BEFORE THE

INDIANA UTILITY REGULATORY COMMISSION

PETITION OF DUKE ENERGY INDIANA, LLC FOR APPROVAL OF: (1) ITS DEMAND SIDE MANAGEMENT AND ENERGY EFFICIENCY PLAN FOR 2024-2026, INCLUDING ENERGY EFFICIENCY PROGRAMS AND DEMAND RESPONSE PROGRAMS; (2) ACCOUNTING AND RATEMAKING TREATMENT, INCLUDING TIMELY RECOVERY OF ASSOCIATED PROGRAM COSTS, INCLUDING REASONABLE LOST REVENUES AND FINANCIAL INCENTIVES, AND AUTHORITY TO DEFER COSTS; AND (3) NEW STANDARD CONTRACT RIDER 74, LOAD CONTROL ADJUSTMENT.	**)))))))))))))**	**CAUSE NO. 45803**

INDIANA OFFICE OF UTILITY CONSUMER COUNSELOR'S
PUBLIC'S EXHIBIT NO. 1
REDACTED TESTIMONY OF OUCC WITNESS
JOHN E. HASELDEN

February 9, 2023

Respectfully submitted,

Jeffrey M. Reed
Attorney No. 11651-49
Deputy Consumer Counselor

TESTIMONY OF OUCC WITNESS JOHN E. HASELDEN
CAUSE NO. 45803
DUKE ENERGY INDIANA, LLC

NOTE: GREY HIGHLIGHT INDICATES CONFIDENTIAL INFORMATION

I. INTRODUCTION

Q: Please state your name and business address.

A: My name is John E. Haselden. My business address is 1711 Wellington Ct. Avon, IN 46123. I recently retired from my position as a Senior Utility Analyst in the Electric Division of the Indiana Office of Utility Consumer Counselor ("OUCC"). I describe my educational background and professional work experience in Appendix A to my testimony.

Q: By whom are you employed and in what capacity?

A: I am a self-employed consultant. I have been retained by the OUCC to present testimony in this proceeding.

Q: Have you previously testified before the Indiana Utility Regulatory Commission ("Commission")?

A: Yes. I have testified in many cases before the Commission, including cases on demand side management ("DSM"), renewable energy, Transmission, Distribution, and Storage System Improvement Charges ("TDSIC"), electric vehicle charging, and applications for Certificates of Public Convenience and Necessity ("CPCN").

Q: What is the purpose of your testimony?

A: The purpose of my testimony is to discuss Duke Energy Indiana, LLC's ("DEI") request for approval of the proposed Demand-Side Management and Energy Efficiency Plan for 2024 – 2026 ("DSM Plan"), recovery of costs associated with the DSM Plan, lost revenues, and a financial incentive.

Q: Please describe the review and analysis you conducted to prepare your testimony.

A: I reviewed the Verified Petition, Direct Testimony and Exhibits submitted by DEI in this Cause relative to my testimony. I composed data requests ("DRs") and reviewed DEI's discovery responses. I reviewed responses to DRs from other interveners and reviewed recent Evaluation, Measurement and Verification ("EM&V") reports.

Q: Are you sponsoring any attachments in this proceeding?

A: Yes. I am sponsoring:

- Attachment JEH-1 - Petitioner's Responses to selected OUCC DRs;
- Attachment JEH-1C - Petitioner's Confidential Responses to selected OUCC DRs;
- Attachment JEH-2 - Energy Efficiency in Schools Program 2020-2021 Evaluation Report;
- Attachment JEH-3 - Smart $aver 2020-2021 Evaluation Report; and
- Attachment JEH-4 - Petitioner's Responses to Citizens Action Coalition DR.

Q: To the extent you do not address a specific item in your testimony, should it be construed to mean you agree with DEI's proposal?

A: No. My silence regarding any topics, issues or items DEI proposes does not indicate my approval of those topics, issues, or items. Rather, the scope of my testimony is limited to the specific items addressed herein.

II. <u>DEI'S DSM PLAN</u>

Q: What is DEI proposing regarding its DSM Plan?

A: DEI is proposing:

1. To implement a new DSM Plan containing programs largely the same as those contained in the current DSM Plan approved by the Commission in Cause No. 43955 DSM-8;
2. To re-introduce a Residential New Construction program;
3. A new Non-Residential demand response ("DR") program; and
4. Recovery of lost revenues and a shareholder incentive structured in the same manner as the current DSM Plan.

Q: Does the OUCC have concerns with DEI's proposed DSM Plan?

A: Yes. The OUCC's concerns are associated with the following:

1. The Energy Efficiency Education Program for Schools ("Schools Program") contains an Energy Efficiency Starter Kit, which is the source of most of the savings for the program. The contents of future kits are not currently defined. See Attachment JEH-1, Response to OUCC DR 1.9. Consequently, it is not clear the Schools Program will be cost effective. The OUCC proposes the Schools Program be revised and converted to a marketing program.

2. The Residential Smart Saver® Program includes Smart thermostats, Heating, Ventilating and Air Conditioning ("HVAC") and Heat Pump Water Heater ("HPWH") measures which are not cost effective and should be removed. In addition, savings attributed to Non-participant Spillover ("NPSO") are not appropriately evaluated and should be removed. NPSO effects are not authorized under the Commission's administrative rules (170 IAC 4-8).
3. Petitioner's calculation of avoided Transmission and Distribution ("T&D") capacity costs is inappropriate and overstated, resulting in artificially high benefit / cost ("B/C") scores for the DSM programs. The OUCC recommends the value for avoided T&D costs be set to zero for the purposes of calculating the B/C tests of the proposed DSM programs.
4. The extent and timing with which DEI proposes to incorporate measure characteristics contained in the new Indiana Technical Reference Manual ("TRM"), upon which cost effectiveness and lost revenues are based, are insufficient. The OUCC recommends the Commission require DEI to use the new TRM parameters beginning in 2024 for all covered measures.
5. Operation of the Oversight Board ("OSB") in terms of access to DEI's EM&V contractors.
6. Cumulative lost revenues should be limited to a maximum of three years or life of the measure, whichever is shorter.

Q: Please explain the OUCC's concerns with the Schools Program.

A: Schools Program energy savings are quantified on the basis of measures included in the Energy Efficiency Starter Kit and, to a small degree, behavior modification. While it is important to educate children about energy efficiency, the program's cost effectiveness is declining due to the decreased or eliminated presence of LED lighting in kits. Should kits continue to be distributed, the OUCC recommends eliminating all LED lighting measures from the kits. Federal lighting efficiency standards have now been implemented under the Energy Independence and Security Act of 2007 ("EISA"). LED general service and specialty bulbs are now the baseline for such lighting and provide no future savings.

The remaining measures in the kits are primarily hot water reduction measures of limited cost effectiveness. The recent EM&V report for this program shows many hot water reducing kit measures, such as low flow showerheads, have low installation rates (39%) and are given to residences with a low percentage of electric water heaters (47%).[1] Taken together, only about 18% (39% x 47%) of kit water measures are effective in reducing electric consumption. In addition, the OUCC was unable to tie the amounts for showerhead deemed savings discussed in DEI's testimony with the supporting data. The OUCC questions the continued cost effectiveness of this program and recommends DEI discontinue distributing kits. The remaining costs associated with this program should be included as a marketing expense. The program should be excluded from lost revenues and shareholder

[1] Attachment JEH-3, page 18.

incentives.

Q: Please explain the OUCC's concerns with the Residential HVAC Equipment Program.

A: DEI's Residential Smart Saver® Program contains customer incentives for Smart thermostats, Central Air Conditioners, Heat Pumps, and Heat Pump Water Heater Measures that are not cost effective.[2] The primary reason for this is the recent increase in the federal minimum efficiency standards for these types of equipment. Much less energy and demand are saved as a result of the federally mandated increase in baseline efficiency. In addition, free ridership levels are relatively high in the 40% to 50% range.[3] Incentivizing these measures no longer makes economic sense and should be discontinued. These measures are major components acquired as stand-alone purchases by customers. They are not part of a suite of measures for which the cost effectiveness can be logically leveraged with other better performing measures. Furthermore, the cost effectiveness of the program is propped up by the overstated avoided cost of T&D capacity which is discussed below. The cost effectiveness of the noted measures is much worse than DEI represents. The Smart $aver program would likely not be cost effective if reasonable or zero avoided T&D capacity costs were used in the calculation of net benefits. This can be seen by examining the large "benefits" attributed by avoided T&D capacity costs shown in the spreadsheets included in Attachment JEH-4[4].

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[2] Attachment JEH-1, Response to OUCC DR 1.1.

[3] Attachment JEH-3, pages 52-53.

[4] Attachment JEH-4, Response to CAC DR 15, CAC Attachment 1.5-A.

The recent EM&V report for this program includes an assessment of Non-Participant Spillover ("NPSO").[5] The OUCC does not agree with the savings estimate in the report based upon the methods used by the evaluator and lack of verification in the process. There are two major flaws in the evaluation process.

First, the EM&V report states surveys of HVAC contractors asked what influence the DSM programs had on the HVAC contractors' business practices of recommending non-rebated energy efficiency measures to their DEI non-participating customers. However, except for questions regarding spillover of participants, I could find no questions in the survey asking for the contractors' opinions of the behavior of non-participants.[6] Opinions of HVAC contractors are not verifiable data sources that explain the actions of non-participating DEI customers. Not all contractors make additional recommendations. Nevertheless, DEI proposes to extrapolate measure savings across the whole population without a verifiable, repeatable analysis justifying this action. The degree of any influence of DEI's HVAC program is subjective (survey Q149) and is not based upon data. The survey questions ask about <u>rebate-qualifying</u> measures[7] and do not ask about non-rebated measures, as stated in the report (page 54). The added savings allegedly created by NPSO have not been justified. There is no evidence supporting the extrapolation of this questionable, limited data, over the entirety of all potential customers.

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[5] Attachment JEH-3, Section 4.2.2.

[6] Attachment JEH-3, pages D-13-14.

[7] Attachment JEH-3, Page 14.

Second, the survey questions were asked to several trade allies, not the actual non-participating DEI customers. Asking a third party why another person acted in a specific manner is inherently subjective and significantly less reliable than direct contact. NPSO purports to measure non-participant DEI customers installing energy efficient measures because of DEI's influence. The EM&V report describes the practice of some HVAC contractors suggesting other energy efficient measures to their customers, but the report is not clear what these non-rebated measures were. It may be a sales technique to put a customer in an energy efficiency frame of mind to upsell higher efficiency equipment. Regardless, DEI has not shown it is influencing non-participating customers to install other energy efficiency measures. NPSO amounts should be completely removed from the expected savings for these measures.

Q: Does DEI propose a methodology or process for calculating lost revenues that accurately accounts for "spillover" pursuant to 170 IAC 4-8-6(b)?

A: No. While DEI proposes a methodology / process for calculating lost revenues that accounts for participant spillover, it does not accurately account for "spillover," pursuant to 170 IAC 4-8-6. DEI includes NPSO within its calculations. However, "spillover" is defined within the rule to mean "additional reductions in energy consumption or demand <u>by program participants</u> beyond those directly associated with program participation." 170 IAC 4-8-1(kk)(emphasis added).

Q: Does DEI's EM&V plan effectively measure spillover?

A: No. While DEI's EM&V plan does describe how the utility will measure its effectiveness in measuring participant spillover pursuant to 170 IAC 4-8-4(a)(4)(C), it includes NPSO in its measurements. Spillover, as defined in the regulation, does not include additional reduction in energy consumption or demand by non-participants, as noted above. Therefore, including non-participant spillover in its measurements creates an overstated amount of spillover.

Q: Does DEI's EM&V plan accurately collect data to determine net energy savings and net demand reduction.

A: No. While DEI's EM&V plan does demonstrate how it will collect data pursuant to 170 IAC 4-8-4(a)(3)(E and F), its data collection includes NPSO. Both Net Energy Savings and Net Demand Reduction are subject to adjustment for spillover, as those terms are defined in the regulation. 170 IAC 4-8-1(z) and (aa). Spillover, as defined in the regulation, does not include additional reduction in energy consumption or demand by non-participants. 170 IAC 4-8-1(kk).

Q. Do any other Indiana investor-owned jurisdictional electric utility DSM plans include NPSO in data or measurements, or calculations for lost revenue, net energy savings, or net demand reduction?

A. No.

Q: What are the OUCC's concerns about DEI's calculation of avoided T&D costs?

A: In Cause No. 43955 DSM 8, the OUCC criticized DEI's method of estimating avoided T&D capacity costs.[8] Responding to OUCC's concerns, DEI rebuttal witness Jayme Stemle stated at page 6:

> In recent years, the Company's load forecast has flattened considerably. Due to this decrease in peak load growth, the methodology used by the Company to calculate T&D avoided cost is now under review and the Company is investigating more sophisticated modeling approaches.

In the present case, DEI has not followed through on this commitment. In response

[8] Cause No. 43955 DSM 8, direct testimony of John E. Haselden, pages 22-25.

to OUCC DR 2.2 inquiring about the status or results of the "more sophisticated modeling approaches" Mr. Stemle discussed, DEI provided a spreadsheet documenting the identical approach used in DSM 8 with some numbers updated from 2016 to 2020. DEI's proposed avoided T&D capacity cost estimating method has not changed and addresses none of the problems identified by the OUCC in Cause No. 43955 DSM 8.

Q: Please describe these problems and their effects.

A: DEI significantly overstates the avoided cost of avoided T&D capacity which improves the calculation of the net present value of benefits for DSM programs and consequently increases shareholder incentives.

T&D capacity benefits (avoided T&D capacity costs) are generated when DSM programs alleviate capacity issues <u>on specific circuits</u>. DEI's transmission system is large and robust. The very small demand reductions created by DSM have no meaningful impact on savings associated with incremental transmission system construction of added capacity. DEI assumes each kW of load reduced through DSM is a direct and immediate avoided capacity cost savings to the expansion of its transmission system. DEI has not demonstrated any of its transmission lines are at or near capacity and would benefit from load reductions due to DSM. Thus, the value of any demonstrable avoided transmission capacity will not be recognized until some future time, making these estimates less meaningful and less reliable. The net present value of any future benefit would need to be calculated, which would presumably be an even smaller number. DEI estimates the cost of expanding the transmission system to serve new loads and applies this cost to all kW reduced by DSM despite there being no nexus between the DSM savings incurred on all other circuits and the marginal cost of building new circuits on which DSM effects do not yet exist.

The same concept applies for distribution circuit avoided capacity costs. Load reductions created by DSM programs <u>will</u> impact existing distribution circuits and free up capacity on those circuits. However, there are no construction cost savings if the capacity on those circuits is currently adequate, as most circuits are. Again, DEI has not demonstrated any of its distribution circuits are at or near capacity and would benefit from load reductions due to DSM. DEI quantifies the avoided T&D capacity savings as equivalent to the marginal cost to build a distribution circuit for new load. This is an incorrect assumption. Load reductions created by DSM programs never impact distribution circuit construction costs serving new load. The construction costs for a new circuit built to serve new load without existing DSM impacts on that circuit has no relationship to DSM load reductions throughout the rest of the DEI system. Other utilities identify circuits at or near capacity that might benefit from DSM programs and apportion a percentage of the benefits to those circuits. For example, assume 10% of circuits are at or near capacity, the marginal cost of distribution capacity is $50/kW-year, and the DSM program saved 1,000 kW system-wide. Avoided distribution capacity costs would equal:

10% x $50/kW-year x 1,000 kW = $5,000/year

Alternatively, the scaler value can be 10% x $50/kW-year, or $5/kW-year for each kW saved by DSM programs.

DEI offers no evidence identifying any circuits at or near capacity that might benefit from DSM program capacity reductions. In fact, DEI's 2021 IRP shows a load forecast for system peak demand declining from 2023 through 2034.[9]

As stated at 170 IAC 4-8-7 (c):

> A financial incentive shall not provide an incentive payment for an energy efficiency or demand response program unless the net kilowatt or kilowatt-hour impact, or both, can be reasonably determined.

DEI has not met this requirement. The financial incentive calculated by DEI is affected directly by the overstated T&D avoided capacity costs.

Q: How does the avoided T&D capacity cost presented by DEI compare to other Indiana utilities?

A: Unlike any of the other jurisdictional utilities, DEI's avoided T&D capacity costs *exceed* avoided generating capacity costs and by a wide margin. Other utilities in Indiana use avoided T&D capacity costs in the range of $[redacted]/kW-year to approximately $[redacted]/kW-year. DEI estimates avoided T&D capacity costs for its system at over $[redacted]/kW-year for 2024, more than double that of the next highest in the state.[10] This is both unsupported and unreasonable.

Q: Does the OUCC have a recommendation concerning treatment of avoided T&D capacity costs?

A: Yes. DEI should calculate avoided T&D capacity costs as demonstrated above using factors appropriate to their system. Absent identification and quantification of specific circuits that would benefit from capacity savings attributed to DSM

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[9] 2021 Duke Energy Indiana Integrated Resource Plan, Volume 1, page 133, Table VI.2.

[10] Attachment JEH-1C, Confidential response to OUCC DR 2.1.

programs, there is no evidence offered that satisfies the requirements of 170 IAC 4-8-7. Savings are even more unlikely in an environment where system demand is decreasing. Further, DEI is continuing to invest billions of dollars in its ongoing TDSIC program which, aside from upgrading existing T&D circuits, also includes new construction to alleviate system capacity constraints. These are the same issues DEI claims DSM alleviates but are being overridden by the TDSIC projects. DEI shareholders are already earning a return on TDSIC investments and should not earn an additional incentive through DSM for the same result. For these reasons, the OUCC recommends avoided T&D capacity costs be set to zero for the purposes of calculating the Benefit/Cost tests and shareholder incentives.

Q: Please explain the OUCC's concern with DEI's intentions concerning incorporating the new Indiana TRM parameters into assumptions about program parameters for the 2024-2026 Plan.

A: The OUCC inquired how DEI planned to incorporate the new TRM in its updated DSM in a data request.[11] DEI responded the TRM parameters would be incorporated prospectively in future EM&V reports, as they occur. DEI does not evaluate all programs annually and several years may pass between evaluations of the same programs. See the direct testimony of DEI witness Jean P. Williams, Attachment 3-B (JPW). Consequently, DEI is proposing the new TRM parameters will only be applied to a few programs beginning in 2024 and at later dates for all other programs. There will be significant changes in measure impacts and useful lives contained in the new TRM that should be applied beginning in 2024 for all

[11] Attachment JEH-1, Response to OUCC DR 2.8.

programs containing affected measures installed after 1/1/24. Applying the new TRM parameters to all new measures installed in all DSM programs effective 1/1/24 provides a clean break and a simple line of demarcation for EM&V. It provides transparency for Commission and stakeholder review with more timely feedback of the impacts of the TRM changes. Most importantly, it does not unreasonably delay bringing ratepayers the full benefits of the new TRM.

Q: Please explain the OUCC's concerns with the Oversight Board.

A: The OUCC has a concern with the lack of direct access to EM&V contractors to discuss EM&V report content. EM&V reports are given to the OSB by DEI, only after they have been nearly finalized by DEI and the company requests a vote for report approval. OUCC has greater direct access to EM&V vendors with other OSBs.

The OSB no longer has regular direct communication with the EM&V contractors. A more open communication format would be better to facilitate understanding of issues and methods earlier in the process and would be more efficient in resolving issues. As ratepayers pay 100% of the EM&V vendor costs via the DSM program, stakeholder access to EM&V vendors throughout the process should not be controversial.

Q: Please explain the OUCC's recommendation to cap lost revenues.

A: 170 IAC 4-8-6 provides for the recovery of reasonable lost revenues so long as other parameters are accounted for in the calculation. One of the listed parameters is the change in the number of program participants between rate cases. In addition, the efficiency of equipment may degrade over time. Therefore, initial program savings erode over time and lost revenues should decline proportionally. There is no mechanism in DEI's DSM Plan to account for this, as required by the rule. Cumulatively, lost revenues can become very large (for example, DEI's lost revenues in DSM-7 were $27 million/year), if there is a substantial interval between rate cases. This can be a substantial burden on ratepayers' bills. Therefore, the OUCC believes a reasonable compromise is to limit the expected useful life of any measure or program to the lesser of life of the measure or three years for the purpose of recovery of lost revenues.

Q: Please summarize your recommendations to the Commission in this Cause.

A: The OUCC offers the following recommendations:

1. The Schools program should be revised as described above and included under marketing efforts to continue its educational function. Resulting savings should be counted, but excluded from lost revenues and shareholder incentives. Direct costs of the revised Schools program may be recovered. DEI should discontinue kit distribution funded by ratepayers.
2. Smart thermostats, HVAC and HPWH measures in the Residential Smart Saver® Program which are not cost effective should be removed as measures incentivized by the program. Further, NPSO effects should be removed from savings estimates;
3. The calculation of avoided T&D capacity costs should be set to zero and the B/C tests recalculated;
4. The OUCC recommends the Commission require DEI to use TRM parameters for all programs for all deemed impacts for measures installed on or after

January 1, 2024. DEI should file an update to the Plan reflecting updates to their input assumptions reflective of the new TRM parameters;

5. The OUCC recommends the Commission limit the expected useful life of any measure or program to no more than three years for the purpose of recovery of lost revenues; and

6. The OUCC recommends DEI be directed to provide direct access to EM&V vendors throughout the EM&V process.

Q: Does this conclude your testimony?

A: Yes.

APPENDIX TO TESTIMONY OF
OUCC WITNESS JOHN E. HASELDEN

Q: Please describe your educational background.

A: I am a graduate of Purdue University with a Bachelor of Science degree in Civil Engineering. I am also a graduate of Indiana University with the degree of Master of Business Administration, majoring in Finance. I am a registered Professional Engineer in the State of Indiana. I have attended and presented at numerous seminars and conferences on topics related to demand-side management ("DSM") and renewable energy.

Q: Please describe your utility business experience.

A: I began employment with Indianapolis Power & Light Company in April, 1982 as a Design Project Engineer in the Mechanical-Civil Design Engineering Department. I was responsible for a wide variety of power plant projects from budget and cost estimation through the preparation of drawings, specifications, purchasing and construction supervision.

In 1987, I became a Senior Engineer in the Power Production Planning Department. I was responsible for assisting and conducting studies concerning future generation resources, economic evaluations, and other studies.

In 1989, I was promoted to Division Supervisor of Fuel Supply and in 1990, became Director of Fuel Supply. I was responsible for the procurement of the various fuels used at IPL's generating stations.

In 1993, I became Director of Demand-Side Management. I was responsible for the development, research, implementation, monitoring, and evaluation of all marketing and

DSM programs. In particular, I was responsible for the start-up of this new department and for the start-up and implementation of the DSM programs approved by the Commission in its Order in Cause 39672 dated September 8, 1993. The DSM Department was dissolved at IPL in 1997 and I left the company.

From 1997 until May, 2006, I held the positions of Director of Marketing and later, Director of Industrial Development and Engineering Services at The Indiana Rail Road Company. I was responsible for the negotiation of coal transportation contracts with several electric utilities, supervision of the Maintenance-of-Way and Communications and Signals departments, project engineering, and development of large capital projects.

I rejoined IPL in May, 2006 as a Principal Engineer in the Regulatory Affairs Department. I was responsible for the evaluation and economic analysis of DSM programs and assisted in the planning and evaluation of environmental compliance options and procurement of renewable resources.

In May, 2018, I joined the OUCC as a Senior Utility Analyst - Engineer. I reviewed and analyzed utilities' requests and filed recommendations on behalf of consumers in utility proceedings. As applicable to a case, my duties also included evaluating rate design and tariffs, examining books and records, inspecting facilities, and preparing various studies. I retired from the OUCC in July, 2022.

Q: Have you previously testified before the Indiana Utility Regulatory Commission?

A: Yes. I have provided testimony in several proceedings on behalf of IPL regarding the subjects of Fuel Supply, DSM and renewable energy most recently in Cause Nos. 43485, 43623, 43960, 43740, 44328, 44018, and 44339. My testimony on DSM concentrated on the evaluation, measurement and verification ("EM&V") of DSM programs. My testimony on renewable energy concentrated on IPL's Rate REP (feed-in tariff, wind power purchase agreements and solar energy. I have provided testimony on behalf of the OUCC in Cause Nos. 43955 (DSM-7 and 8), 43827 (DSM-8 and 9), 43623 (DSM-19), 43405 (DSMA-17), 45086, 45145, 45193, 45194, 45235, 45245, 45253, 45285, 45370, 45387, 45465, 45485, 44733 (TDSIC-5, 7 and 8), 44910 (TDSIC-4, 6, 7, 8 and 9), 45576, 45506, 45616, and 45772.

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CONFIDENTIAL

OUCC ATTACHMENT JEH-1C

CAUSE NO. 45803

Office of Utility Consumer Counselor
IURC Cause No. 45803
Data Request Set No. 1
Received: December 16, 2022

OUCC 1.1

Request:

In reference to page 13, line 16: Please list the 25 residential measures that do not pass the UCT, the programs in which each measure resides and the UCT ratio for each individual measure.

Response:

Program	Measure Name	UCT
Smart $aver® Residential	IN_ Smart Saver - Central Air Conditioner Tier 3 - Non-Referred	0.94
Smart $aver® Residential	IN_ Marketplace Showerhead	0.90
Smart $aver® Residential	IN_ Marketplace Thermostatic Valve Device	0.90
Smart $aver® Residential	IN_ Smart Thermostat - Referred	0.86
Smart $aver® Residential	IN_ Smart Saver - Central Air Conditioner Tier 3 - Referred	0.79
Smart $aver® Residential	IN_ Smart Saver - Central Air Conditioner Tier 2 - Non-Referred	0.76
Smart $aver® Residential	IN_ Smart Saver - Attic Insul & Air Sealing - Non-Referred	0.74
Smart $aver® Residential	IN_ Smart Saver - Central Air Conditioner Tier 2 - Referred	0.74
Smart $aver® Residential	IN_ Smart Saver - Duct Sealing - Non-Referred	0.67
Smart $aver® Residential	IN_ Smart Saver - Heat Pump Tier 2 - Non-Referred	0.66
Smart $aver® Residential	IN_ Retail Dehumidifier	0.63
Smart $aver® Residential	IN_ Smart Thermostat - Non-Referred	0.58
Smart $aver® Residential	IN_ Smart Saver - Heat Pump Tier 2 - Referred	0.51
Smart $aver® Residential	IN_ Heat Pump Water Heater	0.50
Smart $aver® Residential	IN_ Marketplace Air Purifier	0.50
Smart $aver® Residential	IN_ Smart Saver - Heat Pump Tier 3 - Referred	0.47
Smart $aver® Residential	IN_ Retail Ceiling Fan with Light Kit	0.43
Smart $aver® Residential	IN_ Marketplace Dehumidifier	0.34
Smart $aver® Residential	IN_ Retail Air Purifier	0.28
Smart $aver® Residential	IN_ Marketplace Smart Strips	0.11
Multi-Family EE Products & Services	IN_ RLEDPM - Track	0.45
My Home Energy Report	IN_ Multifamily MyHER	0.79
Power Manager®	IN_ Bring Your Own Thermostat	0.62
Residential Energy Assessments	IN_ HEHC - Smart Thermostat -Only CAC Fuel Htd	0.84
Residential Energy Assessments	IN_ HEHC - Smart Thermostat -Elec	0.84

Witness: Amy B. Dean

Office of Utility Consumer Counselor
IURC Cause No. 45803
Data Request Set No. 1
Received: December 16, 2022

OUCC 1.2

Request:

In reference to page 13, lines 17-18: Please list the 25 non-residential measures that do not pass the UCT, and the UCT ratio for each individual measure.

Response:

Measure Name	UCT
IN_ LED Garage replacing 176W-250W HID retrofit	0.97
IN_ LED Garage replacing up to 175W HID retrofit	0.97
IN_ LED Garage replacing 251W-400W HID retrofit	0.97
IN_ LED Garage replacing above 400W HID retrofit	0.97
IN_ Faucet Aerator 1.0 gpm (DI) cmrcl, pvt use	0.91
IN_ Time Clocks Internal Lighting	0.90
IN_ VFD Process Pump 1-50 HP	0.90
IN_ Control sensor for lighting and exhaust fan in restrooms	0.88
IN_ Pre Rinse Sprayers	0.79
IN_ HVAC Maintenance - Coil Cleaning	0.78
IN_ Connected Smart Thermostats	0.77
IN_ VFD HVAC Fan	0.74
IN_ Low Flow Showerhead 1.5 gpm (DI) cmrcl, pvt use	0.73
IN_ Photocells with Time Clocks Exterior	0.72
IN_ Photocells Exterior	0.72
IN_ Bi-level Controls Exterior Retrofit	0.72
IN_ Strip Curtains - Refrigerated Warehouse	0.68
IN_ Strip Curtains - Freezers	0.68
IN_ Low Flow Showerhead 1.5 gpm (DI) cmrcl, public use	0.63
IN_ Heat Pump Water Heater C&I	0.62
IN_ Setback Programmable Thermostat	0.60
IN_ Faucet Aerator 0.5 gpm (DI) cmrcl, public use	0.59
IN_ VFD on Chilled Water Pump	0.56
IN_ VFD on Hot Water Pump	0.56
IN_ Night covers for displays	0.54

Witness: Amy B. Dean

Office of Utility Consumer Counselor
IURC Cause No. 45803
Data Request Set No. 1
Received: December 16, 2022

OUCC 1.9

Request:

Referencing Attachment 1-B (ABD), page 6: What is contained in the Energy Efficiency starter kit?

Response:

Currently, the Energy Efficiency kit contains the following:

- 1.5 GPM low flow shower head
- 1.5 GPM kitchen faucet aerator with swivel and flip valve
- 1.0 GPM bubble spray bathroom faucet aerator
- Water flow meter bag
- Water temperature gauge card
- Two 5 Watt Candelabra LED bulbs (substitutions being explored in light of EISA rulings)
- Energy Efficient Limelight style night light
- Duke Energy labeled DOE "Energy Savers" booklet
- Roll of Teflon tape for showerhead
- Product information and instruction sheet

Witness: Amy B. Dean

Office of Utility Consumer Counselor
IURC Cause No. 45803
Data Request Set No. 1
Received: December 16, 2022

OUCC 1.10

Request:

Referencing Attachment 1-B (ABD), page 14: What are the federal baseline SEER ratings for residential HVAC equipment to be incentivized by Duke for 2024-2026?

Response:

New metrics used to designate systems' efficiencies will change to reflect updates to the underlying testing protocols. The new efficiency designations will be referred to as SEER2, replacing the outgoing SEER designations.

The SEER/SEER2 ratings that will be incentivized in Indiana for 2024-2026 will be:

SEER Rating	Corresponding SEER/2 Rating
15	14.2
16	15.2
17+	16+

Witness: Amy B. Dean

OUCC
IURC Cause No. 45803
Data Request Set No. 2
Received: January 19, 2023

OUCC 2.3

Request:

In Cause No. 43955 DSM-8, DEI Rebuttal, witness Jayme Stemle stated at page 6 (emphasis added):

> *"In recent years, the Company's load forecast has flattened considerably. Due to this decrease in peak load growth, the methodology used by the Company to calculate T&D avoided cost is now under review and the Company is investigating more sophisticated modeling approaches."*

Please provide documentation and reports of DEI's review of T&D avoided costs referenced in Mr. Stemle's testimony filed in 2020.

Objection:

Duke Energy Indiana objects to the request as such information is not relevant to this proceeding and not reasonably calculated to lead to admissible evidence as it is beyond the scope of Duke Energy Indiana's case-in-chief testimony.

Response:

Subject to and without waiving or limiting its objections, please reference Confidential Attachment OUCC 2.2-A for the documentation of Duke Energy Indiana's current review of T&D avoided costs.

Witness: Melissa E. Adams

OUCC
IURC Cause No. 45803
Data Request Set No. 2
Received: January 19, 2023

OUCC 2.5

Request:

If carbon costs are included in avoided energy costs, please provide this component in terms of $/kWh, by year and supporting calculations demonstrating the conversion of $/ton of CO_2 to $/kWh.

Response: Carbon costs are not included in the avoided energy costs.

Witness: Melissa E. Adams

OUCC
IURC Cause No. 45803
Data Request Set No. 2
Received: January 19, 2023

OUCC 2.8

Request:

A new Indiana TRM is expected to be completed in 2023. How will DEI apply the revised parameters from the new Indiana TRM to the proposed 2024 – 2027 DSM programs, to the extent they differ from the estimates contained in Confidential Attachment OUCC 1.12?

Objection: Duke Energy Indiana objects to this request to the extent it calls for speculation regarding events that may or may not occur.

Response:

Subject to and without waiving or limiting its objections: The Company's application of the new Indiana TRM is expected to be completed sometime in 2023. Given information availability, the estimates contained in Confidential Attachment OUCC 1.12 have been used throughout the DSM planning process, beginning with the Market Potential Study (MPS), and continuing on through the Integrated Resource Plan (IRP) and the 2024-2026 Portfolio filing.

The planning process for the next MPS will begin in 2023. The Company hopes to have any updated measure values from the new Indiana TRM to use as part of this MPS effort that can then be carried through to the next IRP and Portfolio filing, which would likely be for 2027-2029.

The Company also intends to use the new Indiana TRM, once complete and approved, prospectively in all Evaluation, Measurement and Verification moving forward. An evaluation with sample participation occurring after the final completion of the Indiana TRM would utilize the new Indiana TRM parameters, unless the Company's third-party evaluators determine inputs captured from participant survey research provide a more accurate estimation of measure and/or program savings. Put more simply, the 2024-2026 portfolio will reflect the new Indiana TRM through the application of future EM&V results that are prepared by the Company's independent evaluators in accordance with the new TRM after it is complete and approved.

Witness: Jean P. Williams

Energy Efficiency in Schools Program 2020-2021 Evaluation Report

Duke Energy Indiana

Submitted to Duke Energy

Date: 1.19.2023

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Contents

1. Executive Summary

1.1. Program Summary

The Energy Efficiency in Schools (K12 Education) Program is a Duke Energy Indiana program offering implemented by the National Theatre for Children (NTC). The program provides school performances, tailored to student's grade-level, by NTC's professional actors that teach students about energy and energy conservation in a humorous, engaging, and entertaining format. Performances were delivered virtually, either as a recording or live performance, during the evaluation period due to COVID-19. NTC also provides participating schools with a classroom curriculum to coincide with the performance, which includes energy efficiency kit request forms that student families can use to request a free kit of energy efficiency measures to install in their home.

1.2. Objectives and Results

This report presents the results and findings of evaluation activities for the DEI Energy Efficiency in Schools Program conducted by the Resource Innovations (RI) evaluation team for the program year of August 1, 2020 through July 31, 2021.

1.2.1. Impact Evaluation

The impact evaluation was divided into two tasks: first to determine gross savings (or impacts) and second to determine net savings. Gross impacts are energy and demand savings estimated at a participant's home that are either the direct result of the homeowner's installation of a measure included in the Duke Energy home kit, or the adoption of energy saving behaviors inspired by NTC's performance and Duke Energy's informational materials. Net impacts reflect the degree to which the gross savings are a result of the program efforts and funds.

Table 1-1 and Table 1-2 present the summarized findings of the gross impact evaluation.

Table 1-1: Energy and Demand Savings per Kit

Measurement	Reported Savings	Realization Rate	Gross Verified Savings
Energy (kWh)	358.3	134.3%	481.5
Summer Demand (kW)	0.0570	93.7%	0.0535
Winter Demand (kW)	0.1010	153.0%	0.1546

Table 1-2: Program Savings

Measurement	Population	Reported Savings	Realization Rate	Gross Verified Savings	NTG	Net Savings
Energy (kWh)	4,045	1,449,510	134.3%	1,948,081	92.01%	1,792,416
Summer Demand (kW)		231	93.7%	216		199
Winter Demand (kW)		409	153.0%	620		571

The portion of gross verified savings by measure type are presented in Figure 1-1. Per unit energy and demand savings are presented in Table 1-3 alongside program level freeridership, spillover, and the corresponding net-to-gross (NTG) ratio.

Figure 1-1: Portion of Program Verified Savings by Measure

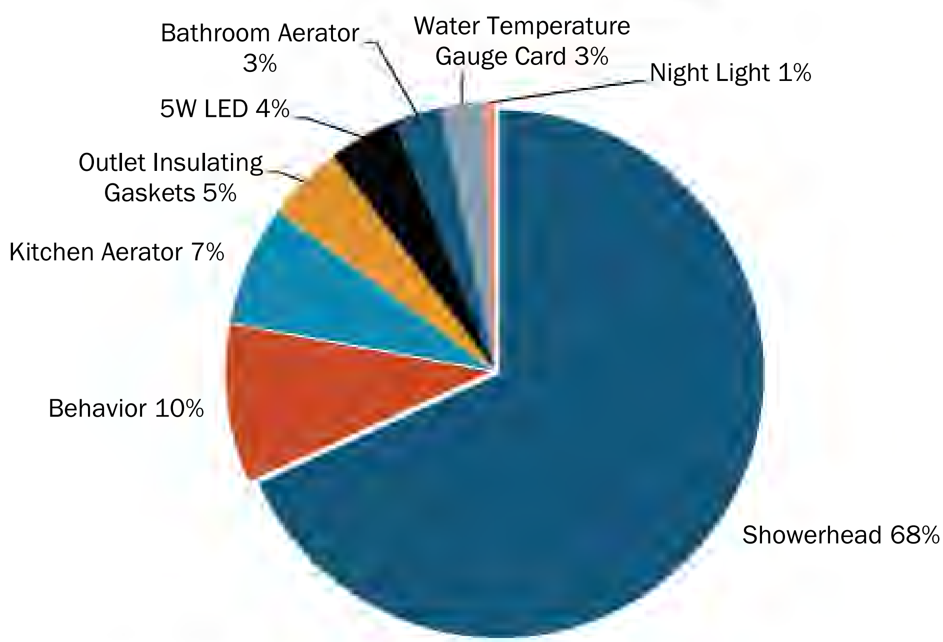


Table 1-3: Verified Impacts by Measure

Measure	Energy Savings (kWh)	Summer Demand Savings (kW)	Winter Demand Savings (kW)	Free Ridership	Spillover	NTG Ratio
Showerhead	328.3	0.0192	0.0827	16.85%	8.00%	91.15%
Kitchen Aerator	35.0	0.0049	0.0063			
Outlet Insulating Gaskets	22.3	0.0035	0.0035			
5W LED	19.9	0.0018	0.0034			
Bathroom Aerator	13.8	0.0027	0.0034			
Water Temperature Gauge Card	12.3	0.0014	0.0014			
Night Light	3.5	0.0000	0.0012			
Behavior*	46.5	0.0201	0.0526	0%	0%	100%
Kit	481.5	0.0535	0.1545	15.22%	7.23%	92.01%

* Adjustment factors were applied to gross verified savings for behavioral measures. Therefore, no NTG adjustments were needed for behavioral measures.

1.2.2. Process Evaluation

The process evaluation informed and assessed opportunities for improving the program's design and delivery in DEI's service territory. The evaluation assessed teacher, student, and parent experiences by investigating: 1) teachers' assessments of the program materials, curriculum, and kits in terms of ease of use, quality of content, and ability to engage and motivate students; and 2) teachers' and student families' responses to the energy efficiency kits and the extent to which the kits are effective in engaging families in energy conservation.

The evaluation team reviewed program documents and web surveys with student families that received a kit (n=168) and teachers who attended the performance (n=18). The team also conducted in-depth interviews with Duke Energy program staff, NTC staff, R1 staff, and four teachers who completed the web survey.

Key findings from the process evaluation include:

- Parents most often requested energy saving kits from the program website.
- Parents were highly satisfied with the kit measures.

- Parents and teachers reported low student use of the Kilowatt Krush app.
- Teachers reported that the NTC performances were engaging, entertaining, and informative.
- Teachers reported that the instructional materials provided by NTC were age-appropriate and aligned with curriculum standards.
- Teachers enjoyed the option of a classroom-specific performance as they were able to hold the performance at a time that was convenient for them.
- Due to COVID-19, the performances for this evaluation period were held virtually. Teachers reported that students were less engaged in the program this year when compared to the in-person performances held previously. This lower engagement may have contributed to the finding that less than half of the students brought home kit request forms. This in turn, may have impacted the total number of kit requests received in this program year.

1.3. Conclusions and Recommendations

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

Conclusion: Teachers were generally satisfied with the material provided and the quality of the National Theatre for Children performances.

> Recommendation: Keep the National Theatre for Children performances to the same quality.
>
> Recommendation: Although the teachers generally reported that the material provided was age-appropriate for their students and aligned with curriculum standards, all interviewed teachers mentioned time as a barrier for using all the instructional material in the kit. The program implementers may want to consider highlighting which information would be most important to present given a time constraint for teachers. This would allow teachers to present all the material should they have the time, as well as help guide teachers who may have time constraints.
>
> Recommendation: For scheduling purposes, teachers suggested keeping the livestream/pre-recorded performance as an option, even though the in-person performance is more engaging, to acknowledge that some schools still need flexibility coming out of the pandemic.

Conclusion: Teacher incentives were appreciated by the teachers, but changes to incentives were suggested.

> Recommendation: Some participating schools are small, making the teacher incentive impossible to reach. Consider scaling the teacher incentive in the program to the size of the school.

Conclusion: Educational material provided in the kit was engaging and useful to parents, but the Kilowatt Krush app was not successful in engaging students after the performance.

Recommendation: Students do not always have access to electronics that support app usage such as smartphones or tablets. Teachers interviewed mentioned, however, that their students (even in low-income schools) are provided with Chromebooks for use in class and at home for homework. If feasible, consider transferring the Kilowatt Krush app content to a website so that teachers may assign Kilowatt Krush activities as part of their lessons or as homework.

Conclusion: Parents generally found the instructional booklet that came with the kit helpful, however many found the booklet too long.

Recommendation: Develop a supplemental one-page guide to present the information from the booklet to families.

Conclusion: Many participants did not install measures from the kit because their current measure was still working, or they already had the item.

Conclusion: Electric water heater saturation continues to decline over previous program evaluations. Low electric water heater saturation among program participants reduces gross verified savings of low-flow showerhead, bathroom aerator, kitchen aerator, water temperature gauge card, and several behavioral change measures.

Recommendation: It may be beneficial to investigate avenues to claim gas savings as part of the program cost effectiveness calculations.

Conclusion: Nearly 16% of survey respondents claim that they did not receive a kit.

Recommendation: A high number of participants claim that they did not receive a kit. It may be beneficial to investigate methods to increase the reliability of kit delivery such as shipping kits with receipt signature required.

2. Introduction and Program Description

2.1. Program Description

2.1.1. Overview

The Energy Efficiency in Schools (K12 Education) Program is an energy efficiency program sponsored by Duke Energy Indiana (DEI). The program provides free performances by the National Theatre for Children (NTC) that teach elementary, middle, and high school students about energy and conservation concepts in a humorous and engaging format. Historically, performances were delivered in-person at participating schools in schoolwide assemblies. However, all performances were delivered virtually during this evaluation period due to COVID-19 concerns. During this evaluation period, teachers were also able to choose whether they held the performance in their classroom, or as a school wide performance.

In addition to the NTC performance, NTC provides teachers with: 1) student workbooks that reinforce topics taught in the NTC performance, including a take-home form that students and parents can complete to request an energy efficiency starter kit (kit) from Duke Energy[1]; and 2) instructional material for teachers associated with the content in the student workbooks. All workbooks, assignments and activities meet state curriculum requirements. The NTC performers encourage students to have their parents request the kits.

The program can achieve energy savings in two ways:

1. Through the installation of specific energy efficiency measures provided in the kit.
2. By increasing students' and their families' awareness about energy conservation and engaging them to change behaviors to reduce energy consumption.

2.1.2. Energy Efficiency Kit Measures

Table 2-1 lists the kit contents included in the program. The contents of all kits provided by the program are identical.

[1] All families can request kits, regardless of whether they are Duke Energy customers to contribute to classroom numbers of kit requests. However, only Duke Energy customers will be eligible to receive a kit.

Table 2-1: Kit Measures

Measure	Details
5 Watt LEDs	2 LED clear candelabra bulbs, 5 Watts each
Nightlight	1 LED Nightlight, 0.3 Watts
Showerhead	1 Low-flow showerhead, 1.5 GPM
Bathroom Faucet Aerator	1 Low-flow bathroom aerator, 1.0 GPM
Kitchen Faucet Aerator	1 Low-flow kitchen aerator, 1.5 GPM
Water Temperature Gauge Card	1 Temperature gauge card indicating water temperature
Outlet Insulating Gaskets	12 Switch and outlet sealing gaskets
Energy Saving Behaviors	Performances by NTC, teacher instructional materials, Department of Energy booklets, a guide on how to install the measures, and the Kilowatt Krush app encouraging changes in behavior to reduce energy consumption

2.2. Program Implementation

2.2.1. Program Marketing and School Recruitment

Duke Energy sends NTC a list of approved schools in each utility territory, which NTC's communications staff uses to contact schools to schedule NTC performances. These communications include phone calls, emails, and postcards describing the program. During this program year, teachers reported that the majority of the communication occurred over email. Once a school has agreed to participate, NTC ships curriculum materials to participating schools approximately two weeks prior to the performance date.

2.2.2. NTC Performance

NTC has four shows tailored to different grade levels: two for elementary age students (Kindergarten through 2nd grade and another for grades 3 through 5), another for middle school age students (6th through 8th grade), and a new offering for high school students (9th through 12th grade). Two actors perform in each show, where they use an entertaining, humorous, and interactive format to educate students on four general areas:

- Sources of energy
- How energy is used
- How energy is wasted
- Energy efficiency and conservation

Performers also discuss how their utility offers students and their families free energy efficiency starter kits, how the items in the kit can save energy in their homes, ways to sign up for the kit, and hand out collateral to remind students of these tips.

2.2.3. Kit Form Promotion

In the performance, the actors explain to students that they must fill out the kit request form to receive their kit. Following the performance, teachers give their students the NTC workbooks that – in addition to educational activities to reinforce the concepts from the NTC performance – include a detachable postage-prepaid postcard kit request form. Students take the form home to their parents or guardians, who complete and mail the form. Parents or guardians may also request a kit via a toll-free telephone number or by signing up at MyEnergyKit.org, the program website administered by NTC. The latter mode of sign up was the most popular in 2020-2021. To encourage participation, for every 100 parents to sign up, their children's school receives $250.

2.2.4. Kit Distribution

Duke Energy uses two vendors to fulfill kit requests: R1 and AM Conservation. The participant's eligibility is confirmed by the firm R1 who manages and processes kit requests (both paper and online), removes non-Duke customers from the eligibility list, and sends this to Duke Energy, who also cleans this data and verifies the participant's eligibility and contact information. Once this is complete, the cleaned participation list is sent back to R1, as well as AM Conservation. A fulfillment request is then sent to AM Conservation who has 9 business days to ship the kits. Customers are told to expect 4-6 weeks for delivery of their energy kit, though this will generally happen much more quickly.

2.2.5. Energy Kit Eligibility

Student families can only receive a kit once every 36 months and must be Duke Energy customers. The schools where the performances occur must also be a Duke Energy customer. These eligibility requirements present challenges in finding and motivating new schools, as well as new student families, to participate.

2.2.6. Participation

For the defined evaluation period of August 1, 2020 through July 31, 2021, the program recorded a total of 4,804 kit recipients.

2.2.7. Program Changes

There were two major changes made to the program for PY 2020-2021.

Due to the COVID-19 pandemic, NTC was required to change their programming from in-person to virtual performances. NTC offered both livestream and pre-recorded performance options. For the livestream performance, classrooms were to open the performance link at a designated time and the performers would be presenting virtually as the students were watching from their classroom. This option allowed for more personalization and engagement as performers were able to give specific shout-outs to the schools that were watching, as well as a chat function which allowed students to send in questions and comments to the performers. The pre-recorded performance option was a video that teachers were able to play at any time to their classrooms.

Next, due to the aforementioned restrictions, the program learned the more effective method of soliciting school performances was to change outreach from school-focused to teacher-focused. Prior to the pandemic, NTC performances were held in person at schoolwide assemblies. However, due to COVID-19 regulations, such as social distancing, the program began offering a classroom performance option where teachers played the virtual performance, whether livestream or prerecorded, just to their classroom groups. This may have influenced kit request numbers as performances that previously reached hundreds of students at a time, were now only reaching one classroom.

This change to the program was circumstantial given COVID-19 restrictions and the performances are expected to return to in-person for the 2022-2023 school year. However due to positive feedback from teachers and schools, the virtual performances may still be an option in future iterations of the program.

2.3. Research Objectives

Over-arching project goals follow the definition of impact evaluation established in the "Model Energy-Efficiency Program Impact Evaluation Guide – A Resource of the National Action Plan for Energy Efficiency," November 2007:

"Evaluation is the process of determining and documenting the results, benefits, and lessons learned from an energy-efficiency program. Evaluation results can be used in planning future programs and determining the value and potential of a portfolio of energy-efficiency programs in an integrated resource planning process. It can also be used in retrospectively determining the performance (and resulting payments, incentives, or penalties) of contractors and administrators responsible for implementing efficiency programs."

Evaluation has two key objectives:

1) To document and measure the effects of a program and determine whether it met its goals with respect to being a reliable energy resource.

2) To help understand why those effects occurred and identify ways to improve the program.

2.3.1. Impact

As part of evaluation planning, the evaluation team outlined the following activities to assess the impacts of the DEI Energy Efficiency in Schools Program:

- Quantify accurate and supportable energy (kWh) and peak demand (kW) savings for energy efficient measures implemented in participants' homes;
- Assess the rate of free riders from the participants' perspective and determine spillover effects;
- Benchmark verified measure-level energy impacts to applicable technical reference manual(s) and other Duke similar programs in other jurisdictions.

2.3.2. Process

The process evaluation assessed opportunities for improving the design and delivery of the program in DEI service territory. It specifically documented teacher, student, and parent experiences by investigating: 1) teachers' assessments of the NTC performance, program materials, and curriculum in terms of quality of content, and ability to engage and motivate students to save energy; and 2) student families' responses to the energy efficiency kits and the extent to which the kits effectively motivate families to save energy.

The evaluation team assessed several elements of the program delivery and customer experience, including:

- Awareness:
    - How aware are teachers and student families of DEI's sponsorship of the program?
    - How did they become aware?
- Program experience and satisfaction:
    - How satisfied are teachers with the NTC performance and program curriculum in terms of ease of use, ability to engage, and motivate students to conserve energy at home?
    - How satisfied are student families with the measures in the kit and to what extent do the kits motivate families to save energy?
    - How is the phone app Kilowatt Krush being received by teachers and families?
- Challenges and opportunities for improvement:
    - Program staff report that the program has received participation of only 40-50% of its pre-COVID-19 participation. What driver(s) are leading to this significant reduction in participation?
        - Were fewer schools and/or fewer students able to participate due to COVID-19 restrictions?
    - Are there any systemic (i.e., non-COVID-19 related) inefficiencies or challenges associated with program delivery?
    - How engaged are teachers in implementing the curriculum and motivating student families to request program kits?

        - Have changes in schools due to COVID-19 affected how teachers interact with the program (e.g., teachers are too busy, teachers need different resources to adapt better to remote learning, school policy, not a priority for teacher, etc.)?
    - What are teachers' assessments of the NTC performance, program information, and curriculum?
- Student family characteristics:
    - What are the demographic characteristics of kit recipients?

2.4. Evaluation Overview

The evaluation team divided its approach into key tasks to meet the outlined goals:

Task 1 – Develop and manage evaluation work plan to describe the processes that will be followed to complete the evaluation tasks outlined in this project;

Task 2 – Conduct a process review to determine how successfully the programs are being delivered to participants and to identify opportunities for improvement;

Task 3 – Verify gross and net energy and peak demand savings resulting from the Energy Efficiency in Schools Program through verification activities of a sample of 2020-2021 program participants.

2.4.1. Impact Evaluation

The impact evaluation was comprised of the following key steps, which are described in further detail in Section 3:

Advanced Metering Infrastructure (AMI) data analysis: Home-level AMI consumption data was analyzed to determine if savings due to the program could be discerned. The team's false experiments indicated that savings were not discernable using an AMI data approach. Therefore, the evaluation team deferred to a savings analysis approach based on engineering algorithms.

Family surveys: As part of a joint data collection effort with the process portion of the evaluation, the impact evaluation conducted a web-based survey of the participants. These surveys included questions pertaining to key savings parameters such as in-service rates and water heater fuel saturation. Table 2-2 below summarizes the number of surveys completed.

Estimate gross savings: Data collected via participant surveys were used as inputs to engineering algorithms to calculate gross verified energy and demand savings for each measure. The ratio of verified (ex post) savings to reported (ex-ante) savings within the sample produced the realization rate. The realization rate was then applied to the program population's reported savings to yield program-level gross verified savings estimates.

Estimate net savings: Net impacts are a reflection of the degree to which the gross savings are a result of the program efforts and incentives. The evaluation team estimated free-ridership and spillover based on self-report methods through surveys with program participants. The ratio of net verified savings to gross verified savings is the net-to-gross ratio, and applied as an adjustment factor to the reported savings.

2.4.2. Process Evaluation

Process evaluation examines and documents:

- Program operations
- Stakeholder satisfaction
- Opportunities to improve the efficiency and effectiveness of program delivery

To satisfy the EM&V objectives for this research effort, the evaluation team reviewed program documents and conducted web surveys with participating student families and teachers who attended the performance. These surveys served both the process and impact evaluation work.

The team also held in-depth interviews (IDI) with utility staff, implementation staff, and teachers. Table 2-2 provides a summary of the evaluation team activities.

Table 2-2: Summary of Process Evaluation Activities

Target Group	Method	Sample Size
Duke Energy program staff, NTC, R1 Staff	Phone Interview	3
Teachers	Web Survey	18
Teachers volunteering for additional interview	Phone Interview	4
Student Families (kit recipients and Duke Energy customers)	Web Survey	168*

*The process analysis included those families that reported not receiving a kit as they were established to still have valuable insights into the NTC program more generally.

3. Impact Evaluation

3.1. Methodology

The evaluation team's impact analysis focused on the energy and demand savings attributable to the Energy Efficiency in Schools Program for the period of August 2020 through July 2021. The evaluation was divided into two research areas: to determine gross savings and net savings (or impacts). Gross impacts are energy and demand savings estimated at a participant's home that are the direct result of the homeowner's installation of a measure included in the program-provided energy saving kit. Net impacts are a reflection of the degree to which the gross savings are a result of the program efforts and funds. The evaluation team verified energy and demand savings attributable to the program by conducting the following impact evaluation activities:

- Review of the DEI participant database.
- Completion of web-based surveys to verify key inputs into savings calculations.
- Estimation of verified savings using primary data collected from participants.
- Comparison of the gross verified savings to program reported savings to determine a kit-level realization rate.
- Application of attribution survey data to estimate a net-to-gross ratio and net-verified savings at the program level.

3.2. Sampling Plan and Achievement

To provide representative results and meet program evaluation goals, a sampling plan was created to guide all evaluation activity. A random sample was created to target 90/10 confidence and precision at the program level assuming a coefficient of variation (C_v) equal to 0.5.

After reviewing the program database, the evaluation team identified a population of 4,804 participants within the defined evaluation period. Customers who were flagged as “do not contact” in the participation database were excluded from the sample frame. As illustrated in Table 3-1 below, the evaluation completed 144 surveys among program participants between June 23rd and July 20th, 2022. This sample size resulted in a precision of ±6.8 at a 90% confidence interval.

Table 3-1: Impact Sampling

Population	Sample Size	Precision at 90% Confidence
4,804	144*	±6.8%

*The impact evaluation includes only those families that reported receiving a kit.

3.3. Description of Analysis

3.3.1. Family Web Surveys

The evaluation team administered web-based surveys to gather key pieces of information used in savings calculations. Results of the completed surveys were used to inform our program-wide assumptions as detailed in Table 3-2.

Table 3-2: Family Data Collected and Used for Analysis

Measure	Data Collected	Assumption
5W LEDs Night Light	Units Installed	In-Service Rate
	Units Later Removed	
	Location Installed	Annual Hours of Use
	Base Lamp Type	Base Lamp Wattage
Showerhead	Units Installed	In-Service Rate
	Units Later Removed	
	Hot Water Fuel Type	% Electric DHW
	Frequency of Showers	Hot Water Consumption
	Duration of Showers	
Bathroom Faucet Aerator Kitchen Faucet Aerator	Units Installed	In-Service Rate
	Units Later Removed	
	Hot Water Fuel Type	% Electric DHW
	Residents per Home	Hot Water Consumption
Outlet Insulating Gaskets	Units Installed	In-Service Rate
	Units Later Removed	
Water Temperature Gauge Card	Hot Water Setback Performed	In-Service Rate
	Hot Water Setback Later Undone	
	Hot Water Fuel Type	% Electric DHW
Energy Savings Behaviors	New Behaviors	Adoption Rate
	Existing Behaviors	
	Influence of Energy Savers Booklet	Adjustment Factors
	Influence of Kit and Materials	

3.3.2. In-Service Rate

The in-service rate (ISR) represents the ratio of equipment installed and operable to the total pieces of equipment distributed and eligible for installation. For example, if 15 telephone surveys were completed for customers receiving 1 night light each, and five customers reported to still have the night light installed and operable, the ISR for this measure would be 5 out of 15, or 33%. In some instances, equipment was installed but may have been removed later due to homeowner preferences. In these cases, the equipment is no longer operable and therefore contributes negatively to the ISR. In-service rates for each measure from all eligible survey respondents are detailed in Table 3-3 and are used to adjust measure level savings to accurately reflect equipment in use.

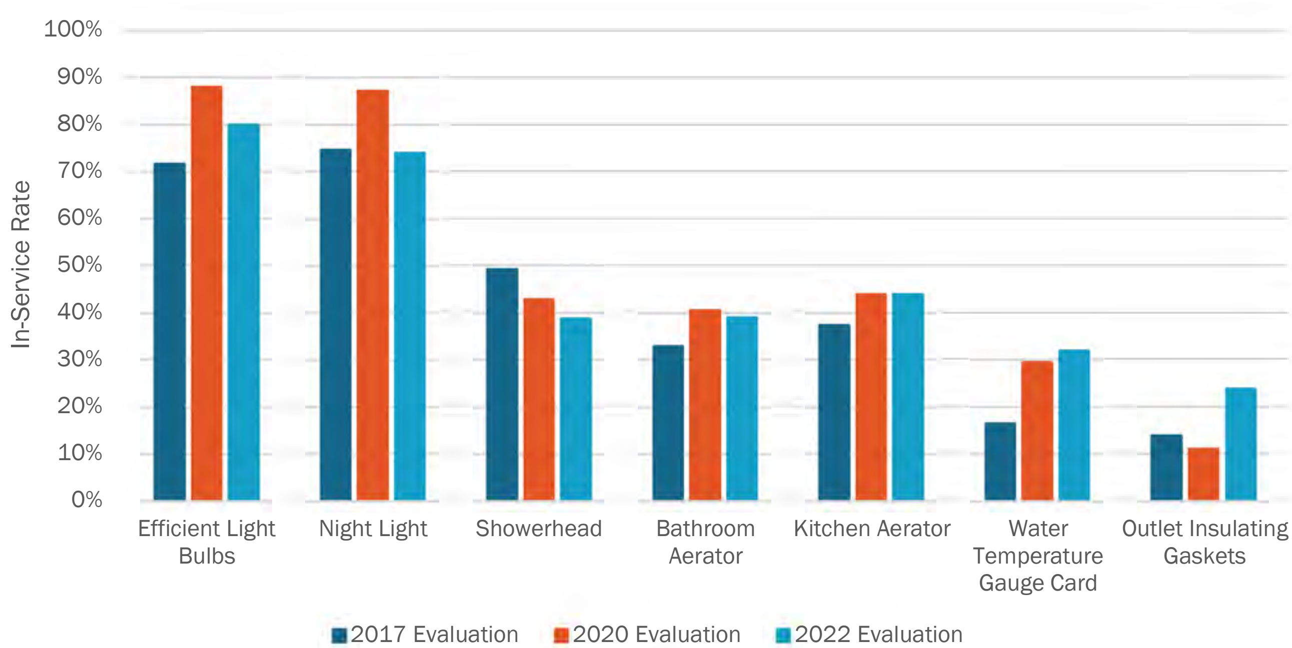
Table 3-3: Sample In-Service Rates

Measure	Distributed	Installed	Removed	ISR
5W LEDs	254	211	8	80%
Night Light	127	104	10	74%
Kitchen Aerator	141	64	2	44%
Showerhead	137	63	10	39%
Bathroom Aerator	141	57	2	39%
Water Temperature Gauge Card	113	38	2	32%
Outlet Insulating Gaskets	1,728	412	2	24%

Figure 3-1 shows historical in-service rates for physical measures distributed through the program. LEDs, night lights, and showerheads were found to have a lower in-service rate compared to the 2020 program evaluation. The outlet insulating gasket in-service rate is much higher than previous program evaluations. Bathroom aerator, kitchen aerator, and water temperature gauge card measure in-service rates are relatively consistent compared to the 2020 program evaluation.[2,3]

[2] Energy Efficiency Education in Schools Program Year 2015-2016 Evaluation Report, July 28th, 2017
[3] K12 Education Program 2018-2019 Evaluation Report, November 2nd, 2020

Figure 3-1: Historical Equipment In-Service Rates



3.3.3. Kit Measure Savings

The following section of this report provides a summary of the algorithms used to estimate energy and demand savings for each of the kit items. As much as possible, input parameters referenced program participant responses from the family surveys. For inputs more technical in nature and which could not reliably be collected in participant surveys, the evaluation applied deemed values provided by Indiana TRM v2.2.

Verified savings were calculated individually for each measure and participant, then those savings were averaged to derive the measure level savings presented in the remainder of this section and in Section 3.4.

3.3.3.1. Showerheads

The Energy Education in Schools Kit contained one low-flow showerhead. The algorithm provided by Indiana TRM v2.2 determines average showerhead savings by calculating the total shower use in the home across all showerheads and dividing by the number of showerheads per home. The survey instrument developed for this evaluation collected data that is relevant to only the showerheads replaced through the program. This was done by asking survey respondents to indicate the average minutes per shower and average showers per day specifically for each showerhead that was retrofitted using fixtures provided by the program. Energy and demand savings algorithms provided by Indiana TRM v2.2 were therefore modified to make use of the data collected in order to present a more accurate estimation of savings from this measure.

Demand savings coincident factors (CF) for the summer and winter seasons were estimated to align with peak demand periods[4] using the study on residential domestic hot water use referenced by the Indiana TRM[5]. This method considers the average hot water use by fixture type (showerhead, faucet aerator) during the peak period along with the probability of the evaluated daily hours of use occurring within that time frame.

Equation 3-1 and Equation 3-2 below outline the algorithms utilized to estimate savings accrued by the showerhead measure. Algorithm input parameters for the 2022 evaluation are shown in Table 3-4. For comparison, Table 3-4 also presents the algorithm input parameters from the 2020 evaluation.

Equation 3-1: Showerhead Energy Savings Algorithm

$$\Delta kWh = ISR \times ELEC \times \frac{(GPM_{base} - GPM_{low}) \times \left(\frac{Avg.Time}{Showe}\right) \times \left(\frac{Avg.Total\ Showers\ Taken}{Day}\right) \times 365 \times 8.3 \times (T_{Mix} - T_{in})}{3412 \times RE}$$

Equation 3-2: Showerhead Demand Savings Algorithm

$$\Delta kW = ISR \times ELEC \times \frac{(GPM_{base} - GPM_{low}) \times 60 \times 8.3 \times (T_{Mix} - T_{in})}{3412 \times RE} \times CF$$

[4] The Duke Energy Indiana jurisdiction defines their demand peaks as 3pm to 4pm during July (Summer) and 7am to 8am during January (Winter)

[5] Aquacraft, DeOreo and Mayer, *The End Uses of Hot Water in Single Family Homes from Flow Trace Analysis*

Table 3-4: Inputs for Showerhead Savings Calculations

Variable	Source	2022 Evaluation	2020 Evaluation
ISR	Family Survey	39%	43%
ELEC	Family Survey	47%	65%
GPM_{base}	Federal code maximum	2.5	2.5
GPM_{low}	Program provided equipment	1.5	1.5
Time/MS	Family Survey	12.5	9.8
SPD_{Total}	Family Survey	2.62*	
PH	Family Survey		3.9
SPD_{Person}	Family Survey		0.60
SH	Family Survey		1.6
365	Days per year	365	365
60	Minutes per hour	60	60
3,412	Btu per kWh	3,412	3,412
8.3	Btu per gallon per degree Fahrenheit	8.3	8.3
T_{Mix}	Indiana TRM v2.2	101	101
T_{in}	Indiana TRM v2.2	58.1	58.1
RE	Indiana TRM v2.2	0.98	0.98
CF_{Summer}	Indiana TRM v2.2, adjusted	0.0142	0.0076
CF_{Winter}	Indiana TRM v2.2, adjusted	0.0611	0.0329

*SPD_{Total} was directly collected in surveys during the 2021 evaluation through asking participants to respond specifically about the showerhead(s) replaced through the program. In the 2019 evaluation, SPD_{Total} was calculated using a more general approach, collecting PH (people per home), SPD_{Person} (showers taken per day per person in all showers in the home), and SH (quantity of showers in the home).

As Table 3-4 shows, the TRM deemed input parameters did not change between the two evaluations. However, this evaluation relied on family survey data, in place of TRM deemed inputs, to determine average shower use in participating homes. This change results in significant increases to gross verified energy savings, despite in-service rates and electric water heater saturation that are lower than the previous evaluation. Demand savings also increased, as daily average shower use is an input parameter for the calculation of adjusted coincidence factors. Average kit savings attributable to the showerhead measure are presented in Table 3-5.

Table 3-5: Showerhead Gross Verified Savings Per Kit

Energy (kWh)	Summer Demand (kW)	Winter Demand (kW)
328.3	0.0192	0.0827

3.3.3.2. Faucet Aerators

The Energy Efficiency in Schools Kit contained one kitchen faucet aerator and one bathroom faucet aerator. Equation 3-3 and Equation 3-4 below outline the algorithms utilized to estimate savings accrued by the faucet aerator measures.

Equation 3-3: Faucet Aerator Energy Savings Algorithm

$$\Delta kWh = ISR \times ELEC \times \frac{(GPM_{base} - GPM_{low}) \times MPD \times PH \times 365 \times DR \times 8.3 \times (T_{Mix} - T_{in})}{FH \times 3412 \times RE}$$

Equation 3-4: Faucet Aerator Demand Savings Algorithm

$$\Delta kW = ISR \times ELEC \times \frac{(GPM_{base} - GPM_{low}) \times 60 \times DR \times 8.3 \times (T_{Mix} - T_{in})}{3412 \times RE} \times CF$$

The algorithm input parameters provided for kitchen and bathroom faucet aerators are shown in Table 3-6 and Table 3-8, respectively. As with for showerheads measures, Table 3-6 and Table 3-8 present the algorithm input parameters from the 2020 evaluation as well for comparison.

Table 3-7 and Table 3-9 present the gross verified savings per kit for kitchen aerators and bathroom aerators, respectively.

Table 3-6: Inputs for Kitchen Aerator Savings Calculations

Variable	Source	2022 Evaluation	2020 Evaluation
ISR	Family Survey	44%	44%
ELEC	Family Survey	47%	63%
GPM_{base}	Federal code maximum	2.2	2.2
GPM_{low}	Program provided equipment	1.5	1.0
MPD	Indiana TRM v2.2	4.5	4.5
PH	Family Survey	3.7	3.7
FH	Family Survey	1.1	1.0
365	Days per year	365	365
60	Minutes per hour	60	60
3,412	Btu per kWh	3,412	3,412
8.3	Btu per gallon per degree Fahrenheit	8.3	8.3
DR	Indiana TRM v2.2	50%	50%
T_{Mix}	Indiana TRM v2.2	93	93
T_{in}	Indiana TRM v2.2	58.1	58.1
RE	Indiana TRM v2.2	0.98	0.98
CF_{Summer}	Indiana TRM v2.2, adjusted	0.0122	0.0045
CF_{Winter}	Indiana TRM v2.2, adjusted	0.0157	0.0058

All TRM inputs for the kitchen aerator measure were consistent between evaluations. In-service rate also remained unchanged from the 2020 evaluation. However, electric water heater saturation decreased significantly among families who installed this measure, resulting in lower savings.

There is also a significant difference in adjusted coincidence factors between the 2020 and 2022 evaluations. Daily minutes of household faucet use, as determined by minutes of faucet use per person per day (MPD) and people per household (PH), is the primary input parameter in calculating adjusted coincidence factors. These input parameters are consistent between the 2020 and 2022 evaluations, so a large variation in coincidence factors was not expected. However, the 2020 evaluation leveraged coincidence factors calculated in the DEI Save Energy and Water Kits Program (SEWKP) 2020 Evaluation[6], which differed from this evaluation calculation in two ways. First, the 2020 DEI SEWKP Evaluation applied an overly conservative adjustment methodology that accounted for the fraction of water flowing down drains (DR). Second, the SEWKP program also showed a lower number of people per home (PH) of 2.6. The Energy Efficiency in Schools program shows a higher

[6] Save Energy and Water Kits 2018-2019 Evaluation Report, prepared for Duke Energy Indiana, June 10, 2020

number of people per home, as would be expected of a program that targets families with children when compared to the general DEI residential customer population the SEWKP targets.

Table 3-7: Kitchen Aerator Gross Verified Savings Per Kit

Energy (kWh)	Summer Demand (kW)	Winter Demand (kW)
35.0	0.0049	0.0063

Table 3-8: Inputs for Bathroom Aerator Savings Calculations

Variable	Source	2022 Evaluation	2020 Evaluation
ISR	Family Survey	39%	41%
ELEC	Family Survey	47%	59%
GPM_{base}	Federal code maximum	2.2	2.2
GPM_{low}	Program provided equipment	1.0	1.0
MPD	Indiana TRM v2.2	1.6	1.6
PH	Family Survey	3.7	3.7
FH	Family Survey	2.4	2.0
365	Days per year	365	365
60	Minutes per hour	60	60
3,412	Btu per kWh	3,412	3,412
8.3	Btu per gallon per degree Fahrenheit	8.3	8.3
DR	Indiana TRM v2.2	70%	70%
T_{Mix}	Indiana TRM v2.2	86	86
T_{in}	Indiana TRM v2.2	58.1	58.1
RE	Indiana TRM v2.2	0.98	0.98
CF_{Summer}	Indiana TRM v2.2, adjusted	0.0043	0.0014
CF_{Winter}	Indiana TRM v2.2, adjusted	0.0056	0.0018

In line with kitchen faucet aerators, all TRM based inputs in Table 3-8 for bathroom aerators remained the same from the 2020 evaluation, and electric water heater saturation decreased. In-service rate for this measure also decreased relative to the previous evaluation. There was also a significant discrepancy in adjusted coincidence factors, as discussed above for the kitchen aerator measure. Table 3-8 presents kit savings attributable to the bathroom aerator measure.

Table 3-9: Bathroom Aerator Gross Verified Savings Per Kit

Energy (kWh)	Summer Demand (kW)	Winter Demand (kW)
13.8	0.0027	0.0034

3.3.3.3. Water Temperature Gauge Card

The kit also encourages participants to reduce the temperature setting of their water heater through the use of a Water Temperature Gauge Card. A temperature scale is embedded in the card to inform the user if their hot water is above 120 F. Excessively high water heater temperatures lead to greater stand-by losses from the heater's water tank. This information can then be used to determine if water heater temperature should be reduced, resulting in energy savings for the home. Savings methodology and parameters were sourced from Illinois TRM v10.0. Energy and demand savings algorithms associated with reduced water heater temperature are outlined below in Equation 3-5 and Equation 3-6.

Equation 3-5: Water Temperature Gauge Card Energy Savings Algorithm

$$\Delta kWh = ISR \times ELEC \times \frac{U \times A \times (T_{base} - T_{new}) \times Hours}{RE \times 3{,}412 \frac{Btu}{kWh}}$$

Equation 3-6: Water Temperature Gauge Card Demand Savings Algorithm

$$\Delta kW = \frac{\Delta kWh}{Hours} \times CF$$

In the same format as showerheads and faucet aerators above, algorithm input parameters for both 2020 and 2022 evaluations are shown in Table 3-10.

Table 3-10: Inputs for Water Temperature Gauge Card Savings Calculations

Variable	Source	2022 Evaluation	2020 Evaluation
ISR	Family Survey	32%	29%
ELEC	Family Survey	47%	62%
U	Illinois TRM v10.0	0.083	0.083
A	Illinois TRM v10.0	24.99	24.99
T_{base}	Illinois TRM v10.0	135	135
T_{new}	Kit Information Materials	120	120
Hours	Illinois TRM v10.0	8,760	8,760
RE	Illinois TRM v10.0	0.98	0.98
CF_{Summer}	Illinois TRM v10.0	1.0	1.0
CF_{Winter}	Illinois TRM v10.0	1.0	1.0

Table 3-10 shows consistent deemed TRM input parameters between the 2020 and 2022 evaluations. In-service rate increased slightly, while electric water heater saturation decreased significantly compared to the previous evaluation. Kit savings attributable to this measure are presented below in Table 3-11.

Table 3-11: Water Temperature Gauge Card Gross Verified Savings Per Kit

Energy (kWh)	Summer Demand (kW)	Winter Demand (kW)
12.3	0.0014	0.0014

3.3.3.4. Lighting

The lighting measures in the kit include two 5 Watt LEDs and an LED nightlight. Equation 3-7 and Equation 3-8 outline the algorithms utilized to estimate savings accrued by lighting measures. Key parameters for the 5W LED measures are defined in Table 3-12, while night light key parameters are given in Table 3-14.

Equation 3-7: Lighting Energy Savings Algorithm

$$\Delta kWh = ISR \times \frac{Watts_{Base} - Watts_{EE}}{1000\frac{W}{kW}} \times HOU \times (1 + WHF_E) \times 365\frac{Days}{Year}$$

Equation 3-8: Lighting Demand Savings Algorithm

$$\Delta kW = ISR \times \frac{Watts_{Base} - Watts_{EE}}{1000\frac{W}{kW}} \times (1 + WHF_D) \times CF$$

Table 3-12: Inputs for 5 Watt LED Savings Calculations

Variable	Source	2022 Evaluation	2020 Evaluation
ISR (ALL)	Family Survey	80%	88%
ISR (LED1)*	Family Survey	84%	
ISR (LED2)*	Family Survey	76%	
$Watts_{Base}$ (ALL)	Family Survey	18.3	29.1
$Watts_{Base}$ (LED1)*	Family Survey	18.4	
$Watts_{Base}$ (LED2)*	Family Survey	18.2	
$Watts_{EE}$	Program Provided Equipment	5	9
Daily HOU (ALL)	Family Survey	2.90	2.72
Daily HOU (LED1)*	Family Survey	3.41	
Daily HOU (LED2)*	Family Survey	2.33	
WHF_E	Indiana TRM v2.2	-0.059	-0.059
WHF_D	Indiana TRM v2.2	0.057	0.057
CF_{Summer}	DEO Residential Lighting LED HOU Study	0.08	0.08
CF_{Winter}	DEO Residential Lighting LED HOU Study	0.15	0.14

*The 2020 evaluation report did not provide disaggregated ISR, baseline wattage, and daily HOU for each individual LED installed through the program.

In-service rate decreased slightly compared to the 2020 evaluation. This may be due to a change in the style of light bulb provided, as the kit now includes candelabra style light bulbs instead of the general purpose light bulbs that were previously provided by the program.

Baseline lamp wattage was estimated based on survey responses that asked families about the type of bulb removed when they installed their new 5W LEDs. The survey offered participants the choice of incandescent (32.5W), halogen (23W), compact fluorescent (7.5W), or LED (5W) lamps as baseline options. The appropriate baseline wattage was applied to each participating family, based on their survey responses. A similar process was followed to determine daily hours of use (HOU) for LED lighting, as participants were asked which room type best describes the location where kit provided LEDs were installed. An estimated daily HOU was applied to each room type based on a study completed for Duke Energy Ohio in 2018.[7] As Table 3-12 shows, the 2022 evaluation found that baseline wattages decreased relative to the 2020 evaluation, while daily HOU increased slightly.

It is important to show savings associated with each individual LED provided in the kit, as there is some variation between in-service rates for the first LED and the second LED. Gross energy and demand savings for each LED, as well as the total savings of all LEDs in the kit, are summarized in Table 3-13.

Table 3-13: 5 Watt LED Gross Verified Savings Per Kit

Item	Energy (kWh)	Summer Demand (kW)	Winter Demand (kW)
LED 1	12.2	0.0010	0.0018
LED 2	7.7	0.008	0.0016
Total	19.9	0.0018	0.0034

[7] Duke Energy Ohio, Energy Efficient Appliances and Devices Program, Appendix 3 – LED HOU Study. June 5th 2018

Table 3-14: Inputs for Night Light Savings Calculations

Variable	Source	2022 Evaluation	2020 Evaluation
ISR (ALL)	Family Survey	74%	87%
$Watts_{Base}$	Family Survey	1.9	2.2
$Watts_{EE}$	Program Provided Equipment	0.30	0.03
Daily HOU	Indiana TRM v2.2	8	8
WHF_E	Indiana TRM v2.2	0	0
WHF_D	Indiana TRM v2.2	0	0
CF_{Summer}	DEO Residential Lighting LED HOU Study	0	0
CF_{Winter}	DEO Residential Lighting LED HOU Study	1	0

Table 3-14 shows that in-service rate and baseline wattage decreased relative to the 2020 evaluation. Baseline lamp wattage was estimated based on survey responses that asked participants the type of night light removed when they installed their new LED night light. The survey offered participants the choice of incandescent (5W) or LED (0.3W) night lights as baseline options. The appropriate baseline wattage was applied to each participating family, based on their survey responses.

Table 3-14 also shows a change in winter peak demand coincidence factor. Duke Energy Indiana's winter peak demand period is defined as 7 AM – 8 AM on weekdays in January. Secondary research showed that the sun does not fully rise until approximately 8 AM in January in Indiana.[8] As such, the night lights are likely still operating during the full winter peak demand period. Gross verified savings for the night light measure are shown in Table 3-15.

Table 3-15: Night Light Gross Verified Savings Per Kit

Energy (kWh)	Summer Demand (kW)	Winter Demand (kW)
3.3	0	0.0013

[8] National Oceanic and Atmospheric Administration, Earth System Research Laboratory, Sunrise/Sunset Calculator, Indianapolis, IN (NOAA Improved Sunrise/Sunset Calculation)

3.3.3.5. Outlet Insulating Gaskets

A set of twelve outlet insulating gaskets were provided in the kit. Gaskets provide sealing to reduce air infiltration through electrical outlets, thereby saving energy through reductions in heating and cooling loads. Equation 3-9 and Equation 3-10 outline the algorithms to determine energy and demand savings. Input parameters for these equations are shown in Table 3-16.

Equation 3-9: Outlet Insulating Gaskets Energy Savings Algorithm

$$\Delta kWh = ISR \times N_{Gaskets} \times \frac{\Delta CFM}{gasket} \times \frac{kWh}{CFM}$$

Equation 3-10: Outlet Insulating Gaskets Demand Savings Algorithm

$$\Delta kW = ISR \times N_{Gaskets} \times \frac{\Delta CFM}{gasket} \times \frac{kW}{CFM}$$

Table 3-16: Inputs for Outlet Insulating Gaskets Savings Calculations

Variable	Source	2022 Evaluation	2020 Evaluation
ISR	Family Survey	24%	11%
$N_{gaskets}$	Quantity Provided by Program	12	12
ΔCFM/gasket	2008 DEK NEED Evaluation Final Report	0.69	0.69
kWh/CFM	Indiana TRM v2.2 with DEI 2019 RASS	11.35	16.64
kW/CFM	Indiana TRM v2.2 with DEI 2019 RASS	0.0018	0.0019

Air reduction per gasket was sourced from an evaluation conducted in the Duke Energy Kentucky Territory in 2008.[9] This evaluation determined air reduction using equivalent leakage area change data taken from the ASHRAE Handbook of Fundamentals. Energy and demand savings were sourced from Indiana TRM v2.2 in conjunction with heating and cooling system saturation from the most recent Residential End-Use Study for Duke Energy.[10]

As Table 3-16 shows, gasket in-service rate increased significantly compared to the 2020 evaluation. However, specific energy savings (kWh/CFM) and specific demand savings (kW/CFM) decreased due to differences in model calibration when accounting for saturation of heating and cooling equipment

[9] Energy Impact Evaluation of the NEED Program in Kentucky, Final Report, September 15th, 2008
[10] 2019 Duke Energy Residential End-Use Study – FINAL.pptx

types. Table 3-17 shows kit-level gross verified energy and demand savings for outlet insulating gaskets.

Table 3-17: Outlet Insulating Gaskets Gross Verified Savings Per Kit

Energy (kWh)	Summer Demand (kW)	Winter Demand (kW)
22.3	0.0035	0.0035

3.3.3.6. Behavioral Measures

Delivery of the Energy Efficiency in Schools program includes performances by NTC, the Energy Savers booklet, instruction materials for teachers, and the Kilowatt Krush app. These program features help to promote energy conservation behaviors in the homes of participating families.

Savings were estimated for each behavioral change as the product of several factors. An engineering analysis was performed to determine unadjusted savings (kWh, Summer Peak kW, and Winter Peak kW) of each behavior. Adoption rates were then applied for each behavior based on family survey responses. Adjustment factors were also applied to account for the influence of the program kit, the influence of kit information materials, and estimated persistence of behavioral changes. Equation 3-11 and Equation 3-12 show the algorithms used to determine savings from behavioral changes.

Equation 3-11: Behavioral Changes Energy Savings Algorithm

$$\Delta kWh = \sum Unadjusted\ kWh \times Adoption\ Rate \times Kit\ Influence \times Kit\ Information\ Materials \times Persistence$$

Equation 3-12: Behavioral Changes Demand Savings Algorithm

$$\Delta kW = \sum Unadjusted\ kW \times Adoption\ Rate \times Kit\ Influence \times Kit\ Information\ Materials \times Persistence$$

The following subsections outline and summarize the analysis methods used to determine unadjusted savings, adoption rates, and adjustment factors.

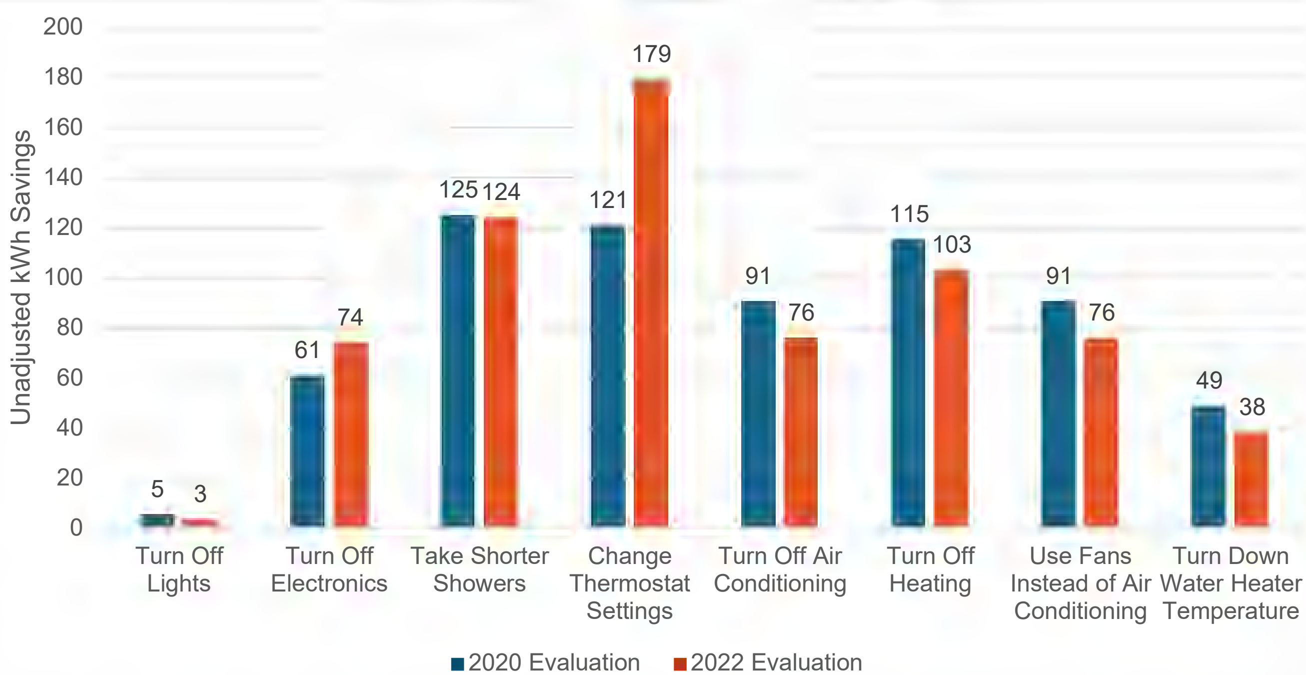
3.3.3.6.1. Unadjusted Behavioral Savings

Engineering analyses were performed to determine unadjusted kWh savings, unadjusted Summer kW savings, and unadjusted Winter kW savings for each behavioral change measure. Unadjusted savings refers to the expected savings of the new behavior, before adjusting for adoption rate, program influence factors, and persistence. The analyses relied on data and methods from TRMs, family survey data, and applicable secondary sources. A summary of unadjusted behavioral savings is given in Table 3-18 and Figure 3-2.

Table 3-18: Energy Efficiency Behavior Unadjusted Gross Verified Savings

Behavior	Energy (kWh)	Summer Demand (kW)	Winter Demand (kW)
Turn Off Lights	3.4	0.0015	0.0029
Turn Off Electronics	74.0	0.0051	0.0051
Take Shorter Showers	124.0	0.0892	0.3846
Change Thermostat Settings	179.0	0.0540	0
Use Fans Instead of Air Conditioning	75.9	0.0540	0
Turn Off Air Conditioning When Not Home	75.9	0.0540	0
Turn Off Heating When Not Home	103.1	0	0.0255
Turn Down Water Heater	38.2	0.0044	0.0044

Figure 3-2: Historical Energy Efficiency Behavior Unadjusted Energy Savings



Turn Off Lights

Turning off lights reduces energy consumption by reducing the hours of use (HOU) for a lighting system. The algorithms to determine energy and demand savings for this behavior are similar to those used to calculate savings for the 5W LED measure included in the kit, as outlined in Equation 3-13 and Equation 3-14.

Equation 3-13: Turn Off Lights Energy Savings Algorithm

$$\Delta kWh = \frac{Watts}{1000\frac{W}{kW}} \times \Delta HOU_{Daily} \times (1 + WHF_E) \times 365\frac{Days}{Year}$$

Equation 3-14: Turn Off Lights Demand Savings Algorithm

$$\Delta kW = \frac{Watts}{1000\frac{W}{kW}} \times (1 + WHF_D) \times CF$$

An estimated daily reduction in HOU was determined based on a study completed for Duke Energy Ohio in 2018.[11] A likely reduction in operating hours was determined as the average difference in lighting hours between different room types in a typical single family home. Daily operating hours by room type, as well as the differences between room types, are shown in Table 3-19.

[11] Duke Energy Ohio, Energy Efficient Appliances and Devices Program, Appendix 3 – LED HOU Study. June 5th 2018

Table 3-19: Difference in Daily Lighting HOU by Room Type

Room Type & Daily HOU		Kitchen 4.33	Dining Room 3.39	Living Room 3.17	Basement 2.88	Other 1.93	Bedroom 1.91	Hallway 1.50	Bathroom 1.40
Kitchen	4.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dining Room	3.39	0.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Living Room	3.17	1.16	0.22	0.00	0.00	0.00	0.00	0.00	0.00
Basement	2.88	1.45	0.51	0.29	0.00	0.00	0.00	0.00	0.00
Other	1.93	2.40	1.46	1.24	0.95	0.00	0.00	0.00	0.00
Bedroom	1.91	2.42	1.48	1.26	0.97	0.02	0.00	0.00	0.00
Hallway	1.50	2.83	1.89	1.67	1.38	0.46	0.41	0.00	0.00
Bathroom	1.40	2.93	1.99	1.77	1.48	0.53	0.51	0.10	0.00

Each entry in Table 3-19 is calculated as the daily HOU from the top row, less the daily HOU from the leftmost column. In cases where this resulted in a daily HOU reduction of less than zero, the calculation defaults to a value of zero. An average of the differences shown in Table 3-19 produces a likely reduction in HOU of 0.54 hours/day.

Wattage was determined as the average of base wattages by baseline lamp type indicated as by the family survey responses for the 5W LED measure. Input parameters for this unadjusted savings calculation are shown in Table 3-20.

Table 3-20: Inputs for Turn Off Lights Savings Calculations

Variable	Source	2022 Evaluation
$Watts_{Base}$	Family Survey	18.3
ΔHOU_{Daily}	DEO Residential Lighting LED HOU Study	0.54
WHFE	Indiana TRM v2.2	-0.059
WHFD	Indiana TRM v2.2	0.057
CF_{Summer}	DEO Residential Lighting LED HOU Study	0.08
CF_{Winter}	DEO Residential Lighting LED HOU Study	0.15
Daily HOU (LED2)	Family Survey	2.33

Unadjusted savings for the Turn Off Lights behavior are given in Table 3-21.

Table 3-21: Turn Off Lights Unadjusted Gross Verified Savings

Energy (kWh)	Summer Demand (kW)	Winter Demand (kW)
3.4	0.0015	0.0029

Turn Off Electronics

Unadjusted savings for turning off electronics behavioral changes were determined by examining Smart Strip or Advanced Power Strip measures of regional TRMs, as well as planning estimates developed for the Smart Strip Entertainment measure for DEI's 2019-2020 Market Potential Study (MPS). Data collected from these sources is listed in Table 3-22, and algorithms to determine savings are given in Equation 3-15 and Equation 3-16.

Equation 3-15: Turn Off Electronics Energy Savings Algorithm

$$\Delta kWh = Average\ Deemed\ kWh\ Savings = \frac{\sum_1^n Annual\ kWh\ Savings}{n}$$

Equation 3-16: Turn Off Electronics Demand Savings Algorithm

$$\Delta kW = \frac{\Delta kWh}{Daily\ Idle\ Time\ (Hours) \times 365} \times CF$$

Table 3-22: Inputs for Turn Off Electronics Savings Calculations

Variable	Source	2022 Evaluation
Annual kWh Savings	Duke Energy Indiana Market Potential Study	65.7
Annual kWh Savings	Illinois TRM v9.0	80.0
Annual kWh Savings	Indiana TRM v2.2	23.0
Annual kWh Savings	Mid-Atlantic TRM v10	112.3
Annual kWh Savings	Pennsylvania TRM, February 2021	88.8
Daily Idle Time (Hours)	Duke Energy Indiana Market Potential Study	20
CF_{Summer}	Indiana TRM v2.2	0.5
CF_{Winter}	Assumed	0.5

The winter coincidence factor was assumed to be the same as the summer coincidence factor based on the results of DEI's MPS. Unadjusted savings for the Turn Off Electronics behavior are presented in Table 3-23.

Table 3-23: Turn Off Electronics Unadjusted Gross Verified Savings

Energy (kWh)	Summer Demand (kW)	Winter Demand (kW)
74.0	0.0051	0.0051

Take Shorter Showers

Taking shorter showers reduces energy consumption of residential water heaters by reducing the average minutes per shower, and therefore hot water consumed during each shower. The algorithms to determine energy and demand savings for this behavior are similar to those used to calculate savings for the showerheads measure included in the kit, as outlined in Equation 3-17 and Equation 3-18.

Equation 3-17: Take Short Showers Energy Savings Algorithm

$$\Delta kWh = ISR \times ELEC \times \frac{GPM \times \Delta Time \times \left(\frac{Avg.\,Total\,Showers\,Taken}{Day}\right) \times 365 \times 8.3\frac{Btu}{gal\cdot°F} \times (T_{Mix} - T_{in})}{3412\frac{Btu}{kWh} \times RE}$$

Equation 3-18: Take Short Showers Demand Savings Algorithm

$$\Delta kW = ISR \times ELEC \times \frac{GPM \times 60 \times 8.3\frac{Btu}{gal\cdot°F} \times (T_{Mix} - T_{in})}{3412\frac{Btu}{kWh} \times RE} \times CF$$

An estimated reduction in shower minutes was determined by comparing family survey responses to the assumed minutes per shower given in Indiana TRM v2.2. Survey responses were grouped into bins of two minutes, with the mean of the bin taken as the estimated shower time. A reduction goal for each bin was then estimated, under the assumption that the goal was to reach the average shower time of 7.8 minutes as given by Indiana TRM v2.2. A reduction goal of zero minutes was assumed for survey respondents who indicated that their average shower time was less than eight minutes. Reduction goals and survey responses are shown in Table 3-24.

Table 3-24: Reduction in Minutes per Shower Based on Family Survey Responses

Minutes Per Shower				Survey Responses	
Bin Start	Bin End	Bin Mean	Reduction Goal	Count	Fraction
0	2	1	0	0	0.0%
2	4	3	0	0	0.0%
4	6	5	0	5	9.4%
6	8	7	0	4	7.5%
8	10	9	1.2	20	37.7%
10	12	11	3.2	0	0.0%
12	14	13	5.2	1	1.9%
14	16	15	7.2	14	26.4%
16	18	17	9.2	0	0.0%
18	20	19	11.2	9	17.0%
20	22	21	13.2	0	0.0%

A weighted average of reduction goal by the fraction of survey responses gives a likely reduction of 4.35 minutes per shower. A summary of input parameters for these savings calculations are presented in Table 3-25.

Table 3-25: Inputs for Take Shorter Showers Savings Calculations

Variable	Source	2022 Evaluation
ELEC	Participant Survey	47%
GPM	Family Survey	2.1
ΔTime	Participant Survey	4.35
SPD_{Person}	Family Survey	0.74
T_{Mix}	Indiana TRM v2.2	101
T_{in}	Indiana TRM v2.2	58.1
365	Days per year	365
RE	Indiana TRM v2.2	0.98
CF_{Summer}	Indiana TRM v2.2, adjusted	0.0142
CF_{Winter}	Indiana TRM v2.2, adjusted	0.0611

Showerhead GPM was applied as either federal code maximum (2.5 GPM) or program provided equipment (1.0 GPM) based on family survey responses indicating if a showerhead from the kit was in-service at the home. Unadjusted savings attributable to taking shorter showers are shown in Table 3-26.

Table 3-26: Take Shorter Showers Unadjusted Gross Verified Savings

Energy (kWh)	Summer Demand (kW)	Winter Demand (kW)
124.0	0.0892	0.3846

Change HVAC Use

Several behavioral changes regarding residential heating, ventilation, and air conditioning (HVAC) can result in significant energy savings if adopted by parents. These include adjusting thermostat settings, using fans instead of air conditioning, turning off air conditioning when not home, and turning off heating when not home. Unadjusted savings for these behaviors were calculated by applying an estimated savings fraction to typical household energy use for heating and cooling systems. The algorithms for determining unadjusted savings of HVAC changes are shown in Equation 3-19 and Equation 3-20.

Equation 3-19: Change HVAC Use Energy Savings Algorithm

$$\Delta kWh = \%\,Savings_{Heat} \times kWh_{Heat} + \%\,Savings_{Cool} \times kWh_{Cool}$$

Equation 3-20: Change HVAC Use Demand Savings Algorithm

$$\Delta kW = \frac{\Delta kWh}{EFLH} \times CF$$

Estimated savings fractions were determined by investigating the deemed savings of smart thermostat measures in several TRMs. Indiana TRM v2.2 was excluded, as the energy savings factors given were much higher than the mean of energy savings fractions given by other, more recently updated, TRMs that were considered. Estimated savings fractions are shown in Table 3-27.

Table 3-27: Annual Smart Thermostat Savings Estimates

Source	% Annual Heating Savings	% Annual Cooling Savings
Illinois TRM v10.0	8.5%	8.4%
Mid-Atlantic TRM v10	6.0%	7.0%
Pennsylvania TRM, February 2021	7.9%	7.5%
Average	7.5%	7.6%

The average annual savings fractions presented in Table 3-27 were then applied to average annual household heating and cooling energy. Annual household heating and cooling energy was estimated as total space heating and air-conditioning electricity use in the East North Central census division of the Midwest United States, as given by the U.S. Energy Information Administration Residential Energy Consumption Survey.[12] A summary is given in Table 3-28.

Table 3-28: Annual Household Heating and Cooling Energy Use

Parameter	Heating Systems	Cooling Systems
Housing Units (Millions)	18.1	
Electricity Use (Billion kWh/year)	25	18
Average Household Electricity Use (kWh/year)	1,381	994

A summary of these factors, as well as other calculation inputs, is presented in Table 3-29.

[12] U.S. Energy Information Administration, Residential Energy Consumption Survey 2015, Table CE4.3, Released May 2018

Table 3-29: Inputs for Change HVAC Use Savings Calculations

Variable	Source	2022 Evaluation
% $Savings_{Heat}$	TRM Estimates	7.5%
% $Savings_{Cool}$	TRM Estimates	7.6%
kWh_{Heat}	US EIA RECS 2015	1,381
kWh_{Cool}	US EIA RECS 2015	994
$EFLH_{Heat}$	DEI Smart $aver Evaluation 2020-2021	1,652
$EFLH_{Cool}$	DEI Smart $aver Evaluation 2020-2021	409
CF_{Summer}	DEI Smart $aver Evaluation 2020-2021	0.291
CF_{Winter}	DEI Smart $aver Evaluation 2020-2021	0.408

Calculation inputs were used to determine energy, summer peak demand, and winter peak demand savings for each of the four behavioral changes related to HVAC use. Changing thermostat settings is expected to provide energy savings in both heating and cooling seasons, as well as summer peak demand savings. Reductions in air conditioning use, either by using fans when home or by turning off the system when not home, provide cooling season energy savings and summer peak demand savings. Turning off heating when not home provides heating season energy savings and winter peak demand savings. Unadjusted savings attributable to changes in HVAC use are given in Table 3-30.

Table 3-30: Change HVAC Use Unadjusted Gross Verified Savings

Behavior	Energy (kWh)	Summer Demand (kW)	Winter Demand (kW)
Change Thermostat Settings	179.0	0.0540	0
Use Fans Instead of Air Conditioning	75.9	0.0540	0
Turn Off Air Conditioning When Not Home	75.9	0.0540	0
Turn Off Heating When Not Home	103.1	0	0.0255

Turn Down Water Heater

Excessively high water heater temperatures contribute to greater stand-by losses from the heater's water tank. Participating families are encouraged to reduce the temperature setting of their domestic water heaters through a variety of educational methods. However, the kit also includes a Water Temperature Gauge Card measure as described in Section 3.3.3.3. Families that indicated they used the Water Temperature Gauge Card were not allotted savings for the Turn Down Water Heater behavior. This was done to avoid accounting for the same savings twice. The algorithms for estimating unadjusted savings are similar to those for the Water Temperature Gauge Card measure, as shown in Equation 3-21 and Equation 3-22.

Equation 3-21: Turn Down Water Heater Energy Savings Algorithm

$$\Delta kWh = ELEC \times \frac{U \times A \times (T_{base} - T_{new}) \times Hours}{RE \times 3{,}412 \ \frac{Btu}{kWh}}$$

Equation 3-22: Turn Down Water Heater Demand Savings Algorithm

$$\Delta kW = \frac{\Delta kWh}{Hours} \times CF$$

Algorithm input parameters are given in Table 3-31. These match the input parameters of the Water Heater Gauge Card measure, with the exclusion of in-service rate, which is taken into account with the adoption rate discussed in the following section.

Table 3-31: Inputs for Turn Down Water Heater Savings Calculations

Variable	Source	2022 Evaluation
ELEC	Family Survey	47%
U	Illinois TRM v10.0	0.083
A	Illinois TRM v10.0	24.99
T_{base}	Illinois TRM v10.0	135
T_{new}	Kit Information Materials	120
Hours	Illinois TRM v10.0	8,760
RE	Illinois TRM v10.0	0.98
CF_{Summer}	Illinois TRM v10.0	1.0
CF_{Winter}	Illinois TRM v10.0	1.0

Unadjusted savings associated with the Turn Down Water Heater behavior are presented in Table 3-32.

Table 3-32: Turn Down Water Heater Unadjusted Gross Verified Savings

Energy (kWh)	Summer Demand (kW)	Winter Demand (kW)
38.2	0.0044	0.0044

3.3.3.6.2. Behavior Adoption Rates

Adoption rates were applied to the unadjusted savings of each behavioral change based on family survey responses. Adoption rates estimate the portion of family survey respondents that indicated new energy saving behaviors in their homes following participation in the Energy Efficiency in Schools program. This is similar to an in-service rate, except that it is a representation of people's habits instead of the installation of a physical measure.

Adoption rates were determined using responses to the parent survey discussed in Section 3.3.1. The family survey included the following questions to determine if new behaviors were adopted in the home:

- Since your child learned about energy conservation at school and signed up for your energy kit from Duke Energy, has <u>your child</u> adopted or increased any <u>new behaviors</u> to help save energy in your home? This would only include new energy saving <u>behaviors</u> that your child adopted since receiving the kit.
- Since receiving your energy kit from Duke Energy, have <u>you or other adults in the home</u> adopted or increased any of the following behaviors to help save energy in your home?

A comparison of child and parent behavior adoption rates between the 2022 and 2020 evaluations are shown in Figure 3-3 and Figure 3-4, respectively.

Figure 3-3: Child Energy Efficiency Behavior Adoption Rates

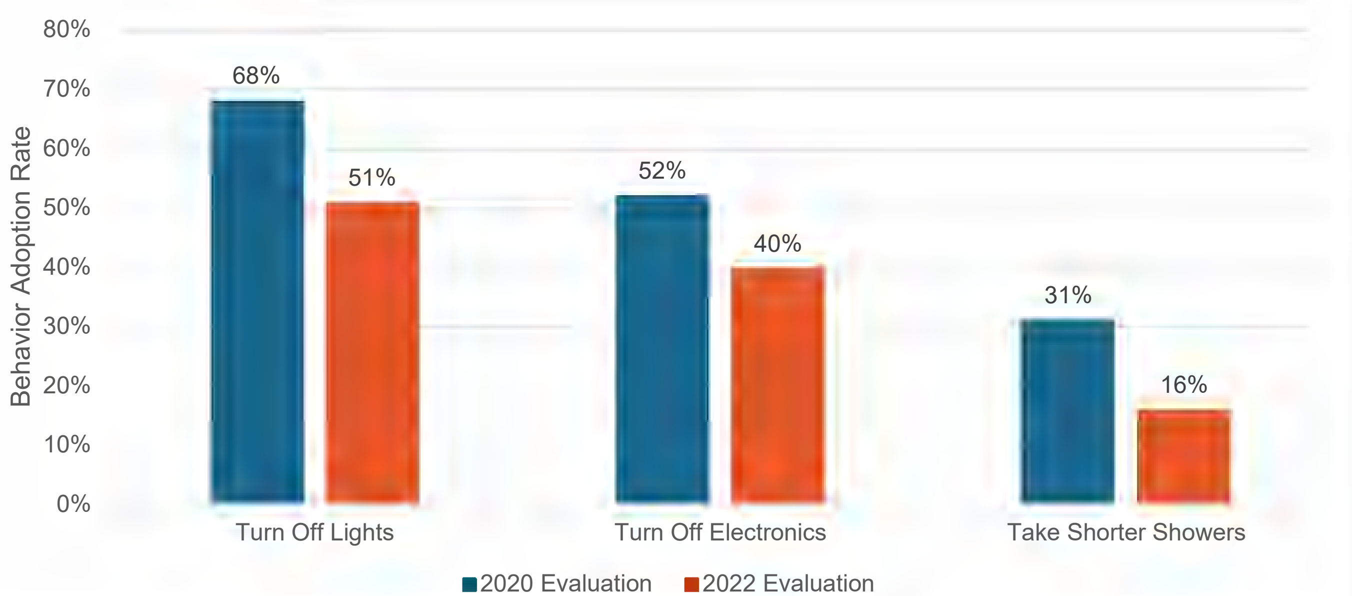
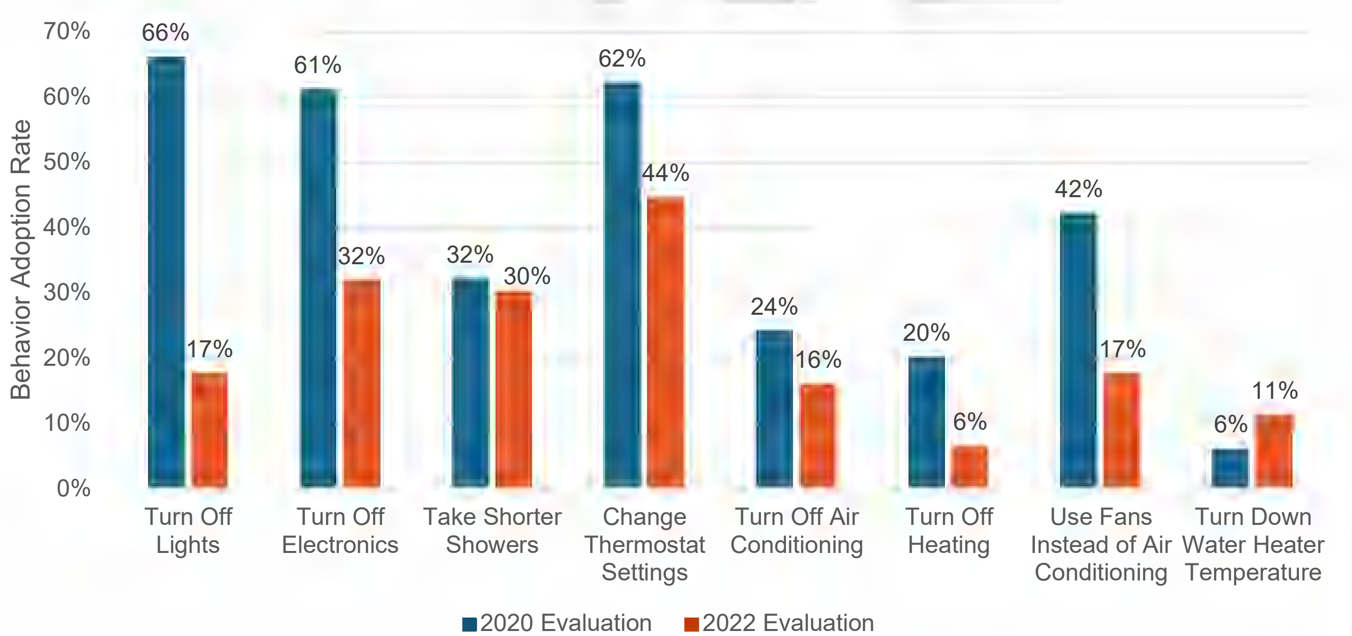


Figure 3-4: Parent Energy Efficiency Behavior Adoption Rates



An adjustment was made to the adoption rate of the Turn Down Water Heater Temperature behavior. This behavior includes performing the same energy saving action as the physical Water Temperature Gauge Card measure. Parents who indicated that they used the Water Temperature Gauge Card were not considered to have adopted the Turn Down Water Heater Temperature behavior. This prevented the evaluation team from accounting for the same verified savings twice.

3.3.3.6.3. Behavioral Adjustment Factors

Adjustment factors were applied to behavioral savings to account for the influence of the program kit, the influence of kit information materials, and estimated persistence of behavioral changes. A comparison of adjustment factors applied in this program evaluation and the 2020 program evaluation are shown in Table 3-33.

Table 3-33: Historical Behavioral Savings Adjustment Factors

Variable	2022 Evaluation	2020 Evaluation
Kit Influence	80.2%	78.7%
Kit Information Materials	70.0%	74.4%
Persistence	27.8%	27.8%
Total Adjustment	16.3%*	16.3%

*The three individual adjustment factors presented in this table multiplied together do not produce the exact Total Adjustment shown, as they are individually calculated for this table only. The Total Adjustment is a direct average inclusive of all three contributing adjustment factors (i.e., not a simple average of the three individual adjustment factor averages) and was therefore used for the evaluation's savings calculations.

Kit Influence

A kit influence adjustment was applied to account for the impact of the Energy Efficiency in Schools kit on the adoption of new energy saving behaviors. The family survey included the following question to assess kit influence:

- On a scale of 0 to 10, where 0 means "not at all influential" and 10 means "extremely influential," how much influence did Duke Energy's kit and materials on saving energy have on this change of energy using behaviors?

A kit influence adjustment factor was applied to the behavioral savings of each participating family according to the values listed in Table 3-34. The average kit influence among responding parents was 80%.

Table 3-34: Kit Influence Behavior Adjustment Factors

Parent Survey Response	Kit Influence Adjustment	Number of Responses
0	0%	0
1	10%	0
2	20%	0
3	30%	0
4	40%	1
5	50%	6
6	60%	1
7	70%	17
8	80%	14
9	90%	6
10	100%	18

Kit Informational Materials

The Energy Efficiency in Schools kit included an Energy Savers booklet describing ways that participating families could save energy in their homes. The family survey included the following questions to assess the influence of informational materials provided in the kit:

- Did you read any of the Energy Savers booklet that came in the kit? This is the 44-page booklet with information about how to save energy in the home.
- On a scale from 0 to 10 where 0 is not at all helpful and 10 is very helpful, how helpful was the Energy Savers booklet in identifying ways your household could save energy at home?

A kit informational materials adjustment factor was applied to the behavioral savings of each participating family according to the values listed in Table 3-35. The average influence of kit informational materials among responding parents was 70%.

Table 3-35: Kit Informational Materials Behavior Adjustment Factors

Parent Survey Response	Kit Informational Materials Adjustment	Number of Responses
Did Not Read	0%	8
0	0%	0
1	10%	0
2	20%	0
3	30%	0
4	40%	2
5	50%	4
6	60%	1
7	70%	12
8	80%	16
9	90%	5
10	100%	15

Persistence

While behavioral changes designed to increase energy efficiency result in immediate impacts, the initial activity is expected to wane in the absence of consistent intervention. This decay of energy savings resulting from a change in behavior has been carefully documented through random control trials of home energy report (HER) programs such as Duke Energy's MyHER program or programs implemented in other jurisdictions by Oracle (formally Opower). The rate at which energy savings persists after a customer receives a report depends on the frequency and longevity of follow-up reports.

The Energy Efficiency in Schools kit provides a single educational intervention to inspire energy efficient behaviors. The decay of savings from a single intervention was determined in order to provide an estimate of the persistence of energy saving behaviors attributable to program participation. A 2014 study of the Opower program provides estimates of savings resulting from quarterly behavioral interventions, as well as observed decay when reports are no longer provided.[13] Estimated persistence of behavioral changes resulting from the Energy Efficiency in Schools program is shown in Table 3-36.

[13] Allcott, H, Rogers, T., The Short-Run and Long-Run Effects of Behavioral Interventions: Experimental Evidence from Energy Conservation. American Economic Review 2014, 104(10): 3003-3037. Tables 2 and 3.

Table 3-36: Energy Saving Behavior Persistence

Item	kWh / Day
Quarterly Report, Immediate Impact	0.197
Quarterly Report, Decay Between Reports	0.708
Savings / Decay (Persistence)	27.8%

3.3.3.6.4. Summary of Behavioral Impacts

After applying the total adjustment factor and applicable child or parent adoption rates to the unadjusted savings, kit-level gross verified savings for each behavior, as well as the behavioral total, are presented in Table 3-37.

Table 3-37: Gross Verified Behavioral Savings Per Kit

Children/Parents	Behavior	Energy (kWh)	Summer Demand (kW)	Winter Demand (kW)
Children	Turn Off Lights	0.3	0.0001	0.0002
	Turn Off Electronics	5.1	0.0003	0.0003
	Take Shorter Showers	4.9	0.0035	0.0152
Parents	Turn Off Lights	0.1	0.0000	0.0001
	Turn Off Electronics	4.5	0.0003	0.0003
	Take Shorter Showers	11.7	0.0084	0.0362
	Change Thermostat Settings	14.4	0.0043	0.0000
	Turn Off Air Conditioning	1.7	0.0012	0.0000
	Turn Off Heating	0.7	0.0000	0.0002
	Use Fans Instead of Air Conditioning	2.4	0.0017	0.0000
	Turn Down Water Heater Temperature	0.7	0.0001	0.0001
Kit Total Behavioral Savings		46.5	0.0201	0.0526

3.4. Results

Measure, kit, and program savings are summarized in the following tables. Table 3-38 shows measure-level gross verified savings that contribute to total kit savings. Measure specific calculations are discussed above in Section 3.3.3.

Table 3-38: Gross Verified Measure Savings Per Kit

Measure	Energy Savings (kWh)	Summer Demand Savings (kW)	Winter Demand Savings (kW)
Showerhead	328.3	0.0192	0.0827
Behavior	46.5	0.0201	0.0526
Kitchen Aerator	35.0	0.0049	0.0063
Outlet Insulating Gaskets	22.3	0.0035	0.0035
5W LEDs	19.9	0.0018	0.0034
Bathroom Aerator	13.8	0.0027	0.0034
Water Temperature Gauge Card	12.3	0.0014	0.0014
Night Light	3.5	0.0000	0.0012
Kit Total	**481.5**	**0.0535**	**0.1545**

Program changes and family survey responses led to energy savings adjustments which contributed to a program energy realization rate of 141%. Kit savings and program savings are presented in Table 3-39 and Table 3-40, respectively.

Table 3-39: Energy and Demand Savings per Kit

Measurement	Reported Savings	Realization Rate	Gross Verified Savings
Energy (kWh)	358.3	134.3%	481.5
Summer Demand (kW)	0.0570	93.7%	0.0535
Winter Demand (kW)	0.1010	153.0%	0.1545

Table 3-40: Program Savings

Measurement	Population	Reported Savings	Realization Rate	Gross Verified Savings
Energy (kWh)	4,045	1,449,510	134.3%	1,948,081
Summer Demand (kW)		231	93.7%	216
Winter Demand (kW)		409	153.0%	620

4. Net-To-Gross Evaluation

The evaluation team used student family survey data to calculate a net-to-gross (NTG) ratio for the Energy Education in Schools Program. NTG reflects the effects of free ridership (FR) and spillover (SO) on gross savings. Free ridership refers to the portion of energy savings that participants would have achieved in the absence of the program through their own initiatives and expenditures (U.S. DOE, 2014).[14] Spillover refers to the program-induced adoption of additional energy-saving measures by participants who did not receive financial incentives or technical assistance for the additional measures installed. The evaluation team used the following formula to calculate the NTG ratio:

$$NTG=100\%-FR\%+SO\%$$

The evaluation team calculated the FR and the SO separately for each measure and aggregated those values to the program level.

4.1. Free Ridership

Free ridership estimates how much the program influenced participants to install the energy-saving items included in the energy efficiency kit. Free ridership ranges from 0% to 100%, with 0% being no free ridership and 100% being total free ridership, with values in between representing varying degrees of partial free ridership.

The evaluation team used participant survey data to estimate free ridership. The survey used several questions to identify items that a given participant installed and remain in use:

- For items that came one to a kit (showerhead, kitchen and bathroom faucet aerators, and night light), the survey asked whether the participant installed the item and, if so, whether the participant later removed the item.
- For insulator gaskets, which came 12 to a kit, the survey asked how many the participant installed and if the participant later removed them.
- For the LEDs, the survey first asked whether the participant installed one, both, or neither. The survey then asked whether the participant removed the bulbs.

This line of questioning was important for the NTG calculation, as the NTG questions were asked only for those measures that remained installed.

[14] The U.S. Department of Energy (DOE) (2014). The Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific Measures. Chapter 23: Estimating Net Savings: Common Practices. Retrieved August 29, 2016 from http://energy.gov/sites/prod/files/2015/02/f19/UMPChapter23-estimating-net-savings_0.pdf.

The evaluation team's methodology for calculating free ridership consists of two components, free ridership change (FRC) and free ridership influence (FRI), both of which range from 0% to 100% in value and are equally averaged.

$$FR=50\%*FRC+50\%*FRI$$

4.1.1. Free Ridership Change

FRC reflects what participants reported they would have done if the program had not provided the items in the kit. For each respondent, the survey assessed FRC for each measure that the respondent installed and did not later remove.

Specifically, the survey asked respondents which, if any, of the currently installed items they would have purchased and installed on their own within the next year if Duke Energy had not provided them. For each measure, the evaluation team assigned one of the FRC values shown in Table 4-1, based on the response.

Table 4-1: Free Ridership Change Values

What Respondent Would Have Done Absent the Program	FRC Value
Would not have installed measure on their own	No free ridership
Would have installed measure on their own	Full free ridership
Don't know if they would have installed measure on own	Partial free ridership

4.1.2. Free Ridership Influence

FRI assesses how much influence the program had on a participant's decision to install (and keep installed) the items in the kit. The survey asked respondents to rate how much influence six program-related factors had on their respective decisions to install the measures, using a scale from 0 ("not at all influential") to 10 ("extremely influential"). The program-related factors included:

- The fact that the items were free
- The fact that the items were sent to their home
- The chance to win cash prizes for their household and school
- Information in the kit about how the items would save energy
- Information that their child brought home from school
- Other information or advertisements from Duke Energy, including its website

Asking respondents to separately rate the influence of each of the six above items had on the decision to install each measure would have been overly burdensome. Therefore, while the survey assessed FRC for each measure, it assessed influence at the end-use level once for all water-saving measures and once for the light bulbs.

For each end-use (water-saving and light bulbs), the highest-rated item for each respondent represents the overall program influence. The evaluation team assigned the following FRI scores, based on that rating (Table 4-2). The evaluation team calculated up to two FRI scores for each respondent: one FRI score for water-saving measures and one FRI score for light bulbs.

Table 4-2: Free Ridership Influence Values

Influence Value	Score Assigned
0	100%
1	90%
2	80%
3	70%
4	60%
5	50%
6	40%
7	30%
8	20%
9	10%
10	0%

4.1.3. End Use Specific Total Free Ridership

The evaluation team calculated total free ridership by measure by:

- Calculating measure-specific FR scores for each respondent by summing each measure-specific FRC score with the corresponding end-use-specific FRI score.
- Calculating the mean FR score for each measure across all respondents from the individual measure-specific FR scores.
- Calculating a savings-weighted mean of the measure-specific FR means for water-saving measures and a separate savings-weighted mean of the measure-specific FR means for light bulbs.

Table 4-3 presents the end-use FR estimates.

Table 4-3: Measure Level Free Ridership Scores

Kit Measures	FRC	FRI	Total FR
Showerhead	29.27%	5.37%	17.32%
Kitchen Aerator	23.03%	5.79%	14.41%
Bathroom Aerator	20.83%	3.47%	12.15%
Night Light	27.30%	5.74%	16.52%
Light Bulb	51.64%	5.07%	28.36%
Gaskets	18.25%	6.19%	12.22%
Overall Kit Measures	28.30%	5.39%	16.85%

4.1.4. Program Level Free Ridership

The evaluation team estimated program-level free ridership by calculating a savings-weighted mean of the measure specific FR scores presented in Table 4-3. The behavior FR is already taken into account in the gross savings analysis and is therefore assigned a FR value of 0%. Combining the 16.85% FR found for kit measures with the 0% FR for behavioral measures on a savings weighting basis yields an overall free ridership for the NTC kits of 15.22%.

Table 4-4: Measure Level Free Ridership Scores

Component	FR
Kit Measures	16.85%
Behavior	0%
Savings Weighted Program Total	15.22%

4.2. Spillover

Spillover estimates energy savings from additional energy improvements made by participants who are influenced by the program to do so and is used to adjust gross savings. Since behavioral actions are considered gross impacts, spillover calculations only include additional installations of energy saving technologies. The evaluation team used participant survey data to estimate spillover. The survey asked respondents to indicate what energy-saving measures they had implemented since participating in the program. The evaluation team then asked participants to rate the influence the Energy Education Program had on their decision to purchase these additional energy-saving measures on a scale of 0 to 10, where 0 means “not at all influential” and 10 means “extremely influential.”

The evaluation team converted the ratings to a percentage representing the program-attributable percentage of the measure savings, from 0% to 100%. The team then applied the program-attributable percentage to the savings associated with each reported spillover measure to calculate the participant measure spillover (PMSO) for that measure. We defined the per unit energy savings for the reported spillover measures based on ENERGY STAR® calculators as well as algorithms and parameter assumptions listed in the in the Illinois TRM v10.0., outputs from this impact evaluation, as well as previous evaluations conducted by our team for Duke Energy Indiana.

Participant measure spillover (PMSO) is calculated as follows:

PMSO=Deemed Measure Savings*Program Attributable Percentage

Table 4-5 exhibits the PMSO by measure category.

Table 4-5: Participant Measure Spillover, by Measure Category

Measure	Count	Weight	Attributable Savings (kWh)
EnergyStar Refrigerator	5	86%	159
EnergyStar Clothes Washer	6	67%	504
EnergyStar Clothes Dryer	5	74%	592
EnergyStar Freezer	2	90%	63
EnergyStar Dishwasher	3	93%	104
Central Air Conditioner	3	40%	209
Furnace	1	80%	334
Insulation	6	52%	1,275
Seal Leaks	15	49%	460
Seal Ducts	1	30%	135
LEDs	33	65%	3,097
Total	80		6,931

The evaluation team summed all PMSO values and divided them by the sample's gross savings to calculate an estimated spillover percentage for the Energy Education Program:

$$Program\ SO = \frac{\sum Program\ PMSO}{\sum Sample\ Gross\ Program\ Savings} = \frac{6{,}931}{86{,}596} = 8.00\%$$

These calculations produced a spillover estimate of 8.00% for kit items. Spillover for behavioral actions was 0%.

4.3. Net-To-Gross

Inserting the FR and SO estimates into the NTG formula (NTG = 100% – FR% + SO%) produces an NTG value of 91.15% for the kit measures (Table 4-6). Incorporating the behavior NTG of 100% produces a savings weighted NTG of 92.01% for the program overall.

Table 4-6: Program Net-to-Gross Results

Component	Verified Savings (kWh)	FR	SO	NTG	Net Savings (kWh)
Kit Measures	1,758,947	16.85%	8.00%	91.15%	1,603,419
Behavior	188,291	0%	0%	100%	188,291
Program Total	1,947,238	15.22%	7.23%	92.01%	1,791,709

5. Process Evaluation

5.1. Summary of Data Collection Activities

The process evaluation is based on phone interviews with Duke Energy program staff, implementer staff from NTC and R1, and teachers who had attended an NTC performance. The process evaluation is also based on web surveys with teachers who had attended an NTC performance and student families who received a kit during the program evaluation year (Table 5-1).

Table 5-1: Summary of Process Evaluation Data Collection Activities

Target Group	Method	Sample Size
Duke Energy program staff, NTC, R1 Staff	Phone Interview	3
Teachers	Web Survey	18
Teachers volunteering for additional interview	Phone Interview	4
Student Families (kit recipients and Duke Energy customers)	Web Survey	168*

*The process analysis included those families that reported not receiving a kit as they were established to still have valuable insights into the NTC program more generally.

5.1.1. Teacher Surveys and Follow-Up Interviews

The evaluation team surveyed and interviewed teachers who attended NTC performances to better understand program success and delivery and to gather an educator perspective on what could be improved.

In June and July 2022, the evaluation team contacted 304 teachers who attended NTC performances via email, and ultimately surveyed 18 teachers who saw performances between September 10, 2020 and May 13, 2021. Of the 18 teacher respondents, 79% taught elementary school, 8% taught middle school, and 12% taught high school. We report elementary and middle school findings together unless a meaningful difference emerged between school types.

In July 2022, the evaluation team contacted teachers who completed the teacher web survey conducted by RI and indicated interest in being interviewed about their experience. The evaluation team requested their participation in a follow-up in-depth interview (IDI) about their experience with the performance, curriculum materials, and kit request forms. These IDIs allowed the evaluation team to get a deeper understanding of topics uncovered in the web survey and to provide additional details about the teacher's experience with the program. The evaluation team completed interviews with four of these teachers.

5.1.2. Survey of Student Families Who Received Kits

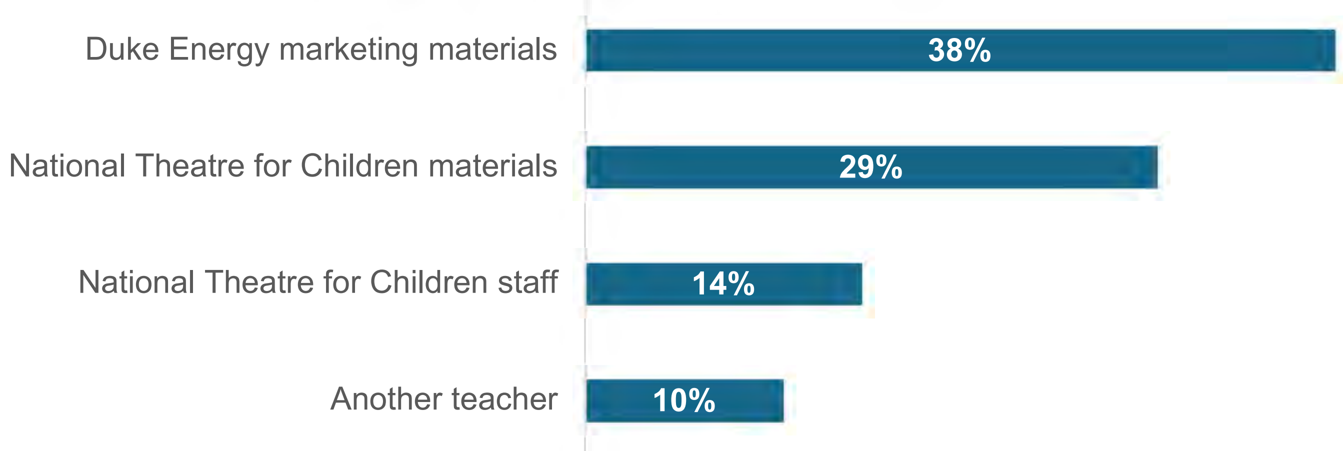
In June and July 2022 the evaluation team surveyed 168 families who received energy efficiency kits from DEI in the 2020-2021 school year. During that period, DEI claimed distribution of 4,804 kits to families who completed the kit request form their child brought home from school. Through email survey invitations, the evaluation team attempted to contact a random sample frame of 3,256 households for which program records provided an email address. Ultimately, the data collection effort achieved a 5.2% response rate, providing a sample with 6% precision at the 90% confidence level. Comparisons with census data demonstrate that the sample is largely representative of ownership status for the region. However, respondents reported slightly higher income levels, greater educational attainment and larger-sized households than typical of the region.[15]

5.2. Process Evaluation Findings

5.2.1. Awareness of DEI Sponsorship of the Program

Teachers and student families were largely aware of DEI's sponsorship of the program. All teachers (100%) reported they were aware of DEI's sponsorship. As Figure 5-1 shows, the teachers most often learned about the sponsorship through DEI marketing materials (38%) or National Theatre for Children materials (29%).

Figure 5-1: How Teachers Learned About Duke Sponsorship

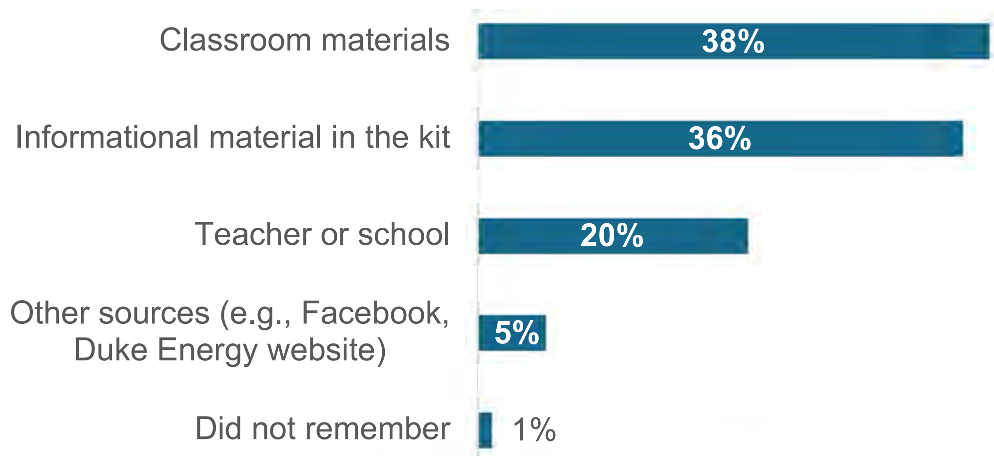


Awareness of DEI sponsorship among student families was also high, with most (93%) stating they knew the kit was sponsored by Duke Energy. Figure 5-2 presents the ways student families learned about Duke Energy's sponsorship of the program. Parents indicated they learned about Duke Energy's sponsorship most frequently via the classroom materials their child brought home (38%).

[15] Region comparisons come from 2018 American Community Survey (Census) 5-year period estimates data for Indiana.

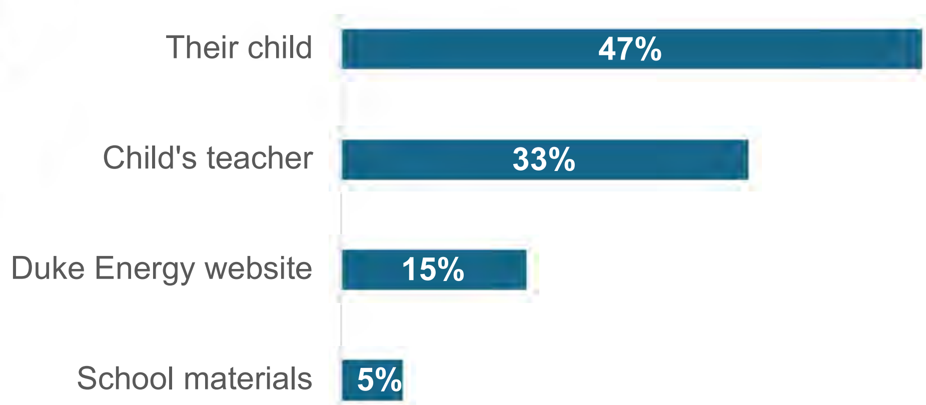
Other common ways that families learned about Duke Energy sponsorship were informational material included in the kit (36%) and communications from their child's teacher or school (20%).

Figure 5-2: How Student Families Learned About Duke Sponsorship



Just over a quarter (29%) of student family respondents said they knew about the energy-related classroom activities and NTC performance at their child's school. Of those, almost half (47%) said they found out about the NTC activities from their child (Figure 5-3). Of the remaining parents, most stated that they found out about NTC activities from their child's teacher (33%), on Duke Energy's website (15%), or from materials sent home with their child from the school (5%).

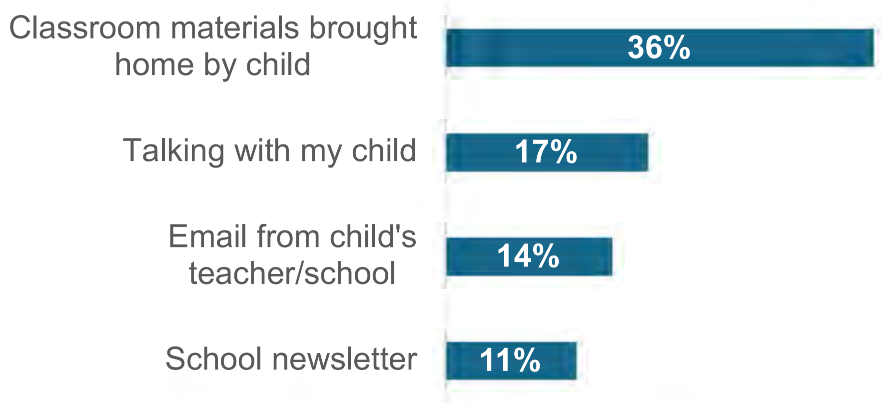
Figure 5-3: How Student Families Learned About NTC Performances



5.2.2. Parent Awareness of DEI Kit Opportunity

Classroom materials sent home with students were the key source of awareness of kits for families, with the highest proportion of student families (36%) hearing about the opportunity to receive a Duke Energy kit via this medium (Figure 5-4). Other respondents learned about the kits from talking with their child (17%), or various communications from the school such as an email from the child's teacher (14%) or from the school newsletter (11%).

Figure 5-4: How Student Families Became Aware of Energy Kits



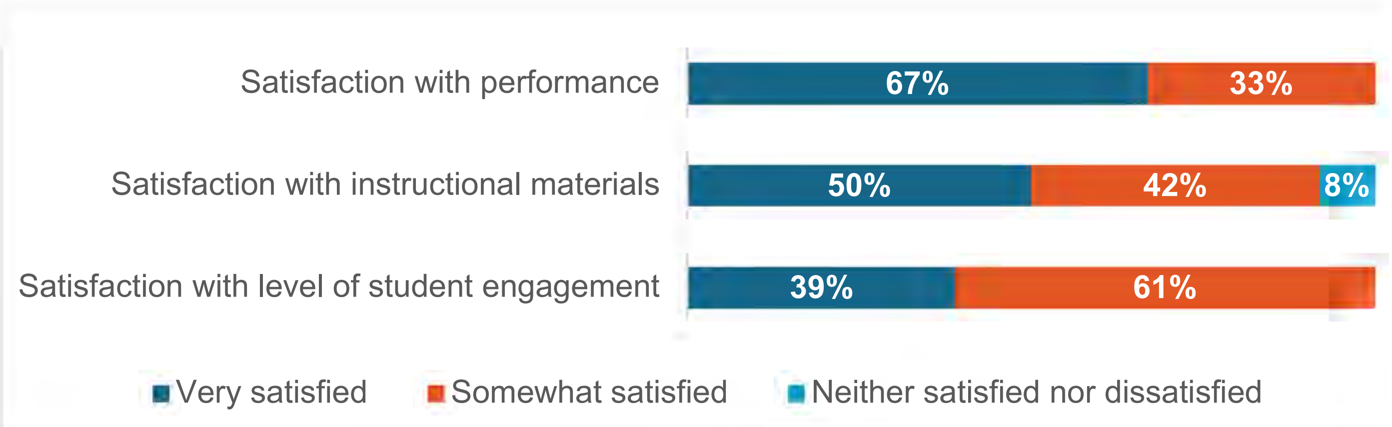
5.2.3. Teacher Experience with the Program

5.2.3.1. NTC Performance

Due to the COVID-19 pandemic, the NTC performances were held virtually during the 2020-2021 school year. Of the interviewed teachers, most saw a livestreamed (53%) performance and 69% of all performances occurred at the classroom level, as opposed to for the whole school. Teachers were very satisfied with the NTC performance. They specified that the content was age-appropriate and the performance itself was engaging and entertaining. However, they did note that students were more engaged with the performances in previous years when the performances were held in-person. The interviewed teachers attributed this lower level of engagement to the challenges of living through a pandemic, as opposed to the performance itself.

Overall, teachers were largely satisfied with the performance, with all 18 teachers surveyed rating their satisfaction as "very satisfied" or "somewhat satisfied" (Figure 5-5). Notably, 67% of teachers reported that they were "very satisfied" with the performance. When asked for reasons for the high satisfaction, teachers reported that the performers were engaging and funny, the performance was entertaining and appropriately paced, the performances were informative, students appreciated having a different way of learning from their usual classroom activities, and that the concepts were interesting and related to the curriculum being taught.

Figure 5-5: Teacher Satisfaction with NTC Program



In addition, all of the surveyed teachers said the explanation of energy-related concepts were presented at about the right level for most of their students. It is important to note here, that the majority of teachers surveyed (79%) taught Kindergarten through Grade 5, and as a result a larger sample at the middle school and high school level would be necessary to assess whether those performances are generally age appropriate for students as well.

Regarding age appropriateness, the interviews expanded and reinforced the survey findings. All four interviewed teachers said the performance was age appropriate and kept their students' attention.

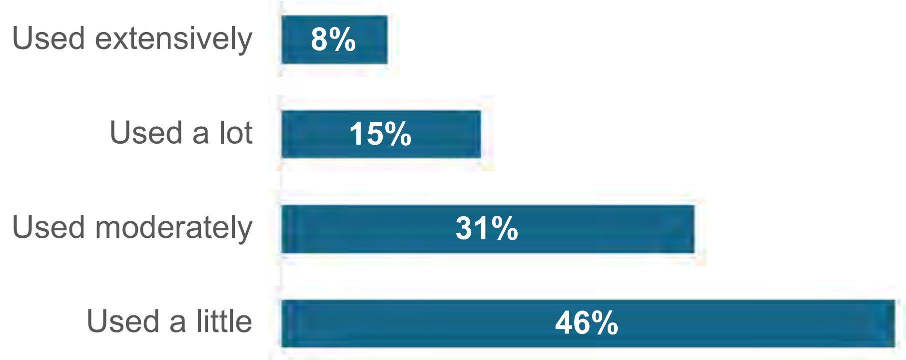
The interviewed teachers commented on the quality of the performance, specifically that the performance was engaging, humorous, and informative. When asked how performances might be improved, teachers reiterated their enthusiasm for it, and did not offer suggestions. One teacher said, "Students get into [the performance] and the material sticks because it has an element of fun."

5.2.3.2. Curriculum and Instructional Materials

Most teachers reported that they distributed or made their students aware of kit request forms (90%). The highest proportion of those teachers distributed the paper form (67%), while 17% of teachers made students aware of the online form and distributed the paper form, and 6% of teachers only directed students to the online form.

A large majority of teachers reported receiving the materials (81%). Of those teachers who received the materials, Figure 5-6 presents how much teachers used the materials. Teachers who stated that they used the educational material infrequently were asked to describe why; the most common response was that teachers did not for the time to incorporate the materials into their already full curriculums. This highlights the fact that educational material is not regularly used in conjunction with the presentation as intended.

Figure 5-6: Teachers Use of Instructional Materials



Teachers reported use of the instructional materials and they reported on the materials' usefulness, age-appropriateness, alignment with state science standards, or concepts children had trouble understanding. From their comments, also reflected in interview findings, the following observations emerged:

- Use of materials was minimal to moderate: 46% of teachers reported using the materials "a little," and 31% reported using the materials "moderately."
- Materials were useful: When asked to rate the usefulness of the materials, most respondents rated the usefulness as extremely useful (25%) or somewhat useful (34%). The remaining 41% of respondents rated the usefulness as "neither useful nor not useful."
- Materials were age-appropriate: All teachers reported that the materials and performances were age-appropriate.
- Most respondents said that the materials aligned with state science standards: Seventeen percent reported that the workbooks aligned "completely" with state science standards, while 50% reported that they "mostly aligned." The remaining 33% reported that the materials "somewhat aligned" with state science standards.

5.2.3.3. Kit Requests Forms

As mentioned, most teachers reported sending kit request forms home with children. However, teachers also indicated in both interviews and surveys that student families predominantly requested kits online.

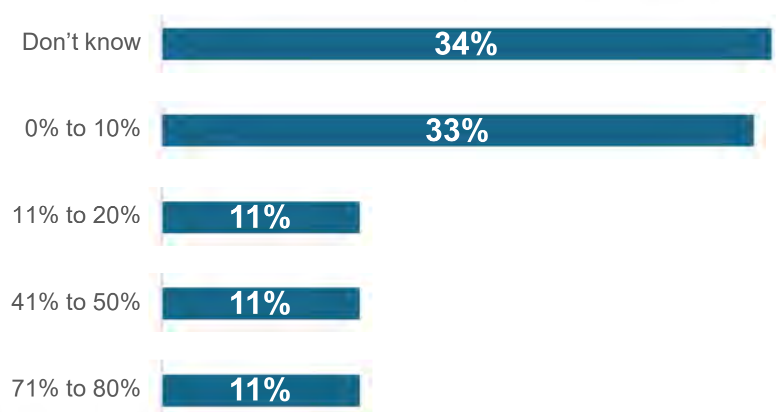
The interviewed teachers reported no challenges related to receiving or distributing the kit request forms. Some noted that the teacher incentive was useful in motivating them to distribute the kit request form, however others noted that the student's enthusiasm for the program was motivation enough to encourage kit sign-ups.

Half of the teachers (50%) reported following up with students to find out whether their household requested a kit. Of those, teachers generally estimated that less than half of their students brought back kit request forms or signed up online.

5.2.3.4. Kilowatt Krush App

All teachers reported that the performers or the instructional material had mentioned the Kilowatt Krush app. Of the surveyed teachers, 34% reported that they didn't know if students had downloaded the app, and another 33% reported that a small proportion (0% to 10%) of students downloaded the app (Figure 5-7). Two interviewed teachers mentioned that many students do not have a device that would allow them to use the app. Of the 168 parents surveyed, only 6% reported that their child used the app, with the majority only using it a few times (70%). The parents reported that children mainly did not use the app because they forgot to download it (32%) or they were not interested (25%).

Figure 5-7: Teacher Perceptions on How Many Students Downloaded Kilowatt Krush App



5.2.4. Student Family Experience with the Program

5.2.4.1. Installation and Use Rates

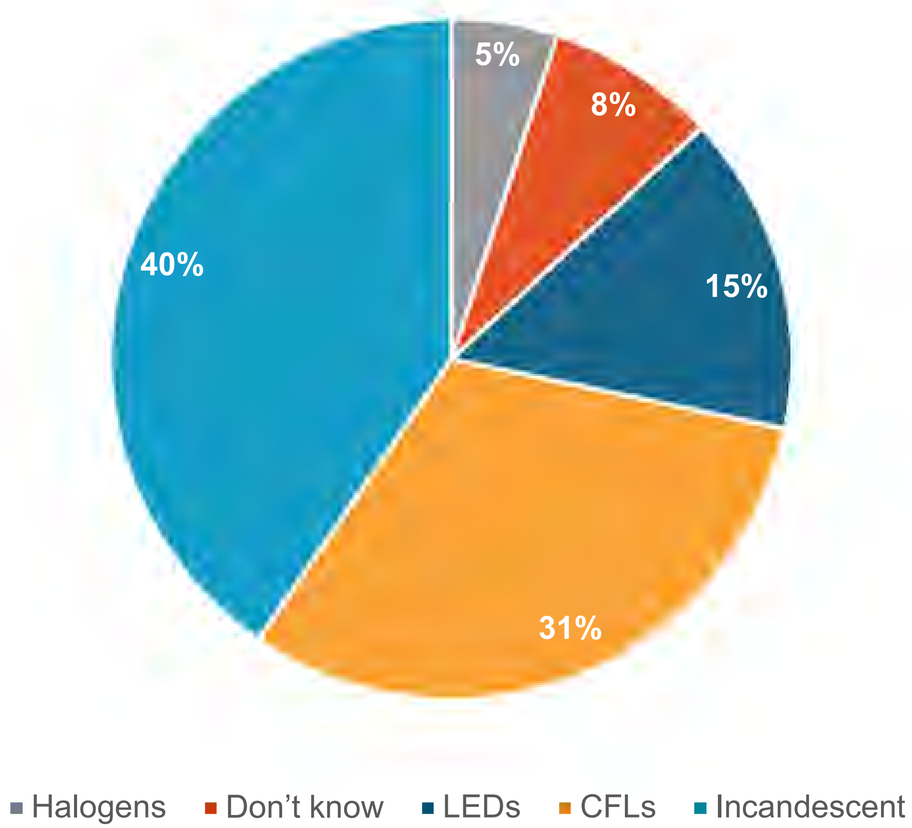
Almost all (93%) participants installed at least one measure in the kit. Most kit recipients installed the lighting measures including LEDs (80%) and night lights (74%); far fewer used the insulator gaskets and water related measures (ranging from 24% to 44%). Showerheads and night lights were the most commonly uninstalled measures. Most of the respondents who chose to remove kit measures reported dissatisfaction with the measure performance, and aesthetic reasons.

Table 5-2: Student Family Installation Rates by Measure

Measure	Percent of Respondents who Installed
LEDs	80%
Night lights	74%
Kitchen faucet aerator	44%
Showerhead	39%
Bathroom faucet aerator	39%
Insulator gaskets	24%

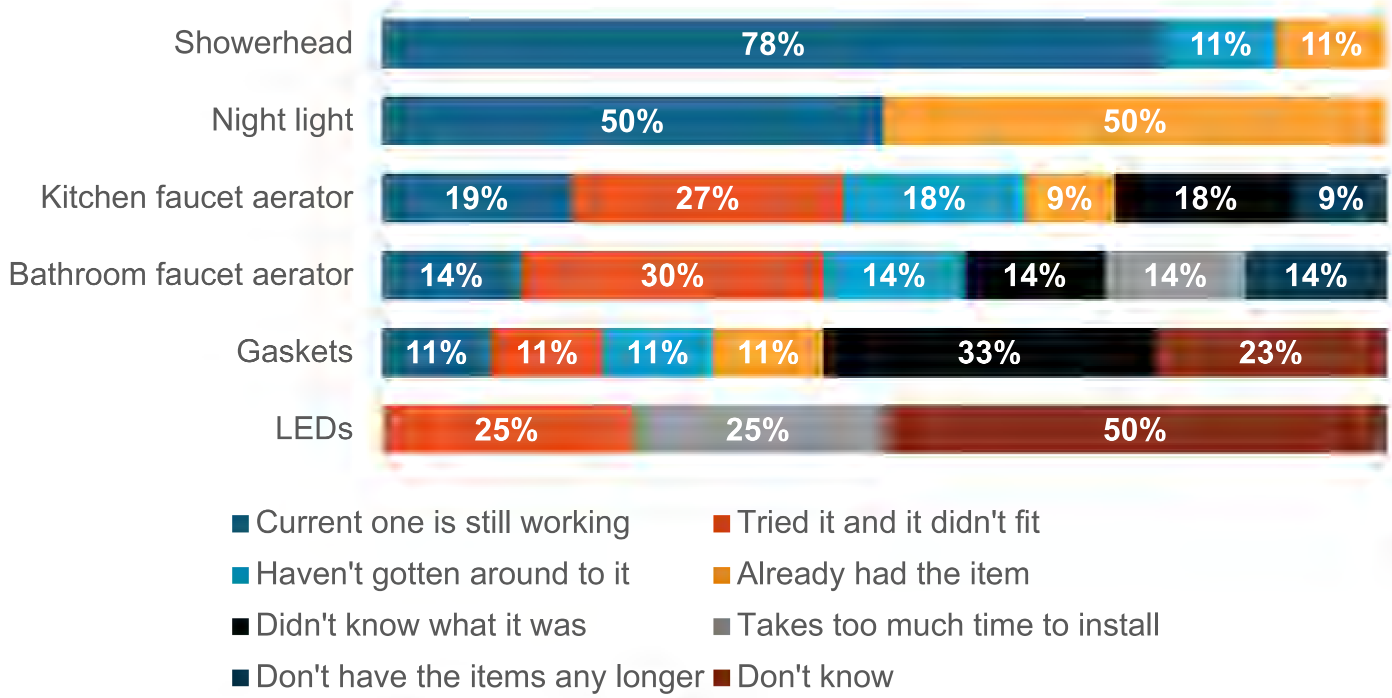
The large majority of those installing light bulbs said that they typically replaced incandescent (40%) or CFL (31%) bulbs.

Figure 5-8: Student Family Lights Replaced by Type



Of those who did not install all items in the kit, only 4% of respondents said that they do not plan to install any of the items they had not yet installed. Reasons for not planning to install individual measures varied across measure and are summarized in Figure 5-9. Respondents generally said, however, that they would not install the remaining items because the currently installed item is still working, they already had the item, or they tried the measure, and it did not fit.

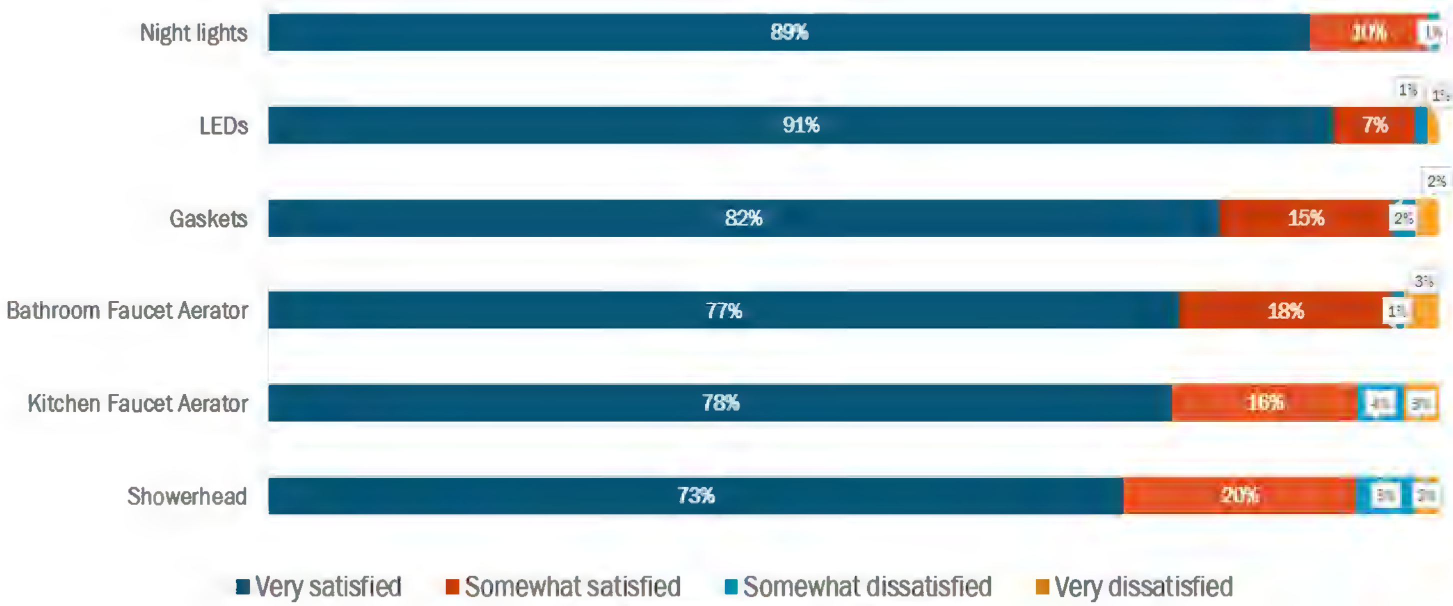
Figure 5-9: Reasons for Not Installing Measures in the Future



5.2.4.2. Measure Satisfaction

Nearly all kit recipients reported high satisfaction with the items they installed from their kit. To best gauge the experience with the measures, we asked respondents to rate their satisfaction with all measures they installed, including those they later removed (Figure 5-10). Respondents explained that any dissatisfaction they had with water measures was due to low water pressure. Most dissatisfaction with lighting measures was attributed to the light not being bright enough.

Figure 5-10:Student Family Measure Satisfaction



5.2.4.3. Energy Saving Educational Materials in the Kit

The Energy Efficiency Kit includes a Duke Energy-labeled Department of Energy (DOE) Energy Saver Booklet that includes educational information on saving energy at home. Most (81%) respondents said they read the booklet, a majority of whom (90%) found it highly helpful. While only 10% of respondents did not find the booklet highly helpful, a variety of concerns with the booklet were raised. For example, they stated that the booklet was too long, the information was not relevant to readers who lived in manufactured homes or apartments, and that the information presented was basic and vague. To improve the booklet, the respondents suggested making it shorter or in point form, include more information relevant to manufactured homes/apartments, include region-specific information, and use more complicated language.

The research team is aware that the Duke Energy program team did not develop the booklet themselves and would thus be unable to make adjustments to the information presented. However, the Duke Energy program team may want to consider developing a one-page quick guide to saving energy to provide to families as supplemental to the DOE Energy Saver booklet. This would address the concerns that the booklet was too long and would allow for an opportunity for Duke to provide helpful information to families living in manufactured homes and apartments.

5.2.4.4. Energy Saving Behaviors

Parents and children reported adopting new energy-saving behaviors since their involvement in the program. Most parents (91%) reported adopting an energy-saving behavior and a large majority (75%) reported their child has adopted new energy saving behaviors since receiving their kit. Parents most commonly said that their child now turns off lights when not using a room (51%) or that they turn off electronic devices when not in use (40%). The average kit influence among responding parents was 80%.

The kit motivated some respondents to purchase energy efficient equipment or services. Thirty-four percent of respondents reported purchasing or installing additional energy efficiency measures since receiving their kit. LEDs and/or CFLs were the most commonly reported energy efficiency measures installed since participation (37%).

Eighteen respondents who purchased or installed an additional measure reported receiving a Duke Energy rebate for their additional measure. Of these 18 respondents, eight said they received rebates for purchasing LEDs and/or CFLs, four for sealing air leaks, three for energy efficient appliances, two for efficient heating or cooling equipment, and one for efficient windows.

Almost half of the respondents (43%) who installed an additional measure said the Duke Energy schools program was highly influential on their decision to purchase and install additional energy saving measures.

5.3. Key Findings

Key findings from the process evaluation include:

- Parents most often requested energy saving kits from the program website.
- Parents were highly satisfied with the kit measures.
- Teachers reported that the NTC performances were engaging, entertaining, and informative.
- Teachers reported that the instructional material provided by NTC were age appropriate and aligned with curriculum standards.
- Due to COVID-19, the performances for this evaluation period were held virtually. Teachers reported that students were less engaged in the program this year when compared to the in-person performances held previously.

6. Conclusions and Recommendations

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

Conclusion: Teachers were generally satisfied with the material provided and the quality of the National Theatre for Children performances.

> **Recommendation:** Keep the National Theatre for Children performances to the same quality.
>
> **Recommendation:** Although the teachers generally reported that the material provided was age-appropriate for their students and aligned with curriculum standards, all interviewed teachers mentioned time as a barrier for using all the instructional material in the kit. The program implementers may want to consider highlighting which information would be most important to present given a time constraint for teachers. This would allow teachers to present all the material should they have the time, as well as help guide teachers who may have time constraints.
>
> **Recommendation:** For scheduling purposes, teachers suggested keeping the livestream/pre-recorded performance as an option, even though the in-person performance is more engaging, to acknowledge that some schools still need flexibility coming out of the pandemic.

Conclusion: Teacher incentives were appreciated by the teachers, but changes to incentives were suggested.

> **Recommendation:** Some participating schools are small, making the teacher incentive impossible to reach. Consider scaling the teacher incentive in the program to the size of the school.

Conclusion: Educational material provided in the kit was engaging and useful to parents, but the Kilowatt Krush app was not successful in engaging students after the performance.

> **Recommendation:** Students do not always have access to electronics that support app usage such as smartphones or tablets. Teachers interviewed mentioned, however, that their students (even in low-income schools) are provided with Chromebooks for use in class and at home for homework. If feasible, consider transferring the Kilowatt Krush app content to a website so that teachers may assign Kilowatt Krush activities as part of their lessons or as homework.

Conclusion: Parents generally found the instructional booklet that came with the kit helpful, however many found the booklet too long.

Recommendation: Develop a supplemental one-page guide to present the information from the booklet to families.

Conclusion: Many participants did not install measures from the kit because their current measure was still working, or they already had the item.

Conclusion: Electric water heater saturation continues to decline over previous program evaluations. Low electric water heater saturation among program participants reduces gross verified savings of low-flow showerhead, bathroom aerator, kitchen aerator, water temperature gauge card, and several behavioral change measures.

Recommendation: It may be beneficial to investigate avenues to claim gas savings as part of the program cost effectiveness calculations.

Conclusion: Nearly 16% of survey respondents claim that they did not receive a kit.

Recommendation: A high number of participants claim that they did not receive a kit. It may be beneficial to investigate methods to increase the reliability of kit delivery such as shipping kits with receipt signature required.

Recommendation: It may be beneficial to offer lighting only kits, that do not include water measures, to participants who do not have an electric water heater.

Recommendation: It may be beneficial to investigate avenues to claim gas savings as part of program cost effectiveness calculations.

Conclusion: Nearly 16% of survey respondents claim that they did not receive a kit.

Recommendation: A high number of participants claim that they did not receive a kit. It may be beneficial to investigate methods to increase the reliability of kit delivery such as shipping kits with receipt signature required.

Appendix A Summary Form

DEI Summary Form

Description of program

The Energy Education in Schools Program is an energy efficiency program that provides free in-school performances by the National Theatre for Children (NTC) that teach elementary, middle and high school students about energy and conservation concepts in a humorous and engaging format. NTC provides teachers with: 1) student workbooks that reinforce topics taught in the NTC performance, which include a take-home form that students and parents can complete to receive an energy efficiency starter kit from DEI and 2) lesson plans associated with the content in the student workbooks.

Date	November 1, 2022
Region(s)	Indiana
Evaluation Period	August 1, 2020 – July 31, 2021
Annual Gross kWh Savings	1,947,238 kWh
Per Kit kWh Savings	481.3 kWh
Annual Gross Summer kW Savings	216.3 kW
Annual Gross Winter kW Savings	620.1 kW
Net-to-Gross Ratio	0.920
Process Evaluation	Yes
Previous Evaluation(s)	2018-19

Evaluation Methodology

Impact Evaluation Activities

- *144 web surveys and analysis of 8 unique measures.*

Impact Evaluation Findings

- *Realization rates*
  - *134% for energy*
  - *14% for summer demand*
  - *153% for winter demand*
- *Net-to-gross ratio = 0.920*

Process Evaluation Activities

- *168 web surveys with student families and analysis of 8 unique measures.*
- *18 web surveys with teachers from participating schools; 4 in-depth follow up interviews*
- *1 in-depth interview with program staff*
- *1 in-depth interview with NTC implementation staff*
- *1 in-depth interview with R1 implementation staff*

Process Evaluation Findings

- *Teachers are highly satisfied with the NTC performance*
- *Parents largely learning about performances, kits, and materials from their children*
- *Student families are highly satisfied with kit items*
- *The NTC program is successfully influencing families to adopt energy saving behaviors*

Appendix B Measure Impact Results

Table B-1: Per Unit Verified Impacts by Measure – Key Measure Parameters

Measure	Gross Verified Energy Savings (kWh)	Gross Verified Summer Demand Savings (kW)	Gross Verified Winter Demand Savings (kW)	Realization Rate (Energy)	Free Ridership	Spillover	Net to Gross Ratio
Showerhead	328.3	0.0192	0.0827	Estimated at kit level			
Behavior	46.5	0.0201	0.0526				
Kitchen Aerator	35.0	0.0049	0.0063				
Outlet Insulating Gaskets	22.3	0.0035	0.0035				
5W LED	19.9	0.0018	0.0034				
Bathroom Aerator	13.8	0.0027	0.0034				
Water Temperature Gauge Card	12.3	0.0014	0.0014				
Night Light	3.5	0.0000	0.0012				
Kit Total	481.5	0.0535	0.1533	134.40%	15.22%	7.23%	92.01%

Appendix C Consumption Analysis

The K12 Energy Efficiency Education Program is a Duke Energy Indiana (DEI) offering implemented by the National Theatre for Children (NTC). The program provides age-appropriate school performances by NTC's professional actors that teach students about energy and energy conservation in an engaging and entertaining format. In addition, NTC provides participating schools with classroom curriculum to coincide with the performance, as well as the opportunity for student families to request free kits containing energy efficiency measures that can be installed in their own homes.

At the request of Duke Energy the evaluation team attempted to estimate energy savings attributable to the K12 Education program by analyzing energy use patterns before and after receipt of program kit items. The objective of the analysis was to assess the effectiveness of standard approaches in detecting energy savings of marginal size that are attributable to the program.

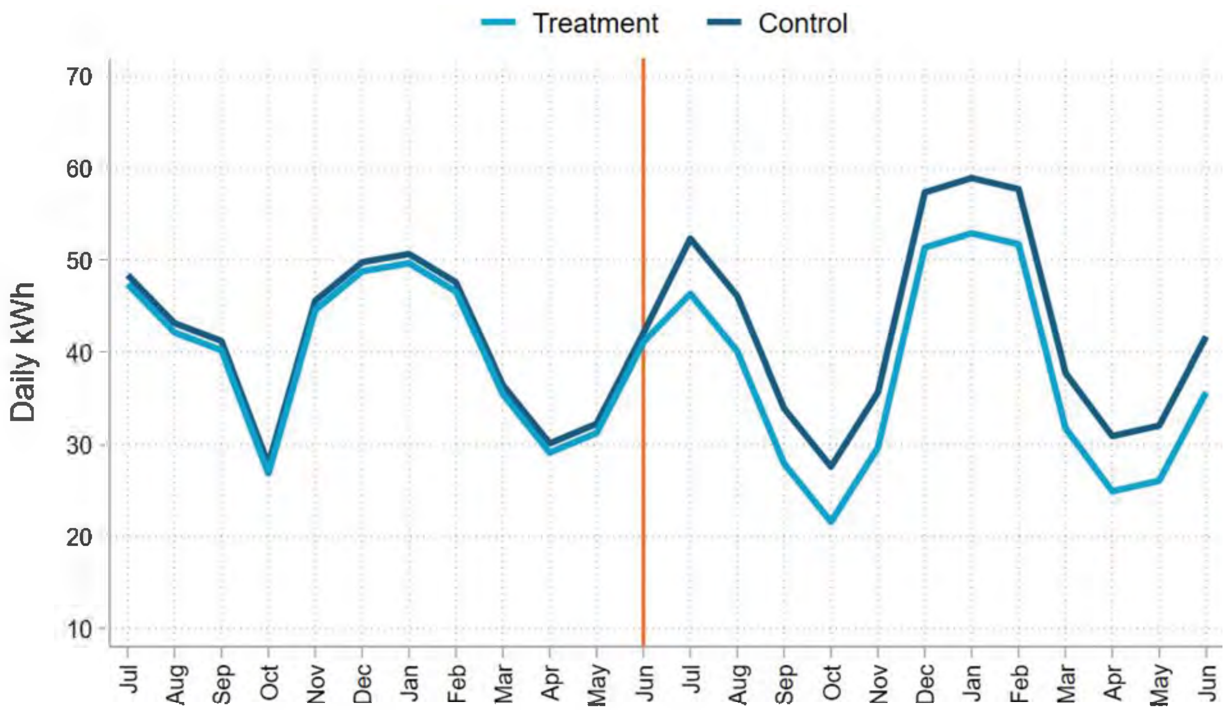
C.1 Methodology

To estimate energy savings with household consumption data, it is necessary to estimate what energy consumption would have occurred in the absence of the program – the counterfactual or baseline. To infer that the program led to energy savings, it is necessary to systematically eliminate plausible alternative explanations for differences in electricity use patterns.

The basic framework for the analysis is illustrated in Figure C-1 and relies on both a control group and pre- and post-enrollment consumption data. The analysis is implemented via a difference-in-differences regression approach. The methodology compares program participants to a matched comparison group, and removes any pre-existing differences between the treatment and control groups. If the program's kit led to reductions in consumption, we should observe:

- A change in consumption for households that participated in the K12 Education Program
- No similar change in consumption for the control group
- The timing of the change should coincide with the receipt of kits

Figure C-1: Framework for Consumption Analysis with Comparison Groups



While the K12 Education program design did not involve a randomly assigned control group, the evaluation team did develop a comparison group to use in its analysis. However, there were challenges to producing reliable energy savings estimates using billing analysis. The primary challenge is the small effect size of the program. On a percentage basis, the expected energy savings from each kit are generally a small share of annual household energy consumption, and therefore it is difficult to isolate the impacts of the program from other potential explanations, including random chance. Second, households that signed up for the kit self-selected from their peers. Despite using a comparison group, it only accounts for observable characteristics like pre-treatment energy use patterns. As a result, while the participant and comparison group may have had similar energy use patterns in the pre-treatment period, their energy use trajectories absent program participation are not necessarily the same due to differences in the household use patterns.

Including to the key challenges discussed in more detail above, below is a broader list of challenges posed by using a consumption based analysis for the K12 Education program savings analysis.

- Effect size - on a percentage basis, expected impacts from the program are small and difficult to distinguish from the inherent “noise” in the consumption data;
- Timing of intervention - changes in the mix of participants and/or the timing of individual measure installations can be confused with natural changes in energy use;

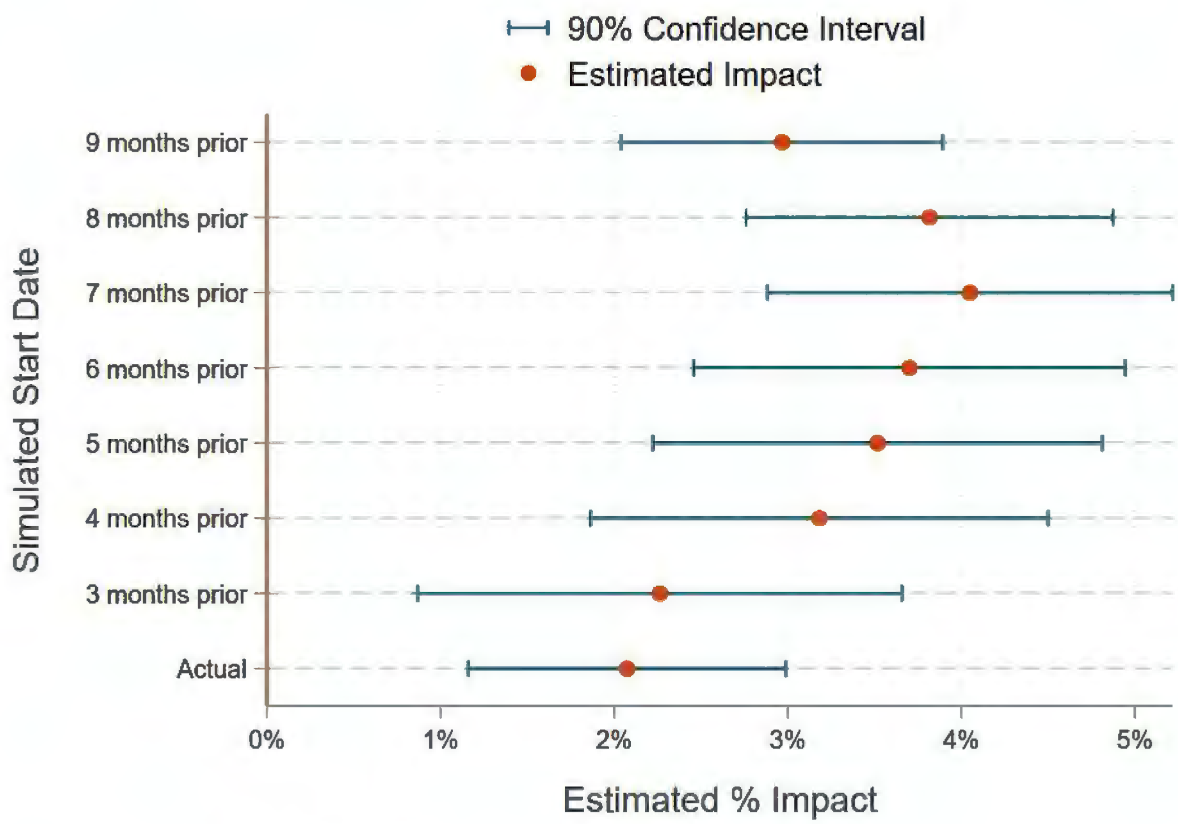
- Self-selection - customers who enroll in the K12 Education program are inherently different than customers who do not:
- They likely have different household occupancy, and/or electric consumption needs that can yield different responses to program intervention(s);
- In order to be effective, the kits rely on customers to correctly install the individual measures themselves.

C.2 Results

In order to assess if the consumption analysis produced reliable results, Resource Innovations implemented a series of false experiments. This approach consisted of simulating fake enrollment dates for each customer prior to their actual participation in the program and assessing if the models detected an effect when using data from the false “pre” period to estimate the counterfactual for the false “post” period. Because enrollment dates were fictitious and actual post periods were excluded, we knew impacts due to the program were actually zero and any estimated impacts were due to modeling error. The evaluation team used two years of pre-treatment data for the false experiments and each participant’s enrollment date was simulated to have occurred between three to nine months prior to actual participation, in increments of one month.

Figure C-2 shows the results from the difference-in-differences model false experiments. It estimated energy increases in the range of roughly 2% to 4% when no intervention had taken place.

Figure C-2: Difference-in-Difference Consumption Analysis with Comparison Group Results



C.3 Conclusion

When the percent change in household energy use is small, as it is with the K12 Education program, the only reliable way to estimate energy savings using a consumption analysis is through a randomized control trial (RCT) using large treatment and control groups combined with pre- and post-enrollment consumption data. The most critical component of a well-designed RCT is to guarantee there are no differences between the treatment and control groups, other than the treatment of the program. This is a critical step to ensure that the analysis is able to accurately estimate the counterfactual – or what would have happened absent the treatment. If inherent differences exist between the treatment group and control group, any changes in the post-treatment period could be due to these differences, rather than the treatment itself. In order to verify that effects are purely the result of the treatment intervention, the two groups must be ostensibly identical in every way except for the intervention.

Guaranteeing homogeneity between treatment and control groups is not achievable with an opt-in enrollment method. The fact that one group of customers chose to enroll in the program while the other did not implies that some intrinsic difference between them does exist. These differences may include:

- Behavioral preferences or predispositions for energy and water efficiency measures
- Information about the program that is not accessible to non-enrollees
- Higher energy needs and therefore a greater incentive to curb their consumption

Any of these characteristics are likely to contribute to consumption responses or patterns that cannot be attributable to the program intervention. A well-designed RCT includes randomly selected customers in the treatment and control groups, thereby ensuring that the analysis avoids adverse effects of selection bias and/or lurking confounding variables. Due to these variables, RCTs can be impracticable for opt-in programs.

After a thorough investigation, we concluded that, absent an RCT, a consumption analysis was unable to reliably detect energy savings resulting from participation in the program. The evaluation team's conclusion is not that there were no energy savings generated by the program, but rather that this approach is not the correct tool for estimating energy savings attributable to the program. Thus, the evaluation team's recommendation is to rely on the engineering analysis and findings as the source of our verified gross and net savings for the programs.

Appendix D Program Performance Metrics

Figure D-1: Student Family Demographics Reach PPIs

Program experience & satisfaction PPIs	Participants %	Participants n
Usefulness of kit instructions	91%	139
Satisfaction with Showerhead	73%	82
Satisfaction with Kitchen faucet aerator	78%	76
Satisfaction with Bathroom faucet aerator	77%	71
Satisfaction with Night lights	89%	140
Satisfaction with Energy Efficient Light Bulbs	91%	151
Satisfaction with Insulator Gaskets	82%	62
Program influence on behavior PPIs		
Installed at least one kit measure	93%	168
Most common measure installed: *LEDs*	80%	157
Respondents reporting program attributable spillover	8%	116
Challenges and opportunities for improvement PPIs		
Measure with lowest installation rate: Insulator Gaskets	24%	51
Measure with highest uninstallation rate: Showerhead	16%	10
Measure with highest dissatisfaction: kitchen faucet aerator & showerhead	7%	76 & 82

Appendix E Data Collection Instruments

E.1 Program Staff In-Depth Interview Guide

Introduction

Today, we'll be discussing your role in the Energy Efficiency Education Program in the Duke Energy Indiana territories. We would like to learn about your experiences administering this program in the 2020-2021 school year.

Your comments are confidential. If I ask about areas you are not familiar with, please feel free to tell me and we will move on.

I would like to record this interview for my note-taking purposes. Do I have your permission? Do you have any questions before we start?

Roles & Responsibilities

Q1. First please describe your role at Duke Energy as well as your role in Duke Energy's Energy Efficiency Education Program. How long have you been in this role? Has your role changed since the last time this program was evaluated?

Q2. Has Duke Energy's role changed in terms of program delivery since the last time this program was evaluated?

Delivery and **Operations**

Next, I'd like to learn more about how this offering was delivered since your involvement. If any elements of implementation are different during the 2020-2021 school year than in the past, please let me know.

Q3. What were your targets for the 2020-2021 school year for the following metrics, and were you successful in meeting them? If not successful, what do you think may have contributed to challenges in meeting the goals?

1. Number of schools recruited
2. Number of students involved
3. Number of classes attending performances
4. Use of curricula by teachers
5. Number of kit requests
6. Savings
7. Subcontractor SLAs (NTC, R1, AMC)
8. Incentives (e.g., kit request incentives, teacher award)

Q4. Has the delivery process changed since 2019-2020, prior to any forced upon the program by COVID-19?

Q5. How did COVID-19 affect program delivery, if at all, in terms of the:

1. Recruitment, Marketing, Outreach, Website
2. Curriculum and Performance
3. App (KiloWatt Krush)
4. Kit: contents, request process, delivery schedule

Q6. In our previous evaluation period, there were some concerns mentioned about the age appropriateness of the performances. Are there any noteworthy concerns about the age appropriateness of the materials and performances, or has that largely been addressed?

1. Have there been any issues with language of the performance?

Q7. During our last evaluation period, it was mentioned that a high school program was being piloted and implemented. In what ways, does the delivery strategy for the high school program differ from the elementary and middle school strategy?

Q8. Can you talk a bit about the development of the high school delivery strategy? What were the priorities, goals, etc.?

Q9. How has the high school program been going generally in Indiana? Have there been any significant challenges or successes specific to the high school program in 2020-2021? How have these been addressed?

Q10. Are there any changes, beyond those caused by COVID-19, that you have implemented in the 2021-2022 school year? Any planned for 2022-2023?

Q11. Has anything changed with staffing or management of the program (communications, staff, budget, program goals, data management, subcontractor performance, etc.) since the previous evaluation, both related to COVID-19 and unrelated to COVID-19? If so, how has this affected program delivery or operations?

Communication

Q12. In the previous evaluation, we were told that the operational staff (NTC, R1, and Duke Energy) gathered on bi-weekly calls. Has the communication frequency stayed the same or changed? Are there any other established communication protocols?

Program Experience and Satisfaction

Q13. From your experience, how is the new phone app Kilowatt Krush being received by teachers, students, and families?

Q14. Do you have any metrics to measure satisfaction or usage of the Kilowatt Krush app? If so, how has the app been received thus far?

Q15. During the last evaluation, no app download data was available. Is this data now available?

Q16. From our understanding, there were no live performances during this evaluation period. What did the online delivery of the program look like? How did this differ from previous years in terms of curriculum, content delivery, etc?

1. Were participants satisfied with online delivery of the program? How was this success measured?

Q17. Have there been any changes to the incentive structure where schools were previously awarded $100/250 kit requests? (PROBE IF NECESSARY: Are the incentives proportional to the size of the school?)

Marketing and Outreach

Q18. How was the program marketed during COVID-19? Was there more, less, or the same amount of marketing during this program year as compared to previous years?

Q19. How was outreach to schools conducted during COVID-19? Was there more, less, or the same amount of schools targeted and contacted this program year as compared to previous years?

1. Who do you connect with to coordinate the program offering in the schools? Does this differ by grade level? (e.g., principal, teacher, etc.)

Q20. In previous evaluations, we became aware of issues with recruiting and reaching saturation of schools. Was this an issue that was encountered this year in terms of outreach?

Q21. When outreach was conducted, did school representatives mention any concerns with the virtual delivery of the program during the 2020-2021 program year? If so, how did these concerns impact the school decision to sign up for the program?

Measures in the Kit

Q22. Have measures provided in the kit changed since the last time the evaluation was conducted? Any future plans to change them?

Kit Tracking and Reporting

Q23. How many kits were requested during this program year? How does this compare to previous years? If this is different, why do you think the number of requests has differed?

Q24. Were there any changes with kit distribution as a result of the pandemic? (e.g., supply chain issues, increased delivery windows, etc.)

Wrap Up

We are almost done. I have a few more questions.

Q25. We know that no live performances were held due to COVID-19. Did COVID-19 impact the program in any other ways during the 2020-2021 school year? If so, how? Have these effects persisted in the 2021-2022 school year?

Q26. What would you say are the greatest strengths of the program in the 2020-2021 school year? Is this specific to the DEI jurisdiction?

Q27. What would you say is the biggest challenge in administering this program in 2020-2021? Is this specific to the DEI jurisdiction?

Q28. How can this offering be improved?

Q29. Is there anything else about the program that we have not discussed that you feel should be mentioned?

Q30. What would you like to learn from this program evaluation?

Closing

Those are all of my questions. Thank you very much for your time.

E.2 NTC Staff In-Depth Interview Guide

Introduction

Today, we'll be discussing your role in the Energy Efficiency Education Program in the Duke Energy Indiana territories. We would like to learn about your experiences administering this program in the 2020-2021 school year.

Your comments are confidential. If I ask about areas you are not familiar with, please feel free to tell me and we will move on.

I would like to record this interview for my note-taking purposes. Do I have your permission? Do you have any questions before we start?

Roles & Responsibilities

Q1. First please describe your role in NTCs work with the Duke Energy Energy Efficiency Education Program. How long have you been in this role? Has your role changed since the last time this program was evaluated?

Q2. Has NTC's role changed in terms of program delivery since the last time this program was evaluated?

Delivery and Operations

Next, I'd like to learn more about how this offering was delivered since your involvement. If any elements of implementation are different during the 2020-2021 school year than in the past, please let me know.

Q3. Has the delivery process changed since the last evaluation, prior to any forced upon the program? Separately, how did COVID-19 affect program delivery, if at all, in terms of:

1. Marketing and outreach (Can you provide recruitment materials?): [PROBE: We were told that the outreach approach changed to be teacher-focused. What did that outreach look like?]
2. Recruitment:
3. Curriculum:
4. Performance:
5. Kit request process:

Q4. In the last evaluation, we were told that there were some challenges with recruiting new schools because a saturation point of eligibility had been reached. What has been done to address this challenge?

Q5. In what ways, if at all, does the delivery strategy for the high school program differ from the others?

Q6. Can you talk a bit about the development of the high school delivery strategy, including how this applies to materials, performances, etc.?

Q7. Have there been any significant challenges or successes specific to the high school program in 2020-2021? How have these been addressed?

Q8. Do you have copies of the 2020-2021 materials for all three programs that you could send me?

Q9. We were told that school level incentives have changed, and teacher incentives have been added. How has the change in incentive impacted participation?

Q10. What does teacher involvement in the program look like?

Q11. In past years, students were able to request their energy saving kits from the program website, a sign-up form in the classroom materials given to students, by calling a toll-free number, or through the Kilowatt Krush app. Did the way that students were able to request their kit change due to COVID? (i.e., did they still get a sign-up form through classroom materials?)

Q12. What energy saving behaviors do you encourage through the plays?

- Switching to LEDs, insulation for doors and windows, powerstrips, turning off the lights, shorter showers, what you can do in your community and careers, etc.

Q13. Are there any changes, beyond those caused by COVID-19, that you have implemented in the 2021-2022 school year? Any planned for 2022-2023?

Q14. Does the operational staff still gather on bi-weekly calls (NTC, R1, Duke Energy)? Are there any other established communication protocols? Any changes there?

Q15. Has anything changed with staffing/management at NTC (communications, content creation, admin, or management staff)? If so, how has this affected program delivery or operations?

Q16. How has the introduction of the Kilowatt Krush app impacted, if at all, student engagement with the performances or curriculum?

Q17. Have you heard any feedback about the Kilowatt Krush app? If yes, has the app been received positively or negatively? Why do you say that?

Wrap Up

We are almost done. I have a few more questions.

Q18. We know that no live performances were held due to COVID-19. Did COVID-19 impact the program in any other ways during the 2020-2021 school year? If so, how? Have these effects persisted in the 2021-2022 school year?

Q19. What would you say are the greatest strengths of the program in the 2020-2021 school year? Is this specific to the DEI jurisdiction?

Q20. What would you say is the biggest challenge in administering this program in 2020-2021? Is this specific to the DEI jurisdiction?

Q21. How can this offering be improved?

Q22. Is there anything else about the program that we have not discussed that you feel should be mentioned?

Q23. What would you like to learn from this program evaluation?

Closing

Those are all of my questions. If any other questions come up for us while analyzing the data, would you be willing to be contacted again over e-mail? Thank you very much for your time.

E.3 R1 Staff In-Depth Interview Guide

Introduction

Today, we'll be discussing your role in the Energy Efficiency Education Program in the Duke Energy Indiana territories. We would like to learn about your experiences administering this program in the 2020-2021 school year.

Your comments are confidential. If I ask about areas you are not familiar with, please feel free to tell me and we will move on.

I would like to record this interview for my note-taking purposes. Do I have your permission? Do you have any questions before we start?

Roles & Responsibilities

Q1. First please describe your role at R1 as well as your role in Duke Energy's Energy Efficiency Education Program. How long have you been in this role? Has your role changed since the last time this program was evaluated?

Q2. Has R1's role changed in terms of program delivery since the last time this program was evaluated?

Delivery and Operations

Next, I'd like to learn more about how this offering was delivered since your involvement. If any elements of implementation are different during the 2020-2021 school year than in the past, please let me know.

Q3. Has anything changed in this delivery process? (Prompts: relationship with AMC, data verification and transfer with Duke Energy/Duke Energy online look-up tool, processing of paper applications, online processing)

Q4. How long does it typically take for kit requests to be fulfilled and shipped out to customers?

Q5. Does all the operational staff still gather on bi-weekly calls? Can you briefly describe communication protocols?

Q6. Have there been any changes to the process that you follow since the inclusion of high schools in the program?

Challenges and Successes

Q7. Have you experienced any specific challenges due to the introduction of the high school program? Any successes?

Q8. Have you experienced any specific challenges with data management or processing? Any successes?

Q9. In the last evaluation, we were told that Duke was redoing their internal systems and introducing Customer Connect where they merged their systems together. Has Customer Connect been introduced? Can you please describe your experience working with Customer Connect thus far?

1. What do you like best about the system?
2. What do you like least about the system?
3. How can the system be improved?

Wrap Up

We are almost done. I have a few more questions.

Q10. We know that no live performances were held due to COVID-19. Did COVID-19 impact the program in any other ways during the 2020-2021 school year? If so, how? Have these effects persisted in the 2021-2022 school year?

Q11. Do you have any insight into the Kilowatt Krush app that was introduced as part of this program during the evaluation period? If yes, please describe how the app impacted your role or the number of kit requests that you received.

Q12. What would you say are the greatest strengths of the program in the 2020-2021 school year? Is this specific to the DEI jurisdiction?

Q13. What would you say is the biggest challenge in administering this program in 2020-2021? Is this specific to the DEI jurisdiction?

Q14. How can this offering be improved?

Q15. Is there anything else about the program that we have not discussed that you feel should be mentioned?

Q16. What would you like to learn from this program evaluation?

Closing

Those are all of my questions. Thank you very much for your time.

E.4 Teacher Interview Guide

Introduction

Today, we'll be discussing your experience in Duke Energy Indiana's Energy Efficiency Education

Program during the 2020-2021 school year.

Your comments are confidential. If I ask about areas you are not familiar with, please feel free to tell me and we will move on.

I would like to record this interview for my note-taking purposes. Do I have your permission? Do you have any questions before we start?

Awareness, Grades and Subjects Taught, Type of Performance Seen

Q1. Confirm the following from the survey responses:

1. What grade(s) and subject(s) do you teach?
2. How did you hear about the program?
3. Did you experience a school wide performance, or an individual classroom performance?
4. Did your class participate in a livestream performance or a pre-recorded performance?

Q2. How were the performances scheduled for your school? Are you involved with this? If so, in what way? [PROBE BASED ON ANSWER IF IT WAS THROUGH THE TEACHER: Did your school participate in the past? How was the program marketed to you?]

Q3. On a scale of 1 to 5, where 1 is "not satisfied at all" and 5 is "very satisfied," how satisfied were you with the process of scheduling performances for the school or for your class?

Q4. We were told that Duke Energy introduced teacher incentives for the program where for every 20 kids who put in a kit request, the teacher received $50. Please tell us what you think about that incentive model. How did the incentive model impact the way you promoted kit requests to students?

Q5. Do you have any suggestions to improve recruitment and performance scheduling?

Program Experience and Satisfaction

Q6. What did you and/or your students think about the [LIVESTREAM OR PRE-RECORDED] performance? What did you enjoy? What could be improved?

Q7. What topics were covered in the performance?

Q8. Do you think any of the topics could have been better emphasized or explained? If so, which ones and why?

Q9. Should any topics be removed from the performance? If so, which ones and why?

Q10. Was the content appropriate for all ages [elementary, middle, or high]? If not, what was not age appropriate? How could this be improved?

Q11. Did the performance keep your students' attention? If not, how could the content be improved to keep the students entertained and attentive?

Q12. What did you like most about the performance?

Q13. Is there anything that you disliked? How could this be improved?

Q14. How did your students respond to the performance? [PROBES: What did your students say about the performance? Did they like it? What specifically did they like most about it?]

Q15. One of the goals of the NTC program is for performers to get students' families to sign up for energy efficiency kits from Duke Energy. Did the performers talk about the kits and how to sign up? [IF YES: What did they say?]

Q16. Have you seen any other NTC performances?

1. [IF YES] When did you see those performances? How did the latest performance compare to the prior performance(s)?
2. Were the other performance(s) that you saw performed in person? How did the in-person performance compare to the virtual delivery of the program?

Q17. On a scale of 1 to 5, where 1 is "not at all interested" and 5 is "very interested," how interested were the students in the virtual or recorded performances?

Q18. Do you have any suggestions that might improve the National Theatre for Children performance(s)?

Q19. NTC provides student workbooks that contain educational materials and a form to get an energy saver kit for their home. Did you distribute these workbooks and forms to your students either electronically or print outs?

1. IF NO: Why not?
2. IF YES: How does the distribution work? Did you print them yourselves, view it online, or were paper copies delivered? How did you use the workbook in your classroom?

Q20. Did you get any teacher-facing instructional material from NTC? What was it? How did you receive it? To what extent did you use that material?

1. [IF MATERIAL WAS NOT USED] Why haven't you used the materials? What would make you more likely to use them?
2. [IF USED] Using a 1 to 5 scale, where 1 means "not at all useful" and 5 means "extremely useful," how useful was the instructional material? Why did you give that rating? What was the most/least useful about them?

Q21. Thinking about the educational materials that NTC provided…

1. In what ways, if any, did you incorporate the material into your lesson plans? [IF NOT MENTIONED] That is, did you extensively use it – such as weaving it into your course work over the year – or did you briefly use it in the time surrounding the performance? Please explain how extensively you used the material.
2. Was the content age appropriate, or was it too advanced or too basic? What was too basic/advanced? How effective is it in teaching kids about energy concepts?

Q22. Do you have any suggestions that might improve the classroom materials received from the National Theatre for Children?

Q23. Did anyone or any of the materials you received emphasize the value of the kits to you? If so, what did they say?

Q24. In the online survey you said you [DID/DID NOT] distribute the kit request form to your students.

1. [IF DISTRIBUTED] What challenges, if any, did you encounter when trying to distribute the kit forms? Did remote learning and/or COVID-19 restrictions make distributing the kit request form more challenging? Did you have to coordinate with other faculty or staff? If so, can you describe the process and how well the process worked? What can NTC or Duke Energy do to make this process easier for you?
2. [IF NOT DISTRIBUTED] Why did you not distribute the kit forms? Were there challenges in distributing the form due to remote learning and/or COVID-19 restrictions? What can NTC or Duke Energy do to make this process easier for you?

Q25. Do you have any suggestions that might improve the distribution of the kit forms to students, or the online sign-up process?

Q26. In what ways did the performers or the materials mention the Kilowatt Krush app, if at all? Did your students report using it? Do you have any feedback about the app or how it's communicated to participants?

Q27. Thinking about the performance and curriculum as a whole, in what ways, if any, did your students subsequently demonstrate knowledge on the topics presented? [IF NOT MENTIONED] What were some of their main takeaways? What is the evidence of their increased knowledge? (test scores, etc.)

Wrap Up

We are almost done. I have a few more questions.

Q28. We know that no live performances were held due to COVID-19. Did COVID-19 impact student engagement with the content? If so, how? Have these effects persisted in the 2021-2022 school year?

Q29. What would you say are the greatest strengths of the program in the 2020-2021 school year? Is this specific to the DEI jurisdiction?

Q30. How can this offering be improved?

Q31. Is there anything else about the program that we have not discussed that you feel should be mentioned?

Closing

Those are all of my questions. Thank you very much for your time.

E.5 Teacher Survey

Landing Page Introduction

Thank you for agreeing to take this survey. It starts with a few questions about what grades and subjects you teach, which we need for our analysis of the survey responses. The survey then asks for your feedback on various elements of the program.

Grades and Subjects Taught

Q1. What grade(s) did you teach during the 2020-2021 school year? *Please select all that apply.*

[multiple response]

1. Kindergarten
2. Grade 1
3. Grade 2
4. Grade 3
5. Grade 4
6. Grade 5
7. Grade 6
8. Grade 7
9. Grade 8
10. Grade 9
11. Grade 10
12. Grade 11
13. Grade 12
14. Other, please specify: [Open-ended response] – Collect open end response- then TERMINATE
15. None; I did not teach last year [TERMINATE]

[IF Q1= 7-Grade 6 to 13-Grade 12]

Q2. What subject(s) did you teach during the 2020-2021 school year? *Please select all that apply.*

[MULTIPLE RESPONSE]

1. Math
2. Natural sciences
3. English/language arts
4. Social studies/social sciences/history
5. Music
6. Art
7. Physical education
8. Other – please specify: [OPEN-ENDED RESPONSE]

[IF Q2=1,2,4]

Q3. Did you teach any topics on energy (electricity, gas, coal, etc.) generation, transformation, use, or conservation (including, but not limited to, topics/materials provided by the Energy Efficiency for Schools program)?

[SINGLE RESPONSE]

1. Yes
2. No

Performance Seen

[IF Q1= 1-Kindergarten to 6-Grade 5 AND Q1<> 7-Grade 6 to 13-Grade 12]

Q4. Did you view The National Theatre for Children performance for elementary school students in [PERFORMANCE_MONTH] of [PERFORMANCE_YEAR]?

1. Yes – I attended a school-wide performance
2. Yes – I attended a classroom performance
3. No [TERMINATE]

98. Don't know/ Can't recall [TERMINATE]

[IF Q4 = 1]

Q5. Did your students see a performance even more specific to their grade level?

1. Yes, they saw the K-2 performance
2. Yes, they saw the performance for grades 3-5

3. No, they saw the K-5 performance
4. Don’t know / Can’t recall

[IF Q1= 7- Grade 6 to 9- Grade 8]

Q6. Did you see the National Theatre for Children performance for middle school students in [PERFORMANCE_MONTH] of [PERFORMANCE_YEAR]?

1. Yes – I attended a school-wide performance
2. Yes – I attended a classroom performance
3. No [TERMINATE]

98. Don't know/ Can’t recall [TERMINATE]

[IF Q1= 10- Grade 9 to 13- Grade 12]

Q7. Did you see the National Theatre for Children performance for high school students in [PERFORMANCE_MONTH] of [PERFORMANCE_YEAR]?

1. Yes – I attended a school-wide performance
2. Yes – I attended a classroom performance
3. No [TERMINATE]

98. Don't know/ Can’t recall [TERMINATE]

Q8. Was the performance you saw via scheduled livestream or pre-recorded?

1. Livestream
2. Pre-recorded

98. Don't know/ Can’t recall

Q9. Was your class in-person or remote learning at the time of the performance?

1. My students were in class with me in person
2. My students were learning remotely from their homes

98. Don't know/ Can’t recall

[TERMINATION SCREEN TEXT: We have determined that you do not meet the qualification criteria for this study. Thank you for your time!

Awareness of Duke Energy Sponsorship

Q10. Before today, were you aware that Duke Energy sponsored the National Theatre for Children performance(s) in your school?

1. Yes
2. No

98. Don't know

[If Q10= 1 (YES)]

Q11. How did you learn of Duke Energy's involvement with the National Theatre for Children program? *Please select all that apply.*

[MULTIPLE RESPONSE]

1. Another teacher
2. Duke Energy marketing materials
3. Duke Energy staff
4. National Theatre for Children staff
5. National Theatre for Children materials
6. Other, please describe: [OPEN-ENDED RESPONSE]

98. Don't know

Q12. Are you (one of) the decision-maker(s) regarding the National Theatre for Children performances at your school?

1. Yes – I helped organize the schoolwide session
2. Yes – I organized my specific classroom session
3. No
4. Don't know

Q13. [Q12=2] How did you learn about the option to have a classroom session?

1. I knew about the National Theatre for Children performances from previous years
2. National Theatre for Children contacted me
3. NTC contacted my school
4. A colleague at my school told me about it
5. A colleague at a different school told me about it
6. Other: [Record Response]
7. Don't know

[IF Q12 = 1 or 2 (YES)]

Q14. Do you recall how the importance of the program was communicated to you? If so, how was it communicated to you?

1. Yes: [OPEN-ENDED RESPONSE]
2. No

Program Experience and Satisfaction

The next few questions are about the performance(s) that National Theatre for Children presented to your school.

Q15. Thinking back to the school performance, would you say that energy related concepts presented in the performance were:

[SINGLE RESPONSE]

1. Far too advanced for most of your students
2. Somewhat too advanced for most of your students
3. About right for most of your students
4. Somewhat too basic for most of your students
5. Far too basic for most of your students

96 Other, please specify: [Open-ended response]

98. Don't know

[IF Q15= 1 or 2]

Q16. What about the performance was too advanced for most of your students?

1. [OPEN-ENDED RESPONSE]

[IF Q15= 4 or 5]

Q17. What about the performance was too basic for most of your students?

1. [OPEN-ENDED RESPONSE]

Q18. Were there any concepts that the performance(s) did not cover that *should have been* covered?

1. Yes
2. No [SKIP TO Q20]

98. Don't know [SKIP TO Q20]

[IF Q18= 1 (YES)]

Q19. What concepts were not covered that *should have been* covered?

1. [OPEN ENDED]

Q20. Please estimate **your student's** overall engagement level with the National Theatre for Children performance on the following scale WHERE 1=NOT AT ALL ENGAGED AND 5=COMPLETELY ENGAGED, with DK; LABEL ONLY THE END POINTS (1 AND 5) – DISPLAY AS HORIZONTAL GRID:

Not at all Engaged				Completely Engaged	Don't Know
1	2	3	4	5	98

Q21. Please rate **your** overall satisfaction with the National Theatre for Children performance on the following scale. [Single response; insert 1-5 scale WHERE 1=NOT AT ALL SATISFIED AND 5=COMPLETELY SATISFIED, with DK; LABEL ONLY THE END POINTS (1 AND 5) – DISPLAY AS HORIZONTAL GRID

Not at all Satisfied				Completely Satisfied	Don't Know
1	2	3	4	5	98

Q22. Please explain why you offered this satisfaction rating.

1. [OPEN ENDED]

The next few questions are about the <u>curriculum or instructional materials</u> that you may have received from the National Theatre for Children around the time of the performance.

Q23. Did you receive curriculum or instructional materials, such as student workbooks, related to energy and energy conservation from National Theatre for Children for the Fall 2020-Spring 2021 school year?

1. Yes, they were mailed to our schools
2. Yes, we were directed to these resources on the program website, myenergykit.org
3. No [SKIP TO Q37]

98. Don't know [SKIP TO Q37]

[IF Q23= 1 or 2 (YES)]

Q24. To what degree did you use the curriculum or instructional materials in teaching your students about energy?

[Single response]

1. Not at all [SKIP TO Q36]
2. A little
3. Moderately
4. A lot
5. Extensively

98. Don't know [SKIP TO Q37]

[IF Q24= 2 (A little)]

Q25. Why did you only use the curriculum or instructional materials "a little" in teaching your students about energy?

1. [OPEN-ENDED RESPONSE]

[IF Q24= 2 through 5]

Q26. Thinking about how the student workbooks explained energy-related concepts, would you say that the material was generally:

[SINGLE RESPONSE]

1. Far too advanced for most of your students
2. Somewhat too advanced for most of your students
3. About right for most of your students
4. Somewhat too basic for most of your students
5. Far too basic for most of your students

96. Other, please specify: [Open-ended response]

98. Don't know

[IF Q24= 2, 3, 4, or 5]

Q27. Please rate how useful the materials were to you in teaching your students about energy. [Single response; insert 1-5 scale WHERE 1=NOT AT ALL USEFUL AND 5=EXTREMELY USEFUL, with DK

Not at all Useful				Extremely Useful	Don't Know
1	2	3	4	5	98

[IF Q24= 2, 3, 4, or 5]

Q28. Please rate the degree to which the topics in the workbook aligned with your state's science standards for the grade(s) you teach.

1. Completely aligned
2. Mostly aligned
3. Somewhat aligned
4. Poorly aligned
5. Not aligned at all
6. N/A – no science standards for my grade(s)

98. Don't know

[IF Q28= 4 or 5]

Q29. Which topic(s) was or were poorly aligned or not aligned at all with your state's science standards? In what way(s)?

1. [OPEN-ENDED RESPONSE]

[IF Q24= 2, 3, 4, or 5]

Q30. Were there any concepts covered in the curriculum or instructional materials that your students had challenges with?

1. Yes
2. No [SKIP TO Q32]

98. Don't know [SKIP TO Q32]

[IF Q30= 1 (yes)]

Q31. What concepts did your students have challenges with?
1. [OPEN-ENDED RESPONSE]

[IF Q24= 2, 3, 4, or 5]

Q32. Were there any concepts that the materials did not cover that *should have been* covered?
1. Yes
2. No [SKIP TO Q34]

98. Don't know [SKIP TO Q34]

[IF Q32= 1 (YES)]

Q33. What concepts were not covered that *should have been* covered?
1. [OPEN-ENDED RESPONSE]

[IF Q24= 2, 3,4, or 5]

Q34. Please rate your overall satisfaction with curriculum or instructional materials you received from the National Theatre for Children program using the following scale.
[Single response; insert 1-5 scale WHERE 1=NOT AT ALL SATISFIED AND 5=COMPLETELY SATISFIED with DK; LABEL ONLY END POINTS (1 and 5)]

Not at all Satisfied				Completely Satisfied	Don't Know
1	2	3	4	5	98

[IF Q23= 1 or 2 (YES)]

Q35. Do you have any additional input regarding the **curriculum or instructional materials** received from the National Theatre for Children that you would like to provide, including other things you liked or think could be improved? This might include things like overall presentation, length, level of detail, messaging, or anything else.

1. [OPEN ENDED]

[IF Q24= 1 (NOT AT ALL)]

Q36. Why did you *not* use the curriculum or instructional materials in teaching your students about energy?

1. [OPEN ENDED]

Interactions with NTC Staff

Q37. Did you have any interactions with anyone from the National Theatre for Children regarding the curriculum or instructional materials?

1. Yes
2. No [SKIP TO Q40]

98. Don't know [SKIP TO Q40]

[IF Q37= 1 (YES)]

Q38. What did those interactions involve?

1. [OPEN-ENDED RESPONSE]

[IF Q37= 1 (YES)]

Q39. Using the scale provided, how satisfied were you with:

a. Your interactions with the National Theatre for Children staff, overall
b. The professionalism and courtesy of the National Theatre for Children staff
c. The National Theatre for Children staff’s knowledge about the topics you discussed with them

[Single response; for each item, insert 1-5 scale WHERE 1=NOT AT ALL SATISFIED AND 5=COMPLETELY SATISFIED with; LABEL ONLY THE END POINTS (1 AND 5)]

Not at all Satisfied				Completely Satisfied	Don't Know
1	2	3	4	5	98

Encouragement of Students to Complete Kit Request Form; Use of App

The National Theatre for Children provided a form that parents can fill out to receive a kit from Duke Energy. The kit contains energy efficient bulbs, a low flow showerhead, and a few additional items that students and their parents can install in their home to save energy.

Q40. Did you make students aware of the kit request form (Online and/or Paper version)?

1. Yes – I distributed the paper kit request form
2. Yes – I provided information to students on where they can request a kit online.
3. Yes, I made students aware of the online form and provided the paper form.
4. No

98. Don't recall

[IF Q40= 4 (NO)]

Q40a. Why didn't you distribute the kit request forms to your students?

[OPEN-ENDED]

Q40.b Did you make parents aware of the program and the kit request form in any of your regular communications to them (e.g. weekly/monthly emails or newsletters)?

1. Yes

2. No, why not? [Open text box]

98. Don't recall

[IF Q40= 1 OR 3 (YES)]

Q41. On average, about what percentage of your students took the kit request form home? Your best estimate is fine.

1. 0% to 10%
2. 11% to 20%
3. 21% to 30%
4. 31% to 40%
5. 41% to 50%
6. 51% to 60%
7. 61% to 70%
8. 71% to 80%
9. 81% to 90%
10. 91% to 100%

98. Don't know

[IF Q40= 1, 2 OR 3 (YES)]

Q42. After students take the kit form home or are provided with the MyEnergyKit.org link, do you follow up with students later to find out if their parents completed the form or signed up online?

1. Yes
2. No

98. Don't know

[IF Q40= 1, 2 OR 3 (YES)]

Q43. About what percentage of your students either brought the kit form back to you to mail, or reported their parents completed the online form to receive their kit?

1. 0% to 10%
2. 11% to 20%
3. 21% to 30%
4. 31% to 40%
5. 41% to 50%
6. 51% to 60%
7. 61% to 70%
8. 71% to 80%
9. 81% to 90%
10. 91% to 100%

98. Don't know

[IF Q40= 1, 2, 3 OR 98 OR IF Q40a=1 OR 98]

Q44. About what percentage of student families who had signed up for kits signed up on the website? Your best estimate is fine.

1. 0% to 10%
2. 11% to 20%
3. 21% to 30%
4. 31% to 40%
5. 41% to 50%
6. 51% to 60%
7. 61% to 70%
8. 71% to 80%
9. 81% to 90%
10. 91% to 100%

98. Don't know

Q45. In cases where a family did not request a kit, why do you think they would not have requested one?

1. Didn't need the items
2. Didn't have time to install them
3. Not interested in energy or water efficiency
4. Other: ________

Q46. Did the National Theatre for Children performers or the instructional materials mention the "Kilowatt Krush" app?

1. Yes
2. No [SKIP TO Q49]

98. Don't know [SKIP TO Q49]

[IF Q46= 1 (YES)]

Q47. About what percentage of students would you say downloaded and used the app?

1. 0% to 10%

2. 11% to 20%
3. 21% to 30%
4. 31% to 40%
5. 41% to 50%
6. 51% to 60%
7. 61% to 70%
8. 71% to 80%
9. 81% to 90%
10. 91% to 100%

98. Don't know

Q48. Do you have any suggestions to improve the app or how it was presented to students?
1. Yes; [OPEN ENDED RESPONSE]
2. No

Challenges and Opportunities for Improvement

Q49. Did government or organizational responses to COVID-19 offer any challenges for you regarding your participation in this program (e.g., different resources needed for remote learning, school policy, changing school or learning priorities, etc.), other than those you've already discussed? If so, what were they, and how do you think they might best be addressed moving forward?
1. Yes: [OPEN-ENDED RESPONSE]
2. No

98. Don't know

Q50. Do you have any additional feedback regarding this program or Duke Energy that you would like to provide?
1. Yes; [OPEN ENDED RESPONSE]
2. No

In-Depth Interview Recruitment

Q51. Would you be willing to participate in a phone interview, so we might learn more about you and your students' experience with the program? It should take about 15 minutes to complete, and we will provide you with an additional $25 gift card for your time.
1. Yes
2. No [SKIP TO CLOSE]

98. Don't know [SKIP TO CLOSE]

[IF Q51= 1 (YES)]

Q52. Thank you for your willingness to be interviewed! If we have not yet met our goal for completed interviews, we will be in touch with you regarding scheduling.

CLOSE:

Thank you for your time completing this survey. Your responses have been recorded.

Have a great day!

E.6 Student Parent Survey

Landing Page (Web)

Thank you for agreeing to take this survey! It starts with a few questions about your experience in the program. The survey then asks for your feedback on various elements of the kit you received.

Introduction/Screening

Q32. Your student viewed an energy efficiency educational theatrical performance that Duke Energy sponsored in your child's school during the 2020-2021 school year. In addition to sponsoring classroom activities, Duke Energy sent a kit containing energy saving items to your home.

This kit included light bulbs, a showerhead, and other items that help you save energy in your home. Do you recall receiving this kit?

1. Yes
2. No [If no: Is there another adult in the home that remembers receiving the kit?]
98. Don't know

Q1-a. [IF Q1= 2 or 98] Is there another adult in the home that remembers receiving the kit?
1.Yes
2. No [Terminate]
98. Don't know [Terminate]

Q1-1. [IF Q1-a=Yes] Please have the adult who remembers receiving the kit answer the remainder of the questions in this survey. Your student viewed an energy efficiency educational theatrical performance that Duke Energy sponsored in your child's school during the 2020-2021 school year. In addition to sponsoring classroom activities, Duke Energy sent a kit containing energy saving items to your home.

This kit included light bulbs, a showerhead, and other items that help you save energy in your home. Do you recall receiving this kit?

1.Yes
2. No [Terminate]
98. Don't know [Terminate]

Termination Language: *We have determined that you do not meet the qualification criteria for this study. Thank you for your time!*

Program Experience

Q2. Before today, did you know the kit you received was sponsored by Duke Energy?

1. Yes
2. No
98. Don't know

[IF Q2=1]
Q3. How did you learn that the kit was sponsored by Duke Energy? *[Select all that apply]*

1. Classroom materials brought home by child
2. My child's teacher/school
3. Information material included in/on the kit
4. Other (specify: ___________)
98. Don't know

Q4. How did you hear about the opportunity to receive the kit from Duke Energy? *[Select all that apply]*

1. From talking with my child
2. Classroom materials brought home by child
3. School newsletter
4. Email from my child's teacher/school
5. School website or school web portal
6. In-person conversations with my child's teacher
7. Saw a poster at my child's school
8. After hours event at my child's school
9. Other (specify: ___________)
98. Don't know

Q5. How did you request your kit?

1. Program's website (www.myenergykit.org)
2. Sign-up form in the classroom materials my child brought home
3. By calling the toll-free number
4. Via the "Kilowatt Krush" app on my smartphone

98. Don't know

Q6. Has your child used the "Kilowatt Krush" app on any smartphone in your household?
1. Yes
2. No
98. Don't know [SKIP TO Q7]

Q6.No. [AFTER DISPLAYING THIS QUESTION SKIP TO Q7] Why has your child not used the "Kilowatt Krush" app on any smartphone in your household?
1. Forgot to download
2. Felt it was not age-appropriate
3. Downloaded the app but child has not tried it yet
4. Not interested
5. Other, please specify:
98. Don't know

Q6a. About how often would you say that your child uses the "Kilowatt Krush" app?
1. They used it once
2. They used it a few times
3. They use it daily
4. They use it weekly
5. Other: [OPEN-ENDED RESPONSE]
98. Don't know

Q6b. Have you noticed your child engaging in energy saving behaviors you can attribute to their use of the "Kilowatt Krush" app?
1. Yes
2. No
3. Don't know

Q6c. [If Q6b = 1] What energy saving behaviors have you noticed?
1. Turning off the lights when not in a room
2. Turning off electronics when not in use
3. Taking shorter showers
4. Spending less time with the refrigerator door open
5. Student asked parents to change light bulbs to LED
6. Using a small lamp instead of overhead lights
7. Helping parents shop for energy efficient appliances
8. Opening blinds in the winter to let sun heat the room
9. Other - Please specify.
10. Don't know

Q6d. Do you have any feedback that might help improve the "Kilowatt Krush" app?

1. Yes [Q6d.1 What might improve the app? [OPEN-ENDED RESPONSE]
2. No
98. Don't know

Q7. Did you read any of the Energy Savers booklet that came in the kit? This is the 44-page booklet with information about how to save energy in the home.

1. Yes
2. No
98. Don't know

Q8. [If Q7=1] On a scale from 0 to 10 where 0 is not at all helpful and 10 is very helpful, how helpful was the Energy Savers booklet in identifying ways your household could save energy at home?

0. Not at all helpful
1.
2.
3.
4.
5.
6.
7.
8.
9.
10. Very helpful

[ASK Q9 IF Q8<7]

Q9. What might have made the information more helpful?

[OPEN-ENDED RESPONSE]

Q10. In addition to sending the energy saving kits, Duke Energy sponsored a performance about energy and energy efficiency at your child's school, which included classroom materials and a virtual performance by the National Theatre for Children. Were you aware of this performance before today?

1. Yes
2. No
98. Don't know

[ASK IF Q10=1]

Q11. From whom or where did you hear about this program?

[MULTIPLE RESPONSE]

1. From my child/children
2. From a teacher/school administrator
3. On Duke Energy website
4 Other, please specify:
98 Don't Know

Assessing Energy Saver Kit Installation

We'd like to ask you about the energy saving items included in your kit.

The kit contained an energy-efficient showerhead, faucet aerators for the bathroom and kitchen, energy efficient light bulbs, a night light, and some insulator gaskets for light switches and electricity outlets.

Q12. Have you or anyone else installed any of those items in your home, even if they were taken out later?

1. Yes
2. No [SKIP TO Q20]

[ASK IF Q12 = 1]
Q13. Which of the items did you install, even if they were taken out later?

Item	Response
Q13a Showerhead	1. Yes 2. No
Q13b Kitchen faucet aerator	1. Yes 2. No
Q13c Bathroom faucet aerator	1. Yes 2. No
Q13d Night light	1. Yes 2. No
Q13e Energy efficient light bulb(s) (LEDs)	1. Yes 2. No
Q13f Insulator gaskets for light switches and electricity outlets	1. Yes 2. No

[ASK IF Q13E (ENERGY EFFICIENT LIGHT BULB(S)) = 1 (YES)]

Q14. In addition to the night light, there were two LED light bulbs in the kit. Did you install one or both LED light bulbs in the kit?

1. I installed only one LED light bulb
2. I installed both LEDs

[ASK IF Q13f = 1]

Q15. How many of the twelve (12) light switch and electric outlet gasket insulators from the kit di*d you, or someone else,* install in your home?

1. None
2. One
3. Two
4. Three
5. Four
6. Five
7. Six
8. Seven
9. Eight
10. Nine
11. Ten
12. Eleven
13. Twelve

[ASK IF ANY PART OF Q13= 1]

Q16. Overall, how satisfied are you with the item[s] you installed? Please use 0 to 10 scales, where 0 is very dissatisfied and 10 is very satisfied. How satisfied are you with…?

DISPLAY IF	Item	Rating
Q13a = 1	Q16a Showerhead	0-10
Q13b = 1	Q16b Kitchen faucet aerator	0-10
Q13c = 1	Q16c Bathroom faucet aerator	0-10
Q13d = 1	Q16d Night light	0-10
Q13e = 1	Q16e Energy efficient light bulbs (LEDs)	0-10
Q13f = 1	Q16f Insulator gaskets	0-10

[ASK IF ANY ITEMS IN Q16a - Q16f <7]

Q16.1. Can you please explain any dissatisfaction you had with the [DISPLAY ALL ITEMS IN Q16 THAT ARE <7]?

Q16.1a [IF Q16a < 7] Showerhead

Q16.1b [IF Q16b < 7] Kitchen Faucet aerator

Q16.1c [IF Q16c <7] Bathroom faucet aerator

Q16.1d [IF Q16d< 7] Night light

Q16.1e [IF Q16e <7] Energy efficient light bulbs (LEDs)

Q16.1f [IF Q16f < 7] Insulator gaskets

[OPEN END]

[ASK IF Q13a OR Q13b OR Q13c OR Q13d OR Q13e OR Q13f = 1]
Q17. Have you since uninstalled any of the items from the kit that you had previously installed?

[SINGLE RESPONSE]

1. Yes
2. No

[ASK IF Q17= 1]
Q18. Which of the items did you uninstall?

[MULTIPLE RESPONSE]

1. [DISPLAY IF Q13a = 1] Showerhead
2. [DISPLAY IF Q13b = 1] Kitchen faucet aerator
3. [DISPLAY IF Q13c = 1] Bathroom faucet aerator
4. [DISPLAY IF Q13d = 1] Night light
5. [DISPLAY IF Q13e = 1] Energy efficient light bulbs (LEDs) [Q18.5.a – How many did you uninstall?]
6. [DISPLAY IF Q13f = 1] Insulator gaskets [Q18.6.a – How many did you uninstall?]

[ASK IF Q18 1-6 OPTIONS WERE SELECTED]

Q19. Why were those items uninstalled?

	Item	Reason
IF Q18 = 1	Q19a Showerhead	Repeat reason options
IF Q18 = 2	Q19b Kitchen faucet aerator	Repeat reason options
IF Q18 = 3	Q19c Bathroom faucet aerator	Repeat reason options
IF Q18 = 4	Q19d Night light	Repeat reason options
IF Q18 = 5	Q19e Energy efficient light bulbs	Repeat reason options
IF Q18 = 6	Q19f Insulator gaskets	Repeat reason options

Response options:

[MULTIPLE RESPONSE]

1. It was broken
2. I didn't like how it worked
3. I didn't like how it looked
4. Other: (specify)
98. Don't Know

[ASK IF Q12 = 2]
Q20. a-b. You said you haven't installed [INPUT ONLY THOSE ITEMS IN Q13 IF Q13a-f = 2]. Which of those items do you plan to install in the next three months?

[SELECT ALL THAT APPLY].

1. [Q13a = 2] Showerhead
2. [Q13b = 2] Kitchen faucet aerator
3. [Q13c = 2] Bathroom faucet aerator
4. [Q13d = 2] Night light
5. [Q13e = 2] Energy efficient light bulbs(LEDs)
6. [Q13f = 2] Insulator gaskets
98. None

[ASK IF Q12 = 2 and Q13 only one item has NOT been installed]
Q20c. You said you haven't installed the [INPUT THE ONE ITEM IN Q13=2]. Do you plan to install this item in the next 3 months?

1. Yes
2. No

[ASK IF Q20c = 2]

Q20c.1 What's preventing you from installing the [INPUT THE ONE ITEM IN Q13=2]?

3. Didn't know what that was
4. Tried it, didn't fit
5. Tried it, didn't work as intended (Please specify: ______________________________)
6. Haven't gotten around to it
7. Current one is still working
8. Takes too much time to install it/No time/Too busy
9. Too difficult to install it, don't know how to do it
10. Don't have the tools I need
11. Don't have the items any longer (threw away, gave away)
12. [DISPLAY IF Q20.5 was not selected] Already have energy efficient light bulbs
13. [DISPLAY IF Q20.1 was not selected] Already have efficient showerhead
14. [DISPLAY IF Q20.2 was not selected] Already have efficient kitchen faucet aerator
15. [DISPLAY IF Q20.3 was not selected] Already have efficient bathroom faucet aerators
96. Other, please specify: [OPEN-ENDED RESPONSE]
98. Don't know

[ASK IF ANY 1-6 OPTIONS WERE NOT SELECTED IN Q20 OR OPTION 98 "NONE" WAS SELECTED]
Q21. What's preventing you from installing those items?

[MULTIPLE RESPONSE]

DISPLAY IF	Item	Reason
SKIP IF Q20=1 ,98	Q21a Showerhead	Use multiple response options below
SKIP IF Q20=2,98	Q21b Kitchen faucet aerator	Use multiple response options below
SKIP IF Q20=3,98	Q21c Bathroom faucet aerator	Use multiple response options below
SKIP IF Q20=4,98	Q21d Night light	Use multiple response options below
SKIP IF Q20=5, 98	Q21e Energy efficient light bulbs	Use multiple response options below
SKIP IF Q20=6,98	Q21f Insulator gaskets	Use multiple response options below

[MULTIPLE RESPONSE OPTIONS FOR Q21]

1. Didn't know what that was
2. Tried it, didn't fit
3. Tried it, didn't work as intended (Please specify: ______________________________)
4. Haven't gotten around to it
5. Current one is still working
6. Takes too much time to install it/No time/Too busy
7. Too difficult to install it, don't know how to do it
8. Don't have the tools I need
9. Don't have the items any longer (threw away, gave away)
10. [DISPLAY IF Q20.5 was not selected] Already have energy efficient light bulbs

11. [DISPLAY IF Q20.1 was not selected] Already have efficient showerhead
12. [DISPLAY IF Q20.2 was not selected] Already have efficient kitchen faucet aerator
13. [DISPLAY IF Q20.3 was not selected] Already have efficient bathroom faucet aerators
96. Other, please specify: [OPEN-ENDED RESPONSE]
98. Don't know

[IF ANY PART OF Q13 = 1 AND IT'S NOT THE CASE THAT ALL PARTS OF Q18=SELECTED (THAT IS, THEY INSTALLED ANYTHING AND DID NOT UNINSTALL EVERYTHING THEY INSTALLED)]

[ASK IF Q13A (SHOWERHEAD)) = 1 (YES) AND Q18 <>1 (SHOWERHEAD); THAT IS, SHOWERHEAD WAS INSTALLED AND NOT UNINSTALLED]

Q22. Thinking of the efficient showerhead currently installed in your home that you <u>received from the program</u>...on average, how many showers per day are taken in this shower (by all occupants)?

[INTEGER RESPONSE]

Q23. Again, thinking specifically about the showerhead installed in your home that you <u>received from the program</u>, what is the average shower length taken in this shower? Please provide your response in minutes.

[INTEGER RESPONSE]

[ASK IF Q13d = 1 AND Q18 <>4 NIGHT LIGHT OPTION WAS NOT SELECTED]
Q24. YOU SAID YOU INSTALLED THE NIGHT LIGHT. Did the night light replace an existing night light?

1. Yes
2. No

[ASK IF Q24 = 1]
Q25. Did the old night light use an incandescent or LED bulb? If you could take out and replace the bulb once it burned out, it was likely an incandescent bulb.

1. Incandescent
2. LED
98. Don't know

[ASK IF (Q13E = 1 AND Q18 <> 5 (ENERGY EFFICIENT LIGHTS WERE NOT SELECTED)]
Q26. You said you installed at least one of the energy efficient lights. What type of bulb(s) did you replace with the energy efficient lightbulb(s)?

1. Incandescent (*Old-fashioned light bulb - likely purchased more than two years ago*)
2. Halogen (*Bulb that looks like an incandescent, but has a glass tube inside of the bulb*)

3. CFL (*Spiral, or twisty shape bulb that fit into ordinary light fixtures)*
4. LED (*New bulb type that uses little electricity and lasts a long time*)
98. Don't know

[ASK IF (Q13E = 1 AND Q18 <> 5 (ENERGY EFFICIENT LIGHT BULBS NOT SELECTED)]
Q27. In what rooms did you install the energy efficient lightbulbs that were included in the kit? [MULTIPLE RESPONSE]

1. Living room
2. Dining room
3. Bedroom
4. Kitchen
5. Bathroom
6. Den
7. Garage
8. Hallway
9. Basement
10. Outdoors
11. Other area (please specify):_______

Q28. Have you adjusted the temperature of your water heater based on the Hot Water Gauge Card included in your kit?

1. Yes
2. No
3. Don't recall seeing the Hot Water Gauge Card

[ASK IF Q28 = 1]
Q29. Is the new water heater temperature setting still in place?

1. Yes
2. No
98. Don't know

[IF Q29 = 2]
Q30. Why did you change the water heater temperature a second time?

[Record response]

Net-To-Gross

[IF ANY PART OF Q13 = 1 AND IT'S NOT THE CASE THAT ALL PARTS OF Q18 =SELECTED (THAT IS, THEY INSTALLED ANYTHING AND DID NOT UNINSTALL EVERYTHING THEY INSTALLED)]

ASK Q31 IF [Q13a = 1 AND Q18<>1]OR [Q13b = 1 AND Q18 <>2] OR [Q13=c AND Q18 <> 3] OR [Q13d = 1 AND Q18 <>4] OR Q13e = 1 AND Q18 <> 5] OR [Q13f = 1 AND Q18 <>6]

Q31. If you had not received the free efficiency items in the kit, would you have purchased and installed any of these same items within the next year?

1. Yes
2. No [Skip to Q34]
98. Don't know

Q32. What items would you have purchased and installed in the next year?

1. [DISPLAY IF Q13A = 1 AND Q18 <>1] Energy-Efficient Showerhead
2. [DISPLAY IF Q13B = 1 AND Q18 <> 2] Kitchen Faucet Aerator
3. [DISPLAY IF Q13C = 1 AND Q18 <>3] Bathroom Faucet Aerator
4. [DISPLAY IF Q13D = 1 AND Q18 <>4] Energy-Efficient Light Bulbs (LEDs)
5. [DISPLAY IF Q13E = 1 AND Q18 <> 5] Energy-Efficient Night Light
6. [IF Q13F = 1 AND Q18 <>6] Switch/Outlet Gasket Insulators
7. No, I would not have purchased any of the items
98. Don't know

[ASK Q33 IF Q32.4 = YES]

Q33. If you had not received them for free in the kit, how many LED light bulbs would you have purchased?

1. One
2. Two
98. Don't know

[IF (Q13*a*=1 AND Q18 <>1) OR (Q13*b*=1 AND Q18 <>2) OR (Q13*c*=1 AND Q18 <>3)]

Q34. Using a scale from 0 to 10, where 0 means "not at all influential" and 10 means "extremely influential", how influential were the following factors on your decision to install the low flow kitchen aerator, bathroom aerator, and showerhead from the kit? How influential was...

Elements	Responses
The fact that the items were free	0-10 scale with DK
The fact that the items were mailed to your house	0-10 scale with DK
Information in the kit about how the items would save water or energy	0-10 scale with DK
Information that your child brought home from school	0-10 scale with DK
Other information or advertisements from Duke Energy, including its website	0-10 scale with DK

[ASK Q35 IF (Q13D=1 AND Q18 <>4) OR (Q35 IF Q13E=1 AND Q18 <>5) OR (Q35 IF Q13F=1 AND Q18 <>6)] (THAT IS, ANY OF THE 3 MEASURES WERE INSTALLED AND NOT REMOVED)

Q35. Using a scale from 0 to 10, where 0 means "not at all influential" and 10 means "extremely influential" how influential were the following factors on your decision to install the lightbulbs, night light, or outlet gaskets from the kit? *How influential was…*

Elements	Responses
The fact that the items were free	0-10 scale with DK
The fact that the items were mailed to your house	0-10 scale with DK
Information in the kit about how the items would save energy	0-10 scale with DK
Information that your child brought home from school	0-10 scale with DK
Other information or advertisements from Duke Energy, including its website	0-10 scale with DK

Q36. Since your child learned about energy conservation at school and signed up for your energy kit from Duke Energy, has <u>your child</u> adopted or increased any <u>new behaviors</u> to help save energy in your home? This would only include new energy saving <u>behaviors</u> that your child adopted since receiving the kit.

[MULTIPLE RESPONSE]

1. Not applicable - no new behaviors
2. Turning off lights when not in a room
3. Turning off electronics when not using them
4. Taking shorter showers
5. Other (specify: ____________)
98. Don't know

Q36a. [IF ☐ =2 OR 3 OR 4 OR 5] Before receiving the kit, was your child already… [DISPLAY ITEMS SELECTED IN ☐]

Q37b.2 [Display IF ☐ = 2] Turning off lights when not in a room
Q37b.3 [Display IF ☐ = 3] Turning off electronics when not using them
Q37b.4 [Display if ☐ = 4] Taking shorter showers
Q37b.5 [Display IF ☐ = 5 [Insert Q37 "other"]__________)

1. Yes
2. No
98. Don't know

Q37. Since receiving your energy kit from Duke Energy, have <u>you or other adults in the home</u> adopted or increased any of the following behaviors to help save energy in your home?

[Multiple response]

1. Not applicable - no new behaviors
2. Turning off lights when not in a room
3. Turning off furnace when not home
4. Turning off air conditioning when not home
5. Changing thermostat settings so heating or cooling system uses less energy
6. Using fans instead of air conditioning
7. Turning off electronics when not using them
8. Taking shorter showers
9. Turning water heater temperature down
10. Other (specify: ____________)
11. Don't know

☐b. [IF ☐= 2-10] Before receiving the kit, were you already...

[DISPLAY ITEMS SELECTED IN ☐- [Question labels: ☐b2 – ☐b10]

1. Yes
2. No
98. Don't know

[ASK ☐ IF ☐b2 OR ☐b3 OR ☐b4 OR ☐b5 OR ☐b6 OR ☐b7 OR ☐b8 OR ☐b9 OR ☐b10 = 2]

Q38. On a scale of 0 to 10, where 0 means "not at all influential" and 10 means "extremely influential," how much influence did Duke Energy's kit and materials on saving energy have on this change of energy using behaviors?

0 – Not at all influential	1	2	3	4	5	6	7	8	9	10 – Extremely influential	98 DK

Q39. Since receiving your energy kit from Duke Energy, have you purchased and installed any other **products** or made any improvements to your home to help save energy?

1. Yes
2. No
98. Don't know

[ASK IF Q39 = 1] [IF Q39 = 2 OR 98, SKIP TO Q57]

Q40. What **products** have you purchased and installed to help save energy in your home?

[MULTIPLE RESPONSE]

1. Energy efficient appliances
2. Efficient heating or cooling equipment

3. Efficient windows
4. Insulation
5. Products to seal air leaks in your home
6. Products to seal ducts
7. LEDs and/or CFLs
8. Water heater
9. None – no other actions taken
96. Other, please specify: ____________________
98. Don't know

[ASK IF Q40= 1-8,96]
Q41. Did you get a rebate from Duke Energy or another entity for any of those products or services? If so, which ones?

[LOGIC] Item	Response
Q41.1 [IF Q40.1 IS SELECTED] 1. Energy efficient appliances	Yes, No DK
Q41.2 [IF Q40.2 IS SELECTED] 2. Efficient heating or cooling equipment	Yes, No DK
Q41.3 [IF Q40.3 IS SELECTED] 3. Efficient windows	Yes, No DK
Q41.4 [IF Q40.4 IS SELECTED] 4. Additional insulation	Yes, No DK
Q41.5 [IF Q40.5 IS SELECTED] 5. Products to seal air leaks in your home	Yes, No DK
Q41.6 [IF Q40.6 IS SELECTED] 6. Products to seal ducts	Yes, No DK
Q41.7 [IF Q40.7 IS SELECTED] 7. LEDs and/or CFLs	Yes, No DK
Q41.8 [IF Q40.8 IS SELECTED] 8. Install an energy efficient water heater	Yes, No DK
Q41.96 [IF Q40.96 IS SELECTED] 96. [Q40 OPEN ENDED RESPONSE]	Yes, No DK

[ASK IF ANY ITEM IN Q40 WAS SELECTED AND Q41=NO]
Q42. On a scale of 0 to 10, where 0 means "not at all influential" and 10 means "extremely influential", how much influence did the Duke Energy schools program have on your decision to…

[MATRIX QUESTION: SCALE]

[LOGIC] Item	Response
Q42.1 [IF Q40.1 IS SELECTED] 1. Buy energy efficient appliances	0-10 scale with DK
Q42.2 [IF Q40.2 IS SELECTED] 2. Buy efficient heating or cooling equipment	0-10 scale with DK

Q42.3 [IF Q40.3 IS SELECTED] 3. Buy efficient windows	0-10 scale with DK
Q42.4 [IF Q40.4 IS SELECTED] 4. Buy additional insulation	0-10 scale with DK
Q42.5 [IF Q40.5 IS SELECTED] 5. Seal air leaks in your home	0-10 scale with DK
Q42.6 [IF Q40.6 IS SELECTED] 6. Seal ducts	0-10 scale with DK
Q42.7[IF Q40.7 IS SELECTED] 7. Buy LEDs and/or CFLs	0-10 scale with DK
Q42.8 [IF Q40.8 IS SELECTED] 8. Install an energy efficient water heater	0-10 scale with DK
Q42.96[IF Q40.96 IS SELECTED] **[Q40 open ended response]**	0-10 scale with DK

[ASK IF Q40.1 IS SELECTED AND Q42.1 <> 0, DK]
Q43. What kinds of appliance(s) did you buy?

[MULTIPLE RESPONSE]

1. Refrigerator
2. Stand-alone Freezer
3. Dishwasher
4. Clothes washer
5. Clothes dryer
6. Oven
7. Microwave
96. Other, please specify: ____________

[A*SK Q44* IF Q43 = 1-96] [REPEAT Q44 FOR EACH ITEM MENTIONED IN Q43]

Q44. Was the [INSERT Q43 RESPONSE] an ENERGY STAR or high-efficiency model?

[SINGLE RESPONSE]

1 Yes
2 No
98. Don't know

[ASK IF Q43 = 5]
Q45. Does the new clothes dryer use natural gas?

1 Yes - it uses natural gas
2 No – does not use natural gas
98. Don't know

[ASK IF Q43 = 6]

Q45A. Does the new oven use natural gas?

1 Yes - it uses natural gas
2 No – does not use natural gas
98. Don't know

[ASK IF Q40 = 2 AND Q42.2 > 0]
Q46. What type of heating or cooling equipment did you buy?

[MULTIPLE RESPONSE]

1. Central air conditioner
2. Window/room air conditioner unit
3. Wall air conditioner unit
4. Air source heat pump
5. Geothermal heat pump
6. Boiler
7. Furnace
8. WIFI-enabled thermostat
96. Other, please specify: _______________
98. Don't know

[ASK IF Q46 = 6-7]
Q47. Does the new [INSERT Q46 RESPONSE] use natural gas?

1. Yes - it uses natural gas
2. No – does not use natural gas
98. Don't know

[ASK IF Q46 = 1-7, 96] QUESTION LABELS: Q48.1, Q48.2, Q48.3, Q48.4, Q48.5, Q48.6, Q48.7, Q48.96
Q48. Was the [INSERT Q46 RESPONSE] an ENERGY STAR or high-efficiency model?

[SINGLE RESPONSE]

1. Yes
2. No
98. Don't know

[REPEAT Q48 FOR EACH ITEM MENTIONED IN Q46]

[ASK IF Q40 = 3 AND Q42.3 > 0]

Q49. HOW MANY WINDOWS DID YOU INSTALL?

1. [_______________] [Numeric Response 1-30

98. Don't know

[ASK IF Q40 = 4 AND Q42.4 > 0]
Q50. Did you add insulation to your attic, walls, or below the floor?

[MULTIPLE RESPONSE]

1. Attic
2 Walls
3 Below the floor
98. Don't know

[ASK IF Q50 <> 98]
[PROGRAMMER: REPEAT Q51 FOR EACH ITEM MENTIONED IN Q50] Q51.1 = ATTIC Q51.2 = WALLS Q51.3 = BELOW THE FLOOR]

Q51. Approximately what proportion of the [ITEM MENTIONED IN Q50] SPACE DID YOU ADD INSULATION TO? Your best estimate is fine.

1 [RECORD AS %] [NUMERIC RANGE 1 – 100]
98 Don't know

[ASK IF Q40 = 7 AND Q42.7 > 0]

Q52. How many of LEDs and CFLs did you install in your property?

1. [NUMERIC RESPONSE 1- 100]
98. Don't know

[ASK IF Q52 > 50)

Q53. You said that you installed [Q53 RESPONSE] LED and CFL bulbs on your property. Is this the correct number?

1. Yes, this is number of LED and CFL bulbs I installed
2. No, the correct number is: _______
98. Don't know

[ASK IF Q40 = 8 IS SELECTED AND Q42.8 > 0]
Q54. Does the new water heater use natural gas?

1 Yes - it uses natural gas
2. No – does not use natural gas
98. Don't know

[ASK IF Q40 = 8 IS SELECTED AND Q42.8 > 0]
Q55. Which of the following water heaters did you purchase?

1. A traditional water heater with a large tank that holds the hot water
2. A tankless water heater that provides hot water on demand
3. A heat pump water heater
4. A solar water heater
5. Other, please specify: _______________
98. Don't know

[ASK IF Q40 = 8 AND Q42.8 > 0]
Q56. Is the new water heater an ENERGY STAR model?

[SINGLE RESPONSE]

1. Yes
2. No
98. Don't know

Demographics

Q57. Which of the following types of housing units would you say best describes your home?

1 Single-family detached house
2 Single-family attached home (such as a townhouse or condo)
3 Duplex, triplex or four-plex
4 Apartment or condominium with 5 units or more
5 Manufactured or mobile home
6 Other _______________
98. Don't know

Q58. How many showers are in your home? Please include both stand-up showers and bathtubs with showerheads. [SINGLE RESPONSE]

1. One
2. Two
3. Three
4. Four
5. Five
6. More than five
98. Don't know

Q59. How many bathroom sink faucets are in your home? (Keep in mind that some bathrooms may have multiple bathroom sink faucets in them.) [SINGLE RESPONSE]

1. One

2. Two
3. Three
4. Four
5. Five
6. Six
7. Seven
8. Eight or more
98. Don't know

Q60. How many kitchen faucets are in your home? [SINGLE RESPONSE]

1. One
2. Two
3. Three
4. Four or more
98. Don't know

Q61. What is the fuel type of your water heater?

1. Electricity
2. Natural Gas
3. Other, please specify: [OPEN-ENDED RESPONSE]
98. Don't know

Q62. How many square feet of living space are there in your residence, including bathrooms, foyers and hallways (exclude garages, unfinished basements, and unheated porches)?

1. Less than 500 square feet
2. 1,000 to under 1,500 square feet
3. 1,500 to under 2,000 square feet
4. 2,000 to under 2,500 square feet
5. 2,500 to under 3,000 square feet
6. 3,000 to under 4,000 square feet
7. Greater than 4,000 square feet
98. Don't know

Q63. Do you or members of your household own your home, or do you rent it?

1. Own / buying
2. Rent / lease
3. Occupy rent-free
98. Don't know

Q64. Including yourself, how many people currently live in your home year-round?

1. I live by myself
2. Two people
3. Three people
4. Four people
5. Five people
6. Six people
7. Seven people
8. Eight or more people
98. Don't know

Q65. What was your total annual household income for 2021, before taxes?

1. Under $15,000
2. 15 to under $25,000
3. 25 to under $35,000
4. 35 to under $50,000
5. 50 to under $75,000
6. 75 to under $100,000
7. 100 to under $150,000
8. 150 to under $200,000
9. $200,000 or more
99. Prefer not to say

Q66. What is the highest level of education achieved among those living in your household?

1. Less than high school
2. Some high school
3. High school graduate or equivalent (such as GED)
4. Trade or technical school
5. Some college (including Associate degree)
6. College degree (Bachelor's degree)
7. Some graduate school
8. Graduate degree, professional degree
9. Doctorate
99. Prefer not to say

Q67. Lastly, did the COVID-19 pandemic, or government or organizational responses to it, offer any challenges to you regarding your participation in this program? If so, what were these challenges, and how do you think they might best be addressed moving forward?

1. Yes: [OPEN-ENDED RESPONSE]
2. No
98. Don't know

CLOSE:

Thank you very much for your time today! On behalf of Duke Energy, thank you for your time in completing this survey. If you were one of the first 100 to complete the survey, you will receive a $5 gift card!

Appendix F Participant Demographics

Home type	%	n
Single-family detached	78%	91
Single-family attached	8%	9
Duplex, triplex, four-plex	1%	1
Apartment or condo 5 units or more	3%	4
Manufactured or mobile home	9%	10
Other	1%	1
Don't know	1%	1
Home size	**%**	**n**
Less than 500 square feet	1%	1
500 to under 1,000 square feet	12%	13
1,000 to under 1,500 square feet	39%	43
1,500 to under 2,000 square feet	23%	25
2,000 to under 2,500 square feet	15%	17
2,500 to under 3,000 square feet	5%	5
Greater than 3,000 square feet	5%	6
Ownership Status	**%**	**n**
Own / buying	84%	97
Rent / lease	16%	18
Occupy rent-free	1%	1
Don't know	0%	0
Prefer not to say	0%	0
Water Heater Fuel Type	**%**	**n**
Electric	68%	78
Natural Gas	27%	31
Other	4%	5
Household Size	**%**	**n**
I live by myself	22%	26
Two people	34%	39
Three people	16%	18
Four people	16%	19
Five people	5%	6
Six people	3%	4
Seven people	1%	1
Eight or more people	0%	0
Prefer not to say	3%	3
Household Income	**%**	**n**

Under $20,000	6%	6
20 to under $30,000	11%	11
30 to under $40,000	18%	17
40 to under $50,000	12%	12
50 to under $60,000	13%	13
60 to under $75,000	10%	10
75 to under $100,000	14%	14
100 to under $150,000	12%	12
150 to under $200,000	0%	0
$200,000 or more	2%	2
Education Level	**%**	**n**
Less than high school	1%	1
Some high school	2%	2
High school graduate or equivalent (such as GED)	21%	24
Trade or technical school	3%	4
Some college (including Associate degree)	23%	27
College degree (Bachelor's degree)	23%	26
Some graduate school	6%	7
Graduate degree, professional degree	13%	15
Doctorate	4%	5
Prefer not to say	3%	4

Appendix G Participant Responses

Measurement	Value
Survey Responses	144
Average Occupants per Home	3.65
Electric Water Heater %	46.8%
Showerheads	
Provided	137
Installed	63
Removed	10
Installed %	46.0%
Removed %	15.9%
In-Service Rate	38.7%
Shower per Day (per person)	0.74
Minutes per Shower	12.5
Showerheads per Home	1.80
Kitchen Faucet Aerator	
Provided	141
Installed	64
Removed	2
Installed %	45.4%
Removed %	3.1%
In-Service Rate	44.0%
Bathroom Faucet Aerator	
Provided	141
Installed	57
Removed	2
Installed %	40.4%
Removed %	3.5%
In-Service Rate	39.0%

Measurement	Value
Water Temperature Gauge Card	
Provided	113
Installed	38
Removed	2
Installed %	33.6%
Removed %	5%
In-Service Rate	32%
5W LEDs	
Provided	254
Installed	211
Removed	8
Installed %	83.1%
Removed %	3.8%
In-Service Rate	79.9%
Base Lamp Wattage	18.3
Daily Hours of Use	2.90
Night Light	
Provided	127
Installed	104
Removed	10
Installed %	81.9%
Removed %	9.6%
In-Service Rate	74.0%
Base Lamp Wattage	1.9
Outlet Insulating Gaskets	
Provided	1,728
Installed	412
Removed	2
Installed %	23.8%
Removed %	0.5%
In-Service Rate	23.7%

Measurement		Value
Behavior		
Turn Off Lights Children	Opportunity	63
	Adoption	32
	Adoption Rate	50.8%
Turn Off Lights Parents	Opportunity	63
	Adoption	11
	Adoption Rate	17.5%
Turn Off Electronics Children	Opportunity	63
	Adoption	25
	Adoption Rate	39.7%
Turn Off Electronics Parents	Opportunity	63
	Adoption	20
	Adoption Rate	31.7%
Take Shorter Showers Children	Opportunity	63
	Adoption	10
	Adoption Rate	15.9%
Take Shorter Showers Parents	Opportunity	63
	Adoption	19
	Adoption Rate	30.2%
Change Thermostat Settings Parents	Opportunity	63
	Adoption	28
	Adoption Rate	44.4%
Turn off Air Conditioning Parents	Opportunity	63
	Adoption	10
	Adoption Rate	15.9%
Turn Off Heating Parents	Opportunity	63
	Adoption	4
	Adoption Rate	6.3%
Use Fans Instead of Air Conditioning Parents	Opportunity	63
	Adoption	11
	Adoption Rate	17.5%
Turn Down Water Heater Parents	Opportunity	63
	Adoption	7
	Adoption Rate	11.1%

Smart $aver 2020-2021 Evaluation Report

Duke Energy Indiana

Submitted to Duke Energy

Date: October 10, 2022

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Contents

1. Executive Summary

1.1. Program Summary

The Smart $aver program offers Duke Energy Indiana (DEI) existing and new construction residential customers incentives for improving their home's energy efficiency through the installation of energy efficient heating, ventilating, and air conditioning (HVAC) units, smart thermostats, heat pump water heating, variable-speed pool pumps, duct sealing, and attic insulation with air sealing. A tiered incentive structure of eligible HVAC equipment, along with optional smart thermostat, offers larger rebates for higher efficiency units. Smart thermostats are not offered as a standalone incentive (but are available at Duke Energy's online marketplace), therefore customers must receive a rebate for a new HVAC system to be eligible for this additional $65 incentive. The program is provided through independent, prequalified contractors who install the eligible energy efficiency measures consistent with the program standards and guidelines, and submit the rebate application documentation on behalf of the customer.

1.2. Evaluation Objectives and Results

This report presents the results and findings of evaluation activities for the Smart $aver program conducted by the evaluation team in the evaluation period of May 1, 2020 – April 30, 2021.

1.2.1. Impact Evaluation

The impact evaluation was divided in two tasks: first to determine gross savings and second to determine net savings. The evaluation team reviewed the program database to help inform the design of the evaluation effort and sampling approach. Activities included an in-situ metering study (n=63) to estimate operational load of air source heat pumps and central air conditioners as well as engineering desk analyses to estimate gross savings for all measures in the program during the evaluation period. Net savings reflect the degree to which the gross impacts are a result of the program-specific efforts and incentives. Attribution surveys with program participants and contractors were administered to estimate the rates of free ridership and spillover. Program level results for the Smart $aver program are provided in Table 1-1.

Table 1-1: Program Impact Results

Measurement	Reported	Realization Rate	Gross Verified	Net-to-Gross Ratio*	Net Verified
Energy (kWh)	2,986,175	137.4%	4,103,733	84.01%	3,447,546
Summer Demand (kW)	639.2	127.5%	814.7		684.4
Winter Demand (kW)	544.2	49.0%	266.6		224.0

* The overall program net-to-gross rate of 84.01% is comprised of two evaluated values of 100.0% for smart thermostats (derived from a billing analysis providing a net result) and a value of 68.85% for all other measures from self-report surveys. Measure level NTG values used for program planning can be found in Appendix B.

In the evaluation period of May 1, 2020 – April 30, 2021, the program provided rebates for 5,700 measures installed in single family homes, resulting in 4,104 MWh in gross verified energy savings, and 3,448 MWh in net verified energy savings. The program primarily incentivized HVAC equipment and add-on smart thermostats, which accounted for approximately 86% of verified energy savings, as shown in Figure 1-1 and 1-2.

Figure 1-1: Count of Smart $aver Rebated Measures

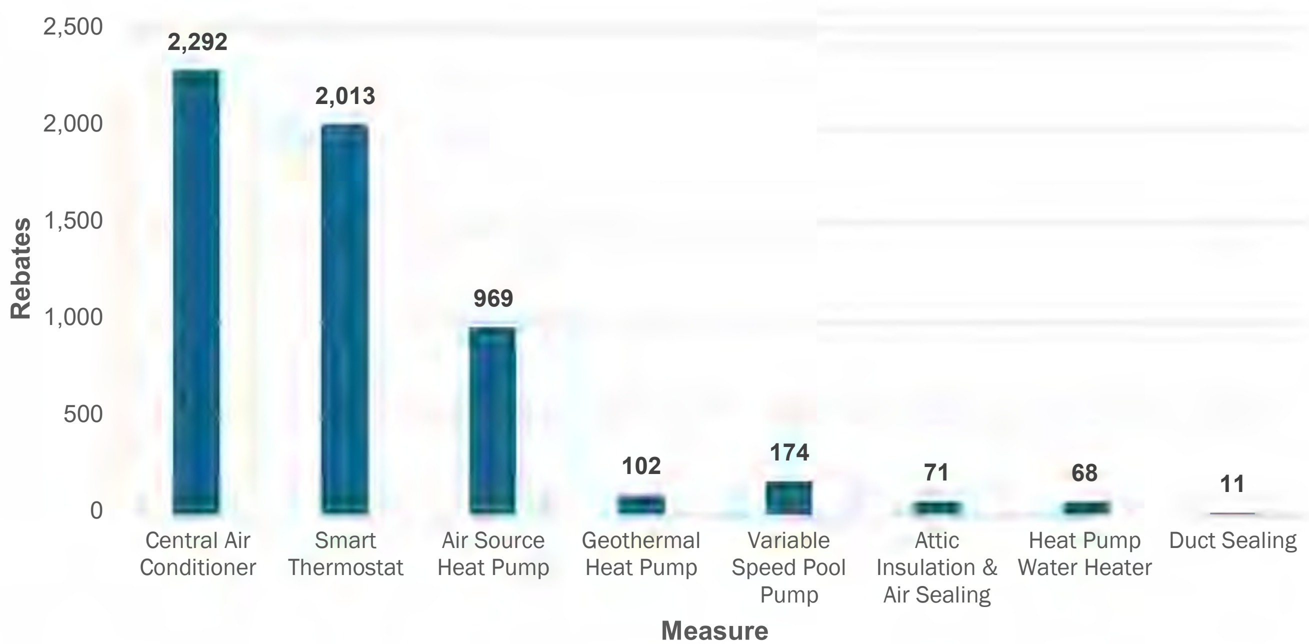
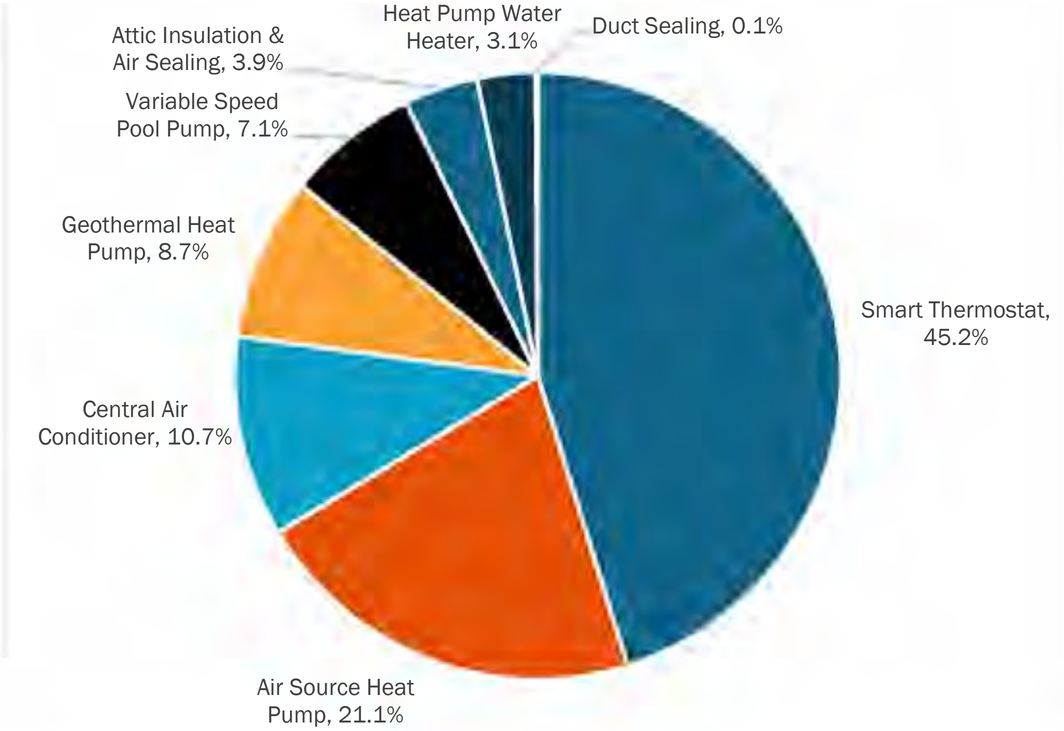


Figure 1-2: Smart $aver Verified Energy Savings Portion by Measure



The evaluation resulted in verified savings with a wide range of realization rates. The specific measure savings findings include:

- The smart thermostat measure achieved an energy realization rate of 237% due to the results of an AMI analysis as described in Section 3.4.3.
- Central air conditioner savings decreased significantly due to several factors. Many of the air conditioning units rebated through the program have a low capacity and a low energy efficiency ratio (EER), respectively contributing to low energy savings and low summer demand savings. A change in the federal code governing fan efficiency ratio (FER) resulted in winter demand savings reducing to zero, while also reducing energy savings.
- Gross verified savings for air source heat pumps remained relatively steady.
- Geothermal heat pumps achieved very high realization rates due to low reported savings for the measure.

- Variable speed pool pump energy savings increased slightly as participants installed units with higher horsepower compared to previous evaluations, and summer demand savings increased significantly due to a change in analysis methodology.

- Attic insulation and air sealing achieved high realization rates, as participants installed more insulation in larger attic areas compared to previous years.

- Heat pump water heater energy savings were updated using recent data sources, and demonstrated verifiable summer demand savings due to reductions in household cooling loads.

- Deemed savings were applied to duct sealing measures, but realization rates varied due to inconsistencies in reported savings for this measure.

Table 1-2 below presents per unit verified gross energy and demand savings for each rebated measure.

Table 1-2: Gross Verified Impacts by Measure (Per Unit)

Measure	Energy Savings (kWh)			Summer Demand Savings (kW)			Winter Demand Savings (kW)		
	Reported	Realization Rate	Gross Verified	Reported	Realization Rate	Gross Verified	Reported	Realization Rate	Gross Verified
Central Air Conditioner	361	53.2%	192	0.178	58.3%	0.104	0.113	0.0%	0.000
Smart Thermostat	388	237.0%	922	0	N/A	0	0	N/A	0
Air Source Heat Pump	809	110.7%	895	0.111	73.5%	0.081	0.236	71.2%	0.168
Geothermal Heat Pump	1,265	276.6%	3,499	0.166	147.1%	0.244	0.374	198.8%	0.744
Variable Speed Pool Pump	1,516	110.0%	1,667	0.505	483.2%	2.440	0	N/A	0
Attic Insulation & Air Sealing	1,202	188.9%	2,271	0.220	189.2%	0.416	0.251	151.9%	0.381
Heat Pump Water Heater	1,615	116.1%	1,874	0.000	N/A	0.256	0.000	N/A	0.000
Duct Sealing	503	89.7%	451	0.341	23.2%	0.079	0.029	275.0%	0.079

1.2.2. Net-to-Gross

Net-to-gross assessment measures the extent to which a utility program motivates a customer to undertake energy saving installations that they would not otherwise have performed. The net-to-gross formula is comprised of free-ridership, participant spillover, and nonparticipant spillover (NTG = 100% - FR + PSO + NPSO). Inserting the freeridership and spillover estimates into the NTG formula produces a NTG value of 100% for smart thermostats (due to the billing analysis result producing a net value) and 69% for the other combined DEI program measures in 2020-2021 as shown in 1-3. This result is in line with the previous evaluation in 2016-2017, which produced a NTG value of 68%.

Table 1-3: Net-to-Gross Results

NTG Type	Free Ridership	Participant Spillover	Non-Participant Spillover	NTG
Non-Thermostat Measures (Self-Report)	39.31%	1.58%	6.58%	68.85%
Smart Thermostat (Billing Analysis)	0%	0%	0%	100%

The estimates for each NTG component came from the following source:

- Freeridership: the survey that was completed by participants included a freeridership battery, consisting of a change and influence component, to assess what participants would have done in the absence of the program. Smart thermostat measures were assessed via a net billing analysis.
- Participant Spillover: participant surveys assessed whether participants installed additional measures after participating in the program, and whether this could be attributed to the Smart$aver program.
- Nonparticipant Spillover: trade ally surveys assessed whether trade allies installed energy efficient measures for non-participating customers but attributed their efficient recommendation to their participation in the program.

1.2.3. Process Evaluation

This process evaluation assessed the customer and trade ally experience, why and how rebated energy saving measures were implemented through Smart$aver, and identified ways to improve the program design and implementation. To answer these research questions, the evaluation team interviewed program and implementer staff (n=2) and “high volume” trade allies (n=4), and surveyed a random sample of trade allies (n=45), and participants (n=114).[1]

Program Successes
The DEI Smart $aver Program found success in the following areas.

[1] High volume trade allies are companies in the top 20% of trade allies in terms of number of rebated measures, for a given measure type.

- **Overall, participants are highly satisfied with Smart $aver.** Participants were especially satisfied with their contractors, their upgrade project, and the program overall.

- **Smart $aver influences energy efficiency contracting services in DEI service territory.** Trade allies reported that participating in Smart $aver at least partially influenced them to recommend and implement qualifying measures and has generally increased their knowledge of energy efficient technologies.

- **Trade allies appreciate the enhanced trade ally portal.** Trade allies reported high satisfaction with both the incentive application submission process, and the trade ally portal application tracking system. The majority of trade allies (92%) do not experience any challenges with this portal.

- **Trade allies are Smart $aver's most successful marketing channel.** Participant surveys demonstrated that trade allies are the primary source of program awareness and are the most influential factor on the customer's decision to implement rebated measures. This is true across all measures updated through the Smart $aver program. Furthermore, most trade allies reported their customers typically have not heard of Smart $aver rebates until they mention them to the customer. This emphasizes the importance of the trade allies to the Smart $aver program.

Program Challenges
The following concerns were highlighted by trade allies and participants.

- **Consumer communication from Duke Energy could be improved.** Few (14%) of participants heard about the Smart $aver program through Duke Energy. Of participants who offered suggestions for improvement, over a quarter (5 out of 19) reported that more information and better communication to customers from Duke Energy about available rebates and energy saving measures is needed.

- **Few participants noted challenges to participating as a result of COVID-19.** While only 6% of participants reported challenges to participation related to COVID-19, these challenges provide insight into the program. The challenges were:
    - Supply chain issues
    - Cancellation of installation
    - Rebates expiring before they could be used

- **Updates to the portal may still be necessary to ensure that trade allies are completely satisfied.** Despite the high satisfaction ratings from the trade allies about the portal, they suggested the following to further enhance their experience:

- Customers should be able to submit the application themselves as this takes a lot of work for trade allies
- Allow for instant rebates (to still be approved through the portal)
- Better explanations if the application is returned as invalid
- Ability to search for the customer account number by using their name or address[2]

1.3. Evaluation Conclusions and Recommendations

Based on the findings, the evaluation team suggest the following recommendations for program improvement.

Conclusion 1: The market has changed since the last program update several years ago.

Recommendation 1: Consider the following updates to the program design:

- Remove the SEER 15 CAC and ASHP tier offering
- Add an additional tier for SEER 18+ for both CAC and ASHP with a higher incentive
- Add a ductless mini-split heat pump offering
- Consider adding an EER requirement in addition to SEER (as this impacts summer kW)
- Separate GSHP from ASHP and assign specific savings to each
- Assign referred measures the same gross savings as non-referred measures
    - Free ridership for referred measures may then be set to 0% and incorporated into the overall evaluation

Conclusion 2: Smart thermostats produce high savings. The AMI analysis showed very robust savings for smart thermostats installed through the program. Many trade allies noted that smart thermostat incentives used to be higher.

Recommendation 2: Consider returning smart thermostats to a higher incentive to help drive higher participation.

Conclusion 3: Trade allies appreciate the new portal. Most respondents (92%) reported that they did not have any issues with the enhanced Rebate Application Entry and Tracking Platform as compared to 50% of trade allies who reported that they occasionally experienced challenges or frustrations with the old platform.

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[2] Note that though the trade allies have requested this capability, it is not advisable due to personally identifiable information (PII) concerns.

Recommendation 3: Trade allies offered several suggestions for application improvements, including:

- Better explanations if the application is returned as invalid
- Auto-populate referral information

Conclusion 4: Though most are satisfied with the incentives, some customers and trade allies voiced alternatives.

Recommendation 4a: Decrease the processing time and increase the gift card expiration date longer (past 6 months). Consider a "payment in check" option as there are sometimes issues with gift cards expiring before people can use them.

Recommendation 4b: Trade allies are the most commonly cited way customers hear about the program, and the incentive application process is completed by them (for most measures). Consider reinstating a direct incentive for trade allies.

Recommendation 4c: For high volume trade allies that submit a lot of applications, and that prefer financially to do so, consider allowing for an instant incentive (still to be approved through the portal). Some trade allies noted that the time and cost they incur from being the "middle man" between the customer and the gift card processor is a large burden and they would prefer to give the incentive as an invoice credit. Then, on a regular cadence, trade allies could bundle incentive payments into one incentive to Duke to be paid back directly. This could save on gift card processing costs and would alleviate issues with long wait times for incentives.

2. Introduction

2.1. Program Description

2.1.1. Overview

The Smart $aver program offers Duke Energy Indiana (DEI) existing and new construction residential customers incentives for improving their home's energy efficiency through the installation of energy efficient heating, ventilating, and air conditioning (HVAC) units, smart thermostats, heat pump water heaters, variable-speed pool pumps, duct sealing, and attic insulation with air sealing. A tiered incentive structure of eligible HVAC equipment, along with an optional smart thermostat, offers larger rebates for higher efficiency units. Smart thermostat incentives are not offered as a standalone incentive (but they are available in the online marketplace). Customers must receive a rebate for a new HVAC system to be eligible for this additional incentive.

The program is provided through independent prequalified contractors – called "trade allies" – who install the eligible energy efficiency measures consistent with the program standards and guidelines, and submit the rebate application documentation on behalf of the customer. Trade allies receive no monetary incentives for measures they install in existing buildings, but builders are eligible to receive rebates for qualified HVAC equipment installed in residential new construction projects.

2.1.2. Energy Efficiency Measures

Energy efficiency measures included in the Smart $aver program are summarized in Table 2-1.

Table 2-1: 2021 Smart $aver Measures and Incentives

Measures		Rebate Amount	Details
Central Air Conditioner		Tier 2: $200 Tier 3: $300	Tier 2: 15 and 16 SEER, with ECM Tier 3: 17 SEER or greater, with ECM
Heat Pump	*Air Source*	Tier 2: $300 Tier 3: $400	Tier 2: 15 and 16 SEER, with ECM Tier 3: 17 SEER or greater, with ECM
	Geothermal	Tier 3: $400	Tier 3: 19 EER or greater, with ECM
Smart Thermostat		$65	Add-on incentive for HVAC participants
Attic Insulation & Air Seal		$250	R-19 or below to R-30 or greater; decrease home air leakage by 5% or more; at least 1,000 square feet of air-conditioned attic space
Variable Speed Pool Pump		$300	Equipment must be an ENERGY STAR® qualified variable-speed pool pump for use with main filtration of in-ground residential swimming pool
Heat Pump Water Heater		$350	ENERGY STAR® qualified units. Must have an EF ≥ 2
Duct Sealing		$100/duct system	Decrease air duct leakage by 12% or more

2.2. Program Implementation

The Smart $aver program is chiefly implemented by Blackhawk Engagement Solutions (BES). BES manages the trade ally registration process, incentive application submission and fulfillment, the trade ally online portal, and the program call center. As part of the prequalification process, all contractors who wish to participate are required to enter into a Letter of Agreement or Prequalified Contractor Participation Agreement for participation in the program. Contractors who meet program requirements are included in a prequalified contractor listing on the program website. Prequalified contractors have permission to promote Smart $aver program measures and identify themselves as a program contractor.

Upon selection by the customer, contractors will complete the requested installation in accordance with all Smart $aver Program standards and guidelines, and all applicable building codes. Contractors use the online portal to submit incentive applications. Prequalified contractors provide itemized invoices with sufficient detail describing what was installed.

Upon receipt of the application, BES verifies that the application is complete and accurate, and will follow up with customers or contractors to resolve any discrepancies. DEI staff conduct quality control inspections on a random sample (5%+) of installed measures. Inspections are to be shared across all contractors, with new contractors and those who have had quality issues being inspected at a higher rate. Upon approval of applications, incentives are issued to participating customers (and, when applicable, builders or trade allies) for the incentive value.

DEI provides marketing through several channels, including: direct mail campaigns, utility website, participating contractor outreach and advertising, and contractor associations. DEI also performs trade ally outreach and training services.

Eligibility

DEI residential account holders residing in DEI electric service territory are eligible for the Smart $aver rebates. All customers participating in the program must be on a DEI residential electric rate. The program is open to existing residential electric service customers living in single-family homes, condominiums, mobile homes, townhomes and duplexes. Builders may also apply for HVAC rebates for their residential new construction projects.

2.3. Key Research Objectives

Over-arching project goals follow the definition of impact evaluation established in the "Model Energy-Efficiency Program Impact Evaluation Guide – A Resource of the National Action Plan for Energy Efficiency," November 2007:

"Evaluation is the process of determining and documenting the results, benefits, and lessons learned from an energy-efficiency program. Evaluation results can be used in planning future programs and determining the value and potential of a portfolio of energy-efficiency programs in an integrated resource planning process. It can also be used in retrospectively determining the performance (and resulting payments, incentives, or penalties) of contractors and administrators responsible for implementing efficiency programs."

Thus, evaluation has two key objectives:

1) To document and measure the effects of a program and determine whether it met its goals with respect to being a reliable energy resource (impact evaluation).
2) To help understand why those effects occurred (net-to-gross) and identify ways to improve (process evaluation).

2.3.1. Impact

Project impact evaluation processes followed standard industry protocols and definitions, where applicable, and include the Department of Energy Uniform Methods Protocol, as an example. As part of evaluation planning, the evaluation team outlined the following activities for this program evaluation:

- Quantify accurate and supportable energy (kWh) and demand (kW) savings for energy efficient measures and equipment implemented in participants' homes.
- Assess the rate of free riders from customers and determine spillover effects from customers and contractor perspectives.
- Benchmark verified measure level energy impacts to applicable technical reference manuals (TRMs) and other Duke-similar programs in other jurisdictions.
- To the extent possible for the purposes of program planning, the evaluation team will provide estimated per-unit savings by measure.

2.3.2. Process

The process evaluation was designed to support organizational learning and program adaptation. To this end, the evaluation team sought to research several elements of the program delivery and customer experience as outlined below:

Awareness and Engagement:

- How aware are customers of the Smart $aver program?
- What are the primary source of information (e.g., trade allies, program website, bill inserts) that customers use to learn more about the program?
- How do customers typically learn about energy efficient technologies?
- How are trade allies engaged in the Smart $aver program, and what is the most effective engagement source (e.g., implementer, program website)?
- Is there a need to conduct any additional marketing of the program and/or provide marketing support to trade allies?

Program Satisfaction:

- How satisfied are participants with the overall program experience, their contractor, and the quality of the installation, incentive turnaround, energy savings after the work was performed, and Duke Energy?
- How satisfied are trade allies with the program?

Program Influence:

- Does the program influence participants to engage in other Duke Energy energy-efficiency programs?
- Does the program increase contractor's knowledge of energy-efficient technologies?
- Does the program increase how often participating contractors promote energy-efficient equipment and services to their customers?

Challenges and Opportunities for Improvement:

- Are there any inefficiencies or challenges with the application, incentive turnaround, or trade allies?
- What training opportunities could be offered to trade allies to help them more effectively sell rebated equipment?
- How engaged are trade allies in using the implementer web portal or other program resources?

Participant Characteristics:

- What are the demographic characteristics of those participating in the program?

2.4. Evaluation Overview

The evaluation team divided its approach into key tasks to meet the goals outlined:

Task 1 – Develop and manage an evaluation plan to describe the processes that will be followed to complete the evaluation tasks outlined in this project.

Task 2 – Conduct a process review to determine how successfully the program is being delivered to market and identify opportunities for improvement.

Task 3 – Verify gross energy and peak demand savings resulting from the Smart $aver program through on-site measurements and verification activities of a sample of program participants and projects, and perform engineering analysis on the population.

Task 4 – Determine net savings resulting from the Smart $aver program through on-line surveys with a sample of participants and trade allies.

As the evaluation plan was completed and approved previously, the following two subsections provide a more detailed description of the impact and process evaluations.

2.4.1. Impact Evaluation

The impact evaluation comprised of a gross savings analysis and a net savings analysis. Techniques used to conduct the evaluation, measurement, and verification (EM&V) activities included a database review, an ex-ante savings review, on-site metering for central air conditioners and air source heat pumps, an AMI analysis of smart thermostats, TRM-based engineering analysis, and web surveys with participants and trade allies to determine the net-to-gross.

Net impacts are a reflection of the degree to which the gross savings are a result of the program efforts and incentives. The evaluation team estimated free-ridership and spillover for the sample utilizing self-report methods through surveys with program participants and non-participant spillover from trade allies. The ratio of net verified savings to gross verified savings is the net-to-gross ratio as an applied scaling factor to the reported savings.

Error! Reference source not found., in Section **Error! Reference source not found.** below summarizes the number of surveys and on-site inspections completed. The samples were drawn to meet a 90% confidence and 10% precision at the program level.

2.4.2. Process Evaluation

Process evaluation tells the qualitative story behind the quantitative impact evaluation by understanding the program in its unique context. The goal of process evaluation is to perform a systematic assessment of an energy efficiency program by generating feedback that achieves the following outcomes:

- Document program operations
- Recommend improvements to increase the program's efficiency and effectiveness
- Assess stakeholder satisfaction

These outcomes can inform program planning, existing program implementation, or efforts to redesign a program. Process evaluations typically cover all aspects of a program including its design, implementation, marketing and outreach, data tracking, quality assurance, customer and stakeholder feedback, and market conditions. By evaluating the broad context in which a program operates, evaluators can recommend realistic improvements. Evaluators typically examine program aspects through the following mechanisms:

- Database and document review
- Interviews with program staff and key stakeholders, such as trade allies
- Surveys with customers
- Benchmarking research

Information gathered from participating customers and trade allies through process evaluation activities can be measured and analyzed to form the basis of a NTG ratio. For example, participant surveys used to assess participant satisfaction also provide opportunity to ask participants about their motivations for participating and the influence of the program on their decisions, both of which are key components of a free ridership calculation. Similarly, the participant surveys are used to assess whether participants installed additional energy savings measures, which may be attributed to spillover.

2.4.3. Summary of Activities

Techniques utilized to conduct the evaluation, measurement, and verification (EM&V) activities, and to meet the goals for this evaluation, included field inspection and metering, web surveys with program participants and trade allies, program database reviews and in-depth interviews (IDI) with utility staff, implementer, and trade allies. Table 2-2**Error! Reference source not found.** provides a summary of the activities Resource Innovations conducted as part of the Smart $aver program process and impact evaluation for the period of May 1, 2020 – April 30, 2021.

Table 2-2: Summary of Evaluation Activities

Target Group	Population	Achieved Sample	Method
Central Air Conditioner and Air Source Heat Pump	3,261	63	Field Inspection and Metering
Participants (rebated measures)	5,700	114	Online Survey
Duke Energy Program Staff	N/A	1	In-depth Interview (IDI)
Implementer Staff	N/A	1	IDI
Most Active Trade Allies	342	4	IDI
Trade Allies	342	45	Online Survey
Engineering Analysis	3,687	3,687	Analysis
Smart Thermostats	2,013	851	AMI Analysis

3. Impact Evaluation

3.1. Methodology

An impact evaluation was performed to evaluate energy and demand savings attributable to the Smart $aver program. The evaluation was divided into two research areas; determining gross savings and net savings. Gross savings are energy and demand savings found at a participant's home that are the direct result of a measure installed and rebated through the program. Net savings are a reflection of the degree to which the gross savings are a result of the program efforts and funds. The evaluation team verified energy and demand savings attributable to the Smart $aver program by conducting the following impact evaluation activities:

- Database and ex ante savings review.
- Sampling of participating measures.
- Performing on-site metering for air source heat pump and central air conditioner replacements to estimate hours of operation and associated load.
- Consumption AMI data analysis via difference-in-differences regression modeling approach with matched control group.[1]
- Estimating gross verified savings using data collected in previous tasks and applying appropriate technical resource manual (TRM) algorithms to complete engineering analysis.
- Comparing the DEI ex ante savings to gross-verified savings to determine program- and measure-level realization rates.
- Applying attribution surveys to estimate net-to-gross ratios and net-verified savings at the program level.

The impact evaluation activities result in the calculation of realization rates, which are applied to the reported savings documented in the program tracking records. A realization rate is the ratio of the savings determined from the EM&V activities to the program-reported savings.

3.2. Database and Ex Ante Review

Review of the program database provided details that informed all evaluation activities. The scope of the evaluation was oriented based on information referenced from the program database, including the number of rebates for each measure and measure specific installation details. These data were considered when designing approaches and methods to evaluate the program.

The evaluation team also conducted a review of ex ante savings values, i.e., program reported savings, for each measure rebated during the evaluation period. This review consisted of benchmarking the ex ante savings against the previous evaluation results of the DEI Smart $aver program and regional technical reference manuals (TRMs). This review allowed the evaluation team to understand if the program's assumed savings values were in line with expectations.

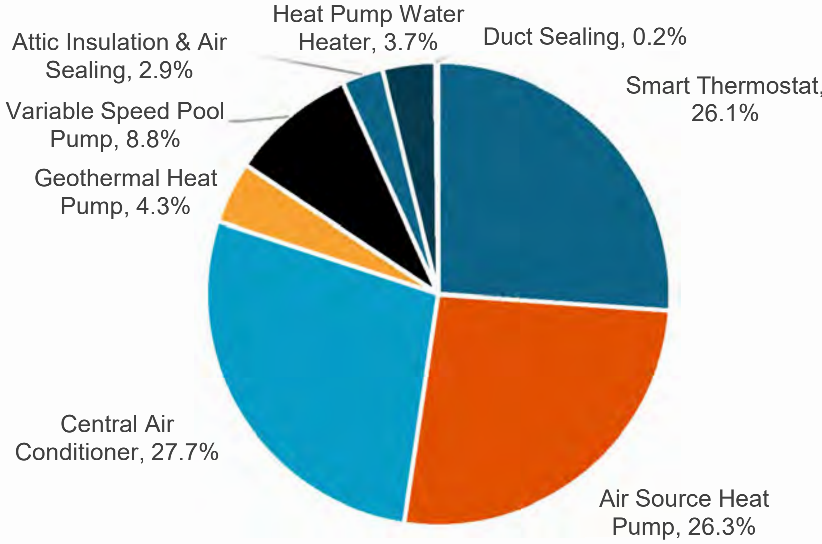
[1] This impact evaluation activity was used to estimate savings for the smart thermostat measure only.

3.3. Sampling Plan and Achievement

For the evaluation period of May 1st, 2020 – April 30th, 2021, smart thermostats, air source heat pumps and central air conditioners were the largest measure contributors for reported energy savings. Therefore, these measures received the largest share of research activities and the highest level of rigor with on-site equipment measurement (AC and heat pump) or AMI analysis (smart thermostats).

The evaluation team requested a participation database extract of 2020 and 2021 program results, which included counts and details on installed measures. The distribution of reported energy savings based on measure counts from the participation database, shown in Figure 3-1, provided insight to measures with greater influence on total program savings.

Figure 3-1: Smart $aver Reported Energy Savings Portion by Measure



The sampling plan designed for the evaluation period is included in Table 3-1Error! Reference source not found..

Table 3-1: Impact Sampling Plan

Measure	Metering Sites		Web Survey	
	Achieved	Targeted	Achieved**	Targeted
Central Air Conditioner	34	37	66	68
Air Source Heat Pump	28	29	33	
Geothermal Heat Pump	n/a	n/a	4	
Smart Thermostat	n/a	n/a	66	
Attic Insulation & Air Seal	n/a	n/a	3	
Variable Speed Pool Pump	n/a	n/a	7	
Duct Sealing	n/a	n/a	0	
Heat Pump Water Heater	n/a	n/a	1	
Total	62*	66	114	68

*Data from four sites were not used in the final metering analysis.
** The total achieved is greater than 114 as Smart Thermostats were an add-on measure.

3.4. Description of Analysis

The evaluation team applied varying analysis techniques based on the measure technology, the measure's prominence within the program, and the availability of data on baseline and retrofit savings. A database of program participation provided useful information about measures installed, participants, as well as some measure-specific parameters. Table 3-2 shows the type of analysis applied to each measure.

Table 3-2: Analysis Approach

Measure	Approach
Central Air Conditioner	Metering study and engineering analysis
Air Source Heat Pump	Metering study and engineering analysis
Geothermal Heat Pump	Engineering analysis
Smart Thermostat	AMI Analysis
Attic Insulation & Air Seal	Engineering analysis
Variable Speed Pool Pump	Engineering analysis
Heat Pump Water Heater	Desk analysis
Duct Sealing	Deemed

The following sections describe the different impact analysis approaches used for each of the program measures analyzed.

3.4.1. Metering Study

Given that a large share of overall program savings is derived from air source heat pumps (ASHP) and central air conditioners (CAC), an end-use metering approach was applied for the analysis of these two measures. The units' heating/cooling efficiencies and capacities were provided by the program database or obtained from the Air-Conditioning, Heating, & Refrigeration Institute (AHRI). System usage was collected through a data logging device installed directly on the household's HVAC equipment by RI's evaluation team. The metering study enabled an estimate of cooling and heating Equivalent Full Load Hours (EFLH) for the program. The methodology used for the metering study follows the Uniform Methods Project (UMP) and most closely resembles IPMVP Option A: Partial Retrofit Isolation/Metered Equipment.

3.4.1.1. Data Collection

To complete the metering study, field engineers were dispatched to the recruited homes of Smart $aver participants who received a rebate for an air source heat pump or central air conditioner replacement. Participants who took part in the metering study were provided a $100 incentive divided across two visits to their home. Sixty-three sites were metered across all the DEI territory. Four data sets were dropped due to data quality and ultimately 59 sites were used in the analysis, including 33 central air conditioners and 26 air source heat pumps. All meters were installed in September 2021 and collected in January 2022.

During site visits, field engineers performed various data collection activities. Voltage, amperage, and power factor spot measurements were taken on each unit while in operation. Unit specifications, including capacity, were obtained from each system's nameplate information. Finally, a HOBO CTV-A current transducer (CT) was connected on the conductors supplying electricity to the condensing unit located on the exterior of the home to record electrical current measurements. The CT was paired with a U12-006 data logger that stored each data point at 10-minute intervals. The result was a trended data log of electrical current over the metered period.

Data collected during the metering study was used in a regression analysis that supplied an estimated EFLH for both cooling and heating periods.

3.4.2. Analysis, Regression, EFLH Calculation

Three primary inputs are required to estimate annual cooling and heating savings for air source heat pumps and central air conditioners:

1. Capacity - the size (kBtuh) of the efficient unit
2. Efficiency - the SEER or Heating Seasonal Performance Factor (HSPF) value of the efficient unit
3. Equivalent Full Load Hours (EFLH) - how often the unit is in operation at full capacity

EFLH is an effective measure for estimating the cooling and heating requirement for a specific region and provides a comparison of energy use between regions and equipment types. The general form for the EFLH term is shown in Equation 3-1.

Equation 3-1: Effective Full Load Hours

$$EFLH_{cool} = \sum_{h=1}^{8760} \frac{Estimated\ Hourly\ Load\ (kW)}{Connected\ Load\ (kW)}$$

Where:

Estimated Hourly Load	*= Electric demand of the unit in hour h*
Connected Load	*= Electric demand draw of the unit when operating at full power*

The evaluation team assigned a connected load to each unit in the sample using its metered amperage data, whereby the full load was set as the 99th percentile amperage reading. The underlying assumption is that, for a given HVAC unit, the maximum amperage value represents the electric load required to operate the system at full capacity, or full load. The 99th percentile value was used to allow for a margin of deviation in the meter data. The hourly load was also obtained from the logger data and was divided by the full connected load to calculate the unit's runtime for each hour in the evaluated period.

The evaluation team collected hourly weather records for the full metering period (September 2021 through January 2022) from the Indianapolis International Airport weather station in order to develop a relationship between observed HVAC system usage runtimes and outdoor temperature. In addition, the evaluation team obtained data for typical meteorological year (TMY3) weather and applied the observed relationship between runtimes and weather to the TMY3 data to estimate annual $EFLH_{heat}$ and $EFLH_{cool}$ for a typical year.

Due to the timing of the metered period, only a small portion of the cooling season was captured by the data loggers. As a result, fewer observations were available for the $EFLH_{cool}$ analysis which led to marginally greater uncertainty in the results. Nevertheless, because the metering period covered portions of both cooling and heating seasons, the regression analysis was performed twice to estimate annual $EFLH_{cool}$ and annual $EFLH_{heat}$ separately. The evaluation team split the meter data into two separate datasets. The first dataset contained only observations where average daily temperatures exceeded the base temperature of 65°F, or where temperatures indicated cooling. The second dataset contained observations where average daily temperatures fell below the base temperature of 65°F, or where outdoor temperatures indicated heating.

The evaluation team developed weather-normalized estimates of $EFLH_{cool}$ for each unit in the sample using a linear regression model of observed runtimes as a function of the observed cooling degree days (base 65°F) during the cooling season. Figure 3-2 shows the relationship between average daily runtimes (hours) and cooling degree days. Each blue + represents the average air conditioning runtime in hours for each day in the cooling dataset, i.e. each day with an average temperature exceeding 65°F.

Figure 3-2: Cooling Runtime as a Function of Temperature

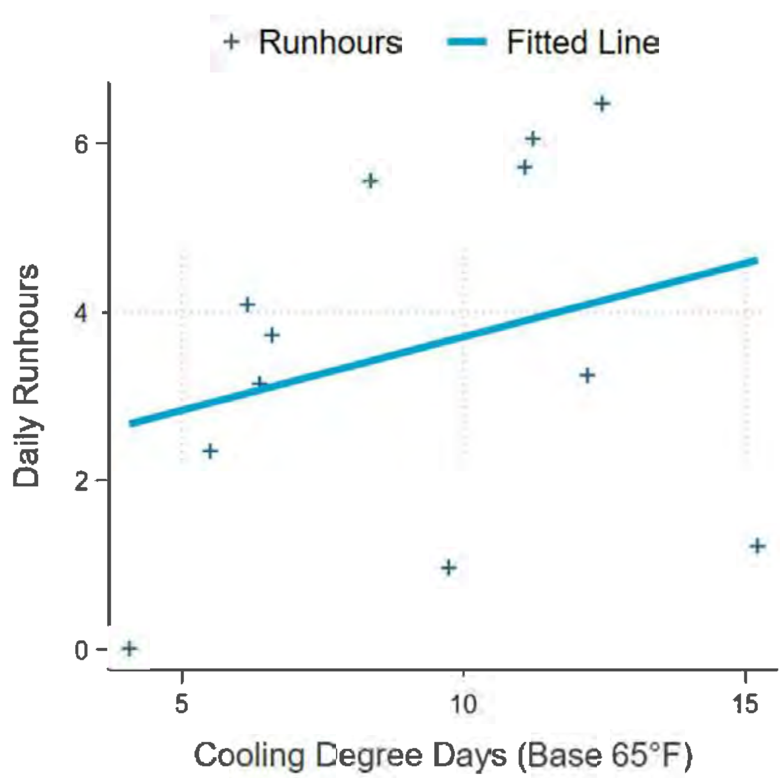


Table 3-3 shows the regression output for the relationship described in Figure 3-2. The key value to consider is the Cooling Degree Day (CDD) coefficient of 0.52. This term indicates that DEI customers use an average of 0.52 hours, or approximately 31 minutes, of additional cooling per CDD.

Table 3-3: $EFLH_{cool}$ Regression Output

Model Term	Coefficient	Std. Err.	t-stat	P-value	[90% Confidence Interval]
CDD	0.52	0.020	25.49	0.000	± 6.45%

The evaluation team ran a similar linear regression model to develop weather-normalized estimates of $EFLH_{heat}$ for each air source heat pump unit. The key difference is that instead of CDD, the model estimated runtimes as a function of observed Heating Degree Days (HDD) during the heating season.

Figure 3-3 shows the relationship between average daily runtimes and heating degree days. Each blue + represents the average air source heat pump runtime in hours for each day in the heating dataset, i.e. each day with an average daily temperature below 65 ° F.

Figure 3-3: Heating Runtime as a Function of Temperature

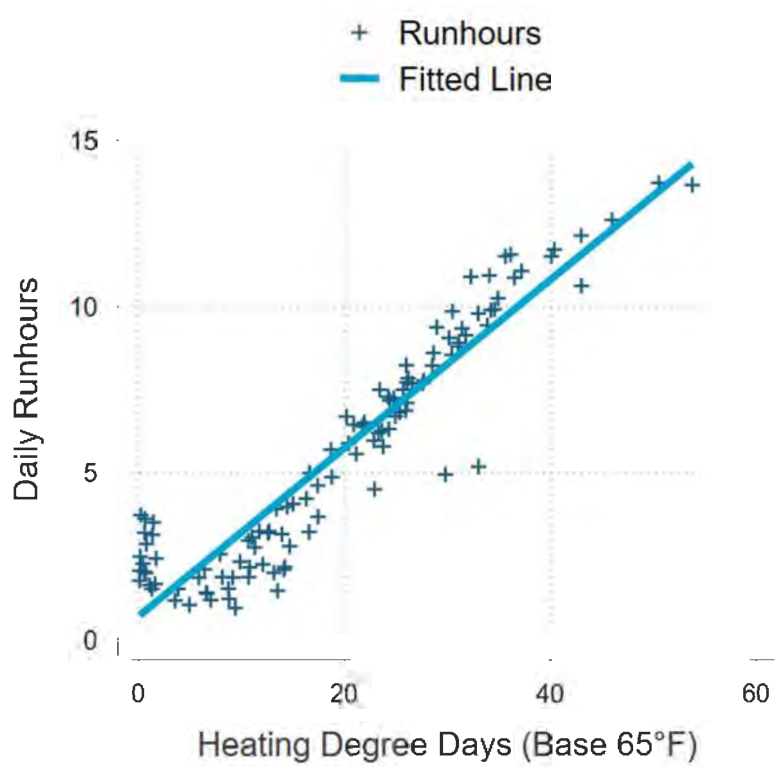


Table 3-4 shows the regression output for the relationship described in Figure 3-3: Heating Runtime as a Function of Temperature

. The coefficient term 0.28 indicates that DEI customers use an average of 0.28 hours, or approximately 17 minutes, of additional heating per HDD.

Table 3-4: $EFLH_{heat}$ Regression Output

Model Term	Coefficient	Std. Err.	t-stat	P-value	[90% Confidence Interval]
HDD	0.28	0.002	114.99	0.000	± 1.43%

The evaluation team utilized hourly TMY3 data for the Indianapolis International Airport weather station to calculate annual CDD and HDD and used those values to estimate $EFLH_{cool}$ and $EFLH_{heat}$ for each the region. Table 3-5 shows regression coefficients, annual CDD, annual HDD, and estimated EFLH values for each season. $EFLH_{cool}$ and $EFLH_{heat}$ were calculated by multiplying each term's regression coefficient by the average CDD and HDD values determined by TMY3 data.

Table 3-5: EFLH Calculations

Term	Regression Coefficient	Annual Degree Days	EFLH	Relative Precision (at 90% CI)
CDD	0.52	788	410	6.45%
HDD	0.28	5,886	1,648	1.43%

The field data collected by Resource Innovations also provided the peak summer cooling demand coincidence factor (CF_{summer}). Just as EFLH is a necessary component of the annual energy savings calculation, peak coincidence factor is a necessary component of the peak demand savings calculation. Peak demand coincidence factor is defined here as the probability that the cooling equipment is operating during system peak hours. The basic form for the CF term is a ratio of hourly load to full load during a given hour of the day, and is shown in Equation 3-2.

Equation 3-2: Coincidence Factor

$$CF_h = \frac{Hourly\ Load_h\ (kW)}{Full\ Load\ (kW)}$$

Where:

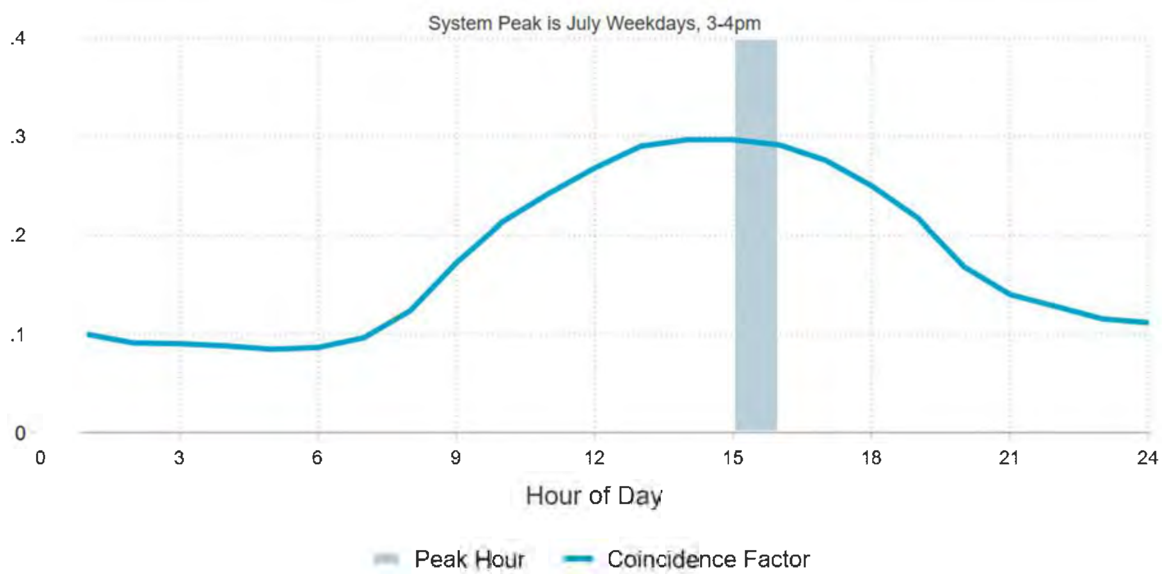
Hourly Load = *Electric demand of the unit at hour h*

Full Load = *Electric demand draw of the unit when operating at full power*

The evaluation team calculated the peak demand coincidence factor to estimate peak demand savings for the sample. A system's peak demand period refers to the period during which the highest level of power is needed to satisfy its electric demand requirement. DEI defines its summer peak period as July weekdays between 3:00pm and 4:00pm (hour ending 16). Figure 3-4Figure 3-4: Summer Peak Demand Coincidence Factor

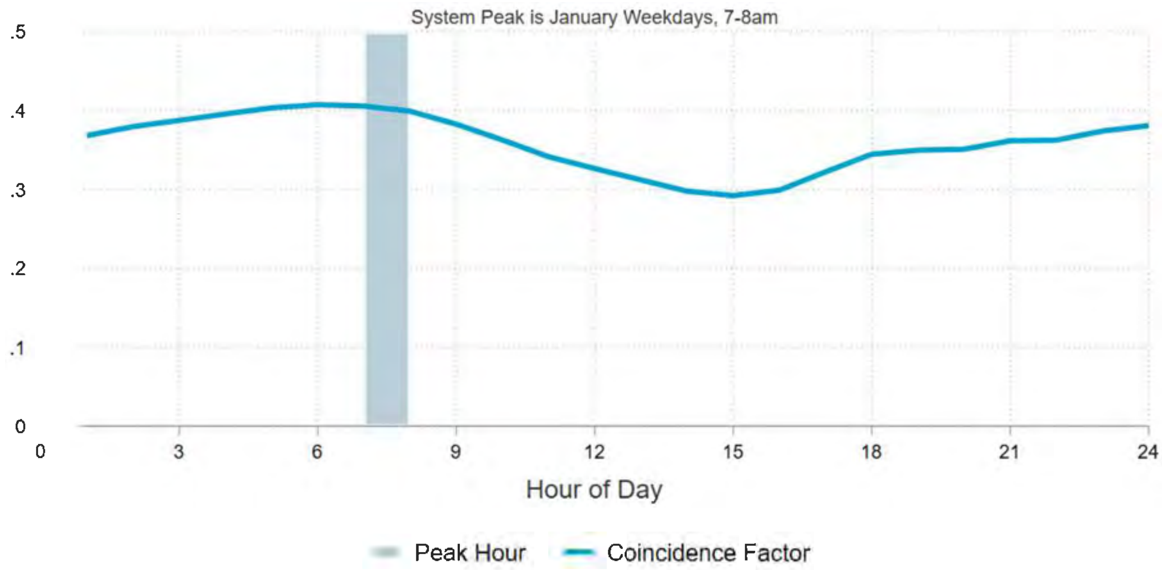
shows the average CF_{summer} load curve for the metered sample. The system's peak period is highlighted in light blue. The CF_{summer} during the system peak is 0.29.

Figure 3-4: Summer Peak Demand Coincidence Factor



The evaluation team also calculated the peak winter heating demand coincidence factor. DEI defines its winter peak period as January weekdays between 7:00am and 8:00am (hour ending 8). Figure 3-5 shows the average CF_{winter} load curve for each weekday of January. The system's winter peak period is highlighted in light blue. The CF_{winter} during the system peak is 0.4.

Figure 3-5: Winter Peak Demand Coincidence Factor



3.4.3. AMI Analysis – Smart Thermostats

Resource Innovations opted to estimate savings derived from smart thermostats independently from other program measures, even though there is no standalone smart thermostat option available to participants. Rather, customers who enroll in the smart thermostat option through the program must also enroll in a HVAC upgrade measure. This framework leads to some difficulty in isolating the savings directly attributable to smart thermostats from the savings derived from the HVAC upgrade. To overcome this challenge, the evaluation team applied a difference-in-differences regression analysis approach, where a control group was constructed of program participants who received a HVAC upgrade but no other measures, including smart thermostats. The treatment group consisted of all participants who received only HVAC upgrades and smart thermostats.

Figure 3-6: Smart Thermostats Treatment and Control Group Framework

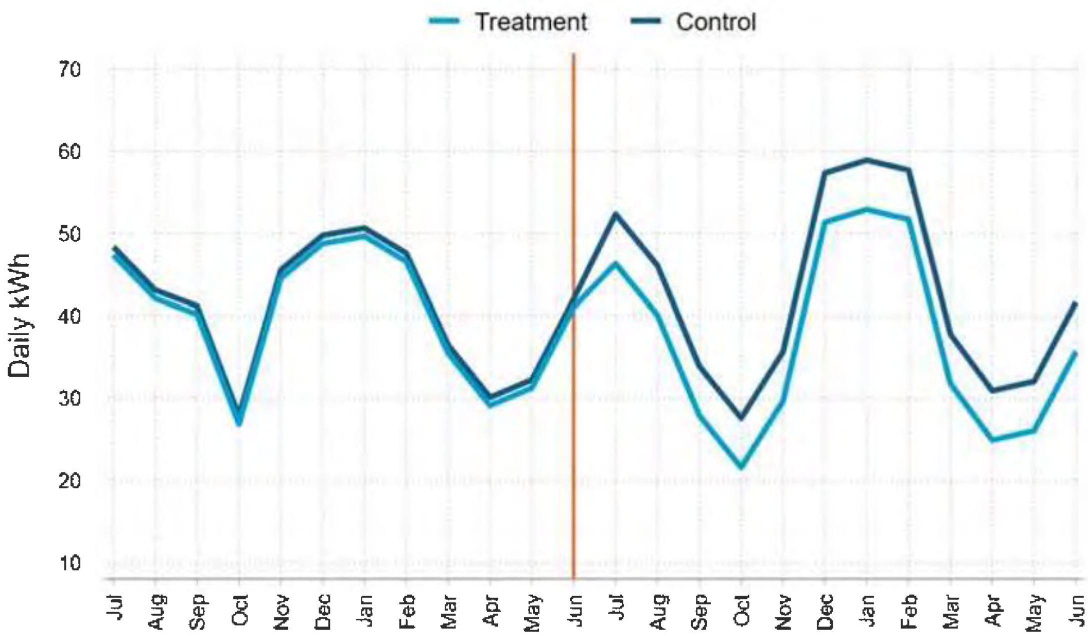
More than 3,000 participants received HVAC upgrades during the 2020-2021 program year and of those, 60% also received a smart thermostat. Due to sample sizes, the analysis excluded HVAC participants who received gas pack units and geothermal systems.

Table 3-6: HVAC and Smart Thermostat Measure Counts

	Central Air Conditioners	Air Source Heat Pumps
HVAC Measures	2,275	939
Smart Thermostats	1,359	591

A difference-in-differences methodology is designed to compare consumption patterns between the treatment and control groups during the periods before and after the measure is implemented. This approach relies on the groups being identical to one another in all observable ways, except that one group received the intervention while the other did not. A properly constructed control group should display usage patterns that are similar to the treatment group during the pre-intervention period and serves as the baseline during the post-intervention period against which to compare the treatment group's usage. Savings are calculated as the difference in post-treatment usage minus the difference in pre-treatment usage. In this way, any pre-existing differences between the groups is effectively netted out of the calculation, resulting in a net savings estimate. Figure 3-7 shows a simplified example of the difference-in-differences framework. In the figure, both groups exhibit similar usage patterns in the pre-treatment period, illustrating the congruence between groups. After the intervention (indicated by the orange line), there is an observed reduction in consumption among the treatment group relative to the control group. The growth in the gap between the two blue lines from the pre-treatment period to the post-treatment period represent the measure savings.

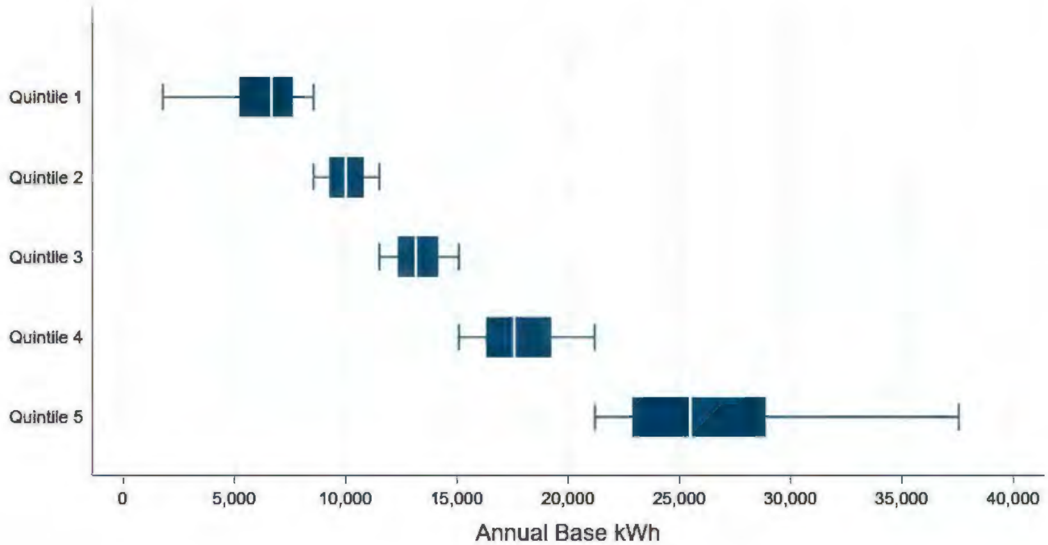
Figure 3-7: Difference-in-Differences Example Figure



Because space conditioning often makes up the vast majority of a household's overall energy consumption, HVAC measure savings are generally tethered to the home's total annual energy consumption. The usage data shows that DEI participants exhibited a wide range of annual base consumption, with 20% of participants above 20,000 kWh. Figure 3-8Figure 3-8: Annual Base Consumption by Quintile

presents the relative distribution of annual consumption (kWh) for the smart thermostat enrollees, by quintile. For each box-and-whisker plot, the white line represents the mean value, while the outer boundaries of the box serve as the 25th and 75th percentiles. The whiskers extend to the 5th and 95th percentiles.

Figure 3-8: Annual Base Consumption by Quintile



The regression analysis produced the results shown in Table 3-7. The term of interest is the coefficient 2.525, which represents the average daily kWh impact attributable to smart thermostats. Results of the AMI data analysis show an average annual household savings of 6.2% (922 kWh).

Table 3-7: Smart Thermostat Regression Analysis Results

Coefficient	Annual Base kWh	Annual Savings (kWh)	% Savings	90% Confidence Bounds
2.525	14,968	921.7	6.2%	1.76 - 3.28

As aforementioned, savings derived from smart thermostats are largely tied to a home's annual consumption. To illustrate this, Resource Innovations performed a segmented analysis in order to estimate measure savings as a function of annual household consumption. The population, including both treatment and control customers, were evenly split into five groups (quintiles) and separate regressions were performed on each group. The results of this segmented analysis indicate that the largest savings – in terms of both % and kWh – are achieved by the largest consumers.

Table 3-8: Smart Thermostat Regression Analysis Results, by Quintile

Quintile	Coefficient	Annual Base kWh	Annual Savings kWh	% Savings	90% Confidence Bounds
1	0.881	6,237	321	5.2%	-0.05 – 1.81
2	2.095	10,028	765	7.6%	1.07 – 3.12
3	0.617	13,227	225	1.7%	-0.59 – 1.82
4	1.773	17,781	647	3.6%	-0.22 – 3.77
5	5.635	26,620	2,057	7.7%	3.51 – 7.76

Finally, Resource Innovations performed separate analyses to distinguish savings achieved by equipment type (CAC vs. ASHP). Customers who received ASHP upgrades with the thermostat option achieved greater kWh savings compared to customers who received CAC upgrades with the thermostat option. On a percent basis, CAC savings exceeded ASHP savings which logically stands, as customers that heat with a heat pump would have a larger overall electric load.

Table 3-9: Smart Thermostat Regression Analysis Results, by Equipment Type

Equipment Type	Annual Base kWh	Annual Savings kWh	% Savings	90% Confidence Bounds
Central Air Conditioners	11,268	871	7.7%	± 284 kWh
Air-Source Heat Pumps	17,625	1,023	5.8%	± 659 kWh

To provide additional frame of reference, Resource Innovations collected a brief list of other resources that indicate annual savings for smart thermostats fall within a range of 2.6% to 7.3% across the jurisdictions listed.

Table 3-10: Smart Thermostats Annual Savings Benchmarks

Source	Annual Savings	Percent Savings	Notes
Indiana TRM (v2.2)	832 kWh	7.3%*	
Illinois TRM (v10)	1,103 kWh	6.2%	Heating consumption only
Pennsylvania TRM (2021)	408 kWh	4.0%*	
Missouri TRM (2017)	614 kWh	5.0%*	
Arkansas TRM	668 kWh	5.3%*	
Iowa TRM (v5.0)	724 kWh	7.0%*	Assumes electric heat; direct install program
Avista Utilities (WA and ID) HVAC Program Evaluation	549 kWh	2.6%	Resource Innovations EM&V, 2017
Georgia Power Company HEIP Program Evaluation	612 kWh	4.3%	Resource Innovations EM&V, 2017
Duke Energy Indiana Smart$aver Program Evaluation	922 kWh	6.2%	

3.4.4. Engineering Analysis

The following sections describe the engineering analyses performed for each of the remaining measure types in the Smart $aver program.

3.4.4.1. Central Air Conditioner Savings Calculation

The evaluation of central air conditioner measures was done with an engineering analysis of each participant using algorithms provided in Indiana TRM V2.2, as outlined in Equation 3-3 and Equation 3-4.

Equation 3-3: Central Air Conditioner Energy Savings Algorithm

$$\Delta kWh = EFLH_{cool} \times kBtuh_{cool} \times \left(\frac{1}{SEER_{base}} - \frac{1}{SEER_{ee}}\right)$$

Equation 3-4: Central Air Conditioner Demand Savings Algorithm

$$\Delta kW_{Summer} = kBtuh_{cool} \times \left(\frac{1}{EER_{base}} - \frac{1}{EER_{ee}}\right) \times CF_{Summer}$$

Table 3-11 provides savings parameter inputs for central air conditioner measures and their sources. Algorithm input parameters from the 2017 evaluation are also provided for comparison. Parameters sourced from Indiana TRM V2.2 or the metering study discussed in Section 3.4.1 were applied to each participant in the dataset. Savings were calculated for each participant using these parameters, as well as the efficiency ratios and capacities specific to the participant. Population averages from the program dataset are provided for comparison.

Table 3-11: Inputs for Central Air Conditioning Energy and Demand Savings

Variable	Source	2021 Evaluation		2017 Evaluation	
		Tier 2	Tier 3	Tier 2	Tier 3
$EFLH_{cool}$	Metering Study	409		501	
$kBtuh_{cool}$	Population Average	32.8	36.3	36.7	38.7
$SEER_{base}$	Indiana TRM V2.2	13		10/13	
$SEER_{ee}$	Population Average	15.6	17.6	15.7	17.9
EER_{base}	Indiana TRM V2.2	11		N/A	
EER_{ee}	Population Average	12.7	11.9	N/A	
CF_{Summer}	Metering Study	0.291		0.322	
ECM kWh Savings	Secondary Sources	0		83.7	
ECM Winter kW Savings	Secondary Sources	0		0.114	

Table 3-11 shows a difference in the baseline Seasonal Energy Efficiency Ratio (SEER) as provided by Indiana TRM V2.2. The 2017 evaluation applied a baseline SEER of 10 to participants who indicated that their central air conditioning system was in good working order, indicating that the unit was replaced before the end of its useful life. The 2017 evaluation found that this could be applied to 1.9% of rebated central air conditioners. This adjustment was not applied in the 2021 evaluation, as a baseline SEER of at least 13 is required under federal code for any central air conditioner manufactured after January 1st, 2015.

The 2017 evaluation did not provide baseline and efficient case Energy Efficiency Ratios (EERs), as SEER values were the input parameters for summer demand savings calculations. Baseline and efficient case EERs are provided for the 2021 evaluation, as specified in the algorithm provided by Indiana TRM V2.2.

A review of the program database found that the average capacity of central air conditioning units decreased relative to the 2017 evaluation. This contributed to lower energy and demand savings for this measure.

The 2017 Smart $aver evaluation determined that energy and winter demand savings from electrically commutated motor (ECM) furnace fans were attributable to program participation. This is due to the more efficient furnace fan motor operating year-round as part of the HVAC system. However, the federal code governing fan efficiency ratios (FERs) of residential furnace fans was updated on July 3rd, 2019. This update included an increase to the minimum FER required of a furnace fan, such that ECM furnace fans are now an effective baseline for residential furnace fan motors. Therefore, there are no longer saving that can be attributed to ECM furnace fans, unless it can be shown that the FER of the installed fan exceeds federal code minimum. Thus, winter demand savings are set to zero.

Energy and demand savings for central air conditioners are presented in Table 3-12 below.

Table 3-12: Central Air Conditioner Gross Verified Savings (Per Unit)

Tier	Measurement	Reported Savings	Realization Rate	Verified Savings
2	Energy (kWh)	337	51%	174
	Summer Demand (kW)	0.163	69%	0.112
	Winter Demand (kW)	0.113	0%	0.000
3	Energy (kWh)	500	60%	298
	Summer Demand (kW)	0.266	22%	0.058
	Winter Demand (kW)	0.113	0%	0.000

3.4.4.2. Air Source Heat Pump Savings Calculation

An engineering analysis for air source heat pump measures was conducted for each participant using algorithms given in Indiana TRM V2.2, as outlined in Equation 3-5 and Equation 3-6.

Equation 3-5: Air Source Heat Pump Energy Savings Algorithm

$$\Delta kWh = EFLH_{cool} \times kBtuh_{cool} \times \left(\frac{1}{SEER_{base}} - \frac{1}{SEER_{ee}}\right) + EFLH_{heat} \times kBtuh_{heat} \times \left(\frac{1}{HSPF_{base}} - \frac{1}{HSPF_{ee}}\right)$$

Equation 3-6: Air Source Heat Pump Demand Savings Algorithms

$$\Delta kW_{Summer} = kBtuh_{cool} \times \left(\frac{1}{EER_{base}} - \frac{1}{EER_{ee}}\right) \times CF_{Summer}$$

$$\Delta kW_{Winter} = kBtuh_{heat} \times \left(\frac{1}{HSPF_{base}} - \frac{1}{HSPF_{ee}}\right) \times CF_{Winter}$$

Table 3-13 shows savings parameter inputs for air source heat pump measures. Algorithm input parameters from the 2017 evaluation are also provided for comparison. Parameters sourced from Indiana TRM V2.2 or the metering study discussed in Section 3.4.1 were applied to each participant in the dataset. Savings were calculated for each participant using these parameters, as well as the efficiency ratios and capacities specific to the participant. Population averages from the program dataset are provided for comparison.

Table 3-13: Inputs for Air Source Heat Pump Energy and Demand Savings

Variable	Source	2021 Evaluation		2017 Evaluation	
		Tier 2	Tier 3	Tier 2	Tier 3
$EFLH_{cool}$	Metering Study	409		501	
$kBtuh_{cool}$	Population Average	32.4	34.5	36.3	33.9
$SEER_{base}$	Indiana TRM V2.2	13		14	
$SEER_{ee}$	Population Average	15.7	17.9	15.5	17.8
EER_{base}	Indiana TRM V2.2	11		N/A	
EER_{ee}	Population Average	12.4	12.0	N/A	N/A
$EFLH_{heat}$	Metering Study	1,652		1,447	
$kBtuh_{heat}$	Population Average	32.5	33.1	36.3	33.9
$HSPF_{base}$	Indiana TRM V2.2	8.2		8.2	
$HSPF_{ee}$	Population Average	8.9	9.8	8.8	9.9
CF_{Summer}	Metering Study	0.291		0.322	
CF_{Winter}	Metering Study	0.408		0.538	

Table 3-13 shows that a lower baseline SEER was applied in this evaluation compared to the 2017 evaluation. The 2021 evaluation has sourced this baseline SEER from Indiana TRM V2.2.

The 2017 evaluation did not provide baseline and efficient case EERs, as SEER values were the input parameters for Summer demand savings calculations. Baseline and efficient case EERs are provided for the 2021 evaluation, as specified in the algorithm provided by Indiana TRM V2.2.

Energy and demand savings for air source heat pumps are shown in Table 3-14 and Table 3-15.

Table 3-14: Air Source Heat Pump Gross Verified Savings by Season (Per Unit)

Season	Tier	Energy Savings (kWh)	Summer Demand Savings (kW)	Winter Demand Savings (kW)
Cooling	2	172	0.090	0
	3	297	0.064	
Heating	2	477	0	0.118
	3	1,071		0.265
Total	2	649	0.090	0.118
	3	1,368	0.064	0.265

Table 3-15: Air Source Heat Pump Gross Verified Savings (Per Unit)

Tier	Measurement	Reported Savings	Realization Rate	Verified Savings
2	Energy (kWh)	579	112%	649
	Summer Demand (kW)	0.082	110%	0.090
	Winter Demand (kW)	0.168	70%	0.118
3	Energy (kWh)	1,250	109%	1,368
	Summer Demand (kW)	0.165	39%	0.064
	Winter Demand (kW)	0.366	72%	0.265

3.4.4.3. Geothermal Heat Pump Savings Calculation

Geothermal heat pumps make use of constant ground temperature to provide heating and cooling and operate at higher efficiency levels than air source heat pumps. The Smart $aver Program provides incentives for these systems to encourage participants to install higher efficiency HVAC systems for their homes. Geothermal heat pumps were excluded from the EFLH metering study; however, the evaluation team estimated savings based on the assumption that heating and cooling EFLH for a geothermal heat pump are equivalent to an air source heat pump. Savings algorithms for geothermal heat pump measures are given in Equation 3-7 and Equation 3-8.

Equation 3-7: Geothermal Heat Pump Energy Savings Algorithm

$$\Delta kWh = EFLH_{cool} \times kBtuh_{cool} \times \left(\frac{1}{SEER_{base}} - \frac{1}{EER_{ee} \times 1.02}\right) + EFLH_{heat} \times kButh_{heat} \times \left(\frac{1}{HSPF_{base}} - \frac{1}{COP_{ee} \times 3.412}\right)$$

Equation 3-8: Geothermal Heat Pump Demand Savings Algorithms

$$\Delta kW_{Summer} = kBtuh_{cool} \times \left(\frac{1}{EER_{base}} - \frac{1}{EER_{ee} \times 1.02 \times 0.37 + 6.43}\right) \times CF_{Summer}$$

$$\Delta kW_{Winter} = kBtuh_{hea} \times \left(\frac{1}{HSPF_{base}} - \frac{1}{COP_{ee} \times 3.412}\right) \times CF_{Winte}$$

Table 3-16 shows savings parameter inputs for geothermal heat pump measures. Algorithm input parameters from the 2017 evaluation are also provided for comparison. Parameters sourced from Indiana TRM V2.2 or the metering study discussed in Section 3.4.1 were applied to each participant in the dataset. Savings were calculated for each participant using these parameters, as well as the efficiency ratios and capacities specific to the participant. Population averages from the program dataset are provided for comparison.

Table 3-16: Inputs for Geothermal Heat Pump Gross Verified Savings

Variable	Source	2021 Evaluation	2017 Evaluation
$EFLH_{cool}$	Metering Study	409	501
$kBtuh_{cool}$	Population Average	44.2	43.6
$SEER_{base}$	Indiana TRM V2.2	13	14
EER_{base}	Indiana TRM V2.2	11	N/A
EER_{ee}	Population Average	20.0	N/A
$EFLH_{heat}$	Metering Study	1,652	1,447
$kBtuh_{heat}$	Population Average	36.5	43.6
$HSPF_{base}$	Indiana TRM V2.2	8.2	8.2
COP_{ee}	Population Average	4.1	3.7
CF_{Summer}	Metering Study	0.291	0.322
CF_{Winter}	Metering Study	0.408	0.538

The input parameters noted in Table 3-16 compare the 2021 and 2017 evaluations. However, the reported savings for this measure are not based on the results of the 2017 evaluation, as geothermal heat pumps were reported with the same savings as tier 3 air source heat pumps. A comparison of these input parameters is not expected to directly correlate to realization rates for this measure.

Energy and demand savings for geothermal heat pumps are given in Table 3-17 and Table 3-18Table 3-18: Geothermal Heat Pump Gross Verified Savings (Per Unit).

Table 3-17: Geothermal Heat Pump Gross Verified Savings by Season (Per Unit)

Season	Energy Savings (kWh)	Summer Demand Savings (kW)	Winter Demand Savings (kW)
Cooling	448	0.244	0
Heating	3,010	0	0.744
Total	3,499	0.244	0.744

Table 3-18: Geothermal Heat Pump Gross Verified Savings (Per Unit)

Measurement	Reported Savings	Realization Rate	Verified Savings
Energy (kWh)	1,265	277%	3,499
Summer Demand (kW)	0.166	147%	0.244
Winter Demand (kW)	0.374	199%	0.744

3.4.4.4. Attic Insulation and Air Sealing

The evaluation considered attic insulation and air sealing data provided by the program database to inform savings calculations for this measure. These inputs include baseline and retrofit insulation R-values and attic area.

To estimate the impacts of the attic insulation component of this measure, the evaluation team reviewed the savings algorithm from Indiana TRM V2.2; which are based on energy models and expected savings at pre-defined levels of insulation. Given the level of detail provided by the program database, the evaluation was based on site specific values and the algorithm provided by Illinois TRM V9, and weather data based on typical meteorological year (TMY3) in Indianapolis, IN. Algorithms are given in Equation 3-9 and Equation 3-10. Table 3-19 shows input parameters for these algorithms.

Equation 3-9: Attic Insulation Energy Savings Algorithms

$$\Delta kWh_{cool} = \frac{CDD \times 24 \times Area \times DUA \times (1 - FF_{attic}) \times ADJ_{attic\ cool} \times \left(\frac{1}{R_{base}} - \frac{1}{R_{retrofit}}\right)}{\eta_{cool} \times 1000} \times \%_{cool}$$

$$\Delta kWh_{heat} = \frac{HDD \times 24 \times Area \times (1 - FF_{attic}) \times ADJ_{attic\ heat} \times \left(\frac{1}{R_{base}} - \frac{1}{R_{retrofit}}\right)}{COP \times 3412} \times \%_{electric\ heat}$$

Equation 3-10: Attic Insulation Demand Savings Algorithms

$$\Delta kW_{summer} = \frac{\Delta kWh_{\ cool}}{EFLH_{cool}} \times CF_{Summer}$$

$$\Delta kW_{winter} = \frac{\Delta kWh_{\ heat}}{EFLH_{hea}} \times CF_{Winter}$$

Table 3-19: Inputs for Attic Insulation Energy and Demand Savings

Variable	Source	2021 Evaluation	2017 Evaluation
R_{Base}	Population Average	9.4	9.7
$R_{Retrofit}$	Population Average	44.9	42.6
Area	Population Average	1,854	1,390
CDD	Calculated from Indianapolis TMY3	1,212	1,212
HDD	Calculated from Indianapolis TMY3	4,853	4,853
η_{cool}	Illinois TRM v9	10.5	10/13
COP	Illinois TRM v9	1.28	1.7/1.9
$ADJ_{attic\ cool}$	Illinois TRM v9	1.21	0.80
$ADJ_{attic\ heat}$	Illinois TRM v9	0.60	
DUA	Illinois TRM v9	0.75	0.75
FF	Illinois TRM v9	0.07	0.07
$\%_{cool}$	Duke Energy 2019 Residential End-Use Study	0.99	1
$\%_{electric\ heat}$	Duke Energy 2019 Residential End-Use Study	0.41	0.27
$EFLH_{cool}$	Metering Study	409	501
$EFLH_{heat}$	Metering Study	1,652	1,447
CF_{Summer}	Metering Study	0.291	0.322
CF_{Winter}	Metering Study	0.408	0.538

This evaluation showed an increase in the difference between existing insulation and newly installed insulation, as the baseline R-value is lower and the retrofit R-value is higher, compared to the 2017 evaluation. There was also an increase in attic area relative to the 2017 DEI Smart $aver evaluation. Attic insulation gross verified energy savings by season are shown in Table 3-20.

Table 3-20: Attic Insulation Gross Verified Savings by Season (Per Home)

Season	Energy Savings (kWh)	Summer Demand Savings (kW)	Winter Demand Savings (kW)
Cooling	574	0.408	0
Heating	1,498	0	0.370
Total	2,071	0.408	0.370

All participants who installed attic insulation were also required to air seal the attic plane to reduce air leakage from conditioned areas of the home. Savings for this component of the measure are separated from the insulation improvement and calculated using pre- and post-retrofit blower door results provided by the program database. The savings algorithms from Indiana TRM V2.2 are given in Equation 3-11 and Equation 3-12. Input parameters for air sealing are shown in Table 3-21.

Equation 3-11: Air Sealing Energy Savings Algorithm

$$\Delta kW\text{h}_{\ cool} = \frac{CFM_{base} - CFM_{retrofit}}{N_{Factor}} \times \frac{\text{kWh}}{\text{CFM}}$$

Equation 3-12: Air Sealing Demand Savings Algorithms

$$\Delta kW_{summer} = \frac{CFM_{base} - CFM_{retrofit}}{N_{Factor}} \times \frac{\text{kW}}{\text{CFM}} \times CF_{summer}$$

$$\Delta kW_{winter} = \frac{CFM_{base} - CFM_{retrofit}}{N_{Factor}} \times \frac{\text{kW}}{\text{CFM}} \times CF_{winter}$$

Table 3-21: Inputs for Air Sealing Energy and Demand Savings

Variable	Source	2021 Evaluation	2017 Evaluation
CFM_{base}	Population Average	1,826	3,421
$CFM_{Retrofit}$	Population Average	1,572	2,690
N_{Factor}	Indiana TRM V2.2	16.3	16.3
kWh/CFM	Indiana TRM V2.2	12.87	2.4/30.9
kW/CFM	Indiana TRM V2.2	0.0018	0.001/0.003
CF_{Summer}	Metering Study	0.291	0.322
CF_{Winter}	Metering Study	0.408	0.538

Air sealing gross verified energy savings are given in Table 3-22.

Table 3-22: Air Sealing Gross Verified Savings (Per Home)

Energy Savings (kWh)	Summer Demand Savings (kW)	Winter Demand Savings (kW)
200	0.008	0.011

Total savings for the combined attic insulation and air sealing measure are presented in Table 3-23.

Table 3-23: Attic Insulation and Air Sealing Gross Verified Savings (Per Home)

Measurement	Reported Savings	Realization Rate	Verified Savings
Energy (kWh)	1,202	189%	2,271
Summer Demand (kW)	0.220	189%	0.416
Winter Demand (kW)	0.251	152%	0.381

3.4.4.5. Variable Speed Pool Pumps

Variable speed pool pumps save the participant energy by reducing flow rates through a pump and achieving significant energy savings. Reducing pump flow by 50% is expected to save 87% of the energy needed to operate the system.

The evaluation team applied model number data provided by the Duke Energy Indiana Smart $aver Program database to estimate pump horsepower. The algorithms provided by Indiana TRM V2.2 estimate the consumption of a standard single speed pool pump, then applies an energy savings factor (ESF) and a demand savings factor (DSF) based on expected usage of a variable speed motor. Savings algorithms are given in Equation 3-13 and Equation 3-14. Input parameters for these algorithms are shown in Table 3-24.

Equation 3-13: Variable Speed Pool Pump Energy Savings Algorithm

$$\Delta kWh = \frac{HP \times LF \times 0.746}{\eta_{pump}} \times \frac{Hrs}{Day} \times \frac{Days}{Year} \times ESF$$

Equation 3-14: Variable Speed Pool Pump Demand Savings Algorithm

$$\Delta kW_{Summer} = \frac{HP \times LF \times 0.746}{\eta_{pump}} \times DSF \times CF_{Summer}$$

Table 3-24: Inputs for Variable Speed Pool Pump Gross Verified Savings

Variable	Source	2021 Evaluation	2017 Evaluation
HP	Population Average	2.13	1.94
LF	Indiana TRM V2.2	0.66	0.66
η_{Pump}	Indiana TRM V2.2	0.33	0.33
Hours/Day	Indiana TRM V2.2	6	6
Days/Year	Indiana TRM V2.2	100	100
ESF	Indiana TRM V2.2	0.86	0.91
DSF	Indiana TRM V2.2	0.91	N/A
CF_{Summer}	Indiana TRM V2.2	0.83	0.20

Table 3-24 shows an increase in the average horsepower of variable speed pool pumps, which was the primary contributor to an increase in energy savings. The input parameter comparison does not show a demand savings factor (DSF) for the 2017 evaluation, as the approach used to determine demand savings did not include this factor. There is also a significant difference in Summer coincidence factor for this reason.

Energy and demand savings for variable speed pool pumps are presented in Table 3-25.

Table 3-25: Variable Speed Pool Pump Gross Verified Savings (Per Unit)

Measurement	Reported Savings	Realization Rate	Verified Savings
Energy (kWh)	1,516	110%	1,667
Summer Demand (kW)	0.505	483%	2.440
Winter Demand (kW)	0	N/A	0

3.4.4.6. Heat Pump Water Heater

A desk review was conducted to determine the average savings of a heat pump water heater in the Duke Energy Indiana territory. Indiana TRM V2.2 provides an energy savings algorithm that includes energy saved from heating water, energy saved due to reducing cooling loads on air conditioners, and an energy penalty due to increasing heating loads. This algorithm was modified to account for the fraction of water heaters in Indiana that were installed in a conditioned space, the fraction of Duke Energy Indiana customers who heat their homes with heat pumps, and the fraction of Duke Energy Indiana customers who heat their homes with electric resistance heating.

Savings algorithms are given in Equation 3-15 and Equation 3-16. Input parameters for these algorithms are shown in Table 3-26.

Equation 3-15: Heat Pump Water Heater Energy Savings Algorithms

$$\Delta kWh = kWh_{base} \times \frac{COP_{new} - COP_{base}}{COP_{new}} + kWh_{cooling\ (DEI)} - kWh_{heati\quad (DEI)}$$

$$kWh_{cooling(DEI)} = \%_{conditioned\ space} \times kWh_{cooling\ (TRM)}$$

$$kWh_{heati\quad (DEI)} = \%_{conditioned\ space} \times \left(\%_{elec\ res} \times kWh_{elec\ res\ (TRM)} + \%_{heat\ pump} \times kWh_{heat\ pump\ (TRM)}\right)$$

Equation 3-16: Heat Pump Water Heater Demand Savings Algorithm

$$\Delta kW_{Summer} = \frac{\Delta kWh}{Hours} \times CF_{Summer}$$

Table 3-26: Inputs for Heat Pump Water Heater Gross Verified Savings

Variable	Source	2021 Evaluation
kWh_{base}	Indiana TRM V2.2	3,460
COP_{base}	Indiana TRM V2.2	0.904
COP_{new}	Indiana TRM V2.2	2.0
$\%_{conditioned\ space}$	Vectren 2020 DSM Evaluation[4]	25%
$kWh_{cooling\ (TRM)}$	Indiana TRM V2.2	180
$\%_{elec\ res}$	Duke Energy 2019 Residential End-Use Study	8%
$kWh_{elec\ res\ (TRM)}$	Indiana TRM V2.2	1,577
$\%_{heat\ pump}$	Duke Energy 2019 Residential End-Use Study	18%
$kWh_{heat\ pump\ (TRM)}$	Indiana TRM V2.2	779
Hours	Indiana TRM V2.2	2,533
CF_{Summer}	Indiana TRM V2.2	0.346

Table 3-26 does not show parameters from the 2017 evaluation, as deemed savings were applied at that time due to low program participation. This desk review showed a slight increase in energy savings, and determined that there are summer demand savings attributable to this measure

[4] 2020 Vectren Demand-Side Management Portfolio Process and Electric Impacts Evaluation, June 4th, 2021

(previously reported as zero). Energy and demand savings for heat pump water heaters are provided in Table 3-27.

Table 3-27: Heat Pump Water Heater Gross Verified Savings (Per Unit)

Measurement	Reported Savings	Realization Rate	Verified Savings
Energy (kWh)	1,615	116%	1,874
Summer Demand (kW)	0	N/A	0.256
Winter Demand (kW)	0	N/A	0

3.4.5. Deemed Analysis

Due to low program participation the evaluation team applied deemed savings from the previous evaluation for duct sealing measures.

3.4.5.1. Duct Sealing

Gross verified savings from the 2017 DEI Smart $aver evaluation were applied as deemed savings for the duct sealing measure. A review of the program database found that reported savings did not match previously evaluated gross verified savings for some participants. This caused realization rates to deviate from 100%, despite the application of deemed savings. Savings for the duct sealing measure are presented in Table 3-28.

Table 3-28: Duct Sealing Gross Verified Savings (Per Home)

Measurement	Reported Savings	Realization Rate	Verified Savings
Energy (kWh)	503	90%	451
Summer Demand (kW)	0.341	45%	0.154
Winter Demand (kW)	0.029	275%	0.079

3.5. Targeted and Achieved Confidence and Precision

The Smart $aver evaluation plan was developed with the goal of achieving a target goal of 10% relative precision at the 90% confidence interval for the program as a whole. As the program is composed of different measures, and the energy savings estimation approach varies by measure, the evaluation team assigned sampling, verification, and impact estimate effort among the program measures in accordance with the measures' contribution to total reported Smart $aver savings. The evaluation team calculated the relative precision for each of these samples and combined the error bound to calculate a program-level relative precision. As presented in Table 3-29 the evaluation team reported confidence and precision for the program is +/- 8.7% at the 90% confidence level.

Table 3-29: Targeted and Achieved Confidence and Precision

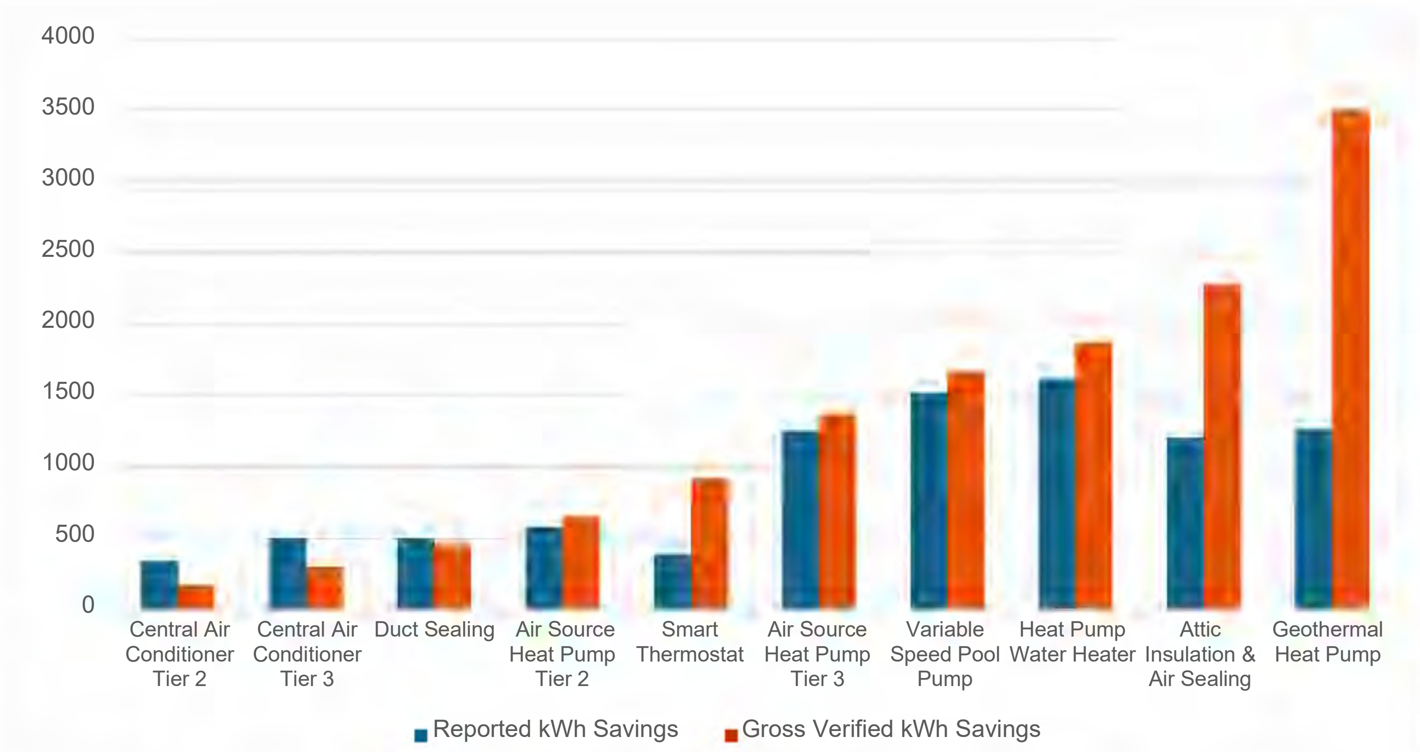
Program	Targeted Confidence/Precision	Achieved Confidence/Precision
Smart $aver	90/10.0	90/8.7

3.6. Program Results

3.6.1. Results per Unit

Reported and verified per unit energy savings are shown in Figure 3-9. Discussion on measure realization rates can be found in earlier subsections.

Figure 3-9: DEI Smart $aver 2021 Reported and Verified Energy Savings (Per Unit)



This evaluation showed energy realization rates above 100% for the majority of Smart $aver measures, with central air conditioners and duct sealing as the only exceptions. Low summer demand realization rates for HVAC measures were primarily due to low EER of new equipment. The evaluation of central air conditioner measures resulted in no verified winter demand savings, as savings due to ECM furnace fans have reduced to zero due to an update in federal efficiency regulations. Table 3-30, Table 3-31, and Table 3-32 provide the per unit energy and demand savings and realization rates for each measure.

Table 3-30: Average Reported and Gross Verified Energy Savings (Per Unit)

Measure	Reported Energy Savings per Unit (kWh)	Realization Rate	Verified Gross Energy Savings per Unit (kWh)
Central Air Conditioner Tier 2	337	51.5%	174
Central Air Conditioner Tier 3	500	59.7%	298
Air Source Heat Pump Tier 2	579	112.0%	649
Air Source Heat Pump Tier 3	1,250	109.5%	1,368
Geothermal Heat Pump	1,265	276.6%	3,499
Smart Thermostat	388	237.6%	922
Variable Speed Pool Pump	1,516	110.0%	1,667
Attic Insulation & Air Sealing	1,202	188.9%	2,271
Heat Pump Water Heater	1,615	116.1%	1,874
Duct Sealing	503	89.7%	451

Table 3-31: Reported and Gross Verified Summer Demand Savings (Per Unit)

Measure	Reported Summer Demand Savings per Unit (kW)	Realization Rate	Verified Gross Summer Demand Savings per Unit (kW)
Central Air Conditioner Tier 2	0.163	68.5%	0.112
Central Air Conditioner Tier 3	0.266	21.9%	0.058
Air Source Heat Pump Tier 2	0.082	109.9%	0.090
Air Source Heat Pump Tier 3	0.165	38.9%	0.064
Geothermal Heat Pump	0.166	147.1%	0.244
Smart Thermostat	0	N/A	0
Variable Speed Pool Pump	0.505	483.2%	2.440
Attic Insulation & Air Sealing	0.220	189.2%	0.416
Heat Pump Water Heater	0	N/A	0.256
Duct Sealing	0.341	45.1%	0.154

Table 3-32: Reported and Gross Verified Winter Demand Savings (Per Unit)

Measure	Reported Winter Demand Savings per Unit (kW)	Realization Rate	Verified Gross Winter Demand Savings per Unit (kW)
Central Air Conditioner Tier 2	0.113	0.0%	0
Central Air Conditioner Tier 3	0.113	0.0%	0
Air Source Heat Pump Tier 2	0.168	70.0%	0.118
Air Source Heat Pump Tier 3	0.366	72.2%	0.265
Geothermal Heat Pump	0.374	198.8%	0.744
Smart Thermostat	0	N/A	0
Variable Speed Pool Pump	0	N/A	0
Attic Insulation & Air Sealing	0.251	151.9%	0.381
Heat Pump Water Heater	0	N/A	0
Duct Sealing	0.029	275.0%	0.079

3.6.2. Impact Results Summary

Program level energy savings, demand savings, and realization rates for each measure are shown in Table 3-33, Table 3-34, and Table 3-35.

Table 3-33: Reported and Verified Gross Energy Savings

Measure	Rebates	Reported Energy Savings (kWh)	Realization Rate	Gross Verified Energy Savings (kWh)
Central Air Conditioner Tier 2	1,955	659,547	51%	339,642
Central Air Conditioner Tier 3	337	168,483	60%	100,511
Air Source Heat Pump Tier 2	637	368,903	112%	413,279
Air Source Heat Pump Tier 3	332	414,982	109%	454,292
Geothermal Heat Pump	102	129,030	277%	356,849
Smart Thermostat	2,013	780,752	237%	1,855,396
Variable Speed Pool Pump	174	263,784	110%	290,095
Attic Insulation & Air Sealing	71	85,346	189%	161,244
Heat Pump Water Heater	68	109,820	116%	127,465
Duct Sealing	11	5,528	90%	4,961
TOTAL	5,700	2,986,175	137%	4,103,733

Table 3-34: Reported and Verified Summer Demand Gross Savings

Measure	Rebates	Reported Summer Demand Savings (kW)	Realization Rate	Gross Verified Winter Demand Savings (kW)
Central Air Conditioner Tier 2	1,955	318.2	69%	218.1
Central Air Conditioner Tier 3	337	89.6	22%	19.6
Air Source Heat Pump Tier 2	637	52.3	110%	57.4
Air Source Heat Pump Tier 3	332	54.9	39%	21.4
Geothermal Heat Pump	102	16.9	147%	24.9
Smart Thermostat	2,013	0	N/A	0
Variable Speed Pool Pump	174	87.9	483%	424.6
Attic Insulation & Air Sealing	71	15.6	189%	29.6
Heat Pump Water Heater	68	0	N/A	17.4
Duct Sealing	11	3.8	45%	1.7
TOTAL	5,700	639.2	127%	814.7

Table 3-35: Reported and Verified Winter Demand Gross Savings

Measure	Rebates	Reported Winter Demand Savings (kW)	Realization Rate	Gross Verified Winter Demand Savings (kW)
Central Air Conditioner Tier 2	1,955	221.1	0%	0.0
Central Air Conditioner Tier 3	337	38.0	0%	0.0
Air Source Heat Pump Tier 2	637	107.2	70%	75.0
Air Source Heat Pump Tier 3	332	121.6	72%	87.8
Geothermal Heat Pump	102	38.1	199%	75.8
Smart Thermostat	2,013	0	N/A	0
Variable Speed Pool Pump	174	0	N/A	0
Attic Insulation & Air Sealing	71	17.8	152%	27.1
Heat Pump Water Heater	68	0	N/A	0
Duct Sealing	11	0.3	275%	0.9
TOTAL	5,700	544.2	49%	266.6

The smart thermostats measure contributed significantly to the program energy realization rate of 137%. This is due to high per-unit verified energy savings, as well as the large number of smart thermostats rebated through the Smart $aver program. The program summer demand realization rate of 127% was primarily due the increased savings attributable to variable speed pool pump measures, as well as the attic insulation and air sealing measures. Central air conditioners contributed no winter demand savings, resulting in a significant decrease in program level winter demand savings.

Table 3-36 presents total program reported and verified savings.

Table 3-36: DEI Smart $aver 2021 Gross Program Savings

Measurement	Rebates	Reported	Realization Rate	Gross Verified
Energy (kWh)	5,700	2,986,175	137%	4,103,733
Summer Demand (kW)		639	127%	815
Winter Demand (kW)		544	49%	267

4. Net-To-Gross

The evaluation team used participant survey data to calculate a net-to-gross (NTG) ratio for Smart $aver. NTG reflects the effects of free ridership (FR) and both participant spillover (PSO) and non-participant spillover (NPSO) on gross savings. Free ridership refers to the portion of energy savings that participants would have achieved in the absence of the program through their own initiatives and expenditures (U.S. DOE, 2014).[5] Spillover refers to the program-induced adoption of additional energy-saving measures by participants who did not receive financial incentives or technical assistance for the additional measures installed (U.S. DOE, 2014). The evaluation team used the following formula to calculate the NTG ratio:

$$NTG = 100\% - FR + PSO + NPSO$$

4.1. Free Ridership

Free ridership estimates how much the program influenced participants to participate in the Smart $aver initiative. Free ridership ranges from 0% to 100%, with 0% being no free ridership and 100% being total free ridership.

The evaluation team used participant survey data to estimate free ridership. The survey used several questions to identify what the participant would have installed in the absence of an incentive.

[5] The U.S. Department of Energy (DOE) (2014). *The Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific Measures. Chapter 23: Estimating Net Savings: Common Practices*

The evaluation team's methodology for calculating free ridership consists of two components, free ridership change (FRC) and free ridership influence (FRI).

$$FR = 50\% \times FRC + 50\% \times FRI$$

There is an important consideration to note for free ridership. Because the smart thermostat impact savings were determined using a comparison group AMI analysis, those savings are already defined as net, and therefore no additional free ridership or spillover should be attributed to that measure. Smart thermostats are thus defined as 100% NTG and those savings are weighted into the program total at the end.

4.1.1. Free Ridership Change

FRC reflects what participants reported they would have done if the program had not provided an incentive to participate. For each respondent, the survey assessed FRC for what actions the participant would have taken if Duke Energy rebates and information were not available, and when the participant would have likely purchased the unit.

Specifically, the survey asked respondents to indicate whether they would not have installed, would have bought a less expensive or less efficient unit, would have bought the exact same efficiency and paid the full cost, or "don't know" what they would have done in the absence of an incentive. For participants who either would have bought a unit, whether that be the less expensive or less efficient, or the same efficiency, or if they did not know what they would do, we asked a follow-up question to determine when they would have likely purchased the unit.

For each participant and each measure, the evaluation team assigned one of the FRC values outlined in Table 4-1.

Table 4-1: Free Ridership Change Values

Q1 Response	Q2 Response	FRC Value
Would not have installed	N/A	0%
Would have bought a less expensive or less efficient unit	At the same time	75%
	Within 6 months	50%
	Within a year	25%
	Later than a year	0%
	Don't know	25%

Would have bought the exact same efficiency and paid the full cost	At the same time	100%
	Within 6 months	67%
	Within a year	33%
	Later than a year	0%
	Don't know	50%
Don't know	At the same time	50%
	Within 6 months	37.5%
	Within a year	12.5%
	Later than a year	0%
	Don't know	N/A

Each respondents' answers to the two free ridership change questions were calculated and then savings weighted to derive an overall program average. The program weighted free ridership change value was calculated as 62%.

4.1.2. Free Ridership Influence

FRI assesses how much influence the program had on a participant's decision to purchase the measure. The survey asked respondents to rate how much influence four program-related factors had on their respective decisions to install the measures, using a scale from 0 ("not at all influential") to 10 ("extremely influential"). The program-related factors included:

- The rebate that was received
- Information or ads from DEI, including website
- Recommendation from contractor
- Other reason [specified]

FRI is based on the highest-rated item in the FRI battery. The evaluation team assigned the following FRI scores, based on that rating (

Table 4-2).

Table 4-2: Free Ridership Influence Values

Highest Influence Rating	FRI Value
0	100%
1	90%
2	80%
3	70%
4	60%
5	50%
6	40%
7	30%
8	20%
9	10%
10	0%

A free ridership influence of 13% was calculated.

4.1.3. Total Free Ridership

The evaluation team calculated the total free ridership by measure by calculating the average between each measure's change and influence score, then savings weighting each result with the evaluated per unit savings for each unit installed by respondents to derive the overall total.

Table 4-3

Table 4-3 presents the measure-specific and overall FR estimates. Note that this value does not include smart thermostats, which are defined as 100% NTG and included in the final program value.

Table 4-3: Self-Report Free Ridership Results

Measure	FRC	FRI	Full FR
Air-Source Heat Pump	69%	16%	42%

Central Air Conditioner	80%	18%	49%
Geothermal Heat Pump	88%	0%	44%
Pool Pump	46%	23%	35%
Heat Pump Water Heater	0%	0%	0%
Attic Insulation and Air Sealing	13%	7%	10%
Savings Weighted	65%	13%	39%

4.2. Spillover

4.2.1. Participant Spillover (PSO)

Spillover estimates energy savings from additional energy improvements made by participants who are influenced by the program to do so and is used to adjust gross savings. The evaluation team used participant survey data to estimate spillover. The survey asked respondents to indicate what non-rebated energy-saving measures they had implemented since participating in the program. The evaluation team then asked participants to rate the influence the program had on their decision to purchase these additional energy-saving measures on a scale of 0 to 10, where 0 means “not at all influential” and 10 means “extremely influential.”

The evaluation team converted the ratings to a percentage representing the program-attributable percentage of the measure savings, from 0% to 100%. The team then applied the program-attributable percentage to the savings associated with each reported spillover measure to calculate the participant spillover (PSO) for that measure. We defined the per-unit energy savings for the reported spillover measures based primarily on previous Duke Energy Smart $aver and other recent program evaluations to be consistent across programs, which draw upon ENERGY STAR® calculators and algorithms and parameter assumptions listed in the Indiana TRM v2.2 and other sources.

Since Duke Energy offered program incentives for a variety of energy-saving measures throughout the evaluation period, we compared the list of customers reporting measures as spillover against participation records for other Duke Energy programs that offered the measure. To avoid double-counting savings for measures already claimed by another Duke Energy offering, we excluded savings from measures that appeared in another program’s tracking data from our estimation of spillover savings.

Participant spillover is calculated as follows:

$$Participant\ SO = \frac{\sum PSO\ \ kWh}{Sample\ Gross\ Program\ Savings\ kWh}$$

Where:

$$PSO = (Number\ Installed * Deemed\ Measure\ Savings) * Program\ Influence\ on\ Non - Rebated\ Measure$$

Of the 114 completed surveys, 60 measures were defined as potential spillover measures, but 36 of these were given 0% program influence. The 24 remaining measures had calculated savings of 1,208 kWh total for the sample population.

$$PSO = \frac{\sum PMSO}{\sum Sample\ Gross\ Program\ Savings}$$

$$PSO = \frac{1{,}208}{76{,}367} = 1.6\%$$

These calculations produced a participant spillover estimate of 1.6% for the DEI program.

4.2.2. Non-Participant Spillover (NPSO)

The evaluation team then calculated eligible equipment installs made by nonparticipants who are influenced by the participating trade allies, but did not receive rebates. The survey asked respondents to indicate what non-rebated energy-saving measures they had recommended to the customer. The evaluation team then asked trade allies to rate the influence the program had on their business practice of recommending those measures to customers on a scale of 0 to 10, where 0 means “not at all influential” and 10 means “extremely influential.” The evaluation team converted the ratings to a percentage representing the program-attributable percentage of the measure savings, from 0% to 100%.

The team then applied the program-attributable percentage to the savings associated with each reported spillover measure to calculate the non-participant spillover (NPSO) for that measure. We defined the per-unit energy savings for the reported spillover measures from the verified gross measure savings.

Each of the surveyed trade allies was asked a series of questions to determine the number of measures installed within Duke Energy’s territory, that qualified as energy efficient measures, and did not receive a rebate. Of the qualifying units within DEI territory, trade allies reported that 87% of those units went on to participate in the program. Of those that did not participate, it was reported that only 34% of those units were claimed to had been influenced by the program. Table 4-4 lists the resulting spillover measures.

Table 4-4: DEI Non-participating Spillover Measures Claimed by Trade Allies

Measure Category	Count
Air-Source Heat Pump	112
Central Air Conditioner	144
Geothermal Heat Pump	1
Pool Pump	0
Heat Pump Water Heater	0
Attic Insulation and Air Sealing	0

Because the survey did not reach the entire program population of trade allies, the results were extrapolated to the population. The survey effort reached trade allies that covered around half of the CAC and ASHP installs, and about a quarter of the GSHP installs.

Nonparticipant spillover is calculated as follows:

$$NPSO = \frac{\sum NP\ Measure\ SO\ \ kWh\ Extrapolated\ to\ population\ \times Program\ Influence}{Gross\ Program\ Savings\ kWh}$$

$$NPSO = \frac{269{,}607\ kWh}{4{,}099{,}061\ kWh} = 6.6\%$$

These calculations produced a nonparticipant spillover estimate of 6.6% for the DEI program.

4.3. Net-to-Gross

Inserting the NTG component estimates into the NTG formula (NTG = 100% – FR + PSO + NPSO) produces an NTG value of 84% for the DEI program, after savings weighting each measure result and including smart thermostats (Table 4-5).

Table 4-5: Net-to-Gross Results

Measure	FR	PSO	NPSO	NTG
Air-Source Heat Pump	42.4%	1.6%	6.6%	65.8%
Central Air Conditioner	49.1%	1.6%	6.6%	59.1%
Geothermal Heat Pump	43.8%	1.6%	6.6%	64.4%
Pool Pump	34.6%	1.6%	6.6%	73.5%
Heat Pump Water Heater	0.0%	1.6%	6.6%	108.2%
Attic Insulation and Air Sealing	9.6%	1.6%	6.6%	98.6%
Self Report Savings Weighted	39.3%	1.6%	6.6%	68.85%
Smart Thermostat	0%	0%	0%	100%
Program Level NTG				**84.0%**

The evaluation team applied this NTG ratio to program-wide verified gross savings to calculate Smart $aver net savings (Table 4-6).

Table 4-6: DEI Program Level Savings

Measurement	Population	Gross Verified	NTG Ratio	Net Verified
Energy (kWh)	5,700	4,103,733	84%	3,447,546
Summer Demand (kW)		815		684
Winter Demand (kW)		267		224

5. Process Evaluation

The following sections describe the methods used to collect data for the process evaluation, as well as important findings from the evaluation.

5.1. Summary of Data Collection Activities

The process evaluation is based on telephone interviews and telephone and web surveys with program and implementer staff, trade allies, and participants (Table 5-1).

Table 5-1: Summary of Process Evaluation Data Collection Activities

Target Group	Method	Sample Size	Confidence/Precision
Program Staff	Phone in-depth interview	1	N/A
Implementation Staff	Phone in-depth interview	1	N/A
High Volume Trade Allies[a]	Phone in-depth interview	4	N/A
Trade Allies (various rebate volumes)	Web/Phone survey	45	11.5%
Program Participants	Web survey	114	7.6%

[a] High volume trade allies are companies in the top 20% of trade allies in terms of number of rebated measures, for a given campaign.

5.1.1. Program and Implementer Staff

The evaluation team conducted interviews with the Smart $aver Program Manager and a senior manager from the implementation staff in order to understand how the program was working and to capture their insights about the program's operations, challenges, expectations, and interactions with market actors and customers.

5.1.2. Trade Allies

Participating contractors – called "trade allies" – are the primary program delivery channel for Smart $aver. In spring of 2021, the evaluation team conducted four in-depth interviews with high volume Smart $aver trade allies. The evaluation team also used a web instrument to survey 45 trade allies, asking them about various program topics such as satisfaction with the program and program-related challenges (Table 5-2). All reported trade ally results come from the initial survey, unless noted otherwise.

Table 5-2: Trade Ally Research Objectives

Research Objectives
Assess Trade Ally engagement with the program and how they and their customers heard of the program
Assess program satisfaction
Document Trade Ally program experience, including any challenges and opportunities for improving the program
Gather data for non-participant spillover
Ask about Trade Ally firmographics and customer characteristics
Document program influence

The evaluation team found that trade ally specializations (such as insulation, for example) can significantly shape trade ally experience with the program. The distribution of the trade ally sample's measure experience generally reflects that of the larger trade ally population as shown in Table 5-3.

Table 5-3: Trade Ally Experience with Smart $aver Measures in 2020-2021

Measure	Number installed in evaluation timeframe	Number installed by TAs in survey sample	Number TA installers in survey sample
Central Air Conditioner	2,292	805	34
Air-Source Heat Pump	969	422	31
Geothermal Heat Pump	102	27	7
Attic Insulation and Air Sealing	71	7	2
Variable Speed Pool Pump	174	20	3
Heat Pump Water Heater	68	5	3
Duct Sealing	11	2	1
Smart Thermostat	2,013		

5.1.3. Participants

The evaluation team surveyed 114 Smart $aver participants who received rebates through the program. The purpose of this data collection activity was to obtain a more detailed understanding of the customer experience with the program, identify potential areas for program improvement, and collect data to inform NTG estimates. Table 5-4 documents the specific research objectives of the participant survey.

Table 5-4: Participant Research Objectives

Research Objectives
Assess program outreach and marketing
Document customer experience with the program, equipment, and trade allies
Document reasons for participation and program influence
Gather feedback needed to estimate Net-to-Gross
Assess population segments the program is reaching
Gather demographic information

To ensure the results were applicable to the larger participant population, the evaluation team stratified the sample by measure type, thus ensuring that sampled participants were representative of the measures in the population (Table 5-5). Aside from survey respondents that received add-on HVAC measures (smart thermostat), only one survey respondent received Smart $aver rebates for more than one measure. This respondent received rebates for attic insulation/air sealing and duct sealing, and was asked measure-specific questions for all measures for which they received rebates.

Table 5-5: Measures Installed by Participant Sample

Measure Installed	Sample % (n=114)	Participant Population %
Central Air Conditioner	58%	40%
Air-Source Heat Pump	29%	17%
Attic Insulation & Air Sealing	3%	1%
Pool Pump	6%	3%
Geothermal Heat Pump	4%	2%
Heat Pump Water Heater	<1%	1%
Duct Sealing	0%	<1%
Smart Thermostat	58%	35%

5.2. Process Evaluation Findings

The following subsections describe program successes and challenges as well as opportunities for program improvement.

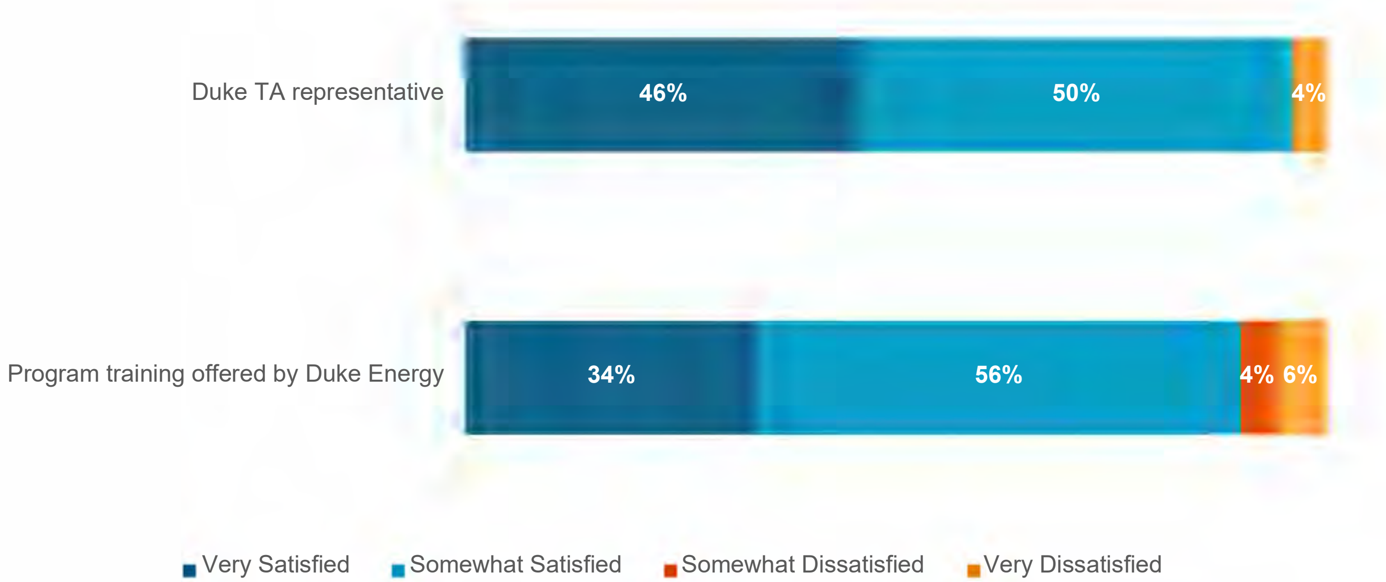
5.2.1. Trade Ally Perspective

This section reports the results from trade ally surveys regarding their experience participating in the Smart $aver program in the Duke Energy Indiana jurisdiction.

5.2.1.1. Training

Trade allies were asked about their satisfaction with program assistance measures, such as their Duke trade ally representative, as well as program training offered by Duke Energy. Overall, trade allies were largely satisfied with their trade ally representative and program training (Figure 5-1). Of the 3 respondents who were dissatisfied, two out of the three mentioned that they did not receive any training or were not aware of training opportunities.

Figure 5-1: Satisfaction with Program Assistance Factors (n=32)

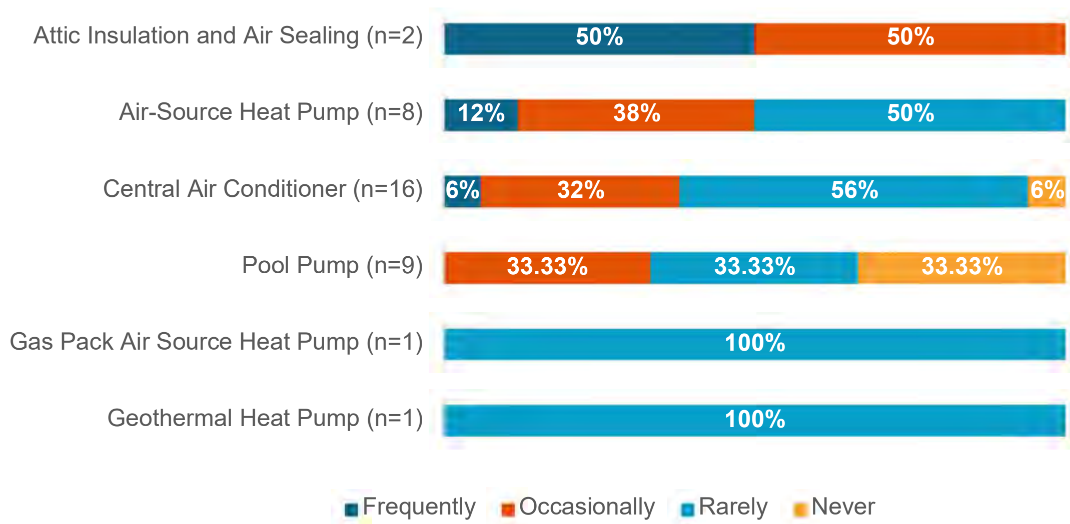


5.2.1.2. Recruiting Customers into Smart $aver

Resource Innovations asked trade allies about the primary reasons why their customers replace HVAC, water heating, or pool pump equipment, as well as why their customers insulate and seal their ducts or attics. While insulation trade allies reported that their customers add insulation to save money on energy bills and to improve comfort, HVAC trade allies reported that most new HVAC units are replacing broken or aging systems, and that few customers replace fully functional standard efficiency HVAC units with high efficiency units just for the energy savings. Participant findings (see section **Error! Reference source not found.**) corroborate these trade ally reports, as only 13% of HVAC replacement participants reported replacing an HVAC unit that was in good working condition. Of the respondents who replaced air source heat pumps, over half of them (57%) replaced units that were 15 years or older, while the remaining respondents replaced newer systems. Of the respondents who replaced air conditioners, most (78%) replaced units that were 15 years or older, while the remaining replaced newer systems.

Trade ally survey data – which is further corroborated by participant survey data (see section **Error! Reference source not found.**) – reveals that trade allies are largely responsible for recruiting customers into the program. As seen in Figure 5-2Figure 5-2, the majority of surveyed trade allies said that their customers "rarely" or "never" ask about Smart $aver, regardless of the measure that they installed. Instead, trade allies typically introduce their customers to Smart $aver rebate opportunities. The exception would be attic insulation and air sealing, where trade allies reported that customers "frequently" or "occasionally" ask about Smart $aver. However, since the samples are small, these results cannot be interpreted as representative.

Figure 5-2: How Often Customers Ask About Smart $aver Rebates (n=31)



Further, a majority of surveyed trade allies (97%) expressed satisfaction with DEI's marketing of the program. Despite the marketing, however, trade allies are critical in bringing participant awareness to the program, as well as to educate their customers on the benefits of energy efficiency and the availability of Smart $aver rebates to bring new households into the program.

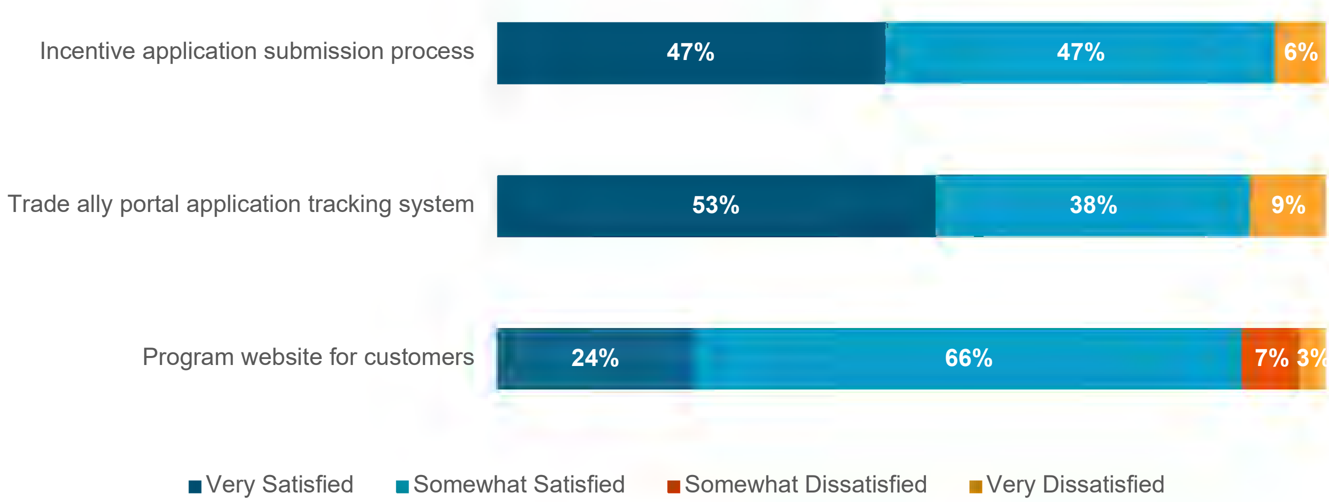
5.2.1.3. Rebate Application Process

Smart $aver transitioned to an online application system (called the "trade ally portal") in April 2016, with an enhanced version of the system being introduced in 2021. We asked trade allies how frequently they have experienced problems or frustrations using both the old portal, and the new enhanced portal. Half of the trade allies reported that they occasionally experienced problems or frustrations with the old Rebate Application Entry and Tracking Platform. Under half of the respondents (41%) reported that the issues have gotten somewhat better over time, with 30% reporting that the issues have been completely resolved by the enhanced portal. When asked specifically about the enhanced trade ally portal, the majority of respondents (92%) reported that they did not have any issues.

Trade allies that reported experiencing problems or frustrations with the rebate application process typically mentioned challenges with finding customer accounts due to address formatting, challenges with looking up previous rebates that were filed, and various issues with submissions. For example, they reported notices that attachments were missing even though they had been attached, or issues with the platform being slow.

Despite these problems and frustrations, the rebate application process and the trade ally portal were highly rated in the trade ally satisfaction battery. Ninety-four percent of trade allies were satisfied with the incentive application submission process, and 91% were satisfied with the trade ally portal (Figure 5-3).

Figure 5-3: Trade Ally Satisfaction with Online Systems (n=32)



5.2.1.4. Program Influence on Trade Allies

Trade ally survey results reveal that the program is influencing energy efficiency contracting services offered by contractors in the trade ally network. Half (50%) of the surveyed trade allies reported their knowledge of energy efficient products and services had increased since they became involved with Smart $aver, 44% of which said the program was highly influential on their increased knowledge (Figure 5-4: Smart $aver Influence on Increased Trade Ally Knowledge of Energy Efficient Products and Services (n=16)*

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Figure 5-4: Smart $aver Influence on Increased Trade Ally Knowledge of Energy Efficient Products and Services (n=16)*

* Asked on a 0-10 scale, where 0 is "not at all influential" and 10 is "extremely influential." Low influence represents responses ranging from 1 to 3, moderate influence represents responses ranging from 4 to 7, and high influence represents responses ranging from 8 to 10. No respondents gave a "0" rating.

Most HVAC trade allies reported that Smart $aver has at least partially influenced their practice of recommending qualifying HVAC measures, with the majority (83%) indicating that Smart $aver was moderately or highly influential (Figure 5-5).

Figure 5-5: Program Influence on Trade Ally Practice of Recommending Program Qualified Measure (n=40)*

* Asked on a 0-10 scale, where 0 is "not at all influential" and 10 is "extremely influential." "No influence" represents trade allies that reported "0," low influence represents responses ranging from 1 to 3, moderate influence represents responses ranging from 4 to 7, and high influence represents responses ranging from 8 to 10. Figure excludes "don't know" responses. Each row only includes trade allies who had experience with the measure.

However, Smart $aver has limited influence on stocking of energy efficient equipment, as few (8%) trade allies who install equipment measures through the program reported keeping equipment in stock in the first place. Instead, most (92%) purchase equipment on an as-needed basis, which was what they were doing prior to participation in Smart $aver and are continuing to do.

5.2.1.5. Suggestions for Improvement

Despite their high satisfaction ratings, trade allies had a few suggestions for program improvement, including:

- Just over half of the trade allies (52%) believe that mini splits should be offered through Smart $aver. The question in the survey asked what additional measures should we offered through Smart $aver, so this does not imply that 48% of trade allies do not want the ductless mini split included, but that 52% of trade allies mentioned this explicitly. Information from in-depth interviews confirmed that customers have begun requesting incentives for ductless mini splits.
- Better explanations if the application is returned invalid through the portal; allow the ability to search for customer account numbers by using name or address; auto-populate referral information.
- Shorter processing time for rebates and applications; simplify the rebate process so that it takes less time.
- Sending out emails to trade allies when there are updates to the portal as opposed to having the information directly in the portal.
- Give customers the ability to fill out the rebate application by themselves without intervention from the trade allies.

5.2.2. Participant Experience

5.2.2.1. Participant Awareness

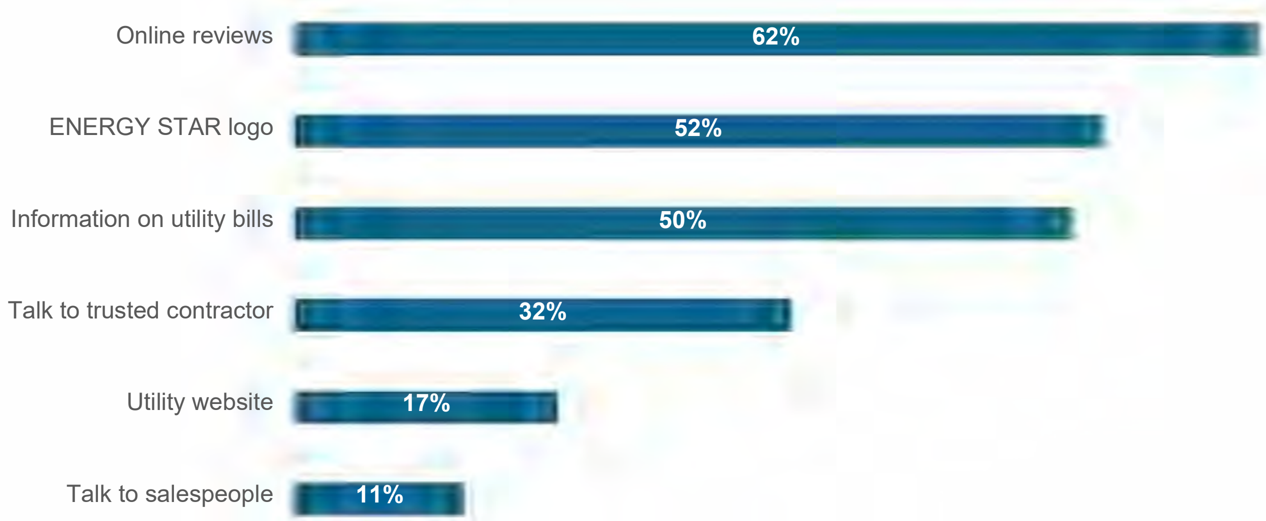
Trade allies are the primary way consumers learn about the program, as evidenced by more than half (51%) of participants citing their contractor as their source of program awareness (Table 5-6). Just under half of the participants heard about Smart $aver via Duke Energy's marketing efforts, as fewer participants said they learned about the program from the Duke Energy website (14%), direct (paper) mail (11%), or the internet (3%).

Table 5-6: Source of Smart $aver Program Awareness (Multiple Responses Allowed)

Source of Program Awareness	n=114
Trade ally	51%
Duke Energy website	14%
Direct (paper) mail	11%
Email	9%
Other	7%
Word of mouth	5%
Online advertisement	3%

Respondents typically reported searching for information on how to save energy at their residence over the Internet, with the highest proportion (62%) of surveyed participants reporting reading reviews about products online for information regarding energy savings (Figure 5-6). Just over half (52%) of the respondents reported looking for the ENERGY STAR logo on products, and half (50%) of the respondents reading tips on how to save energy that is provided on their utility bill.

Figure 5-6: Source of Energy Savings Information (Multiple Responses Allowed) (n=114)

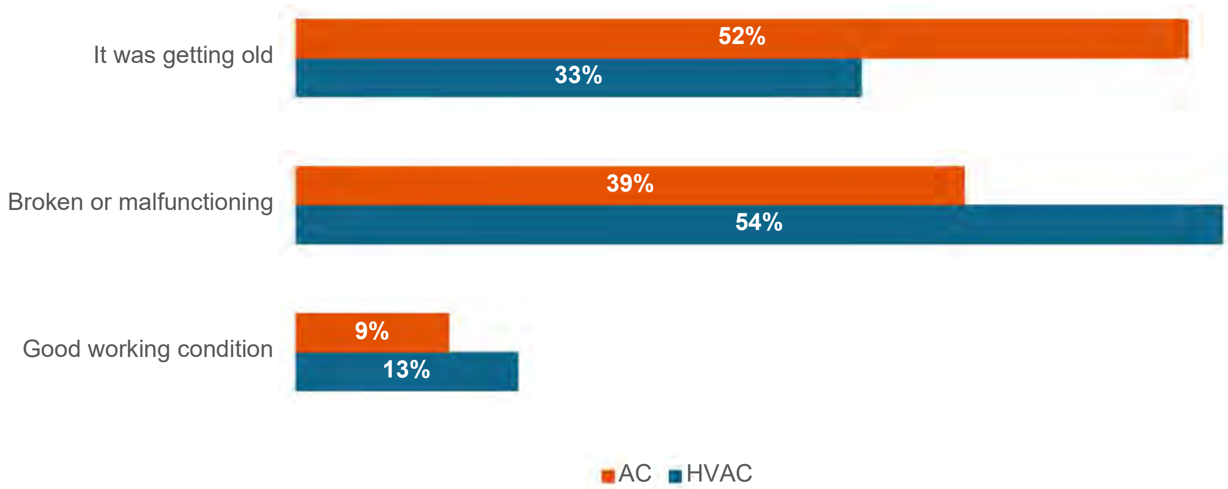


5.2.2.2. Motivation to Participate

The evaluation team asked participants a series of questions to determine why they selected qualifying Smart $aver measures. For those participants who installed equipment measures, the evaluation team asked about the condition of the previous equipment they replaced, and then asked why they chose an energy efficient version of that equipment.

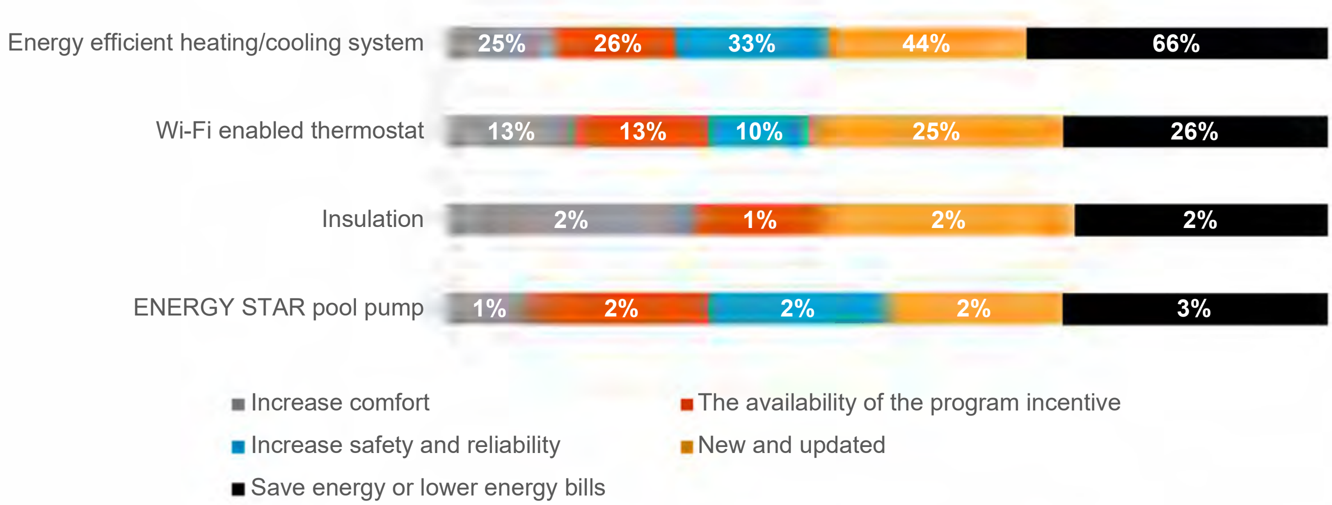
Overall, a slight majority (52%) of participants who replaced their air conditioner reported doing so because it was "getting old." Of participants who replaced their HVAC system, a slight majority (54%) did so because it was "broken or malfunctioning." Few participants replaced equipment that was in good working condition. Of those who replaced air conditioners, 9% of participants replaced a unit that was in good working condition. Of those who replaced their HVAC system, 13% of participants replaced a unit that was in good working condition.

Figure 5-7: Reasons for Equipment Replacement (AC n=70); HVAC n=40)



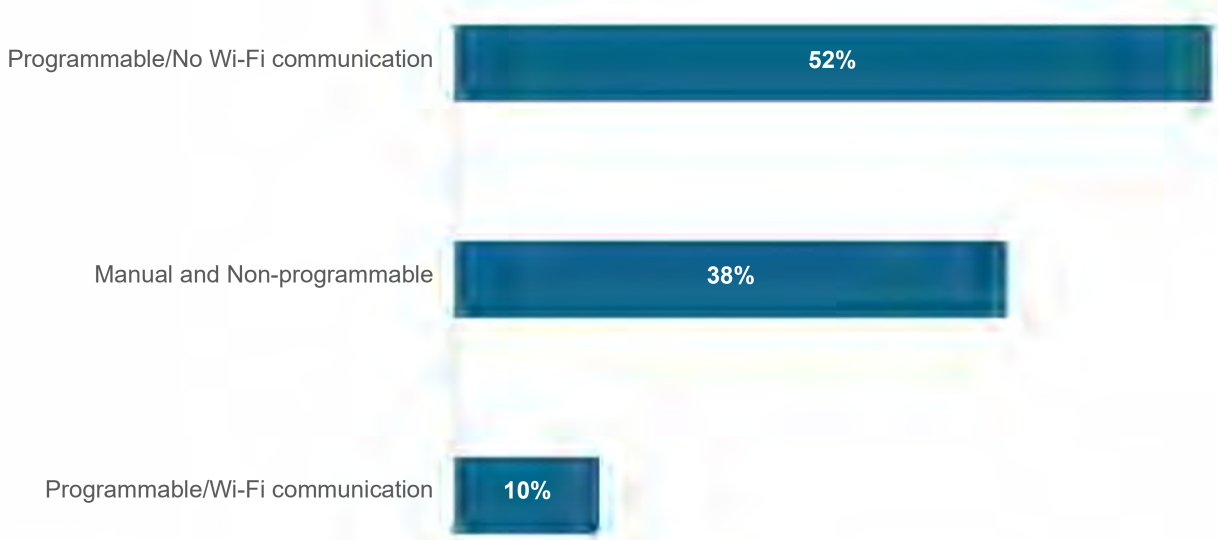
Participants typically selected energy efficient HVAC equipment over standard efficiency models due to the desire to use less energy or to accrue monetary savings (Figure 5-8).

Figure 5-8: Motivation for Installing Energy Efficient Equipment Broken by Measure (Multiple Responses Allowed) (n=114)



Participants mainly replaced programmable thermostats that were not Wi-Fi connected (Figure 5-9). This indicates there is still large potential for increased adoption.

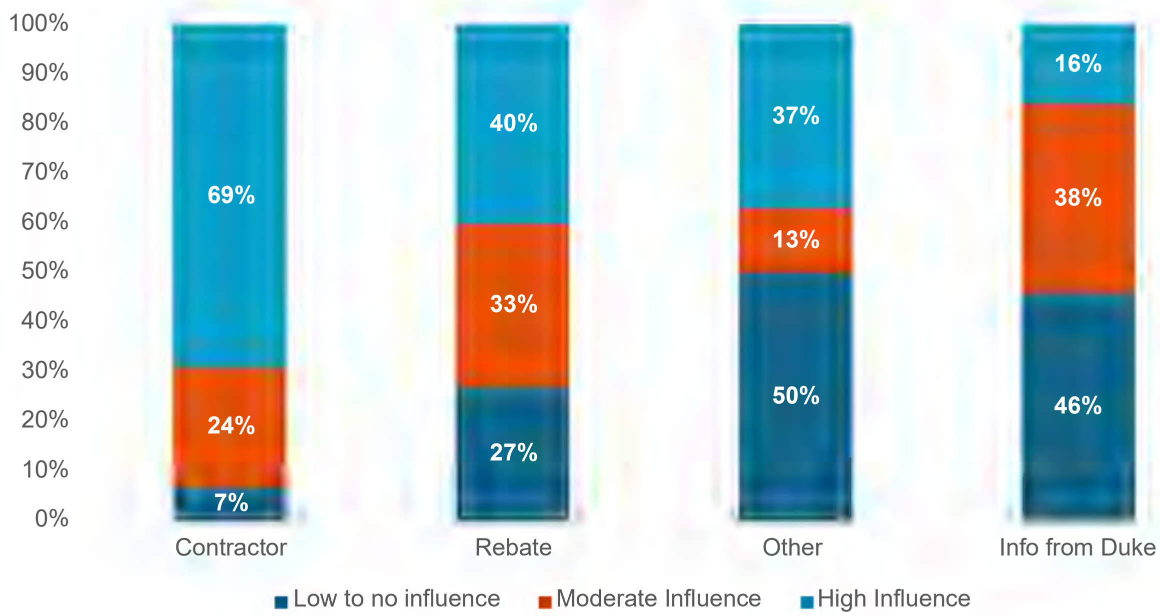
Figure 5-9: Thermostats Replaced by Type (n=66)



5.2.2.3. Program Influence

Overall, the majority of participants heard about Smart $aver rebates from their contractor. Across all measures installed, the recommendation from the contractor was the most influential in helping customers decide to participate in the Smart $aver program, and select which measures to install.

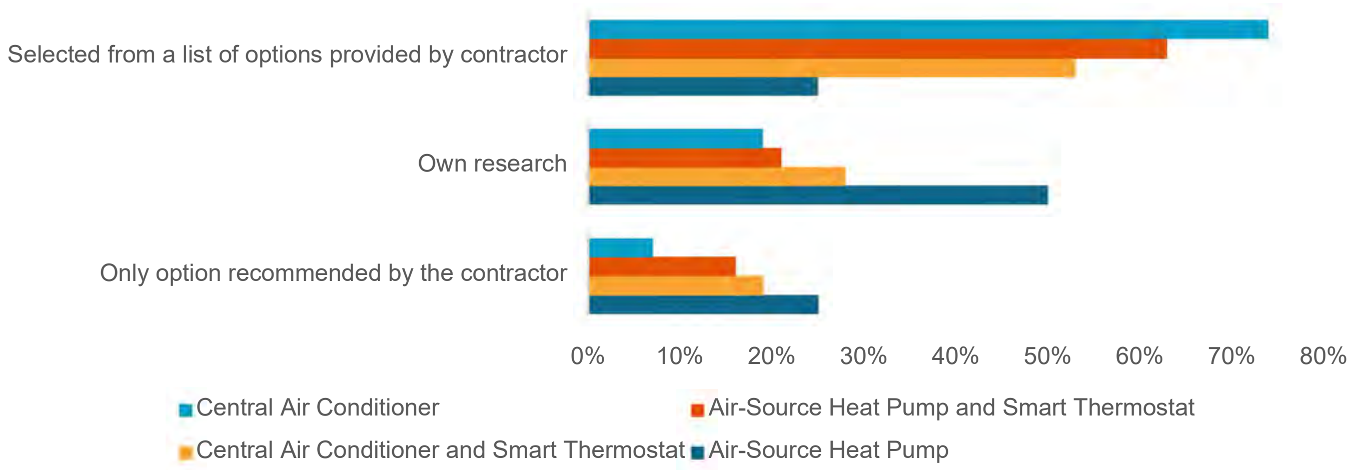
Figure 5-10: Influential Factors in Decision to Purchase Efficient Measures* (n=114)



* Participants were asked to rate each factor using a 0 to 10 scale where 0 meant “not at all influential,” and 10 meant “extremely influential.” Low influence represents responses ranging from 0 to 3, moderate influence represents responses ranging from 4 to 7, and high influence represents responses ranging from 8 to 10. This only includes influence of these factors on participants’ decision to purchase a primary measure, not add-on measures (smart thermostats or quality installation). For more information on influence on add-on measures, see section **Error! Reference source not found.**.

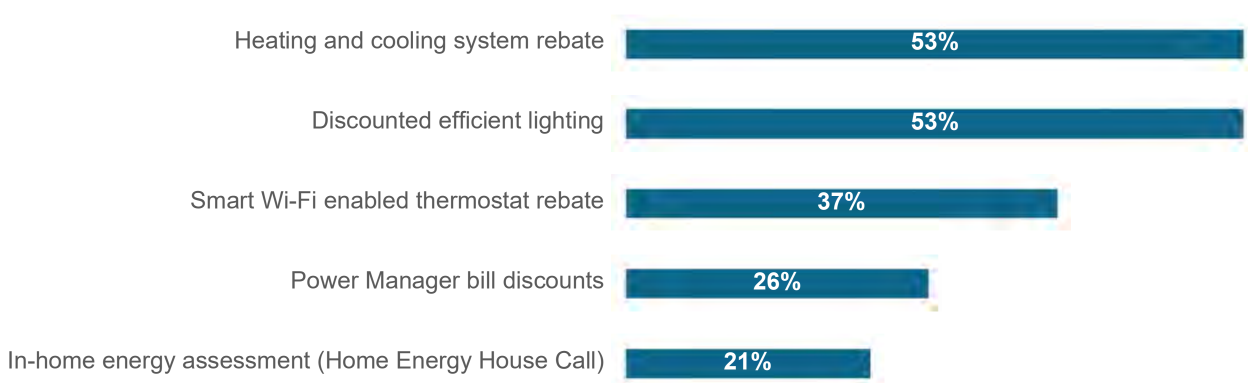
Participants were also asked how they decided which product to install through the Smart $aver program. For all measures, except for the air-source heat pump, participants reported selecting the product based on a list of recommendations from their contractor. In the case of the air-source heat pump measure, half of the participants selected the product to install based on their own research. More than three-quarters of the participants (78%) reported that if their contractor did not offer high efficiency products, they would have looked for a different contractor who was able to install a rebate-qualified high efficiency unit. Figure 5-11 breaks down how participants selected the equipment to install, broken down by measure installed.

Figure 5-11: How Participants Selected Equipment to Install (n=103)



Just over a third (41%) of participants reported being familiar with other DEI energy efficiency rebates. Participants were most aware of discounted efficient lighting (69%) and heating and cooling system rebates (64%). Of the 41% of participants who were familiar with other Duke Energy rebates, half (50%) reported receiving another rebate. The most commonly received rebates are shown in Figure 5-12.

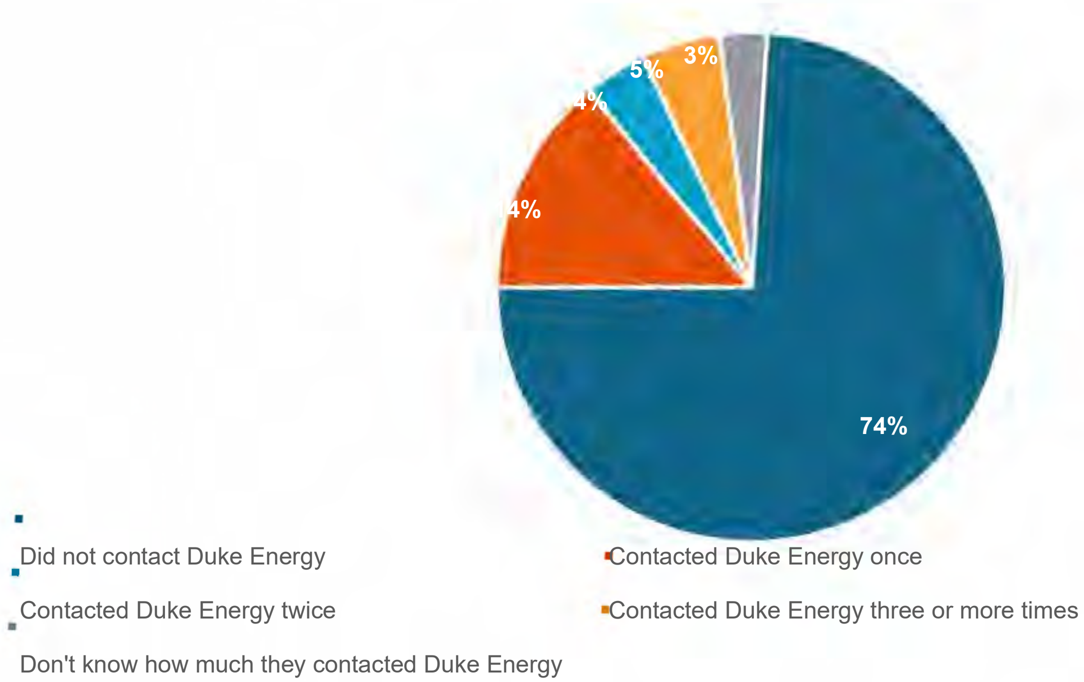
Figure 5-12: Participation in Other Duke Energy Programs (Multiple Responses Allowed) (n=44)



5.2.2.4. Participant Experience with the Program

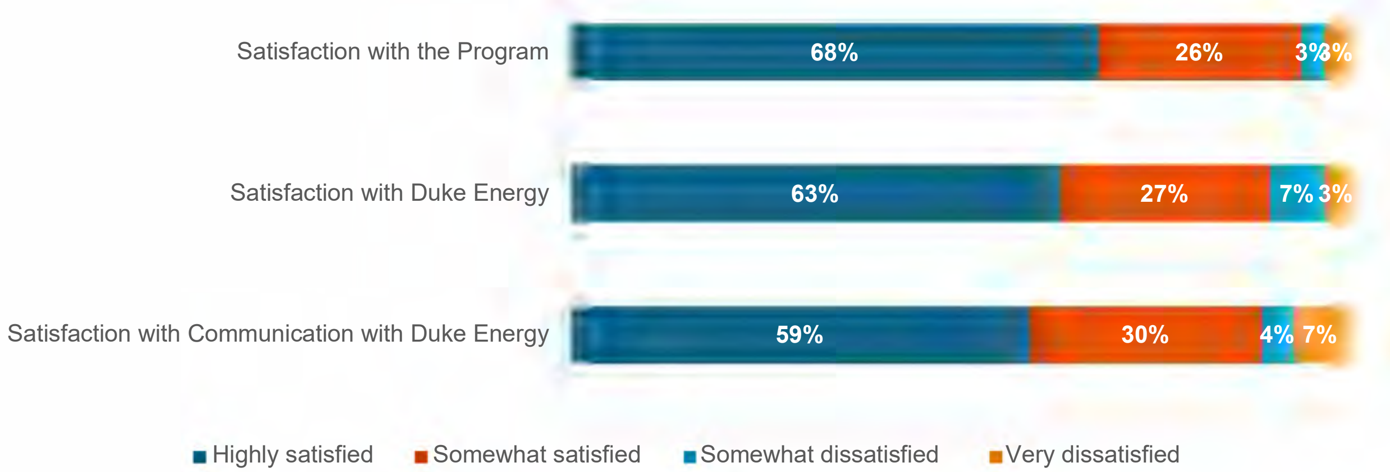
Almost three quarters (74%) of surveyed participants reported that they did not contact Duke Energy program staff with questions while participating in the program. Of the 26% of participants that contacted program staff, most (14%) contacted them just once. Of those who contacted program staff, most (81%) reported doing so over the phone.

Figure 5-13: Frequency of Communication with Duke Energy (n=114)



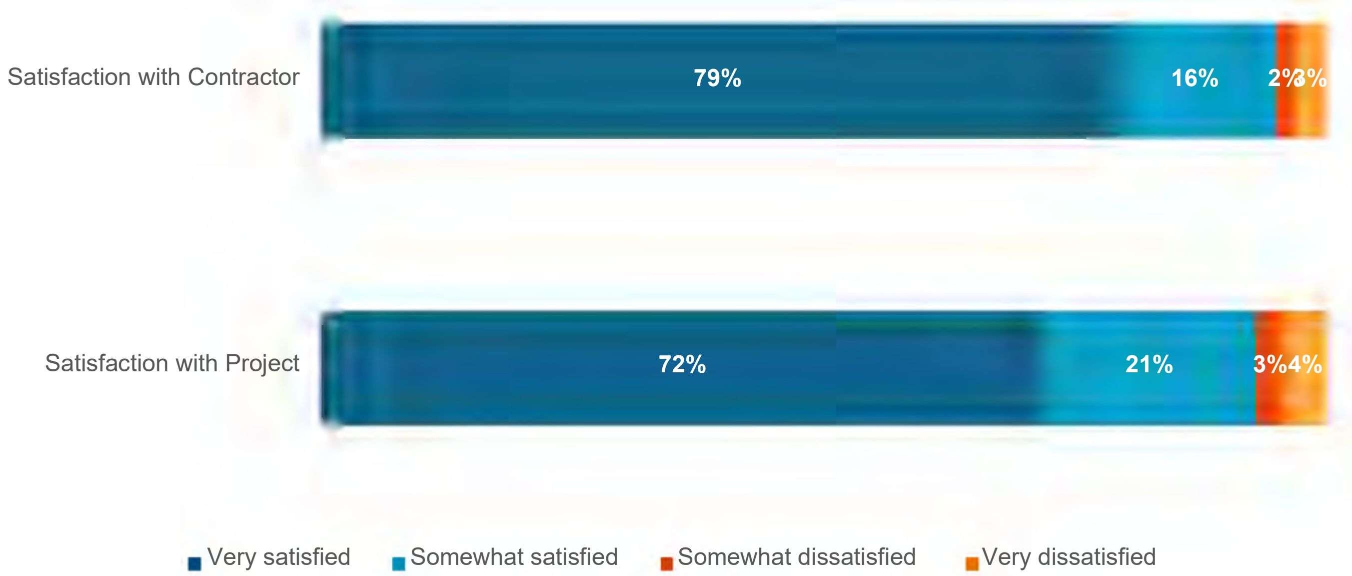
Most participants reported high satisfaction levels with the Smart $aver rebate program (Figure 5-14). The majority (94%) reported being satisfied with the Smart $aver program. Further, most participants reported being satisfied with Duke Energy in general (90%), and the communication that they had with Duke Energy (89%).

Figure 5-14: Participant Satisfaction with The Program (n=114)



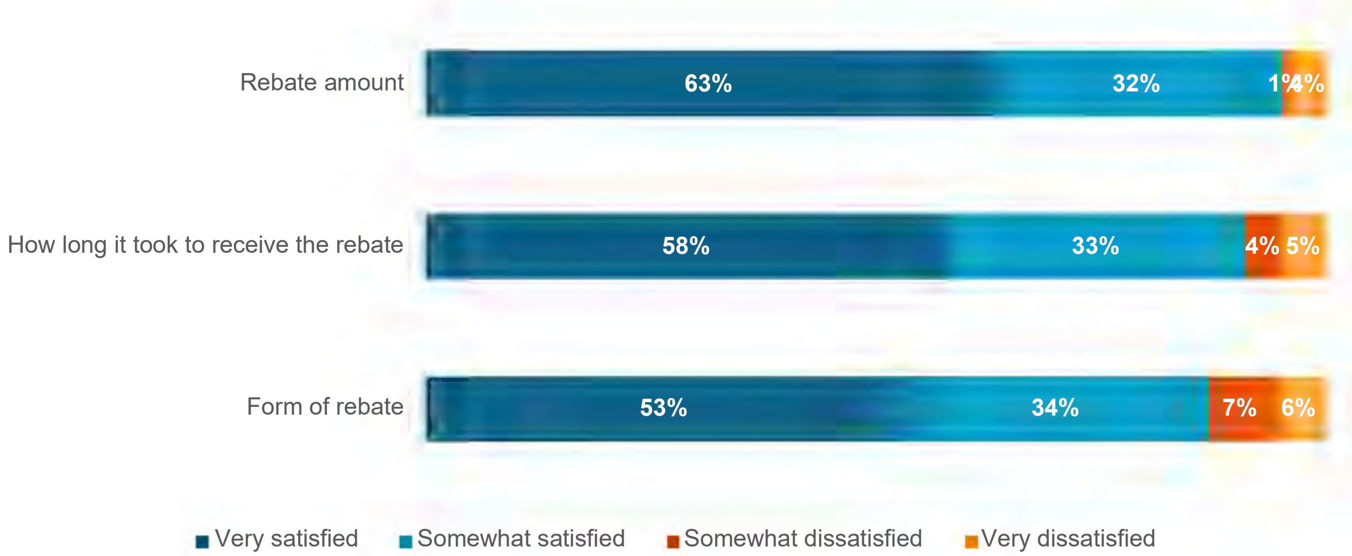
When it came to the project completed and the contractor (Figure 5-15), the majority of participants (95%) were satisfied with their contractor, and the project (93%).

Figure 5-15: Participant Satisfaction with Contractor and Project (n=114)



Participants were also generally satisfied with the rebate amount (95%), the time it took to get the rebate (91%), and the form of rebate (87%). The majority of participants received a physical prepaid gift card as their rebate (Figure 5-16).

Figure 5-16: Satisfaction with Rebates (n=114)



To further understand Smart $aver's effect on participants attitudes towards Duke Energy, the evaluation team asked whether their participation in the program had a positive, neutral, or negative effect on their overall satisfaction with Duke Energy. Overall, participation was beneficial, with nearly three-quarters of respondents (72%) reporting a positive effect.

Although savings were not a driving factor for participants' program satisfaction, more than half (59%) reported noticing savings on their electric bill since their last project was completed (Table 5-7).

Table 5-7: Resulting Energy Savings on Electric Bill

Experienced Savings on Electric Bill	n=114
Yes, they noticed savings	59%
No - they looked but did not notice any savings	19%
No - they looked but it is too soon to tell	9%
They did not look	6%
Don't know	8%
Total	100%

The evaluation team asked respondents if they had any suggestions to improve the program. Among the 20 participants who provided a response, about one-quarter (5 of 19) suggested improvements to the rebate amount and/or process of receiving a rebate. The remaining suggestions revolved around more information from Duke Energy about energy savings and rebates that are available, expand offerings, and the ability for the customer to apply for the rebate themselves.

Table 5-8: Suggestions for Improving Smart $aver Program (Multiple Responses Allowed)

Suggestions for Improving the Program	Count (n=19)
Updates to rebates	5
More information about other rebates available	5
Expand offerings	2
Customer apply for rebates themselves	2
Other	5

5.2.3. Participant Demographics

The evaluation team surveyed 114 Smart $aver participants who received rebates through the program. Nearly all surveyed participants reported owning their home (99%), with only 1% of respondents reporting that they rented their home. Nearly all (88%) reported living in a single-family detached home (Table 5-9**Error! Reference source not found.**). Additionally, the majority of respondents (97%) reported living at the residence where the work was performed.

The participant sample was highly educated with over half of the respondents either having a bachelor's degree (29%), a graduate degree (24%), or a doctorate (7%). The highest proportion of respondents in the sample reported earning over $100k a year (26%), yet 31% of respondents preferred to not report their income.

Table 5-9: Participant Housing Type

Housing Type	n=114
Single-family detached home	88%
Row house or town house or condo, with two or more units but no common area(s)	5%
Factory manufactured single-family home	3%
Other	3%
Multifamily apartment or condo building, with four or more units and a common area(s)	2%
Total	100%

The highest proportion of homes were built before 1960-1969 (26%), or between 2000 and 2009 (25%), with almost half of the homes (45%) measuring between 1,001-2,000 square feet. The majority of participants had a natural gas furnace as their heating system (88%), and a central air conditioner as their cooling system (67%). More than half of respondents reported that their fuel source is natural gas (61%).

6. Conclusions and Recommendations

Based on evaluation findings, the evaluation team concluded the following and provides several suggestions on how to improve the program:

Conclusion 1: The market has changed since the last program update several years ago.

Recommendation 1: Consider the following updates to the program design:

- Remove the SEER 15 CAC and ASHP tier offering
- Add an additional tier for SEER 18+ for both CAC and ASHP with a higher incentive
- Add a ductless mini-split heat pump offering
- Consider adding an EER requirement in addition to SEER (as this impacts summer kW)
- Separate GSHP from ASHP and assign specific savings to each
- Assign referred measures the same gross savings as non-referred measures
    - Free ridership for referred measures may then be set to 0% and incorporated into the overall evaluation

Conclusion 2: Smart thermostats produce high savings. The AMI analysis showed very robust savings for smart thermostats installed through the program. Many trade allies noted that smart thermostat incentives used to be higher.

> **Recommendation 2:** Consider returning smart thermostats to a higher incentive to help drive higher participation.

Conclusion 3: Trade allies appreciate the new portal. Most respondents (92%) reported that they did not have any issues with the enhanced Rebate Application Entry and Tracking Platform as compared to 50% of trade allies who reported that they occasionally experienced challenges or frustrations with the old platform.

> **Recommendation 3: Trade allies offered several suggestions for application improvements, including:**
>
> - Better explanations if the application is returned as invalid
> - Auto-populate referral information

Conclusion 4: Though most are satisfied with the incentives, some customers and trade allies voiced alternatives.

> **Recommendation 4a:** Decrease the processing time and increase the gift card expiration date longer (past 6 months). Consider a payment in check option as there are sometimes issues with gift cards expiring before people can use them.
>
> **Recommendation 4b:** Trade allies are the most commonly cited way customers hear about the program, and the incentive application process is completed by them (for most measures). Consider reinstating a direct incentive for trade allies.
>
> **Recommendation 4c:** For high volume trade allies that submit a lot of applications, and that prefer financially to do so, consider allowing for an instant incentive (still to be approved through the portal). Some trade allies noted that the time and cost they incur from being the "middle man" between the customer and the gift card processor is a large burden and they would prefer to give the incentive as an invoice credit. Then, on a regular cadence, trade allies could bundle incentive payments into one incentive to Duke to be paid back directly. This could save on gift card processing costs and would alleviate issues with long wait times for incentives.

Appendix A Appendix A Summary Form

Save Energy and Water Kit Program

Completed EMV Fact Sheet

Description of program

The Smart $aver program offers Duke Energy existing residential customers incentives for improving their homes' energy efficiency through the installation of energy efficient heating, ventilation, and air conditioning (HVAC), smart thermostats, pool pump, and water heating equipment replacements, duct sealing, duct insulation, and attic insulation with air sealing.

Date	2020-2021
Region(s)	Indiana
Evaluation Period	May 1st, 2020 – April 30th, 2021
Annual Gross MWh Savings	4,104
Annual Gross MW Savings	0.81 (summer), 0.27 (winter)
Net-to-Gross Ratio	100% Smart Thermostats 68.85% All Other Measures
Process Evaluation	Yes
Previous Evaluation(s)	2016-2017

Evaluation Methodology

Impact Evaluation Activities

Web surveys (n=114) and analysis of 4 unique measures

Impact Evaluation Findings

- Realization rates:
  - 137% (energy); 127% (summer demand); 49% (winter demand)

Process Evaluation Activities

- Participant web surveys (n=114)
- Trade ally web and phone surveys (n=45)
- 1 interview with program staff
- 1 interview with program implementer
- 4 interviews with high volume trade allies

Process Evaluation Findings

- Overall, participants and trade allies are satisfied with the Smart $aver program.
- Trade allies are an important source of program awareness for customers, with most participants hearing about rebates from their contractors.
- The desire to save energy or lower energy bills were the primary motivators for customers to install energy efficient equipment.
- Trade allies are satisfied with the enhanced trade ally portal.
- Trade allies believe that ductless mini splits should be added to the program.

Appendix B Measure Impact Results

Table B-1: DEI Per Unit Verified Impacts by Measure – Key Measure Parameters

Measure Category	Gross Energy Savings (kWh)	Gross Summer Demand (kW)	Gross Winter Demand (kW)	Realization Rate (Energy)	FR	PSO	NPSO	Net-to-Gross Ratio (Energy)
Central Air Conditioner Tier 2	174	0.112	0.000	51.5%	39.31%	1.58%	6.58%	68.85%
Central Air Conditioner Tier 3	298	0.058	0.000	59.7%	39.31%	1.58%	6.58%	68.85%
Air Source Heat Pump Tier 2	649	0.090	0.118	112.0%	39.31%	1.58%	6.58%	68.85%
Air Source Heat Pump Tier 3	1,368	0.064	0.265	109.5%	39.31%	1.58%	6.58%	68.85%
Geothermal Heat Pump	3,499	0.244	0.744	276.6%	39.31%	1.58%	6.58%	68.85%
Smart Thermostat	922	0.000	0.000	237.0%	0.00%	0%	0%	100.00%
Variable Speed Pool Pump	1,667	2.440	0.000	110.0%	39.31%	1.58%	6.58%	68.85%
Attic Insulation & Air Sealing	2,271	0.416	0.381	188.9%	39.31%	1.58%	6.58%	68.85%
Heat Pump Water Heater	1,874	0.256	0.000	116.1%	39.31%	1.58%	6.58%	68.85%
Duct Sealing	451	0.154	0.079	89.7%	39.31%	1.58%	6.58%	68.85%

Appendix C Participant Demographics

Figure C-1: Participant Demographics

Ownership Status	
Own	99%
Rent	1%

Living Arrangement	
Live at residence	97%
Do not live at residence	3%

Education	
High school or less	10%
Some college	20%
Bachelor's degree	29%
Graduate degree	24%
Doctorate	7%
Prefer not to say	11%

Income	
<$35k	7%
$35k to <$50k	4%
$50k to <$75k	17%
$75k to <$100k	14%
$100k+	26%
Prefer not to say	31%

Figure C-2: Participant Household Characteristics

Housing Type	
Before 1960-1969	26%
1970-1979	11%
1980-1989	18%
1990-1999	13%
2000-2009	25%
2010-2019	4%
2020-2021	2%
Don't Know	1%

Fuel Source	
Electric	35%
Natural Gas	61%
Other	5%

Home Square Feet	
Less than 1,000	4%
1,001-2,000	45%
2,001-3,000	32%
3,001-4,000	11%
4,001-5,000	5%
>5,000	3%
Don't Know	1%

Heating System	
Natural gas furnace	88%
Heat pump	6%
Other	6%

Cooling System	
Central air conditioner	67%
Heat pump	33%

Appendix D Survey Instruments and In-Depth Interview Guides

Program Staff In-Depth Interview Guide

Introduction

Today, we'll be discussing your role in the Indiana Smart $aver Program. We would like to learn about your experiences in administering this program during the time period between May 1st, 2020, and April 30th, 2021.

Your comments are confidential. If I ask about areas you are unsure about, please feel free to tell me and we will move on. Also, if you want to refer me to specific documents to answer any of my questions, that's great – I'm happy to look things up if I know where to find the information.

I would like to record this interview for my note-taking purposes. Do I have your permission?

Roles & Responsibilities

Q1. Can you briefly describe your role(s) in the Indiana Smart $aver program and provide your current job title? How long have you been in this role?

Program Changes and Targets

Q2. Have any aspects of the program changed during this time period? Why were these changes made?

Q3. How well do you think Indiana Smart $aver program is structured now to meet your energy savings goals in 2022?

If not mentioned, ask:

a. Are you considering any measures or incentive structures to add to the program? If so, what and why?
b. Are you considering offering any financing options to encourage more customers to participate in the program? If so, what are your thoughts as to how the program might implement this?
c. Are there any other program enhancements you are considering?
d. Do you feel the program has engaged enough trade allies to generate enough participation to reach your 2022 savings goals?

Application Processing

Now I'd like to hear about program processes.

Q4. We understand your implementer is responsible for rebate application processing, rebate incentive fulfillment, and customer care call center services. They also provide the IT platform for the Trade Ally Portal. Is this correct? Do they provide any other services?

Q5. Please describe the application processing process. Specifically, what happens after an application is received? *(Probes: Does implementer log receipt of submission, verifies there are no errors on the application, approves or rejects application, mail/email/deposit funds, provide report to Duke Energy, etc.? Are trade allies still submitting paper applications or are all applications submitted online now?)*

a. Comparing Indiana's to Ohio's or Carolinas' Smart $aver program, are there any differences in how applications are processed between these programs? If so, what are the differences?
b. *[If the application processing varies between Indiana and Ohio/Carolinas programs, ask:]* Is there anything that you have learned from the differences that has led to you wanting to make changes to the Indiana program? If so, what would you like to change?
   - Is Duke Energy trying to standardize the application tracking and processing across all Duke Energy Smart $aver/HVAC programs?

Q6. What are the most common errors or problems with rebate applications?

b. How often do these occur?
c. How are these application errors tracked/monitored internally with your implementer?
d. Are these issues reported to Duke Energy?
e. Does Duke Energy get involved at any point, or does the implementer handle these issues?
f. Is there a certain time or times of year when you see the most problems?
g. Are there some trade allies or types of trade allies that generally have more errors/problems than others?
h. In the last few years, what actions have been taken by Duke Energy and/or the Implementer to reduce issues with application submissions? *(Probes: Education, training, changes in forms, submission process changes, etc.)*
   - Have these actions been effective?

Q7. Which parts of the application processing do you think work particularly well? Why?

a. Which parts work less well? Why?

Q8. What is the satisfaction amongst recipients of the mode (digital payment, gift/credit card, etc) and timeline of rebate payments? How do you know?

QA/QC

Now, let's talk briefly about Quality Assurance / Quality Control.

Q9. Does Duke Energy require on-site inspections of at least some number of HVAC or other projects done through the Indiana program? If so, what proportion of projects are inspected? Has COVID impacted this?

Q10. We have heard that Duke Energy staff conducts these inspections. Is this correct?

Q11. What are typical types of QA/QC issues that come up?

a. How often do these come up?
b. Are the issues more common with certain trade allies or certain equipment?
c. How are the issues addressed?

Communication

Next, I'd like to hear briefly about how communication processes are working between Duke Energy, the implementer, and trade allies.

Q12. How often do you interact with implementer staff? What do you discuss during these meetings? (*Probe: What types of issues come up during the meetings?*)

Q13. How do you and/or your implementer communicate program changes to trade allies? What challenges, if any, have you had in communicating program changes to trade allies?

Q14. How often do you have to resolve an issue with a trade ally or a customer? What types of issues come up?

Tracking & Reporting

Q15. Can you tell me about the tracking and reporting data that you receive from the implementer or internally about the program?

a. In what form are these data provided? To whom is it provided? How often is it provided?

b. Is there information that you need about the program but are not getting?

c. What reports or other information provided by the implementer or internally that you find to be most useful? Least useful (if anything)? Why?

d. Do you or the implementer collect and track any information on baseline equipment such as efficiency or age of replaced equipment? If not, is this baseline information collected by the trade allies?

e. Thinking of the smart thermostat measure, what information do you collect and track on that measure?

- [*If not addressed*] Does the program require trade allies to program the temperature setting on the new thermostat? [*If yes*] At what setting do contractors program the thermostat? [*If not*] Do you track the default temperature setting of the installed thermostats? Are you able to collect this information via the wi-fi connection?

Trade Allies

From what we know, participation of the trade ally network is vital to the success of the program. I'd like to hear a bit more detail about how the program works with trade allies.

Q16. How are trade allies recruited to participate in your program? (*Note to interviewer: contractors must complete a Trade Ally registration form to be considered a Trade Ally. There are two separate forms: one for HVAC and one for Insulate and Seal measures.*)

a. Do you know what percent of potentially qualified trade allies are in the program? Has this percent increased, decreased, or stayed the same? [*If increased or decreased*] Why did it increase/decrease?

Q17. What is your sense of what motivates trade allies to pre-qualify and participate in the program? How do you know?

Q18. What services or support do you offer to your participating trade allies? Let's start with:

a. Marketing support? Do you offer co-op advertising materials? Anything else?
b. How about training support? (*Probe about sales, program, or other training*)
c. Anything else?

Q19. Do contractors use the Duke Energy Indiana website and/or Trade Ally portal to locate information about the program? How do you know?

Q20. Are there any other services you would like to provide to trade allies in the near future? If so, what?

Q21. Have you recently had to remove any trade allies from your list of participating contractors due to disengagement or inability to perform according to program requirements? If so, how many did you have to remove? (*Probe: Do you have a list?)*

Q22. What have you heard from trade allies regarding their interest in any new equipment/technology or any new incentives/offerings?

Marketing & Outreach

Now, I'd like to hear about the current status of marketing activities for the program.

Q23. How do you market the program?

Q24. Could you provide us with blocking charts, marketing expenditures, or reach and frequency of marketing for the Indiana Smart $aver HVAC program?

Q25. How does Duke Energy decide which marketing strategy to implement?

a. How do you typically measure the success of the marketing campaign(s)?

Q26. [*If they offer co-op marketing materials to trade allies*] How many trade allies use these co-op marketing materials? Do you have a goal for how many should use these materials?

Q27. Have you recently begun, or planning to, include expanded marketing efforts to non-English speaking customers? Or any other recent and/or planned Diversity, Equity, Inclusion (DEI) strategies?

Q28. Thinking about customers, are there any additional opportunities for expanding market penetration that the program is currently pursuing, or planning to pursue?

[Probe as needed] For example, are there other…

a. Population segments to target?

b Trade allies to target?

Q29. Do you survey and track residential customer and/or business customer satisfaction metrics? If so, when? How? What have you been seeing, generally, regarding customer satisfaction with the Smart $aver program?

Wrap-up

Q30. What would you say are the greatest strengths of the Smart $aver Program?

Q31. What challenges are you facing in delivering this program to the market - currently or in the near future?

Q32. What would you say most needs to be changed about the program?

Q33. What would you say is the single best thing you have done during this time period (May 1st, 2020 to April 30th, 2021) to foster program participation and customer satisfaction?

Q34. What would you say is the main thing you are planning in the short term to foster program participation and customer satisfaction?

Q35. What would you personally like to learn from this program evaluation?

Q36. Is there anything else about the program that we have not discussed that you feel should be mentioned?

Close:

Those are all of my questions. Thank you very much for your time.

Implementer Staff In-Depth Interview Guide

Introduction

My firm, Resource Innovations, on behalf of Duke Energy Indiana (DEI), is conducting an evaluation of the Smart $aver program. Since your organization is involved in rebate application processing, fulfillment, and customer call center services for this program, we would like to get your valuable perspective on how the program works.

Before we begin the interview, I would like to record this interview for my note-taking purposes. Do I have your permission? *[If needed: It is simply so that I can go back and clean up my notes after we are done talking, as to ensure I accurately captured everything you said.]*

Roles & Responsibilities

Q37. Let's start with a bit about you. What is your job title?

Q38. How long have you been at your current company?

Q39. What are your responsibilities with regards to the Smart $aver program?

- How long have you had those responsibilities?

Program Expectations and Market Response

First, I'd like to discuss a few questions about program participation and program performance. The timeframe I'll be asking you about in this survey is May 1st, 2020, through April 31st, 2021.

Q40. Thinking of Duke Energy program participation goals, how have participation levels been during this timeframe, relative to program expectations?

Q41. Have you noticed any differences in the participation rates by things like geography, home type, age, ethnicity/race, measures installed, or something else? [*If any, ask*] What accounts for these differences?

Q42. Are there any additional opportunities for expanding market penetration that the program is currently pursuing? If not, should the program consider expanding their market penetration?

[Probe as needed] For example, are there other…

- Incentive structures that should be considered?
- Measures that should be considered?
- Population segments to target?
- Trade ally targets?
- Any others?

Q43. What, if any, barriers do you see to expanding market penetration? [*If any, ask*] What do you think can be done to overcome those barriers?

Communication

Now, I'd like to hear about communication processes, starting with internal communication.

Q44. What regularly scheduled program communication do you have with other implementer staff regarding the Smart $aver Program?

[If not mentioned, ask]

- With whom do you communicate and/or meet with about the program?
- What is the frequency of these meetings?
- What is the purpose/objective of these meetings?
- Have there been any challenges?

Q45. What regularly scheduled program communication do you have with Duke Energy staff regarding the program?

[If not mentioned, ask]

- With whom do you communicate and/or meet with about the program?
- What is the frequency of these meetings?
- What is the purpose/objective of these meetings?
- Have there been any challenges?

Q46. Do you have any other regular but informal communications with any Duke Energy staff regarding the program?

Q47. Overall, how would you characterize your communications with Duke Energy? [*If any issues, ask*] What are they? Any suggested improvements/solutions?

Application Processing

Next, I'd like to hear about application and rebate processing.

Q48. Please describe the application processing from the point when the application is received through the final rebate processing steps. [*Probes: Implementer log receipt of submission, verifies there are no errors on the application, approves or rejects application, mail/email/deposit funds, provide report to Duke Energy, etc.)*

- How long does it typically take? *[Probe: KPI metric versus actual (in days)]*
- Does the timeline differ for different offerings/measures?
- Do you only process online applications? Or, do customers or trade allies (on behalf of customers) still submit paper applications? *[If any]* What percentage would you say are still paper? What are the timelines for online versus paper rebates?
- What is the process for ensuring applications and rebates are processed in a timely fashion?

Q49. Between May 1st, 2020, and April 30th, 2021, were any changes been made to the program application process? [*If yes*] What was the change? When was the change made? Why? What is the impact?

Q50. What are the most common errors/problems with applications?

- How often do these occur?
- How are these application errors tracked/monitored internally at your firm?
- How are these reported to Duke Energy?
- Is there a certain time (or times) of year when you see the most problems?
- In the last year, what actions have been taken by your firm or by Duke to reduce errors/problems with the application submissions? *(Probes: Education, training, changes in online or paper forms, submission process changes, etc.)*
    - Have these actions been effective?

Q51. [*If not addressed*] What type of information is typically incorrect or missing on the application? *[If any]* Is this by the customer or Trade Ally or both? Why do you think this is?

Q52. Which parts of the application processing do you think work particularly well and why?

- Which parts work less well? *[If any]* Why?

Trade Ally Network

The next section of questions will be regarding Trade Allies.

Q53. We understand you provide an IT platform for the Trade Ally Portal where trade allies can submit applications. What, if any, feedback have you received from trade allies about this portal?

Q54. What, if any, feedback have you received from trade allies about the program in general?

Q55. Do you know how changes in the program are communicated to trade allies? Via the trade ally portal? Scheduled trainings? Newsletters? Some other way?

- [*If implementer is involved in this process*] What success or challenges are you having with communicating program changes? [*If challenges mentioned*] What could be done to resolve the challenges?

Q56. What suggestions, if any, do you have for improving the program in regards to the trade ally portal or trade allies involvement in application processing?

Q57. What makes trade allies interested in participating in the program? What benefits do they derive from participating?

Q58. Have trade allies communicated to you additional or other perceived benefits that the program is not currently supporting? *[If any]* Can you describe? Are you considering these?

Call Center Services

Q59. Since your firm also provides customer call center services for the Duke Energy Indiana Smart $aver program, can you describe the types of issues customers typically call about?

- How do you address or resolve these issues?
- Are there any program improvements that could help reduce the number of calls you get regarding these issues?

Q60. Duke Energy is responsible for program marketing and awareness campaigns. Are there any improvements that could help increase the number of customer calls inquiring about participation in the program?

Q61. Do you have customer service metrics you track specifically regarding the performance of your call center? *[If so]* What are they? How are you doing regarding those metrics?

Q62. Do you have customer service metrics you track outside of the call center, meaning customer program satisfaction? [If so] Who collects this data, by what method is it collected (online survey, etc), and where is it tracked/stored?

Q63. What are customers generally saying they like the least and the best about the Smart $aver program? Does Duke Energy share this customer feedback on an established regular basis with you the implementer?

Q64. Have you received any feedback directly from customers about the program in general? If yes, please describe the feedback.

Tracking & Reporting

Now let's talk about the tracking and reporting data that you collect for Duke Energy.

Q65. Your firm likely has a database for tracking the progress and status of each application. Please tell me what type of information is in this database?

- [*If not addressed*] What type of demographic & house information do you collect and track in the database?
- [*If not addressed*] What type of information do you collect and track on the equipment that was replaced? [*Probe: age, efficiency, fuel, size/capacity*]

Q66. Are there any common data quality issues or errors that your team has encountered? *[If so]* How have you addressed this?

Q67. What data do you send to Duke Energy on a regular basis?

- In what form are these data provided?
- To whom is it provided?
- How often is it provided?

Q68. Is there information from this database that Duke Energy staff needs about the program but is not getting? If so, what?

Q69. Thinking about your tracking system, where do you feel data tracking could be improved or streamlined?

Conclusion

We are almost done. I have a few high-level questions about your overall impressions and feedback.

Q70. What would you say is/are the most effective way(s) that residential customers engage with the program? Could these or others be leveraged further?

Q71. What would you say are the greatest strengths of the Smart $aver Program?

Q72. What would you say are the program areas that are in most need of update or improvement?

Q73. Is there anything else about the program that we have not yet discussed that you feel should be mentioned?

Q74. Is it okay if I get in touch with you later in case of any clarifications or if I have any additional questions?

Close

Those are all of my questions. Thank you very much for your time.

Trade Ally In-Depth Interview Guide

Introduction

Hi____, my name is ____ and I'm calling from Resource Innovations on behalf of Duke Energy Indiana. We are evaluating the SMART $AVER program and we are looking to speak with contractors like yourself who have been particularly active in the program. Our program records indicate that your firm completed several projects this year for which a customer received an incentive from Duke Energy Indiana's SMART $AVER program, is that correct? And are you knowledgeable about those incentivized projects?

[If "no," ask to speak to someone who is knowledgeable about SMART $AVER work]

Your participation in this study is very important to Duke Energy Indiana – this is your chance to tell us what is working well, what isn't, and how Duke Energy Indiana can improve the program to better serve you and your customers. Do you have time to speak on the phone with me about your experiences in the program?

Great. Rest assured, your answers will be kept strictly confidential and will not be tied to you or your firm. Is it okay if I record our conversation for note keeping purposes? *[If needed: It is simply so that I can go back and clean up my notes after we are done talking, as to ensure I accurately captured everything you said.] [If asked: Our conversation is designed to take 30-60 minutes, depending on how much you have to say.]*

Background

Q1. My records show your company provides [PIPE IN SERVICES OFFERED: HVAC, plumbing, shell] services through SMART $AVER. Is that correct?

Q2. Have you completed any new construction projects that received incentives from the Smart Saver program?

Awareness and Engagement

Q3. How do you explain the value of energy efficiency upgrades to your customers? What are some successful strategies?

Q4. [ASK IF INSTALLED HVAC] Thinking about all customers – including those that do and don't go through the program, what are the primary reasons your customers replace their HVAC equipment?

[ASK IF INSTALLED HPWH] Thinking about all customers – including those that do and don't go through the program, what are the primary reasons your customers replace their water heaters?

[ASK IF INSTALLED POOL PUMPS] Thinking about all customers – including those that do and don't go through the program, what are the primary reasons your customers install ENERGY STAR efficient pool pumps that are equipped with variable speed drives? What proportion of efficient pool pump sales are replacing used pool pumps (as compared to pool pumps that go into newly constructed pools)?

[ASK IF INSTALLED ATTIC/DUCT INSULATION] Thinking about all customers – including those that do and don't go through the program, what are the primary reasons your customers insulate and seal their attics and ducts?

Q5. How did your company first learn about the SMART $AVER program?

Q6. About what proportion of your SMART $AVER customers knew about the program prior to you mentioning it? *[If needed: about what proportion of your SMART $AVER customers requested SMART $AVER rebates before you had a chance to mention them?]*

Q7. Duke Energy conducts various marketing efforts to promote the SMART $AVER program to your customers. Would you say the program has the right amount, too much, or too little marketing?

Q8. How do you think Duke Energy Indiana could improve their marketing and outreach efforts?

Q9. What does your company do to market the SMART $AVER program?

Q10. How can Duke Energy better support your SMART $AVER marketing efforts?

Q11. Have you attended any orientations or training events from Duke Energy Indiana? If yes: What events did you attend? Did the training provide you with information you found useful? Is there anything that you wish had been discussed in the training, but was not?

Q12. Would you like additional training opportunities to help your team more effectively sell rebated equipment? [*Probe: what type of training: sales/marketing training*]

Q13. Tell me about your experience with the online application system. How has it worsened or improved the application process? Do you have any suggestions regarding the online application system?

Q14. Do you ever use the program's online Trade Ally portal for contractors for reasons other than submitting rebate applications? If so, for what? Is it helpful? Could it use any improvements?

Q15. A company is on contract with Duke Energy to act as the program implementer, and as such, they take care of rebate application processing, fulfillment, and the call center. How do you feel they are doing? How does this implementer affect your experience in the program, if at all?

Q16. How satisfied are you with your Duke Energy Trade Ally Representative? *[If needed: Please explain why you said that.]*

Q17. Regarding your future engagement level with the Smart $aver program, going forward would you say you plan to participate less, about the same, or more than your current engagement level? *[If needed: Why would you say that?]*

Q18. For completed and rebated [MEASURE] projects, about what percentage of your customers were replacing working equipment early versus replacing a non-functioning item?

1. Early replacement of functioning equipment [*Record percent*]
2. Replacement of non-functioning equipment [*Record percent*]

Q19. During this time period, for completed and rebated [MEASURE] projects, about what was the average age of the units you replaced?

1. Average age:

Non-Participant Spillover

Q1. During May 2020-April 2021, approximately how many [MEASURE]s did your company install at ALL locations (in and outside of Duke Energy Indiana territory combined)?

1. [Integer response]

Q2. Of these [pipe in answer from Q1] installations, about what percentage were completed within Duke Indiana territory?

1. [Record % response]

Q3. During this time period, of all the [Q1 integer x Q2%] [MEASURE] projects that your company completed in Duke Indiana territory, about what percentage would have qualified for a Smart $aver rebate?

1. [Record % response]

Q4. Of all these [Q1 integer x Q2% x Q3%] Duke rebate-qualified [MEASURE] projects, about what percent did you actually apply for Smart $aver rebates?

[Record % response]

Q5. For the roughly [Q1 x (100% - Q2%)] [MEASURE]s installed outside of Duke territory, about what percentage would you say would have qualified for Duke incentives?

1. [Record % response]

Q6. [Ask only if Q5 >0%] Of these [MEASURES] installed outside of Duke's territory but would have qualified for a Duke incentive, what percentage did receive an incentive from another utility?

1. [Record % response]

Q7. Using a 0 to 10 scale, where 0 is "not at all influential" and 10 is "extremely influential," how much influence has the Duke Smart $aver program had on your business practice of recommending rebate-qualifying [MEASURE]s to your customers?

Trade Ally Program Experience

Q20. What are the challenges you have experienced in the program?

Probes:

- QA audit process (Common fails? QA process cumbersome?)
- Variety of measures offered (ask specifically about mini/multi-split DHP)
- Customer participation rates
- Rebate application process
- Delays
- Communications with Duke Energy and implementer
- Other

Q21. Do you have any suggestions on how to improve the program process?

Program Satisfaction

Q22. What do you like *best* about the program?

Q23. What do you like *least* about the program?

Market Changes

Q24. What new energy efficient technologies do you see taking off in the near future?

Q25. What products/technology are your customers asking for?

Q26. Are there any energy efficient technologies you think would sell better if Duke offered incentives for them? If so, what?

HVAC Offerings [ASK IF HVAC CONTRACTOR]

As you may know, Duke Energy offers additional rebates for HVAC for customers who also install smart thermostats that connect to the internet.

Q27. Has this rebate affected the number of smart thermostats you install each year? If so, by how much?

Q28. How, if at all, has the smart thermostat rebate influenced you to recommend smart thermostats to your customers?

Q29. Do you think the smart thermostat rebate has any influence on a consumer's decision to replace their HVAC system?

Program Influence

Q30. Thinking back to *before* you were involved in the SMART $AVER program, about how often did you recommend equipment that would have qualified for SMART $AVER rebates?

Q31. And what about now?

Q32. Using a 0 to 10 scale, where 0 is "not at all influential" and 10 is "extremely influential," how much influence has the SMART $AVER program had on your business practice of recommending the equipment that qualifies for SMART $AVER rebates to your customers?

Q33. Why do you say that?

Q34. Do you keep the equipment you install in stock, or do you mostly purchase equipment on an as-needed basis?

Q35. [IF THEY KEEP STOCK] Would you say the energy efficiency of your equipment stock has increased, decreased, or stayed about the same since you joined the program?

Q36. [IF INCREASED] Using a 0 to 10 scale, where 0 is "not at all influential" and 10 is "extremely influential," how much influence has the SMART $AVER program had on your increased stocking of energy efficient equipment?

Q37. Why do you say that?

Q38. Would you say your knowledge of energy efficient equipment has increased, decreased, or stayed about the same since you joined the program?

Q39. [IF INCREASED] Using a 0 to 10 scale, where 0 is "not at all influential" and 10 is "extremely influential," how much influence has Duke's SMART $AVER program had on your increased knowledge of energy efficient equipment?

Q40. Why do you say that?

Q41. We're interested to know how much Duke's rebates influence your customers to purchase energy efficient equipment and services that they otherwise wouldn't have purchased. About what proportion of your customers would purchase equipment and services that qualify for SMART $AVER rebates even if the rebates were not available?

Firmographics

Q42. Including yourself, how many employees work at your location?

Q43. How many locations does your organization have?

Q44. [IF MORE THAN ONE LOCATION] Including yourself, how many employees work at your organization across all locations?

Q45. And about how many residential HVAC installation jobs do you all do each year?

Closing

Q46. In closing, are there any other comments you would like to provide for feedback? Thanks so much for your time today.

Participant Survey

Instrument

Landing Page (Web)

Thank you for particpating in this survey effort. It begins with a few questions about your awareness of energy efficiency offerings available through Duke Energy, and then transitions to your experience with the Smart $aver program.

Interviewer Instructions / Introduction (Phone)

[*READ IF CONTACT NAME IS KNOWN:*]

Hello, may I speak with _____.

[*READ IF NAME IS UNKNOWN*] Hi, my name is __________.

I'm calling on behalf of Duke Energy. Our records show that you received a rebate for [LIST ALL MEASURES] from the Duke Energy Smart $aver Program during the timeframe of May 1st, 2020, to April 30th 2021

[*INTERVIEWER – IF PERSON ON PHONE IS UNAWARE OF THE REBATED WORK, ASK TO SPEAK WITH SOMEONE IN THE HOME WHO MIGHT RECALL RECEIVING A REBATE FROM DUKE ENERGY.*

IF PERSON ON PHONE SAYS THEY ARE RENTER (AND/OR THEIR LANDLORD OR PROPERTY MANAGER WAS RESPONSIBLE FOR THE PROJECT), ASK FOR LANDLORD/PROPERTY MANAGER'S NAME AND PHONE NUMBER AND USE THAT AS THE NEW POINT OF CONTACT].

Duke Energy would like your feedback about upgrades that were completed at the residence through the program as well as feedback on your experience with the program itself. Is now a good time to talk?

[*IF NEEDED*]*:* The survey will take about 10 to 15 minutes, depending on the details you have for us.

[*IF NEEDED*: *SCHEDULE A TIME TO CALL THEM TO COMPLETE THE SURVEY*]

Please note that this call may be monitored or recorded for quality assurance purposes.

Building information and screening

[ASK ALL]

Q47. Please indicate the building type that best describes the residence where the upgrades were performed.

[SINGLE RESPONSE]

1. Single-family detached home [*IF NEEDED*: *NOT A DUPLEX, TOWNHOME, OR APARTMENT; ATTACHED GARAGE IS OK*]
2. Factory manufactured single family home
3. Row house or town house or condo, with two or more units but no common area(s) (includes duplex, triplex, fourplex, etc)
4. Multifamily apartment or condo building, with four or more units and a common area(s)

-96. 96. Other, please specify: [OPEN-ENDED RESPONSE]
-97. 98. I don't know

Awareness

[ASK ALL]

Q48. How did you hear about the Duke Energy Smart $aver rebate(s) that you received? Please select all that apply. [LIST ALL MEASURES THEY RECEIVED FROM SMART $AVER PROGRAM [allow multiple]

1. Duke Energy program website
2. Direct (paper) mail or bill inserts
3. Email
4. Word of mouth: Friend, family, colleague, etc.
5. From my contractor
6. Online advertisement
7. Billboard
8. Radio
9. Advertisement on bus
10. Other; please specify: [OPEN-ENDED RESPONSE]

[ASK ALL]

Q49. Are you familiar with other energy-efficiency rebates that Duke Energy offers, aside from the rebate(s) you received?

[SINGLE RESPONSE]

1. Yes
2. No
-96. 98. I don't know
-97.

[ASK IF Q49= 1 (Yes)]
Q50. Which other rebates are you familiar with? Please select all that apply. [PROGRAMMER: EXCLUDE THE REBATES THAT THEY RECEIVED FROM THE LIST BELOW]

[MULTIPLE RESPONSE]

1. Heat pump water heater rebate
2. Heating and cooling system rebate
3. Geothermal heat pump rebate
4. Smart Wi-Fi enabled thermostat rebate
5. Attic insulation and air seal rebate
6. Duct sealing/insulation rebate
7. In-home energy assessment (Home Energy House Call)
8. Pool pump rebate
9. Outdoor lighting rebate
10. Rebates for Income Eligible customers
11. Rebates available on Duke Energy's Online Store
12. Rebates available through Duke Energy at local retailers for LED bulbs
13. Power Manager bill discounts (for allowing Duke Energy to ramp down air-conditioning or heating during peak usage events, via AC device or smart thermostat)
14. Discounted efficient lighting (CFLs, LEDs, and specialty bulbs)
15. Other – please specify: [OPEN-ENDED RESPONSE]

98. Don't know

[ASK IF Q49= 1 (Yes)]
Q51. Have you received any of these other rebates?

[SINGLE RESPONSE]

1. Yes
2. No
-96. 98. I don't know
-97.

[ASK IF Q51= 1 (Yes) AND MORE THAN ONE ITEM SELECTED IN Q50; IF ONLY ONE ITEM SELECTED IN Q50 AND Q51=1, AUTOCODE Q50 RESPONSE FOR Q52]
Q52. Which rebate(s) did you receive? Please select all that apply. *[Do not read list]*

[MULTIPLE RESPONSE]

1. Heat pump water heater rebate
2. Heating and cooling system rebate

3. Geothermal heat pump rebate
4. Smart Wi-Fi enabled thermostat rebate
5. Attic insulation and air seal rebate
6. Duct sealing/insulation rebate
7. In-home energy assessment (Home Energy House Call)
8. Pool pump rebate
9. Outdoor lighting rebate
10. Rebates for Income Eligible customers
11. Rebates available on Duke Energy's Online Store
12. Rebates available through Duke Energy at local retailers for LED bulbs
13. Power Manager bill discounts (for allowing Duke Energy to ramp down air-conditioning or heating during peak usage events, via AC device or smart thermostat)
14. Discounted efficient lighting (CFLs, LEDs, and specialty bulbs)
15. Other – please specify: [OPEN-ENDED RESPONSE]
98. I don't know

Program Influence

[ASK IF Q51= 1 (Yes)]

Q53. Did you receive the [**Insert rebated measures from Q52**] before or after [**PROJECT#1 LIST**] work was done? [REPEAT THIS QUESTION FOR EACH REBATE OPTION SELECTED IN Q52]

[SINGLE RESPONSE]

1. Before
2. After
3. Both before and after
4. At the same time

-96. 98. Don't know
-97.

[ASK IF Q53= 2 or 3 ("After" or "Both before and after")]

Q54. Using a scale from 0 to 10, where 0 means "Not at all influential" and 10 means "Extremely influential," how influential was the rebate for [**PROJECT#1 LIST**] in your decision to take advantage of Duke Energy's rebate for [**Insert response from Q52**]? [REPEAT THIS QUESTION FOR EACH REBATE OPTION SELECTED IN Q52 WHERE RESPONSE TO Q53=2 ("After") OR Q53=3 ("Both before and after")]

[SINGLE RESPONSE]

0.	0. Not all influential
1.	1.
2.	2
3.	3

4.	4
5.	5.
6.	6.
7.	7.
8.	8.
9.	9.
10.	10. Extremely influential
98.	I don't Know

-96.

[ASK IF RESPONDENT HAS A **PROJECT#2 LIST**]

Q55. Using a scale from 0 to 10, where 0 means "Not at all influential" and 10 means "Extremely influential," how influential was the rebate for [**PROJECT#1 LIST**] in your decision to take advantage of additional Duke Energy rebates for [**PROJECT#2 LIST**]?

[SINGLE RESPONSE]

0.	0. Not all influential
1.	1.
2.	2
3.	3
4.	4
5.	5.
6.	6.
7.	7.
8.	8.
9.	9.
10.	10. Extremely influential
98.	I don't Know

Motivations

Next, we'd like to know more about your motivations to participate in the Duke Energy Smart $aver Program.

[ASK IF AIR SOURCE HEAT PUMP, GEOTHERMAL HEAT PUMP, OR CENTRAL AIR CONDITIONER WAS INSTALLED]

Q56. [IF AIR SOURCE HEAT PUMP OR GEOTHERMAL HEAT PUMP WAS INSTALLED] Which of the following best describes the condition of the previous HVAC system that you replaced with a [PIPE IN WHICHEVER WAS INSTALLED: AIR SOURCE HEAT PUMP OR GEOTHERMAL HEAT PUMP]?

[IF CENTRAL AIR CONDITIONER WAS INSTALLED] Which of the following best describes the condition of the previous air conditioner that you replaced?

[MULTIPLE RESPONSE]

1. It was broken or malfunctioning
2. It was getting old
3. It was in good working condition

96. Other, please specify: [OPEN-ENDED RESPONSE]
98. I don't know

Q57. [ASK IF AIR SOURCE HEAT PUMP, GEOTHERMAL HEAT PUMP, OR CENTRAL AIR CONDITIONER WAS INSTALLED] Approximately, how many years old was the previous HVAC unit that you replaced with your new [PIPE IN WHICHEVER WAS INSTALLED: AIR SOURCE HEAT PUMP, CENTRAL AIR CONDITIONER, OR GEOTHERMAL HEAT PUMP]

[Allow integer response]

Q58. [ASK IF CENTRAL AIR CONDITIONER, AIR SOURCE HEAT PUMP, OR GEOTHERMAL HEAT PUMP WAS INSTALLED] What motivated you to install an energy efficient heating/cooling system rather than a less efficient one that would use more energy? Please select all that apply. [RANDOMIZE SELECTION CHOICES]

1. *The availability of the program incentive*
2. *The ease of participating in the program*
3. *Knowing that any equipment or service Duke Energy would incentize must be realiable*
4. *To save energy or lower your energy bills*
5. *To be associated with "green" or "sustainable" actions*
6. *To increase my comfort*
7. *To increase safety and reliability of my heating/cooling system*
8. *To get a new heating/cooling system*

96. *Other,please specify* [OPEN-ENDED RESPONSE*]*
98. *I don't know (MAKE ANSWER EXCLUSIVE)*

Q59. [ASK IF CENTRAL AIR CONDITIONER, AIR SOURCE HEAT PUMP, OR GEOTHERMAL HEAT PUMP WAS INSTALLED] I'd like to know how you selected the specific make and model of the [**PIPE IN WHICHEVER WAS INSTALLED: AIR SOURCE HEAT PUMP, CENTRAL AIR CONDITIONER, OR GEOTHERMAL HEAT PUMP**] you purchased. Would you say that you chose it…

1. Yourself, based entirely on your own research?
2. From a list of options provided by the contractor?
3. Because it was the only option recommended by your contractor?

-0. 96. In some other way, please specify: [RECORD OPEN-ENDED RESPONSE]
-1. 98. I don't know

Q60. [ASK IF CENTRAL AIR CONDITIONER, AIR SOURCE HEAT PUMP, OR GEOTHERMAL HEAT PUMP WAS INSTALLED] Suppose the contractor that installed your [**PIPE IN WHICHEVER WAS INSTALLED: AIR SOURCE HEAT PUMP, CENTRAL AIR CONDITIONER, OR GEOTHERMAL HEAT PUMP**] did not offer high efficiency [**PIPE IN WHICHEVER WAS INSTALLED: AIR SOURCE HEAT PUMP, CENTRAL AIR CONDITIONER, OR GEOTHERMAL HEAT PUMP**]s that qualify for Duke rebates. Which of the following is most likely what you would have done[SINGLE RESPONSE]

1. You would have installed the cheaper less efficient unit that would not have qualified for rebates if that's all your contractor offered, or
2. You would have looked for a contractor that could install a rebate-qualified high efficiency unit

-96. 96. Other, please specify: [OPEN-ENDED RESPONSE]
-97. 98. I don't know
-98.
-99. [ASK IF SMART THERMOSTAT WAS INSTALLED]

Q61. Which of the following best describes the old thermostat that you replaced?

1. Manual non-programmable thermostat,
2. Programmable thermostat that does not communicate with your wi-fi network, or
3. Programmable thermostat that communicates with your wi-fi network
96. Other, please specify: [OPEN-ENDED RESPONSE]
98. I don't know

[ASK IF SMART THERMOSTAT WAS INSTALLED]

Q62. What motivated you to install a Wi-Fi enabled thermostat? *Please select all that apply.*

1. *The availability of the program incentive*
2. *The ease of participating in the program*
3. *Knowing that any equipment or service Duke Energy would incentize must be realiable*

4. *To save energy or lower your energy bills*
5. *To be associated with "green" or "sustainable" actions*
6. *To increase my comfort*
7. *To increase reliability of my thermostat*
8. *To get a new and updated thermostat*
96. *Other,please specify [*OPEN-ENDED RESPONSE*]*
98. *I don't know (MAKE ANSWER EXCLUSIVE)*

[ASK IF HEAT PUMP WATER HEATER WAS INSTALLED]

Q63. Which of the following best describes the condition of the previous water heater that you replaced?

1. It was broken or malfunctioning
2. It was getting old
3. It was in good working condition
96. Other, please specify: [[OPEN-ENDED RESPONSE]
98. I don't know

Q64. [ASK IF HEAT PUMP WATER HEATER WAS INSTALLED] Approximately, how many years old was the previous water heater that you replaced with your new heat pump water heater? *[RECORD VERBATIM]*

[ASK IF HEAT PUMP WATER HEATER WAS INSTALLED]

Q65. Where did you install your new heat pump water heater?

1. Garage
2. Basement
3. Closet
4. Laundry room
96. Other, please specify: [OPEN-ENDED RESPONSE]
98. I don't know

[ASK IF HEAT PUMP WATER HEATER WAS INSTALLED and IF Q65<>98 or 99]

Q66. Do you use your HVAC system to heat and cool the [PIPE IN ANSWER FROM Q65] where the heat pump water heater is located?

1. Yes
2. No
96. Other, please specify: [[OPEN-ENDED RESPONSE]
98. I don't know

[ASK IF HEAT PUMP WATER HEATER WAS INSTALLED]

Q67. What motivated you to install an **energy efficient** water heater rather than a less efficient one that would use more energy? *[RECORD VERBATIM] Please select all that apply.*

1. *The availability of the program incentive*
2. *The ease of participating in the program*
3. *Knowing that any equipment or service Duke Energy would incentize must be realiable*
4. *To save energy or lower your energy bills*
5. *To be associated with "green" or "sustainable" actions*
6. *To increase my comfort*
7. *To increase the safety and reliability of my water heater*
8. *To get a new and updated water heater*

96. *Other,please specify [*OPEN-ENDED RESPONSE*]*
98. *I don't know (MAKE ANSWER EXCLUSIVE)*

[ASK IF DUCT SEALING OR INSULATION WAS PERFORMED/INSTALLED]

Q68. A) [IF DUCT SEALING WAS PERFORMED] What motivated you to repair your ductwork?

B) [IF ATTIC INSULATION WAS INSTALLED] What motivated you to add insulation to your attic? *[RECORD VERBATIM] Please select all that apply.*

1. *The availability of the program incentive*
2. *The ease of participating in the program*
3. *Knowing that any equipment or service Duke Energy would incentize must be realiable*
4. *To save energy or lower your energy bills*
5. *To be associated with "green" or "sustainable" actions*
6. *To increase my comfort*
7. *To increase the safety and reliability of my ducts*
8. *To get a new and updated ducts*

96. *Other,please specify [*OPEN-ENDED RESPONSE*]*
98. *I don't know (MAKE ANSWER EXCLUSIVE)*

[ASK IF POOL PUMP WAS INSTALLED]

Q69. What motivated you to install an ENERGY STAR pool pump? *Please select all that apply.*

1. *The availability of the program incentive*
2. *The ease of participating in the program*
3. *Knowing that any equipment or service Duke Energy would incentize must be realiable*
4. *To save energy or lower your energy bills*
5. *To be associated with "green" or "sustainable" actions*
6. *To increase my comfort*
7. *To increase the safety and reliability of my pool pump*
8. *To get a new and updated pool pump*

96. *Other,please specify [*OPEN-ENDED RESPONSE*]*

98. *I don't know (MAKE ANSWER EXCLUSIVE)*

[ASK IF POOL PUMP WAS INSTALLED]

Q70. Approximately what date do you first **open** your pool for the season? [Prompt if needed: "For example June 1st"]

1. [SELECT MONTH AND DAY FROM DROP DOWN]

98. I don't know

[ASK IF POOL PUMP WAS INSTALLED]

Q71. Approximately what date do you **close** your pool for the season? [Prompt if needed: "For example October 30th]

1. [SELECT MONTH AND DAY FROM DROP DOWN]

98. I don't know

Q26. How many hours is the pool pump programmed to run per day? Please respond with a whole number rounded to the nearest number of hours. [Integer response]

1. Hours: [open-ended numerical response greater than or equal 0 and less than or equal to 24]

98. I don't know

Free-ridership

The next few questions ask what you most likely would have done had you NOT received assistance from Duke Energy for the [LIST ALL MEASURES].

[ASK IF THEY INSTALLED: CENTRAL AIR CONDITIONER, AIR SOURCE HEAT PUMP OR GEOTHERMAL HEAT PUMP]

Q73. Regarding heating and cooling, which of the following statements best describes the actions you would have taken if *Duke Energy rebates and information were not available*:

[SINGLE RESPONSE]

1. Would not have installed the [PIPE IN WHICHEVER WAS INSTALLED: CENTRAL AIR CONDITIONER, AIR SOURCE HEAT PUMP OR GEOTHERMAL HEAT PUMP] at all
2. Would have bought a less expensive or less energy efficient heating and cooling system
3. Would have bought the exact same high efficiency [PIPE IN WHICHEVER WAS INSTALLED: CENTRAL AIR CONDITIONER, AIR SOURCE HEAT PUMP OR GEOTHERMAL HEAT PUMP], and paid the full cost

-96. 98. I don't know

[ASK IF Q73=2 or 3]

Q74. You indicated you would have still purchased a/an [PIPE IN WHICHEVER WAS INSTALLED: CENTRAL AIR CONDITIONER, AIR SOURCE HEAT PUMP OR GEOTHERMAL HEAT PUMP]. Without the incentive, when would you have likely done so?

1. At the same time
2. Within 6 months
3. Within a year
4. Later than a year

-96. 98. I don't know
-97.

[ASK IF THEY INSTALLED: SMART THERMOSTAT]

Q75. Now we want to ask you about the smart thermostat you got with your [PIPE IN WHICHEVER WAS INSTALLED: CENTRAL AIR CONDITIONER, AIR SOURCE HEAT PUMP OR GEOTHERMAL HEAT PUMP]. Which of the following statements best describes the actions you would have taken if *Duke Energy rebates and information were not available*:

[SINGLE RESPONSE]

1. Would not have purchased a new thermostat at all
2. Would have installed a manual non-programmable thermostat
3. A programmable thermostat that is not wi-fi enabled
4. Would have bought the exact same wi-fi thermostat, and paid the full cost

-96. 98. I don't know

[ASK IF Q75 = 2,3,4]

Q76. You indicated you would have still purchased a thermostat. Without the incentive, when would you have likely done so?

1. At the same time
2. Within 6 months
3. Within a year
4. Later than a year

-96. 98. I don't know

[ASK IF THEY INSTALLED: HEAT PUMP WATER HEATER]

Q77. Regarding water heating, which of the following statements best describes the actions you would have taken if *Duke Energy rebates and information were not available*:

[SINGLE RESPONSE]

1. Would not have replaced my water heater
2. Would have bought a less expensive or less energy efficient water heater
3. Would have bought the exact same high efficiency Heat Pump Water Heater, and paid the full cost

-96. 98. I don't know

[ASK IF Q77= 2,3]

Q78. You indicated you would have still purchased a new water heater. Without the incentive, when would you have likely done so?

1. At the same time
2. Within 6 months
3. Within a year
4. Later than a year

-96. 98. I don't know

[ASK IF THEY UPGRADED: ATTIC INSULATION]

Q79. Regarding attic insulation, which of the following statements best describes the actions you would have taken if *Duke Energy rebates and information were not available*:

[SINGLE RESPONSE]

1. Would not have done the attic insulation
2. Would have added less insulation
3. Would have done the exact same upgrade, and paid the full cost

-96. 98. Don't know

[ASK IF Q79= 2]

Q80. You said you would have added less insulation if you had not received the rebate or information from Duke Energy. How much less insulation would you have purchased? Please answer in a percentage, such as "50% less."

1. [RECORD VERBATIM:] _______________
98. I don't know
-96.

[ASK IF Q79= 2 or 3]

Q81. You indicated you would have still added insulation. Without the incentive, when would you have likely done so?

1. At the same time
2. Within 6 months
3. Within a year
4. Later than a year
-96. 98. I don't know
-97.

[ASK IF THEY DID DUCT SEALING]

Q82. Regarding duct sealing, which of the following statements best describes the actions you would have taken if *Duke Energy rebates and information were not available*:

[SINGLE RESPONSE]

1. Would not have had ducts sealed or repaired
2. Would have had the exact same work done, and paid the full cost
-96. 98. I don't know
-97.

[ASK IF Q82= 2]

Q83. You indicated you would have still had your ducts sealed or repaired. Without the incentive, when would you have likely done so?

1. At the same time
2. Within 6 months
3. Within a year
4. Later than a year
-96. 98. I don't know
-97.

[ASK IF THEY INSTALLED A VARIABLE SPEED POOL PUMP]

Q84. Regarding your pool pump, which of the following statements best describes the actions you would have taken if *Duke Energy rebates and information were not available*:

[SINGLE RESPONSE]

1. Would not have installed or replaced the variable speed pool pump

2. Would have bought a less expensive or less energy efficient pool pump, or
3. Would have had the exact same high efficiency pool pump installed, and paid the full cost
-96. 98. I don't know
-97.

[ASK IFQ84 = 2 or 3]
Q85. You indicated you would have still purchased a pool pump. Without the incentive, when would you have likely done so?

1. At the same time
2. Within 6 months
3. Within a year
4. Later than a year
-96. 98. Don't know
-97.

[ASK ALL]
Q86. Using a scale from 0 to 10, where 0 means "not at all influential" and 10 means "extremely influential" how influential were the following factors on your decision to purchase the [**MEASURE**]? *How influential was…*

[*INTERVIEWER NOTE: IF RESPONDENT SAYS 'NOT APPLICABLE; I DIDN'T GET/USE THAT,' THEN FOLLOW UP WITH: "So would you say it was "not at all influential?" AND PROBE TO CODE*] [MATRIX QUESTION: SCALE]

Elements	0 – Not at all influential	1	2	3	4	5	6	7	8	9	10 – Extremely influential	98 DK	99 RF
The rebate you received													
Information or advertisements from Duke Energy, including their website													
Recommendation from your contractor													
Did anything else influence you? If so, please specify: ______________ [*INTERVIEWER: PROBE IF UNCLEAR. RECORD VERBATIM RESPONSE*]													

[PROGRAMMER: REPEAT Q86 FOR EACH MEASURE IN MEASURE LIST. WHEN REPEATING, CALLERS CAN USE ABBREVIATED LANGUAGE (E.G.: "AND FOR THE INSULATION, HOW INFLUENTIAL WAS…"]

Spillover

Q87. Since receiving your rebate from Duke Energy for the [LIST ALL SMART $AVER MEASURES], have you purchased any other products or services to help save energy in your home?

1. Yes
2. No

-96. 98. I don't know

[If Q87= 1]
Q88. What **products** have you purchased and installed to help save energy in your home?

[Do not read list. After each response, ask, "Anything else?"] [MULTIPLE RESPONSE]

1. Installed energy efficient appliances
2. Moved into an ENERGY STAR home *[VERIFY:"Is Duke Energy still your gas or electricity utility?" Yes/No/I don't know]*
3. Installed efficient heating or cooling equipment, including a Smart Thermostat
4. Installed efficient windows
5. Added insulation
6. Sealed air leaks in windows, walls, or doors
7. Sealed or insulated ducts
8. Installed LEDs
9. Installed an energy efficient water heater
10. None – no other actions taken [*EXCLUSIVE ANSWER*]

-96. 96. Other, please specify: ___________________
-97. 98. I don't know [*EXCLUSIVE ANSWER*]

[ASK IF Q88 1 THROUGH 9, 96]
Q89. Did you get a rebate from Duke Energy or another organization for any of those products or services? If so, which ones?

YES OR NO ANSWER

[LOGIC] Item
[IF Q88.1 IS SELECTED] 1. Installed energy efficient appliances
[IF Q88.2 IS SELECTED] 2. Moved into an ENERGY STAR home
[IF Q88.3 IS SELECTED] 3. Installed efficient heating or cooling equipment, including a Smart Thermostat
[IF Q88.4 IS SELECTED] 4. Installed efficient windows
[IF Q88.5 IS SELECTED] 5. Installed additional insulation
[IF Q88.6 IS SELECTED] 6. Sealed air leaks in windows, walls, or doors
[IF Q88.7 IS SELECTED] 7. Sealed or insulated ducts

[IF Q88.8 IS SELECTED] 8. Installed LEDs
IF Q88.10 IS SELECTED] 10. Installed an energy efficient water heater
[IF Q88.96 IS SELECTED] **[Q88 open ended response]**
I DID NOT GET ANY DUKE REBATES *[EXCLUSIVE ANSWER]*
98. DON'T KNOW *[EXCLUSIVE ANSWER]*

[ASK IF ANY ITEM IN Q88 WAS SELECTED]

Q90. On a scale of 0 to 10, where 0 means "not at all influential" and 10 means "extremely influential", how much influence did the **[LIST ALL SMART $AVER MEASURES]** Smart $aver program have on your decision to...

[MATRIX QUESTION: SCALE]

[LOGIC] Item	Response
[IF Q88.1 IS SELECTED] 1. Buy energy efficient appliances	0-10 scale with DK
[IF Q88.2 IS SELECTED] 2. Move into an ENERGY STAR home	0-10 scale with DK
[IF Q88.3 IS SELECTED] 3. Buy efficient heating or cooling equipment	0-10 scale with DK
[IF Q88.4 IS SELECTED] 4. Buy efficient windows	0-10 scale with DK
[IF Q88.5 IS SELECTED] 5. Buy additional insulation	0-10 scale with DK
[IF Q88.6 IS SELECTED] 6. Seal air leaks in windows, walls, or doors	0-10 scale with DK
[IF Q88.7 IS SELECTED] 7. Seal or insulate ducts	0-10 scale with DK
[IF Q88.8 IS SELECTED] 8. Buy LEDs	0-10 scale with DK
IF Q88.10 IS SELECTED] 10. Install an energy efficient water heater	0-10 scale with DK
[IF Q88.96 IS SELECTED] **[Q88 open ended response]**	0-10 scale with DK

[ASK IF Q88.1 IS SELECTED AND Q90.1 =NO]

Q91. What kinds of appliance(s) did you buy?

[Do not read list] [MULTIPLE RESPONSE]

1. Refrigerator
2. Stand-alone Freezer
3. Dishwasher
4. Clothes washer
5. Clothes dryer
6. Oven
7. Microwave

-96. 96. Other, please specify: ____________
-97. 98. Don't know
-98. 99. Refused

[ASK IF Q91 = 1-96]
Q92. Was the [INSERT Q91 RESPONSE] an ENERGY STAR or high-efficiency model?

[SINGLE RESPONSE]

1. Yes
2. No
-96. 98. I don't know
-97. 99.
-98. [REPEAT THIS QUESTION FOR EACH ITEM MENTIONED IN Q91]

[ASK IF 45 = 5]
Q93. Does the new clothes dryer use natural gas?

1. Yes - it uses natural gas
2. No – does not use natural gas
-96. 98. I don't know
-97. 99. Refused

[ASK IF Q88.3 IS SELECTED AND Q90.3 > 0]
Q94. What type of heating or cooling equipment did you buy?

[Do not read list] [MULTIPLE RESPONSE]

1. Central air conditioner
2. Window/room air conditioner unit
3. Wall air conditioner unit
4. Air source heat pump
5. Geothermal heat pump
6. Boiler
7. Furnace
8. Wi-Fi-enabled smart thermostat
-96. 96. Other, please specify: ________________
-97. 98. Don't know
-98. 99. Refused

[ASK IF Q94= 6-7]
Q95. Does the new [INSERT Q94 RESPONSE] use natural gas?

1. Yes - it uses natural gas
2. No – does not use natural gas
-96. 98. Don't know
-97. 99. Refused

[ASK IF Q94= 1-7, 96]

Q96. Was the [INSERT Q94 RESPONSE] an ENERGY STAR or high-efficiency model appliance?

[SINGLE RESPONSE]

1. Yes
2. No
-96. 98. I don't know
-97. 99.
-98. [REPEAT THIS QUESTION FOR EACH ITEM MENTIONED IN Q94, EXCLUDING wifi-enabled thermostat]

[ASK IF Q88.4 IS SELECTED AND Q90.4 =NO]

Q97. How many windows did you install?

1. [RECORD VERBATIM ________________]
98. Don't know
-96.

[ASK IF Q88.5 IS SELECTED AND Q90.5 =NO]

Q98. Did you add insulation to your attic, walls, or below the floor?

[Do not read list] [MULTIPLE RESPONSE]

1. Attic
2. Walls
3. Below the floor
-96. 98. I don't know
-97.

[ASK IF Q98<>98-99]

[PROGRAMMER: REPEAT Q99 FOR EACH ITEM MENTIONED IN Q98]

Q99. Approximately what proportion of the space did you add insulation? [ITEM MENTIONED IN Q98]

1. [RECORD VERBATIM AS % - INPUT MID-POINT IF RANGE IS OFFERED:] ________________[IF NEEDED: Your best estimate is fine]
98. Don't know

[ASK IF Q88.8 IS SELECTED AND Q90.8 =NO]

Q100. How many of LEDs did you install in your property?

1. [RECORD VERBATIM:] ________________[IF NEEDED: Your best estimate is fine]
98. I don't know

[ASK IF Q88.10 IS SELECTED AND Q90.10 =NO]
Q101. Does the new water heater use natural gas?

1. Yes - it uses natural gas
2. No – does not use natural gas
-96. 98. Don't know

[ASK IF Q88.10 IS SELECTED AND Q90.10 =NO]
Q102. Which of the following water heaters did you purchase? [read list]

1. A traditional water heater with a large tank that holds the hot water
2. A tankless water heater that provides hot water on demand
3. A solar water heater
4. Other, please specify: _______________
-96. 98. I don't know

[ASK IF Q88.10 IS SELECTED AND Q90.10 =NO]
Q103. Is the new water heater an ENERGY STAR model?

[SINGLE RESPONSE]

1. Yes
2. No
-96. 98. Don't know

How Residents Search For Energy Efficiency Information

[ASK ALL]

Q104. Where do you typically search for information on how to save energy at your residence?

[MULTIPLE RESPONSE]

1. Online – read reviews about products
2. Go to utility website
3. Read my utility bill information – it has tips on how to save energy
4. Go to the store and talk to salespeople
5. Look for ENERGY STAR logo on products
6. Talk to trusted equipment vendor or contractor
-96. 96. Other, please specify: [OPEN-ENDED RESPONSE]
-97. 97. Not applicable – I don't typically search for information on how to save energy in my home/property
-98. 98. Don't know

Program Satisfaction and Challenges

The next few questions pertain to your satisfaction with the Smart $aver program.

[ASK ALL]

Q105. How satisfied were you with the rebate dollar amount for [**LAST PROJECT**]? Please use a 0 to 10 scale where 0 means "very dissatisfied," 5 means "neither satisfied nor dissatisfied," and 10 means "very satisfied." [SINGLE RESPONSE]

0.	0. Very dissatisfied
1.	1.
2.	2
3.	3
4.	4
5.	5. Neither satisfied nor dissatisfied
6.	6.
7.	7.
8.	8.
9.	9.
10.	10. Very satisfied
97.	N/A
98.	I don't Know

-96.

[ASK ALL]

Q106. How satisfied were you with how long it took to receive that rebate? Please use a 0 to 10 scale where 0 means "very dissatisfied," 5 means "neither satisfied nor dissatisfied," and 10 means "very satisfied." [SINGLE RESPONSE]

0.	0. Very dissatisfied
1.	1.
2.	2
3.	3
4.	4

5.	5. Neither satisfied nor dissatisfied
6.	6.
7.	7.
8.	8.
9.	9.
10.	10. Very satisfied
97.	N/A
98.	Don't Know

[ASK IF Q1069<5 (Somewhat to Very Dissatisfied)]

Q107. Why did you give that rating? _________[RECORD VERBATIM]

[ASK ALL]

Q108. What was the form of payment in which you received your rebate?

1. Physical prepaid card
2. Digital prepaid card
96. Other: [RESPONSE BOX]
98. I don't know

Q109. How satisfied were you with the form of payment for the rebate amount (physical prepaid card, digital prepaid card, etc) you received? Please use a 0 to 10 scale where 0 means "very dissatisfied," 5 means "neither satisfied nor dissatisfied," and 10 means "very satisfied." [SINGLE RESPONSE]

0.	0. Very dissatisfied
1.	1.
2.	2
3.	3
4.	4
5.	5. Neither satisfied nor dissatisfied

6.	6.
7.	7.
8.	8.
9.	9.
10.	10. Very satisfied
97.	N/A
98.	Don't Know

[ASK IF Q1132<5 (Somewhat to Very Dissatisfied)]

Q110. Why did you give that rating? ________[RECORD VERBATIM]

[ASK ALL]

Q111. In the course of participating in the Duke Smart $aver program, how often did you contact Duke Energy or program staff with questions?

[Do not read list] [SINGLE RESPONSE]

1. Never
2. Once
3. 2 or 3 times
4. 4 times or more

-96. 98. I don't know

[ASK IF Q108 = 2-4]

Q112. How did you contact them?

[MULTIPLE RESPONSE]

1. Phone
2. Email
3. Fax
4. Letter
5. In person

-96. 98. I don't know

[ASK IF Q65=2-4]

Q113. Using the 0 to 10 scale, how satisfied were you with these communications?

[SINGLE RESPONSE]

0.	0. Very dissatisfied
1.	1.
2.	2
3.	3
4.	4
5.	5. Neither satisfied nor dissatisfied
6.	6.
7.	7.
8.	8.
9.	9.
10.	10. Very satisfied
97.	N/A
98.	I don't Know

[ASK IF Q1136<5 (Somewhat to Very Dissatisfied)]

Q114. Why did you give that rating? ________[RECORD VERBATIM]

[ASK ALL]

Q115. Have you noticed any savings on your electric bill since the [ALL MEASURES] project?

[SINGLE RESPONSE]

1. Yes, I have noticed savings
2. No – I have looked but did not notice any savings
3. No - I have looked but it is too soon to tell
4. I haven't look yet but plan to
5. I haven't looked yet and don't plan to

-96. 98. Don't know

-97.

[ASK IF Q115= Yes (if noticed savings)]

Q69_B. How satisfied are you with any savings you noticed on your electric bill since the [**ALL MEASURES**] project? [*INTERVIEWER NOTE: REPEAT SCALE IF NECESSARY: Please use a 0 to 10 scale where 0 means "very dissatisfied," 5 means "neither satisfied nor dissatisfied," and 10 means "very satisfied."*]

[SINGLE RESPONSE]

0.	0. Very dissatisfied
1.	1.
2.	2
3.	3
4.	4
5.	5. Neither satisfied nor dissatisfied
6.	6.
7.	7.
8.	8.
9.	9.
10.	10. Very satisfied
98.	Don't Know

[ASK ALL]

Q116. How satisfied are you with your [**ALL MEASURES**] project? [*INTERVIEWER NOTE: REPEAT SCALE IF NECESSARY: Please use a 0 to 10 scale where 0 means "very dissatisfied," 5 means "neither satisfied nor dissatisfied," and 10 means "very satisfied."*] [*INTERVIEWER NOTE: IF RESPONDENT SAYS 'TOO SOON TO TELL,' THEN FOLLOW UP WITH: "So would you say you are "Neither satisfied nor dissatisfied?" or you just don't know yet AND PROBE TO CODE*]

[SINGLE RESPONSE]

0.	0. Very dissatisfied
1.	1.
2.	2
3.	3

4.	4
5.	5. Neither satisfied nor dissatisfied
6.	6.
7.	7.
8.	8.
9.	9.
10.	10. Very satisfied
98.	I don't know

[ASK IF Q70<5 (Somewhat to Very Dissatisfied)]

Q117. Why did you give that rating?

1. [*RECORD VERBATIM*] ________
-96. 98. Don't know
-97. 99. Refused

[ASK ALL]

Q118. How satisfied are you with the interaction with the contractors who worked on the [**LAST PROJECT**] project? [*INTERVIEWER NOTE: REPEAT SCALE IF NECESSARY: Please use a 0 to 10 scale where 0 means "very dissatisfied," 5 means "neither satisfied nor dissatisfied," and 10 means "very satisfied."*]

[SINGLE RESPONSE]

0.	0. Very dissatisfied
1.	1.
2.	2
3.	3
4.	4
5.	5. Neither satisfied nor dissatisfied
6.	6.
7.	7.
8.	8.

9.	9.
10.	10. Very satisfied
98.	Don't Know

[ASK IF Q72< 5 (Somewhat to Very Dissatisfied)]

Q119. Why did you give that rating?

1. [*RECORD VERBATIM*] ________
-96. 98. Don't know
-97.

[ASK ALL]

Q120. If you were rating your overall satisfaction with the Duke Energy Smart $aver Rebate Program, would you say you were Very Satisfied, Somewhat Satisfied, Neither Satisfied nor Dissatisfied, Somewhat Dissatisfied, or Very Dissatisfied? [SINGLE RESPONSE]

1.	Very dissatisfied
2.	Somewhat dissatisfied
3.	3. Neither satisfied nor dissatisfied
4.	Somewhat satisfied
5.	Very satisfied
98.	Don't Know

[ASK IF Q1207= 1,2]

Q121. Why do you give that rating? _________

[ASK ALL]

Q122. How satisfied you are with Duke Energy's overall performance as your electricity supplier? [*INTERVIEWER NOTE: REPEAT SCALE IF NECESSARY: Please use a 0 to 10 scale where 0 means "very dissatisfied," 5 means "neither satisfied nor dissatisfied," and 10 means "very satisfied."*]

[SINGLE RESPONSE]

0.	0. Very dissatisfied
1.	1.
2.	2
3.	3
4.	4
5.	5. Neither satisfied nor dissatisfied
6.	6.
7.	7.
8.	8.
9.	9.
10.	10. Very satisfied
98.	Don't Know
99.	Refused

Q123. Would you say that your participation in Duke Energy Smart $aver Rebate Program has had a positive effect, a negative effect, or no effect on your overall satisfaction with Duke Energy?

1. Negative effect
2. No effect
3. Positive effect
-96. 98. I don't know

Demographics/Property Characteristics

Finally, we will ask you some questions about yourself and the residence where the rebated work was done.

[ASK ALL]

Q124. Do you live at this residence where the work was performed?

1. Yes
2. No

[ASK IF Q124=2]

Q125. Are you a property manager or an owner of the residence where the work was performed?

1. Owner
2. Property manager
-96. 96. Other, please specify: [OPEN-ENDED RESPONSE]

[ASK IF Q124=1]

Q126. Do you own or rent this residence?

[SINGLE RESPONSE]

1. Own
2. Rent
-96. 98. I don't know
-97.

[ASK IF Q126=2]

Q127. Do you pay your own electric bill or is it included in your rent?

[Single RESPONSE] [*DO NOT READ*]

1. Pay own bill
2. Included in rent
-96. 98. I don't know
-97.

[ASK ALL]

Q128. Approximately when was this residence first built?

[SINGLE RESPONSE]

1. Before 1960
2. 1960-1969
3. 1970-1979
4. 1980-1989
5. 1990-1999
6. 2000-2009
7. 2010-2019
8. 2020-2021
98. I don't know
-96.

Q129. What would you estimate the residence square footage to be: [*READ LIST*]

[SINGLE RESPONSE]

1. less than 1,000 sq ft
2. 1,001-2,000 sq ft
3. 2,001-3,000 sq ft
4. 3,001-4,000 sq ft
5. 4,001-5,000 sq ft
6. Greater than 5,000 sq ft

-96. 98. Don't know

[ASK ALL]

Q130. What is the fuel source of the primary heating system at the residence?

[SINGLE RESPONSE]

1. Electricity
2. Natural Gas (not propane)
3. Liquid propane gas
4. Fuel Oil
5. Wood
6. Or something else, please specify: [Open-ended response]

[Do not read list]

-96. 98. I don't know

Q131. ASK IF AIR SOURCE HEAT PUMP OR GEOTHERMAL HEAT PUMP WAS NOT INSTALLED] What type of system do you use to heat your home? Please select all that apply. [Multiple response allowed]

1. Heat pump
2. Electric baseboard heaters
3. Natural gas furnace
4. Plug in space heaters
5. Cadet wall heaters
96. Other, please specify: [[OPEN-ENDED RESPONSE]
98. I don't know

[ASK IF CENTRAL AIR CONDITIONER, AIR SOURCE HEAT PUMP, OR GEOTHERMAL HEAT PUMP WAS NOT INSTALLED]

Q132. What type of system do you use to cool your home? Please select all that apply. [Multiple response allowed]

1. Central air conditioner
2. Heat pump
3. Room/window air conditioner
4. Evaporative/swamp cooler
5. I do not have any air conditioning in my home
96. Other, please specify: [[OPEN-ENDED RESPONSE]
98. Don't know

[ASK ALL]

Q133. The following are a list of income ranges. Please identify the range that includes your annual household income.

[SINGLE RESPONSE]

1. Less than $15,000
2. $15,000 to less than $25,000
3. $25,000 to less than $35,000
4. $35,000 to less than $50,000
5. $50,000 to less than $75,000
6. $75,000 to less than $100,000
7. $100,000 to less than $150,000
8. $150,000 to less than $200,000
6. $200,000 or more
98. Don't know

99. Prefer not to say

Q134. In what year were you born?

1. [NUMERIC RESPONSE – FIELD WIDTH =4, 1900-2003]
-96.
-97. 99. Prefer not to say
-98.

Q135. What is the highest level of education achieved among those living in your household?

1 Less than high school
2 Some high school
3 High school graduate or equivalent (such as GED)
4 Trade or technical school
5 Some college (including Associate degree)
6 College degree (Bachelor's degree)
7 Some graduate school
8 Graduate degree, professional degree
9 Doctorate
-96. 98 Don't know
-97. 99. Prefer not to say

Q136. Do you feel the COVID-19 pandemic, or government or organizational responses to it, presented any challenges to you regarding your participation in the Smart $aver program? If so, what were these challenges, and how do you think they might best be addressed moving forward?

1 Yes: [OPEN-ENDED RESPONSE]
2 No
-96. 98 Don't know

[ASK ALL]

Q137. In closing, do you have any other suggestions on how to improve Duke Energy's Smart $aver Program?

1. [YES, RECORD VERBATIM] ________
2. No
-96. 98. Don't know

CLOSE:

On behalf of Duke Energy Indiana, thank you for your time in completing this survey. If you were one of the first 100 customers to complete the survey, you will receive a $5 gift card!

Have a great day!

Trade Ally Survey

Landing Page (Web)

Thank you for taking this survey! The survey covers your involvement in energy efficiency offerings available through Duke Energy and your experience and satisfaction with the Smart $aver program.

Interviewer Instructions / Introduction (Phone)

Hi, I'm ____ calling from Resource Innovations on behalf of Duke Energy Indiana. May I speak with whomever is most knowledgeable about the rebated [MEASURE LIST] projects that your firm has done through the Duke Energy Smart $aver rebate program?

[*If needed:*] I need to speak with someone who is knowledgeable about the sales and installation process – which is typically an installer or a salesperson.

[*Once appropriate contact is on phone:*]

We want to get some feedback on how the Duke Energy Smart $aver program is working for your firm. This is your chance to tell us what is working well, what isn't, and how Duke Energy can improve the program to better serve you and your customers. Is this a good time to talk?

[*If needed:*]

- The survey takes about 10-15 minutes, depending on how much you have to say.
- If now isn't a good time, when could I call you back?

Please note that this call may be monitored or recorded for quality assurance purposes. Rest assured, your answers will be confidential and not tied to you or your firm.

Building information and screening

What residential project types does your firm primarily focus on: new construction homes, existing homes, or both?

3. Existing homes
4. New construction projects
5. Both

-97. 98. Don't know
-98.

How many locations does your company have?

6. One
7. Two
8. Three
9. Four
10. Five
11. More than five: Specify: _________
98. Don't Know

For the questions in this survey, we would like to focus primarily on the Duke Energy Indiana territory. Are you able to answer questions regarding the work associated with this area?

12. Yes [CONTINUE]
13. No [*Ask to forward survey link to co-worker that can*]
98. Don't know [*Ask to forward survey link to co-worker that can]*

Sources of Program Awareness

Q138. How did you originally hear about Duke Energy Indiana Smart $aver rebate offerings?

1. Word-of-mouth (co-worker, another contractor)
2. Duke Energy website
3. Duke Energy program representative
4. TV/Radio/Newspaper/Billboard Ad
5. Event (home show, workshop, etc.)
96. Other, please specify:______________

-96. 98. Don't know

Q139. How do you stay engaged with the Smart $aver program? [Allow multiple answers]

1. Newsletters or other program marketing
2. Trade Ally portal
3. Coordination with program staff
4. Program website
5. Other, specify:__________
6. None
7. Don't know

Nonparticipant Spillover

The next set of questions ask about the work your company did specifically during the time period from May 1st, 2020, to April 30th, 2021.

[START LOOP – LOOP THROUGH TOP THREE MOST INSTALLED MEASURE TYPES THAT TRADE ALLY INSTALLED during May 1st, 2020, to April 30th, 2021.]

Q140. Our records show your company performed [**MEASURE TYPE**] between May 1st 2020 to April 20, 2021. Is this correct?

1. Yes [continue to Q4]
2. No [Ask Q3 again with next measure type]

Q141. During this time period, approximately how many [**MEASURE]s** did your company install at ALL locations (in and outside of Duke Energy Indiana territory combined)?

1. [Integer response]

Q142. Of these [pipe in answer from Q4] installations, about what percentage were completed <u>within</u> Duke Indiana territory?

1. [Record % response]

Q143. During this time period, of all the [Q4 integer x Q5%] [**MEASURE**] projects that your company completed <u>in Duke Indiana territory</u>, about what percentage <u>would have qualified</u> for a Smart $aver rebate?

1. [Record % response]

Q144. Of all these [Q4 integer x Q5% x Q6%] Duke rebate-qualified [MEASURE] projects, about what percent did you <u>actually apply</u> for Smart $aver rebates?

[Record % response]

Q145. For the roughly [Q4 x (100% - Q5%)] [MEASURE]s installed <u>outside</u> of Duke territory, about what percentage would you say would have qualified for Duke incentives?

1. [Record % response]

Q146. [Ask only if Q8 >0%] Of these [MEASURES] installed <u>outside</u> of Duke's territory but would have qualified for a Duke incentive, what percentage did receive an incentive from another utility?

1. [Record % response]

Q147. For those Duke territory and rebate-qualified projects where you did not apply for Smart $aver rebates,

1. What are the reasons that this happens? _______________
2. And what could Duke Energy do to address these issues? ____________

Q148. During this time period, for completed and Duke rebated [**MEASURE**] projects, about what percentage of your customers specifically requested the [**MEASURE**] on their own and were not influenced by your recommendation?

1. [*Record percent*]

Q149. Using a 0 to 10 scale, where 0 is "not at all influential" and 10 is "extremely influential," how much influence has the Duke Smart $aver program had on your business practice of recommending rebate-qualifying [**MEASURE**]s to your customers?

[SINGLE RESPONSE]

0. Not at all influential
1.
2.
3.
4.
5.
6.
7.
8.
9.
10. Extremely influential

Q150. During this time period, for completed and rebated [**MEASURE**] projects, about what percentage of your customers were replacing working equipment early versus replacing a non-functioning item?

1. Early replacement of functioning equipment [*Record percent*]

2. Replacement of non-functioning equipment [*Record percent*]

Q151. During this time period, for completed and rebated [MEASURE] projects, about what was the average age of the units you replaced?

1. Average age:

[END LOOP]

Program Influence and Effects on TAs

Q152. During the time period of May 1st, 2020, to April 30th, 2021, how often did your customers ask about the Duke Energy rebates before you've had the chance to bring them up?

1. Never
2. Rarely
3. Occasionally
4. Frequently
5. Always
98. Don't know

[BASE: TRADE ALLIES THAT INSTALLED AIR SOURCE HEAT PUMPS, CENTRAL AIR CONDITIONERS, GEOTHERMAL HEAT PUMPS, VARIABLE SPEED POOL PUMPS, OR HEAT PUMP WATER HEATERS]

Q153. Thinking back to before you were involved in the Smart $aver program, how often did you recommend higher efficiency equipment that uses less energy than standard models to your customers? Would you say none of the time, some of the time, most of the time, or every time?

[SINGLE RESPONSE]

1. None of the time
2. Some of the time
3. Most of the time
4. Every time

-96. 97. Not applicable – I've been involved with the Duke program since starting in the industry/this company

-97. 98. Don't know

-99. [BASE: TRADE ALLIES THAT INSTALLED AIR SOURCE HEAT PUMPS, CENTRAL AIR CONDITIONERS, GEOTHERMAL HEAT PUMPS, VARIABLE SPEED POOL PUMPS, OR HEAT PUMP WATER HEATERS]

Q154. And what about now? How often did you recommend higher efficiency equipment that uses less energy than standard models to your customers

[SINGLE RESPONSE.]

1. None of the time

2. Some of the time
3. Most of the time
4. Every time
98. Don't know

-97.
-98.

Q155. Would you say your knowledge of energy efficient products and services has increased, decreased, or stayed about the same since you became involved with the Smart $aver program?

[SINGLE RESPONSE]

1. Increased
2. Decreased
3. Stayed about the same

-96. 98. Don't know
-97.
-98. [ASK IF Q38=1]

Q156. Using a 0 to 10 scale, where 0 is “not at all influential” and 10 is “extremely influential,” how much influence has the Smart $aver program had on your increased knowledge of energy efficient products and services?

[SINGLE RESPONSE]

0. Not at all influential
1.
2.
3.
4.
5.
6.
7.
8.
9.
10. Extremely influential

-96. 98. Don't know
-97.

Q157. How have your equipment stocking practices changed, if at all, after participating in the Smart $aver program?

1. [OPEN-ENDED RESPONSE]
2. 98. Don't know

Challenges and Suggestions for Improvement

Q158. What energy efficient products, technologies, or services do you feel should be added to the Duke Energy rebate program? [MULTIPLE RESPONSE, Randomize Order]

1. Modulating furnaces
2. Heat recovery ventilation (HRV) systems
3. Boilers
4. Furnaces equipped with electronically commutated motors (ECMs)
5. Mini-split heat pumps
6. Multi-split heat pumps
7. Tankless water heaters
8. Humidifiers
9. Air handlers
10. Windows
11. Doors
12. No others should be added

-96. 96. Other, please specify: [OPEN-ENDED RESPONSE]
-97. 98. Don't know
-98.
-99.

An enhanced Rebate Application Entry and Tracking platform was launched on March 1st, 2021. Please answer the next set of questions about your experience *before* this new platform.
-100.

Q159. From May 1st, 2020, to April 30th, 2021, have you experienced problems or frustrations with the rebate application process?

1. Never
2. Rarely
3. Occasionally
4. Frequently
5. Always
98. Don't know

-97.
-98.
-99.
-100. [ASK IF Q22=2-5]

Q160. What types of problems or frustrations did you experience with the rebate application process?

1. [*Record response*]
98. Don't know

[ASK IF Q22=2-5]

Q161. Overall, have these problems with the rebate application process persisted or gotten better over time?

1. Persisted
2. Gotten somewhat better, or
3. Have been completely resolved at this point

-96. 98. Don't know

Q162. Now, thinking about the enhanced Rebate Application Entry and Tracking platform was launched on March 1st, 2021, have you had any challenges with this platform?

1. Yes
2. No

98. Don't know

Q163. [Q26=1] What challenges did you experience, and do you have any suggestions on how Duke Energy can further improve this platform?

1. [Record response]

98. Don't know

Q164. Do you have any suggestions on how Duke Energy can improve the rebate application process?

1. [*Record response*]

98. Don't know

Q165. Do you have any suggestions on how Duke Energy can improve the project inspection process?

1. [*Record response*]

98. Don't know

Q166. Do you feel there other processes not described thus far that are critical to your program participation experience, and if so, do you have any suggestions on how Duke Energy can improve them?

1. [*Record response*]

98. Don't know

Satisfaction

Thanks for your feedback so far, next are some questions about your satisfaction with the Smart $aver program.

Q167. Please rate the extent to which you are satisfied with the following aspects of the program using a 0 to 10 scale where 0 means "very dissatisfied," 5 means "neither satisfied nor dissatisfied," and 10 means "very satisfied." How satisfied are you with:

A	Program training offered by Duke Energy
B	Your Duke Energy Trade Ally Representative
C	The program website for customers
D	The trade ally portal application tracking system
E	The marketing of the program
F	The incentive application submission process
G	The selection of eligible equipment and services
H	The overall program

[SINGLE RESPONSE ON EACH A-H ITEM]

0.	0. Very dissatisfied
1.	1.
2.	2
3.	3
4.	4
5.	5. Neither satisfied nor dissatisfied
6.	6.
7.	7.
8.	8.
9.	9.
10.	10. Very satisfied
97.	N/A
98.	Don't Know
99.	Refused

[PROGRAMMER'S NOTE: REPEAT Q30 FOR EACH STATEMENT FROM Q29 WHERE Q29<5]

Q168. Please explain why you were dissatisfied with [INSERT STATEMENT FROM Q29 A-H]:

1. [*Record response*]
98. Don't know

Wrap-up

Q169. Do you have any other feedback you would like to provide about the Smart $aver Program?

1. [*Record response*]

CLOSE:

Thank you for your time in completing this survey.

Your responses have been recorded.

Have a great day!

Appendix E Participant Demographics

	DEI	
Home type	**%**	**n**
Single-family detached	88%	100
Manufactured or mobile home	3%	3
Row house or townhouse or condo	5%	6
Apartment or condo 4 units or more	2%	2
Other	3%	3
Home size	**%**	**n**
Less than 1,000 square feet	4%	4
1,001 to under 2,000 square feet	45%	51
2,001 to under 3,000 square feet	32%	37
3,001 to under 4,000 square feet	11%	12
4,001 to under 5,000 square feet	5%	6
Greater than 5,000	3%	3
I don't know	1%	1
Ownership Status	**%**	**n**
Own	99%	110
Rent	1%	1
Fuel source type	**%**	**n**
Electric	35%	40
Natural Gas	61%	69
Other	4%	5
Year residence was built	**%**	**n**
Before 1960	15%	17
1960-1969	11%	13
1970-1979	11%	13
1980-1989	18%	20
1990-1999	13%	15
2000-2009	25%	29
2010-2019	4%	4
2020-2021	2%	2
I don't know	1%	1
Household Income	**%**	**n**
Under $15,000	1%	1
15 to under $25,000	3%	3
25 to under $35,000	4%	4
35 to under $50,000	4%	5

	DEI	
50 to under $75,000	17%	19
75 to under $100,000	13%	15
1,000 to under $150,000	15%	17
150 to under $200,000	4%	5
$200,000 or more	7%	8
I don't know	1%	1
Prefer not to say	32%	36
Education Level	**%**	**n**
Less than high school	0%	0
Some high school	0%	0
High school graduate or equivalent (such as GED)	10%	11
Trade or technical school	6%	7
Some college (including Associate degree)	13%	15
College degree (Bachelor's degree)	23%	26
Some graduate school	5%	6
Graduate degree, professional degree	24%	27
Doctorate	7%	8
I don't know	1%	1
Prefer not to say	11%	13

CAC
IURC Cause No. 45803
Data Request Set No. 1
Received: November 15, 2022

CAC 1.5

Request:

For each DSM program, please provide all cost-effectiveness results for the following tests (a) Utility Cost test; (b) Total Resource Cost Test; (c) any other test used. Please provide the following results for each of the tests, for each year from 2024-2026, in electronic spreadsheet format with all formulas and links intact

a. Annual utility costs for each year;

b. Annual participant costs for each year;

c. Annual benefits for each year;

d. Cumulative present value of costs;

e. Cumulative present value of benefits;

f. Net benefits; and,

g. Benefit cost ratio.

Objection: Duke Energy Indiana objects to this data request on the basis that it is vague, ambiguous, and not reasonably calculated to lead to the discovery of admissible evidence. The terms "all cost-effectiveness results" and "any other test used" are not defined or reasonably limited in scope.

Response: Subject to and without waiving or limiting its objections, Duke Energy Indiana responds as follows: See Attachment CAC 1.5-A.

Witness: Jean P. Williams

4tod,-111CACLS-A

Program:ll»ortfolio Cost EffectiveMSS. 2024

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M1,1hl.fMillv IE Prodix:ts & s.nnc.s	2.16	2.16	0<5	>l.00
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Program/PortfolioCost Effectiveness - 2025"

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Home Enerrv Report	l.&7	1.<7	0.45	>l.00
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Program/Portfolio Cost Effectiveness - l026•

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Dffnand Pro•nirns				
POWflMaMHr•	,•••,	3.s	2.47	>1.00
Power Mana•.,.. f « Bus:irw,,s	1.1	1.72	0.86	>1.00
Non-ROR	2.22	14.22	2.,2	>l.00
.flor'ttolio Oamand tlnpome Total	216	'1.0'5	,•••	,,•••,
" - " ' TOU!l	2.U	i " '	••••	•,•

Su'l ol 20)&	Cld161'1'1erftpPro,,.M	Tot,,INPVAIIC»M4 (CKtofT&O	Total NPV Avoided C:onafCftW'fy	Tot.INPVA oWN CutofCa	c- Lattt lllV N;n of Fll•l	'''oer•mCQN	P:.rtlclp•nt ln<iellttvu	NPV ,ilnki,..t C..OstslMl)	NPVP i,.-t: Costs ltross)	P•rtkipoin..ce.N Yinp{rfot.sl
,	E'M!fllvEdu:ltlaf1Pr°'r3mfc,	6l0,ll7	182,07)	l44.6'8	;l,DCD.363	9•7,660	-		-	2,47J.,4i5
	low lt1C0lT• Ne'lhborhood	1157,930	3S6.o82	•U97U	tol,.U	1,217,379	-	-	-	l,071,148
	lOWlntGIT'tV,,Qtku!ution	l2U47	256,565	11,''441	•••••••	1,70'1,06&	-	-	-	121.,59
	'-'u_,,1\1 EE P'roducu & icff	210.,	l,S,ll.101	lal,CN!	3,424,4!6	S6U10	-	-	-	4321,1508
	HomtliMJ11VReoott:	lJ6,0'56	1.73S,Sl2	63',00	5,-1.)'.)6,'lMi	2.llA.Jl7	-	-	-	6.6'6,152!
	ll •l!MrJY •m•nn	2,31',$21	3,426,851	1,SS:l,s:41	7,732,.-7]	2,733,361	15,698	151.691	18S,786	10.398,357
	Sm111 SM..- il.tollktltf41l	1,410,8.,	S,029,1'24	m,lf,l	..,45';4,a	3,9Sl,3lC		3.!41,5,S	4075,Sl6	10,561,992
it.T«.11		5,7J0.2.12	11,1'9.JJ'-	3,514,7.d()	26,2'1,071	13,608,211	2,364,'M	3.4'3,22.S	•.161.602	36,822.636
NonR	Putll Ur,u,xy Stt'Md hlinr;	-	668,357	-	1,068,219	,,,,,,,,		-	-	1,nuw
	81JSlMulwtyS,,, .	3,2()1,542	7,6"6,3U	u,!,211	lS,0'1'-173	s.21c.orn	4,291,825	,,,40.468	f.821.750	24,Q,g7,29'
	Smart .,...fl;on-Ae icitnf.-.1	9.430,-,S	19,229,292	5.70l,5,0	4'1,l!l,74g	B,411.4'5		19ill9.242	U,252,595	82,240,!!07
Nvii!eloul		12,S.U,941	27,S.U.Ml	1,.li87,'17ll	6'..35e,lll	11.a;.:.1t:.1	12.947.503	26,869,710	32,016,3.16	1015,061,61'
Q										
	'-M..ag@('"	1,762.326	-	5,102,923	-	••.0,766	l.3,0,.416	-	-	-
	RWM: '4 ,,,,for !l.IHldl	!,S97,Ei20	!73,5G7	l,lll,71'	8'-9,!27	2.79-4,019	9SS,67C5	-	-	1,l2UM
	Na-.Z:.-skllflr.wl OR	2,.0,,,11,	-	l'1,41 .l27	-	19,987,ll&	16.861,754	-	-	-
OR Tot;,!		13,197,824	J7J.56i7	IS,,AlS,944	Hed27	21.cs21.,21		-	-	1,221,1531
Gr1ndTo(ll		H,417JXl2	3!.116,'4.2	57,0!8,462	'3;1.'i54,SJ:6	60.124,276	3,ll,440J!137	3Q.l6l'',ti3S	36,337,S.:7	14',1,!'37

•Oo1count r•t• iJ 6.92%
. . . ,t.,,CT$0lof.CW11'101: t>.nkul.tad"""- re4f• lD Pl"'" Co,ts. lnlMC!'.-t•ACM, the, ptVl(ll!l p,amr..thitl'O' nt.c..1N tM·,1.a:,• intN' t,blt abtw•.
Net•• The'"Mt"H t-MS1.r-.-tr:.at.wt • fnt<tr\dklto .,.,,.,. ttwr.-l•Uomhci brt-•ntnit Mti,racfl(v1lu.of •.oided COfllQ<'OIY11 tnd ,..., 0lA of RCC •._p,rtldpentCORa:n1oOC11tadwdl N d i pr01r1m for cr v-•r 2026. 51nc• costs end partclp10onof1 pro1n1m m1yv1ry y.'1'ftov-1row-r l prccnm',lf.c, thes91151 ,m.lllU ml)"Ol'tn.l\l'l'IM M indic:M-ofrhecon l'ffKtlv«-o<1,erttl•f.Al lrfeof1ht proar.m,.

U O C l b b t f o n • 'A•9+Ct(Tot.ll Benef1tsJ/CEMTol Cosu)
TRC CMculat!on • (A,tl+C)(Total Benefit:sl/jE-f+Gl(Tot. COlt1)
a1M Cil1cuh11tiofl • lA—••q(1'ot•1 Deneflbl/(OtE)fTot:lt Cosb)
PCT C,,k\.htion"' (F+l)(Tot.l Beoefttll/!H)(Tot- Gotts)

AFFIRMATION

I affirm, under the penalties for perjury, that the foregoing representations are true.

John E. Haselden
Consultant for the
Indiana Office of Utility Consumer
Counsel

Cause No. 45803
DEI, LLC

Date: February 9, 2023

CERTIFICATE OF SERVICE

This is to certify that a copy of ***OUCC Public's Exhibit No. 1 Redacted Testimony of OUCC Witness John E. Haselden*** has been served upon the following parties of record in the captioned proceeding by electronic serve on February 9, 2023.

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