{a2} * 50\ percent$$

The final participant free-ridership ratio is multiplied by that respondent's verified gross savings to result in free rider savings, or savings that would have occurred without the program. The program free-ridership ratio is the sum of free rider savings divided by the sum of verified gross savings as shown in Equation 17.

Equation 17 Program Free-ridership Ratio

$$FR_p = \frac{\sum(FR_i \times kWh_{gv})}{\sum kWh_{gv}}$$

5.1.2 Spillover

Spillover is an estimate of savings resulting from the installation of energy-efficient projects completed without a program incentive, but that still was influenced by the program. Participant spillover was calculated from program participants who reported additional installations. Nonparticipant spillover was calculated from talking with participating contractors about their sales of program-eligible equipment that did not receive Duke Energy incentives.

5.1.2.1 Participant spillover

Participant spillover attributes savings to the program for equipment that participants installed without the incentive that was influenced by the program. For participant spillover, there are two components to arriving at these program-attributable savings.

First, the survey collects information on the type of energy-efficiency equipment installed but for which an incentive was not received. This is used to estimate energy savings by applying established calculation methodologies, often a technical reference manual.

Second, the survey asks the respondent to rate the program's influence on their decision to implement the project despite not receiving an incentive. That score is used to prorate the total project savings, recognizing that the program may not have been the only influence in the completion of the project. The result of this calculation is program-attributable participant spillover, shown in Equation 18:

Equation 18 Program-Attributable Participant Spillover

$$kWh_{apso} = kWh_{gso} \times Influence$$

Where:

kWh_{apso} is the program-attributable participant spillover savings

kWh_{gso} is the gross spillover savings

Influence is the value based on the respondent's rating of the program influence, as shown in Table 5-6.

Table 5-6 Participant Spillover Program Influence Values

Reported Smart $aver Program Influence	Influence Value
0	0.0
1	0.1
2	0.2
3	0.3
4	0.4
5	0.5
6	0.6
7	0.7
8	0.8
9	0.9
10	1.0
Don't know / Refused	Sector-level measure average

This number is divided by the total verified gross energy savings for the program to produce a program spillover ratio (Equation 19):

Equation 19 Program Participant Spillover Ratio

$$Program\ Participant\ SO\ Ratio = \frac{\sum kWh_{apso}}{kWh_{gv}}$$

5.1.2.2 Nonparticipant Spillover

Nonparticipant spillover attributes savings to the program for equipment contractors install for customers without a Duke Energy incentive that was influenced by the program. Nonparticipant spillover was captured from talking with contractors who participated in the program. Similar to

participant spillover, contractor spillover was calculated from two components to arrive at program-attributable savings.

The survey first asked about the sales of program-eligible projects of the same type installed through the Smart $aver program that did not receive an incentive from Duke Energy. The number of projects was used as weighting so that contractors and project sizes were weighted equally.

Contractors were also asked to rate the program's influence on their sales of projects that did not receive an incentive from Duke Energy. That score was used to adjust the spillover amount to recognize the program's impact on their program-eligible sales. The result of this calculation is program-attributable nonparticipant spillover, shown in Equation 18:

Equation 20 Program-Attributable Nonparticipant Spillover

$$Nonparticipant\ SO = Sales \times Influence$$

Where:

Sales is the percent of sales of program-eligible equipment that did not receive an incentive are the program-attributable nonparticipant spillover projects

Influence is the value based on the respondent's rating of the program influence, as shown in Table 5-7.

Table 5-7 Nonparticipant Spillover Influence Values

Reported Smart $aver Program Influence	Influence Value
1	0.0
2	0.5
3	0.5
4	1.0
5	1.0
Don't know / Refused	0.0

5.2 Sampling

Tetra Tech received program tracking data for PY2018 and PY2019 for the Duke Smart $aver Custom Program. The tracking data included a total of 88 records for the Kentucky territory. The tracking data was aggregated to the Sector, or measure-category level, summing incentive amounts and kWh savings, using the Unique Project ID variable. The detailed measure descriptions were retained for reference in the participant survey. After aggregation, the Kentucky territory sample frame included 44 measure-level records, all of which were included in the study's sample. A total of 22 unique customer contacts were associated with the 44 projects included in the sample.

The table below reports the sample size and estimated completed surveys for the Kentucky territory. We assumed a response rate of 35% and therefore expected to complete a total of 16 surveys.

Table 5-8 Survey Sample Design by Initiative

Measure Category	Original Tracking Data*	Number of Projects**	Estimated Completed Surveys***
Lighting	79	35	12
Whole Building	4	4	1
HVAC	1	1	1
Compressed Air	1	1	1
Food Service	3	3	1
Total	**88**	**44**	**16**

*Counts provided are the number of measures.

**The number of the unique customer contact totals 22.

***The number of estimated completed surveys assumes a 35 percent response rate.

5.3 Net-to-Gross Analysis and Findings

The evaluation team conducted interviews with 7 customers who completed 11 projects at locations in Kentucky.

5.3.1 Intention

Customers reported that for most projects (7 of 11 surveyed projects) they would have put off the work, canceled it entirely, or reduced the scope or efficiency of the project. The remaining customers said they planned to do the same project before learning about the Smart $aver Custom Program, and all but one of those customers said they would have paid the full cost of the upgrade if the incentive were not available. The full distribution of responses is shown in Table 5 9. These responses resulted in an average, unweighted intention score of 23.9 and a weighted intention score of 6.7. The difference between the weighted and unweighted figures was driven by one case with twice the savings as the next record.

Table 5-9 What Would You Have Done Had You Not Received an Incentive (Intention)

Response	Intention Score	Current Evaluation	2015-2017 Evaluation*
		Projects	Projects
Canceled or postponed the project (retrofit) Installed all standard efficiency or code equipment (new construction)	0	2	37
Done a smaller or less efficient project (retrofit) Installed some energy efficient equipment, but less (new construction)	Large reduction = 12.5 Moderate reduction = 25 Small reduction = 37.5 Don't know = 25	5 Large reduction (3) Moderate reduction (2) Small reduction (0) Don't know (0)	9 Large reduction (2) Moderate reduction (5) Small reduction (1) Don't know (1)
Done exactly the same project (retrofit) Installed the same efficient equipment (new construction)	Would have paid = 50 Would not have paid = 25 Don't know = 37.5	4 Would have paid (3) Would not have paid (1)	9 Would have paid (9)
Don't know	25	0	2

Source: Participant Survey; FR1
*Note: All respondents in previous evaluation used the retrofit language

The evaluation team reviewed the four responses that indicated the customer would have completed the same project. Three of the cases said they would have paid the incentive amount on their own. The three projects were all lighting projects completed by the same company. The company that said they would not have paid the additional incentive amount on their own was a new construction case.

5.3.2 Influence

When asked to rate the influence of the program on their decision to complete the energy-efficiency project, all respondents rated at least one program aspect an 8 or higher on a 0 to 10 scale, where 0 means "not at all influential" and 10 means "extremely influential." This results in an average unweighted influence score of 1.7, and weighted score of 0.1, meaning the program had a great deal of influence on customers.

The program incentive and contractors' recommendations were the program aspects most commonly given a high rating. Among respondents completing new construction projects, the energy design assistance and the bundle of options for new construction projects were rated highly in their decision to participate in the program.

Table 5-10 Influence of the Highest Rated Program Factor

Response	Influence Score	Respondents
0-1	50.00	0
2	43.75	0
3	37.50	0
4	31.25	0
5	25.00	0
6	18.75	0
7	12.50	0
8	6.25	3
9-10	0.00	8
Don't know	25.00	0

Source: Participant Survey; FR4A - FR4J

The program factor that was rated the highest most often was the incentive, followed by the recommendation of the contractor or vendor. The table below shows how often each program factor was rated the highest. In situations where multiple items were given the same highest rating, the evaluation team counted them in each factor.

Table 5-11 Program Factor with the Highest Influence Rating

Factor	Highest rating	Lowest rating	Mean	Times Factor was Selected as Highest Rated	Respondents
The incentive provided by Duke Energy	10	6	8.8	7	11
The recommendation from your contractor or vendor	10	7	8.2	4	11
The technical support provided by Duke Energy engineer staff	10	0	5.9	3	8
The calculators provided by Duke Energy	10	9	9.8	3	4
The energy design assistance provided for your new construction project (New Construction only)	10	10	10	1	1
The bundle options provided for your new construction project (New Construction only)	10	10	10	1	1
SmartSaver marketing materials or webinars	8	0	5.2	0	11

Factor	Highest rating	Lowest rating	Mean	Times Factor was Selected as Highest Rated	Respondents
Previous experience with the SmartSaver program	8	8	8.0	0	1
The incentive provided by Duke Energy	10	6	8.8	7	11
The recommendation from your contractor or vendor	10	7	8.2	4	11

Source: Customer Survey; FR4 – FR4J

There were seven customers, representing 11 projects, who reported the contractor as influential, and we were able to complete four surveys with those contractors. Contractors generally corroborated customer-reported influence. No customer records had their influence score adjusted due to the contractor reporting greater program influence than the customer.

5.3.3 Adjustments

The analysis further adjusted participant free-ridership by reviewing responses if customers provided inconsistent Influence and Intention responses. A total of three records were flagged as being inconsistent. After the evaluation team reviewed the open-ended responses, all three remained ambiguous and no adjustment was made.

Two final adjustments were made for 1) customers who found out about the program after they had already selected the equipment and 2) customers who had changed their policies as a result of any Duke Energy conversations. No respondents had their free-ridership score changed from these adjustments.

5.3.4 Net-to-Gross Results

The following table shows the progression of the free-ridership value based on each of these adjustments.

Table 5-12 Progression of Free-ridership Adjustments (weighted results)

Preliminary FR Score	Contractor adjusted FR Score	FR Score after Consistency Checks	FR Score after Adjusting for when Customer Heard about Program	FR Score after Including Policy Changes (Final FR Score)
6.81%	6.81%	6.81%	6.81%	6.81%

To calculate participant spillover, the evaluation team reviewed the data for customers who said they installed additional equipment without a program incentive. If the customer indicated the program had some influence on the project, the team reviewed the project details to determine the amount of spillover attributable to the program. One customer indicated they installed equipment without an incentive and confirmed that the program had some influence in their

decision. This respondent indicated they installed 130 interior high bays and a four-foot section of strip lighting but did not provide wattage or sizes to be able to quantify the spillover.

The evaluation team talked with contractors who were involved in projects completed by participating customers to calculate nonparticipant spillover. The evaluation team talked to these contractors about program-qualifying sales that did not receive a Duke Energy incentive. Nonparticipant spillover was attributed to the program if contractors indicated their Duke program knowledge was responsible for some or all of their sales that did not receive Duke incentives.

The resulting free-ridership, spillover, and net savings are shown in Table 5-13 below. With a free-ridership ratio of 6.81%, the resulting net of free-ridership ratio is 93.19%. When the net of free-ridership, participant spillover, and nonparticipant spillover ratios are combined, the program's outcome is a 104.88% net-to-gross ratio.

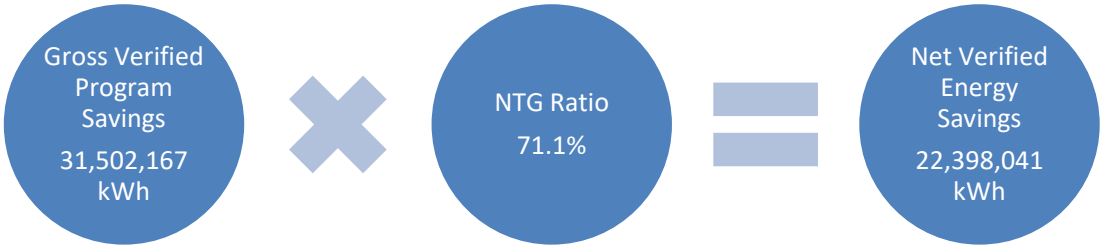
Table 5-13 Net-to-Gross Evaluation Results

Measurement	Ratio
Free-ridership (FR)	6.81%
Net of Free-ridership (1-FR)	93.19%
Program-influenced Participant Spillover (PSO)	0.00%
Program-influenced Nonparticipant Spillover (NPSO)	11.69%
Net-to-Gross* (1-FR)+PSO+NPSO	**104.88%**

*Precision of ± 3.8% for free-ridership and ± 0.5% for spillover at the 90% confidence interval at the program level

The program net verified energy savings are calculated by multiplying the program net-to-gross ratio by the gross verified energy savings resulting from the impact evaluation activities described in Section 4.

Figure 5-3: Net Verified Program Savings Calculation



The free ridership ratio (6.8%) was heavily influenced by one large project in a small sample size. Since free ridership responses are weighted by the customer's total kWh, this project impacted the overall ratio. This project was a non-free rider (or had a 0% free-ridership ratio)

and had savings more than twice the size of the other projects. If this project was removed, the free-ridership ratio would increase to 11.5%.

The analysis found that the nonparticipant spillover ratio was higher in Kentucky than in the other territories. This is likely driven by the limited budget available in the Kentucky territory. Discussions with program staff indicate the funds available to the Custom program are limited and sometimes result in only a few customers able to complete projects through the program. Some of the contractors we spoke with provided similar feedback. One contractor indicated “We didn't think the program was available - we were told the legislation had changed and that for a while the rebates were not available anymore” and another said, “the only reason we have not done an incentive is when they ran out of money and the program closed.” This feedback suggests the program is resulting in efficient equipment being installed, but not receiving an incentive, resulting in a higher spillover rate.

With a net-to-gross greater than the prior evaluation (84.7%), the program was successful at encouraging customers to install energy-efficient equipment that they would not have otherwise done. One possible reason for the difference may be that limited funding can create a sense of urgency in customers and motivate them to do projects sooner than they had initially been planning. Comparisons across the evaluation years are shown in Table 5-14 below. There were two noteworthy differences between the evaluation years. The Ohio and Kentucky territories were combined during reporting in the prior evaluation. This year, the program team added additional adjustments to the FR calculation for this evaluation, resulting in NAs in the table below. The modifications added to this year’s free-ridership calculation did not result in any changes to the free-ridership score.

Table 5-14 Free-ridership Results by Measure Type

Program Year	Preliminary FR Score	FR Score after Consistency Checks	FR Score after Adjusting for when Customer Heard about Program	FR Score after Including Policy Changes (Final FR Score)
2018 – 2019	6.8%	6.8%	6.8%	6.8%
2015 – 2017 (KY and OH)	15.4%	NA	NA	NA

We also reviewed results by measure type to look at the drivers of free-ridership. Lighting projects made up most program participation and savings, which one could argue generally drove results. Because the one case with the large savings is in the lighting measure category, we present both weighted and unweighted free-ridership figures. Care should be used when reviewing these figures as the number of respondents is limited.

Table 5-15 Free-ridership Results by Measure Type[3]

Measure	Gross (unverified) Population Savings (kWh)	Population Respondents (n)	Surveyed Savings (kWh)	Projects (n)	Free-ridership Ratio (unweighted)	Free-ridership Ratio (weighted)
Whole Building	1,362,556	4	72,879	1	25.0%	25.0%
Lighting	7,259,572	35	4,302,285	10	25.6%	6.5%

We also reviewed stratum results, which show free-ridership rates were slightly higher among the small stratum than the large.

Table 5-16 Free-ridership Results by Stratum

Stratum	Gross (unverified) Population Savings (kWh)	Surveyed Savings (kWh)	Surveyed Projects (n)	Free-ridership Ratio (%) (weighted)
L-Large (>500 MWh)	5,217,348	4,027,670	5	4.9%
L-Small (<500 MWh)	2,042,224	274,615	5	30.6%
NL-Large (>500 MWh)	6,196,344	0	0	NA
NL-Small (<500 MWh)	1,312,227	72,879	1	25.0%
Total	**14,768,143**	**4,375,164**	**11**	**6.8%**

One other element reviewed was national chain stores that participated in the program. These include stores such as dollar stores, grocery stores, and convenience stores that typically had numerous locations participate in the program. For these customers, we were able to talk with some of the decision-makers from the store, while others we were able to talk with a third-party vendor, typically a rebate processer, whose role it was to find rebates and incentives across geographies where they stores were located.

Qualitatively, when talking with the third-party vendors, they indicated that the custom incentives were a driving factor in the customers doing projects through the program. One customer needed to include the incentives in the ROI calculation to get projects approved by their board. Another customer went through a great deal of additional effort to find new lamps and rerun all the calculations to be eligible for the program incentives. These customers tend to be able to do

[3] Measures where we were unable to complete surveys (compressed air, food service, and HVAC) do not appear in the table.

more locations because of the custom incentives but also focus on the locations where utility rebates are offered.

National account customers may use the incentives to make other projects possible, but those are unlikely to result in spillover for Duke Energy. Additional projects are more likely to be located in nearby communities where incentives are not offered, or for work that would not have been possible if all the available funds would have been spent on the energy efficiency upgrade.

5.3.5 Benchmarking

To provide context to Duke Energy's NTG rates, the evaluation team conducted a secondary literature review, or benchmarking exercise, to examine NTG results for other custom programs and measures for other utilities. This was not meant to be a comprehensive review of all custom programs but rather a quick look into other custom programs. The evaluation team reviewed publicly available reports from different jurisdictions, some of which use the same NTG methodology (i.e., FirstEnergy and PPL Electric). All of the reports reviewed were taken from reports based upon independent, survey-based research directed at the program under consideration. Appendix D contains a bibliography of sources reviewed.

The benchmarking exercise found 15 utilities with custom commercial offerings (Ameren, Black Hills Energy, Energize Connecticut, ComEd, Energy, Entergy Arkansas, Indianapolis Power & Light, Mass Save, Met-Ed, National Grid Rhode Island, Penelec, Penn Power, PPL Electric, Vectren, West Penn Power, and Xcel Energy). NTG ratios for custom commercial programs ranged from 54% (Met-Ed) to 99% (Entergy Arkansas), and free ridership (when listed) ranged from 2% (Entergy Arkansas) to 46% (Met-Ed). NTG ratios for custom commercial lighting programs ranged from 73% (Xcel Energy) and 89% (Xcel Energy). Xcel Energy's custom Business HVAC+R Systems program produced a NTG ratio of 87%.

Table 5-15 Commercial Custom Program Benchmarking Summary

Category	Free Ridership Ratio	NTG Ratio
Overall	2% - 46%	54% – 99%
Lighting	NA	73% - 89%
HVAC	NA	87%

6 Process Evaluation

6.1 Summary of Data Collection Activities

Process evaluation activities are designed to support continuous program improvement by identifying successful program elements that can be expanded or built upon, as well as underperforming or inefficient program processes that could be holding back program performance or participation. The data collection activities for the process evaluation of the NR Custom Program included a database review and interviews with key contacts involved in program operations, participating customers, and contractors who assisted customers with projects.

The evaluation team developed data collection instruments designed to explore the research questions identified in Section 3 above. Table 6-1 summarizes the process evaluation data collection activities for Duke Energy Kentucky.

Table 6-1 Summary of Process Evaluation Data Collection Activities

Activity	Completes
Duke Energy Staff	6 In-depth interviews
Participants	11 Telephone surveys with participant projects (7 unique participant respondents)
Contractors	4 In-depth interviews (third-party vendors) 10 Telephone surveys with participating contractors
Application Data Review	42 Kentucky records provided by Duke Energy, with the status of why projects were rejected or closed

6.1.1 Program Staff Interviews and Application Data Review

The evaluation team conducted six interviews in August 2020 with Duke Energy's Smart $aver Custom Incentive program staff. To get a well-rounded perspective on the program design and implementation practices, we talked with two program management staff, an Account Executive for large account management, a Business Energy Advisor, an Energy Efficiency Engineer, and a Trade Ally Outreach Representative.

The program staff provided valuable feedback on intended operations, processes of the program's stated (and unstated) goals and objectives, perceived barriers to program up-take, and modifications to any program components based on the previous program cycle as well as the rationale for those modifications. The information the team gathered assisted in the design of the interview guides and surveys for customers and contractors.

The evaluation team also interviewed Willdan as the firm that handles paperwork, modeling, technical assistance, and identification of measures as part of the program's new construction energy design assistance. Willdan sees part of their role as educating the market and is marketing the program by building relationships with promoters such as architects and building organizations. Willdan works with customers to put a bundle of offerings together with different levels of energy efficiency, providing the documents to the Duke Energy team for preapproval. Once a project is complete, Willdan verifies installation, gathers documentation, puts together reports, and submits applications to Duke Energy for the incentive. There is a collaborative effort between Willdan and Duke Energy to deliver the new construction projects. The two parties pass potential leads and project information between each other, so communication is frequent.

In addition to the program staff interviews, the evaluation team reviewed the application screening process and the program tracking data to ensure necessary data and information was being collected to track program progress. Results from this review are presented in the next section (Section 6.2).

6.1.2 Contractor Interviews and Surveys

Contractors are important market actors, especially in large custom programs. For these programs to succeed, contractors must access and use calculation tools, navigate preapproval processes, and communicate the steps involved to project representatives.

The evaluation team selected all the implementation contractors associated with customer projects from the tracking data provided by Duke Energy. Any contractors in the list identified through the participant survey as “influential vendors” were flagged for additional questions in the contractor survey.

General discussion topics in the survey included program awareness among customers, understanding of program guidelines and processes, interactions with customers, and suggestions for improving the program. Influential vendors were also asked questions about the specific projects if participating customers indicated the contractor influenced their decision to install energy-efficient equipment through the program.

In February 2021, 13 surveys were completed with 10 unique program contractors who participated in the program. Six of the completes were from influential vendors. The average survey length was 10 minutes and average number of telephone attempts was five. Table 6-2 outlines the contractor's response for the evaluation.

Table 6-2 Contractor Response Rate

Disposition	Contractor Count
Starting Sample	**24**
Does not recall participating	0
Refusal	1
Incompletes (partial surveys)	0
Language barrier	0
Wrong number	0
Not completed	10
Completes	**13**
Unique contractor completes	**10**
Response Rate (Complete/Starting Sample)	**54.2%**

In addition to the contractor survey, the evaluation team sent emails and called six firms identified through email addresses and contact information in the tracking database as being third-party vendors. These third-party vendors did not install or sell equipment. Instead, they often served in a consulting role to firms looking for energy efficient recommendations and incentives. These firms typically worked with national chains or commercial customers with multiple locations. Four in-depth interviews were conducted in January and February 2021 with these third-party vendors (three of the four contractors had projects in the Kentucky territory). Three of them advise customers on projects and the fourth only helps them apply for incentives.

6.1.3 Participant Surveys

Collecting survey data from program participants provides data suitable for quantitative analyses on participant characteristics and key aspects of the program. The evaluation team conducted a telephone survey with program participants, defined as customers who received an incentive through Duke Energy's Smart $aver Custom Incentive Program for PY2018 and PY2019. Surveys were conducted with program participants between December 14, 2020 and February 2, 2021. Surveys focused on customers' experience with the program, sources of awareness, decisions to install equipment, barriers to participation, satisfaction with various aspects of the program, and any program improvement suggestions. Surveys were completed for 11 of 44 projects completed through the program (7 of 22 unique respondents). Table 6-3 outlines the participant response rate for the evaluation.

Table 6-3 Participant Response Rate

Disposition	Participant Projects
Starting Sample	**44**
Does not recall participating	1
Refusal	4
Incompletes (partial surveys)	0
Wrong number	0
Not completed*	28
Completes	**11**
Response Rate (Complete/Starting Sample)	**25.0%**

*an average of six call attempts were made at different days of the week and times of the day to attempt to reach a decision maker. Additional attempts were made for those with email addresses.

6.2 Process Evaluation Findings

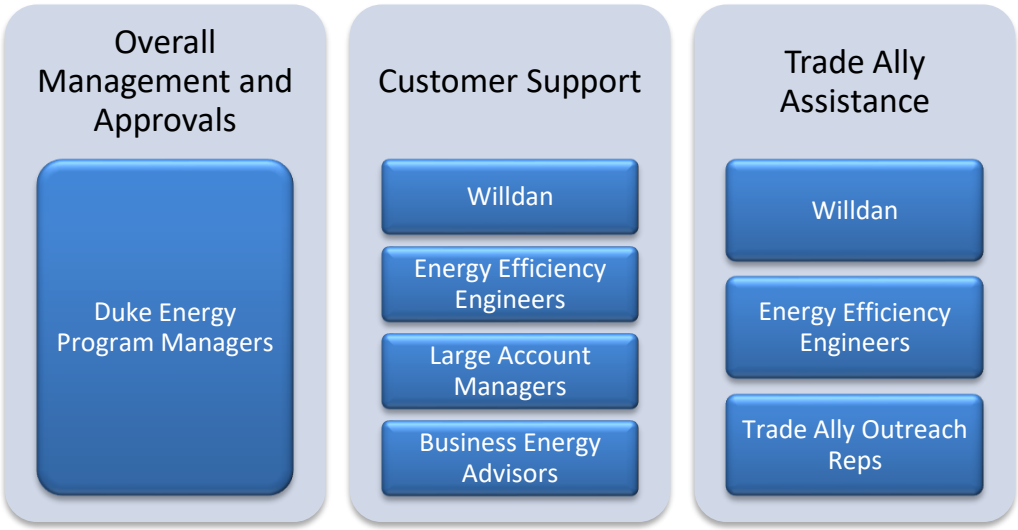
6.2.1 Program Staff

The program staff interviews were extremely useful in helping the evaluation team understand how the program operates and to design the interview guides and surveys for program participants and contractors. Throughout the findings section, we used some of the staff feedback to add context around respondent answers. This section details key discussion topics, including the relationships between staff, marketing and outreach strategies, the application process, and the NCEEDA effort.

6.2.1.1 Roles and Relationships

Duke Energy enlists a wide range of staff to promote and deliver the Smart $aver program. In addition to Program Managers, customers will work with Large Account Managers (LAMs) or Business Energy Advisors (BEAs) who get assistance from Energy Efficiency Engineers (EEEs). Trade allies (TAs), who are critical to the program delivery, get information and assistance from the Trade Ally Outreach Representatives.

Figure 6-1 Smart $aver Custom Program Delivery Support



Large Account Managers

Large Account Managers (LAMs) are responsible for large commercial and industrial customer needs. Each LAM works with specific customer segments or types, such as hospitals, schools, manufacturing, government, grocery.

The number of customers assigned to each LAM varies, depending on a number of different factors, but generally ranges from 20 to 100. The LAM we spoke with working in the Kentucky territory works with approximately 70 customers and handles mostly manufacturing customers, including pharmaceuticals, steel, food, and others. They estimate about 50% of their customers have participated in Smart $aver, mostly receiving prescriptive incentives.

Business Energy Advisors

Duke Energy has a team of 10 BEAs that cover the Carolinas and the Midwest. BEAs are regionally based and assist small and medium business customers assigned to them based on usage levels. They work with a much larger group of customers than LAMs do, with each BEA assisting anywhere from 500 to 4,000 customers. BEAs characterize themselves as the liaison between the customer and Duke Energy.

BEAs can work with several hundred customers about a wide variety of topics, include energy efficiency. To assist customers, BEAs must understand and access information on customer energy use and demand patterns. They look for opportunities for each facility to improve energy use, decrease cost, decrease demand, and access utility rebate programs. When BEAs cannot answer customer questions, they may enlist the help of other Duke Energy staff - particularly Energy Efficiency Engineers. BEAs may also assist customers in identifying trade allies to implement their projects, although BEAs are careful to remain neutral when suggesting contractors.

Energy Efficiency Engineers

Energy Efficiency Engineers (EEEs) review Smart $aver custom projects that come through AESC before they go to offer or payment. If needed, EEEs will work with customers to develop

projects before application when LAMs and BEAs ask for assistance. The EEEs may also respond to questions from Willdan for new construction projects and interact with Trade Ally Outreach Reps when trade allies need guidance.

Trade Ally Outreach Representatives

Trade Ally Outreach Representatives (TA Outreach Reps) work with trade allies on prescriptive and custom projects. They make sure trade allies understand program requirements, equipment eligibility, and assist with the application process.

Multiple TA Outreach Reps are working with contractors assigned to geographic areas. The Kentucky representative we spoke with assists both vendors and customers and is careful to be vendor and product-neutral, giving a list of both based on project type and location. The Kentucky rep encourages customers to move ahead with custom projects and not be intimidated by working with them to ensure they have the necessary information ready for the application process. The rep will also walk them through the Custom tool but pull in EEEs if it gets too complicated.

There is a Trade Ally section on the Duke Energy website where trade allies can register for customers looking for trade allies.[1] TA Outreach Reps review the program rules and forms with contractors who register for the Trade Ally Network and in the process build a relationship with those trade allies. Contractors will be listed on the website for customers looking for trade allies. If contractors want training on the Smart $aver tools, the TA Outreach Reps will take care of the training.

6.2.1.2 Marketing and Outreach

Program staff have tried various tactics to reach out to customers, trade allies, architects, and engineers over the years. They have used print materials, webinars, lunch and learns, emails, phone calls, and in-person visits.

Duke Energy has designed and printed handouts for staff in the field to distribute to customers and trade allies. They also ran a marketing postcard to communicate that programs were available and Duke Energy staff could help customers identify energy-efficient opportunities. Social media marketing was also reported to be an effective marketing tool.

Webinars highlighted certain technologies or ways to optimize projects and focused on trade allies and customers. BEAs contributed to webinar content and contractors would deliver some of the webinars. An annual customer forum has also allowed customers to provide feedback on the Smart $aver program.

Most LAMs and BEAs reported direct outreach to customers through email, phone calls, and in-person visits was their primary marketing approach. In Kentucky, LAMs and BEAs feel relationships are important. They favor in-person visits to customers to develop those relationships. However, the incentive caps in Kentucky have had a dampening effect on outreach in terms of the number of conversations the LAM has with customer and how much they are promoting the Custom program. For the past few years, program incentive funding was fully reserved early during the program year. Because of this, customers developed some

[1] Commercial Trade Allies | Duke Energy (duke-energy.com)

hesitancy in trusting that an incentive will be available for their project. LAMs encourage customers to apply as early as possible for incentives to ensure they have a chance at funding.

TA Outreach Reps will spend most of their time on in-person visits to recruit new trade allies and educate them on the program. The reps may drop off handouts or walk trade allies through the Smart $aver tools. The TA Outreach Reps feel that the trade allies need more assistance, as they often work with several utilities, which can cause confusion.

6.2.1.3 Application Process

Once LAMs and BEAs get customers to the point of selecting equipment, they typically transition the project to a trade ally and the trade ally assists the customer with the application process. However, if the customer has questions beyond what the trade ally can assist with, Duke Energy staff will help the customer complete the application, including getting an EEE involved to check eligibility and savings.

The LAM in Kentucky we spoke with said the main challenge in Kentucky is how early the program runs out of incentive funding, which makes it hard for them to approach customers. The LAM works closely with customers to strongly encourage them to submit an application very early in their planning process to get funds reserved. With limited funding, a few large customers can end up reserving the entire custom incentive budget in a given year. Once all the custom program funding has been reserved, the LAM communicates that the funds are no longer available. This can create challenges late in the year, when only two or three months are left in the program year. Funding from the prescriptive program can be released to the custom program, making the application and approval process challenging. Customers feel they receive mixed messages when this occurs.

Another BEA working across the Midwest thinks the application calculators are intuitive once customers get going. But this BEA also acknowledges that there is a lot of information to keep track of and it can be challenging when requirements change.

All applications are tracked in Salesforce. If a customer is approved and does not proceed, the record is closed out. Based on the relationships staff have with customers, they typically know why projects are not completed. This information is sometimes captured in the tracking data, although not all projects have a reason for being closed.

The TA Outreach Rep serving Kentucky finds the new online tools for calculating savings are user friendly and provide useful output. It has also reduced wait times. The assistance the TA Outreach Reps provide to contractors helps decrease the load on the EEEs.

6.2.1.4 New Construction - NCEEDA

Program Managers for the Smart $aver Custom program feel that NCEEDA offering has been successful and is becoming a larger part of the Custom program. Duke Energy is working with Willdan, who manages the outreach to architects and design engineers up front to incorporate energy efficient designs in new construction. The goal is to influence better efficiency beyond code. The whole building is modeled, creating options for ‘good’, ‘better’, and ‘best’ energy-saving scenarios with ROI attached to each. The assistance from Duke Energy and Willdan is meant to take the burden of finding options and calculating savings off the customer.

EEEs believe that new construction projects are becoming more common, but the LAM in Kentucky said not much new construction going on with the customers they work with, so they have not focused on the NCEEDA opportunities. The BEA in Kentucky thought the NCEEDA option was not available the past two years in Kentucky, but they liked it and used it heavily when it was available.

6.2.1.5 Staff Influence

When asked to rate the influence of Duke Energy staff on their decision to complete their project, respondents provided mixed results. On a 0 to 10 scale, where 0 was 'not at all influential' and 10 was 'extremely influential', Duke Energy engineering staff received an average influence score of 5.9.[2] Account managers and BEAs were not rated by Kentucky participants.

Table 6-4 Influence of Engineer Staff

	Mean	Minimum	Max	Projects
Engineering staff	5.9	0	10	8

Source: Participant Survey; FR4F

6.2.2 Data Review

Two sources of data were reviewed as part of the evaluation. The first was the data associated with the completed projects that was used for the process, NTG, and impact evaluation activities. The second was the data associated with the applications that were submitted from both hard copy and the online portal.

6.2.2.1 Completed Project Review

An additional part of the evaluation activities included reviewing the program tracking data to ensure the necessary information to track the program and conduct evaluation activities was available. Program staff use the tracking data to document customers who participated in the program, the details of the equipment being installed, and the project's savings. Once the application is received, this information is passed to AESC, the technical review vendor. AESC verifies the accuracy of the savings calculations and provides Duke Energy with verification in a systematic format. Duke Energy engineers also review the application information to verify savings calculations.

The evaluation team utilized this same data to select impact and process evaluation activities samples. One area that impacted the evaluation activities was that the data included contact information for third-party vendors in place of some customer contacts. The third-party vendors tend to work with corporate offices and are involved, sometimes in place of local contacts.[3] However, the evaluation team is interested in understanding (1) how the equipment is operating and (2) the decision-making process to purchase the equipment, and therefore, needs to talk directly with someone in the organization.

[2] No respondents provided influential ratings for Duke Energy account managers or Business Energy Advisors.

[3] This occurred less often in the Kentucky territory, but there were still situations where this occurred.

Other information in the tracking system was accurate and thorough, although some areas were not electronically documented. The quantities of installed equipment (particularly for lighting) and some savings associated with projects were missing or incorrect.

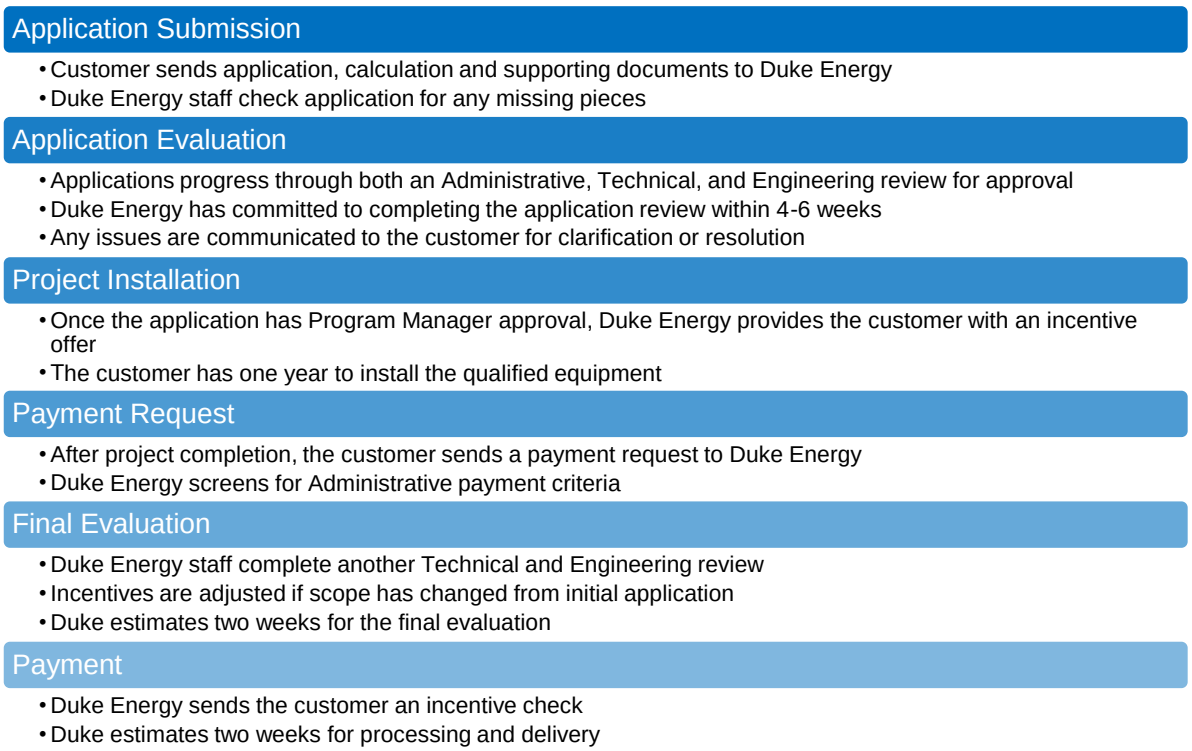
In conducting the process evaluation telephone efforts, some contact information associated with some participants was out of date. Given that evaluation activities went back to 2018, some level of personnel turnover at companies is expected, resulting in out-of-date contact information for people who no longer work for listed companies. The program team should ensure customer contact information is included for each record in the tracking system.

Application Review

The evaluation team reviewed the Duke Energy application and process, which found a thorough review method in place as part of the pre-approval process. The Duke team reviews applications to ensure the customer has not already purchased or committed to the project and meets the eligibility requirements outlined in their application.

As we heard from the program staff interviews, customers or trade allies initiate the application process, often with assistance from Duke Energy staff. The application then goes through the Duke Energy preapproval, installation, and payment stages.

Figure 6-2 Smart $aver Customer Program Application Process



During the “Application Evaluation” stage, Duke Energy reviews the application for several items, including missing documentation, responses to application questions, and energy-saving calculations to determine incentive levels. To better understand how this screening process works, we asked Duke staff to provide projects from the database that had not progressed

through to payment and been closed out. The evaluation team received a data file with 42 applications from the Kentucky territory that were submitted but were not considered completed.

The analysis shows that Duke's screening process for eligibility is working well. Eighteen cases were screened out, with almost half of them failing the early commitment requirement using Question E:

> *A commitment includes but is not limited to signing a purchase order/contract, ordering equipment or starting construction. Have you made any commitment to your project? (Yes or No)*

Another 14 applications were closed at the customer or trade ally request, and just one was closed due to nonresponse from the customer for missing or additional information.

While each of the above-mentioned reasons provides insights into how the preapproval process is working, nine applications were closed out without a clear reason. This reduces the ability to understand where processes are effective, where customers are falling out of the process, and potentially what Duke Energy staff can do to shepherd more projects through the program.

Table 6-4 Analysis of Incomplete Projects

Closed Reason	Count of cases
Kentucky Cases	**42**
Did not appear rejected (Contract approval, M&V Period, payment request received, approved for payment, ongoing)	**0**
Ineligible	**18**
Early commitment (Question E)	7
Opted out	0
Outside Duke territory	0
Payback too short	0
Shifted to prescriptive incentive	7
Kentucky suspension	4
Customer or TA Request project close	**14**
Customer/TA request - NA	1
Customer/TA request - too much delay, incentive not enough, didn't install, went prescriptive	13
Customer nonresponse	**1**
No response to Request for Information	1
No response to Offer Letter	0
Expired	0
Staff changes, unable to reach customer	0
No detailed reason	**9**
Auto close - no details	2
No reason recorded for closed lost	7

Duke Energy has taken an additional step with its application to attempt to monitor and reduce the effects of free-ridership on the program. The application for preapproval has another question, Question G, that asks customers how their project would change without the program incentive. Specifically, the question states:

If an incentive was not available for your project, would you:

a) Purchase and install the entire project
b) Purchase and install some, but not all, of the high-efficiency project
c) Neither purchase nor install any part of the project
d) Don't know

This question is on the application to help the program team understand customer objectives when making the purchasing decision. While this question is on both the hard copy and online applications, it is not required. It also allows customers to select the "Don't know" option, which does not provide much information to the program team. Based on a review of a few applications compared with the survey responses, it also does not appear that the responses are used for any screening.

We reviewed the application responses provided by Duke Energy for the participants who completed the evaluation survey. Those participants who initially answered "Don't Know" on the application had the highest free-ridership scores, with all three receiving an unweighted score of 56.25%. The rest of the free-ridership results were consistent with customer intent to change their planned efficiency level or only slightly inconsistent with what their applications initially indicated. Again, as mentioned above, care should be taken in reviewing these results as one case had significant savings that drove free-ridership down.

Not allowing the "Don't Know" option, which corresponded with an average free-ridership score of 56.25, would have better understood the correlation between how customers answered the application question and their responses to self-report survey questions.

Table 6-5 Analysis of Application and Free-ridership Responses

Application Response	Count of cases	Unweighted Average FR
Would purchase and install the entire project	0	NA
Would purchase and install standard equipment (new construction)	1	25.00%
Don't know	3	56.25%
Would purchase some, but not all, of the high-efficiency project	3	12.50%
Would not purchase nor install any equipment	3	16.67%
Would neither purchase nor install any part of the project	0	NA

6.2.3 Contractors

The evaluation team surveyed 10 unique contractors involved in installing participating customer's projects during the evaluation period. We also include feedback from four of the third-party vendors we spoke with.

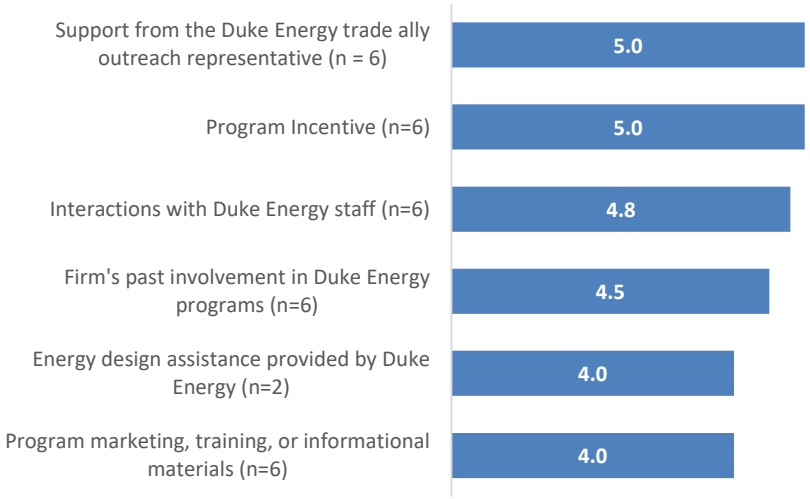
6.2.3.1 Contractor Characteristics

We spoke with a mix of contractors from small businesses to large organizations, with responding contractors reporting having anywhere from two to 65 full-time employees. Four contractors had between two and 10 full-time employees, four contractors had between 11 and 20, and the remaining two contractors had 25 or more employees. None of the responding contractors reported more than 65 employees. Six of the responding contractors do not use part-time staff. Three of them hire on less than five part-time staff and one had 75.

6.2.3.2 Customer Interaction

All contractor respondents said they incorporate the program incentive into their pricing estimates (6 of 6 contractors responding to the question). For the projects that went through the program, contractor respondents felt the program incentive and support from Duke Energy TA Outreach Reps were the most influential factor on a customer's decision to complete their project. Respondents were asked to rate the influence of various factors on their recommendations to specific customers on a 1 to 5 scale, where 1 was 'not at all influential' and 5 was 'very influential.' As shown in Figure 6-3, the program incentive and TA Outreach Rep support received scores of 5.0, while the second most influential factor was their interaction with Duke Energy staff (4.8).

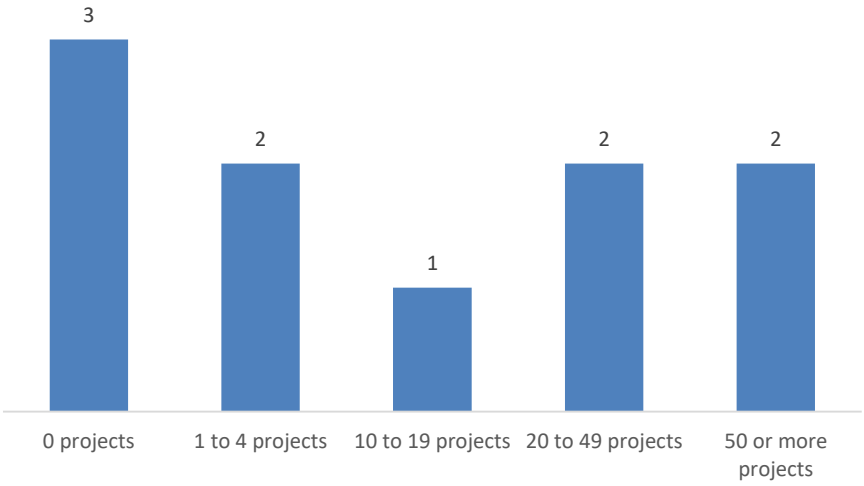
Figure 6-3 Mean Influence of Program Components



Source: Contractor Survey; FR2A – FR2F

Figure 6-4 shows the number of similar projects sold within the last 12 months to Duke Energy nonresidential customers from contractors who participated in the program. Three contractor respondents indicated they had not completed any similar projects in the last 12 months.

Figure 6-4 Number of Similar Projects Completed in Last 12 Months



Source: Contractor Survey; P1

More than half of the responding contractors (four of seven) said that 50% or more of their projects receive an incentive through Duke Energy's programs. Furthermore, four of six responding contractors said that high-efficiency products make up 50% or more of their total sales.

The third-party vendor interviews focused on retail customers who participated at multiple locations. These large national account customers with multiple locations often take a phased approach to implementing energy efficiency, which can span several years. Planning to implementation may take anywhere from two to five years. Store prioritization is typically based on high energy users, store visibility, condition or viability, the project's return on investment, and incentives available. The incentives are usually factored into the ROI.

Equipment specification can also be more complicated for national accounts as there are typically multiple parties involved. There are staff within each company, contractors and equipment dealers, and third-party consultants providing input. One of these parties may reach out to Duke Energy and other utilities for input or assistance at any point in the process.

The third-party vendors have found various Duke Energy staff to be helpful when they have needed assistance. Interview respondents mentioned working with Trade Ally Representatives, Program Managers, and Account Managers. One of them had difficulty initially finding the correct contact, as he is outside any of the Duke Energy territories, but communication is now good.

6.2.3.3 Application Process

As far as the application process, all four third-party vendors assist the customers with applications. Two of the third-party vendors complete the entire application process now that they can sign for the customer. Third-party vendors indicated that most of the projects they help retail customers with are incentivized through the Prescriptive program, but whatever equipment is not eligible through Prescriptive is routed through Custom. This requires third-party vendors to

understand the programs to get preapproval on the Custom projects early enough to keep identified projects on schedule.

The third-party vendors appreciate the online application portal, making tracking application, preapproval, and incentive status easier. While a few vendors commented that the application process was easy and easier than what they experienced with other utility programs, they were likely talking about the Prescriptive process. A couple of vendors said it does not reduce the complexity of the Custom application process. Some specific comments include the following:

> "The application process has dramatically improved in the last five years. Five years ago was all paper applications, now with the online portal - it's a really nice improvement in the work flow. We can track processing status for each project. Preapproved projects can be released for installation."

> "I use the online portal, just in the last year or two. It works pretty well. Some built-in inefficiency for large projects with lots of different measures, those can be cumbersome via the portal. Individual measures require multiple selections for each line item."

> "Keep a paper option even if they offer online. Please don't go to online application only. They are harder to sign and submit transfers."

One vendor specifically called out the issue of having to fill out two application forms for each project - one for Prescriptive and one for Custom for a customer that does 100+ projects per year. Although the vendor understands why Duke Energy may choose to follow this process, he suggested that other utilities have more flexibility. Specifically, some utilities allow them to pull all the equipment into the Custom application and measure actual wattage savings for the entire project, which is more accurate and avoids the Prescriptive assumptions. He feels the calculator is a bit burdensome and not designed for national accounts.

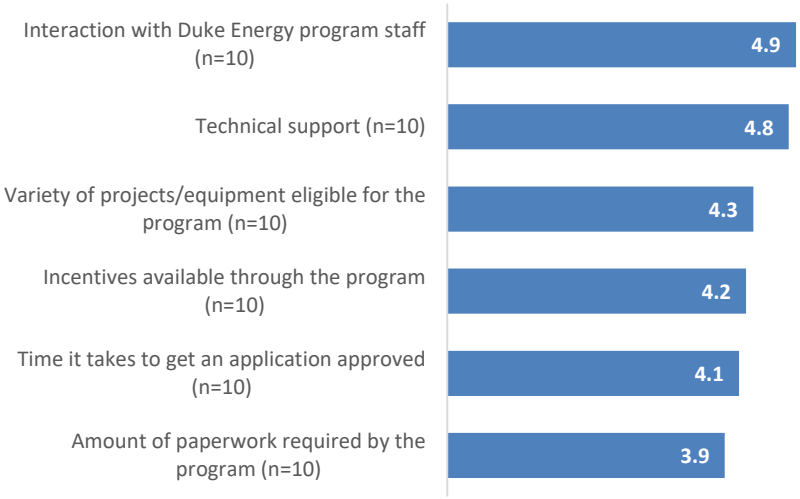
Another vendor had a different experience with the application process. They said they received guidance that the Custom program prefers to submit multiple locations as a single application. That would be easier to manage if the vendor could submit a general scope instead of site-specific.

6.2.3.4 Satisfaction

Contractor satisfaction remains high with the Smart $aver Custom Incentive program. Respondents were asked to rate their satisfaction on a 1 to 5 scale, where 1 was 'not at all satisfied' and 5 was 'very satisfied.' On average, contractor respondents rated their overall satisfaction with the program 4.5.

Contractors were also asked to rate their satisfaction with different program components using the same scale. Contractors were generally satisfied with the program, with all component mean scores higher than 3.8. As shown in Figure 6-5, the program's highest mean score was for the contractors' interactions with Duke Energy program staff (4.9). Contractors were also very satisfied with the technical support they received (4.8).

Figure 6-5 Contractor Satisfaction with Program Components



Source: Contractor Survey; S3A – S3F

As far as improvements to the program, 3 of the 10 contractor respondents indicated they had no recommendations for program changes. The proportion has increased from the last evaluation when only four of the 31 contractors surveyed said they could not think of any improvements. For the remaining seven respondents, two contractors suggested improving the application process, which was consistent with the lowest rated satisfaction item for the amount of paperwork required for the program. Another two respondents requested increased offerings and transparency. These contractors requested the program be offered in Ohio but also increase the transparency of the funds available and status of funds in Kentucky. One respondent thought the incentive could be increased and another suggested adding incentives for different types of equipment.

Table 6-6 Recommended Improvements

Factor	Respondents
Improve application process	2
Increase program offerings and transparency	2
Add incentives for different equipment types	1
Increase incentive	1
Other	1
Respondents	**7**

Source: Contractor Survey; S4o

Some specific comments from contractor respondents include the following:

"Make it a little less paperwork on the custom side"

"I would say transparency on amount of money in the program. It would be helpful to have a transparent way of showing the trade allies still available in the program. We never knew when we were talking to customers if there was money left in the program."

"The rebates available have been reduced significantly over the last couple of years. It would be great to bring them back to where they were because that would incentivize the customers to use the program."

While some contractors made comments about the prescriptive program, most understood the differences between the two programs. All of the responding contractors thought it was very easy (8 of 10 respondents) or somewhat easy (2 respondents) to understand the differences in equipment eligibility between Duke Energy's Custom and Prescriptive programs.

6.2.3.5 Effects of the COVID-19 Pandemic

The process evaluation occurred during the COVID-19 pandemic. We included questions in the survey to understand the impact the pandemic had on contractor business operations. When asked about how the pandemic had affected their business, most contractor respondents indicated that the pandemic had a moderate negative effect on their business (6 of 10 respondents). Three contractors said the pandemic had a large negative impact, and one said they experienced a moderate positive effect.

When discussing specific ways their business was affected, the most common response was that their business was forced to implement social distancing procedures (4 respondents). As can be seen in **Table 6-7**, three contractors said they saw a reduction in the number of projects, while two said they had less access to customers and their work sites.

Table 6-7 Effect of Pandemic

Effects of COVID-19	Respondents
Social distancing	4
Reduction in projects	3
Less contact with customers	2
No change	1
Respondents	**10**

Source: Contractor Survey; CV2

Looking to the future, contractor respondents were divided on when they thought their companies would return to normal operations. One-third of the respondents (3 of 9 respondents) said they thought their operations would return to normal by the end of September 2021. Three other respondents said their operations would likely return to normal as soon as the end of June 2021.

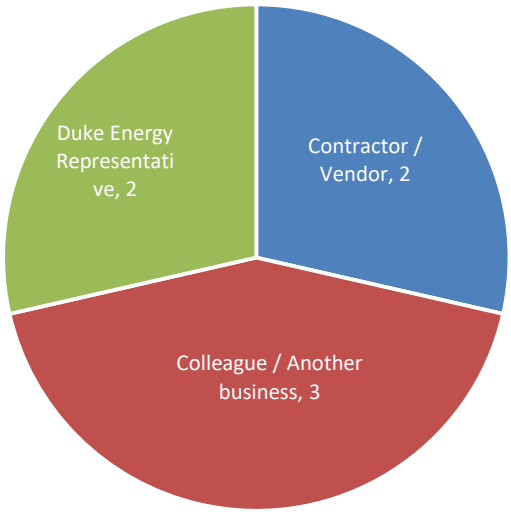
6.2.4 Participants

Surveys were conducted with program participants or customers who received an incentive through the Smart $aver Custom Program. This section provides detailed findings from the seven customer respondents who completed the surveys.

6.2.4.1 Marketing Practices

Traditional marketing channels, such as direct mail, account managers, ads on social media or other websites, and emails to a subset of customers by segment have been used to promote the program. The program also reaches out to builders and architects to support the new construction portion of the program. Trade Ally Outreach Representatives market the program directly to contractors, which Duke Energy staff indicates accounts for a significant percentage of projects. When asked how they heard about the program, the three sources of awareness of the Smart $aver Custom Program reported by participant respondents were from a colleague or another business (3 respondents), Duke Energy representatives (2 respondents), or their contractor or vendor (2 respondents). Figure 6-6 shows the breakdown of the awareness sources from customer respondents.

Figure 6-6: Participant Source of Program Awareness



Source: Participant Survey, Q1

Program website materials note that the Smart $aver Custom incentives “can help you offset up-front costs and improve your bottom line.” When respondents were asked what made them decide to apply for the Smart $aver Custom program, the most common response (four of seven respondents), was that they wanted to save money. Two of the seven respondents needed new equipment and two mentioned energy savings. Other reasons are included in Table 6-8.

Table 6-8: Reasons for Participating in the Smart $aver Custom Incentive Program

Reason	Responses
Save money	4
Needed new equipment	2
Energy savings	2
Following a recommendation	2
Better equipment for less	1
Respondents	**7**

Source: Participant Survey, Q6

6.2.4.2 Application Process

According to program staff, the review process takes about four to six weeks. Staff mentioned they have been meeting this turnaround time and typically exceed it. This is corroborated by the feedback provided by customer respondents, who were highly satisfied with the review process (**Table 6-9**). When asked about their satisfaction with various aspects of the application process, respondents rated their satisfaction highly, with mean scores of 8.8 or higher (using a 0 to 10 scale where 0 is 'very dissatisfied' and 10 is 'very satisfied'). None of the respondents rated their satisfaction low for any aspect of the application process (less than four). The lowest rating provided was a six for the time it took their staff to submit the application and necessary paperwork.

Table 6-9: Satisfaction with Application Process

Application Aspect	Mean	Respondents
Process to fill out and submit your application	9.0	6
Duke Energy's processing and preapproval of your application	9.0	6
Staff time it took to submit the application	8.8	6

Source: Participant Survey, Q8, Q9, Q10

Over two-thirds of respondents (5 of 7) were aware of the online application portal. No follow-up questions were asked of this group, but when we looked at satisfaction with customers aware of the portal and those who were not, we found respondents who were aware of the portal had a mean satisfaction of 8.6. This may not be an indication of true satisfaction, as the question only asked about awareness of the portal and not the actual use of the portal.

Contractors play a role in customer projects. Four of the participant respondents indicated they worked with a contractor to complete the project. One respondent said they worked with a contractor and internal staff on their project.

6.2.4.3 Calculators

Customers must submit an appropriate worksheet or calculator as part of the application process and receive incentives through the program. In addition to the feedback contractors provided, participant respondents were also asked if they used any of the calculators provided by Duke Energy or if they used their own methods to calculate energy savings. Three of the seven respondents said their contractors calculated the savings, while three others said they used Duke's tools (**Table 6-10**). One respondent said they used their own methods.

Table 6-10: Calculators Used by Participants

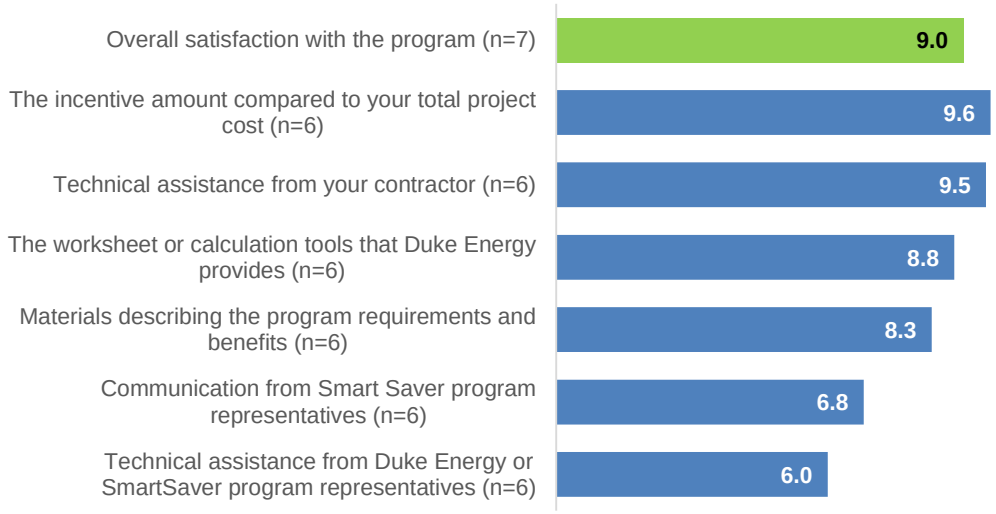
Calculators Used	Respondents	Percent
Contractor calculated only	3	43%
Custom-to-go only	3	43%
Own methods only	1	14%
Respondents	**7**	

Source: Participant Survey, Q12

6.2.4.4 Program Satisfaction

Overall, program participants were highly satisfied with the Smart $aver Custom program. Respondents were asked to rate their overall experience with the program and with Duke Energy on a scale of 0 to 10, where 0 is 'very dissatisfied' and 10 is 'very satisfied.' Respondents were also asked to rate the value of different program components on a similar 0 to 10 scale. Respondents rated their overall satisfaction with the program highly (9.0 out of 10). All program aspects were rated an average of 6.0 or higher (Figure 6-7).

Figure 6-7: Program Participant Satisfaction and Value of Program Aspects



Source: Participant Survey; SAT11, SAT5
Don't know and refused responses are excluded

Since the last evaluation, satisfaction scores have changed slightly (Table 6-11). One of the most noticeable differences between the evaluation years is that the value of the incentive amount increased from 8.4 to 9.6. The worksheets or calculation tools also increased from 7.0 to 8.8, and the program materials rating increased from 6.5 to 8.3. In both evaluations, Duke's technical assistance received the lowest average rating of any program aspect.

Table 6-11: Comparison of Participant Program Satisfaction

Program Aspect	2018-2019 Evaluation	2015-2017 Evaluation
Overall satisfaction with the program	9.0	8.7
The incentive amount compared to your total project cost	9.6	8.4
Technical assistance from your contractor	9.5	8.8
The worksheet or calculation tools that Duke Energy provides	8.8	7.0
Materials describing the the program requirements and benefits	8.3	6.5
Communication from Smart Saver program representatives	6.8	6.8
Technical assistance from Duke Energy or Smart Saver program representatives	6.0	6.4

Source: Participant Survey; SAT11, SAT5

Customers who used Duke Energy-provided calculators provided slightly higher overall value scores than customers who used other calculation methods (9.3 vs. 8.8, respectively). The program aspect with the greatest difference was the satisfaction with communication from Smart $aver representatives. Participants who use Duke's calculators were more satisified with Duke's communication than participants who did not use Duke's calculator (7.3 vs. 6.3, respectively). The figures here are reported on a small number of responses, so care should be taken when using these results.

Table 6-12: Satisfaction with Program Aspect by Calculator Use

Program Aspect	Custom to go		Own / Contractor / Other Methods	
	Mean	Respondents	Mean	Respondents
Overall satisfaction with the program	9.3	3	8.8	4
Technical assistance from your contractor	9.0	3	10.0	3
Communication from Smart Saver program representatives	7.3	3	6.3	3
Technical assistance from Duke Energy or SmartSaver program representatives	5.7	3	6.3	3
Materials describing the program requirements and benefits	8.0	3	8.7	3
The worksheet or calculation tools that Duke Energy provides	9.5	2	10.0	1
The incentive amount compared to your total project cost	9.7	3	10.0	1

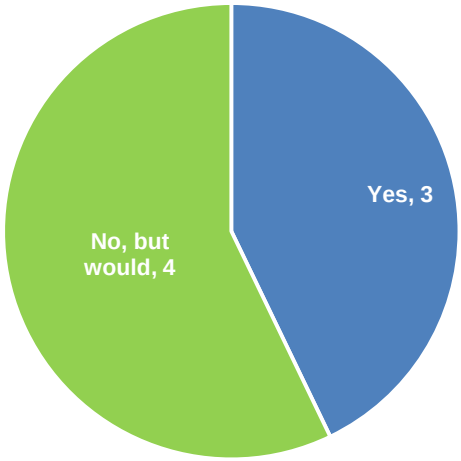
Source: Customer Survey; SAT11, SAT5A, SAT5B, SAT5C, SAT5D, SATD5E, SAT5F

Respondents reported several reasons for rating the program highly, including easy processing (1 respondent), energy savings (1 respondent), and the value of improving their equipment (1 respondent). The most mentioned reason for high ratings was satisfaction with the program's financial incentives (3 respondents).

Five of the seven respondents indicated they would not change anything when asked what they would change about the Smart $aver Custom Incentive program. One of the respondents said they would have the program cover more types of lighting equipment. Another respondent, while not necessarily something to change, said the online portal has already helped out tremendously.

As another gauge of satisfaction, customers were asked if they had recommended the program to others. As shown in Figure 6-8, three participants reported that they had already recommended the program. The remaining four respondents said they would recommend the program if provided the opportunity.

Figure 6-8: Have You Recommended the Program to Others?

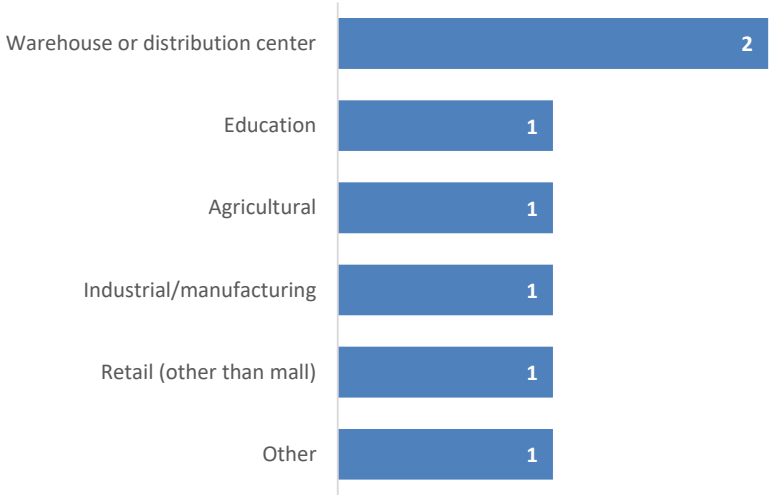


Source: Participant Survey; SAT8, SAT9

6.2.4.5 Participating Customer Characteristics

Facility types varied across the seven participant respondents' locations. Two were warehouses or distribution centers, while other responses included agricultural, industrial, and educational facilities (Figure 6-9).

Figure 6-9: Smart $aver Custom Incentive Program Participant Characteristics



Source: Participant Survey; C1

When participants were asked how their companies make budget decisions and whether they were decided locally, regionally, nationally, worldwide or something else, most respondents reported that decisions are made locally (3 of 7 respondents). Two respondents indicated their budget decisions are made nationally and one respondent each said worldwide and regionally.

When creating budget and financial plans, all respondents reported planning one year (five of five respondents) into the future.

6.2.4.6 COVID Impacts

Similar to the contractor survey, the participant survey occurred during the COVID-19 pandemic. The evaluation team included a few questions in the study to understand the pandemic's impact on any upgrades to customers' energy-using equipment. Two of seven respondents said their organization had plans to upgrade equipment before the pandemic. One respondent said they delayed their planned project while the other cancelled their project.

Respondents were asked to think about the project done during the evaluation period and asked if they had to decide to do the project today, what decision they would make. The majority (5 of 7) indicated they would have made no changes to the project. One respondent said they would have cancelled the project, while the other indicated they would change the product that they installed.

7 Conclusions and Recommendations

7.1 Impact Evaluation

Conclusion 1: The evaluation team saw strong evidence the Duke Program team conducts detailed reviews of the project applications, has quality control checks and revises measure parameters to refine savings estimates. Engineering reviews by AESC[1] provides an additional level of quality control that helps to minimize most calculation errors or instances of over-claimed energy or demand savings. The strata-level realization rates indicate that an appropriate level of rigor is being applied to lighting projects and most non-lighting projects.

Recommendation 1: Continue the level of rigor being applied to projects as it goes through the NR Custom application process while considering the following recommendations to improve the program in specific areas.

Conclusion 2: Of the parameters needed to calculate lighting project savings, verified lighting operating schedules, or annual hours of use, were occasionally found to be slightly different than what was used to calculate reported savings. The main type of difference found was in the number of holidays accounted for in the verified savings and the operating hours during these holidays.

Recommendation 2: Improve the level of detail collected in the application on the hours of operation. Holidays and seasonal changes should also be captured in the annual hours of use.

Conclusion 3: Project reviews, both during the application process and the evaluation, benefit from documentation of all underlying assumptions, trend data, utility billing records and worksheets used for the calculations of savings. Photos serve as a valuable verification of the installed equipment and provide essential information regarding the condition and operating parameters of the old and new equipment. This applies to primarily small and larger non-lighting projects where trend data and manufacturer's specification sheets would allow more detailed analyses of the proposed measures. Analysis of trend data helps confirm that consumption estimates from models are realistic and appropriate. Lighting projects are very well documented but pictures of baseline equipment prior to it being removed would be useful to refine savings calculations.

Recommendation 3a: Collect and document enough information and photos of the project so the calculations of savings could be independently repeated.

Recommendation 3b: The estimates produced by the Duke HVAC/EMS calculator should be reviewed and compared against project trend data and historical utility consumption to ensure savings estimates are reasonable.

Conclusion 4: The Duke NCEEDA protocol defines how savings from new, high performance buildings shall be modeled and estimated. Assumptions on how the building is expected to be occupied and used are also required but do not always match how the new buildings are

[1] The Company contracts with Alternative Energy Systems Consulting (AESC) to perform technical review of applications.

actually used or occupied. This can lead to the modeled consumption and savings not matching the actual consumption and savings.

Recommendation 4: The NCEEDA should incorporate a tiered post construction calibration requirement that uses the ASHRAE 14 tolerances to assess the level of uncertainty in the new construction models and make adjustments to the model in order to minimize the uncertainty.

Conclusion 5: Free-ridership is low (6.8%) and nonparticipant spillover exists in Kentucky (11.7%), leading to a NTG of 104.9%. There is evidence that the low free-ridership and existence of nonparticipant spillover could be a result of customer uncertainty regarding annual program funding levels and incentive availability. It is also impacted by Duke Energy LAM and TA Outreach Reps that work with customers and contractors, and contractor use of the incentives in their pricing estimates.

Recommendation 5: Continue to engage early with customers to motivate them to choose eligible projects and submit applications. Support contractors in their efforts to recommend energy efficient equipment and include the program incentives in their pricing.

7.2 Process Evaluation

Conclusion 6: The program continues to operate as intended. Duke Energy staff work closely with contractors and customers, who both report high overall satisfaction with the program and many program aspects. The most common source of program awareness from customers was other businesses and colleagues, followed closely by Duke Energy staff and contractors. Contractor technical assistance also saw high satisfaction, underscoring the critical role they play.

Recommendation 6: Continue to engage contractors in the program and keep them informed of the program availability to increase awareness among customers and encourage the installation of program-qualifying equipment. Including builders and architects who may be utilizing the new construction design assistance will also benefit the program.

Conclusion 7: Customers who use third-party vendors to assist them with projects present a unique challenge. Some third-party vendors are highly involved in the projects and their contact information is included as the program participant. However, when it comes time to conduct verification or evaluation activities, talking with someone directly at the organization is essential.

Recommendation 7: Ensure organization-specific contact information is collected as part of the application process and include name, phone, and email. This should include a local contact as well as a contact who was part of the decision-making process.

Conclusion 8: Contractors continue to be one of the primary sources of program awareness and also reported using the program incentives as part of their pricing estimates. Contractors are satisfied with the program and appreciate the ability to use the incentives as a sales tool. The main improvement recommended by contractors was to improve the application process and to increase the program offerings and transparency of the program. These contractors requested the program be offered in Ohio but also increase the transparency of the funds available and status of funds in Kentucky.

Recommendation 8: Identify a way to allow contractors and customers to see how much of the program funds remain available. This would alleviate situations where customers and contractors expected incentives, but they were no longer available.

Conclusion 9: The Duke team has an efficient and effective process in place for reviewing applications for preapproval in an effort to focus on projects that are eligible but not already committed. They offer both application and calculation assistance that provides third party assistance to customers and trade allies if needed for a fee. As part of the application, questions are included to identify projects where the customer has already identified or purchased program-qualifying equipment. The questions on the application are a great tool to use in talking with customers about their projects and plans in order to increase the scope and efficiency of projects. As applications are flagged, the program team can encourage customers to revise scope to implement more than what they would do otherwise.

Recommendation 9a: Continue to screen out projects with question E of the application to identify customers who have already selected, purchased, or committed to doing a project or building.

Recommendation 9b: Update question G on the application to 1) require customers to answer the question and 2) revise the wording to allow more response options to be presented to the customer. By requiring customers to answer the question, the project team will have a better understanding of the type of equipment customers are selecting and if the program assistance is responsible for the project. The response to this question can provide insight into the potential free-ridership on the project. The evaluation team recommends updating the question text to the following:

> G. Without the program assistance and incentive, you would…
>
> - ❑ Purchase and install the same high efficiency equipment
> - ❑ Purchase less of the high efficiency equipment
> - ❑ Purchase the high efficiency equipment at a later date
> - ❑ Purchase standard / code minimum efficiency
> - ❑ Neither purchase nor install any part of the project

The project team can then use this question to flag applications and follow-up with customers to discuss items such as the following: a) Would they consider more efficient equipment or more fixtures? b) How did they select the efficiency of the equipment on the application? c) Does the company have policies that encourage or require purchasing higher efficiency equipment or reducing GHGs or to meet sustainability goals? Answers to these questions will allow Duke Energy staff to determine if the project is a good candidate for an incentive and help further manage free-ridership.

Appendix A Summary Form

Duke Energy Kentucky Smart $aver NR Custom Program

Completed EMV Fact Sheet

Description of Program

Duke Energy's Non-Residential Smart $aver® Custom Incentive Program (NR Custom) offers financial assistance to qualifying commercial, industrial and institutional customers in the Duke Energy Kentucky (DEK) service territory to enhance their ability to adopt and install cost-effective electrical energy efficiency projects. The Program targets energy saving projects involving more complicated or alternative technologies, or those measures not covered by the non-residential Smart $aver Prescriptive Program. The intent of the program is to encourage the implementation of energy efficiency projects that would not otherwise be completed without the company's technical or financial assistance. The program requires pre-approval prior to the project implementation.

Summary		Strata	Verified Net Savings (kWh)
Region(s)	*Kentucky*	*L-Small (<342 MWh)*	*2,528,819*
Evaluation Period	*January 1, 2018 – Dec 31, 2019*		
Annual kWh Net Savings	*15,910,014*	*L-Large (≥342 MWh)*	*5,533,224*
Coincident kW Net Impact - Summer	*1,870*		
Coincident kW Net Impact - Winter	*2,053*	*NL-Small (<1,091 MWh)*	*1,349,245*
Net-to-Gross Ratio	*104.88%*		
Process Evaluation	*Yes*	*NL-Large (≥1,091 MWh)*	*6,498,725*
Previous Evaluation(s)	*Yes*		

Evaluation Methodology

Impact Evaluation Activities

- *44 sample project analyses*

Impact Evaluation Findings

- *Energy Realization Rate: 102.18%*
- *Net-to-gross: 104.88%*

Process Evaluation Activities

- *Program Staff; 6 interviews with program staff*
- *Trade Allies; 4 in-depth interviews with high volume contractors, telephone surveys with representative sample of 10 trade allies*
- *Participants; 11 telephone surveys*

Process Evaluation Findings

- *Business colleagues, Duke Energy staff, and contractors all contributed to program awareness*
- *Satisfaction with program is high among participants and trade allies*
- *The incentive amount compared with the total project cost was the most valuable program component as rated by participants*
- *Program-provided calculators were used by half the participants*
- *Contractors value the program and use incentives to encourage customers to purchase high efficiency equipment*

Appendix B Survey Instruments

B.1 Participant Survey

Duke Energy Nonresidential Custom Program
Participant Survey

Sample Variables

CASEID

CONTACT_NAME Primary customer contact name

PROJECT_ID

COMPANY_NAME

ADDRESS The address of the site where the measure was installed

MEASURE Summary of project measure implemented
1 lighting
2 process equipment
3 compressed air
4 HVAC
5 food service equipment
6 whole building (NC)
7 IT equipment
8 other

MEASURE_TXT Sting version of measure

MeasureType Type of measure sampled

DESCRIPT## Detailed description of measure

MEASDESC

NC Flag for new construction project
1 New construction
0 Not new construction

NCEDA Flag for new construction energy design assistance track
1 New construction energy design assistance
0 Not new construction energy design assistance

YEAR The year the measure was completed and paid (2018 or 2019)

INCENTIVE The amount of the incentive paid for the measure

CONTRACTOR Flag that customer worked with external contractor
- 1 Worked with contractor
- 0 Implemented within company

FASTTRACK Flag that customer went through the Custom Fast Track application process
- 1 Fast track customer
- 0 Standard process customer

STRATUM
- NC North Carolina
- SC South Carolina
- IN Indiana
- KY Kentucky

Territory
- DEC Duke Energy Carolinas
- DEP Duke Energy Progress

TOTAL_KWH

MULTFLAG
MULTID
MULTQTY
PRIMARYCASE

VEND_COMPANY
VEND_CONTACT
VEND_PHONE
VEND_PHONE2
VEND_EMAIL

Introduction and Screening

INT01 Hello, my name is _____, and I am calling on behalf of Duke Energy. May I speak with <CONTACT_NAME>?

- 01 Yes
- 02 No

MULTCHK [ASK IF MULTFLAG=1] [INTERVIEWER: Is this the first case of a multiple?

- 01 Yes, first case
- 02 No, subsequent case [SKIP TO Q1]

PREAMBLE I'm calling from Tetra Tech, an independent research firm. We were hired by Duke Energy to talk with some of their customers about their participation in the Smart $aver Custom Incentive Program.

Our records indicate that you participated in Duke Energy's Smart $aver Custom Incentive Program that included a <MEASURE> project in <YEAR> at <ADDRESS>.

Are you able to answer questions about your company's participation in this program?

01	Yes, I'm able to answer	[SKIP TO SCREEN1]
02	Yes, but information isn't quite right [SPECIFY]	[SKIP TO SCREEN1]
03	No, I'm not able to answer	[SKIP TO OTHER_R]
04	We have not participated	[THANK AND TERMINATE 82]
99	Refusal	[THANK AND TERMINATE 91]

OTHER_R Is it possible that someone else in your organization would be more familiar with the program or the project that was completed?

01	Yes	
02	No	[THANK AND TERMINATE 81]
88	Don't know	[THANK AND TERMINATE 81]
99	Refusal	[THANK AND TERMINATE 91]

AVAILABLE_R May I please speak with that person?

01	Yes	[SKIP TO INT01]
02	No (When would be a good time to call back?)	
03	We have not participated	[THANK AND TERMINATE 82]
88	Don't know	[THANK AND TERMINATE 81]
99	Refusal	[THANK AND TERMINATE 91]

SCREEN1 Were you involved in the decision to complete the <MEASURE> project?

01	Yes	
02	No	SKIP TO OTHER_R

PREAMBLE2 Great, thank you. I'd like to assure you that I'm not selling anything, I would just like to ask your opinion about this program. Your responses will be kept confidential and your name will not be revealed to anyone. For quality and training purposes, this call will be recorded.

Program Awareness and Marketing

Q1 [IF MULTCHK=2 SKIP TO MEASCHK] How did you **first** hear about the Smart $aver Custom Incentive Program? (Select one)

01	Account representative	[AcctRep=1]
02	Business energy advisor (BEA)	[BEA=1]
03	Contractor / Vendor	[CONTRACTOR = 1]
04	Email from Duke Energy	
05	Mail from Duke Energy	
06	Colleague / Another business	
07	Conference / Trade Show / Expo	
08	Duke Energy website	
09	Duke Energy representative (other than an account rep/BEA)	
10	Previous program experience / participation	
11	Other [SPECIFY]	
88	Don't know	
99	Refused	

Q2 dropped mid-field because survey length was too long

Q2 [ASK IF Q1 = 1, 2 or 3] Did the <response from Q1> provide you with enough information about the program?

01	Yes	SKIP TO Q6
02	No	

Q3 dropped mid-field because survey length was too long

Q3 [ASK IF Q1 = 1, 2 or 3] What additional information would you have liked <response from Q1> to provide?

[RECORD VERBATIM]

Q6 What made you decide to apply to the Smart $aver program?

[RECORD VERBATIM]

Q4 [ASK IF Q1<>3] Did you work with a contractor or vendor to implement the <MEASURE> project or did you only work with internal staff at your company?

01	Worked with a contractor / vendor	[CONTRACTOR = 1]
02	Internal staff at company	[CONTRACTOR = 0]
03	Both the contractor and internal staff	[CONTRACTOR = 1]
88	Don’t know	[CONTRACTOR = 0]

Q4a Which of the following best describes how your organization selected the new high efficiency equipment for the <MEASURE> project? (Select one)

[READ LIST] [rotate options 1 through 4]

01 We did some research on <MEASURE> efficiency and made our own choice
02 [IF CONTRACTOR=1] Our contractor suggested one <MEASURE> efficiency level, and we agreed
03 [IF CONTRACTOR=1] Our contractor suggested various <MEASURE> efficiency levels, and we chose one
04 We worked with Duke staff who recommended the specific <MEASURE> efficiency
05 Something else [SPECIFY]
88 Don't know

BG3 Does your company have any formal requirements or informal guidelines for the purchase, replacement or maintenance of energy-using equipment?

01 Yes
02 No
88 Don't know
99 Refused

BG4 [IF BG3 = 1] Which of the following best describes these requirements or guidelines? [READ LIST; SELECT ONE] [rotate responses 1-3]

01 Purchase energy efficient equipment regardless of cost
02 Purchase energy efficient equipment if it meets payback or return on investment criteria
03 Purchase standard efficiency equipment that meets code
04 Or something else [SPECIFY]
88 Don't know
99 Refused

Q5 Prior to your <MEASURE> project in <YEAR>, had you participated in the Smart $aver program before?

01 Yes
02 No
88 Don't know

BG4a [IF BG3=1 AND Q5=1] Did your experiences with Duke Energy programs or discussions with Duke Energy staff cause you to change your purchasing policies or guidelines for energy efficient equipment?

01 Yes [SPECIFY]
02 No
88 Don't know
99 Refused

Q12 Now I would like to ask a few questions about your energy savings calculations and the program application process. Did you use the calculators provided by Duke Energy, or did you calculate energy savings using your own methods? (Select all that apply)

01 Duke's calculators
02 Own methods
03 Other [SPECIFY]
04 Contractor / Vendor calculated
88 Don't know

Q12a [ASK IF Q12 = 4] How did the contractor/vendor calculate the energy savings? (Select all that apply)

01 Calculators provided by Duke Energy
02 Own methods
03 Other [SPECIFY]
88 Don't know

Q8 Using a scale of 0 to 10, where 0 is "very dissatisfied" and 10 is "very satisfied", how satisfied are you with the process to fill out and submit your application?

__ [RECORD RESPONSE]
77 Does not apply
88 Don't know
99 Refused

Q9 Using the same scale of 0 to 10, where 0 is "very dissatisfied" and 10 is "very satisfied", how satisfied are you with the time it took your staff to submit the application and necessary paperwork?

__ [RECORD RESPONSE]
77 Does not apply
88 Don't know
99 Refused

Q10 Using the same scale [OPTIONAL: "of 0 to 10, where 0 is "very dissatisfied" and 10 is "very satisfied"], how satisfied are you with Duke Energy's processing and preapproval of your application?

__ [RECORD RESPONSE]
88 Don't know
99 Refused

Q11 dropped mid-field because survey length was too long

Q11 [ASK IF Q8=0,1,2,3 OR Q9=0,1,2,3 OR Q10=0,1,2,3] What could the program have done differently to make the application process easier?

[RECORD VERBATIM]

Q13 dropped mid-field because survey length was too long

Q13 After submitting your initial application for preapproval, did you receive any requests for additional information while Duke Energy was processing your application?

01 Yes
02 No
88 Don't know

Q13a dropped mid-field because survey length was too long

Q13a [ASK IF Q13=1] What additional information was requested? Was it…(READ LIST)

[SELECT ALL THAT APPLY]

01 Information about your building
02 Details about the equipment installed
03 Information about prior equipment replaced
04 Your business schedule
05 Anything else requested [SPECIFY]
88 Don't know

Q25 Are you aware Duke Energy has an online application portal?

01 Yes
02 No
88 Don't know

Q17 [SKIP IF NCEDA = 1 OR NC = 0] Did you receive energy design assistance from Duke Energy for your new construction project?

01 Yes
02 No
88 Don't know

Q19 [ASK Q17=1 OR IF NCEDA = 1] Using a scale of 0 to 10, where 0 is "very dissatisfied" and 10 is "very satisfied", how satisfied are you with the energy design assistance you received through the Smart $aver program as part of your new construction project?

__ [RECORD RESPONSE]
88 Don't know
99 Refused

Q20 [ASK IF NC=1] What was most helpful about the energy design assistance you received?

[RECORD VERBATIM]

Q21 [ASK IF NC=1] Do you have any suggestions for improving the energy design assistance?

[RECORD VERBATIM]

Equipment Questions

[IF NC=1 SKIP TO NEXT SECTION]

E1 Was the high efficiency <MEASURE> installed as part of a new construction or major renovation project? (SELECT ONE)

01	Yes	[SKIP TO NEXT SECTION]
02	No	
88	Don't know	
99	Refused	

E2 Did the high efficiency <MEASURE> you installed replace any existing <MEASURE> or was it a new type of equipment that you did not have before? (select one)

01	Replaced existing equipment	
02	New equipment	[SKIP TO NEXT SECTION]
88	Don't know	[SKIP TO NEXT SECTION]
99	Refused	[SKIP TO NEXT SECTION]

E3 About how many years old was your existing <MEASURE> equipment?

___	Years
888	Don't know

E4 What condition was your existing <MEASURE> unit when you decided to purchase a new one? (Read list)

01 Operating with no performance issues
02 Operating but in need of repair
03 No longer operating (broken, did not work)
88 Don't know
99 Refused

E5 [IF E4=1 or 2] Why did you decide to replace your old equipment?

[RECORD VERBATIM RESPONSE]

Background

BG1 Did you work with anyone from Duke Energy or the Smart $aver program prior to submitting your application for preapproval?

01 Yes
02 No
88 Don't know

BG1a [ASK IF BG1=1] How did the Duke Energy program staff assist you with the project? Did they… [READ LIST] [SELECT ALL THAT APPLY]

01 Connect you with a trade ally
02 Identify potential projects to pursue
03 Identify specific equipment efficiency to install
04 Estimate project financial impacts, including incentives, energy bill savings, or payback
05 Respond to questions about participating in the program, including equipment eligibility or the application process
06 Assist you with anything else [SPECIFY]
88 [DO NOT READ] Don't know
99 [DO NOT READ] Refused

BG2 [ASK IF Q1=01,02] Using a scale of 0 to 10, where 0 is "very dissatisfied" and 10 is "very satisfied", how satisfied are you with your <IF Q1=01 SHOW "Account Representative"> <IF Q1=02 SHOW: "Business Energy Advisor">'s involvement in the <MEASURE> project?

__ [RECORD RESPONSE]
88 Don't know
99 Refused

BG2a [ASK IF BG2=0,1,2,3,4] What could the <IF Q1=01 SHOW "Account Representative"> <IF Q1=02 SHOW: "Business Energy Advisor"> have done differently?

[RECORD VERBATIM]

Net-to-Gross

MeasCHK [ASK IF MULTCHK = 2 ELSE SKIP TO FR0]
[INTERVIEWER QUESTION: Is this case's MEASURE variable the same as a previous case's MEASURE variable?]

1 Yes; Duplicate measure
2 No, New measure [SKIP TO Q4_MULT]

DecisionCHK [ASK IF MeasCHK=1]
Now, thinking about the <MEASURE> project at <ADDRESS>, was the decision making process **the same or different** from the previous <MEASURE> project we discussed?

1 Same decision making process [SKIP TO INT99]
2 Different decision making process

Q4_MULT [ASK IF MULTCHK=02] Did you work with a contractor or vendor to implement the <MEASURE> project or did you work with internal staff at your company?

01	Worked with a contractor / vendor	[CONTRACTOR = 1]
02	Internal staff at company	[CONTRACTOR = 0]
03	Both the contractor and internal staff	[CONTRACTOR = 1]
88	Don't know	[CONTRACTOR = 0]

FR0 According to our records, you received an incentive of $<INCENTIVE> from Duke Energy to complete your <MEASURE> project.

[IF NCEDA=1 OR Q1=1,2 OR BG1A=1,2,3,4,5,6 OR FASTTRACK=1 OR Q12=1 SHOW "As part of that project…"]
[IF NCEDA=1: you received energy design assistance]
[IF Q1=02: you worked with a Business Energy Advisor]
[IF Q1=01: you worked with an Account Executive]
[IF BG1A=01: program staff connected you with a trade ally]
[IF BG1A=02: program staff helped you identify potential projects to pursue]
[IF BG1A=03: program staff helped you identify specific equipment efficiency to install]
[IF BG1A=04: program staff helped you estimate project financial impacts, including incentives, energy bill savings, or payback]
[IF BG1A=05: program staff responded to questions about participating in the program, including equipment eligibility or the application process]
[IF BG1A=06: program staff helped you by… (other specify:) <BG1Ao response>]
[IF FastTrack=1: your application was reviewed under the fast track option]
[IF Q12=1 or Q12a = 1: you or your contractor used savings calculators provided by Duke Energy]

01 Continue

FN1 [IF Q5=02 OR 88] Did you learn about this assistance from Duke Energy for this project BEFORE or AFTER you selected the specific type of <MEASURE> equipment for which you received the incentive?

01 Before
02 After
88 Don't know
99 Refused

FN2 [IF FN1=02] Just to confirm, you found out about the assistance available through Duke Energy's Smart $aver program after you had already decided to implement the energy efficiency <MEASURE> project?

01 Yes, after
02 No, before
03 Other [SPECIFY]
88 Don't know
99 Refused

[IF NC=1, SKIP TO FR1NC]

FR1 Which of the following is most likely what you would have done for your <MEASURE> project if you had not received this assistance from Duke Energy? (Read list)

01 Canceled or postponed the project at least one year
02 Reduced the size, scope, or efficiency of the project
03 Done exactly the same project
04 Done nothing
88 [DO NOT READ] Don't know
99 [DO NOT READ] Refused

FR2 [ASK IF FR1=2] By how much would you have reduced the size, scope, or efficiency of the project? Would you say a small amount, a moderate amount, or a large amount?

01 Small amount
02 Moderate amount
03 Large amount
88 Don't know

[IF NC=0, SKIP TO FR3]

FR1NC Which of the following is most likely what you would have installed if you had not received this assistance from Duke Energy? (Read list)

01 Installed all standard efficiency or code equipment
02 Installed some energy-efficient equipment, but not as much as you did through the program
03 Installed the same efficient equipment as you did with the program's assistance
88 [DO NOT READ] Don't know

FR2NC [IF FR1NC=2] Without the Duke Energy design assistance and incentive, would the energy-using equipment in your building have been closer to standard efficiency or code, closer to what you ended up installing, or somewhere in between?

01 Closer to standard efficiency or code
02 Closer to what you ended up installing
03 Somewhere in between
88 [DO NOT READ] Don't know

FR3 [ASK IF FR1=3 OR FR1NC=3] Would your business have paid the additional $<INCENTIVE> to complete the project on your own?

01 Yes
02 No
88 Don't know

CC2 [IF FR3=1] Where would the additional $<INCENTIVE> have come from if you had not received the incentive from Duke Energy? Would the funds have come from another project, capital budget, another source or were the funds already allocated? [DO NOT READ]

01 Had the money allocated from the start
02 Transferred money from another project
03 Other [SPECIFY – what source]
04 Would have come out of our operating capital budget
88 Don't know
99 Refused

CC3 [IF FR1=2, 3, 88, 99] In your own words, how would your project have been different without the program's assistance?

[RECORD VERBATIM]

FR4 On a scale of 0 to 10, with 0 being "not at all influential" and 10 being "extremely influential", how would you rate the influence of the following factors on your decision to complete the <MEASURE> project? [RANDOMIZE ORDER]

FR4a The incentive provided by Duke Energy
FR4b [IF Q1=02] The support provided by your Duke Energy business energy advisor
FR4c Smart $aver marketing materials or webinars
FR4d [IF Q5<>2] Previous experience with the Smart $aver program
FR4e [IF CONTRACTOR=1] The recommendation from your contractor or vendor
FR4f [IF NC=0] The technical support provided by Duke Energy engineer staff
FR4g [IF Q1=01] The support provided by your Duke Energy account manager
FR4h [IF NC = 1] The energy design assistance provided for your new construction project
FR4i [IF NC = 1] The bundle options provided for your new construction project
FR4j [IF NC=0 and (Q12 = 1 or Q12a = 1)] The calculators provided by Duke Energy

__ Record influence [0-10]
77 Not applicable
88 Don't know
99 Refused

FR4O1 Were there any other interactions you had with Duke Energy or Smart $aver program representatives that influenced your decision to complete the energy efficient <MEASURE> project?

01 Yes [SPECIFY]
02 No
88 Don't know
99 Refused

FR4O2 [ASK IF FR4O1=01] On a scale of 0 to 10, with 0 being "not at all influential" and 10 being "extremely influential", how would you rate the influence of that interaction (if needed: <FR4O1 aspect>) on your decision to complete the <MEASURE> project?

__ Record influence [0-10]
88 Don't know
99 Refused

CC4 [If FR3 = 1 and any in FR4 > 7 SHOW: "Earlier in the interview you said you would have done the exact same project. But you also said the <FR4 category> was influential in your decision to complete the <MEASURE> project.]

[If FR1 = 1, 4 and not any of FR4a through j = 3,4,5,6,7,8,9,10 SHOW: Earlier in the interview you said you would have cancelled or postponed the project. But you also said none of your contact with the program was influential in your decision to complete the <MEASURE> project.]

In your own words, please describe what impact, if any, all the assistance you received from Duke Energy had on your decision to install the amount of energy-efficient <MEASURE> equipment at the time you did?

[RECORD VERBATIM RESPONSE]

Spillover

[IF MULTCHK=02 SKIP TO V1]

SP1 Since your participation in the Smart $aver program, did you complete any additional energy efficiency projects at this facility or another facility served by Duke Energy that did not receive incentives through a Duke Energy program?

01	Yes	
02	No	SKIP TO NEXT SECTION
88	Don't know	SKIP TO NEXT SECTION
99	Refused	SKIP TO NEXT SECTION

SP2 What energy efficient products, equipment, or improvements did you install or implement? (Select all that apply)

01 Lighting
02 Heating / Cooling
03 Hot Water
04 Appliances / Office
05 Insulation
06 Motor / Variable Frequency drives (VFDs)
07 Compressed Air
08 Refrigeration
09 Other1 [SPECIFY]
10 Other2 [SPECIFY]
88 Don't know SKIP TO NEXT SECTION

[START ROSTER; ASK SP3-SP4 FOR EACH MENTIONED IN SP2]

SP3 Can you describe the <SP2> equipment? For example: What was the brand or model? Efficiency rating? Dimensions? or Capacity?

[RECORD VERBATIM]

SP4 How many <SP2> units did you install?

____ [RECORD NUMBER OF UNITS (0-800]
888 Don't know
999 Refused

[END ROSTER]

SP5 On a scale of 0 to 10, with 0 meaning "not at all influential" and 10 meaning "extremely influential", how influential was your participation in the Smart $aver program on your decision to complete the additional energy efficiency project(s)?

__ [RECORD RESPONSE]

Fast Track Feedback

Section dropped mid-field because survey length was too long

FT10 [ASK IF FastTrack=0] Duke Energy offers a fast track option where customers can pay a fee to accelerate the review of a project from 4 to 6 weeks to about one week. Before today, were you aware that this is now offered?

01 Yes
02 No
88 Don't know

FT13 [IF FastTrack = 0] If you have a project under a tight timeline, would you be willing to pay the $550 fee for an accelerated review of your Smart $aver application?

01 Yes
02 No (specify: Why not?)
88 Don't know

FT15 Using a scale of 0 to 10, where 0 is "not at all valuable" and 10 is "very valuable", how valuable <if FastTrack = 1 show "was", else "is"> the fast track application option?

__ [RECORD RESPONSE]
88 Don't know
99 Refused

Customer Satisfaction

SAT11 Considering all aspects of the program, using a scale of 0 to 10, where 0 is "very dissatisfied" and 10 is "very satisfied", how would you rate your overall satisfaction with the Smart $aver Custom Incentive program?

__ Record value [0-10]
77 Not applicable
88 Don't know
99 Refused

SAT12 Why do you say that?

[RECORD VERBATIM]

SAT13 dropped mid-field because survey length was too long
SAT13 Using a scale of 0 to 10, where 0 is "very dissatisfied" and 10 is "very satisfied", how would you rate your overall satisfaction with Duke Energy?

__ Record value [0-10]
77 Not applicable
88 Don't know
99 Refused

SAT14 dropped mid-field because survey length was too long
SAT14 [ASK IF SAT13=0,1,2,3] Why do you say that?

[RECORD VERBATIM]

SAT5 Using a scale of 0 to 10, where 0 is “not at all valuable” and 10 is “very valuable”, how valuable are the following Smart $aver program components to your organization? [RANDOMIZE LIST]

FOR SAT5A through SAT5F

__ Record value [0-10]
77 Not applicable
88 Don’t know
99 Refused

SAT5a Materials describing the program requirements and benefits
SAT5b Communication from Smart $aver program representatives
SAT5c Technical assistance from Duke Energy or Smart $aver program representatives
SAT5d [IF CONTRACTOR=1] Technical assistance from your contractor or vendor
SAT5e The incentive amount compared to your total project cost
SAT5f The worksheet or calculation tools that Duke Energy provides

SAT1 What would you change about the Smart $aver Custom Incentive Program, if anything? (DO NOT READ, Select all that apply)

01 Would not change anything
02 Remove pre-approval requirement
03 Improve initial processing time
04 Increase rebate amount
05 Cover more types of equipment (specify: which types?)
06 Simplify application process (specify: what would you simplify?)
07 Other [SPECIFY]
88 Don’t know

SAT2 [ASK IF SAT1=3] What would you consider to be a reasonable amount of time for processing the initial application?

01 [RECORD VERBATIM]

SAT3 [ASK IF SAT1=4] What percent of the project’s cost do you think would be reasonable for the Smart $aver program to pay?

___ [RECORD PERCENT(0-100)]
888 Don’t know
999 Refused

SAT8 Have you recommended the Smart $aver Custom Incentive Program to anyone?

01	Yes	SKIP TO SAT10
02	No	
88	Don't know	

SAT9 If provided the opportunity, would you recommend the Smart $aver Custom Incentive Program to anyone?

01	Yes
02	No
88	Don't know

SAT10 dropped mid-field because survey length was too long

SAT10 Would you consider participating in the Smart $aver Custom Incentive Program again in the future?

01	Yes	
02	No	(specify: Why not?)
88	Don't know	(specify: Please explain)

COVID

CV1 dropped mid-field because survey length was too long

CV1 Overall, how has your organization been affected in 2020 by the COVID-19 pandemic? Has it been a…[READ LIST]

01	Large negative effect
02	Moderate negative effect
03	Little or no effect
04	Moderate positive effect
05	Large positive effect
77	Organization is closed or closing
88	[DO NOT READ] Don't know
99	[DO NOT READ] Refused
55	[DO NOT READ] Skip to next section

CV2 dropped mid-field because survey length was too long

CV2 Please describe how your business operations changed in 2020 as a result of the pandemic.

01	[RECORD VERBATIM]
77	No change

CV3 dropped mid-field because survey length was too long

CV3 [if CV2 <> 77] In your opinion, when do you think your business will return to its usual level of operations? [READ IF NEEDED]

01 By the end of December 2020
02 By the end of March 2021
03 By the end of June 2021
04 By the end of September 2021
05 Longer than September 2021
06 I do not believe this business will return to its previous usual level of operations
07 There has been little or no effect on this business's usual level of operations
88 Don't know
99 Refused

CV4 dropped mid-field because survey length was too long

CV4 What impact has COVID-19 had on your purchasing decisions?

01 [RECORD VERBATIM]
77 No impact

In this next section, we ask a few question about how the pandemic has impacted your project planning.

CV6 Prior to the COVID-19 pandemic, did your organization have any plans to upgrade or replace any energy using equipment in 2020?

01 Yes
02 No
88 Don't know
99 Refused

CV7 [IF CV6=1] How did your plans change?

01 No changes to planned projects
02 Delayed planned projects
03 Cancelled planned projects
04 Changed the project scope or specifications [SPECIFY]
05 Other [SPECIFY]
88 Don't know
99 Refused

CV8 Thinking about the <MEASURE> project you did in <YEAR>, if you would have to make a decision today about doing that project, what decision would you make?

01 No changes to planned projects
02 Delayed planned projects
03 Cancelled planned projects
04 Changed the project scope or specifications [SPECIFY]
05 Other [SPECIFY]
88 Don't know
99 Refused

Customer Characteristics

C1 What is the main business activity at <ADDRESS> in <CITY>?

01 Office/Professional
02 Warehouse or distribution center
03 Food sales
04 Food service
05 Retail (other than mall)
06 Mercantile (enclosed or strip malls)
07 Education
08 Religious worship
09 Public assembly
10 Health care
11 Lodging
12 Public order and safety
13 Industrial/manufacturing [SPECIFY]
14 Agricultural [SPECIFY]
15 Vacant (majority of floor space is unused)
16 Other [SPECIFY]
88 Don't know

C2 Are your company's budget decisions made locally, regionally, nationally, worldwide, or something else?

01 Locally
02 Regionally
03 Nationally
04 Worldwide
05 Other [SPECIFY]
88 Don't know

C3 When creating budgets and financial plans, how far into the future does your company plan?

00 Less than 1 year
01 One year
02 Two years
03 Three years
04 Four years
05 Five years
06 More than 5 years
07 Other [SPECIFY]
88 Don't know

C4 Does your business' production schedule or business cycle affect when you can implement energy efficiency projects?

[PROBE: "A business cycle refers to time periods when your business' activities might be significantly different. For example, a school might have to wait until summer to implement projects, while a manufacturing facility might wait until production is lower."]

01 Yes (Please describe that schedule or cycle)
02 No
03 Don't know

V1 [ASK IF FR4E = 7, 8, 9, or 10 ELSE SKIP TO C7] Earlier, you indicated that the recommendation from a contractor, vendor, or supplier influenced your decision to implement the <MEASURE> project.

Could you give me the contact information of the vendor you worked through?

[IF "Don't know": Our records show that you worked with:
Vendor Company: <VEND_COMPANY>
Vendor Contact: <VEND_CONTACT>]]

01 Yes
02 No [SKIP TO C7]

V1_ <Programming note: show Contractor, Contractor_Name, and Contractor_phone from the sample as a reference.>

[RECORD VERBATIM]

V1_COMPANY Vendor business name
V1_CITY Vendor city
V1_CONTACT Vendor contact name
V1_PHONE Vendor contact phone number
V1_EMAIL Vendor email

V2 Which of the following assistance did your contractor or vendor provide? (Select all that apply)

Did the contractor assist with…

01 The design phase of the project
02 The selection of equipment to install
03 The completion of the rebate application
04 Any other part of the project (specify)
88 Don't know
99 Refused

[SKIP TO INT99 IF MULTCHK=2]
C7 Would you like someone from Duke Energy to contact you directly to provide more information or answer any questions you might have about their energy efficiency programs?

[PROBE: We will not share your responses to this survey, only pass along your contact information.]

01 Yes
02 No [SKIP TO C9]

C8_phone To confirm, what's the best number to reach you at?

[RECORD VERBATIM]

C8_name And who should they get in touch with? [Can you spell your name?]

[RECORD VERBATIM]

C9 Do you have any comments you would like to share with Duke Energy?

01 Yes [SPECIFY]
02 No

INT99 [SKIP IF MULTCHK=02] [IF MULTFLAG=1 SHOW: "[INTERVIEWER, If R has more surveys to complete read: Now I'd like to ask you a smaller selection of questions about another location we have on record for your firm." OTHERWISE READ:

That completes the survey, thank you very much for your time.

CP Completed survey

INT98 [ASK IF MULTCHK=02] [INTERVIEWER, If R has more surveys to complete read: Now I'd like to ask you a smaller selection of questions about another location we have on record for your firm." OTHERWISE READ:

That completes the survey, thank you very much for your time.

CM Completed survey

B.2 Trade Ally Survey

Duke Energy Midwest Smart $aver Custom Incentive Program
Participating Trade Ally Survey

Sample Variables

CASEID Contractor case identification number

VEND_COMPANY Contractor company name
VEND_CONTACT Contractor contact name
VEND_CITY Contractor city

PHONE_NUM Contractor contact phone number
ALTPHONE_NUM

VEND_EMAIL
Alt_email

VEND_KWH
VEND_PROG
NUMB_PROJECT

IV Flag if the contractor is an influential vendor
- 0 Not an influential vendor
- 1 Influential vendor

MEASURE Summary of project measure implemented
- 1 lighting
- 2 process equipment
- 3 compressed air
- 4 HVAC
- 5 food service equipment
- 6 new construction

MEASURETYPE Detailed description of sampled project, including specific measures installed

DESCRIPT01 to 04

MEASDesc Summary description of sampled measure category

CUST_CASEID
CUST_COMPANY
CUST_CONTACT

CUST_PHONE
CUST_EMAIL
CUST_ADDRESS
CUST_CITY
CUST_STATE
CUST_ZIP
YEAR

INSTALLDATE

NC Sampled project is a new construction project
1 New construction
2 Not new construction

Custom_flag
0 Specific equipment
1 Custom project

PART_Q17

Introduction

INT01 Hello, my name is _____, calling on behalf of Duke Energy. We are talking with design professionals and contractors participating in Duke Energy's Smart $aver energy efficiency programs for businesses. I'm not selling anything; I'd just like to ask you about your firm's recent experiences with this program.

[IF CONTACT NAME AVAILABLE] May I speak with <**VEND_CONTACT**>?

[IF CONTACT NAME NOT AVAILABLE] May I speak with the person who would be most knowledgeable about your firm's involvement with Duke Energy's programs?

01 Yes
02 No, R not knowledgeable [OTHER_R]

FAQ (**Why are you conducting this study**: Studies like this will help Duke Energy to continuously improve their business energy efficiency programs).

(**Timing:** This survey should take about 20 minutes. IF NOT A GOOD TIME, SET UP CALL BACK APPOINTMENT OR OFFER TO LET THEM CALL US BACK AT 1-800-454-5070.)

(**Sales concern**: This is not a sales call; we would simply like to learn about your organization's experiences with Duke Energy's energy efficiency programs. Your responses will be kept confidential.)

MULTCHK [ASK IF MULTFLAG=1] [INTERVIEWER QUESTION: Is this the first case of a multiple?

01 Yes, first case
02 No, subsequent case [SKIP TO C_IV_SKIP]

PREAMBLE I'm with Tetra Tech, an independent research firm. We have been hired by Duke Energy to evaluate their programs. I would like to assure you that your responses will be kept confidential and your name will not be revealed to anyone. For quality and training purposes, this call will be recorded.

01 Continue

Influential Vendor Screener

C_IV_SKIP [IF IV = 0 SKIP TO NEXT SECTION, C_MULT_SKIP1]

INF1 [ASK IF NC=0] Our records show that your firm specified, sold, or installed a <**MEASURE**> project for <**CUST_COMPANY**> at <**CUST_ADDRESS**> in **<CUST_CITY>** around <**INSTALLDATE**> that qualified for a Duke Energy incentive. This project would have included <**MEASDESC**>. Do you recall this project? (Select one)

01 Yes, does recall [SKIP TO INF4]
02 No, does not recall
88 Don't know
99 Refused

INF1NC [ASK IF NC=1] Our records show that your firm was involved with designing or specifying a new construction project for <**CUST_COMPANY**> at <**CUST_ADDRESS**> in **<CUST_CITY>** around <**INSTALLDATE**> that qualified for a Duke Energy incentive. This project would have included <**MEASURE_TYPE**>. Do you recall this project? (Select one)

01 Yes, does recall [SKIP TO INF4]
02 No, does not recall
88 Don't know
99 Refused

OTHER_R1 Is there someone else at your firm who would be more familiar with this project? (Select one)

01	Yes	[RECORD CONTACT INFO FOR CALL NOTES]
02	No	[SKIP TO C1]
88	Don't know	[SKIP TO C1]
99	Refused	[THANK AND TERMINATE 91]

AVAILABLE_R1 May I please speak with that person? (Select one)

01	Yes, currently available	[SKIP TO INT01]
02	Yes, but R is not currently available	[INT15 – CALLBACK]
03	No	[SKIP TO C1]
88	Don’t know	[INT15 – CALLBACK]
99	Refused	[THANK AND TERMINATE 91]

INF4 <**CUST_COMPANY**> indicated that you were influential in their decision to implement the <**MEASURE**> project through the program. Just to confirm, were you involved in the decision-making process at the design stage when the <**MEASURE**> project was specified and agreed upon for this facility? (Select one)

01	Yes	[SKIP TO C_MULT_SKIP2]
02	No	[SKIP TO OTHER_R1]
88	Don't know	[SKIP TO OTHER_R1]

Non-Influential Vendor Screener

C_MULT_SKIP1 [IF MULTCHK=2 SKIP SECTION, C_MULT_SKIP2]

C1 [ASK IF NC=0] Our records show that your firm specified, sold, or installed <**MEASURE**> equipment that qualified for incentives through Duke Energy’s Smart $aver Custom program.

Is that correct? (Select one)

01	Yes	
02	No	[THANK AND TERMINATE 82]
88	Don’t know	[THANK AND TERMINATE 81]
99	Refused	[THANK AND TERMINATE 91]

C1NC [ASK IF NC=1] Our records show that your firm was involved in designing or specifying new construction projects that qualified for incentives through Duke Energy's Smart $aver Custom program.

Is that correct? (Select one)

01	Yes	
02	No	[THANK AND TERMINATE 82]
88	Don't know	[THANK AND TERMINATE 81]
99	Refused	[THANK AND TERMINATE 91]

C2 Are you the person who would be most knowledgeable about your firm's <**MEASURE**> projects completed through Duke Energy's Smart $aver Custom program? (Select one)

01	Yes	[SKIP TO NEXT SECTION]
02	No	
88	Don't know	

OTHER_R2 Is there someone else at your firm who would be more familiar with your firm's involvement in <**MEASURE**> projects completed through Duke Energy's Smart $aver Custom program? (Select one)

01	Yes	[RECORD CONTACT INFO FOR CALL NOTES]
02	No	[THANK AND TERMINATE 81]
88	Don't know	[THANK AND TERMINATE 81]
99	Refused	[THANK AND TERMINATE 91]

AVAILABLER2 May I please speak with that person? (Select one)

01	Yes, currently available	[SKIP TO INT01]
02	Yes, but R is not currently available	[INT15 – CALLBACK]
03	No	[THANK AND TERMINATE 91]
88	Don't know	[THANK AND TERMINATE 81]
99	Refused	[THANK AND TERMINATE 91]

Free-Ridership (asked only of Influential Vendors)

C_MULT_SKIP2 [IF MULTCHK=2 AND INF4<>1 SKIP TO THANK AND TERMINATE 86]

COMPANYCHK [ASK IF MULTCHK=02 ELSE SKIP TO FR2] [INTERVIEWER QUESTION: Is this case's <CUST_COMPANY> variable the same as a previous case's <CUST_COMPANY> variable?]

01	Yes, Duplicate company	[SKIP TO DECISIONCHK]
02	No, New company	[SKIP TO FR2]

DECISIONCHK [ASK IF COMPANYCHK=01] Now thinking about the project at <CUST_ADDRESS> in < CUST_CITY>, were the factors that influenced your recommendations to <CUST_COMPANY> the same or different from the previous project we just discussed?

01	Same decision making process	[SKIP TO INT99]
02	Different decision making process	

FR2 [IF INF4 <> 1 SKIP TO NEXT SECTION, P1] Now on a 1 to 5 scale, where 1 is "not at all influential" and 5 is "extremely influential", how would you rate the influence of the following factors in your recommendations to <**CUST**_**COMPANY**> for this project? (Select one for each) [RANDOMIZE QUESTIONS]

For FR2A through FR2E:

01	Not at all influential
02	
03	
04	
05	Extremely influential
77	Not applicable
88	Don't know
99	Refused

FR2a	the program incentive provided by Duke Energy?
FR2b	your interactions with Duke Energy program staff, including technical assistance?
FR2c	the support from your Duke Energy trade ally outreach representative?
FR2d	the program marketing, training, or informational materials?
FR2e	your firm's past involvement in Duke Energy's programs?
FR2f	the energy design assistance provided by Duke Energy?

FR4 Was the program incentive incorporated into your pricing estimate or proposal to <**CUST_COMPANY**> for the project? (Select one)

01 Yes
02 No
88 Don't know
99 Refused

Program Influence on Sales of Qualifying Equipment (asked for Nonparticipant Spillover)

C_MULT_SKIP3 [SKIP TO INT99 IF MULTCHK=02]

P1 [IF INF4 = 1 SHOW: **"**Next,"] I'd like you to think about ALL of the program-eligible <**MEASURE_TYPE**> projects you sold or installed for Duke Energy's nonresidential customers over the past 12 months. I'd like to focus on projects where you installed the same types of <**MEASURE_TYPE**> equipment that you installed through the Smart $aver Custom program.

Over the past 12 months, approximately how many of these <**MEASURE_TYPE**> projects have you sold or installed within the Duke Energy service territory? (Enter whole number)

___ [ENTER NUMBER OF PROJECTS 0-1000]
0 None [SKIP TO S1]
8888 Don't know
9999 Refused

P2 Thinking about all of these <**MEASURE_TYPE**> sales, approximately what percentage do they make up of your total dollar sales of high-efficiency products in Duke Energy's territory? (Enter whole number)

[Interviewer note: We are referring to projects where you installed the same types of <**MEASURE_TYPE**> equipment that you installed through the Smart $aver Custom program.]

___ [ENTER PERCENTAGE 0-100]
888 Don't know
999 Refused

P3 Now thinking about those sales, approximately what percentage of these <**MEASURE_TYPE**> sales or installations in Duke Energy's service territory involved an incentive through Duke Energy's program? (Enter whole number)

[Interviewer note: We are referring to projects where you installed the same types of <**MEASURE_TYPE**> equipment that you installed through the Smart $aver Custom program.]

___ [ENTER PERCENTAGE 0-100]
888 Don't know
999 Refused

P10 What percentage of these <**MEASURE_TYPE**> sales or installations did you offer or talk about an incentive through Duke Energy's program? (Enter whole number)

___ [ENTER PERCENTAGE 0-100]
888 Don't know
999 Refused

P4 If the incentives or other assistance from Duke Energy's program were NOT available, do you think your company's overall sales of these types of <**MEASURE_TYPE**> equipment would have been about the same, lower, or higher than what you sold in the past 12 months? (Select one)

01 About the same
02 Lower
03 Higher
88 Don't know
99 Refused

P5 [ASK IF P4 = 2] By what percentage do you estimate your company's sales of these types of <**MEASURE_TYPE**> equipment would have been lower if Duke Energy's program was NOT available? (Enter whole number)

[IF NEEDED: Your best estimate is okay]

___ [ENTER PERCENTAGE 1-100]
888 Don't know
999 Refused

Nonparticipant Spillover

NS1 [ASK IF P3 < 100 AND P3 <> 888, 999 ELSE SKIP TO S1] Earlier you indicated that some of your <**MEASURE_TYPE**> sales did not involve an incentive through Duke Energy's program. Some qualifying projects may not receive incentives for one reason or another.

What are the main reasons why your firm or the customer did not pursue or receive an incentive for this program-eligible equipment?

[RECORD RESPONSE VERBATIM]
88 Don't know
99 Refused

NS2 On a scale of 1 to 5, where 1 is "not at all influential" and 5 is "extremely influential", how influential was Duke Energy Smart $aver Custom program on your sales of energy saving <**MEASURE_TYPE**> projects that did NOT receive an incentive? (Select one)

01 Not at all influential
02
03
04
05 Extremely influential
88 Don't know
99 Refused

Program Satisfaction

S1 Next, I'd like to ask you just a few questions about your satisfaction with Duke Energy's Smart $aver Custom Incentives program.

Using a scale of 1 to 5, where 1 is "not at all satisfied" and 5 is "very satisfied", how would you rate your satisfaction with Duke Energy's Smart $aver Custom Incentives program overall? (Select one)

01 Not at all satisfied
02
03
04
05 Very satisfied
88 Don't know
99 Refused

S2 [ASK IF S1 = 1 OR 2] Why do you say that?

[RECORD RESPONSE VERBATIM]

S3 On the same scale of 1 to 5, where 1 is "not at all satisfied" and 5 is "very satisfied", how would you rate your satisfaction with… (Select one for each) [RANDOMIZE QUESTIONS]

For S3A through S3F:
01 Not at all satisfied
02
03
04
05 Very satisfied
77 Not applicable
88 Don't know
99 Refused

S3a. your interactions with Duke Energy program staff?
S3b. the technical support provided by the program?
S3c. the type or variety of projects or equipment eligible for the program?
S3d. the incentives available through the program?
S3e. the amount of paperwork required by the program?
S3f. the time it takes to get an application approved?

S5 How easy or difficult is it to understand the differences in equipment eligibility between the custom and prescriptive programs? (Select one)

01 Very easy
02 Somewhat easy
03 Neither easy nor difficult
04 Somewhat difficult
05 Very difficult
88 Don't know
99 Refused

S4 Do you have any recommendations for improvements regarding the program design or operations? (Select one)

01 Yes [SPECIFY]
02 No
88 Don't know
99 Refused

COVID

CV1 Overall, how much has your organization been affected in 2020 by the COVID-19 pandemic? Has it been a…[READ LIST]

01 Large negative effect
02 Moderate negative effect
03 Little or no effect
04 Moderate positive effect
05 Large positive effect
77 Organization is closed/closing [SKIP TO E3]
88 [DO NOT READ] Don't know
99 [DO NOT READ] Refused

CV2 Please describe how your business operations changed in 2020 as a result of the pandemic.

[RECORD VERBATIM]
77 No change
88 Don't know
99 Refused

CV3 In your opinion, when do you think your business will return to its usual level of operations? [READ IF NEEDED]

01 By the end of March 2021
02 By the end of June 2021
03 By the end of September 2021
04 Longer than September 2021
05 I do not believe this business will return to its previous usual level of operations
06 There has been little or no effect on this business's usual level of operations
07 Already did
88 Don't know
99 Refused

CV4 What impact, if any, has COVID-19 had on your equipment recommendations?

01 No effect
02 Effect (specify)

Wrap-Up

E1 Just for classification purposes, approximately how many full time and part time staff does your firm employ at your location?

E1a. ___ Full-time [0-750]
E1b. ___ Part-time (includes seasonal employees) [0-750]
888 Don't know

E3 Do you have any additional comments that you would like to share with Duke Energy about their Smart $aver Custom Incentives program?

01 Yes [SPECIFY]
02 No

INT99 [SKIP IF MULTCHK=2] I'd like to thank you for your time with this important study. Have a good day.

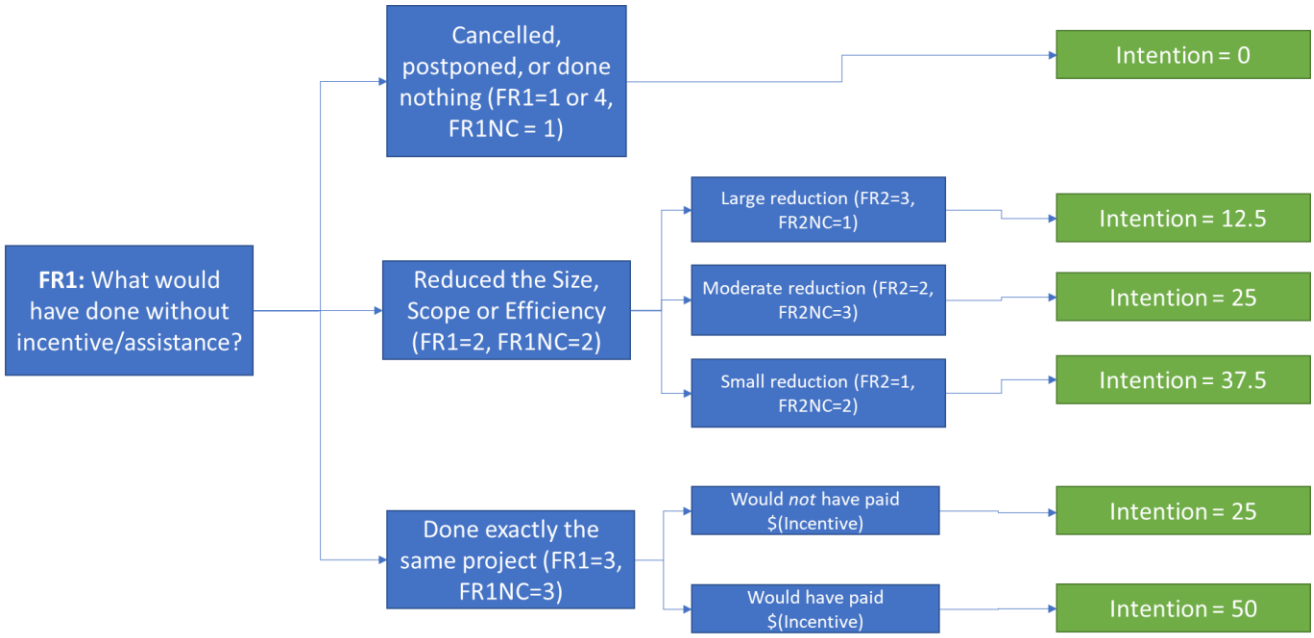
CP Completed

INT98 [ASK IF MULTCHK=2] I'd like to thank you for your time with this important study. Have a good day.

CM Completed

Appendix C Algorithms

C.1 Intention Score



C.2 Influence Score

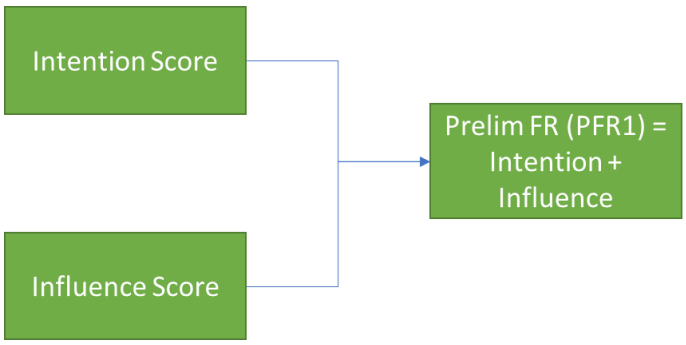
Max FR4 rating	Influence Score
9-10	0
8	6.25
7	12.5
6	18.75
5	25
4	31.25
3	37.5
2	43.75
0-1	50

C.3 Vendor Influence Reconciliation

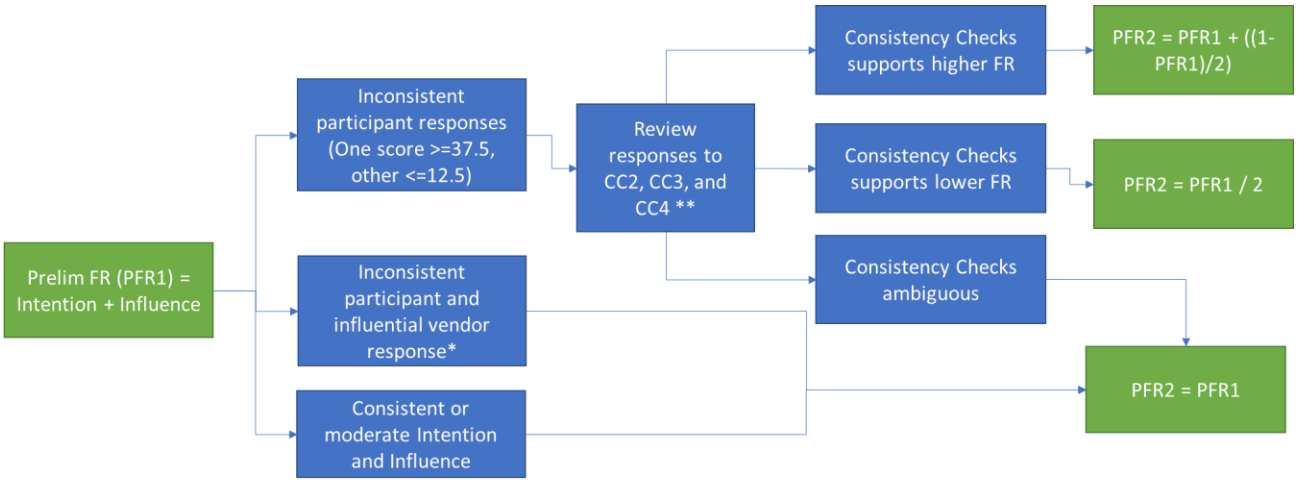
Customer rating of vendor influence	Vendor survey?	Vendor Program Influence Score (max vendor FR2)	Customer Program Influence Score (max customer FR4)	Final Program Influence Score
<=5	No	n/a	0-50	0-50
>=6	Not completed	n/a	12.5	12.5
>=6	Yes	12.5	31.25	12.5
>=6	Yes	25	18.75	18.75

Customer rating of vendor influence	Vendor survey?	Vendor Program Influence Score (max vendor FR2)	Customer Program Influence Score (max customer FR4)	Final Program Influence Score
<=5	No	n/a	0-50	0-50
>=6	Not completed	n/a	12.5	12.5
>=6	Yes	12.5	31.25	12.5
>=6	Yes	25	18.75	18.75

C.4 Preliminary free-ridership score

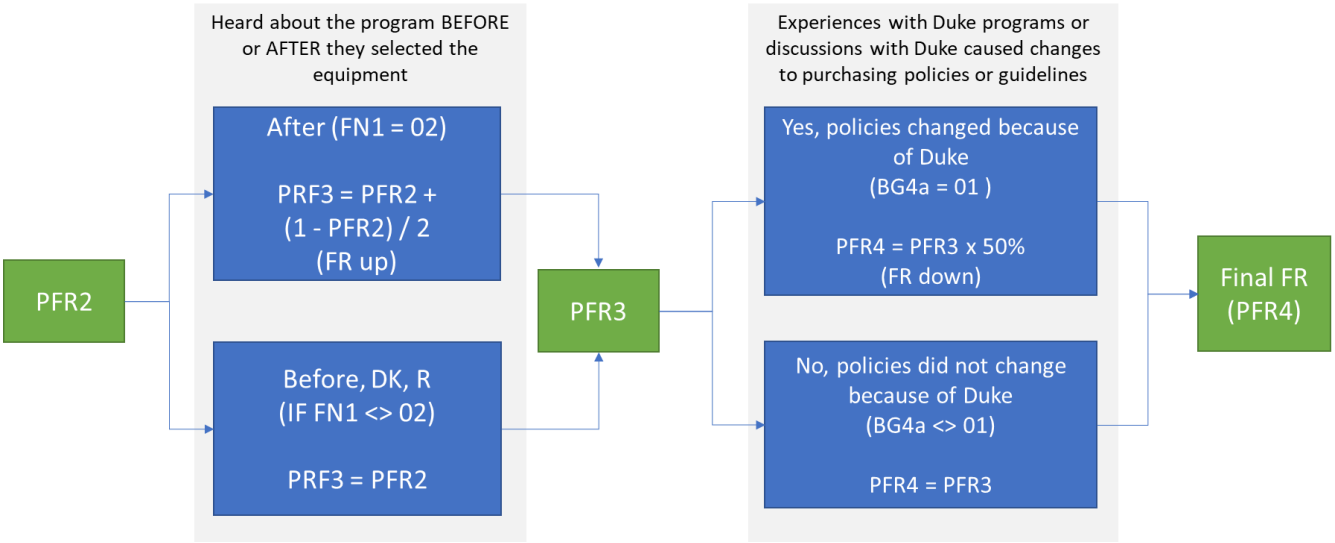


C.5 Consistency check reconciliation

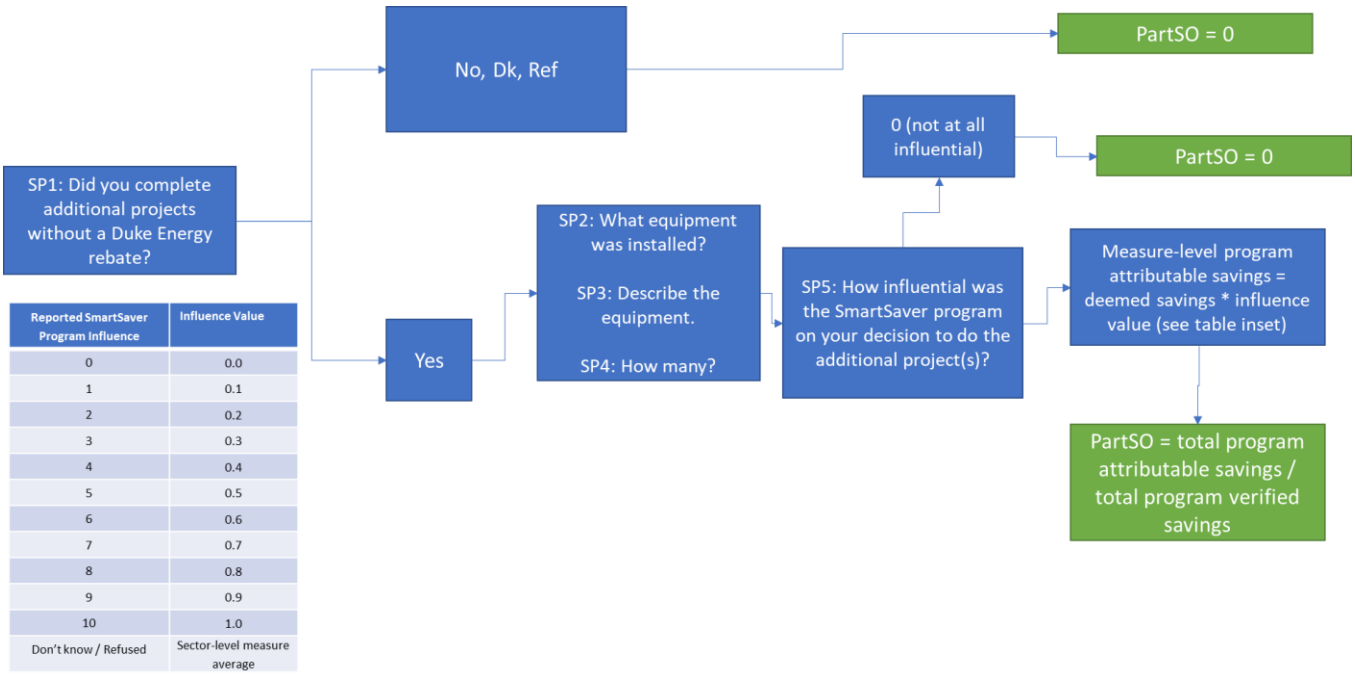


* If inconsistency is due to incorporation of vendor influence, consistency check questions will not be applied since individuals' responses are not inconsistent
** Consistency questions were reviewed (CC2, CC3, CC4) and determined if (1) they were consistent and (2) if it supported either higher or lower FR.

C.6 Free-ridership adjustments



C.7 Participant Spillover



Reported SmartSaver Program Influence	Influence Value
0	0.0
1	0.1
2	0.2
3	0.3
4	0.4
5	0.5
6	0.6
7	0.7
8	0.8
9	0.9
10	1.0
Don't know / Refused	Sector-level measure average

Appendix D Benchmarking Bibliography

Below are the reports reviewed as part of the benchmarking activity.

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